Supporting Information

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1. Chemical Synthesis

1.1 Solvents and Reagents

All starting materials and solvents were obtained from standard chemical suppliers. Dry solvents were purchased in sure sealed bottles stored over molecular sieves. Organic solutions were routinely dried over anhydrous sodium sulfate or magnesium sulfate.

1.2 Chromatography

Thin-layer chromatography (TLC) was performed on pre-coated silica gel plates (Kieselgel 60 F254, BDH). Visualization of the developed chromatogram was achieved by using fluorescence quenching and/or by staining with potassium permanganate. Column chromatography purification was performed on prepacked silica gel (230–400 mesh, 40–63 μm) cartridges. Reverse column chromatography was performed on SWPAFLASH® SW040 Bonded Spherical C18 (20-45μm, 100 Å). All compounds are >95% pure by HPLC analysis.

1.3 NMR Spectroscopy

All ^{1}H NMR spectra were recorded on a Brucker Avance III 400 MHz. Chemical shifts (δ) are expressed in ppm recorded using the residual undeuterated solvent as the internal reference in all cases. Signal splitting patterns are described as singlet (s), doublet (d), triplet (t), quartet (q), multiplet (m), broad (br), or a combination. Coupling constants (J) are quoted to the nearest 0.1 Hz.

1.4 Optical Rotations

Optical rotations were taken using a Perkin Elmer 343 polarimeter and $[\alpha]_D$ values are given in deg dm^{-1} cm^3 g^{-1}.

1.5 Reverse Phase HPLC conditions for the LCMS Analytical Methods

Method 1: Agilent 1200\G6110A Kinetex EVO C18 2.1 × 30 mm, 5 μm at 40 ℃; Mobile Phase: A: 0.0375% TFA in water (v/v); B: 0.01875% TFA in Acetonitrile; flow rate held at 1.5 mL/min; eluted with the mobile phase over 1.50 min employing UV detection at 220&254 nm. Gradient information: 0.01-0.80 min, ramped from 95% A-5% B to 5% A-95% B; 0.80-1.20 min, held at 5% A-95% B; 1.20-1.21 min, returned to 95% A-5% B, 1.21-1.5 min, held at 95% A-5% B.

Method 2: SHIMADZU LCMS-2020 Kinetex EVO C18 2.1 × 30 mm, 5 μm at 40 ℃; Mobile Phase: A: 0.025% $NH_3 \cdot H_2O$ in Water (v/v); B: Acetonitrile; flow rate held at 1.5 mL/min; eluted with the mobile phase over 1.55 min employing UV detection at 220&254 nm. Gradient information: 0-0.80 min, ramped from 95% A-5% B to 5% A-95% B; 0.80-1.20 min, held at 5%

A-95% B; 1.20-1.21 min, returned to 95% A-5% B, 1.21-1.55 min, held at 95% A-5% B.

Method 3: SHIMADZU LCMS-2020 Kinetex EVO C18 2.1 × 30 mm, 5 μm at 50 ℃; Mobile Phase: A: 0.0375% TFA in water (v/v); B: 0.01875% TFA in Acetonitrile; flow rate held at 1.5 mL/min; eluted with the mobile phase over 1.55 min employing UV detection at 220&254 nm. Gradient information: 0-0.80 min, ramped from 95% A-5% B to 5% A-95% B; 0.80-1.20 min, held at 5% A-95% B; 1.20-1.21 min, returned to 95% A-5% B, 1.21-1.55 min, held at 95% A-5% B.

Method 4: SHIMADZU LCMS-2020 Kinetex EVO C18 2.1 × 30 mm, 5 μm at 50℃; Mobile Phase: A: 0.0375% TFA in water (v/v); B: 0.01875% TFA in Acetonitrile; flow rate held at 1.5 mL/min; eluted with the mobile phase over 1.55 min employing UV detection at 220&254 nm. Gradient information: 0-0.80 min, ramped from 100% A-0% B to 40% A-60% B; 0.80-1.20 min, held at 40% A-60% B; 1.20-1.21 min, returned to 100% A-0% B, 1.21-1.55 min, held at 100% A-0% B.

Method 5: SHIMADZU LCMS-2020 Kinetex EVO C18 2.1 × 30 mm, 5 μm at 40℃; Mobile Phase: A: 0.025% $NH_3 \cdot H_2O$ in Water (v/v); B: Acetonitrile; flow rate held at 1.0 mL/min; eluted with the mobile phase over 2.00 min employing UV detection at 220&254 nm. Gradient information: 0-1.20 min, ramped from 100% A-0% B to 40% A-60% B; 1.20-1.60 min, held at 40% A-60% B; 1.60-1.61 min, returned to 100% A-0% B, 1.61-2.00 min, held at 100% A-0% B.

Method 6: Agilent 1200\G6110A Kinetex EVO C18 2.1 × 30 mm, 5 μm at 50℃; Mobile Phase: A: 0.0375% TFA in water (v/v); B: 0.01875% TFA in Acetonitrile; flow rate held at 1.5 mL/min; eluted with the mobile phase over 1.50 min employing UV detection at 220&254 nm. Gradient information: 0.01-0.80 min, ramped from 100% A-0% B to 40% A-60% B; 0.80-1.20 min, held at 40% A-60% B; 1.20-1.21 min, returned to 100% A-0% B, 1.21-1.55 min, held at 100% A-0% B.

Method 7: Agilent 1200\G6110A XBridge C18 2.1 × 50 mm, 5 μm at 50℃; Mobile Phase: A: 0.025% $NH_3 \cdot H_2O$ in water (v/v); B: Acetonitrile; flow rate held at 1.0 mL/min; eluted with the mobile phase over 2.00 min employing UV detection at 220&254 nm. Gradient information: 0-1.20 min, ramped from 100% A-0% B to 40% A-60% B; 1.20-1.60 min, held at 40% A-60% B; 1.60-1.61 min, returned to 100% A-0% B, 1.61-2.00 min, held at 100% A-0% B.

1.6 Reverse Phase HPLC conditions for the HRMS Analytical Methods

Method 1: Agilent 1290 LC & Agilent G6530B Q-TOF Agilent ZORBAX Extend-C18 2.1 × 50 mm, 5 μm at 40 ℃; Mobile Phase: A: 0.0375% TFA in water (v/v); B: 0.0188% TFA in Acetonitrile; flow rate held at 0.8 mL/min; eluted with the mobile phase over 4.50 min employing DAD detection. Gradient information: 0-0.40 min, held at 0% A-100% B; 0.40-3.40 min, ramped from 0% A-100% B to 10% A-90% B; 3.40-3.90 min, ramped from 10% A-90% B to 0% A-100% B; 3.91-4.00 min, returned to 0% A-100% B, 4.00-4.50 min, held at 0% A-100% B (flow rate held at 1.0 mL/min).

1.7 Preparative Reverse Phase HPLC conditions

Method 1: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (NH_4HCO_3)-ACN]; B%: 18%-48%, 10 min.

Method 2: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (ammonia hydroxide v/v)-ACN]; B%: 19%-49%, 9 min.

Method 3: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (ammonia hydroxide v/v)-ACN]; B%: 22%-52%, 9 min

Method 4: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (ammonia hydroxide v/v)-ACN]; gradient: 23%-53% B, 9 min

Method 5: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (NH_4HCO_3)-ACN]; B%: 10%-40%, 8 min

Method 6: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (NH_4HCO_3)-ACN]; B%: 7%-37%, 8 min

Method 6: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (ammonia hydroxide v/v)-ACN]; B%: 2%-30%, 9 min

Method 7: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (NH_4HCO_3)-ACN]; B%: 21%-51%, 10 min

Method 8: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (ammonia hydroxide v/v)-ACN]; B%: 15%-45%, 9 min

Method 9: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (ammonia hydroxide v/v)-ACN]; B%: 14%-44%, 9 min

Method 10: column: Phenomenex luna C18 150 x 25 mm x 10 μm; mobile phase: [water(FA)-ACN]; B%: 20%-50%, 10 min

Method 11: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (ammonia hydroxide v/v)-ACN]; B%: 25%-55%, 9 min

Method 12: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (ammonia hydroxide v/v)-ACN]; B%: 18%-48%, 9 min

Method 13: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (NH_4HCO_3)-ACN]; gradient:22%-52% B, 10 min

Method 14: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (NH_4HCO_3)-ACN]; gradient: 23%-53% B, 9 min

Method 15: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (NH_4HCO_3)-ACN]; gradient: 26%-56% B, 9 min

Method 16: column: Waters Xbridge 150 x 25 mm x 5 μm; mobile phase: [water (NH_4HCO_3)-

ACN]; gradient: 28%-58% B, 9 min

Method 17: column: Waters Xbridge 150 x 25 mm x 5 µm; mobile phase: [water (NH_4HCO_3)-ACN]; gradient: 24%-54% B, 9 min

Method 18: column: Phenomenex C18 80 x 30 mm x 3 µm; mobile phase: [water (NH_4HCO_3)-ACN]; gradient: 16%-46% B, 10 min

Method 19: column: Waters Xbridge 150 x 2 5mm 10 µm; mobile phase: [water (NH_4HCO_3)-ACN]; gradient: 15% - 45% B, 10 min.

1.8 Supercritical Fluid Chromatography Analytical Methods

Method 1: SHIMADZU LC-30ADsf; Column: Chiralcel OJ-3 50×4.6mm I.D., 3um Mobile phase: Phase A for CO_2, and Phase B for MeOH (0.05%DEA); Gradient elution: MeOH (0.05% DEA) in CO_2 from 5% to 40% Flow rate: 3mL/min; Detector: PDA Column Temp: 35℃; Back Pressure: 100Bar.

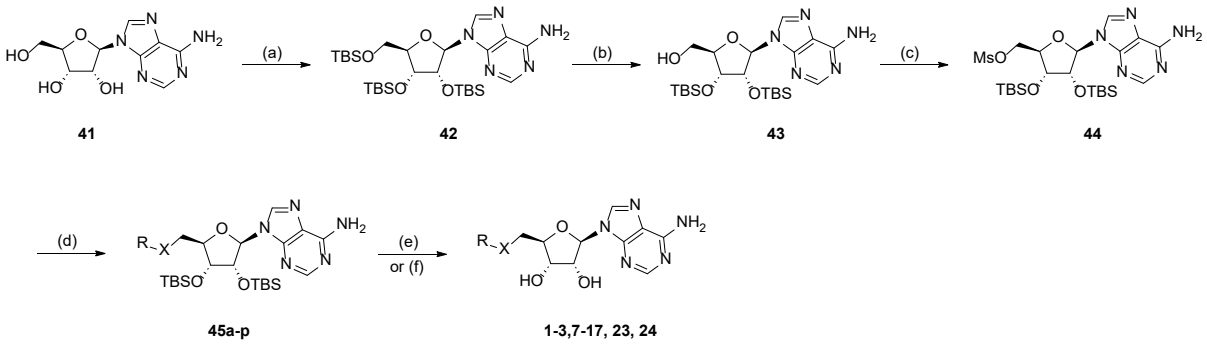
Method 2: SHIMADZU LC-30ADsf; Column: Chiralcel OD-3 50×4.6mm I.D., 3um Mobile phase: Phase A for CO_2, and Phase B for MeOH (0.05%DEA); Gradient elution: MeOH (0.05% DEA) in CO_2 from 5% to 40% Flow rate: 3mL/min; Detector: PDA Column Temp: 35℃; Back Pressure: 100Bar.

Method 3: SHIMADZU LC-30ADsf; Column: Chiralpak AD-3 50×4.6mm I.D., 3um Mobile phase: Phase A for CO_2, and Phase B for MeOH (0.05%DEA); Gradient elution: MeOH (0.05% DEA) in CO_2 from 5% to 40% Flow rate: 3mL/min; Detector: PDA Column Temp: 35℃; Back Pressure: 100Bar.

1.9 Synthetic Procedures

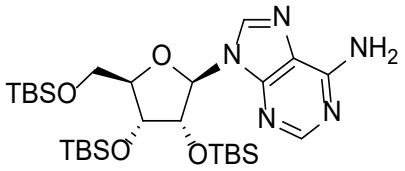
1.9.1 Synthesis of compounds 1-3, 7-17, 23 and 24

Scheme S1



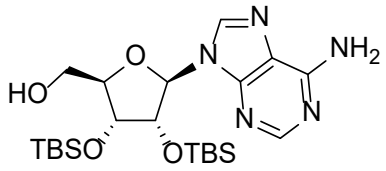
(a) TBS-Cl, 1H-imidazole, DMF, RT, 16 h, 79%; (b) CCl_3CO_2H, THF, H_2O, 0 °C, 4 h, 61%; (c) Ms_2O, TEA, THF, RT, 2 h, 17%; (d) R-XH, NaH, THF, 50 °C, 16 h, 9-87%; (e) KF, MeOH, RT, 16 h, 7-69% or (f) Et_3N-3HF, THF, RT, 16 h, 17-42%.

9-[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert-butyl(dimethyl)silyl] oxymethyl]tetrahydrofuran-2-yl]purin-6-amine (42)



To a solution of (2*R*,3*R*,4*S*,5*R*)-2-(6-aminopurin-9-yl)-5-(hydroxymethyl)tetrahydrofuran -3,4-diol **41** (10.0 g, 37.4 mmol) in DMF (40 mL) was added 1H-imidazole (28.0 g, 411 mmol) and *tert*-butylchlorodimethylsilane (25.2 mL, 206 mmol). The resulting mixture was stirred at RT for 16 h. The reaction was quenched with water (200 mL) and extracted with EtOAc (3 x 100 mL). The combined organic layers were washed with brine (3 x 50 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-20%) to afford compound **42** (18.0 g, 79% yield) as a white solid. LCMS (ES^+, Method 1) *m/z* 610.4 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.34 (s, 1H), 8.16 (s, 1H), 6.02 (d, *J* = 4.8 Hz, 1H), 5.79 (s, 2H), 4.69 (t, *J* = 4.8 Hz, 1H), 4.32 (t, *J* = 4.0 Hz, 1H), 4.15 - 4.13 (m, 1H), 4.03 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.79 (dd, *J* = 11.6, 3.2 Hz, 1H), 0.96 (s, 9H), 0.93 (s, 9H), 0.80 (s, 9H), 0.14 (s, 3H), 0.13 (s, 3H), 0.11 (s, 3H), 0.10 (s, 3H), -0.04 (s, 3H), -0.22 (s, 3H).

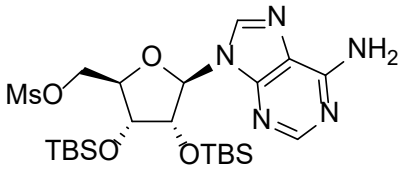
[(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy] tetrahydrofuran-2-yl]methanol (43)



To a solution of compound **42** (10.0 g, 16.4 mmol) in THF (100 mL) was added dropwise a solution of trichloroacetic acid (26.8 g, 164 mmol) in water (30 mL) at 0 °C and stirred for 4 h. The reaction mixture was neutralized with sodium carbonate, diluted with water (100 mL) and extracted with EtOAc (3 x 50 mL). The combined organic layers were dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-20%) to afford compound **43** (5.00 g, 61% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 496.4 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.40 (s, 1H), 8.14 (s, 1H), 7.38 (s, 2H), 5.90 (d, *J* = 7.2 Hz, 1H), 5.72 (dd, *J* = 8.0, 4.0

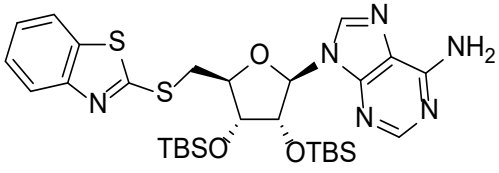
Hz, 1H), 4.91 (dd, *J* = 7.2, 4.4 Hz, 1H), 4.30 (d, *J* = 4.4 Hz, 1H), 3.99 (t, *J* = 2.8 Hz, 1H), 3.76 - 3.72 (m, 1H), 3.62 - 3.59 (m, 1H), 0.93 (s, 9H), 0.70 (s, 9H), 0.13 (s, 3H), 0.12 (s, 3H), -0.04 (s, 3H), -0.13 (s, 3H), -0.46 (s, 3H).

[(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl(dimethyl)silyl] oxy] tetrahydrofuran-2-yl]methyl methanesulfonate (44)



To a solution of compound **43** (1.00 g, 2.02 mmol) and triethylamine (842 µL, 6.05 mmol) in THF (10 mL) was added dropwise a solution of methanesulfonic anhydride (422 mg, 2.42 mmol) in THF (5 mL) under N_2 at 0 °C. The resulting mixture was warmed to RT and stirred for 2 h. The reaction was quenched with water (50 mL) and then extracted with EtOAc (3 x 30 mL). The combined organic layers were washed with brine (3 x 20 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **44** (200 mg, 348 µmol, 17% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 574.2 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): *δ* 8.35 (s, 1H), 7.94 (s, 1H), 5.89 (d, *J* = 5.2 Hz, 1H), 5.74 (s, 2H), 5.02 (t, *J* = 4.8 Hz, 1H), 4.61 (dd, *J* = 11.2, 4.4 Hz, 1H), 4.52 (dd, *J* = 11.2, 5.2 Hz, 1H), 4.41 (t, *J* = 4.0 Hz, 1H), 4.33 - 4.32 (m, 1H), 3.00 (s, 3H), 0.95 (s, 9H), 0.82 (s, 9H), 0.14 (s, 3H), 0.13 (s, 3H), -0.02 (s, 3H), -0.23 (s, 3H).

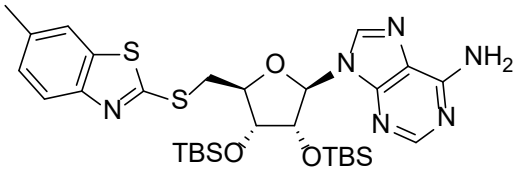
9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl (dimethyl)silyl] oxy]tetrahydrofuran-2-yl]purin-6-amine (45a)



To a solution of compound **44** (100 mg, 174 µmol) in DMF (2 mL) was added 1,3-benzothiazol-2-ylsulfanylsodium (49.5 mg, 261 µmol). The resulting mixture was heated to 50 °C and stirred

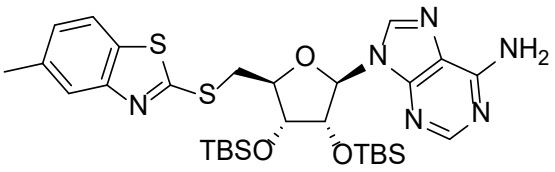
for 16 h. The reaction was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-2%) to afford compound **45a** (70.0 mg, 62% yield) as a white solid LCMS (ES^+, Method 2) *m/z* 645.5 $[M+H]^+$.

9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[(6- methyl-1,3-benzothiazol-2-yl) sulfanylmethyl]tetrahydrofuran-2-yl]purin-6-amine (45b)



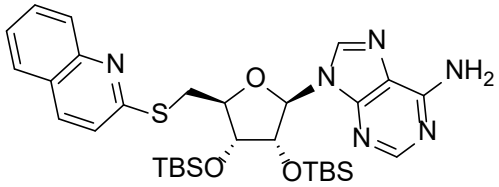
To a solution of 6-methyl-1,3-benzothiazole-2-thiol (63.2 mg, 348 µmol) in THF (2 mL) was added NaH (13.9 mg, 348 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (100 mg, 174 µmol) in THF (1 mL) was then added and the resulting mixture was heated to 70 °C and stirred for 16 h. The reaction was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **45b** (100 mg, 87% yield) as a white solid. LCMS (ES^+, Method 3) *m/z* 659.3 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.45 (s, 1H), 8.16 (s, 1H), 7.80 (s, 1H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.31 - 7.28 (m, 3H), 5.94 (d, *J* = 7.6 Hz, 1H), 5.24 (dd, *J* = 7.6, 4.4 Hz, 1H), 4.44 (d, *J* = 4.4 Hz, 1H) , 4.30 (t, *J* = 7.2 Hz, 1H), 4.04 - 4.01 (m, 1H), 3.80 - 3.75 (m, 1H), 2.41 (s, 3H), 0.88 (s, 9H), 0.67 (s, 9H), 0.08 (s, 3H), 0.07 (s, 3H), -0.13 (s, 3H), -0.46 (s, 3H).

9-[(2*R*,3*R*,4*R*,5*S*)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]-5- [(5-methyl-1,3-benzothiazol-2-yl)sulfanylmethyl]tetrahydrofuran-2-yl]purin-6-amine (45c)



To a solution of 5-methyl-1,3-benzothiazole-2-thiol (63.1 mg, 348 µmol) in THF (2 mL) was added NaH (13.9 mg, 348 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (100 mg, 174 µmol) in THF (2 mL) was then added and the resulting mixture was heated to 70 °C and stirred for 16 h. The reaction was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **45c** (50.0 mg, 43.5% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 659.4 $[M+H]^+$.

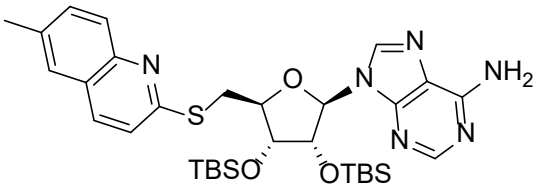
9-[(2*R*,3*R*,4*R*,5*S*)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]-5-(2-quinolylsulfanylmethyl) tetrahydrofuran-2-yl]purin-6-amine (45d)



To a solution of quinoline-2-thiol (112 mg, 697 µmol) in THF (2 mL) was added NaH (27.9 mg, 697 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution compound **44** (200 mg, 348 µmol) in THF (2 mL) was then added and the resulting mixture was heated to 70 °C and stirred for 16 h. The reaction was cooled to RT, quenched with water (30 mL) and extracted with EtOAc (3 x 15 mL). The combined organic layers were washed with brine (2 x 10 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **45d** (180 mg, 80% yield) as colorless oil. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.39 (s, 1H), 8.01 (s, 1H), 7.93 (t, *J* = 8.8 Hz, 2H), 7.74 (d, *J* = 8.4 Hz, 1H), 7.68 - 7.64 (m, 1H), 7.45 (t, *J* = 7.2 Hz, 1H), 7.24 (d, *J* = 8.4 Hz, 1H), 5.92 (d, *J* = 6.4 Hz, 1H), 5.73 (s, 2H), 5.26 (dd, *J* = 6.4, 4.0 Hz, 1H), 4.47 (td, *J*

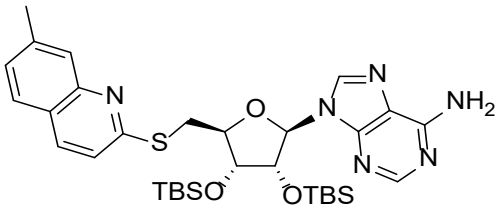
= 6.8, 1.6 Hz, 1H), 4.36 (dd, *J* = 4.4, 1.6 Hz, 1H), 4.10 - 4.05 (m, 1H), 3.85 (dd, *J* = 14.0, 6.4 Hz, 1H), 0.91 (s, 9H), 0.73 (s, 9H), 0.07 (s, 6H), -0.19 (s, 3H), -0.39 (s, 3H).

9-[(2R,3R,4R,5S)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- [(6-methyl-2-quinolyl) sulfanyl methyl]tetrahydrofuran-2-yl]purin-6-amine (45e)



To a solution of 6-methylquinoline-2-thiol **73** (61.1 mg, 348 µmol) in THF (2 mL) was added NaH (13.9 mg, 348 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (100 mg, 174 µmol) in THF (2 mL) was then added and the resulting mixture was heated to 70 °C for 16 h. The reaction was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **45e** (90.0 mg, 79% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 653.5 $[M+H]^+$.

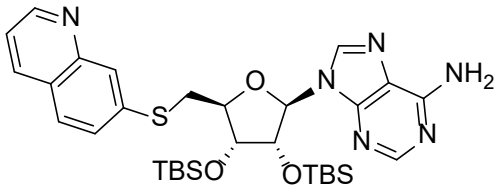
9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[(7 -methyl-2-quinolyl)sulfanyl methyl]tetrahydrofuran-2-yl]purin-6-amine (45f)



To a solution of 7-methylquinoline-2-thiol **77** (61.1 mg, 348 µmol) in THF (2 mL) was added NaH (13.9 mg, 348 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (100 mg, 174 µmol) in THF (1 mL) was added and the resulting mixture was heated to 70 °C for 16 h. The reaction was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The

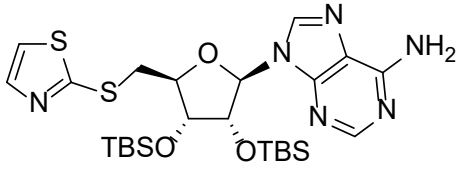
combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by preparative TLC (SiO_2, petroleum ether/ethyl acetate 50%) to afford compound **45f** (60.0 mg, 52% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 635.5 $[M+H]^+$.

9-((2R,3R,4R,5S)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-((quinolin-7-ylthio)methyl) tetrahydrofuran-2-yl)-9H-purin-6-amine (45g)



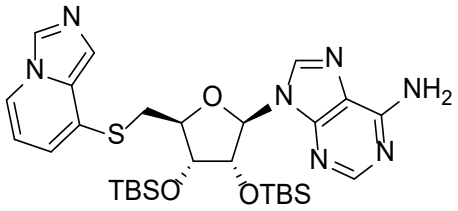
To a solution of imidazo-quinoline-7-thiol (110 mg, 680 µmol) in THF (2 mL) was added NaH (27.2 mg, 680 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (130 mg, 227 µmol) in THF (1 mL) was then added and the resulting mixture was heated at 70 °C for 16 h. The reaction mixture was quenched with water (10 mL) and extracted with EtOAc (3 × 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-100%) to afford compound **45g** (120 mg, 83% yield) as colorless oil. LCMS (ES^+, Method 1) *m/z* 639.3 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.91 - 8.86 (m, 1H), 8.35 (s, 1H), 8.13 - 8.08 (m, 1H), 8.07 - 8.047 (m, 1H), 7.89 (s, 1H), 7.71 (d, *J* = 8.8 Hz, 1H), 7.51 - 7.46 (m, 1H), 7.38 - 7.34 (m, 1H), 5.86 (d, *J* = 6 Hz, 1H), 5.83 - 5.75 (m, 2H), 5.28 - 5.23 (m, 1H), 4.39 - 4.33 (m, 2H), 3.79 - 3.72 (m, 1H), 3.61 - 3.53 (m, 1H), 0.90 (s, 9H), 0.76 (s, 9H), 0.11 - 0.06 (m, 6H), -0.14 (s, 3H), -0.35 (s, 3H).

9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (thiazol-2-ylsulfanylmethyl) tetrahydrofuran-2-yl]purin-6-amine (45h)



To a solution of thiazole-2-thiol (79.6 mg, 679 µmol) in THF (2 mL) was added NaH (27.2 mg, 679 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (130 mg, 226 µmol) in THF (2 mL) was then added, and the resulting mixture was heated to 70 °C for 16 h. The reaction was cooled at 0 °C, quenched with water (20 mL), and then extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (2 x 10 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-100%) to afford compound **45h** (70.0 mg, 52% yield) as a white solid. LCMS (ES^+, Method 1) *m/z* 595.2 $[M+H]^+$. ^1H NMR (400MHz, $CDCl_3$): δ 8.35 (s, 1H), 7.91 (s, 1H), 7.65 (d, *J* = 3.2 Hz, 1H), 7.22 (d, *J* = 3.2 Hz, 1H), 5.88 (d, *J* = 6.0 Hz, 1H), 5.59 (s, 2H), 5.31 - 5.27 (m, 1H), 4.39 (td, *J* = 6.4, 1.6 Hz, 1H), 4.35 - 4.33 (m, 1H), 3.93 (dd, *J* = 14.0, 6.8 Hz, 1H), 3.70 (dd, *J* = 14.4, 6.4 Hz, 1H), 0.93 (s, 9H), 0.77 (s, 9H), 0.10 (s, 3H), 0.09 (s, 3H), 0.01 (s, 3H), -0.09 (s, 3H).

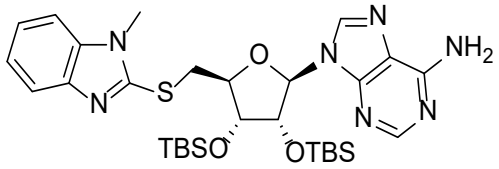
9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (imidazo[1,5-a]pyridin-8-ylsulfanylmethyl)tetrahydrofuran-2-yl]purin-6-amine (45i)



To a solution of compound **80** (47.1 mg, 313 µmol) in THF (2 mL) was added NaH (12.5 mg, 313 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (120 mg, 209 µmol) in THF (1 mL) was then added and the resulting mixture was heated at 70 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **45i** (80.0 mg, 61% yield) as yellow oil. LCMS (ES^+, Method 2) *m/z* 628.5 $[M+H]^+$. ^1H NMR (400MHz, $CDCl_3$): δ 8.33 (s, 1H), 8.13 (s, 1H), 7.85 (s, 1H), 7.80 (d, *J* = 6.8 Hz, 1H), 7.55 (s, 1H), 6.71 (d, *J* = 6.8 Hz, 1H), 6.49 (t, *J* = 6.8 Hz, 1H), 5.83 (d, *J* = 6.0 Hz, 1H), 5.66 (s, 2H), 5.28 (dd, *J* = 6.0, 4.4

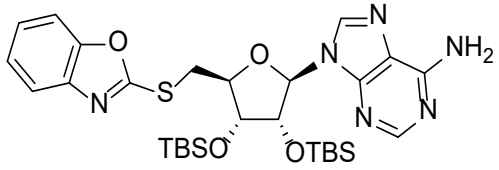
Hz, 1H), 4.35 - 4.34 (m, 1H), 4.32 - 4.28 (m, 1H), 3.72 - 3.70 (m, 1H), 3.48 - 3.43 (m, 1H), 0.90 (s, 9H), 0.76 (s, 9H), 0.08 (s, 3H), 0.04 (s, 3H), -0.02 (s, 3H), -0.36 (s, 3H).

9-((2R,3R,4R,5S)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-(((1-methyl-1H-benzo[d]imidazol-2-yl)thio)methyl)tetrahydrofuran-2-yl)-9H-purin-6-amine (45j)



To a solution of 1-methyl-1H-benzo[d]imidazole-2-thiol (57.2 mg, 349 µmol) in THF (4 mL) was added NaH (13.9 mg, 349 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the reaction mixture was stirred for 30 min. A solution of compound **44** (100 mg, 174 µmol) in THF (1 mL) was then added and the resulting mixture was heated at 70 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 × 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulphate, filtered and then concentrated under reduced pressure. The residue was purified by preparative TLC (SiO_2, petroleum ether/ethyl acetate 50%) to afford compound **45j** (98.0 mg, 87% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 642.4 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): *δ* 8.35 (s, 1H), 7.99 (s, 1H), 7.70 - 7.60 (m, 1H), 7.25 - 7.21 (m, 3H). 5.90 (d, *J* = 6.8 Hz, 1H), 5.79 (brs, 2H), 5.31 - 5.28 (m, 1H), 4.49 - 4.46 (m, 1H), 4.41 - 4.39 (m, 1H), 4.07 - 4.02 (m, Hz, 1H), 3.97 - 3.92 (m, 1H), 3.66 (s, 3H), 0.93 (s, 9H), 0.76 (s, 9H), 0.12 (s, 3H), 0.11(s, 3H), -0.10 (s, 3H), -0.37 (s, 3H).

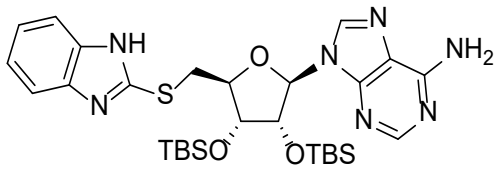
9-((2R,3R,4R,5S)-5-((Benzo[d]oxazol-2-ylthio)methyl)-3,4-bis((tert-butyldimethylsilyl) oxy)tetrahydrofuran-2-yl)-9H-purin-6-amine (45k)



To a solution of 1,3-benzoxazole-2-thiol (105 mg, 697 µmol) in THF (4 mL) was added NaH (27.9 mg, 697 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the

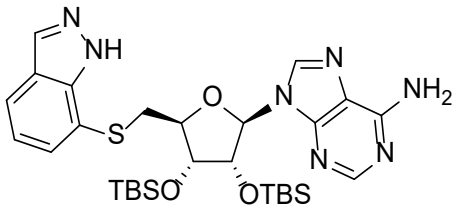
mixture was stirred for 30 min. A solution of compound **44** (200 mg, 349 µmol) in THF (2 mL) was then added and the resulting mixture was stirred initially at RT for 30 min and then heated at 70 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 × 10 mL). The combined organic layers were washed with brine (10 mL), dried sodium sulphate, filtered, and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.1% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-100%) to afford compound **45k** (160 mg, 73% yield) as a yellow oil. LCMS (ES^+, Method 2) *m/z* 629.4 $[M+H]^+$.

9-((2R,3R,4R,5S)-5-(((1H-Benzo[d]imidazol-2-yl)thio)methyl)-3,4-bis((tertbutyldimethyl silyl)oxy)tetrahydrofuran-2-yl)-9H-purin-6-amine (45l)



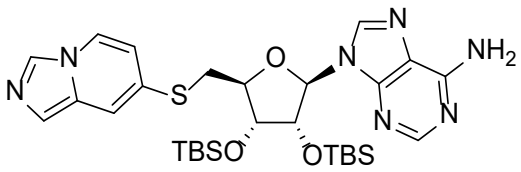
To a solution of 1H-benzimidazole-2-thiol (78.5 mg, 522.8 µmol) in THF (4 mL) was added NaH (20.9 mg, 522.8 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (200 mg, 349 µmol) in THF (2 mL) was added and the resulting mixture was stirred initially at RT for 30 mins and then heated at 70 °C and for 16 h. The reaction was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 × 10 mL). The combined organic layers were washed with brine (10 mL), dried sodium sulphate, filtered, and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.1% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-100%) to afford compound **45l** (103 mg, 47% yield) as a yellow oil. LCMS (ES^+, Method 2) *m/z* 628.4 $[M+H]^+$.

9-((2R,3R,4R,5S)-5-(((1H-Indazol-7-yl)thio)methyl)-3,4-bis((tert-butyldimethylsilyl)oxy) tetrahydrofuran-2-yl)-9H-purin-6-amine (45m)



To a solution of compound **85** (52.7 mg, 349 µmol) in DMF (2 mL) was added NaH (13.9 mg, 349 µmol, 60% dispersion in mineral oil) under N_2 at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (100 mg, 174 µmol) in DMF (1 mL) was then added and the resulting mixture was heated at 70 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (15 mL) and then extracted with EtOAc (3 × 20 mL). The combined organic layers were washed with brine (60 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by preparative TLC (SiO_2, petroleum ether/ethyl acetate 50%) to afford compound **45m** (10.0 mg, 9% yield) as a colorless oil. LCMS (ES^+, Method 3) *m/z* 628.1 $[M+H]^+$.

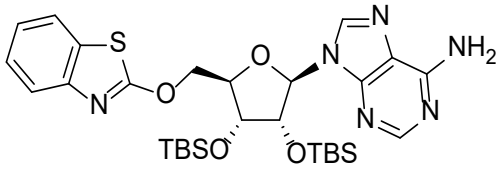
9-[(2*R*,3*R*,4*R*,5*S*)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]-5-(imidazo [1,5-a]pyridin-7-ylsulfanylmethyl)tetrahydrofuran-2-yl]purin-6-amine (45n)



To a solution of imidazo[1,5-a]pyridine-7-thiol **91** (68.1 mg, 453 µmol) in THF (2 mL) was added NaH (18.1 mg, 453 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (130 mg, 226 µmol) in THF (1 mL) was added and the resulting mixture was heated to 70 °C for 16 h. The reaction was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **45n** (120 mg, 84% yield) as yellow oil. LCMS (ES^+, Method 2) *m/z* 628.3 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.30 (s, 1H), 8.04 (s, 1H), 7.87 (s, 1H), 7.80 (d, *J* = 7.6 Hz, 1H), 7.36 (s, 1H), 7.28 - 7.27 (m, 1H), 6.50 (dd, *J* = 7.6, 2.0 Hz, 1H), 6.06 (s, 2H), 5.83 (d, *J* = 5.6 Hz, 1H), 5.24 (dd, *J* =

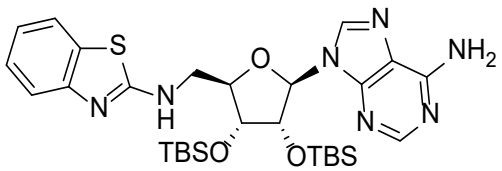
5.6, 4.4 Hz, 1H), 4.38 - 4.36 (m, 1H), 4.30 - 4.26 (m, 1H), 3.54 (dd, *J* = 14.4, 6.8 Hz, 1H), 3.70 (dd, *J* = 14.4, 6.0 Hz, 1H), 0.93 (s, 9H), 0.77 (s, 9H), 0.12 (s, 3H), 0.11 (s, 3H), -0.11 (s, 3H), -0.33 (s, 3H).

9-[(2*R*,3*R*,4*R*,5*R*)-5-(1,3-Benzothiazol-2-yloxymethyl)-3,4-bis[[tert-butyl(dimethyl)silyl] oxy]tetrahydrofuran-2-yl]purin-6-amine (45o)



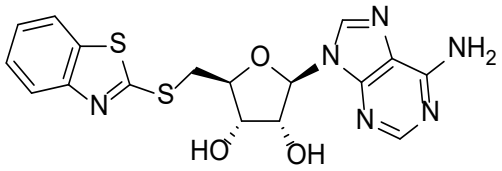
To a solution of 1,3-benzothiazol-2-ol (39.52 mg, 261.39 µmol) in THF (1.5 mL) was added NaH (10.5 mg, 261 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (100 mg, 174 µmol) in THF (1.5 mL) was then added and the resulting mixture was heated to 50 °C for 2 h. The reaction was cooled to RT, quenched with water (10 mL) and extracted with EtOAc (3 x 5 mL). The combined organic layers were washed with brine (5 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-100%) to afford compound **45o** (30.0 mg, 27% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 629.2 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): *δ* 8.40 (s, 1H), 7.81 (s, 1H), 7.44 (d, *J* = 7.6 Hz, 1H), 7.24 (d, *J* = 7.6 Hz, 1H), 7.18 - 7.16 (m, 2H), 5.86 (d, *J* = 7.2 Hz, 1H), 5.60 (s, 2H), 5.36 (dd, *J* = 6.4, 4.4 Hz, 1H), 4.76 (dd, *J* = 14.4, 7.6 Hz, 1H), 4.39 (d, *J* = 4.4 Hz, 1H), 4.36 (d, *J* = 6.8 Hz, 1H), 4.16 (d, *J* = 5.6 Hz, 1H), 0.87 (s, 9H), 0.75 (s, 9H), 0.04 (s, 3H), -0.06 (d, *J* = 5.6 Hz, 6H), -0.37 (s, 3H).

***N*-[[(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy] tetrahydrofuran-2-yl]methyl]-1,3-benzothiazol-2-amine (45p)**



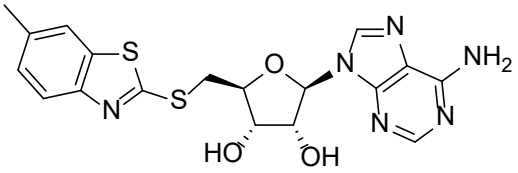
To a solution of 1,3-benzothiazol-2-amine (78.5 mg, 522 µmol) in THF (1 mL) was added NaH (20.9 mg, 522 µmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and the mixture was stirred for 30 min. A solution of compound **44** (100 mg, 174 µmol) in THF (1 mL) was then added and the resulting mixture was heated to 70 °C for 16 h. The reaction was cooled to room RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **45p** (35.0 mg, 32% yield) as colorless oil. LCMS (ES^+, Method 3) *m/z* 628.2 $[M+H]^+$.

(2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol (1)



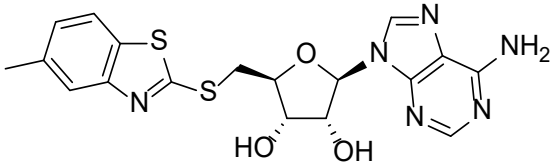
To a solution of **45a** (50.0 mg, 77.5 µmol) in MeOH (2 mL) was added potassium fluoride (13.5 mg, 232 µmol). The reaction mixture was stirred at RT for 16 h and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 1) to afford compound **1** (12.9 mg, 40% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{16}N_6O_3S_2$ 417.0804; found 417.0803. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.39 (s, 1H), 8.15 (s, 1H), 8.01 (d, *J* = 8.0 Hz, 1H), 7.86 (d, *J* = 8.0 Hz, 1H), 7.47 (t, *J* = 7.6 Hz, 1H), 7.39 - 7.33 (m, 3H), 5.88 (d, *J* = 5.6 Hz, 1H), 5.92 (d, *J* = 6.0 Hz, 1H), 5.58 (s, 1H), 5.49 (s, 1H), 7.84 (s, 1H), 4.28 - 4.24 (m, 2H), 3.89 - 3.84 (m, 1H), 3.77 - 3.74 (m, 1H).). ^{13}C NMR (126 MHz, DMSO-d_6) δ 166.21, 156.12, 152.65, 152.57, 149.41, 140.05, 134.63, 126.40, 124.52, 121.82, 121.12, 119.28, 87.68, 82.42, 72.74, 72.58, 35.37. SFC (Method 1) de% = 100%. $[\alpha]_D^{20}$ = +25.0 (c=0.01, MeOH).

(2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-[(6-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol (2)



To a solution of **45b** (100 mg, 0.15 mmol) in DMF (2 mL) was added potassium fluoride (88.1 mg, 1.52 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 2) to afford compound **2** (23.4 mg, 35% yield) as an off-white solid. HRMS *m/z* $[M+H]^+$ calcd for $C_{18}H_{18}N_6O_3S_2$ 431.5090; found 431.0964. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.37 (s, 1H), 8.15 (s, 1H), 7.78 (s, 1H), 7.73 (d, *J* = 8.4 Hz, 1H), 7.30 - 7.27 (m, 3H), 5.92 (d, *J* = 5.6 Hz, 1H), 5.51 (brs, 2H), 4.86 (t, *J* = 5.2 Hz, 1H), 4.29 - 4.27 (m, 2H), 4.23 - 4.22 (m, 1H), 3.84 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.72 (dd, *J* = 13.6, 7.6 Hz, 1H), 2.41 (s, 3H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 164.75, 156.11, 152.65, 150.73, 149.41, 140.04, 134.77, 134.19, 127.69, 121.41, 120.70, 119.26, 87.65, 82.45, 72.73, 72.58, 35.38, 20.93.

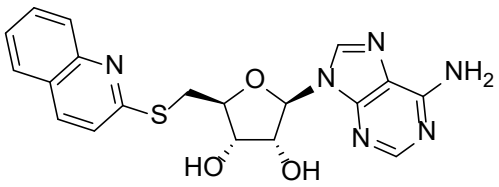
2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-[(5-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol (3)



To a solution of compound **45c** (50.0 mg, 75.8 µmol) in DMF (2 mL) was added potassium fluoride (44.1 mg, 758 µmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 1) to afford compound **3** (11.2 mg, 34% yield) as a white solid. HRMS (Method 3) *m/z* $[M+H]^+$ calcd for $C_{17}H_{17}N_7O_3S$ 431.0960; found 431.0975. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.45 (s, 1H), 8.22 (s, 1H), 7.86 (d, *J* = 8.4 Hz, 1H), 7.67 (s, 2H), 7.66 - 7.56 (m, 1H), 7.19 (d, *J* = 7.6 Hz, 1H), 5.93 (d, *J* = 5.6 Hz, 1H), 5.65 - 5.38 (s, 1H), 4.84 (t, *J* = 5.2 Hz, 1H), 4.21 - 4.32 (m, 2H) , 3.85 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.73 (dd, *J* = 13.6, 5.6 Hz,1H), 2.42 (s, 3H).

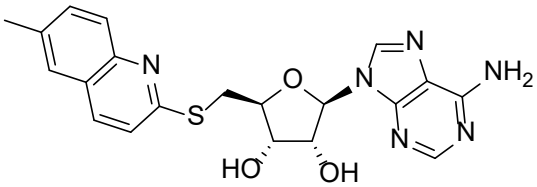
(2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(2-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol

(7)



To a solution of compound **45d** (130 mg, 0.20 mmol) in MeOH (5 mL) was added potassium fluoride (118 mg, 2.03 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 1) to compound **7** (13.12 mg, 16% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{19}H_{18}N_6O_3S$ 411.1239; found: 411.1249. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.40 (s, 1H), 8.18 - 8.15 (m, 2H), 7.89 (t, *J* = 8.4 Hz, 1H), 7.71 (td, *J* = 8.0, 1.2 Hz, 1H), 7.51 (t, *J* = 7.6 Hz, 1H), 7.39 (d, *J* = 8.8 Hz, 1H), 7.30 (s, 2H), 5.92 (d, *J* = 6.4 Hz, 1H), 4.93 (t, *J* = 5.6 Hz, 1H), 4.25 - 4.23 (m, 1H), 4.19 - 4.18 (m, 1H), 3.84 (dd, *J* = 14.0, 6.8 Hz, 1H), 3.64 (dd, *J* = 14.0, 6.8 Hz, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 157.96, 156.11, 152.65, 149.54, 147.49, 139.98, 136.13, 130.05, 128.00, 127.42, 125.78, 125.54, 120.85, 119.26, 87.39, 83.23, 72.76, 72.54, 31.32.

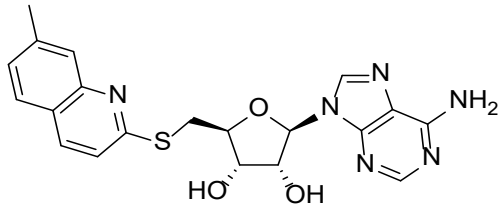
(2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(6-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol (8)



To a solution of compound **45e** (90.0 mg, 0.14 mmol) in DMF (2 mL) was added potassium fluoride (80.1 mg, 1.38 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 1) to afford compound **8** (25.1 mg, 43% yield) as a white solid. HRMS (Method 4) *m/z* $[M+H]^+$ calcd for $C_{20}H_{20}N_6O_3S$ 425.1396; found 425.1416. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.40 (s, 1H), 8.16 (s, 1H), 8.07 (d, *J* = 8.8 Hz, 1H), 7.78 (d, *J* = 8.8 Hz,1H), 7.67 (s, 1H), 7.55 (dd, *J* = 8.8, 1.6 Hz, 1H), 7.34 (d, *J* = 8.8 Hz, 1H), 7.30 (s, 1H), 5.91 (d, *J* = 6.4 Hz, 1H), 5.55 (s, 1H), 5.36

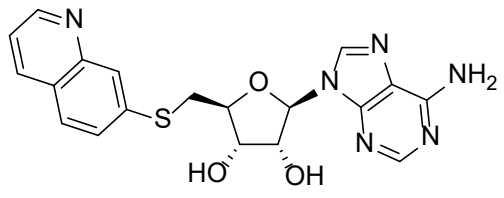
(s, 1H), 4.93 (s, 1H), 4.23 (s, 1H), 4.20 - 4.15 (m,1H), 3.82 (dd, *J* = 14.0, 6.8 Hz, 1H), 3.62 (dd, *J* = 14.0, 6.8 Hz, 1H), 2.46 (s, 3H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 156.79, 156.11, 152.66, 149.55, 146.10, 139.98, 135.58, 134.90, 132.01, 127.22, 126.82, 125.75, 120.80, 119.27, 87.37, 83.27, 72.76, 72.54, 31.32, 20.96.

(2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(7-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol (9)



To a solution of compound **45f** (60.0 mg, 91.9 µmol) in DMF (2 mL) was added potassium fluoride (53.3 mg, 918 µmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 3) to afford compound **9** (14.6 mg, 37% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{20}H_{20}N_6O_3S$ 425.1396; found 425.1391. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.32 (s, 1H), 8.08 (s, 1H), 7.90 (d, *J* = 8.8 Hz, 1H), 7.64 (d, *J* = 8.4 Hz, 1H), 7.62 (s, 1H), 7.30 (dd, *J* = 8.0, 0.8 Hz, 1H), 7.22 (d, *J* = 8.4 Hz, 1H), 6.04 (d, *J* = 3.6 Hz, 1H), 5.74 (s, 2H), 4.69 - 4.65 (m, 2H), 4.44 (t, *J* = 4.8 Hz, 1H), 3.97 (dd, *J* = 14.8, 4.4 Hz, 1H), 3.62 (dd, *J* = 14.8, 5.2 Hz, 1H), 2.52 (s, 3H).

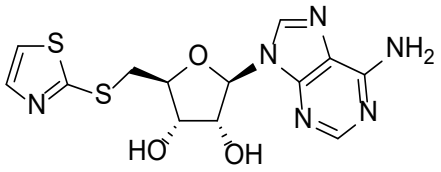
(2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(7-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol (10)



To a solution of compound **45g** (100 mg, 0.16 mmol) in MeOH (3 mL) was added potassium

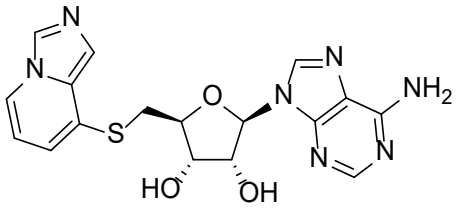
fluoride (90.9 mg, 1.57 mmol). The reaction mixture was stirred at 50 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-25%) to afford compound **10** (29.2 mg, 45% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{19}H_{18}N_6O_3S$ 411.1239; found 411.1243. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.85 (dd, *J* = 4.0, 1.6 Hz, 1H), 8.15 (s, 1H), 7.89 - 7.87 (m, 2H), 7.52 (dd, *J* = 8.4, 1.6 Hz, 1H), 7.45 (dd, *J* = 8.4, 4.0 Hz, 1H), 7.27 (s, 1H), 5.90 (d, *J* = 6.0 Hz, 1H), 4.81 (t, *J* = 5.2 Hz, 1H), 4.24 (t, *J* = 4.4 Hz, 1H), 4.12 - 4.08 (m, 1H), 3.62 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.49 (dd, *J* = 13.6, 7.2 Hz, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 156.56, 153.11, 151.55, 149.94, 148.53, 140.38, 138.96, 136.29, 128.91, 126.92, 126.28, 125.27, 121.39, 119.67, 88.04, 83.09, 73.40, 73.32, 34.84.

(2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(thiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol (11)



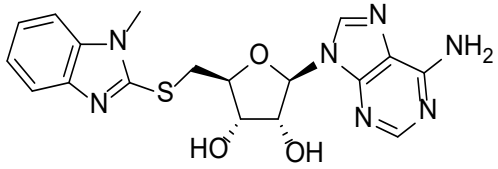
To a solution of **45h** (70.0 mg, 0.12 mmol) in MeOH (5 mL) was added potassium fluoride (68.4 mg, 1.18 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-45%) to afford compound **11** (18.5 mg, 43% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{13}H_{14}N_6O_3S_2$ 367.0647; found 367.0656. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.34 (s, 1H), 8.14 (s, 1H), 7.71 (d, *J* = 3.2 Hz, 1H), 7.64 (d, *J* = 3.6 Hz, 1H), 7.30 (s, 2H), 8.06 (s, 1H), 5.89 (d, *J* = 6.0 Hz, 1H), 4.80 (t, *J* = 5.6 Hz, 1H), 4.21 (t, *J* = 3.6 Hz, 1H), 4.15 - 4.13 (m, 1H), 3.70 (dd, *J* = 14.0, 5.6 Hz, 1H), 3.56 (dd, *J* = 14.0, 7.6 Hz, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 163.37, 156.10, 152.63, 149.42, 142.73, 139.98, 120.40, 119.23, 87.61, 82.55, 72.76, 72.73, 36.28.

(2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridin-8- ylsulfanylmethyl) tetrahydrofuran-3,4-diol (12)



To a solution of compound **45i** (70.0 mg, 0.11 mmol) in MeOH (3 mL) was added potassium fluoride (64.7 mg, 1.11 mmol). The reaction mixture was heated to 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.1% $NH_3 \cdot H_2O$ in water/MeCN gradient 0-50%) to afford compound **12** (31.3 mg, 69% yield) as an off-white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{17}N_7O_3S$ 400.1192; found 400.1201. ^1H NMR (400 MHz, DMSO-d_6): δ 8.40 (s, 1H), 8.35 (s, 1H), 8.21 (d, *J* = 7.2 Hz, 1H), 8.14 (s, 1H), 7.35 (s, 1H), 7.29 (s, 2H), 6.77 (d, *J* = 6.8 Hz, 1H), 6.60 (t, *J* = 6.8 Hz, 1H), 6.03 (brs, 1H), 5.90 (d, *J* = 5.6 Hz, 1H), 4.80 (t, *J* = 5.6 Hz, 1H), 4.22 (t, *J* = 4.8 Hz, 1H), 4.07 - 4.06 (m, 1H), 3.53 (dd, *J* = 13.6, 5.2 Hz, 1H), 3.42 (dd, *J* = 13.6, 7.6 Hz, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 156.10, 152.65, 149.44, 139.94, 129.50, 128.61, 125.95, 120.93, 119.21, 118.56, 116.71, 112.13, 87.59, 82.61, 72.85, 72.71, 33.60.

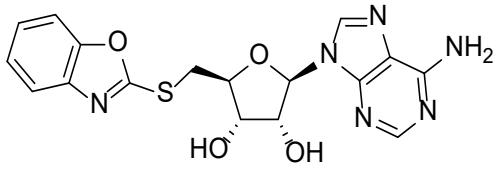
(2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-(((1-methyl-1H-benzo[d]imidazol-2-yl)thio) methyl)tetrahydrofuran-3,4-diol (13)



To a solution of compound **45j** (98.0 mg, 0,15 mmol) in MeOH (4 mL) was added potassium fluoride (3.28 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.1% $NH_3 \cdot H_2O$ in water/MeCN gradient 0-100%) to afford compound **13** (4.67 mg, 7% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{17}N_7O_3S$ 414.1378; found 414.1356. ^1H NMR (400 MHz, DMSO-d_6): δ 8.40 (s, 1H), 8.16 (s, 1H), 7.55 - 7.53(m, 1H), 7.50 - 7.44 (m, 1H), 7.30 (brs, 2H), 7.22 - 7.11 (m, 2H), 5.91 (d, *J* = 6.0 M Hz, 1H),

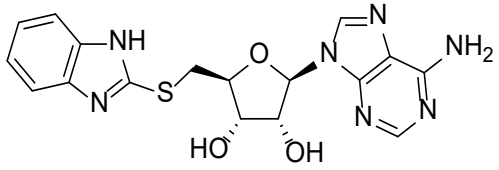
5.54 (d, *J* = 6.0 M Hz, 1H), 5.44 (d, *J* = 4.4 M Hz, 1H), 4.88 - 4.86 (m, 1H), 4.30 - 4.24 (m, 1H), 4.23 - 4.18 (m, 1H), 3.87 - 3.79 (m, 1H), 3.74 - 3.68 (m, 1H), 3.66 (s, 3H).

(2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-((benzo[d]oxazol-2-ylthio)methyl) tetrahydrofuran-3,4-diol (14)



To a solution of compound **45k** (160 mg, 0,25 mmol) in MeOH (4 mL) was added potassium fluoride (119 µL, 5.09 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.1% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-100%) to afford compound **14** (22.0 mg, 21% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{16}N_6O_4S$ 401.1078; found 400.1043. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.38 (s, 1H), 8.14 (s, 1H), 7.65 - 7.61 (m, 2H), 7.36 - 7.29 (m, 4H), 5.9 (d, *J* = 5.6 Hz, 1H), 5.73 - 5.42 (m, 1H), 4.85 (t, *J* = 5.2 Hz, 1H), 4.24 - 4.24 (m, 2H), 3.86 - 3.78 (m, 1H), 3.75 - 3.66 (m, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 164.02, 156.12, 152.64, 151.30, 149.38, 141.19, 140.06, 124.64, 124.28, 119.28, 118.22, 110.19, 87.68, 82.29, 72.67, 72.61, 34.47.

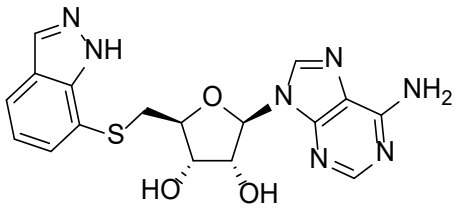
(2S,3S,4R,5R)-2-(((1H-Benzo[d]imidazol-2-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl) tetrahydrofuran-3,4-diol (15)



To a solution of compound **45l** (103 mg, 0.16 mmol) in MeOH (4 mL) was added potassium fluoride (77 µL, 3.28 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.1% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-100%) to afford compound **15** (40.5 mg, 62% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{17}N_7O_3S$

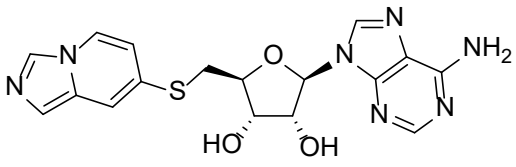
400.1178; found 400.1201. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.39 (s, 1H), 8.15 (s, 1H), 7.44 - 7.42 (m, 2H), 7.30 (s, 2H), 7.15 - 7.05 (m, 2H), 5.97 (d, J = 6 Hz, 1H), 5.53 - 5.52 (m, 1H), 4.84 - 4.83 (m, 1H), 4.25 - 4.19 (m, 2H), 3.80 - 3.73 (m, 1H), 3.67 - 3.62 (m, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 156.10, 152.67, 149.93, 149.48, 139.92, 121.28, 119.23, 87.43, 82.90, 72.71, 72.64, 33.84.

(2S,3S,4R,5R)-2-(((1H-Indazol-7-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl)tetrahydrofuran-3,4-diol (16)



To a solution of compound **45m** (10.0 mg, 15.9 µmol) in MeOH (2 mL) was added potassium fluoride (7.5 µL, 319 µmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.1% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-100%) to afford compound **16** (3.86 mg, 61%). HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{17}N_7O_3S$ 400.4378; found 400.1187. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.36 (s, 1H), 8.17 - 8.13 (m, 2H), 7.69 - 7.66 (m, 1H), 7.41 - 7.38 (m, 1H), 7.31 - 7.28 (s, 2H), 7.07 (t, J = 7.6Hz, 1H), 5.89 (d, J = 6Hz, 1H), 4.82 (t, J = 5.6Hz, 1H), 4.23 - 4.81 (m, 1H), 4.02 - 3.98 (m, 1H), 3.58 - 3.55 (m, 2H).

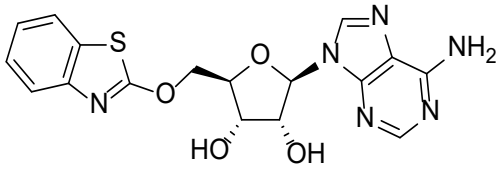
(2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridine-7-ylsulfanylmethyl) tetrahydrofuran-3,4-diol (17)



To a solution compound **45n** (100 mg, 0.16 mmol) in MeOH (2 mL) was added potassium fluoride (92.5 mg, 1.59 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and concentrated under reduced pressure. The residue was purified by reverse column

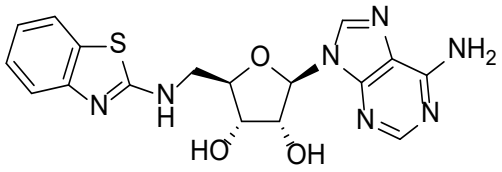
chromatography (100 Å; 0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-25%) to afford compound **17** (22.2 mg, 33% yield) as a green solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{17}N_7O_3S$ 400.1192; found 400.1176. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.36 (s, 1H), 8.27 (s, 1H), 8.24 (d, *J* = 7.6 Hz, 1H), 8.15 (s, 1H), 7.43 (s, 1H), 7.29 (s, 2H), 7.16 (s, 1H), 6.57 (dd, *J* = 7.2, 1.6 Hz, 1H), 5.90 (d, *J* = 6.0 Hz, 1H), 5.82 (s, 1H), 4.80 (t, *J* = 5.6 Hz, 1H), 4.22 (t, *J* = 4.0 Hz, 1H), 4.06 - 4.02 (m, 1H), 3.43 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.36 - 3.34 (m, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 156.10, 152.65, 149.45, 139.94, 129.72, 128.36, 127.00, 123.18, 119.20, 118.04, 114.31, 113.30, 87.53, 82.71, 72.82, 72.69, 34.62.

(2*R*,3*R*,4*S*,5*R*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-yloxymethyl)tetrahydrofuran-3,4-diol (23)



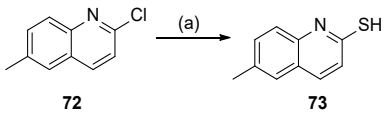
To a solution of compound **45o** (30.0 mg, 47.7 µmol) in THF (3 mL) was added *N*,*N*-diethylethanamine trihydrofluoride (23.1 mg, 143 µmol). The reaction mixture was stirred at RT for 16 h and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 5) to afford compound **23** (8.15 mg, 42% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{16}N_6O_4S$ 401.1032; found 401.1031. ^{1}H NMR (400 MHz, DMSO-d_6): 8.32 (s, 1H), 8.13 (s, 1H), 7.61 (d, *J* = 7.6 Hz, 1H), 7.32 (s, 1H), 7.29 (d, *J* = 5.6 Hz, 1H), 7.17 (t, *J* = 7.6 Hz, 1H), 7.13 (t, *J* = 7.6 Hz, 1H), 6.87 (d, *J* = 5.2 Hz, 1H), 5.57 (d, *J* = 6.0 Hz, 1H), 5.42 (d, *J* = 5.2 Hz, 1H), 4.77 (q, *J* = 5.2 Hz, 1H), 4.35 (t, *J* = 9.2 Hz, 1H), 4.30 - 4.28 (m, 1H), 4.25 - 4.23 (m, 2H). SFC (Method 1) de% = 100%.

2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(1,3-benzothiazol-2-ylamino)methyl] tetrahydrofuran-3,4-diol (24)



To a solution of **45p** (35.0 mg, 55.7 µmol) in THF (4 mL) was added *N*,*N*-diethylethanamine trihydrofluoride (17.9 mg, 111 µmol). The reaction mixture was stirred at RT for 16 h and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 6), followed by (Method 7) to afford compound **24** (4.01 mg, 17% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{17}H_{17}N_7O_3S$ 400.1192; found 400.1197. ^{1}H NMR (400 MHz, DMSO-d_6): δ 9.45 (s, 1H), 8.33 (s, 1H), 8.14 (s, 1H), 7.45 (d, *J* = 7.2 Hz, 1H), 7.32 (d, *J* = 8.4 Hz, 1H), 7.29 (s, 2H), 7.09 (dd, *J* = 8.0, 0.8 Hz, 1H), 6.97 (t, *J* = 7.2 Hz, 1H), 5.88 (d, *J* = 5.6 Hz, 1H), 5.49 (d, *J* = 6.0 Hz, 1H), 5.36 (s, 1H), 4.81 (q, *J* = 5.2 Hz, 1H), 4.17 (t, *J* = 3.6 Hz, 1H), 3.94 - 3.93 (m, 1H), 3.23 - 3.19 (m, 2H). SFC (Method 1) de% = 100%.

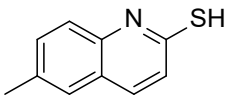
Scheme S2



72 73

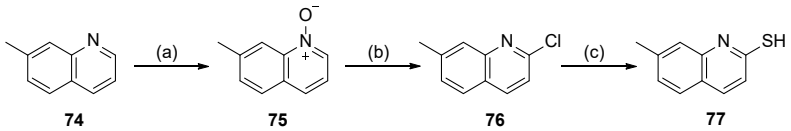
(a) thiourea, EtOH, 80 °C, 16 h, 63%

6-Methylquinoline-2-thiol (73)



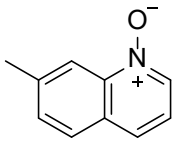
To a solution of 2-chloro-6-methyl-quinoline **72** (200 mg, 1.13 mmol) in EtOH (4 mL) was added thiourea (257 mg, 3.38 mmol) and the reaction mixture was stirred at 80 °C for 16 h. The mixture was cooled to RT, filtered, and the resulting filter-cake was dried under reduced pressure to afford compound **73** (125 mg, 63% yield) as a yellow solid. The isolated material was used in the following step without any further purification. LCMS (ES^+, Method 3) *m/z* 176.1 $[M+H]^+$. ^{1}H NMR (400 MHz, DMSO-d_6): δ 13.62 (s, 1H), 7.76 (d, *J* = 8.8 Hz, 1H), 7.57 - 7.45 (m, 3H), 7.23 (d, *J* = 9.2 Hz, 1H), 2.37 (s, 3H).

Scheme S3



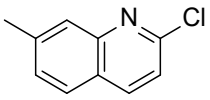
(a) m-CPBA, DCM, RT, 16 h, 72%; (b) $POCl_3$, toluene, 70 °C, 16 h, 68%; (c) thiourea, EtOH, 80 °C, 16 h, 76%

7-Methyl-1-oxido-quinolin-1-ium (75)



To a solution of 7-methylquinoline **74** (1.00 g, 6.98 mmol) in DCM (15 mL) was added meta-chloroperoxybenzoic acid (2.13 g, 10.5 mmol, 85% purity) and stirred at RT for 16 h. The reaction mixture was quenched with sat. aq. sodium bicarbonate solution (20 mL) and extracted with DCM (3 x 10mL). The combined organic layers were dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-5%) to afford compound **75** (800 mg, 72% yield) as a brown solid. LCMS (ES^+, Method 2) *m/z* 160.1 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.54 (d, *J* = 6.0 Hz, 1H), 8.35 (s, 1H), 7.98 (d, *J* = 8.4 Hz, 1H), 7.88 (d, *J* = 8.4 Hz, 1H), 7.57 (d, *J* = 8.4 Hz, 1H), 7.41 - 7.38 (m, 1H), 2.55 (s, 3H).

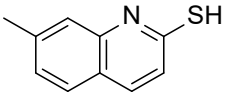
2-Chloro-7-methyl-quinoline (76)



To a solution of compound **75** (500 mg, 3.14 mmol) in toluene (8 mL) was added phosphoryl chloride (583 µL, 6.28 mmol), and stirred at 70 °C for 16 h. The reaction mixture was cooled to 0 °C, quenched with water (20 mL), and the aqueous layer extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (3 x 10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **76** (380 mg, 68% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 340.5 $[M+H]^+$.

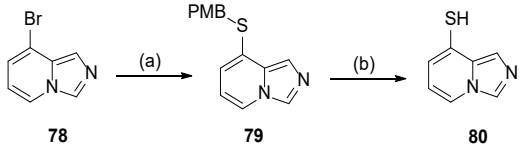
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.05 (d, J = 8.4 Hz, 1H), 7.80 (s, 1H), 7.71 (d, J = 8.4 Hz, 1H), 7.40 (dd, J = 8.0, 0.8 Hz, 1H), 7.32 (d, J = 8.8 Hz, 1H), 2.57 (s, 3H).

7-Methylquinoline-2-thiol (77)



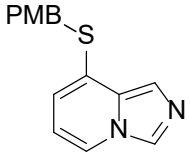
To a solution of compound **76** (200 mg, 1.13 mmol) in EtOH (3 mL) was added thiourea (257 mg, 3.38 mmol) and stirred at 80 °C for 16 h. The reaction mixture was cooled to RT and filtered. The filter-cake was collected and dried under reduced pressure to afford compound **77** (150 mg, 76% yield) as a yellow solid. The isolated material was used in the following step without any further purification. LCMS (ES^+, Method 4) *m/z* 176.1 $[M+H]^+$. ^{1}H NMR (400 MHz, DMSO-d_6): δ 13.58 (s, 1H), 7.78 (d, J = 8.8 Hz, 1H), 7.66 (d, J = 8.0 Hz, 1H), 7.40 (s, 1H), 7.20 - 7.17 (m, 2H), 2.41 (s, 3H).

Scheme S4



(a) (4-methoxyphenyl) methanethiol, $Pd_2(dba)_3$, Xantphos, Cs_2CO_3, DMF, 100 °C, 16 h, 55%; (b) TFA, 70 °C, 16 h, 72%

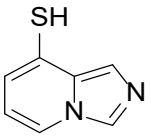
8-[(4-methoxyphenyl)methylsulfanyl]imidazo[1,5-a]pyridine (79)



To a solution of 8-bromoimidazo[1,5-a]pyridine **78** (200 mg, 1.02 mmol) in DMF (5 mL) was added (4-methoxyphenyl)methanethiol (172 mg, 1.12 mmol), $Pd_2(dba)_3$ (46.5 mg, 0.05 mmol), Xantphos (58.7 mg, 0.10 mmol) and cesium carbonate (992 mg, 3.05 mmol) under inert atmosphere. The resulting mixture was stirred at 100 °C for 16 h. The reaction mixture was

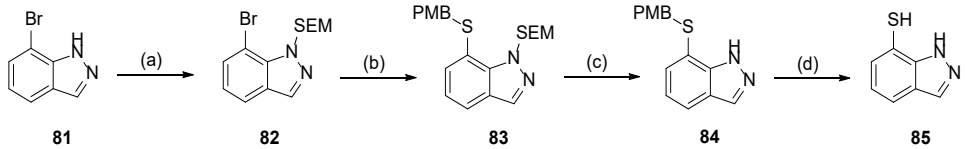
cooled to RT, quenched with water (50 mL) and extracted with EtOAc (3 x 20 mL). The combined organic layers were washed with brine (3 x 20 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **79** (150 mg, 55% yield) as a brown solid. LCMS (ES^+, Method 1) *m/z* 271.1 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.13 (s, 1H), 7.80 (d, *J* = 6.8 Hz, 1H), 7.54 (s, 1H), 7.24 (d, *J* = 8.8 Hz, 2H), 6.86 - 6.82 (m, 2H), 6.58 (d, *J* = 6.4 Hz, 1H), 6.48 (t, *J* = 7.2 Hz, 1H), 4.18 (s, 2H), 3.80 (s, 3H).

Imidazo[1,5-a]pyridine-8-thiol (80)



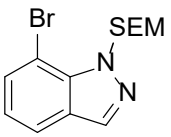
A solution of compound **79** (150 mg, 555 µmol) in trifluoroacetic acid (2 mL) was stirred at 70 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% TFA in water/MeCN gradient 0%-15%) to afford compound **80** (60.0 mg, 72% yield) as brown solid. ^1H NMR (400 MHz, $CDCl_3$): δ 8.25 (s, 1H), 7.90 (d, *J* = 7.2 Hz, 1H), 7.60 (s, 1H), 6.96 (d, *J* = 6.8 Hz, 1H), 6.55 (t, *J* = 6.8 Hz, 1H).

Scheme S5



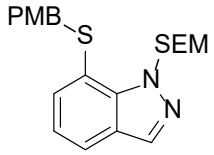
(a) SEM-Cl, NaH, THF, RT, 16 h, 66%; (b) (4-methoxyphenyl) methanethiol, $Pd_2(dba)_3$, Xantphos, Cs_2CO_3, dioxane, 100 °C, 16 h, 74%; (c) TBAF, 70 °C, 16 h, 22%; (d) TFA, 70 °C, 16 h, 50%

7-Bromo-1-((2-(trimethylsilyl)ethoxy)methyl)-1H-indazole (82)



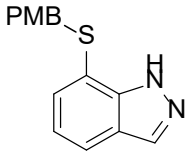
To a solution of 7-bromo-1H-indazole **81** (2.00 g, 10.2 mmol) in THF (20 mL) was added NaH (487 mg, 12.2 mmol, 60% dispersion in mineral oil) under inert atmosphere at 0 °C and stirred for 30 min. 2-(Trimethylsilyl)ehtoxymethyl chloride (2.16 mL, 12.2 mmol) was then added and stirred at RT for 16 h. The reaction mixture was quenched with water (100 mL) and extracted with EtOAc (3 × 50 mL). The combined organic layers were washed with brine (50 mL), dried over sodium sulfate, filtered, and concentrated under reduced pressure. The residue was purified by purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-30%) to afford compound **82** (2.2 g, 66% yield) as a yellow liquid. LCMS (ES^+, Method 2) *m/z* 269.0 $[M+H]^+$. ^1H NMR (400 MHz, CD_3OD): δ 8.04 (s, 1H), 7.71 - 7.68 (m, 1H), 7.62 - 7.60 (m, 1H), 7.05 (t, *J* = 7.6 M Hz, 1H), 6.09 (s, 2H), 3.59 (t, *J* = 8.0 M Hz, 2H), 0.90 (t, *J* = 8.4 M Hz, 2H), -0.067 (s, 9H).

7-((4-Methoxybenzyl)thio)-1-((2-(trimethylsilyl)ethoxy) methyl)- 1H-indazole (83)



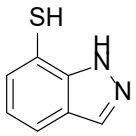
To a solution of compound **82** (2.20 g, 6.72 mmol) in DMF (20 mL) was added (4-methoxyphenyl) methanethiol (1.12 mL, 8.07 mmol), $Pd_2(dba)_3$ (308 mg, 0,34 mmol), Xantphos (389 mg, 0.67 mmol) and cesium carbonate (6.57 g, 20.2 mmol) under inert atmosphere. The resulting mixture was heated at 100 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and then extracted with EtOAc (3 × 20 mL). The combined organic layers were washed with brine (20 mL), dried over sodium sulphate, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-20%) to afford compound **83** (2.00 g, 74% yield) as yellow liquid. LCMS (ES^+, Method 1) *m/z* 400.9 $[M+H]^+$.

S7-((4-Methoxybenzyl)thio)-1H-indazole (84)



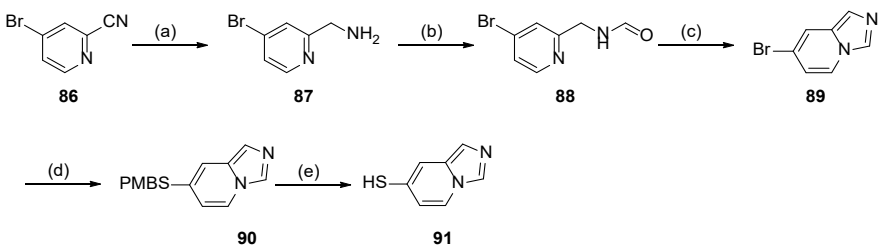
A mixture of compound **83** (1.66 g, 3.25 mmol) and TBAF (15 mL, 10.0 mmol, 1 M in THF) was stirred at 70 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (15 mL) and extracted with EtOAc (3 × 15 mL). The combined organic layers were washed with brine (15 mL), dried over sodium sulphate, filtered and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-20%) to afford compound **84** (360 mg, 22% yield) as a yellow solid. LCMS (ES^+, Method 1) *m/z* 271.2 $[M+H]^+$.

1H-Indazole-7-thiol (85)



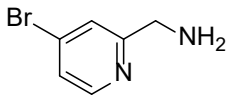
A solution of compound **84** (360 mg, 1.33 mmol) in trifluoroacetic acid (3.00 mL, 40.5 mmol) was stirred at 70 °C for 16 h. The reaction mixture was cooled to RT concentrated under reduced pressure and the residue was purified by flash column chromatography (SWPAFLASH® SW040 Bonded Spherical C18, 20-45µm, 100 Å; 0.1% TFA in water/MeCN gradient 0-100%) to afford compound **85** (100 mg, 50% yield) as a yellow solid. LCMS (ES^+, Method 3) *m/z* 151.1 $[M+H]^+$. ^1H NMR (400 MHz, CD_3OD): δ 8.14 (s, 1H), 7.81 - 7.79 (m, 1H), 7.11 - 7.09 (m, 1H) 7.00 - 6.96 (m, 1H).

Scheme S6



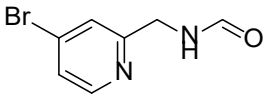
(a) BH_3-THF, THF, RT, 16 h, 49%; (b) HCO_2H, 100 °C, 3 h; (c) TFAA, DCM, RT, 1 h, 43%; (d) (4-methoxyphenyl)methanethiol, $Pd_2(dba)_3$, Xantphos, Cs_2CO_3, dioxane, 100 °C, 16h, 85%, (e) TFA, 70 °C, 16 h, 67%

(4-Bromo-2-pyridyl)methanamine (87)



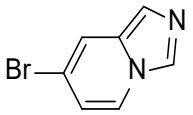
To a solution of 4-bromopyridine-2-carbonitrile **86** (3.00 g, 16.3 mmol) in THF (30 mL) was added dropwise borane (75.0 mL, 1 M in THF) under inert atmosphere and stirred at RT for 16 h. The reaction mixture was cooled to 0 °C, HCl (75.0 mL, 2M aq.) was then added and heated to 80 °C for 30 min. The reaction mixture was cooled to RT, basified to pH = 8 using 2M aq. sodium hydroxide and then extracted with EtOAc (3 x 30 mL). The combined organic layers were washed with brine (30 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-30%) to afford compound **87** (1.50 g, 48.9% yield) as yellow oil. LCMS (ES^+, Method 5) *m/z* 189.0 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.37 (d, *J* = 5.6 Hz, 1H), 7.74 (d, *J* = 1.6 Hz, 1H), 7.51 (dd, *J* = 5.2, 2.0 Hz, 1H), 3.82 (s, 2H).

***N*-[(4-Bromo-2-pyridyl)methyl]formamide (88)**



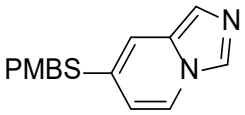
A solution of (4-bromo-2-pyridyl)methanamine **87** (1.5 0g, 8.02 mmol) in formic acid (75.00 mL, 1.99 mol) was heated to 100 °C and stirred for 3 h. The mixture was cooled to RT and concentrated under reduced pressure. The residue was dissolved in sat. aq. sodium bicarbonate solution (50 mL) and extracted with DCM (3 x 50 mL). The combined organic layers were concentrated under reduced pressure to afford crude compound **88** which was used in the following step without any further purification (1.70 g) as a yellow solid. ^1H NMR (400 MHz, $CDCl_3$): δ 8.37 (d, J = 5.2 Hz, 1H), 8.34 (s, 1H), 7.49 (s, 1H), 7.41 (d, J = 5.2 Hz, 1H), 4.60 (d, J = 5.2 Hz, 2H).

7-Bromoimidazo[1,5-a]pyridine (89)



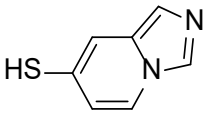
To a solution of compound **88** (1.7 g, 7.91 mmol) in DCM (20 mL) was added trifluoroacetic anhydride (1.21 mL, 8.70 mmol) at 0 °C. The reaction mixture was warmed gradually to RT and stirred for 1 h. The reaction was quenched with sat. aq. sodium bicarbonate solution (2 mL) and water (10 mL), and the mixture was extracted with DCM (3 x 5 mL). The combined organic layers were dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **89** (680 mg, 43% yield) as yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.09 (s, 1H), 7.80 (d, J = 7.2 Hz, 1H), 7.64 (s, 1H), 7.37 (s, 1H), 6.62 (dd, J = 7.2, 1.2 Hz, 1H).

7-[(4-Methoxyphenyl)methylsulfanyl]imidazo[1,5-a]pyridine (90)



To a solution of compound **89** (680 mg, 3.45 mmol) in DMF (10 mL) was added (4-methoxyphenyl)methanethiol (527 µL, 3.80 mmol), $Pd_2(dba)_3$ (158 mg, 0.17 mmol), Xantphos (199mg, 0.35 mmol) and cesium carbonate (3.37 g, 10.3 mmol) under inert atmosphere and stirred at 100 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (3 x 10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **90** (800 mg, 85% yield) as yellow oil. LCMS (ES^+, Method 6) *m/z* 271.1 $[M+H]^+$. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (d, *J* = 4.4 Hz, 2H), 7.80 (d, *J* = 7.6 Hz, 1H), 7.28 (d, *J* = 5.2 Hz, 1H), 7.25 - 7.22 (m, 2H), 6.85 - 6.83 (m, 2H), 6.44 (dd, *J* = 7.2, 1.6 Hz, 1H), 4.08 (s, 2H), 3.79 (s, 3H).

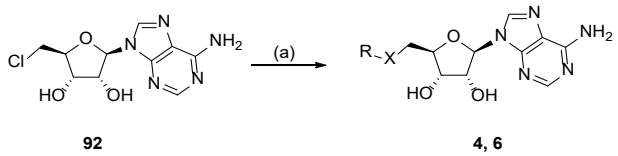
Imidazo[1,5-a]pyridine-7-thiol (91)



A solution of compound **90** (800 mg, 2.96 mmol) in trifluoroacetic acid (16.00 mL 216.1 mmol) was heated to 70 °C and stirred for 16 h. The reaction mixture was cooled to RT and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% TFA in water/MeCN gradient 0-10%) to afford compound **91** (300 mg, 67% yield) as a yellow solid. ^{1}H NMR (400 MHz, DMSO-d_6): δ 9.00 (s, 1H), 8.46 (d, J = 8.4 Hz, 1H), 7.90 (s, 1H), 7.70 (s, 1H), 7.01 (d, J = 7.6 Hz, 1H).

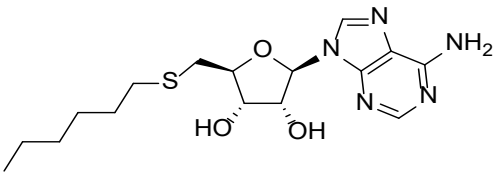
1.9.2 Synthesis of compounds 4 and 6

Scheme S7



(a) R-XH, NaO^{t}Bu, DMF, 75 °C, 10 h, 44-67%.

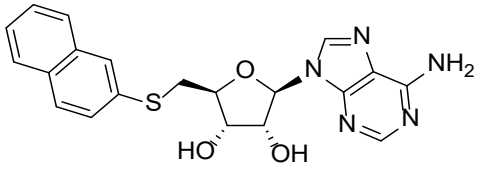
(2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-((hexylthio)methyl)tetrahydrofuran-3,4-diol (4)



To a solution of (2R,3R,4S,5S)-2-(6-amino-9H-purin-9-yl)-5-(chloromethyl)tetrahydrofuran-3,4-diol **92** (500 mg, 1.75 mmol) in DMF (10 mL) was added hexane-1-thiol (494 µL, 3.50 mmol), potassium t-butoxide (393 mg, 3.50 mmol) and stirred at 75 °C for 10 h . The reaction mixture was cooled to RT and quenched with water. The resulting suspension was filtered off and the isolated solid material was dissolved in DMF. To the solution was then added water and the resulting precipitate was filtered off and washed with MeCN to afford compound **4** (222 mg, 34% yield) as a white solid. LCMS (ES$^+$) m/z 368.4 [M+H]$^+$. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.35 (s, 1H) 8.14 (s, 1H) 7.29 (s, 2H) 5.88 (d, J = 5.58 Hz, 1H) 5.49 (d, J = 5.83 Hz, 1H) 5.31

(d, *J* = 5.07 Hz, 1H) 4.77 (d, *J* = 5.32 Hz, 1H) 4.10 - 4.19 (m, 1H) 3.92 - 4.05 (m, 1H) 2.74 - 2.94 (m, 2H) 2.45 - 2.49 (m, 2H) 1.36 - 1.52 (m, 2H) 1.09 - 1.31 (m, 6H) 0.72 - 0.89 (m, 3H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 156.09, 152.62, 149.46, 139.90, 119.19, 87.42, 84.23, 72.63, 72.53, 33.93, 31.85, 30.77, 29.11, 27.84, 21.99, 13.89. $[\alpha]_D^{20}$ = +30.7 (c=0.01, MeOH).

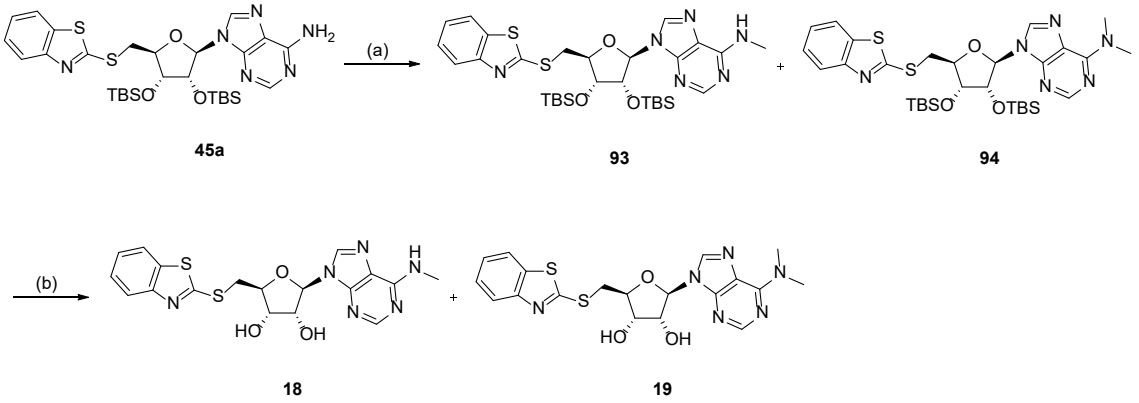
(2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-((naphthalen-2-ylthio)methyl)tetrahydrofuran-3,4-diol (6)



To a solution of (2R,3R,4S,5S)-2-(6-amino-9H-purin-9-yl)-5-(chloromethyl)tetrahydrofuran-3,4-diol **92** (500 mg, 1.75 mmol) in DMF (10 mL) was added 2-naphthalenethiol (561 mg, 3.50 mmol), potassium t-butoxide (393 mg, 3.50 mmol) and stirred at 75 °C for 10 h . The reaction mixture was cooled to RT and quenched with water. The resulting suspension was filtered off and the isolated solid material was dissolved in DMF. To the solution was then added water and the resulting precipitate was filtered off and washed with MeCN to afford compound **6** (480 mg, 67% yield) as a white solid. LCMS (ES$^+$) *m/z* 410.4 $[M+H]^+$. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.39 (s, 1 H) 8.16 (s, 1 H) 7.81 - 7.89 (m, 3 H) 7.75 - 7.80 (m, 1 H) 7.42 - 7.53 (m, 3 H) 7.32 (s, 2 H) 5.90 (d, *J* = 5.83 Hz, 1 H) 5.54 (d, *J* = 6.34 Hz, 1 H) 5.40 (d, *J* = 5.07 Hz, 1 H) 4.80 - 4.89 (m, 1 H) 4.19 - 4.29 (m, 1 H) 3.99 - 4.11 (m, 1 H) 3.50 - 3.59 (m, 1 H) 3.39 - 3.49 (m, 1 H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 156.12, 152.67, 149.48, 139.97, 133.55, 133.39, 131.12, 128.38, 127.60, 126.86, 126.69, 126.52, 125.64, 125.33, 119.23, 87.50, 82.89, 72.77, 72.61, 34.96.

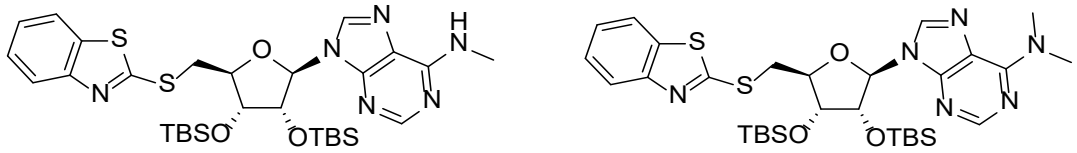
1.9.3 Synthesis of compounds 18 and 19

Scheme S8



(a) MeI, Cs_2CO_3, DMF, RT, 16 h, 58%; (b) $Et_3N{\cdot}3HF$, THF, RT, 16 h, 26-59%.

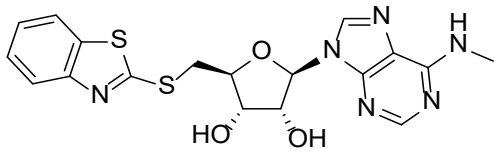
9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl(dimethyl) silyl] oxy]tetrahydrofuran-2-yl]-*N*-methyl-purin-6-amine (93) and 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*,*N*-dimethyl-purin-6-amine (94)



To a solution of compound **45a** (50.0 mg, 77.5 µmol) in DMF (1 mL) was added cesium carbonate (25.2 mg, 77.5 µmol) and methyl iodide (4.83 µL, 77.5 µmol) and stirred at RT for 16 h. The reaction mixture was quenched with water (20 mL) and extracted with EtOAc (3 x 30 mL). The combined organic layers were washed with brine (3 x 20 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **93** (30.0 mg, 58% yield) as yellow oil and compound **94** (30.0 mg, 58% yield) as yellow oil. Compound **93** LCMS (ES^+, Method 2) *m/z* 659.5 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): *δ* 8.41 (s, 1H), 7.91 (s, 1H), 7.85 (d, *J* = 7.6 Hz, 1H), 7.76 (d, *J* = 8.0 Hz, 1H), 7.42 (t, *J* = 7.6 Hz, 1H), 7.31 (t, *J* = 7.6 Hz, 1H), 5.87 (d, *J* = 6.8 Hz, 1H), 5.82 (s, 1H), 5.34 (dd, *J* = 5.6, 4.4 Hz, 1H), 4.50 (t, *J* = 6.0 Hz, 1H), 4.39 (d, *J* = 2.8 Hz, 1H), 4.05 (dd, *J* = 14.0, 6.4 Hz, 1H), 3.89 (dd, *J* = 14.0, 6.8 Hz, 1H), 3.23 (s, 3H), 0.93 (s, 9H), 0.76 (s, 9H), 0.12 (s, 6H), -0.12 (s, 3H), -0.38 (s, 3H). Compound **94** LCMS (ES^+, Method 3) *m/z* 673.2 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): *δ* 8.47 (s, 1H), 8.25 (s, 1H), 8.00 (d, *J* = 7.6 Hz, 1H), 7.81 (d, *J* = 8.0 Hz, 1H), 7.48 (td, *J* = 8.4, 1.2 Hz, 1H), 7.37 (td, *J* = 8.4, 1.2 Hz, 1H), 5.97 (d, *J* = 7.6 Hz, 1H), 5.27 (dd, *J* = 7.6, 4.4 Hz, 1H), 4.45 (d,

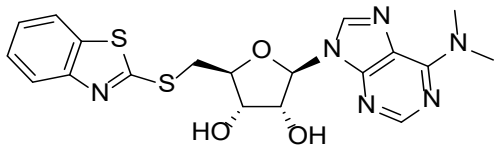
J = 4.4 Hz, 1H), 4.32 (t, *J* = 6.8 Hz, 1H), 4.07 - 4.04 (m, 1H), 3.80 (dd, *J* = 14.0, 7.2 Hz, 1H), 3.51 (s, 6H), 0.88 (s, 9H), 0.68 (s, 9H), 0.08 (s, 6H), -0.13 (s, 3H), -0.45 (s, 3H).

(2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5-[6-(methylamino)purin-9-yl]tetrahydrofuran-3,4-diol (18)



To a solution of compound **93** (30.0 mg, 45.5 µmol) in THF (2 mL) was added N,N-diethylethanamine trihydrofluoride (22.0 mg, 136 µmol) and stirred at 50 °C for 16 h. The reaction mixture was cooled to RT and concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 7) to afford compound **18** (5.10 mg, 26% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{18}H_{18}N_6O_3S_2$ 431.0960; found 431.0970; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.37 (s, 1H), 8.24 (s, 1H), 7.99 (d, *J* = 8.0 Hz, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.78 (s, 1H), 7.46 (td, *J* = 8.4, 1.2 Hz, 1H), 7.36 (td, *J* = 7.6, 1.2 Hz, 1H), 5.92 (d, *J* = 5.6 Hz, 1H), 5.56 (d, *J* = 6.0 Hz, 1H), 5. 46 (d, *J* = 4.8 Hz, 1H), 4.86 (q, *J* = 5.2 Hz, 1H), 4.29 - 4.22 (m, 2H), 3.86 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.75 (dd, *J* = 13.6, 7.6 Hz, 1H), 3.31 (s, 3H). SFC (Method 2) de% = 100%.

(*2S,3S,4R,5R*)-2-((benzo[d]thiazol-2-ylthio)methyl)-5-(6-(dimethylamino)-9H-purin-9-yl)tetrahydrofuran-3,4-diol (19)

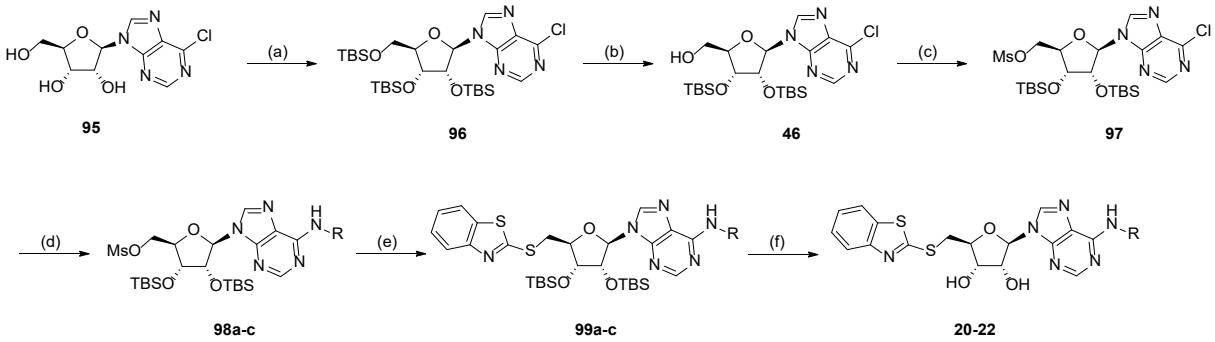


To a solution of compound **94** (200 mg, 297 µmol) in THF (5 mL) was added N,N-diethylethanamine;trihydrofluoride (143 mg, 891 µmol) and stirred at 50 °C for 16 h. The reaction mixture was cooled to RT and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-5%) and then triturated with MeOH (10 mL) to afford compound **19** (80.6 mg, 59% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{19}H_{20}N_6O_3S_2$ 445.1117; found 445.1135. ^{1}H

NMR (400 MHz, DMSO-d_6): δ 8.40 (s, 1H), 8.23 (s, 1H), 8.00 (d, *J* = 7.6 Hz, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.47 (td, *J* = 8.4, 1.2 Hz, 1H), 7.36 (td, *J* = 8.4, 1.2 Hz, 1H), 5.95 (d, *J* = 5.6 Hz, 1H), 5.47 (d, *J* = 5.2 Hz, 1H), 4.84 (q, *J* = 5.2 Hz, 1H), 4.29 - 4.23 (m, 2H), 3.86 (dd, *J* = 13.6, 5.2 Hz, 1H), 3.74 (dd, *J* = 13.6, 7.6 Hz, 1H), 3.46 (brs, 6H). SFC (Method 2) de% = 100%. $[\alpha]_D^{20}$ = +25.0 (c=0.1, MeOH).

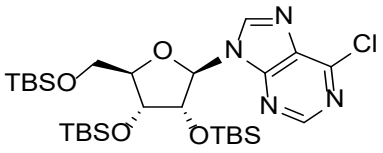
1.9.4 Synthesis of compounds 20-22

Scheme S9



(α) TBS-Cl, 1H-imidazole, DMF, RT, 16 h, 91%; (b) CCl_3COOH, THF, H2O, 0 °C, 56%; (c) Ms_2O, TEA, THF, RT, 18%; (d) TEA, KI, THF, RT, 32 h, 75-92%; (e) DMF, 50 °C, 16 h, 70-90%; (f) KF, MeOH, 60 °C, 16 h, 24-61%.

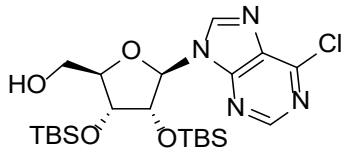
[(2*R*,3*R*,4*R*,5*R)*-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-(6- chloropurin-9-yl) tetrahydrofuran-2-yl]methoxy-tert-butyl-dimethyl-silane (96)



To a solution of (2*R*,3*R*,4*S*,5*R*)-2-(6-chloropurin-9-yl)-5-(hydroxymethyl)tetrahydrofuran- 3,4-diol **95** (10.0 g, 34.9 mmol) in DMF (40 mL) was added imidazole (26.1 g, 383 mmol) and *tert*-butylchlorodimethylsilane (28.9 g, 191 mmol). The resulting mixture was stirred at RT for 16 h. The reaction was quenched with water (200 mL) and extracted with EtOAc (3 x 100 mL). The combined organic layers were washed with brine (3 x 50 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-20%) to afford compound **96** (20.0 g, 91% yield) as a white solid. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.75 (s, 1H), 8.56 (s, 1H), 6.13 (d, *J* = 5.2 Hz, 1H), 4.59 (t, *J* = 4.4 Hz, 1H), 4.31 (t, *J* = 4.0 Hz, 1H), 4.18 - 4.15

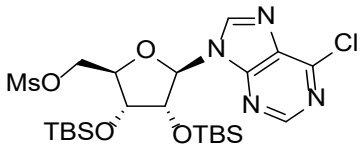
(m, 1H), 4.03 (dd, *J* = 11.6, 3.6 Hz, 1H), 3.81 (dd, *J* = 11.2, 3.2 Hz, 1H), 0.97 (s, 9H), 0.94 (s, 9H), 0.79 (s, 9H), 0.16 (s, 3H), 0.15 (s, 3H), 0.11 (s, 3H), 0.10 (s, 3H), -0.03 (s, 3H), -0.24 (s, 3H).

[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (6-chloropurin-9-yl) tetrahydrofuran-2-yl]methanol (46)



To a solution of compound **96** (5.00 g, 7.94 mmol) in THF (50 mL) was added dropwise a solution of 2,2,2-trichloroacetic acid (12.9 g, 79.4 mmol) in water (15 mL) at 0 °C. The reaction mixture was stirred at 0 °C for 1 h, before being quenched with sat. aq. sodium bicarbonate (50 mL). The aqueous layer was extracted with EtOAc (3 × 50 mL). The combined organic layers were washed with brine (2 × 30 mL), dried over sodium sulfate, filtered, and the filtrate concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 25%) to afford compound **46** (2.30 g, 56% yield) as a white solid. LCMS (ES^+, Method 7) *m/z* 515.2 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.79 (s, 1H), 8.21 (s, 1H), 5.89 (d, *J* = 8.0 Hz, 1H), 5.53 (brs, 1H), 4.99 (dd, *J* = 8.0, 0.8 Hz, 1H), 4.35 (d, *J* = 4.4 Hz, 1H), 4.20 (s, 1H), 3.97 (dd, *J* = 13.2, 2.0 Hz, 1H), 3.75 (d, *J* = 13.2 Hz, 1H), 0.96 (s, 9H), 0.75 (s, 9H), 0.14 (d, *J* = 5.2 Hz, 6H), -0.12 (s, 3H), -0.64 (s, 3H).

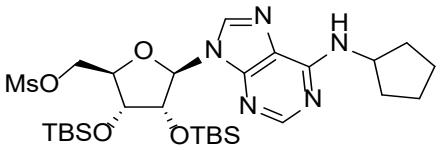
[(2R,3R,4R,5R)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (6-chloropurin-9-yl) tetrahydrofuran-2-yl]methyl methanesulfonate (97)



To a solution of compound **46** (2.20 g, 4.27 mmol) and triethylamine (11.9 mL, 85.4 mmol) in THF (10 mL) was added a solution of methanesulfonic anhydride (7.44 g, 42.7 mmol) in THF (10 mL). The reaction mixture was stirred at RT for 30 min before being quenched with sat. aq. sodium bicarbonate solution (20 mL). The aqueous layer was extracted with EtOAc (3 × 20 mL). The combined organic layers were washed with brine (2 × 10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduce pressure. The residue was purified by

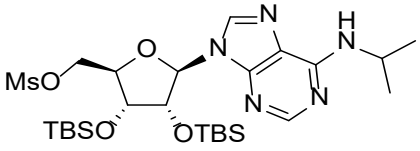
flash column chromatography (petroleum ether/ethyl acetate 18%) to afford compound **97** (2.10 g, 83% yield) as a white solid. LCMS (ES^+, Method 7) *m/z* 593.2 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.78 (s, 1H), 8.34 (s, 1H), 6.01 (d, *J* = 4.8 Hz, 1H), 4.92 - 4.89 (m, 1H), 4.61 - 4.59 (m, 1H), 4.49 - 4.44 (m, 1H), 4.38 - 4.35 (m, 2H), 3.05 (s, 3H), 0.94 (s, 9H), 0.82 (s, 9H), 0.14 (s, 3H), 0.13 (s, 3H), 0.01 (s, 3H), -0.20 (s, 3H).

[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[6- (cyclopentylamino)purin-9-yl]tetrahydrofuran-2-yl]methyl methanesulfonate (98a)



To a solution of compound **97** (500 mg, 0.85 mmol) in THF (5 mL) was added triethylamine (352 µL, 2.53 mmol), potassium iodide (69.9 mg, 0,42 mmol) and cyclopentanamine (332 µL, 3.37 mmol). The reaction mixture was stirred at RT for 32 h and then concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-75%) to afford compound **98a** (420 mg, 77% yield) as colorless oil. LCMS (ES^+, Method 1) *m/z* 642.4 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.34 (s, 1H), 7.85 (s, 1H), 5.86 (d, J=4.8Hz, 1H), 5.82 (s, 1H), 5.03 (t, *J* = 4.8 Hz, 1H), 4.60 (dd, *J* = 11.2, 4.0 Hz, 1H), 4.53 (dd, *J* = 11.2, 4.0 Hz, 1H), 4.42 (t, *J* = 4.0 Hz, 1H), 4.33 - 4.31 (m, 1H), 2.99 (s, 3H), 2.16 - 2.10 (m, 2H), 1.80 - 1.76 (m, 2H), 1.73 - 1.68 (m, 2H), 1.58 - 1.56 (m, 2H), 0.94 (s, 9H), 0.82 (s, 9H), 0.14 (s, 3H), 0.13 (s, 3H), -0.02 (s, 3H), -0.23 (s, 3H).

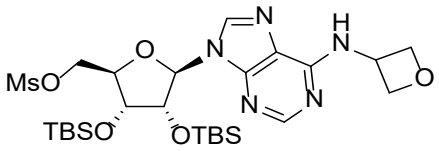
((2R,3R,4R,5R)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-(6-(isopropylamino)-9H-purin-9-yl)tetrahydrofuran-2-yl)methyl methanesulfonate (98b)



To a solution of compound **97** (250 mg, 0.42 mmol) in THF (2 mL) was added triethylamine (176 µL, 1.26 mmol), potassium iodide (35.0 mg, 0.21 mmol) and propan-2-amine (1.45 µL, 1.69 mmol). The reaction mixture was stirred at RT for 16 h and then concentrated under

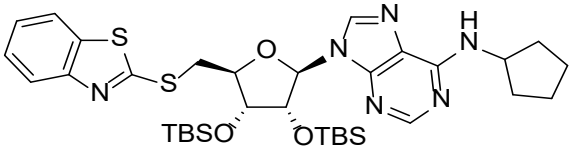
reduced pressure. The residue was purified by preparative TLC (SiO_2, petroleum ether/ethyl acetate 75%) to afford compound **98b** (230 mg, 92% yield) as yellow oil. LCMS (ES^+, Method 1) *m/z* 616.3 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.34 (s, 1H), 7.86 (s, H), 5.87 (d, *J* = 4.8 Hz, 1H), 5.75 - 5.65 (m, 1H), 5.03 (t, *J* = 4.8Hz, 1H), 4.63 - 4.59 (m, 1H), 4.56 - 4.51 (m, 1H), 4.43 - 4.41 (m, 1H), 4.34 - 4.31 (m, 1H), 2.99 (s, 3H), 1.34 - 1.32 (m, 6H), 1.29 - 1.22 (m, 1H), 0.98 - 0.89 (m, 10H), 0.86 - 0.79 (m, 10H), 0.15 - 0.13 (m, 6H), -0.22 (s, 3H).

[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[6-(oxetan -3-ylamino)purin-9-yl]tetrahydrofuran-2-yl]methyl methanesulfonate (98c)



To a solution of compound **97** (500 mg, 0.84 mmol) in THF (5 mL) was added triethylamine (352 µL, 2.53 mmol), potassium iodide (69.9 mg, 0.42 mmol) and oxetan-3-amine (246mg, 3.37 mmol). The reaction mixture was stirred at RT for 16 h and then concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-20%) to afford compound **98c** (400 mg, 75% yield) as a colorless oil. LCMS (ES^+, Method 3) *m/z* 630.1 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.34 (s, 1H), 7.93 (s, 1H), 5.88 (d, *J* = 5.2 Hz, 1H), 5.47 (s, 1H), 5.07 (t, *J* = 7.2 Hz, 2H), 5.01 (t, *J* = 4.4 Hz, 1H), 4.70 - 4.66 (m, 2H), 4.60 (dd, *J* = 11.2, 4.4 Hz, 1H), 4.52 (dd, *J* = 10.8, 5.2 Hz, 1H), 4.40 (t, *J* = 4.0 Hz, 1H), 4.33 - 4.31 (m, 1H), 3.00 (s, 3H), 0.95 (s, 9H), 0.81 (s, 9H), 0.14 (s, 3H), 0.13 (s, 3H), -0.02 (s, 3H), -0.24 (s, 3H).

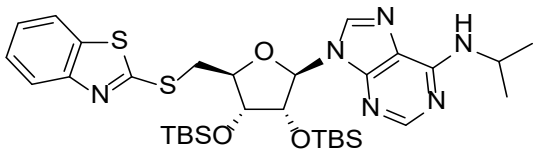
9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*-cyclopentyl-purin-6-amine (99a)



To a solution of compound **98a** (400 mg, 0.62 mmol) in DMF (5 mL) was added 1,3-benzothiazol-2-ylsulfanyl sodium (353mg, 1.87 mmol) and stirred at 50 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (30 mL) and extracted with EtOAc (3

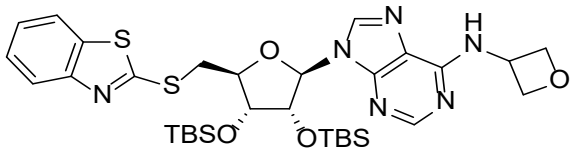
x 15 mL). The combined organic layers were washed with brine (3 x 10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-100%) to afford compound **99a** (400 mg, 90% yield) as a white solid. LCMS (ES^+, Method 3) *m/z* 713.3 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.37 (s, 1H), 7.86 (s, 1H), 7.84 (s, 1H), 7.75 (d, *J* = 8.0 Hz, 1H), 7.44 - 7.40 (m, 1H), 7.32 - 7.28 (m, 1H), 5.87 - 5.84 (m, 2H), 5.33 (dd, *J* = 6.4, 4.4 Hz, 1H), 4.49 (td, *J* = 6.8, 1.6 Hz, 1H), 4.39 (dd, *J* = 4.0, 2.0 Hz, 1H), 4.05 (dd, *J* = 14.0, 6.0 Hz, 1H), 3.87 (dd, *J* = 14.0, 7.2 Hz, 1H), 2.18 - 2.12 (m, 2H), 1.74 - 1.67 (m, 4H), 1.63 - 1.55 (m, 2H), 0.93 (s, 9H), 0.76 (s, 9H), 0.12 (s, 3H), 0.11 (s, 3H), -0.11 (s, 3H), -0.36 (s, 3H).

9-((2R,3R,4R,5S)-5-((Benzo[d]thiazol-2-ylthio)methyl)-3,4-bis((tert-butyldimethylsilyl) oxy)tetrahydrofuran-2-yl)-N-isopropyl-9H-purin-6-amine (99b)



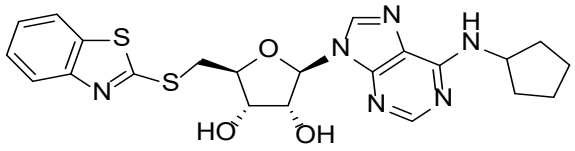
To a solution of compound **98b** (230 mg, 0.37 mmol) in DMF (3 mL) was added 1,3-benzothiazol-2-ylsulfanyl sodium (212 mg, 1.12 mmol) and stirred at 50 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (5 mL) and then extracted with EtOAc (3 × 10 mL). The combined organic layers were washed with brine (15 mL), dried over sodium sulfate**,** filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by preparative TLC (SiO_2, petroleum ether/ethyl acetate 83%) to afford compound **99b** (180 mg, 70% yield) as a colorless oil. LCMS (ES^+, Method 3) *m/z* 687.4 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.36 (s, 1H), 7.90-7.83 (m, 2H), 7.78 - 7.74 (m, 1H), 7.49 - 7.43 (m, 1H), 7.42 - 7.38 (m, 1H), 7.37 - 7.32 (m, 1H), 5.89 - 5.85 (d, *J* = 16 Hz, 1H), 5.80 - 5.60 (m, 1H), 5.40 - 5.27 (m, 1H), 4.53 - 4.45 (m, 1H), 4.43 - 4.36 (m, 1H), 4.08 - 4.01 (m, 1H), 3.93 - 3.83 (m, 1H), 1.36 - 1.33 (m, 6H), 0.93 (s, 9H), 0.76 (s, 9H), 0.12 (d, *J* = 1.6 Hz, 6H), -0.11 (s, 3H), -0.36 (s, 3H).

9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*-(oxetan-3-yl)purin-6-amine (99c)



To a solution of compound **98c** (180 mg, 285 µmol) in DMF (3 mL) was added 1,3-benzothiazol-2-ylsulfanyl sodium (162 mg, 857 µmol) and stirred at 50 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (30 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-100%) to afford compound **99c** (150 mg, 75% yield) as a white solid. LCMS (ES^+, Method 3) *m/z* 701.2 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.36 (s, 1H), 7.93 (s, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.75 (d, *J* = 8.0 Hz, 1H), 7.44 - 7.40 (m, 1H), 7.33 - 7.29 (m, 1H), 6.62 (d, *J* = 6.8 Hz, 1H), 5.88 (d, *J* = 6.4 Hz, 1H), 5.49 - 5.48 (m, 1H), 5.29 (dd, *J* = 6.0, 4.0 Hz, 1H), 5.07 (t, *J* = 6.8 Hz, 1H), 4.70 (q, *J* = 6.0 Hz, 2H), 4.50 (td, *J* = 6.8, 1.6 Hz, 1H), 4.38 (dd, *J* = 4.4, 2.0 Hz, 1H), 4.03 (dd, *J* = 14.0, 6.0 Hz, 1H), 3.86 (dd, *J* = 14.0, 7.2 Hz, 1H), 0.92 (s, 9H), 0.75 (s, 9H), 0.12 (s, 3H), 0.11 (s, 3H), -0.12 (s, 3H), -0.38 (s, 3H).

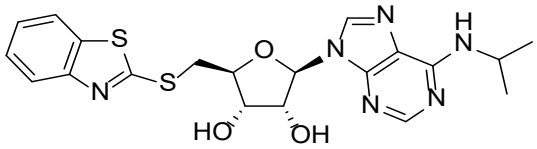
(2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5- [6-(cyclopentylamino)purin-9-yl]tetrahydrofuran-3,4-diol (20)



To a solution of compound **99a** (400 mg, 0.56 mmol) in MeOH (8 mL) was added potassium fluoride (325 mg, 5.61 mmol). The reaction mixture was stirred at 50 °C for 16 h, cooled to RT and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-25%) to afford compound **20** (166 mg, 61% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{22}H_{24}N_6O_3S_2$ 485.1430; found 485.1448. ^1H NMR (400 MHz, DMSO-d_6): δ 8.37 (s, 1H), 8.21 (s, 1H), 8.00 (d, *J* = 8.0 Hz, 1H), 7.86 (d, *J* = 8.0 Hz, 1H), 7.73 (d, *J* = 6.4 Hz, 1H), 7.47 (td, *J* = 8.0, 0.8 Hz, 1H), 7.37 (td, *J* = 8.0, 0.8 Hz, 1H), 5.93 (d, *J* = 6.0 Hz, 1H), 5.56 (d, *J* = 6.0 Hz, 1H), 5.47 (d, *J* = 4.8 Hz, 1H), 4.87 (q, *J* = 5.2 Hz, 1H), 4.53 (br.s, 1H), 4.30 - 4.27 (m, 1H), 4.25 - 4.23 (m, 1H), 3.87 (dd, *J* = 13.6,

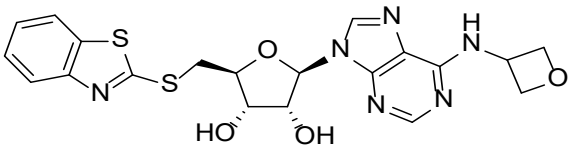
5.6 Hz, 1H), 3.75 (dd, *J* = 13.6, 7.6 Hz, 1H), 2.00 - 1.92 (m, 2H), 1.78 - 1.69 (m, 2H), 1.64 - 1.54 (m, 4H). $[\alpha]_D^{20}$ = +59.0 (c=0.1, MeOH).

(2S,3S,4R,5R)-2-((benzo[d]thiazol-2-ylthio)methyl)-5-(6-(isopropylamino)-9H-purin-9-yl)tetrahydrofuran-3,4-diol (21)



To a solution of compound **99b** (180 mg, 0.26 mmol) in MeOH (3 mL) was added potassium fluoride (123 µL, 5.24 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.1% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-100%) to afford compound **21** (29.4 mg, 24% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{20}H_{22}N_6O_3S_2$ 459.1278; found 459.1292. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.37 (s, 1H), 8.21 - 8.18 (m, 1H), 8.00 (d, *J* = 7.6 Hz, 1H), 7.85 (d, J = 8 Hz, 1H), 7.61 - 7.59 (m, 1H), 7.47 (t, *J* = 7.6 Hz, 1H), 7.36 (t, *J* = 7.6 Hz, 1H), 5.92 (d, *J* = 5.6Hz, 1H), 5.56 (d, *J* = 6 Hz, 1H), 5.48 (d, *J* = 4.8 Hz,1H), 4.88 - 4.84 (m , 1H), 4.54 - 4.35 (m, 1H), 4.31 - 4.27 (m, 1H), 4.26 - 4.22 (m, 1H), 3.91 - 3.83 (m, 1H), 3.79 - 3.69 (m, 1H), 1.22 (d, *J* = 6.4Hz, 6H).

(2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5- [6-(oxetan-3-ylamino)purin-9-yl]tetrahydrofuran-3,4-diol (22)

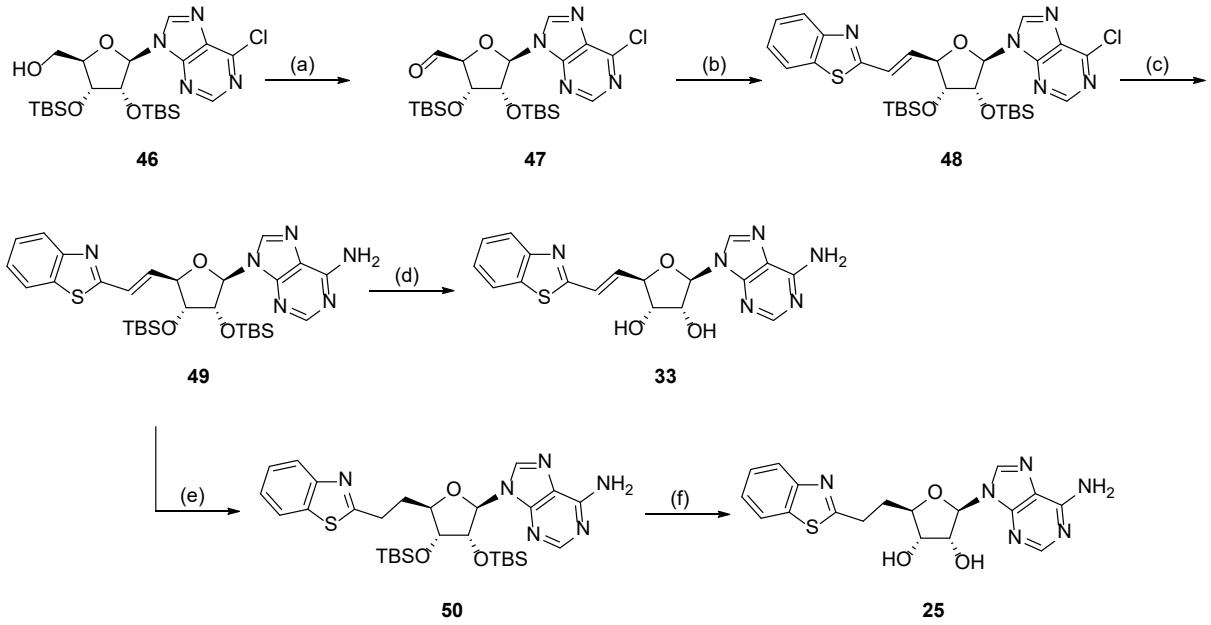


To a solution of compound **99c** (150 mg, 0.21 mmol) in methanol (4 mL) was added potassium fluoride (124 mg, 2.14 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-25%) to afford compound **22** (29.4 mg, 28% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{20}H_{20}N_6O_4S_2$ 473.1066; found 473.1092. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.60 (s, 1H), 8.45 (s, 1H), 8.23 (s, 1H), 8.00 (d, *J* = 7.6 Hz, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.47 (td, *J* = 8.0, 0.8 Hz, 1H), 7.36 (td, *J* =

8.0, 0.8 Hz, 1H), 5.94 (d, *J* = 5.6 Hz, 1H), 5.62 - 5.55 (m, 2H), 5.20 (br.s, 1H), 4.86 (t, *J* = 5.2 Hz, 1H), 4.80 (t, *J* = 6.8 Hz, 2H), 4.65 (t, *J* = 6.0 Hz, 2H), 4.29 (t, *J* = 4.8 Hz, 1H), 4.26 - 4.22 (m, 1H), 3.86 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.75 (dd, *J* = 13.6, 7.6 Hz, 1H).

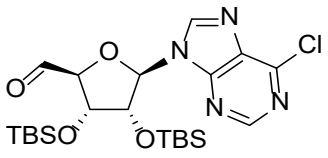
1.9.5 Synthesis of compounds 25 and 33

Scheme S10



(α) $(COCl)_2$, DMSO, TEA, DCM, -60 °C, 3 h, 67%; (b) (benzo[d]thiazol-2-ylmethyl)triphenylphosphonium chloride, KHMDS, THF, -78 °C, 2 h, 87%; (c) NH_3, THF, -70 - 80 °C, 16 h, 51%; (d) KF, DMF, 60 °C, 16 h, 57%; (e) H_2, Pd/C, THF, RT, 16 h, 79%; (f) KF, DMF, 60 °C, 16 h, 35%.

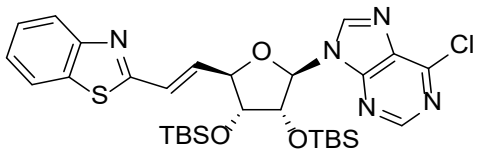
(2*S*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (6-chloropurin-9-yl)tetrahydrofuran-2-carbaldehyde (47)



To a solution of DMSO (3.64 mL, 46.6 mmol) in DCM (30 mL) was added oxalyl chloride (3.06 mL, 34.94 mmol) at -60 °C under inert atmosphere and stirred for 30 min. A solution of compound **46** (3.00 g, 5.82 mmol) in DCM (10 mL) was then added and stirred for additional 30 min, followed by the addition of triethylamine (9.73 mL, 69.88 mmol). The reaction mixture

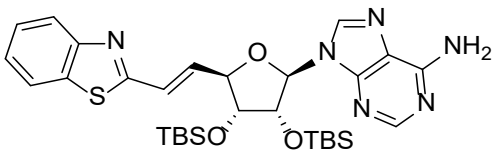
was stirred at -60 °C for 2 h and quenched with water (100 mL) at 0 °C. The aqueous layer was extracted with DCM (3 x 50 mL). The combined organic layers were dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-17%) to afford compound **47** (2.00 g, 67% yield) as yellow oil. LCMS (ES^+, Method 1) *m/z* 513.2 $[M+H]^+$.

[(2*R*,3*R*,4*R*,5*R*)-2-[(*E*)-2-(1,3-Benzothiazol-2-yl)vinyl]-4-[tert-butyl (dimethyl)silyl]oxy-5-(6-chloropurin-9-yl)tetrahydrofuran-3-yl]oxy-tert-butyl-dimethyl-silane (48)



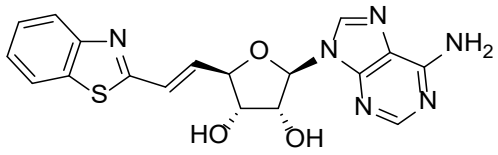
To a solution of (benzo[d]thiazol-2-ylmethyl)triphenylphosphonium chloride (86.9 mg, 194 µmol) in THF (2 mL) was added potassium bis(trimethylsilyl)amide (195 µL, 1M in THF) under inert atmosphere at -78 °C and stirred for 30 min. A solution of compound **47** (100 mg, 195 µmol) in THF (2 mL) was then added and stirred at -78 °C for 1 h. The reaction mixture was quenched with sat. aq. ammonium chloride solution (15 mL) at 0 °C and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by preparative TLC chromatography (SiO_2, petroleum ether/ethyl acetate 25%) to afford compound **48** (110 mg, 87% yield) as yellow oil. LCMS (ES^+, Method 5) *m/z* 644.2 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.86 (s, 1H), 8.27 (s, 1H), 8.02 (d, *J* = 8.0 Hz, 1H), 7.90 (d, *J* = 8.0 Hz, 1H), 7.50 (t, *J* = 7.6 Hz, 1H), 7.42 (t, *J* = 7.6 Hz, 1H), 7.08 - 7.03 (m, 2H), 6.03 (d, *J* = 4.8 Hz, 1H), 5.12 (t, *J* = 4.8 Hz, 1H), 4.81 (t, *J* = 4.8 Hz, 1H), 4.36 (t, *J* = 4.0 Hz, 1H), 0.97 (s, 9H), 0.83 (s, 9H), 0.15 (s, 3H), 0.14 (s, 3H), -0.01 (s, 3H), -0.26 (s, 3H).

9-[(2*R*,3*R*,4*R*,5*R*)-5-[(*E*)-2-(1,3-Benzothiazol-2-yl)vinyl]-3,4-bis [[tert-butyl(dimethyl)silyl] oxy]tetrahydrofuran-2-yl]purin-6-amine (49)



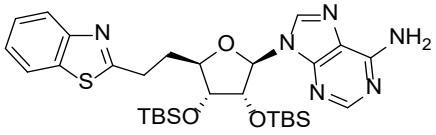
To a solution of compound **48** (30.0 mg, 0.05 µmol) in THF (10 mL) was bubbled ammonia (39.6 mg, 2.33 mmol) at -70 °C for 5 min. The solution was then transferred to a sealed tube, stirred at RT for 16 h and then heated to 80 °C for 16 h. The reaction mixture was cooled to RT and concentrated under reduced pressure. The residue was purified by preparative TLC chromatography (SiO_2, petroleum ether/ethyl acetate 25%) to afford compound **49** (15.0 mg, 51% yield) as yellow oil. LCMS (ES^+, Method 3) *m/z* 625.3 $[M+H]^+$.

(2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(*E*)-2-(1,3-benzothiazol-2-yl) vinyl]tetrahydrofuran-3,4-diol (33)



To a solution of compound **49** (15.0 mg, 24.0 µmol) in DMF (2 mL) was added potassium fluoride (13.9 mg, 240 µmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 8) to afford compound **33** (5.52 mg, 13.9 µmol) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{18}H_{16}N_6O_3S$ 397.1083; found 397.1095; ^1H NMR (400 MHz, DMSO-d_6): δ 8.42 (s, 1H), 8.21 (s, 1H), 8.09 (d, *J* = 8.0 Hz, 1H), 7.97 (d, *J* = 7.6 Hz, 1H), 7.51 (td, *J* = 6.8, 1.2 Hz, 1H), 7.44 (td, *J* = 8.4, 1.2 Hz, 1H), 7.33 (s, 2H), 7.13 - 6.99 (m, 2H), 6.00 (d, *J* = 5.2 Hz, 1H), 5.63 (d, *J* = 5.6 Hz, 1H), 5.58 (d, *J* = 5.2 Hz, 1H), 4.85 (q, *J* = 5.2 Hz, 1H), 4.65 (t, *J* = 4.8 Hz, 1H), 4.33 (q, *J* = 4.8 Hz, 1H).

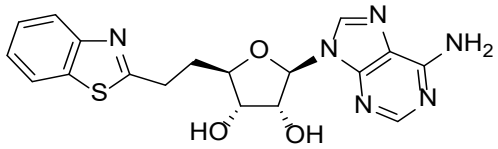
9-[(2*R*,3*R*,4*R*,5*R*)-5-[2-(1,3-Benzothiazol-2-yl)ethyl]-3,4-bis [[tert-butyl(dimethyl)silyl]oxy] tetrahydrofuran-2-yl]purin-6-amine (50)



To a solution of compound **49** (100 mg, 160 µmol) in THF (10 mL) was added Pd/C (20 mg, 160 µmol, 10% wt.) under inert atmosphere. The suspension was degassed under reduced pressure and purged with H_2 several times. The mixture was stirred under H_2 at RT for 16 h,

and then filtered. The filtrate was concentrated under reduced pressure and the residue was purified by preparative TLC chromatography (SiO_2, petroleum ether/ethyl acetate 33%) to afford compound **50** (80.0 mg, 79% yield) as yellow oil. LCMS (ES^+, Method 2) *m/z* 627.4 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.35 (s, 1H), 7.98 (d, *J* = 8.0 Hz, 1H), 7.88 (s, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.46 (t, *J* = 8.0 Hz, 1H), 7.37 (t, *J* = 8.0 Hz, 1H), 5.86 (d, *J* = 6.0 Hz, 1H), 5.65 (s, 2H), 5.19 (dd, *J* = 6.0, 4.4 Hz, 1H), 4.22 - 4.10 (m, 2H), 3.33 - 3.29 (m, 1H), 3.23 - 3.16 (m, 1H), 2.59 - 2.55 (m, 1H), 2.34 - 2.30 (m, 1H), 0.94 (s, 9H), 0.78 (s, 9H), 0.11 (s, 6H), -0.08 (s, 3H), -0.35 (s, 3H).

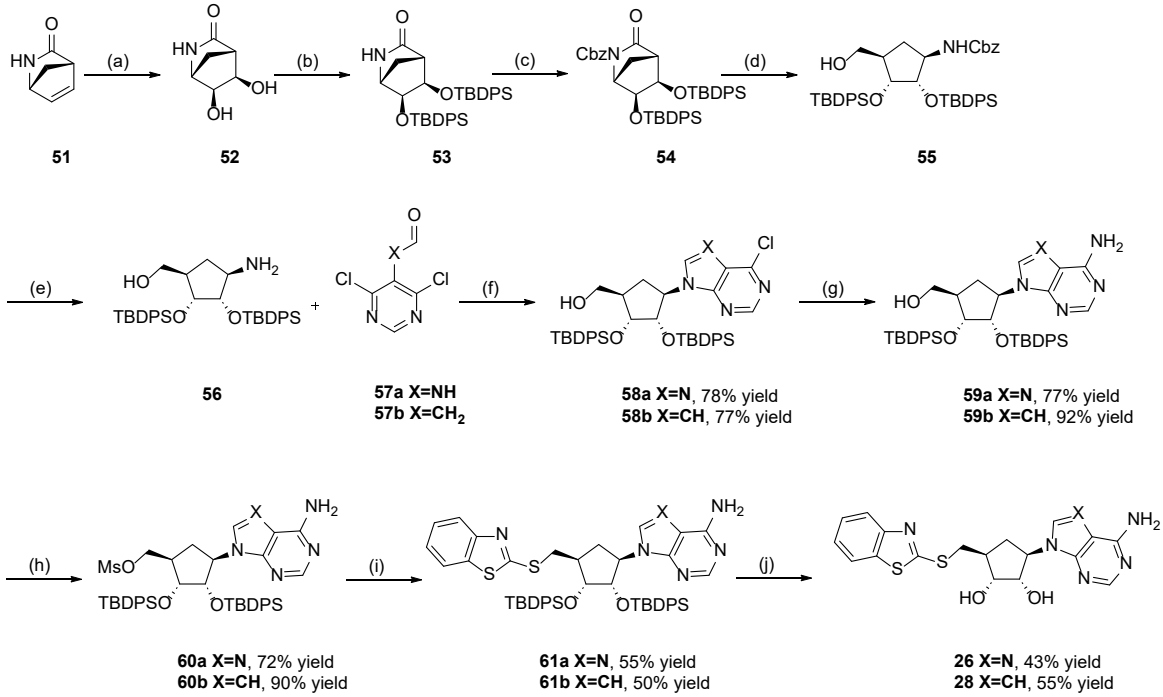
(2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[2-(1,3-benzothiazol-2-yl) ethyl]tetrahydrofuran-3,4-diol (25)



To a solution of compound **50** (80.0 mg, 0.13 mmol) in DMF (2 mL) was added potassium fluoride (74.1 mg, 1.28 mmol). The reaction mixture was stirred at 60 °C for 16 h, cooled to RT and concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 9) to afford compound **25** (17.8 mg, 35% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{18}H_{18}N_6O_3S$ 399.1239; found 399.1251; ^1H NMR (400 MHz, DMSO-d_6): δ 8.36 (s, 1H), 8.15 (s, 1H), 8.04 (d, *J* = 8.0 Hz, 1H), 7.93 (d, *J* = 8.0 Hz, 1H), 7.48 (t, *J* = 7.2 Hz, 1H), 7.40 (d, *J* = 8.0 Hz, 1H), 7.29 (s, 2H), 5.88 (d, *J* = 5.2 Hz, 1H), 5.37 (s, 2H), 4.73 (t, *J* = 5.2 Hz, 1H), 4.16 (d, *J* = 4.8 Hz, 1H), 4.00 - 3.96 (m, 1H), 3.21 - 3.16 (m, 2H), 2.34 (q, *J* = 7.2 Hz, 2H). $[\alpha]_D^{20}$ = +37.7 (c=0.1, MeOH).

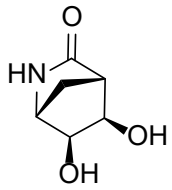
1.9.6 Synthesis of compounds 26 and 27

Scheme S11



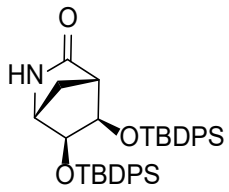
(a) K_2OsO_4, NMO, THF, t-BuOH, H_2O, RT, 16 h, 54%; (b) TBDPSCl, 1H-imidazole, DMF, RT, 24 h, 63%; (c) CbzCl, LiHMDS, THF, -70 °C, 30 min, 92%; (d) $NaBH_4$, THF, MeOH, 0 °C, 2 h, 97%; (e) H_2, Pd/C, THF, RT, 16 h, 82%; (f) TEA, n-BuOH, 130 °C, 24 h; (g) NH_3/MeOH, 90 °C, 16 h; (h) Ms_2O, TEA, THF, RT, 16 h; (i) sodium benzo[d]thiazole-2-thiolate, DMF, 50 °C, 16 h; (j) KF, MeOH, 50 °C, 16 h.

(1*R*,4*S*,5*R*,6*S*)-5,6-Dihydroxy-2-azabicyclo[2.2.1]heptan-3-one (52)



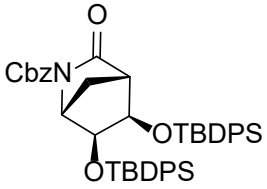
To a solution of (1*R*,4*S*)-2-azabicyclo[2.2.1]hept-5-en-3-one **51** (7.00 g, 64.2 mmol) in THF (140 mL), tert-butyl alcohol (70 mL) and water (20 mL) was added 4-methylmorpholinen-oxidemonohydrate (22.5 g, 192.44 mmol) and potassium osmate(VI) dihydrate (3.55 g, 9.62 mmol). The reaction mixture was stirred at RT for 16 h and then concentrated under reduced pressure. The residue was purified by flash column chromatography (dichloromethane/methanol 0-10%) to afford compound **52** (5.00 g, 54% yield) as a black solid. LCMS (ES^+, Method 4) *m/z* 144.2 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 7.53 (s, 1H), 5.02 (d, *J* = 4.8 Hz, 1H), 4.96 (d, *J* = 5.2 Hz, 1H), 3.77 - 3.76 (m, 1H), 3.71 - 3.70 (m, 1H), 3.43 (s, 1H), 2.25 (s, 1H), 1.89 (d, *J* = 10.0 Hz, 1H), 1.72 (d, *J* = 9.6 Hz, 1H).

(1*R*,4*S*,5*R*,6*S*)-5,6-Bis[[tert-butyl(diphenyl)silyl]oxy]-2-azabicyclo [2.2.1]heptan-3-one (53)



To a solution of compound **52** (4.00 g, 27.9 mmol) in DMF (20 mL) was added 1H-imidazole (19.0 g, 279 mmol) and tert-butylchlorodiphenylsilane (21.5 mL, 83.8 mmol). The reaction mixture was stirred at RT for 24 h. The reaction was then quenched with water (100 mL) and extracted with EtOAc (3 x 50 mL). The combined organic layers were washed with brine (2 x 50 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-50%) to afford compound **53** (11.0 g, 63% yield) as yellow oil. LCMS (ES^+, Method 2) *m/z* 620.2 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 7.67 - 7.62 (m, 7H), 7.49 - 7.45 (m, 4H), 7.41 - 7.36 (m, 9H), 4.14 (d, *J* = 5.6 Hz, 1H), 4.06 (d, *J* = 6.0 Hz, 1H), 3.12 (s, 1H), 2.25 (d, *J* = 9.2 Hz, 1H), 2.03 (s, 1H), 1.70 (d, *J* = 9.6 Hz, 1H), 1.01 (s, 18H).

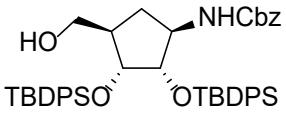
Benzyl (1*R*,4*S*,5*R*,6*S*)-5,6-bis[[tert-butyl(diphenyl)silyl]oxy]-3-oxo-2-azabicyclo[2.2.1] heptane-2-carboxylate (54)



To a solution of compound **53** (8.00 g, 12.9 mmol) in THF (100 mL) under inert atmosphere at -70 °C was added dropwise lithium bis(trimethylsilyl)amide (12.9 mL , 1 M in THF) and was stirred for 10 min. Benzyl carbonochloridate (2.75 mL, 19.36 mmol) was then added and further stirred for 30 min. The reaction mixture was quenched with sat. aq. ammonium chloride solution (300 mL) and extracted with EtOAc (3 x 150 mL). The combined organic layers were washed with brine (2 x 100 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by column chromatography

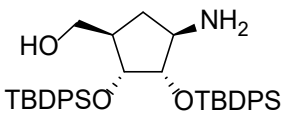
by flash column chromatography (petroleum ether/ethyl acetate 2-25%) to afford compound **54** (9.00 g, 92% yield) as colorless oil. LCMS (ES^+, Method 3) *m/z* 754.3 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 7.67 - 7.57 (m, 5H), 7.46 - 7.45 (m, 5H), 7.40 - 7.34 (m, 10H), 7.29 - 7.38 (m, 3H), 7.20 - 7.17 (m, 2H), 4.94 (d, *J* = 4.0 Hz, 2H), 4.50 (d, *J* = 5.6 Hz, 1H), 4.35 (d, *J* = 5.6 Hz, 1H), 4.09 (s, 1H), 2.32 (d, *J* = 10.0 Hz, 1H), 2.22 (s, 1H), 1.93 (d, *J* = 10.0 Hz, 1H), 0.99 (s, 9H), 0.97 (s, 9H).

Benzyl *N*-[(1*R*,2*S*,3*R*,4*R*)-2,3-bis[[tert-butyl(diphenyl)silyl]oxy]-4 (hydroxymethyl) cyclopentyl]carbamate (55)



To a solution of compound **54** (9.00 g, 11.9 mmol) in THF (100 mL) and MeOH (20 mL) was added portionwise sodium borohydride (1.03 g, 27.2 mmol) at 0 °C. The resulting mixture was stirred at 0 °C for 2 h. The reaction was then quenched with water (300 mL) at 0 °C and extracted with EtOAc (3 x 100 mL). The combined organic layers were washed with brine (2 x 50 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-50%) to afford compound **55** (8.82 g, 97% yield) as colorless oil. LCMS (ES^+, Method 3) *m/z* 680.3 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 7.66 - 7.57 (m, 6H), 7.50 - 7.49 (m, 2H), 7.45 - 7.22 (m, 17H), 4.99 (d, *J* = 12.4 Hz, 1H), 4.92 (d, *J* = 12.4 Hz, 1H), 4.24 (t, *J* = 4.8 Hz, 1H), 4.17 (t, *J* = 8.8 Hz, 1H), 3.94 - 3.92 (m, 1H), 3.83 - 3.82 (m, 1H), 2.89 - 2.85 (m, 1H), 2.67 - 2.62 (m, 1H), 2.03 - 1.99 (m, 1H), 1.96 - 1.93 (m, 1H), 1.01 (s, 9H), 0.92 (s, 9H).

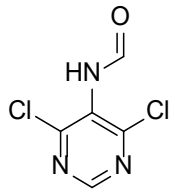
[(1*R*,2*R*,3*S*,4*R*)-4-Amino-2,3-bis[[tert-butyl(diphenyl)silyl]oxy] cyclopentyl]methanol (56)



To a solution of compound **55** (8.00 g, 10.5 mmol) in THF (200 mL) was added Pd/C (10%, 100 mg, 1.06 mmol) under inert atmosphere. The suspension was degassed under reduced pressure and purged with H_2 several times. The mixture was stirred under H_2 at RT for 16 h,

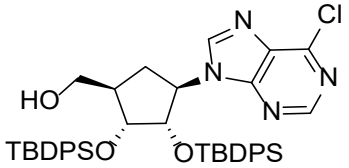
then filtered. The filtrate was concentrated under reduced pressure to afford compound **56** (5.40 g, 82% yield) as a brown solid. The isolated material was used in the following step without any further purification. LCMS (ES^+, Method 3) *m/z* 624.3 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 7.66 - 7.58 (m, 8H), 7.45 - 7.40 (m, 8H), 7.33 - 7.24 (m, 4H), 4.00 - 3.97 (m, 1H), 3.66 - 3.63 (m, 1H), 3.62 - 3.58 (m, 1H), 3.31 (brs, 2H), 3.24 - 3.19 (m, 1H), 2.99 (dd, *J* = 10.4, 4.8 Hz, 1H), 2.69 - 2.64 (m, 1H), 2.05 - 2.02 (m, 1H), 1.95 - 1.89 (m, 1H), 1.01 (s, 9H), 0.98 (s, 9H).

_N_-(4,6-Dichloropyrimidin-5-yl)formamide (57a)



To a suspension of 4,6-dichloropyrimidin-5-amine (5.00 g, 30.5 mmol) in formic acid (62 mL) was added acetic anhydride (83.3 mL, 889 mmol) at 0 °C. The reaction mixture was warmed to RT, stirred for 1 h and then concentrated under reduced pressure to afford compound **57a** (4.00 g, 68% yield) as a white solid. The isolated material was used in the following step without any further purification. ^1H NMR (400 MHz, DMSO-d_6): δ 10.62 (s, 1H), 9.41 (s, 1H), 8.36 (s, 1H).

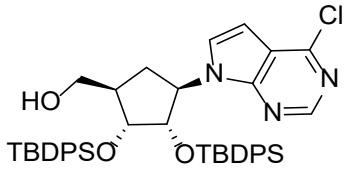
[(1*R*,2*R*,3*S*,4*R*)-2,3-Bis[[tert-butyl(diphenyl)silyl]oxy]-4-(6-chloropurin-9-yl)cyclopentyl] methanol (58a)



To a solution of compound **56** (5.00 g, 8.01 mmol) in n-butyl alcohol (75 mL) was added *N,N*-diisopropylethylamine (4.19 mL, 24.04 mmol) and compound **57a** (1.85 g, 9.62 mmol). The reaction mixture was heated at 130 °C for 24 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-50%) to afford compound **58a** (4.80 g, 78% yield) as a yellow solid. LCMS

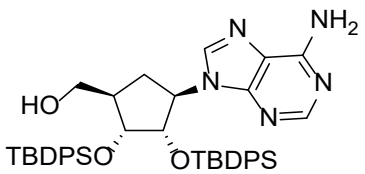
(ES$^+$, Method 3) *m/z* 761.4 [M+H]$^+$. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.48 (s, 1H), 8.43 (s, 1H), 7.78 - 7.76 (m, 2H), 7.71 - 7.69 (m, 2H), 7.50 - 7.39 (m, 6H), 7.32 - 7.23 (m, 5H), 7.11 - 7.04 (m, 5H), 5.34 (q, *J* = 9.6 Hz, 1H), 4.72 (dd, *J* = 10.0, 3.6 Hz, 1H), 4.65 (t, *J* = 5.2 Hz, 1H), 4.23 (d, *J* = 3.6 Hz, 1H), 3.14 - 3.11 (m, 1H), 3.05 - 3.02 (m, 1H), 2.21 - 2.18 (m, 1H), 2.10 - 2.07 (m, 1H), 1.93 - 1.88 (m, 1H), 1.11 (s, 9H), 0.79 (s, 9H).

[(1*R*,2*R*,3*S*,4*R*)-2,3-Bis[[tert-butyl(diphenyl)silyl]oxy]-4-(4-chloropyrrolo[2,3-d]pyrimidin-7-yl)cyclopentyl]methanol (58b)



To a solution of compound **56** (0.80 g, 1.28 mmol) in n-butyl alcohol (20 mL) was added 2-(4,6-dichloropyrimidin-5-yl)acetaldehyde **57b** (293.88 mg, 1.54 mmol) and diisopropylethylamine (670 µL, 3.85 mmol). The reaction mixture was heated at 130 °C for 24 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-75%) to afford compound **58b** (0.70 g, 71% yield) as yellow oil. LCMS (ES$^+$, Method 2) *m/z* 760.3 [M+H]$^+$. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.75 - 7.71 (m, 6H), 7.65 - 7.64 (m, 2H), 7.47 - 7.40 (m, 5H), 7.39 - 7.31 (m, 6H), 7.30 - 7.28 (m, 4H), 4.97 (d, *J* = 12.4 Hz, 1H), 4.89 (d, *J* = 12.4 Hz, 1H), 4.37 (d, *J* = 7.6 Hz, 1H), 4.04 - 4.03 (m, 1H), 4.01 - 3.98 (m, 1H), 3.00 - 2.94 (m, 2H), 2.36 - 2.28 (m, 1H), 2.04 - 2.01 (m, 1H), 1.09 (s, 9H), 1.04 (s, 9H).

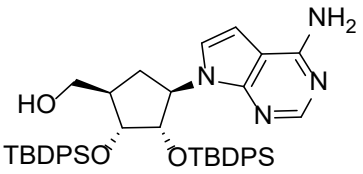
[(1*R*,2*R*,3*S*,4*R*)-4-(6-Aminopurin-9-yl)-2,3-bis[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl] methanol (59a)



A solution of compound **58a** (4.00 g, 5.25 mmol) and ammonia (20 mL, 7 M in methanol) in a sealed tube was heated at 90 °C and stirred for 16 h. The mixture was cooled to RT and

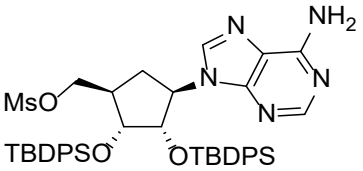
concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-50%) to afford compound **59a** (3.00 g, 77% yield) as a yellow solid. LCMS (ES^+, Method 2) *m/z* 742.7 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 7.90 (s, 2H), 7.65 (t, *J* = 6.0 Hz, 4H), 7.48 - 7.34 (m, 9H), 7.28 - 7.25 (m, 1H), 7.18 (t, *J* = 7.6 Hz, 2H), 7.13 (s, 2H), 7.07 - 7.00 (m, 4H), 5.21 (q, *J* = 9.6 Hz, 1H), 4.73 (dd, *J* = 6.0, 4.8 Hz, 1H), 4.65 (dd, *J* = 9.6, 3.6 Hz, 1H), 4.10 - 4.06 (m, 1H), 3.06 - 3.02 (m, 1H), 2.91 - 2.89 (m, 1H), 2.16 - 2.13 (m, 1H), 1.99 - 1.96 (m, 1H), 1.92 - 1.89 (m, 1H), 1.04 (s, 9H), 0.77 (s, 9H).

[(1*R*,2*R*,3*S*,4*R*)-4-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-2,3-bis [[tert-butyl(diphenyl)silyl] oxy]cyclopentyl]methanol (59b)



A solution of compound **58b** (100 mg, 131 µmol) and ammonia (1.14 mL, 7 M in methanol) in a sealed tube was heated at 110 °C and stirred for 16 h. The mixture was cooled to RT and concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-50%) to afford compound **59b** (90.0 mg, 92% yield) as yellow oil. LCMS (ES^+, Method 1) *m/z* 741.3 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 7.82 (s, 1H), 7.75 - 7.73 (m, 4H), 7.44 - 7.33 (m, 9H), 7.26 - 7.24 (m, 1H), 7.21 - 7.19 (m, 3H), 7.07 (t, *J* = 7.6 Hz, 2H), 6.99 (t, *J* = 7.6 Hz, 2H), 6.82 (d, *J* = 3.2 Hz, 1H), 6.12 (d, *J* = 3.2 Hz, 1H), 5.26 (brs, 1H), 5.02 (dd, *J* = 9.2, 3.6 Hz, 1H), 4.86 - 4.79 (m, 1H), 4.28 (d, *J* = 3.6 Hz, 1H), 3.32 (dd, *J* = 12.0, 2.4 Hz, 1H), 3.04 (dd, *J* = 11.6, 2.4 Hz, 1H), 2.39 - 2.29 (m, 1H), 2.00 - 1.97(m, 2H), 1.16 (s, 9H), 0.97 (s, 9H).

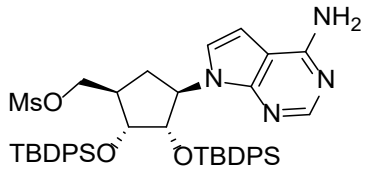
[(1*R*,2*R*,3*S*,4*R*)-4-(6-Aminopurin-9-yl)-2,3-bis[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl] methyl methanesulfonate (60a)



To a solution of compound **59a** (1.00 g, 1.35 mmol) and triethylamine (563 uL, 4.04 mmol) in THF (20 mL) was added a solution of methanesulfonic anhydride (281 mg, 1.62 mmol) in THF

(5 mL) at 0 °C. The reaction mixture was warmed to RT and stirred for 16 h. The reaction was quenched with water (50 mL) and then extracted with EtOAc (3 x 30 mL). The combined organic layers were washed with brine (3 x 20 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-50%) to afford compound **60a** (800 mg, 72% yield) as yellow oil. LCMS (ES^+, Method 3) *m/z* 820.3 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.01 (s, 1H), 7.86 (s, 1H), 7.64 (d, *J* = 6.4 Hz, 2H), 7.59 (d, *J* = 6.8 Hz, 2H), 7.50 - 7.43 (m, 4H), 7.38 - 7.28 (m, 6H), 7.18 (t, *J* = 7.6 Hz, 2H), 7.13 (s, 2H), 7.09 - 7.02 (m, 4H), 5.21 (q, *J* = 9.2 Hz, 1H), 4.70 (dd, *J* = 9.2, 3.6 Hz, 1H), 4.08 (d, *J* =3.6 Hz, 1H), 3.84 (d, *J* = 6.8 Hz, 2H), 2.93 (s, 3H), 2.28 - 2.20 (m, 2H), 2.02 - 1.99 (m, 1H), 1.02 (s, 9H), 0.78 (s, 9H).

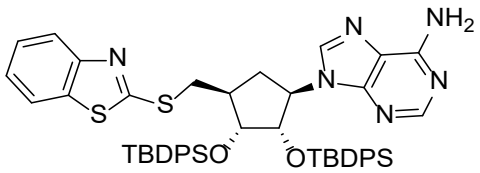
[(1*R*,2*R*,3*S*,4*R*)-4-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-2,3-bis [[tert-butyl(diphenyl) silyl]oxy]cyclopentyl]methyl methanesulfonate (60b)



To a solution of compound **59b** (90.0 mg, 121 µmol) and triethylamine (101 µL, 728 µmol) in THF (5 mL) was added a solution of methanesulfonic anhydride (63.4 mg, 364 µmol) in THF (2 mL) at 0 °C. The reaction mixture was stirred at RT for 2 h. The reaction was quenched with water (20 mL) and then extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (3 x 10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-50%) to afford compound **60b** (90.0 mg, 90% yield) as a white solid. ^1H NMR (400 MHz, $CDCl_3$): δ 7.95 (d, *J* = 6.8 Hz, 2H), 7.87 - 7.81 (m, 4H), 7.75 - 7.70 (m, 2H), 7.65 - 7.57 (m, 4H), 7.54 - 7.49 (m, 4H), 7.43 - 7.34 (m, 5H), 7.15 (s, 1H), 6.93 (d, *J* = 3.6 Hz, 1H), 5.39 (d, *J* = 3.6 Hz, 1H), 4.20 (d, *J* = 4.8 Hz, 1H), 4.08 - 4.06 (m, 1H), 3.87 (d, *J* = 4.4 Hz, 1H), 3.63 (d, *J* = 13.2 Hz, 1H), 3.04 - 2.96 (m, 1H), 2.72 (s, 3H), 2.66 - 2.64 (m, 1H), 2.16 (dd, *J* = 13.6, 4.4 Hz, 1H), 1.65 (d, *J* = 13.2 Hz, 1H), 1.23 (s, 9H), 1.11 (s, 9H).

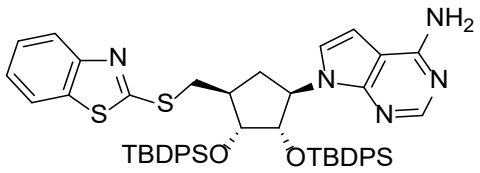
9-[(1*R*,2*S*,3*R*,4*S*)-4-(1,3-Benzothiazol-2-ylsulfanylmethyl)-2,3- bis[[tert-butyl(diphenyl)

silyl]oxy]cyclopentyl]purin-6-amine (61a)



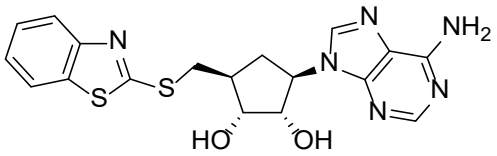
To a solution of compound **60a** (500 mg, 0.61 mmol) in DMF (5 mL) was added 1,3-benzothiazol-2-ylsulfanyl sodium (346 mg, 1.83 mmol) and heated to 50 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate 2-100%) to afford compound **61a** (300 mg, 55% yield) as yellow oil. LCMS (ES^+, Method 3) *m/z* 891.3 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.04 (s, 1H), 7.95 (d, *J* = 8.0 Hz, 1H), 7.86 (s, 1H), 7.62 (d, *J* = 8.0 Hz, 3H), 7.58 (d, *J* = 6.8 Hz, 2H), 7.46 - 7.41 (m, 2H), 7.38 - 7.32 (m, 4H), 7.31 - 7.22(m, 6H), 7.16 - 7.01 (m, 8H), 5.20 (q, *J* = 9.6 Hz, 1H), 4.83 (dd, *J* = 9.2, 3.2 Hz, 1H), 4.14 (d, *J* = 3.6 Hz, 1H), 3.28 - 3.25(m, 2H), 2.38 - 2.30 (m, 2H), 2.07 - 2.03 (m, 1H), 0.10 (s, 9H), 0.77 (s, 9H).

7-[(1*R*,2*S*,3*R*,4*S*)-4-(1,3-Benzothiazol-2-ylsulfanylmethyl)-2,3-bisb[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl]pyrrolo[2,3-d]pyrimidin-4-amine (61b)



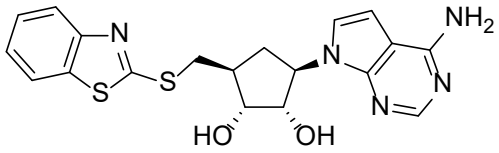
To a solution of compound **60b** (90.0 mg, 110 µmol) in DMF (2 mL) was added 1,3-benzothiazol-2-ylsulfanyl sodium (62.4 mg, 329 µmol) and heated at 50 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (15 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (3 x 10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by preparative TLC (SiO_2, petroleum ether/ethyl acetate 50%) to afford compound **61b** (30.0 mg, 30% yield) as yellow oil. LCMS (ES^+, Method 1) *m/z* 890.2 $[M+H]^+$.

(1*R*,2*S*,3*R*,5*S*)-3-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) cyclopentane-1,2-diol (26)



To a solution of compound **61a** (300 mg, 0.34 mmol) in MeOH (10 mL) was added potassium fluoride (196 mg, 3.37 mmol). The reaction mixture was stirred at 50 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-5%) to afford compound **26** (62.7 mg, 43% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{18}H_{18}N_6O_2S_2$ 415.1011; found 415.1022. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.22 (s, 1H), 8.11 (s, 1H), 8.01 (d, *J* = 8.0 Hz, 1H), 7.86 (d, *J* = 8.0 Hz, 1H), 7.47 (td, *J* = 8.0, 0.8 Hz, 1H), 7.37 (td, *J* = 8.4, 0.8 Hz, 1H), 7.19 (s, 2H), 5.07 (d, *J* = 6.0 Hz, 1H), 4.95 (d, *J* = 4.4 Hz, 1H), 4.72 - 4.67 (m, 1H), 4.48 - 4.43 (m, 1H), 3.96 - 3.92 (m, 1H), 3.69 (dd, *J* = 12.8, 6.4 Hz, 1H), 3.54 (dd, *J* = 13.2, 8.0 Hz, 1H), 2.43 - 2.37(m, 2H), 1.92 - 1.87(m, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 166.63, 156.02, 152.73, 152.10, 149.58, 140.23, 134.57, 126.38, 124.46, 121.80, 121.11, 119.35, 74.36, 73.97, 59.46, 42.50, 36.66, 31.91. $[\alpha]_D^{20}$ = +21.0 (c=0.1, MeOH).

(1*R*,2*S*,3*R*,5*S*)-3-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5- (1,3-benzothiazol-2 -ylsulfanylmethyl)cyclopentane-1,2-diol (28)

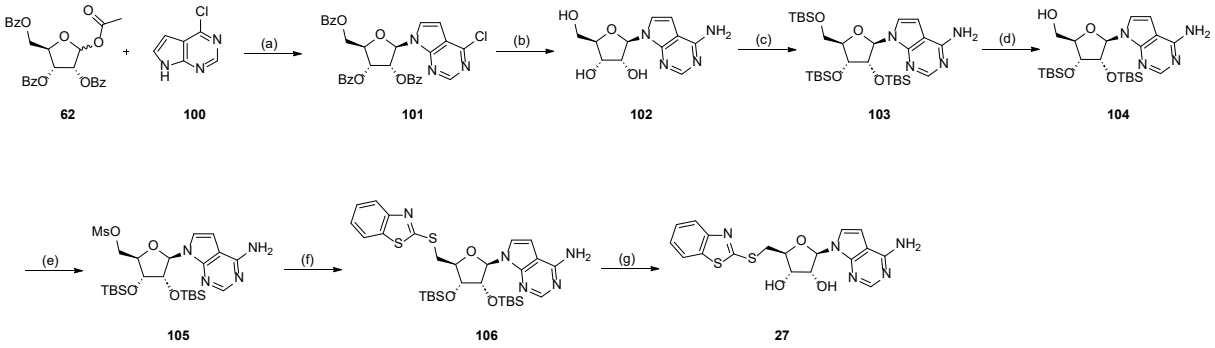


To a solution of compound **61b** (30.0 mg, 33.7 µmol) in MeOH (2 mL) was added p-toluenesulfonic acid (29.0 mg, 168 µmol). The reaction mixture was heated to 70 °C for 16 h, cooled to RT and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-5%) to afford compound **28** (8.16 mg, 55% yield) as a light yellow solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{19}H_{19}N_5O_2S_2$ 414.1058; found 414.1080. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.02 - 8.00 (m, 2H), 7.86 (d, *J* = 8.0 Hz, 1H), 7.47 (t, *J* = 8.0 Hz, 1H), 7.36 (t, *J* = 7.6 Hz, 1H), 7.26 (d, *J* = 3.6 Hz, 1H), 6.91 (s, 2H), 6.54 (d, *J* = 3.2 Hz, 1H), 4.96 (s, 1H), 4.85 - 4.83 (m, 1H), 4.28 (t, *J* = 7.6 Hz,

1H), 3.91 (t, *J* = 4.8 Hz, 1H), 3.67 (dd, *J* = 12.8, 6.4 Hz, 1H), 3.56 - 3.47 (m, 1H), 2.35 - 2.30 (m, 2H), 1.73 - 1.67 (m, 1H).

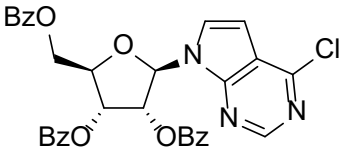
1.9.7 Synthesis of compound 27

Scheme S12



(a) BSA, TMSOTf, MeCN, 25-80 °C, 1.5 h, 27%; (b) NH_3/MeOH, 90 °C, 32 h, 75%; (c) TBS-Cl, 1H-imidazole, DMF, RT, 16 h, 74%; (d) Cl_3CCO_2H, THF/H2O, 0 °C, 16 h, 58%; (e) Ms_2O, TEA, THF, RT, 16 h, 73%; (f) sodium benzo[d]thiazole-2-thiolate, DMF, 50 °C, 16 h, 78%; (g) KF, MeOH, 50 °C, 16 h, 19%

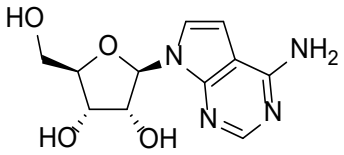
[(2*R*,3*R*,4*R*,5*R*)-3,4-Dibenzoyloxy-5-(4-chloropyrrolo[2,3-d]pyrimidin-7-yl)tetrahydrofuran-2-yl]methyl benzoate (101)



N,*O*-Bis(trimethylsilyl)acetamide (8.05 mL, 32.6 mmol) was added to a stirred suspension of 4-chloro-7*H*-pyrrolo[2,3-d]pyrimidine **100** (5.00 g, 32.6 mmol) MeCN (100 mL) at RT. After stirring for 10 min, [(2*R*,3*R*, 4*R*)-5-acetoxy-3, 4-dibenzoyloxy-tetrahydrofuran-2-yl] methyl benzoate **62** (18.1 g, 35.8 mmol) was added, followed by trimethylsilyl trifluoromethanesulfonate (5.88 mL, 32.56 mmol). The reaction mixture was stirred at RT for 15 min before being heated at 80 °C for 1 h. The reaction mixture was cooled to RT and diluted with EtOAc (75 mL). The organic phase was sequentially washed with sat. aq. sodium bicarbonate solution (2 x 200 mL) and brine (50 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **101** (5.60 g, 27% yield) as yellow oil. LCMS (ES^+, Method 1) *m/z* 598.1 $[M+H]^+$. ^1H NMR (400

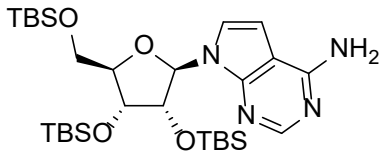
MHz, $CDCl_3$): δ 8.61 (s, 1H), 8.23 - 8.09 (m, 2H), 8.06 - 7.98 (m, 2H), 7.96 - 7.89 (m, 2H), 7.64 - 7.53 (m, 3H), 7.51 - 7.46 (m, 2H), 7.45 - 7.34 (m, 5H), 6.69 (d, *J* = 5.6 Hz, 1H), 6.64 (d, *J* = 3.6 Hz, 1H), 6.25 (t, *J* = 5.6 Hz, 1H), 6.20 - 6.13 (m, 1H), 4.90 (dd, *J* = 3.2, 12.0 Hz, 1H), 4.83 - 4.77 (m, 1H), 4.69 (dd, *J* = 4.0, 12.0 Hz, 1H).

(2*R*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(hydroxymethyl)tetrahydrofuran-3,4-diol (102)



A solution of compound **101** (3.00 g, 5.02 mmol) in ammonia (36.0 mL, 7 M in MeOH) in a sealed tube was heated at 90 °C for 32 h. The mixture was cooled to RT and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-5%) to afford compound **102** (1.00 g, 75% yield) as a yellow solid. LCMS (ES^+, Method 5) *m/z* 267.2 $[M+H]^+$.

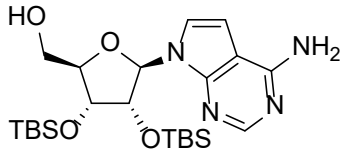
7-[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert-butyl(dimethyl)silyl] oxymethyl]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidin-4-amine (103)



To a solution of compound **102** (1.00 g, 3.76 mmol) and imidazole (2.56 g, 37.5 mmol) in DMF (10 mL) at 0 °C was added tert-butylchlorodimethylsilane (2.83 g, 18.8 mmol). The mixture was warmed to RT and stirred for 16 h. The reaction was quenched with water (50 mL) and extracted with EtOAc (3 x 20 mL). The combined organic layers were washed with brine (3 x 20 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **103** (1.70 g, 74% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 609.6 $[M+H]^+$. ^1H NMR (400 MHz, $CDCl_3$): δ 8.31 (s, 1H), 7.36 (d, *J* = 3.6

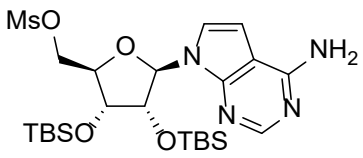
Hz, 1H), 6.37 (d, *J* = 3.6 Hz, 1H), 6.25 (d, *J* = 5.6 Hz, 1H), 5.16 (s, 2H), 4.54 (dd, *J* = 5.6, 4.4 Hz, 1H), 4.29 (dd, *J* = 4.4, 3.2 Hz, 1H), 4.10 - 4.09 (m, 1H), 3.97 (dd, *J* = 11.2, 4.0 Hz, 1H), 3.78 (dd, *J* = 11.2, 2.8 Hz, 1H), 0.97 (s, 9H), 0.94 (s, 9H), 0.78 (s, 9H), 0.13 (d, *J* = 1.6 Hz, 6H), 0.11 (s, 6H), -0.09 (s, 3H), -0.28 (s, 3H).

[(2*R*,3*R*,4*R*,5*R*)-5-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis[[tert-butyl(dimethyl)silyl] oxy]tetrahydrofuran-2-yl]methanol (104)



To a solution of compound **103** (1.70 g, 2.79 mmol) in THF (60 mL) at 0 °C was added dropwise a solution of trichloroacetic acid (4.56 g, 27.9 mmol) in water (20 mL). The resulting mixture was stirred at 0 °C for 16 h and then quenched with sat. aq. sodium bicarbonate (100 mL). The aqueous layer was extracted with EtOAc (3 x 50 mL). The combined organic layers were washed with brine (2 x 50 mL), dried over sodium sulfate**,** filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-100%) to afford compound **104** (800 mg, 58% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 495.2 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.03(s, 1H), 7.37 (d, *J* = 3.6 Hz, 1H), 7.05 (s, 1H), 6.58 (d, *J* = 3.6 Hz, 1H), 5.97 (d, *J* = 3.6 Hz, 1H), 5.69 - 5.67 (m, 1H), 4.74 (dd, *J* = 7.2, 4.4 Hz, 1H), 4.24 (d, *J* = 4.8 Hz, 1H), 3.92 - 3.91 (m, 1H), 3.68 - 3.64 (m, 1H), 3.58 - 3.53 (m, 1H).

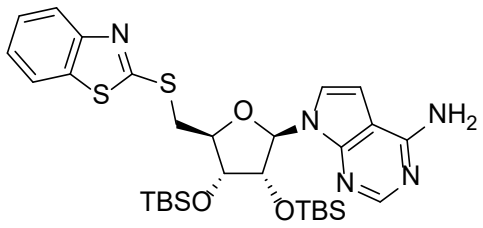
((2*R*,3*R*,4*R*,5*R*)-5-(4-Amino-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tertbutyldimethyl silyl)oxy)tetrahydrofuran-2-yl)methyl methanesulfonate (105)



To a solution of compound **104** (0.20 g, 404 µmol) and triethylamine (169 µL, 1.21 mmol) in THF (5 mL) at 0 °C was added dropwise a solution of methanesulfonic anhydride (84.5 mg,

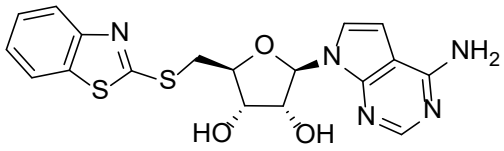
0.49 mmol) in THF (1 mL). The resulting mixture was warmed up to RT and stirred for 16 h. The reaction was quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (2 x 10 mL), dried over sodium sulfate, filtered, and the filtrate concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-100%) to afford compound **105** (170 mg, 73% yield) as a yellow oil. LCMS (ES^+, Method 2) *m/z* 573.1 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.07 (s, 1H), 7.34 (d, *J* = 3.6 Hz, 1H), 7.03 (s, 1H), 6.63 (d, *J* = 3.6 Hz, 1H), 6.13 (d, *J* = 7.2 Hz, 1H), 4.74 (dd, *J* = 7.2, 4.8 Hz, 1H), 4.51 - 4.48 (m, 2H), 4.31 (dd, *J* = 4.4, 1.2 Hz, 1H), 4.13 (t, *J* = 5.2 Hz, 1H), 3.21 (s, 3H), 0.94 (s, 9H), 0.69 (s, 9H), 0.15 (s, 3H), 0.13 (s, 3H), -0.11 (s, 3H), -0.38 (s, 3H).

7-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidin-4-amine (106)



To a solution of compound **105** (170 mg, 297 µmol, 1.0) in DMF (2 mL) was added 1,3-benzothiazol-2-ylsulfanylsodium (84.2 mg, 445 µmol) and stirred at 50 °C for 16 h. The reaction was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (3 x 10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-100%) to afford compound **106** (150 mg, 78% yield) as yellow oil. LCMS (ES^+, Method 3) *m/z* 644.2 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6): δ 8.06 (s, 1H), 8.01 (d, *J* = 8.0 Hz, 1H), 7.82 (d, *J* = 8.0 Hz, 1H), 7.48 (td, *J* = 8.0, 1.2 Hz, 1H), 7.41 - 7.39 (m, 1H), 7.37 - 7.35 (m, 1H), 7.01 (s, 2H), 6.62 (d, *J* = 3.6 Hz, 1H), 6.08 (d, *J* = 7.6 Hz, 1H), 4.95 (q, *J* = 4.4 Hz, 1H), 4.37 (d, *J* = 4.4 Hz, 1H), 4.27 (t, *J* = 6.8 Hz, 1H), 3.94 (dd, *J* = 14.0, 7.2 Hz, 1H), 3.76 (dd, *J* = 14.0, 6.8 Hz, 1H), 0.88 (s, 9H), 0.65 (s, 9H), 0.08 (d, *J* = 1.2 Hz, 6H), -0.16 (s, 3H), -0.44 (s, 3H).

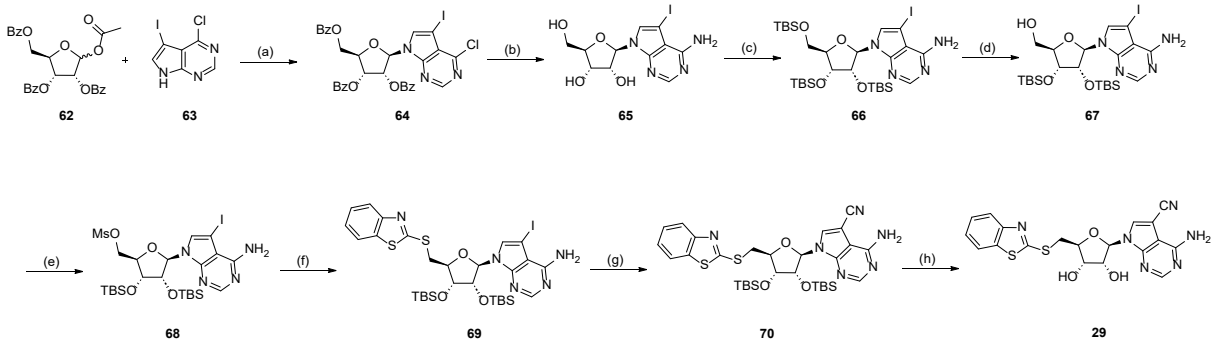
(2*R*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol (27)



To a solution of compound **106** (150 mg, 0.23 mmol) in methanol (3 mL) was added potassium fluoride (135 mg, 2.33 mmol). The resulting mixture was stirred at 50 °C for 16 h, cooled to RT and concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-5%) and then triturated from acetonitrile and methanol (1:1, 4 mL) to afford compound **27** (19.2 mg, 19% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{18}H_{17}N_5O_3S_2$ 416.0851; found 416.0852. ^1H NMR (400 MHz, DMSO-d_6): δ 8.06 (s, 1H), 8.00 (d, *J* = 7.2 Hz, 1H), 7.86 (d, *J* = 7.6 Hz, 1H), 7.47 (td, *J* = 8.0, 1.2 Hz, 1H), 7.39 - 7.34 (m, 2H), 7.02 (s, 2H), 6.61 (d, *J* = 3.6 Hz, 1H), 6.08 (d, *J* = 6.0 Hz, 1H), 5.42 (s, 2H), 4.57 (t, *J* = 5.6 Hz, 1H), 4.19 - 4.17 (m, 2H), 3.82 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.69 (dd, *J* = 13.6, 7.2 Hz, 1H). SFC (Method 3) de% = 100%.

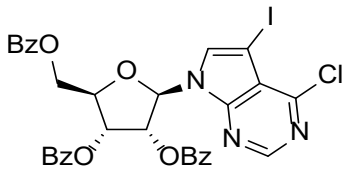
1.9.8 Synthesis of compound 29

Scheme S13



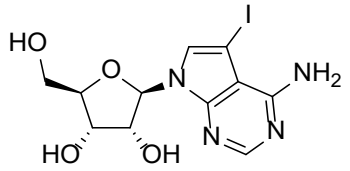
(a) BSA, TMSOTf, MeCN, 25-80 °C, 1.5 h, 49%; (b) NH_3/MeOH, 90 °C, 16 h, 98%; (c) TBS-Cl, 1H-imidazole, DMF, RT, 16 h, 30%; (d) Cl_3CCO_2H, THF/H2O, 0 °C, 1 h, 84%; (e) Ms_2O, TEA, THF, 0°C to RT, 2 h, 89%; (f) sodium benzo[d]thiazole-2-thiolate, DMF, 50 °C, 12 h, 95%; (g) $Pd(PPh_3)_4$, $Zn(CN)_2$, DMF, 90 °C, 16 h, 92%; (h) KF, MeOH, 60 °C, 16 h, 12%.

(2R,3R,4R,5R)-2-((Benzoyloxy)methyl)-5-(4-chloro-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)tetrahydrofuran-3,4-diyl dibenzoate (64)



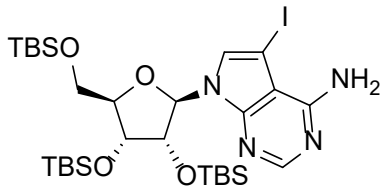
N,O-Bis(trimethylsilyl)acetamide (8.84 mL, 35.7 mmol) was added to a stirred suspension of 4-chloro-5-iodo-7H-pyrrolo[2,3-d]pyrimidine **63** (10.0 g, 35.8 mmol) in MeCN (200 mL). After stirring at RT for 10 min, [(2R,3R,4R)-5-acetoxy-3,4-dibenzoyloxy-tetrahydrofuran-2-yl]methyl benzoate **62** (19.9 g, 39.4 mmol) was added, followed by the addition of trimethylsilyl trifluoromethanesulfonate (6.47 mL, 35.78 mmol). The reaction mixture was stirred at RT for 15 min before being warmed up at 80 °C for 1 h. The reaction mixture was cooled to RT and diluted with EtOAc (75 mL). The organic phase was sequentially washed with sat. aq. sodium bicarbonate (2 x 200 mL) and brine (50 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The isolated material was recrystallized in MeCN to afford compound **64** (12.7 g, 49% yield) as a white solid. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.58 (s, 1H), 8.12 (d, *J* = 7.6 Hz, 2H), 8.00 (d, *J* = 7.6 Hz, 2H), 7.92 (d, *J* = 6.8 Hz, 2H), 7.56 - 7.51 (m, 6H), 7.42 - 7.37 (m, 4H), 6.67 (d, *J* = 5.6 Hz, 1H), 6.17 - 6.14 (m, 1H), 6.12 - 6.10 (m, 1H), 4.91 (dd, *J* = 12.4, 2.8 Hz, 1H), 4.81 (d, *J* = 4.0Hz, 1H), 4.69 (dd, *J* = 12.0, 3.6Hz, 1H)

(2R,3R,4S,5R)-2-(4-Amino-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-5-(hydroxymethyl) tetrahydrofuran-3,4-diol (65)



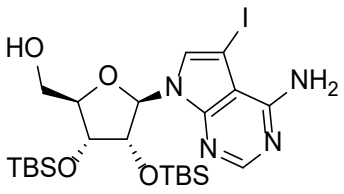
Compound **64** (3 g, 4.14 mmol) was added to a sealed tube containing ammonia (59.2 mL, 7 in MeOH) and stirred at 90 °C for 16 h. The reaction mixture was cooled to RT and concentrated under reduced pressure. The residue was triturated in EtOAc (100 mL) under ultrasonic wave for 10 min and filtered to afford compound **65** (1.60 g, 98% yield) as a black solid. The isolated material was used in the following step without any further purification. ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.09 (s, 1H), 7.67 (s, 1H), 6.67 (brs, 2H), 6.02 (d, *J* = 6.4 Hz, 1H), 5.31 (brs, 1H), 5.16 - 5.12 (m, 2H), 4.35 (s, 1H), 4.06 (d, *J* = 4.4 Hz, 1H), 3.87 - 3.85 (m, 1H), 3.62 - 3.59 (m, 1H), 3.53 - 3.50 (m, 1H).

7-((2R,3R,4R,5R)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-(((tert-butyldimethylsilyl)oxy) methyl)tetrahydrofuran-2-yl)-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-4-amine (66)



To a solution of compound **65** (2.50 g, 6.38 mmol) and 1H-imidazole (5.25 g, 77.2 mmol) in DMF (25 mL) at RT, was added *t*-butyl-chloro-dimethyl-silane (5.82 g, 38.6 mmol) and stirred for 16 h. The reaction mixture was diluted in hexane (50 mL) and washed with brine (250 mL). The separated aqueous layer was re-extracted with hexane (2 x 100 mL) and the combined organic layers dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-15%) to afford compound **66** (1.40 g, 30% yield) as a black solid. LCMS (ES^+, Method 3) *m/z* 735.3 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.26 (s, 1H), 7.54 (s, 1H), 6.26 (d, *J* = 5.2 Hz, 1H), 5.72 (brs, 2H), 4.40 (t, *J* = 4.8 Hz, 1H), 4.22 - 4.12 (m, 1H), 4.10 - 4.08 (m, 1H), 3.98 - 3.97 (m, 1H), 3.94 - 3.79 (m, 1H), 1.00 (s, 9H), 0.92 (s, 9H), 0.78 (s, 9H), 0.18 (d, *J* = 5.6 Hz, 6H), 0.11 (s, 6H), -0.071 (s, 3H), -0.27 (s, 3H).

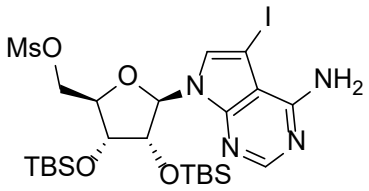
((2R,3R,4R,5R)-5-(4-amino-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)methanol (67)



To a solution of compound **66** (1.40 g, 1.90 mmol) in THF (45 mL) cooled to 0 °C, was added dropwise a solution of 2,2,2-trichloroacetic acid (3.11 g, 19.1 mmol) in H_2O (15 mL). Upon completion of the addition, the reaction mixture was stirred for 1 h at 0 °C. The reaction mixture was neutralized using sodium carbonate, diluted with water (100 mL) and extracted with EtOAc (3 x 50 mL). The combined organic layers were dried over magnesium sulphate,

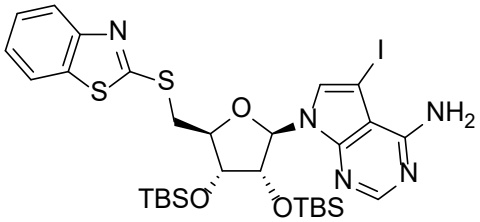
filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 10-50%) to afford compound **67** (1.00 g, 84% yield) as a black solid. LCMS (ES^+, Method 3) *m/z* 621.3 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.2 (s, 1H), 7.14 (s, 1H), 6.57 - 6.54 (m, 1H), 5.89 (brs, 2H), 5.62 (d, *J* = 8.0 Hz, 1H), 5.04 - 5.38 (m, 1H), 4.30 (d, *J* = 4.4 Hz, 1H), 3.92 (d, *J* = 13.4 Hz, 1H), 3.72 - 3.69 (m, 1H), 0.95 (s, 9H), 0.76 (s, 9H), 0.12 (d, *J* = 5.2 Hz, 6H), -0.14 (s, 3H), -0.59 (s, 3H).

((2R,3R,4R,5R)-5-(4-Amino-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)methyl methanesulfonate (68)



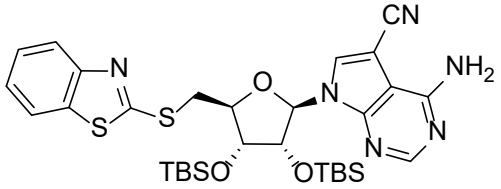
To a solution of compound **67** (1.00 g, 1.61 mmol) and triethylamine (978 mg, 9.67 mmol) in THF (10 mL) was added dropwise methanesulfonic anhydride (842 mg, 4.83 mmol) at 0 °C under inert atmosphere. The mixture was warmed to RT and stirred for 2 h. The reaction was quenched with water (20 mL) and extracted with EtOAc (3 x 20 mL). The combined organic layers were washed with brine (20 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 10-50%) to afford compound **68** (1.00 g, 89% yield) as yellow oil. LCMS (ES^+, Method 3) *m/z* 699.2 $[M+H]^+$; ^1H NMR (400 MHz, MeOH-d_4): δ 8.27 (s, 1H), 7.28 - 7.27 (m, 1H), 6.03 (d, *J* = 4.4 Hz, 1H), 5.76 (s, 1H), 4.72 (t, *J* = 4.4 Hz, 1H), 4.58 - 4.55 (m, 1H), 4.49 - 4.45 (m, 1H), 4.35 - 4.30 (m, 2H), 3.03 (s, 1H), 0.95 (s, 9H), 0.84 (s, 9H), 0.14 (d, *J* = 4.0 Hz, 6H), 0.002 (s, 3H), -0.13 (s, 3H).

7-((2R,3R,4R,5S)-5-((Benzo[d]thiazol-2-ylthio)methyl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-4-amine (69)



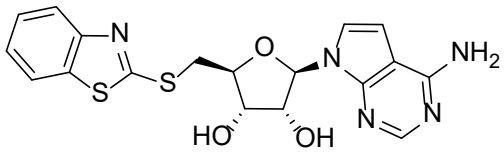
To a solution of compound **68** (1 g, 1.43 mmol) in DMF (3 mL) was added 1,3-benzothiazol-2-ylsulfanyl sodium (812 mg, 4.29 mmol). The resulting mixture was stirred at 50 °C for 12 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and the resulting aqueous layer extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulphate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-15%) to afford compound **69** (1.05 g, 95% yield) as a yellow solid. LCMS (ES^+, Method 3) *m/z* 770.2 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.2 (s, 1H), 7.78 (d, *J* = 8.4 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.45 - 7.40 (m, 1H), 7.35 - 7.33 (m, 1H), 7.24 - 7.2 2(m, 1H), 5.99 (d, *J* = 6.4 Hz, 1H), 5.66 (s, 2H), 4.99 - 4.96 (m, 1H), 4.45 (dd, *J* = 5.8, 2.4 Hz, 1H), 4.33 - 4.32(m, 1H), 3.98 - 3.93 (m, 1H), 3.83 (d, *J* = 6.4 Hz, 1H), 2.05 (s, 4H), 1.28 - 1.25 (m, 4H), 0.97 - 0.91 (m, 10H), 0.11 (d, *J* = 9.3 Hz, 6H), -0.14 (s, 3H), -0.32 (s, 1H).

4-Amino-7-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidine-5-carbonitrile (70)



To a solution of compound **69** (100 mg, 129 µmol) in DMF (5 mL) was added $Pd(PPh_3)_4$ (30.0 mg, 25.9 µmol) and zinc cyanide (30.5 mg, 259 µmol). The reaction mixture was stirred at 90 °C under inert atmosphere for 16 h. The reaction was quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **70** (80.0 mg, 92% yield) as yellow oil. LCMS (ES^+, Method 1) *m/z* 669.2 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.36 (s, 1H), 7.89 (d, *J* = 8.0 Hz, 1H), 7.78 - 7.77 (m, 2H), 7.44 (td, *J* = 8.4, 1.2 Hz, 1H), 7.32 (td, *J* = 8.0, 0.8 Hz, 1H), 5.97 (d, *J* = 6.0 Hz, 1H), 5.62 (s, 2H), 4.98 (dd, *J* = 5.6, 4.4 Hz, 1H), 4.50 - 4.48 (m, 1H), 4.29 (dd, *J* = 4.0, 2.8 Hz, 1H), 3.96 (dd, *J* = 14.4, 5.6 Hz, 1H), 3.88 (dd, *J* = 14.0, 5.6 Hz, 1H), 0.95 (s, 9H), 0.94 (s, 9H), 0.12 (s, 3H), 0.10 (s, 3H), -0.12 (s, 3H), -0.29 (s, 3H).

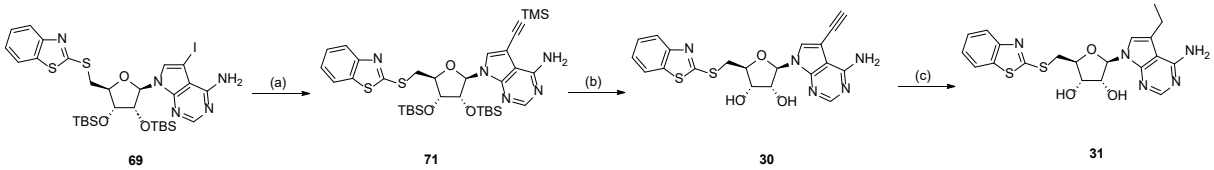
4-Amino-7-[(2*R*,3*R*,4*S*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)-3,4-dihydroxy-tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidine-5-carbonitrile (29)



To a solution of compound **70** (80.0 mg, 0.12 mmol) in MeOH (3 mL) was added potassium fluoride (69.5 mg, 1.20 mmol). The resulting mixture was stirred at 60 °C for 16 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-25%) and then purified by prep-HPLC (Method 10) to afford compound **29** (6.36 mg, 12% yield) as a grey solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{19}H_{16}N_6O_3S_2$ 441.0804; found 441.0817; ^1H NMR (400 MHz, DMSO-d_6): δ8.49 (s, 1H), 8.23 (s, 1H), 8.00 (d, *J* = 8.0 Hz, 1H), 7.86 (d, *J* = 8.0 Hz, 1H), 7.47 (t, *J* = 7.2 Hz, 1H), 7.37 (t, *J* = 7.6 Hz, 1H), 6.90 (brs, 2H), 6.10 (d, *J* = 5.6 Hz, 1H), 5.62 (d, *J* = 6.0Hz, 1H), 5.51 (d, *J* = 4.8 Hz, 1H), 4.59 (q, *J* = 5.2 Hz, 1H), 4.28 - 4.19 (m, 2H), 3.84 (dd, *J* = 13.6, 5.2 Hz, 1H), 3.74 (dd, *J* = 13.6, 7.6 Hz, 1H).

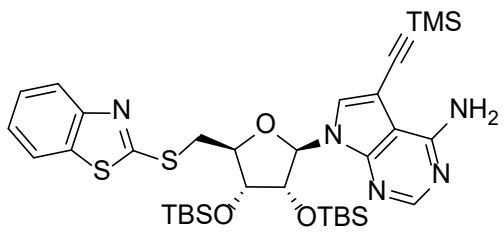
1.9.9 Synthesis of compounds 30 and 31

Scheme S14



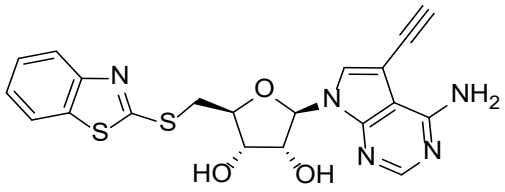
(a) TMS-acetylene, $Pd(PPh_3)_4$, $Zn(CN)_2$, DMF, 60 °C, 2 h, 62%; (b) KF, MeOH, 60 °C, 16 h, 74%; (c) H_2, Pd/C, RT, 2 h, 18%.

7-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-5-(2-trimethylsilylethynyl)pyrrolo[2,3-d]pyrimidin-4-amine (71)



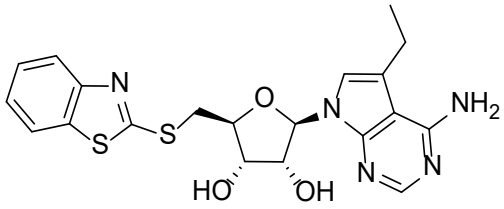
To a solution of compound **69** (200 mg, 259 µmol) in THF (10 mL) was added ethynyl (trimethyl)silane (71.9 µL, 519 µmol), triethylamine (108 µL, 779 µmol), copper iodide (14.84 mg, 77.93 µmol) and $Pd(PPh_3)_4$ (30.0 mg, 25.9 µmol). The reaction mixture was stirred at 60 °C under inert atmosphere for 2 h, cooled to RT and then concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-50%) to afford compound **71** (120 mg, 62% yield) as yellow oil. ^{1}H NMR (400 MHz, $CDCl_3$): *δ* 8.26 (s, 1H), 7.89 - 7.87 (m, 1H), 7.77 - 7.75 (m, 1H), 7.44 - 7.40 (m, 1H), 7.36 (s, 1H), 7.33 - 7.29 (m, 1H), 5.96 (d, *J* = 6.0 Hz, 1H), 4.96 (dd, *J* = 6.4, 4.8 Hz, 1H), 4.45 - 4.43 (m, 1H), 4.31 (dd, *J* = 4.8, 2.8 Hz, 1H), 3.94 (dd, *J* = 14.0, 6.0 Hz, 1H), 3.82 (dd, *J* = 14.0, 6.8 Hz, 1H), 0.93 (s, 9H), 0.77 (s, 9H), 0.30 (s, 9H), 0.12 (s, 3H), 0.09 (s, 3H), -0.13 (s, 3H), -0.29 (s, 3H).

(2*R*,3*R*,4*S*,5*S*)-2-(4-Amino-5-ethynyl-pyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol (30)



To a solution of compound **71** (100 mg, 0.14 mmol) in MeOH (10 mL) was added potassium fluoride (78.4 mg, 1.35 mmol). The reaction mixture was stirred at 70 °C for 16 h. The mixture was concentrated under reduced pressure and the residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-55%) to afford compound **30** (45.0 mg, 74% yield) as an off-white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{20}H_{17}N_5O_3S_2$ 440.0851; found 440.0851; ^{1}H NMR (400 MHz, DMSO-d_6): *δ* 8.14 (s, 1H), 8.00 (d, *J* = 7.6 Hz, 1H), 7.88 - 7.86 (m, 2H), 7.47 (t, *J* = 7.6 Hz, 1H), 7.37 (t, *J* = 7.6 Hz, 1H), 6.73 (brs, 1H), 6.07 (d, *J* = 6.0 Hz, 1H), 5.58 (s, 1H), 4.58 (t, *J* = 5.6 Hz, 1H), 4.31 (s, 1H), 4.21 - 4.16 (m, 2H), 3.82 (dd, *J* = 13.2, 5.2 Hz, 1H), 3.72 (dd, *J* = 13.2, 7.2 Hz, 1H). $[\alpha]_D^{20}$ = +28.3 (c=0.1, MeOH).

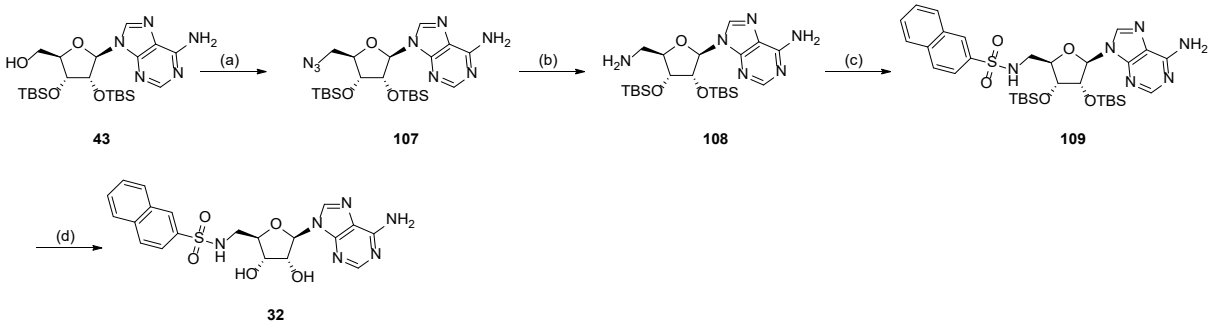
(2*R*,3*R*,4*S*,5*S*)-2-(4-amino-5-ethyl-pyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol (31)



To a solution of compound **30** (20.0 mg, 45.5 µmol) in MeOH (8 mL) was added Pd/C (20.0 mg, 4.55 µmol, 10%) under inert atmosphere. The suspension was degassed under reduced pressure and purged with H_2 several times. The resulting mixture was stirred under hydrogen at RT for 2 h. The reaction mixture was filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-55%) and then by prep-HPLC (Method 11) to afford compound **31** (3.24 mg, 18% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{20}H_{21}N_5O_3S_2$ 444.1164; found 444.1124; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.03 (s, 1H), 8.00 (d, *J* = 8.0 Hz, 1H), 7.86 (d, *J* = 8.0 Hz, 1H), 7.47 (t, *J* = 8.0 Hz, 1H), 7.36 (t, *J* = 7.6 Hz, 1H), 7.07 (s, 1H), 6.56 (s, 2H), 6.07 (d, *J* = 6.0 Hz, 1H), 5.38 - 5.35 (m, 2H), 4.52 (q, *J* = 5.2Hz, 1H), 4.16 - 4.14 (m, 2H), 3.81 (dd, *J* = 13.6, 5.2 Hz, 1H), 3.68 (dd, *J* = 13.6, 6.8 Hz, 1H), 2.75 (q, *J* = 7.2 Hz, 2H), 1.18 (t, *J* = 7.6 Hz, 3H).

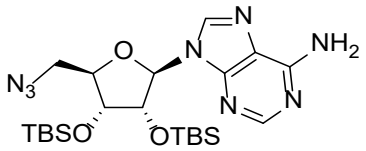
1.9.10 Synthesis of compound 32

Scheme S15



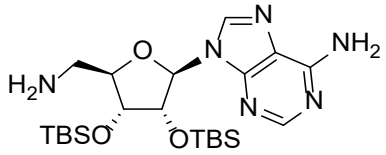
(a) DPPA, PPh_3, DIAD THF, 0 °C to RT, 16 h 38%; (b) PPh_3, THF, water, 40 °C, 16 h, 84%; (c) naphthalene-2-sulfonyl chloride, TEA, DMF, RT, 16 h, 50%; (d) KF DMF, 60 °C, 16 h, 44%.

9-[(2*R*,3*R*,4*R*,5*R*)-5-(azidomethyl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]purin-6-amine (107)



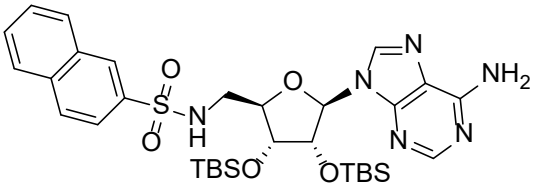
To a solution of compound **43** (1.00 g, 2.02 mmol) and triphenylphosphine (740 mg, 2.82 mmol) in THF (20 mL) was added di*iso*propyl azodicarboxylate (549 µL, 2.82 mmol), followed by a solution of diphenyl phosphoryl azide (611 µL, 2.82 mmol) in THF (10 mL) at 0 °C. The reaction mixture was warmed to RT, stirred for 16 h and then concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-25%) to afford compound **107** (400 mg, 38% yield) as a white solid. LCMS (ES^+, Method 1) *m/z* 521.3 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.35 (s, 1H), 8.01 (s, 1H), 5.90 (d, *J* = 4.4 Hz, 1H), 5.74 (s, 2H), 4.94 (t, *J* = 4.4 Hz, 1H), 4.33 (t, *J* = 4.4 Hz, 1H), 4.21 (q, *J* = 4.8 Hz, 1H), 3.73 - 3.72 (m, 2H), 0.94 (s, 9H), 0.84 (s, 9H), 0.13 (s, 3H), 0.11 (s, 3H), -0.01 (s, 3H), -0.17 (s, 3H).

9-[(2*R*,3*R*,4*R*,5*R)*-5-(Aminomethyl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]purin-6-amine (108)



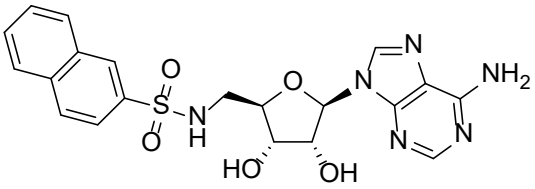
To a solution of compound **107** (400 mg, 768 µmol) in THF (8 mL) and water (0.8 mL) was added triphenylphosphine (241 mg, 921 µmol). The reaction mixture was stirred at 40 °C for 16 h and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-25%) to afford compound **108** (320 mg, 84% yield) as a yellow solid. LCMS (ES^+, Method 2) *m/z* 495.3 $[M+H]^+$.

***N*-[[(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl (dimethyl)silyl] oxy]tetrahydrofuran-2-yl]methyl]naphthalene-2-sulfonamide (109)**



To a solution of compound **108** (50.0 mg, 101 µmol) in DMF (2 mL) was added naphthalene-2-sulfonyl chloride (22.9 mg, 101 µmol) at 0 °C and stirred at RT for 16 h. The reaction was quenched with water (10 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (2 x 5 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by preparative TLC (SiO_2, petroleum ether/ethyl acetate 50%) to afford compound **109** (50.0 mg, 72% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 669.4 $[M+H]^+$.

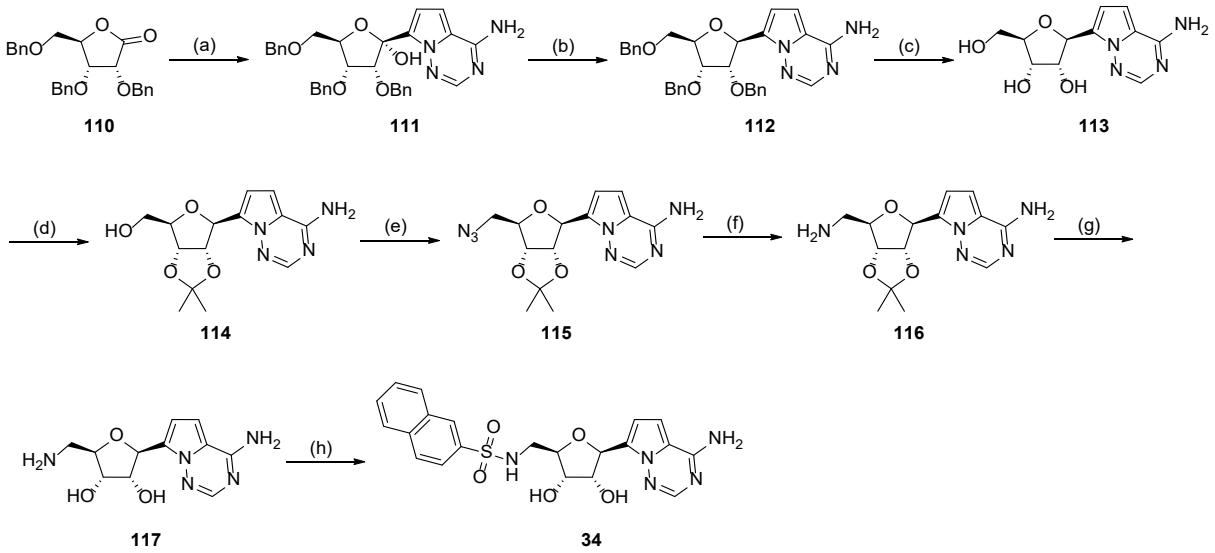
***N*-[[(2*R*,3*S*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-dihydroxy-tetrahyd rofuran-2-yl]methyl]naphthalene-2-sulfonamide (32)**



To a solution of compound **109** (50.0 mg, 72.9 µmol) in DMF (2 mL) was added potassium fluoride (42.4 mg, 729 µmol) and stirred at 60 °C for 16 h. The reaction mixture was then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 12) to afford compound **32** (14.9 mg, 44% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{20}H_{20}N_6O_5S$ 457.1294; found 457.1380; ^1H NMR (400 MHz, DMSO-d_6): δ 8.43 (s, 1H), 8.35 (s, 1H), 8.13 - 8.08 (m, 3H), 8.02 (d, *J* = 7.6 Hz, 1H), 7.80 (dd, *J* = 8.8, 2.0 Hz, 1H), 7.71 - 7.63 (m, 2H), 7.36 (s, 2H), 5.82 (d, *J* = 6.4 Hz, 1H), 5.38 (brs, 1H), 4.70 (t, *J* = 5.6 Hz, 1H), 4.09 - 4.07 (m, 1H), 4.01 - 3.99 (m, 1H), 3.10 (d, *J* = 4.8 Hz, 2H). $[\alpha]_D^{20}$ = +61.3 (c=0.1, MeOH).

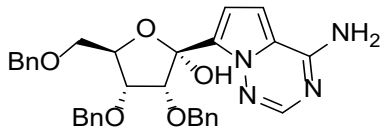
1.9.11 Synthesis of compound 34

Scheme S16



(a) 7-iodopyrrolo[2,1-f][1,2,4]triazin-4-amine 2, n-BuLi, 1,2-bis(chlorodimethylsilyl)ethane, THF, -78 °C, 26%; (b) Et_3SiH, $BF_3{\cdot}Et_2O$ DCM, 0 °C, RT, 97%; (c) H_2, Pd/C AcOH, RT, 16 h, 84%; (d) 2,2-dimethoxypropane, TsOH, DMF, Acetone, 60 °C, 16 h, 92%; (e) DPPA, DIAD, PPh_3, THF, 0 °C to RT, 16 h, 57%; (f) PPh_3, H_2O, THF, 40 °C, 16 h, 18% (g) HCl, MeOH, H_2O, RT, 2 h, 69%; (h) naphthalene-2-sulfonyl chloride TEA, DMF, 0 °C, 2 h, 17%.

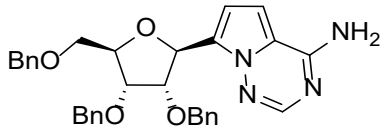
(2*S*,3*R*,4*R*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4- dibenzyloxy-5-(benzyloxy methyl)tetrahydrofuran-2-ol (111)



To a suspension of 7-iodopyrrolo[2,1-f][1,2,4]triazin-4-amine (4.92 g, 18.9 mmol) and chloro-[2-[chloro(dimethyl)silyl]ethyl]-dimethyl-silane (4.07 g, 18.9 mmol) in THF (70 mL) was added n-butyllithium (24.1 mL, 2.5 M in hexane) at -78 °C under inert atmosphere. The reaction mixture was stirred for 30 min prior to the addition of a solution of compound **110** (7.20 g, 17.2 mmol) in THF (20 mL) and then further stirred at -78 °C for 1 h. The reaction was quenched with sat. aq. ammonium chloride solution (150 mL) at 0 °C and then extracted with EtOAc (3 x 50 mL). The combined organic layers were washed with sat. aq. sodium bicarbonate (80 mL), brine (80 mL), dried over sodium sulfate, filtered, and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 2-100%) to afford compound **111** (2.50 g, 26% yield) as yellow oil. LCMS (ES^+, Method 2) *m/z* 575.4 $[M+Na]^+$; ^1H NMR (400 MHz, DMSO-d_6): δ 8.07 (s, 2H), 7.99 (s, 1H), 7.36 - 7.23 (m, 13H), 7.17 - 7.12 (m, 2H), 6.99 - 6.98 (m, 1H), 6.94 (d, *J* = 4.8 Hz, 1H), 5.38 (d, *J* = 6.0 Hz, 1H), 5.07 (d, *J* = 5.2 Hz, 1H), 7.57 (dd, *J* = 11.6, 2.4 Hz, 2H), 4.49

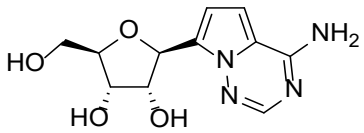
- 4.44 (m, 4H), 4.01 - 4.00 (m, 1H), 3.92 (t, *J* = 6.0 Hz, 1H), 3.68 (dd, *J* = 10.0, 3.2 Hz, 1H), 3.46 (dd, *J* = 10.0, 6.4 Hz, 1H).

7-[(2*S*,3*S*,4*R*,5*R*)-3,4-Dibenzyloxy-5-(benzyloxymethyl) tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine (112)



To a solution of compound **111** (2.00 g, 3.62 mmol) and triethylsilane (1.50 mL, 9.41 mmol) in DCM (20 mL) was added dropwise boron trifluoride diethyl etherate (1.43 mL, 5.43 mmol, 47% purity) at 0 °C under inert atmosphere and stirred for 2 h. The reaction mixture was quenched with sat. aq. sodium bicarbonate (50 mL) at 0 °C, and then extracted with DCM (3 x 20 mL). The combined organic layers were dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **112** (1.90 g, 97% yield) As yellow oil. LCMS (ES^+, Method 3) *m/z* 537.4 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 7.92 (s, 1H), 7.36 - 7.28 (s, 15H), 6.73 (d, *J* = 4.8 Hz, 1H), 6.60 (d, *J* = 4.4 Hz, 1H), 5.68 (d, *J* = 4.0 Hz, 1H), 4.74 (s, 2H), 4.63 - 4.53 (m, 3H), 4.47 - 4.44 (m, 1H), 4.42 - 4.40 (m, 1H), 4.27 (t, *J* = 4.4 Hz, 1H), 4.16 - 4.14 (m, 1H), 3.79 (dd, *J* = 10.8, 3.6 Hz, 1H), 3.67 (dd, *J* = 10.8, 4.0 Hz, 1H).

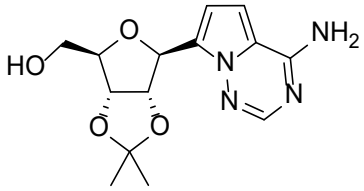
(2*S*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl) -5-(hydroxymethyl) tetra hydrofuran-3,4-diol (113)



To a solution compound **112** (1.90 g, 3.54 mmol) in acetic acid (30 mL) was added Pd/C (1.00 g, 354 µmol, 10% wt.) under inert atmosphere. The reaction mixture was degassed and refilled with H_2 three times and stirred under a H_2 atmosphere (50 psi) at RT for 16 h. The mixture was filtered, and the filtrate was concentrated under reduced pressure to afford compound **113** (800 mg, 84% yield) as a white solid. The isolated product was used in the

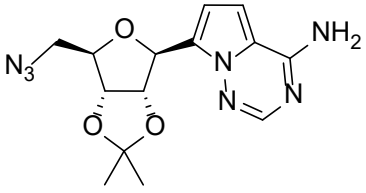
following step without any further purification. LCMS (ES^+, Method 4) *m/z* 267.1 $[M+H]^+$; ^1H NMR (400 MHz, DMSO-d_6): δ 7.82 (s, 1H), 7.68 (s, 1H), 6.84 (d, *J* = 4.8 Hz, 1H), 6.68 (d, *J* = 4.8 Hz, 1H), 5.11 (d, *J* = 6.8 Hz, 1H), 4.23 (t, *J* = 6.0 Hz, 1H), 3.95 (t, *J* = 5.6 Hz, 1H), 3.79 (q, *J* = 4.8 Hz, 1H), 3.55 (dd, *J* = 12.0, 4.0 Hz, 1H), 3.45 (dd, *J* = 12.4, 5.2 Hz, 1H).

[(3a*S*,4*S*,6*R*,6a*R*)-4-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-2,2 -dimethyl-3a,4,6,6a-tetrahydrofuro[3,4-d][1,3]dioxol-6-yl]methanol (114)



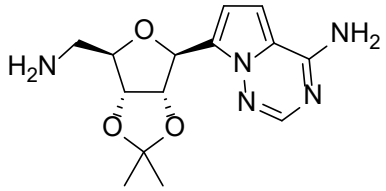
To a solution of compound **113** (800 mg, 3.00 mmol) in DMF (10 mL) and acetone (10 mL) was added 2,2-dimethoxypropane (368 µL, 3.00 mmol) and 4-methylbenzenesulfonic acid (628 mg, 3.31 mmol) and stirred at 60 °C for 16 h. The reaction mixture was cooled to RT, quenched with sat. aq. sodium bicarbonate (50 mL) and extracted with EtOAc (3 x 30 mL). The combined organic layers were washed with brine (3 x 20 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% TFA in water/MeCN gradient 0-55%) to afford compound **114** (850 mg, 92% yield) as a white solid. LCMS (ES^+, Method 3) *m/z* 307.2 $[M+H]^+$; ^1H NMR (400 MHz, DMSO-d_6): δ 7.85 (s, 1H), 7.74 (s, 2H), 6.84 (d, *J* = 4.4 Hz, 1H), 6.74 (d, *J* = 4.4 Hz, 1H), 5.22 (d, *J* = 4.8 Hz, 1H), 5.03 (t, *J* = 5.2 Hz, 1H), 4.88 (t, *J* = 6.0 Hz, 1H), 4.72 (dd, *J* = 6.8, 4.0 Hz, 1H), 3.97 (q, *J* = 4.0 Hz, 1H), 3.48 (t, *J* = 5.6 Hz, 2H), 1.50 (s, 3H),1.30 (s, 3H).

7-[(3a*S*,4*S*,6*R*,6a*R*)-6-(Azidomethyl)-2,2-dimethyl-3a,4,6,6a-tetrahydrofuro[3,4-d][1,3] dioxol-4-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine (115)



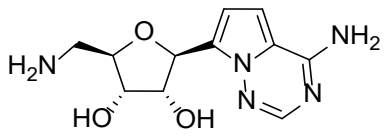
To a solution of compound **114** (480 mg, 1.57 mmol) and triphenylphosphine (575 mg, 2.19 mmol) in THF (6 mL) was added di*iso*propyl azodicarboxylate (425 µL, 2.19 mmol), followed by a solution of diphenyl phosphoryl azide (473 µL 2.19 mmol) in THF (2 mL) at 0°C under inert atmosphere. The reaction mixture was warmed to RT, stirred for 16 h and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% TFA in water/MeCN gradient 0-25%) to afford compound **115** (300 mg, 57% yield) as a white solid. LCMS (ES^+, Method 1) *m/z* 332.2 $[M+H]^+$.

7-[(3a*S*,4*S*,6*R*,6a*R*)-6-(Aminomethyl)-2,2-dimethyl-3a,4,6,6a- tetrahydrofuro[3,4-d][1,3] dioxol-4-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine (116)



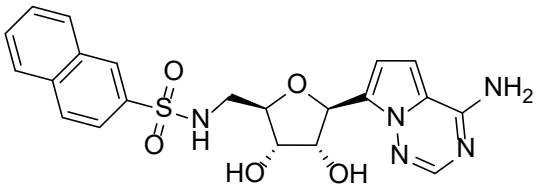
To a solution of compound **115** (300 mg, 0.91 mmol) in THF (5 mL) and water (0.5 mL) was added triphenylphosphine (284 mg, 1.09 mmol) and stirred at 40 °C for 16 h. The reaction mixture was cooled to RT and then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-25%) to afford compound **116** (50.0 mg, 18% yield) as a yellow solid. LCMS (ES^+, Method 2) *m/z* 306.21 $[M+H]^+$.

(2*R*,3*S*,4*R*,5*S*)-2-(Aminomethyl)-5-(4-aminopyrrolo[2,1-f][1,2,4] triazin-7-yl)tetrahydrofuran -3,4-diol (117)



To a solution of compound **116** (50.0 mg, 163 µmol) in MeOH (3 mL) was added hydrochloric acid (3 mL, 1N in MeOH) and stirred at RT for 2 h. The reaction mixture was then concentrated under reduced pressure. The residue was purified by reverse column chromatography (0.05% $NH_3{\cdot}H_2O$ in water/MeCN gradient 0-5%) to afford compound **117** (30.0 mg, 69% yield) as a yellow solid. LCMS (ES^+, Method 6) *m/z* 266.3 $[M+H]^+$.

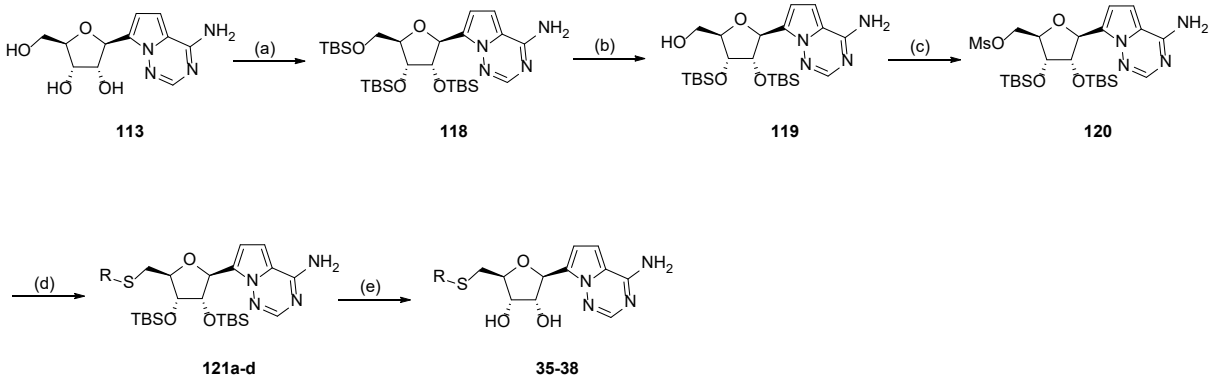
***N*-[[(2*R*,3*S*,4*R*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4- dihydroxy-tetrahydrofuran-2-yl]methyl]naphthalene-2-sulfonamide (34)**



To a solution of compound **117** (30.0 mg, 113 µmol) in DMF (1 mL) was added triethylamine (47.2 µL 339 µmol) and naphthalene-2-sulfonyl chloride (25.6 mg, 113 µmol) at 0 °C and stirred for 2 h. The reaction mixture was concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 13) to afford compound **34** (9.23 mg, 17% yield) as an off-white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{21}H_{21}N_5O_5S$ 456.1342; found 456.1329; ^1H NMR (400 MHz, DMSO-d_6): δ 8.45 (s, 1H), 8.12 (t, *J* = 8.0 Hz, 2H), 8.03 (d, *J* = 8.0 Hz, 1H), 7.97 (t, *J* = 6.0 Hz, 1H), 7.83 - 7.81 (m, 2H), 7.75 - 7.64 (m, 4H), 6.81 (d, *J* = 4.4 Hz, 1H), 6.62 (d, *J* = 4.4 Hz, 1H), 5.03(t, *J* = 6.4 Hz, 2H), 4.98 (d, *J* = 5.2 Hz, 1H), 4.29 (q, *J* = 6.0 Hz, 1H), 3.90 - 3.86 (m, 1H), 3.85 - 3.82 (m, 1H), 3.03 - 3.01 (m, 1H), 2.96 - 2.94 (m, 1H).

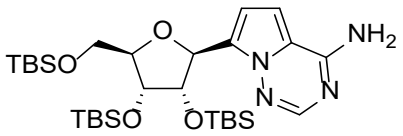
1.9.12 Synthesis of compounds 35-38

Scheme S17



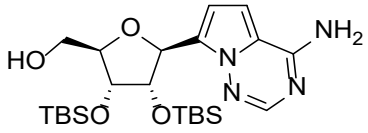
(a) TBSCl, imidazole, DMF, RT, 2 h, 94%; (b) CCl_3COOH, THF, 0 °C, 4 h, 98%; (c) Ms_2O TEA, THF, 0 °C, 2 h, 52%; (d) RSH, NaH, THF, 0-70 °C, 16 h, 69-89%; (e) KF, DMF, 70 °C, 16 h, 13-72 %.

7-[(2*S*,3*S*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert- butyl(dimethyl) silyl]oxymethyl]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine (118)



To a solution of compound **113** (3.00 g, 11.3 mmol) in DMF (30 mL) was added imidazole (8.44 g, 124 mmol) and *tert*-butylchloro dimethylsilane (7.62 mL, 61.9 mmol) and stirred at RT for 2 h. The reaction mixture was quenched with water (100 mL) and extracted with EtOAc (3 x 50 mL). The combined organic layers were washed with brine (4 x 20 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-20%) to afford compound **118** (6.50 g, 94% yield) as yellow oil. LCMS (ES^+, Method 2) *m/z* 609.5 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 7.89 (s, 1H), 6.75 (d, *J* = 4.8 Hz, 1H), 6.59 (d, *J* = 4.4 Hz, 1H), 5.37 (d, *J* = 5.6 Hz, 1H), 4.53 - 4.51 (m, 1H), 4.26 - 4.24 (m, 1H), 4.06 (q, *J* = 4.0 Hz, 1H), 3.90 (dd, *J* = 10.8, 4.8 Hz, 1H), 3.75 (dd, *J* = 11.2, 3.6 Hz, 1H), 0.91 (s, 9H), 0.80 (s, 9H), 0.08 (s, 3H), 0.06 (s, 3H), -0.06 (s, 3H), -0.21 (s, 3H).

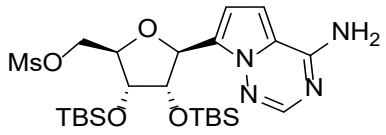
[(2*R*,3*R*,4*S*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl) -3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methanol (119)



To a solution of compound **118** (5.00 g, 8.21 mmol) in THF (50 mL) was added a solution of 2,2,2-trichloroacetic acid (13.4 g, 82.2 mmol) in water (15 mL) at 0 °C and stirred for 4 h. The reaction mixture was quenched by sat. aq. sodium bicarbonate (100 mL) and extracted with EtOAc (3 x 50 mL). The combined organic layers were washed with brine (3 x 20 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-25%) to afford compound **119** (4.00 g, 98% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 495.4 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 7.92 - 7.91 (m, 1H), 6.71 - 6.70 (m, 1H), 6.61 (d, *J* = 4.4 Hz, 1H), 5.99 (brs, 2H), 5.28 (s, 1H), 5.11 (d, *J* = 9.2 Hz, 1H), 4.90 (dd, *J* = 8.8, 4.8 Hz, 1H), 4.29 (d, *J* = 4.8 Hz, 1H), 4.15 - 4.10 (m, 1H), 3.89 (dd, *J* = 12.4, 2.0 Hz, 1H), 3.70

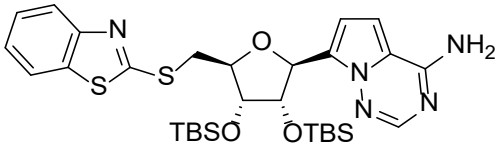
(d, *J* = 12.4 Hz, 1H), 0.95 (s, 9H), 0.73 (s, 9H), 0.12 (s, 3H), 0.11 (s, 3H), -0.19 (s, 3H), -0.67 (s, 3H).

[(2*R*,3*R*,4*S*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methyl methanesulfonate (120)



To a solution of compound **119** (1.00 g, 2.02 mmol) and triethylamine (2.81 mL, 20.2 mmol) in THF (10 mL) was added a solution of methanesulfonic anhydride (1.06 g, 6.06 mmol) in THF (5 mL) at 0 °C under inert atmosphere and stirred for 2 h. The reaction mixture was quenched with sat. aq. sodium bicarbonate (20 mL) at 0 °C, and then extracted with EtOAc (3 x 20 mL). The combined organic layers were washed with brine (3 x 10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **120** (600 mg, 52% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 573.4 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 7.94 (s, 1H), 6.72 (d, *J* = 4.4 Hz, 1H), 6.62 (d, *J* = 4.4 Hz, 1H), 5.67 (s, 2H), 5.39 (d, *J* = 3.6 Hz, 1H), 4.55 - 4.50 (m, 2H), 4.42 (dd, *J* = 11.2, 4.8 Hz, 1H), 4.29 - 4.21 (m, 2H), 2.96 (s, 3H), 0.93 (s, 9H), 0.87 (s, 9H), 0.11 (s, 3H), 0.09 (s, 3H), 0.02 (s, 3H), -0.06 (s, 3H).

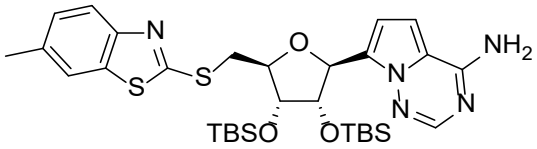
7-[(2*S*,3*S*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl) -3,4-bis[[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine (121a)



To a solution of compound **120** (100 mg, 174 µmol) in DMF (1 mL) was added 1,3-benzothiazol-2-ylsulfanyl sodium (165 mg, 872 µmol) and stirred at 50 °C for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (3 x 10 mL), dried over sodium sulfate,

filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **121a** (100 mg, 89% yield) as a yellow solid. LCMS (ES^+, Method 2) *m/z* 644.4 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 7.91 (s, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.75 (d, *J* = 7.6 Hz, 1H), 7.42 (t, *J* = 7.2 Hz, 1H), 7.32 - 7.29 (m, 1H), 6.77 (d, *J* = 4.8 Hz, 1H), 6.64 (d, *J* = 4.8 Hz, 1H), 5.70 (s, 2H), 5.34 (d, *J* = 5.6 Hz, 1H), 4.75 (t, *J* = 4.4 Hz, 1H), 4.44 (q, *J* = 4.4 Hz, 1H), 4.26 (t, *J* = 4.0 Hz, 1H), 3.95 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.70 (dd, *J* = 13.6, 6.4 Hz, 1H), 0.94 (s, 9H), 0.80 (s, 9H), 0.11 (s, 3H), 0.09 (s, 3H), -0.07 (s, 3H), -0.24 (s, 3H).

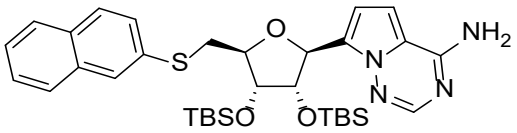
7-[(2S,3S,4R,5S)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[(6-methyl -1,3-benzothiazol-2-yl)sulfanylmethyl]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine (121b)



To a solution of 6-methyl-1,3-benzothiazole-2-thiol (63.3 mg, 349 µmol) in THF (2 mL) was added sodium hydride (13.9 mg, 349 µmol, 60% dispersion in mineral oil) at 0°C under inert atmosphere and stirred for 30 min. A solution of compound **120** (100 mg, 174 µmol) in THF (2 mL) was added and gradually heated to 70 °C and stirred for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **121b** (80.0 mg, 69% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 658.4 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 7.91 (s, 1H), 7.73 (d, *J* = 8.4 Hz, 1H), 7.54 (s, 1H), 7.22 (d, *J* = 8.4 Hz, 1H), 6.77 (d, *J* = 4.8 Hz, 1H), 6.64 (d, *J* = 4.8 Hz, 1H), 5.67 (s, 2H), 5.34 (d, *J* = 5.6 Hz, 1H), 4.75 (dd, *J* = 5.6, 4.8 Hz, 1H), 4.44 - 4.40 (m, 1H), 4.25 (t, *J* = 4.0 Hz, 1H), 3.92 (dd, *J* = 13.6, 5.6 Hz, 1H), 3.68 (dd, *J* = 13.6, 6.4 Hz, 1H), 0.93 (s, 9H), 0.80 (s, 9H), 0.10 (s, 3H), 0.08 (s, 9H), -0.10 (s, 3H), -0.30 (s, 3H).

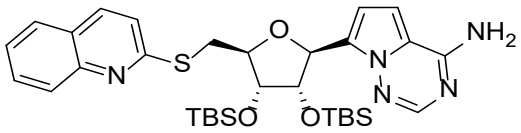
7-[(2*S*,3*S*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (2-naphthylsulfanylmethyl)

tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine (121c)



To a solution of naphthalene-2-thiol (55.9 mg, 349 µmol) in THF (2 mL) was added sodium hydride (13.9 mg, 349 µmol, 60% dispersion in mineral oil) at 0 °C under inert atmosphere and stirred for 30 min. A solution of compound **120** (100 mg, 174 µmol) in THF (2 mL) was added, gradually then heated to 70 °C and stirred for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **121c** (80.0 mg, 72% yield) as a white solid. LCMS (ES^+, Method 2) *m/z* 637.5 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 7.92 (s, 1H), 7.80 (s, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.73 (d, *J* = 8.8 Hz, 1H), 7.70 (d, *J* = 7.6 Hz, 1H), 7.48 - 7.41 (m, 3H), 6.74 (d, *J* = 4.4 Hz, 1H), 6.60 (d, *J* = 4.4 Hz, 1H), 5.62 (s, 2H), 5.33 (d, *J* = 5.6 Hz, 1H), 4.72 (t, *J* = 4.8 Hz, 1H), 4.32 (q, *J* = 4.8 Hz, 1H), 4.24 (t, *J* = 4.4 Hz, 1H), 3.53 (dd, *J* = 14.0, 6.4 Hz, 1H), 3.36 (dd, *J* = 14.0, 6.0 Hz, 1H), 0.91 (s, 9H), 0.79 (s, 9H), 0.08 (s, 3H), 0.07 (s, 3H), 0.01 (s, 3H), -0.24 (s, 3H).

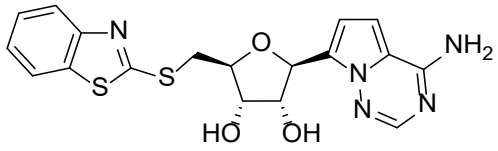
7-[(2*S*,3*S*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]- 5-(2-quinolylsulfanylmethyl) tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4- amine (121d)



To a solution of quinoline-2-thiol (56.3 mg, 349 µmol) in THF (2 mL) was added sodium hydride (13.9 mg, 349 µmol, 60% dispersion in mineral oil) at 0°C under inert atmosphere and stirred for 30 min. A solution of compound **120** (100 mg, 174 µmol) in THF (2 mL) was then added and gradually heated to 70 °C and stirred for 16 h. The reaction mixture was cooled to RT, quenched with water (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic

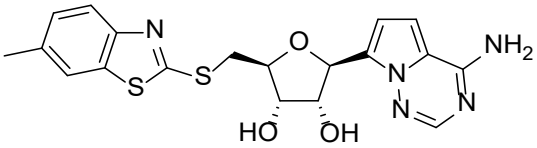
layers were washed with brine (10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-50%) to afford compound **121d** (80.0 mg, 72%) as a white solid. LCMS (ES^+, Method 2) *m/z* 638.5 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 7.95 - 7.94 (m, 2H), 7.89 (d, *J* = 8.4 Hz, 1H), 7.72 (d, *J* = 8.0 Hz, 1H), 7.64 (td, *J* = 7.2, 1.6 Hz, 1H), 7.44 (t, *J* = 6.8 Hz, 1H), 7.25 (d, *J* = 8.8 Hz, 1H), 6.79 (d, *J* = 4.4 Hz, 1H), 6.63 (d, *J* = 4.4 Hz, 1H), 5.70 (s, 2H), 5.36 (d, *J* = 6.0 Hz, 1H), 4.79 (dd, *J* = 5.6, 4.4 Hz, 1H), 4.43 - 4.39 (m, 1H), 4.24 (t, *J* = 4.0 Hz, 1H), 3.99 (dd, *J* = 14.0, 6.4 Hz, 1H), 3.70 (dd, *J* = 14.0, 6.8 Hz, 1H), 0.92 (s, 9H), 0.77 (s, 9H), 0.08 (s, 3H), 0.06 (s, 3H), -0.15 (s, 3H), -0.28 (s, 3H).

(2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol (35)



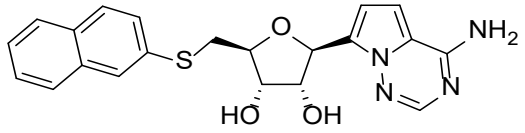
To a solution of compound **121a** (100 mg, 0.16 mmol) in DMF (1 mL) was added potassium fluoride (90.2 mg, 1.55 mmol) and stirred at 70 °C for 16 h. The reaction mixture was cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 14) to afford compound **35** (59.6 mg, 91% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{18}H_{17}N_5O_3S_2$ 416.0851; found 416.0830; ^1H NMR (400 MHz, DMSO-d_6): δ 8.00 (d, *J* = 7.6 Hz, 1H), 7.86 (d, *J* = 8.0 Hz, 1H), 7.84 (s, 1H), 7.70 (brs, 2H), 7.47 (td, *J* = 8.0, 0.8 Hz, 1H), 7.36 (td, *J* = 8.0, 0.8Hz, 1H), 6.85 (d, *J* = 4.4 Hz, 1H), 6.70 (d, *J* = 4.4 Hz, 1H), 5.19 (dd, *J* = 6.0, 4.0 Hz, 2H), 5.15 (d, *J* = 6.0 Hz, 1H), 4.35 (q, *J* = 5.6 Hz, 1H), 4.12 (q, *J* = 6.4Hz, 1H), 4.03 (q, *J* = 4.8 Hz, 1H), 3.77 (dd, *J* = 13.2, 4.8 Hz, 1H), 3.60 (dd, *J* = 13.2, 6.8 Hz, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 166.61, 155.58, 152.61, 147.74, 134.61, 128.40, 126.37, 124.46, 121.80, 121.08, 114.94, 109.55, 100.79, 81.10, 76.16, 73.76, 73.68, 35.90. $[\alpha]_D^{20}$ = -10.9 (c=0.1, MeOH).

(2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [(6-methyl-1,3-benzothiazol-2-yl)sulfanylmethyl]tetrahydrofuran-3,4-diol (36)



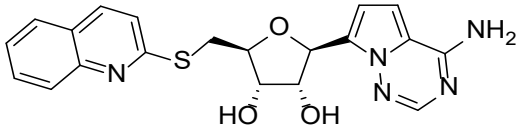
To a solution of compound **121b** (80.0 mg, 0.12 mmol) in DMF (1 mL) was added potassium fluoride (70.6 mg, 1.22 mmol) and stirred at 70 °C for 16 h. The reaction mixture was cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 15) to afford compound **36** (6.85 mg, 13% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{19}H_{19}N_5O_3S_2$ 430.1008; found 430.1006; ^{1}H NMR (400 MHz, DMSO-d_6): δ 7.83 (s, 1H), 7.79 (s, 1H), 7.74 (d, *J* = 8.0 Hz, 1H), 7.70 (brs, 1H), 7.28 (d, *J* = 7.6 Hz, 1H), 6.85 (d, *J* = 4.4 Hz, 1H), 6.69 (d, *J* = 4.4 Hz, 1H), 5.17 (t, *J* = 6.4 Hz, 2H), 5.13 (d, *J* = 6.4 Hz, 1H), 4.34 (q, *J* = 5.2 Hz, 1H), 4.10 (d, *J* = 6.4 Hz, 1H), 4.02 (q, *J* = 4.8 Hz, 1H), 3.73 (dd, *J* = 13.6, 5.2 Hz, 1H), 3.57 (dd, *J* = 12.8, 6.4 Hz, 1H), 2.41 (s, 3H).

(2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)- 5-(2-naphthylsulfanylmethyl) tetrahydrofuran-3,4-diol (37)



To a solution of compound **121c** (80.0 mg, 0.13 mmol) in DMF (1 mL) was added potassium fluoride (72.9 mg, 1.26 mmol) and stirred at 70 °C for 16 h. The reaction mixture was cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 16) to afford compound **37** (21.6 mg, 42% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{21}H_{20}N_4O_3S$ 409.1334; found 409.1345; ^{1}H NMR (400 MHz, DMSO-d_6): δ 7.89 - 7.82 (m, 4H), 7.81 (d, *J* = 8.0 Hz, 1H), 7.69 (brs, 2H), 7.51 - 7.43 (m, 3H), 6.84 (d, *J* = 4.8 Hz, 1H), 6.70 (d, *J* = 4.4 Hz, 1H), 5.18 (d, *J* = 6.0 Hz, 1H), 5.10 (d, *J* = 5.6 Hz, 2H), 4.34 (q, *J* = 5.2 Hz, 1H), 4.04 - 3.97 (m, 2H), 3.42 (dd, *J* = 13.6, 4.8 Hz, 1H), 3.30 - 3.25 (m, 1H).

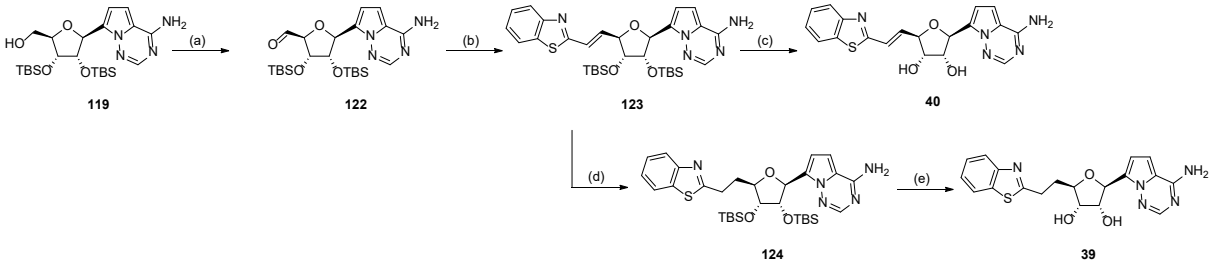
(2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (2-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol (38)



To a solution of compound **121d** (80.0 mg, 0.13 mmol) in DMF (1 mL) was added potassium fluoride (72.8 mg, 1.25 mmol) and stirred at 70 °C for 16 h. The reaction mixture was cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 17) to afford compound **38** (9.52 mg, 19% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{20}H_{19}N_5O_3S$ 410.1287; found 410.1289; ^1H NMR (400 MHz, DMSO-d_6): δ 8.16 (d, *J* = 8.8 Hz, 1H), 7.89 (t, *J* = 8.4 Hz, 2H), 7.84 (s, 1H), 7.74 - 7.70 (m, 2H), 7.51 (t, *J* = 7.6 Hz, 1H), 7.40 (d, *J* = 8.4 Hz, 1H), 6.86 (d, *J* = 4.4 Hz, 1H), 6.72 (d, *J* = 4.4 Hz, 1H), 5.17 (d, *J* = 6.0 Hz, 1H), 5.08 (t, *J* = 5.6 Hz, 2H), 4.39 (q, *J* = 5.6 Hz, 1H),4.07 (q, *J* = 4.8 Hz, 1H), 4.01 (q, *J* = 4.8 Hz, 1H), 3.70 (dd, *J* = 13.6, 6.0 Hz, 1H), 3.55 (dd, *J* = 13.6, 6.4 Hz, 1H).

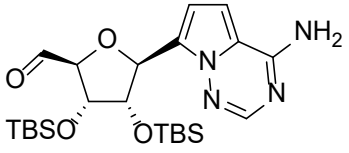
1.9.13 Synthesis of compounds 39 and 40

Scheme S17



(a) IBX, MeCN, 80 °C, 2 h, 80%; (b) (benzo[d]thiazol-2-ylmethyl)triphenylphosphonium chloride, KHMDS, THF, -60 °C, 3 h, 79%; (c) KF, DMF, 70 °C, 16 h, 32%; (e) H_2, Pd/C, THF, RT, 2 h, 95%; (f) KF, DMF, 70 °C, 16 h, 56%

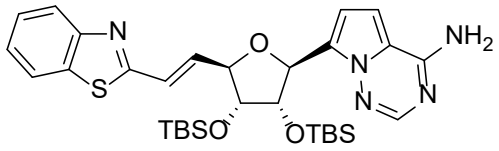
(2S,3R,4S,5S)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-carbaldehyde (122)



To a solution of compound **119** (300 mg, 0.61 mmol) in MeCN (10 mL) was added 1-hydroxy-1,2-benziodoxol-3(1*H*)-one 1-oxide (339 mg, 1.21 mmol) and stirred at 80 °C for 2 h. The reaction mixture was cooled to RT, quenched with sat. aq. sodium sulfite (10 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (3 x

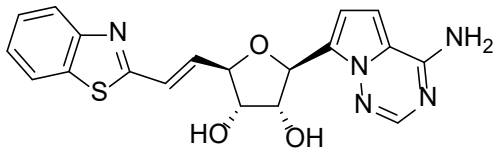
10 mL), dried over sodium sulfate, filtered and the filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-33%) to afford compound **122** (240 mg, 80% yield) as a yellow solid. LCMS (ES^+, Method 2) *m/z* 493.4 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 9.98 (s, 1H), 7.96 - 7.89 (m, 1H), 7.44 (t, *J* = 7.6 Hz, 1H), 7.15 (t, *J* = 8.0 Hz, 1H), 6.81 - 6.77 (m, 1H), 5.38 (d, *J* = 6.8 Hz, 1H), 4.92 - 4.89 (m, 1H), 4.76 - 4.74 (m, 1H), 1.01 (s, 9H), 0.81 (s, 9H), 0.16 (s, 3H), 0.15 (s, 3H), 0.08 (s, 1H), 0.05 (s, 3H).

7-[(2*S*,3*S*,4*R*,5*R*)-5-[(*E*)-2-(1,3-Benzothiazol-2-yl)vinyl]-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine (123)



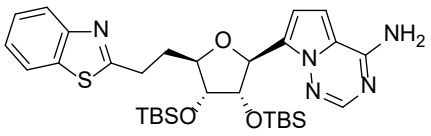
To a solution of (benzo[d]thiazol-2-ylmethyl)triphenylphosphonium chloride (108 mg, 243 µmol) in THF (3 mL) was added dropwise potassium bis(trimethylsilyl) amide (244 µL, 1.0 M in THF) at -60 °C under nitrogen and stirred for 30 min. A solution of compound **122** (80.0 mg, 162.35 µmol) in THF (2 mL) was added and stirred for 1 h. The reaction mixture was quenched with sat. aq. ammonium chloride (20 mL) and extracted with EtOAc (3 x 10 mL). The combined organic layers were washed with brine (2 x 10 mL), dried over sodium sulfate, filtered and the filtrated was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-33%) to afford compound **123** (80.0 mg, 79% yield) as a yellow solid. LCMS (ES^+, Method 2) *m/z* 624.5 $[M+H]^+$; ^1H NMR (400 MHz, $CDCl_3$): δ 8.02 - 8.00 (m, 3H), 7.98 (s, 1H), 7.87 (d, *J* = 8.0 Hz, 1H), 7.48 (t, *J* = 7.6 Hz, 1H), 7.39 (t, *J* = 7.2 Hz, 1H), 7.17 (dd, *J* = 12.0, 1.2 Hz, 1H), 6.93 (dd, *J* = 12.0, 6.4 Hz, 1H), 6.75 (d, *J* = 4.4 Hz, 1H), 6.67 (d, *J* = 4.4 Hz, 1H), 5.64 (s, 2H), 5.45 (d, *J* = 3.6 Hz, 1H), 4.74 (t, *J* = 6.0 Hz, 1H), 4.59 (t, *J* = 4.4 Hz, 1H), 4.18 - 4.15 (m, 1H), 0.94 (s, 9H), 0.89 (s, 9H), 0.09 (s, 3H), 0.08 (s, 3H), 0.03 (s, 3H), -0.06 (s, 3H).

(2*S*,3*R*,4*S*,5*R*)-2-(4-aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5-[(*E*)-2- (1,3-benzothiazol-2-yl)vinyl]tetrahydrofuran-3,4-diol (40)



To a solution of compound **123** (50.0 mg, 80.1 µmol) in DMF (1 mL) was added potassium fluoride (46.5 mg, 801 µmol) and stirred at 70 °C for 16 h. The reaction mixture was cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 18) to afford compound **40** (10.0 mg, 32% yield) as a yellow solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{19}H_{17}N_5O_3S$ 396.1130; found 396.1139; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.07 (d, *J* = 7.6 Hz, 1H), 7.96 (d, *J* = 8.0 Hz, 1H), 7.87 (s, 1H), 7.74 (brs, 2H), 7.50 (td, *J* = 8.0, 0.8 Hz, 1H), 7.43 (td, *J* = 8.4, 1.2 Hz, 1H), 7.00 - 6.88 (m, 3H), 6.70 (d, *J* = 4.4 Hz, 1H), 5.33 - 5.25 (m, 3H), 4.51 (t, *J* = 5.2 Hz, 1H), 4.32 (q, *J* = 4.8 Hz, 1H), 4.04 (q, *J* = 5.2 Hz, 1H).

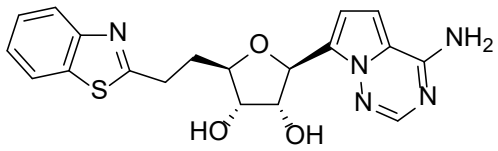
7-((2*S*,3*S*,4*R*,5*R*)-5-(2-(benzo[d]thiazol-2-yl)ethyl)-3,4-bis((tert-butyl dimethylsilyl) oxy)tetrahydrofuran-2-yl)pyrrolo[2,1-f][1,2,4]triazin-4-amine (124)



To a solution of compound **123** (100 mg, 160 µmol) in THF (10 mL) was added Pd/C (50.0 mg, 160 µmol, 10% wt.) under inert atmosphere. The suspension was degassed under vacuum and purged with H_2 several times. The reaction mixture was stirred under H_2 (50 psi) at RT for 2 h, and then filtered. The filtrate was concentrated under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate gradient 0-33%) to afford compound **124** (95.0 mg, 95% yield) as a yellow oil. LCMS (ES^+, Method 2) *m/z* 626.5 $[M+H]^+$; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.98 (d, *J* = 8.4 Hz, 1H), 7.93 (s, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.46 (t, *J* = 7.6 Hz, 1H), 7.36 (t, *J* = 7.6Hz, 1H), 6.68 (d, *J* = 4.4 Hz, 1H), 6.60 (d, *J* = 4.4 Hz, 1H), 5.70 (s, 2H), 5.32 (d, *J* = 4.8 Hz, 1H), 4.67 (t, *J* = 4.4 Hz, 1H), 4.17 - 4.15 (m, 1H), 4.04 (t, *J* = 4.4 Hz, 1H), 3.46 - 3.39 (m, 1H), 3.28 - 3.21 (m, 1H), 2.34 - 2.27 (m, 2H), 0.93 (s, 9H), 0.83 (s, 9H), 0.12 - 0.09 (m, 6H), -0.06 (s, 3H), -0.21 (s, 3H).

(2*S*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [2-(1,3-benzothiazol-2-

yl)ethyl]tetrahydrofuran-3,4-diol (39)



To a solution of compound **124** (90.0 mg, 0.14 mmol) in DMF (2 mL) was added potassium fluoride (83.5 mg, 1.44 mmol) and stirred at 70 °C for 16 h. The reaction mixture was cooled to RT and then concentrated under reduced pressure. The residue was purified by prep-HPLC (Method 19) to afford compound **39** (32.7 mg, 56% yield) as a white solid. HRMS (Method 1) *m/z* $[M+H]^+$ calcd for $C_{19}H_{19}N_5O_3S$ 398.1287; found 398.1292; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.05 (d, *J* = 8.0 Hz, 1H), 7.93 (d, *J* = 8.0 Hz, 1H), 7.84 (s, 1H), 7.70 (brs, 2H), 7.48 (td, *J* = 8.0, 0.8 Hz, 1H), 7.43 (td, *J* = 8.4, 1.2 Hz, 1H), 7.40 (dt, *J* = 8.4, 1.2 Hz, 1H), 6.85 (d, *J* = 7.6 Hz, 1H), 6.65 (d, *J* = 4.4 Hz, 1H), 5.14 (d, *J* = 5.6 Hz, 1H), 5.05 (d, *J* = 6.0 Hz, 1H), 4.98 (d, *J* = 5.6 Hz, 1H), 4.26 (q, *J* = 5.2 Hz, 1H), 3.89 - 3.83 (m, 2H), 3.23 - 3.17 (m, 2H), 2.02 - 2.18 (m, 1H), 2.08 - 2.05 (m, 1H). ^{13}C NMR (126 MHz, DMSO-d_6) δ 171.39, 155.60, 152.81, 147.74, 134.68, 128.91, 126.01, 124.78, 122.13, 122.06, 114.86, 109.48, 100.79, 81.30, 76.31, 74.39, 73.91, 33.03, 30.00. $[\alpha]_D^{20}$ = -5.3 (c=0.1, MeOH).

2 Supplementary Information

2.1 Crystallography table

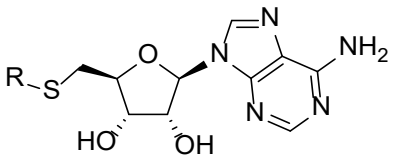
	SARS-CoV-2 nsp14					
Compound	**1**	**5**	**6**	**18**	**26**	**27**
PDB ID	9S0M	9SAJ	9SAK	9SAL	9SAM	9SAN
Wavelength	0.9537	0.9537	1.0000	1.0000	1.0000	1.0000
Resolution range	63.96 - 2.85 (2.90 – 2.85)	64.04 - 2.48 (2.52 – 2.48)	44.84 - 2.30 (2.34 – 2.30)	41.26 - 2.29 (2.33 – 2.29)	44.59 - 2.54 (2.58 – 2.54)	44.79 - 2.73 (2.77 – 2.73)
Space group	P 1 21 1	P 1 21 1	P 1 21 1	P 1 21 1	P 1 21 1	P 1 21 1
Unit cell	67.59 101.86 91.02 90 108.9 90	67.81 102.36 90.74 90 109.2 90	67.38 102.05 90.87 90 108.7 90	67.69 101.63 91.41 90 108.6 90	67.58 101.99 91.19 90 109.4 90	67.81 102.08 91.25 90 109.3 90
Total reflections	110868 (6040)	174595 (9276)	218043 (11092)	290731 (15520)	140935 (7106)	134961 (6843)
Unique reflections	26758 (1348)	40958 (2075)	50538 (2551)	51355 (2638)	36568 (1911)	31372 (1558)
Multiplicity	4.1 (4.5)	4.3 (4.5)	4.3 (4.3)	5.7 (5.9)	3.9 (3.7)	4.3 (4.4)
Completeness (%)	97.5 (100.0)	98.6 (100.0)	97.7 (100.0)	97.4 (100.0)	94.5 (99.9)	99.9 (100.0)
Mean I/sigma(I)	12.3 (1.4)	13.1 (1.3)	16.8 (1.5)	16.3 (1.3)	14.8 (1.3)	10.4 (1.3)
Wilson B-factor	72.26	61.48	66.24	70.21	75.80	73.51
R-merge	0.089 (1.031)	0.060 (0.993)	0.039 (0.825)	0.044 (0.980)	0.045 (0.926)	0.086 (1.105)
R-meas	0.102 (1.165)	0.069 (1.128)	0.044 (0.941)	0.048 (1.077)	0.052 (1.086)	0.099 (1.257)
CC1/2	0.998 (0.556)	0.999 (0.647)	0.999 (0.675)	0.999 (0.653)	0.999 (0.633)	0.984 (0.473)
Reflections used in refinement	25322 (1342)	39956 (2064)	49304 (2540)	50028 (2609)	35664 (1905)	28313 (1556)
Reflections used for R-free	625 (64)	997 (97)	1224 (135)	1304 (136)	884 (94)	717 (82)
R-work	0.2307	0.1978	0.1984	0.2012	0.1936	0.2122
R-free	0.2817	0.2378	0.2487	0.2281	0.2282	0.2647

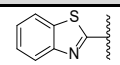
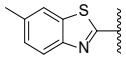
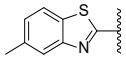
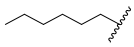
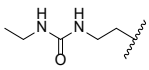
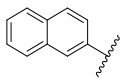
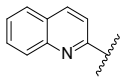
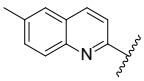
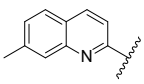
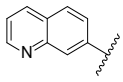
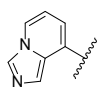
Overall number of atoms	7111	7225	7063	7012	7105	6898
in macromolecules	7019	6983	6806	6826	6920	6773
in ligands	73	119	115	87	83	72
in waters	19	123	142	99	102	53
Protein residues	897	884	876	881	886	882
RMS (bonds)	0.014	0.014	0.014	0.014	0.014	0.014
RMS (angles)	1.727	1.701	1.688	1.708	1.682	1.751
Ramachandran favored (%)	95.34	97.23	97.17	97.79	97.93	94.78
Ramachandran allowed (%)	4.66	2.77	2.83	2.21	2.07	5.22
Ramachandran outliers (%)	0.00	0.00	0.00	0.00	0.00	0.00
Rotamer outliers (%)	0.68	0.82	0.87	0.58	0.42	0.89
Clashscore	1.25	0.58	0.60	0.60	0.22	1.54
Average B-factor	74.02	67.05	75.91	82.16	81.72	74.65
for macromolecules	74.13	67.23	76.18	82.42	81.96	74.84
for ligands	65.02	64.78	71.95	77.27	72.83	62.25
for solvent	68.27	58.88	66.36	68.43	73.00	67.14

Table S1. X-ray crystallography data collection and refinement statistics.

2.2 ADME Summary Tables

Table S2



Compound	R	nsp14 IC_{50} / µM	RNMT IC_{50} / µM	CHI-logD	Mouse liver Mic Clint Ml/min/g	Mouse liver Mic Clint $T_{1/2}$ / min
1		0.42 ± 0.3	> 100	1.2	1.0	> 30
2		0.26 ± 0.07	> 100	1.6	1.4	> 30
3		1.2 ± 0.15	> 100	1.6	2.6	25.7
4		6.1 ± 1.1	> 100	2.0	5.0	13.2
5		1.9 ± 0.30	> 100	-0.2	< 0.5	> 30
6		0.31 ± 0.12	> 100	1.8	2.5	26.9
7		0.33 ± 0.09	> 100	1.3	2.0	> 30
8		1.1 ± 0.07	> 100	1.7	1.4	> 30
9		0.39 ± 0.06	70.5	1.7	2.2	> 30
10		0.36 ± 0.11	> 100	0.6	0.7	> 30
11		> 100	> 100	0.3	< 0.5	> 30
12		15 ± 12	9.3	0.3	-	-

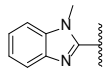
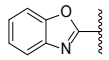
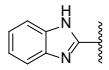
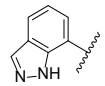
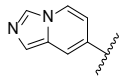
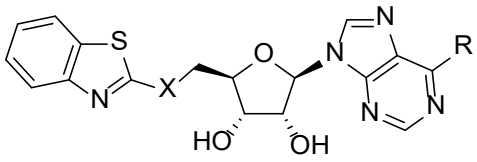
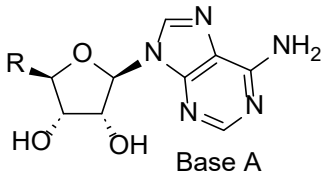
13		0.82 ± 0.13	> 100	0.8	0.7	> 30
14		0.67 ± 0.02	> 100	1.0	0.5	> 30
15		0.59 ± 0.11	> 100	0.3	< 0.5	> 30
16		*79 ± 18	> 100	0.7	-	-
17		6.9 ± 4.6	31.1	0.1	6.0	11.1

Table S3

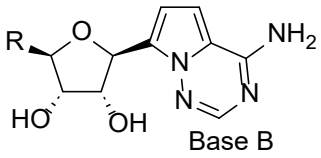


	X	Y	R	nsp14 IC_{50} / µM	RNMT IC_{50} / µM	CHI-logD	Mouse liver $T_{1/2}$ / min
1	O	N	-	0.420 ± 0.3	> 100	1.2	> 30
26	CH_2	N	-	0.053 ± 0.03	> 100	1.5	> 30
27	O	C	H	0.055 ± 0.02	> 100	1.6	> 30
28	CH_2	C	H	0.308 ± 0.34	22.8	1.8	> 30
29	O	C	CN	0.170 ± 0.02	> 100	1.8	12.1
30	O	C	C≡CH	0.054± 0.01	> 100	2.0	10.1
31	O	C	Et	0.250 ± 0.2	> 100	2.1	3.9

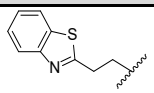
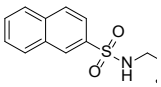
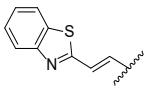
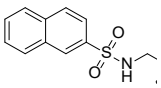
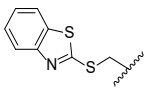
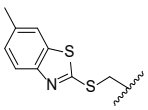
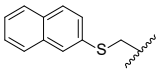
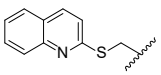
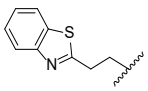
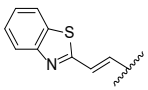
Table S4



25, **32**-**33**



34-**40**

#	R	Base	CHI-log D	Mouse liver Mic Clint mL/min/g	$T_{1/2}$ / min
25		A	1.1	1.0	> 30
32		A	1.5	1.0	> 30
33		A	1.3	< 0.5	> 30
34		B	1.6	6.7	9.9
35		B	1.5	1.1	> 30
36		B	1.9	3.7	18
37		B	2.2	4.9	13.6
38		B	1.7	1.2	> 30
39		B	1.3	1.1	> 30
40		B	1.5	0.8	> 30

2.3 Repeats in biochemical assays

Table S5 – repeat 'n' values for different compounds in stated biochemical assays

Compound	SARS-CoV-2 nsp14	NL63 nsp14	229E nsp14	RNMT
1	11	2	2	2
2	4	2	2	2
3	2	-	-	2
4	4	2	2	2
5	3	-	-	2
6	12	2	2	2
7	11	2	2	2
8	4	2	2	2
9	4	2	2	2
10	8	2	2	2
11	4	2	2	2
12	9	2	2	2
13	5	2	2	2
14	5	2	2	2
15	9	2	2	2
16	3	-	-	2
17	4	2	2	2
18	2	-	-	-
19	6	2	2	2
20	7	2	2	2
21	7	2	2	2
22	3	-	-	2
23	2	-	-	2
24	2	-	-	2
25	10	2	2	2
26	18	2	2	2
27	9	2	2	2
28	4	2	2	2
29	4	2	2	2
30	8	2	2	2
31	4	2	2	2
32	10	2	2	2
33	6	2	2	2
34	10	2	2	2
35	8	2	2	2
36	2	-	-	2
37	2	-	-	2
38	2	-	-	2
39	8	2	2	2
40	8	2	2	2

2.4 MERS AlphaFold2 model

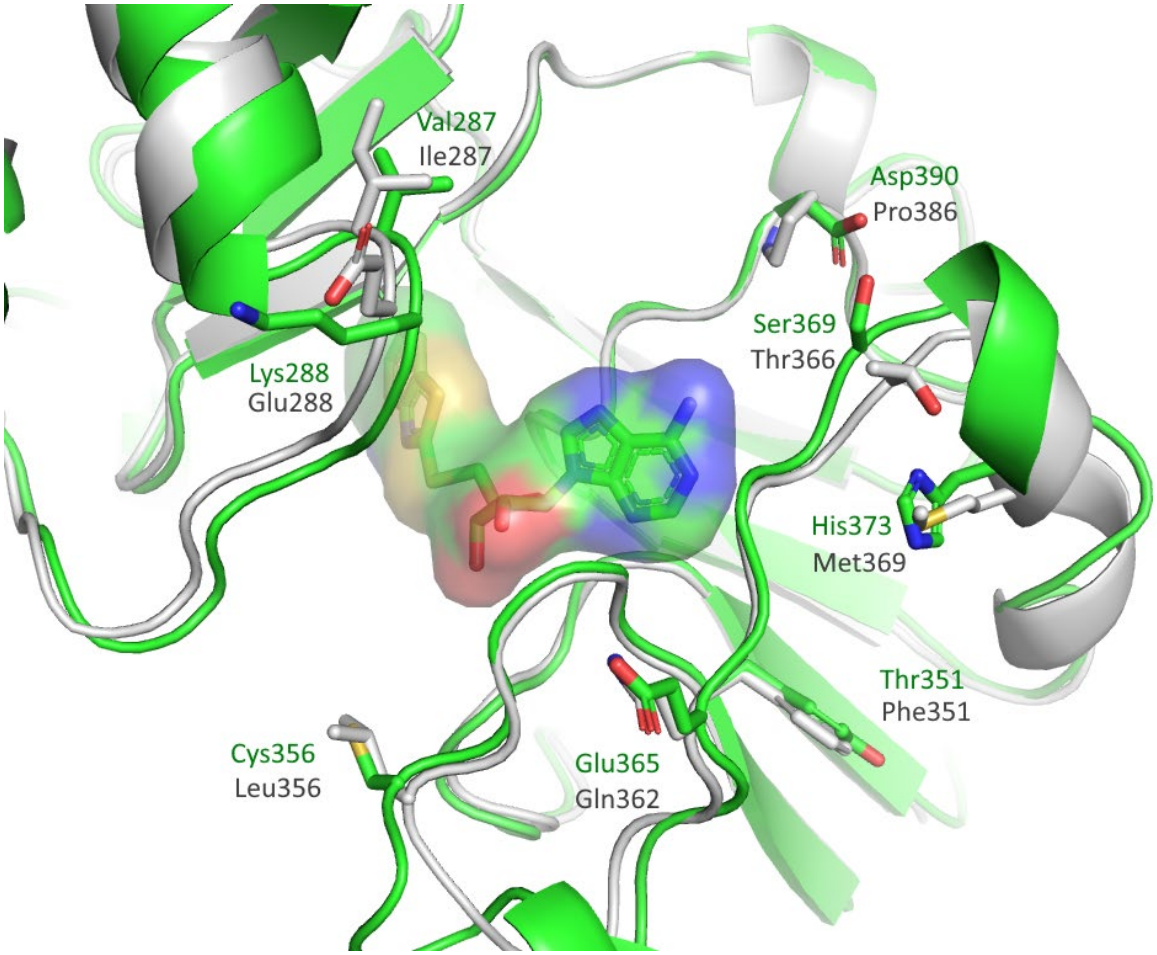


Figure S1 Compound **1** bound to SARS-CoV-2 nsp14 (9s0m, green carbons) superimposed onto a MERS nsp14 AlphaFold2 model (grey carbons). Residues that differ between SARS-CoV-2 nsp14 (green) and MERS nsp14 (grey) in the proximity of the ligand **1** binding site are indicated.

2.5 RNMT structure overlay with SARS-CoV-2 nsp14 in complex with compound 1

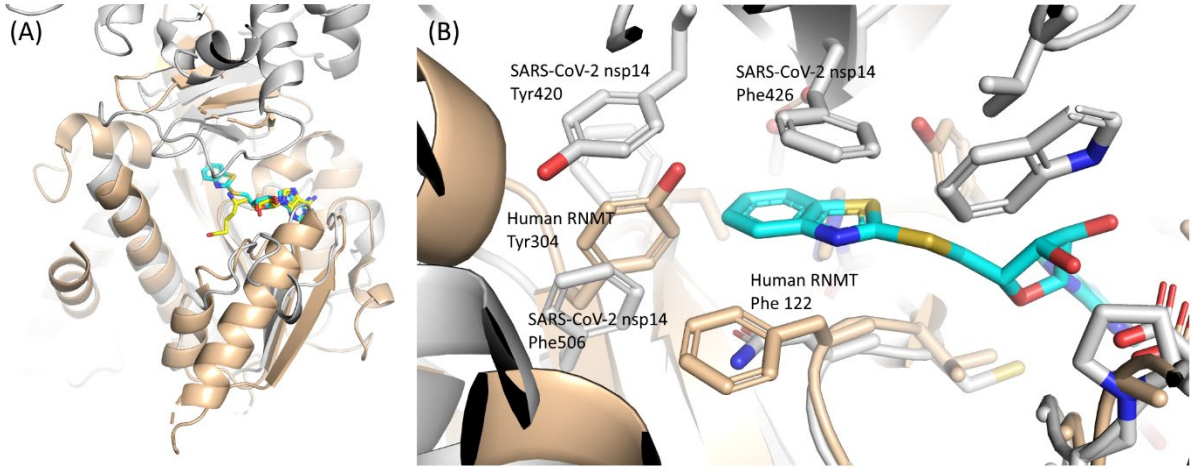


Figure S2 (A) Overlay of Human RNMT (wheat cartoon, pdb code: 3EPP) bound to sinefungin (yellow sticks) and SARS-CoV-2 nsp14 (grey cartoon) bound to compound **1** (cyan sticks). (B) Details of the benzothiazole binding pocket highlighting some of the differences between RNMT and SARS-CoV-2 nsp14.

2.6 Substrate competition experiments with compound 26

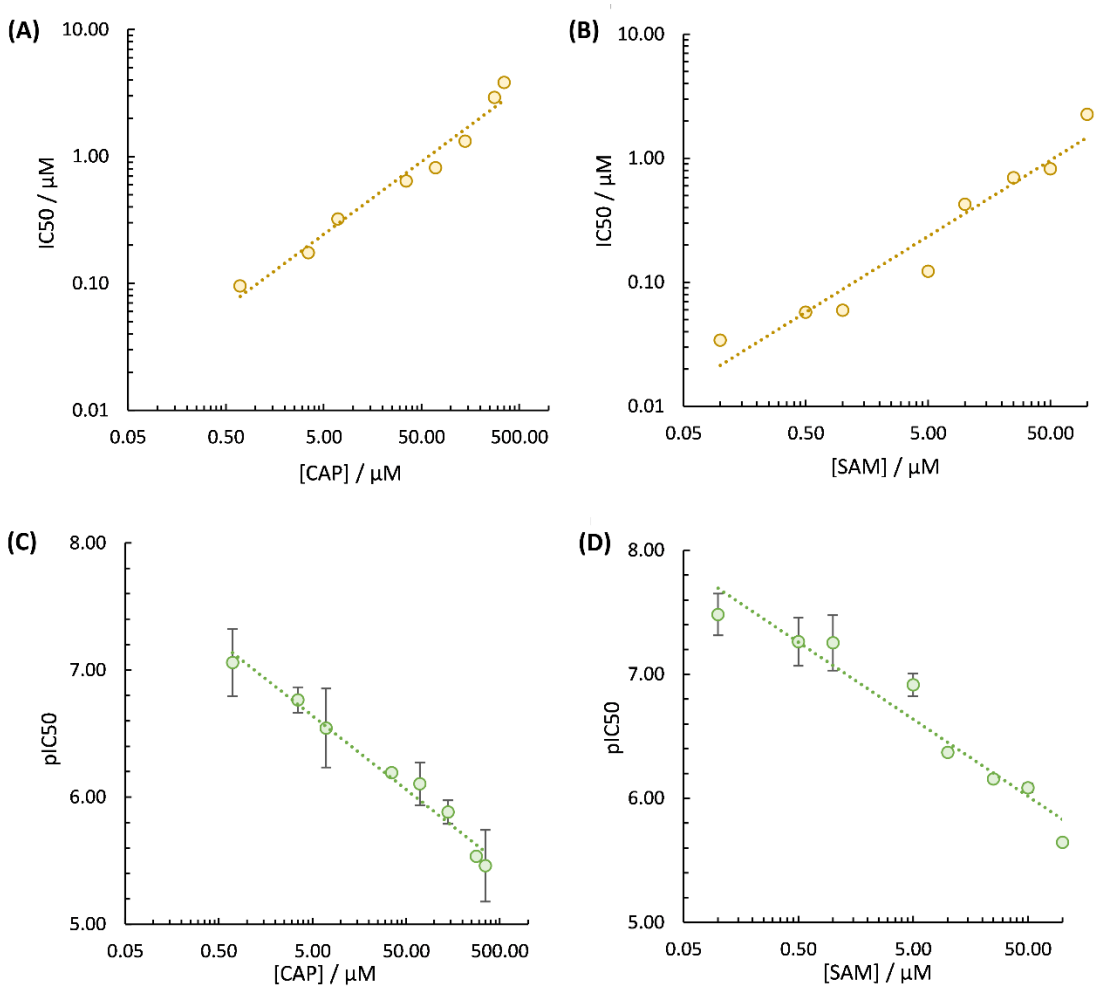


Figure S3 Competition of compound **26** with substrates CAP RNA and SAM. (A) Change in IC_{50} of compound **26** with [SAM] at 10 µM (10-fold Km) and varying the CAP RNA concentration. (B) Change in IC_{50} of compound **26** with [CAP] at 7.0 µM (10-fold Km) and varying the SAM concentration. (C) and (D) The same data is shown as pIC50 values (green markers) with standard deviations (n=2). Dotted lines show line of best fit to data.

2.7 Comparison of electron densities

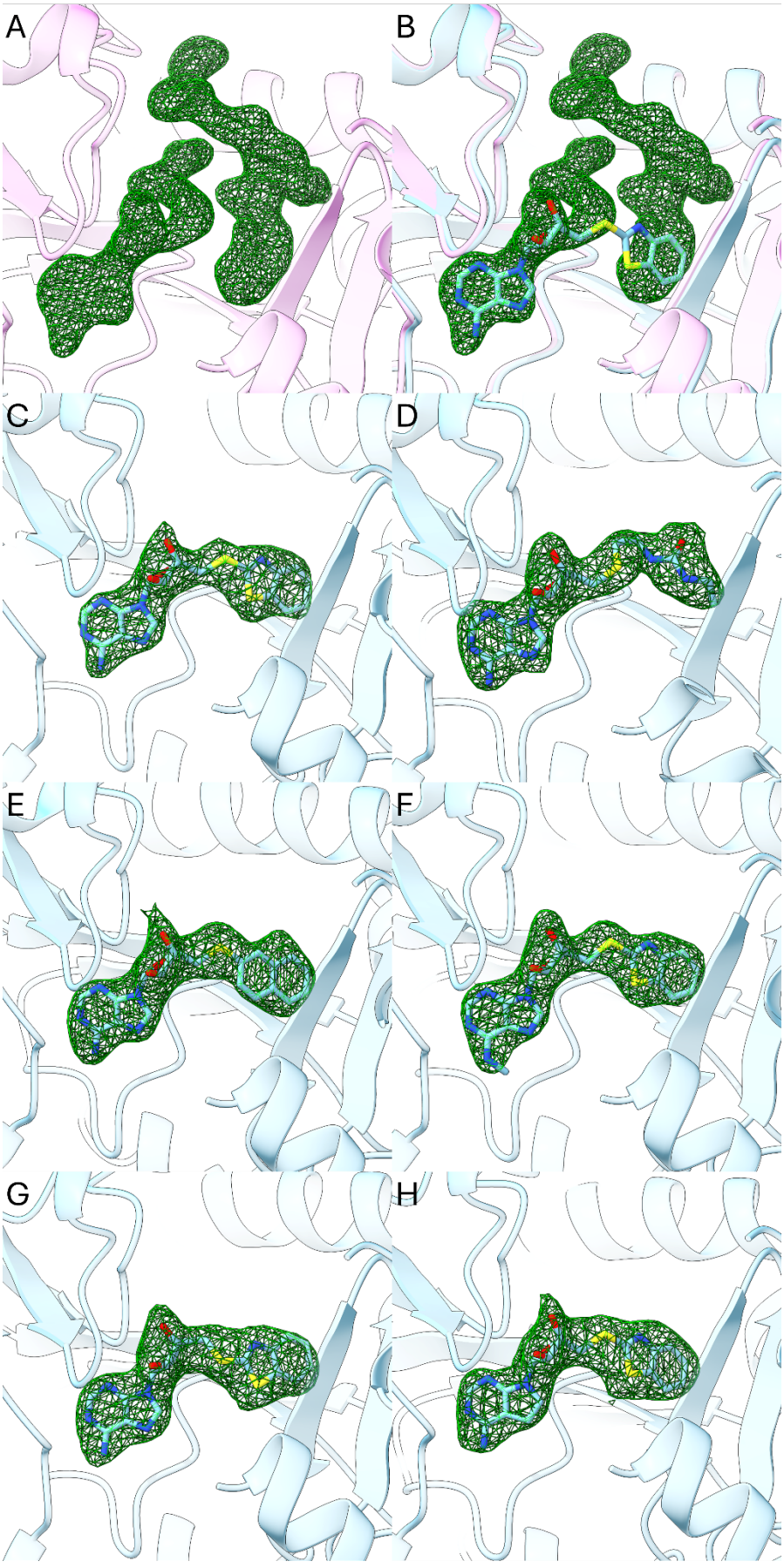
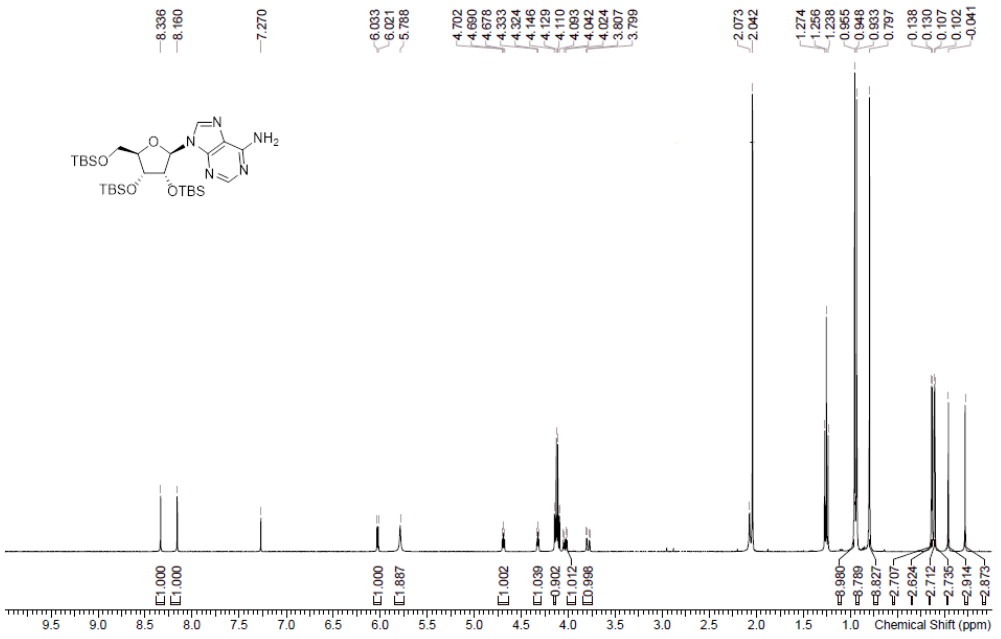


Figure S4 mFo-DFc omit maps for the proprietary ligand and the ligands described in this study, calculated after refinement with the corresponding ligand removed from the model and showed as green density contoured at +3.0σ. (A) Omit map of the proprietary ligand used for back-soaking (pink). (B) Same map as in (A) with compound 1 overlaid for reference (blue). (C - H) Omit maps for the ligands reported in the manuscript, compounds **1**, **5**, **6**, **18**, **26**, **27** respectively. The more compact and distinct omit density for the ligands in panels (C - H) contrasts with the density of the proprietary ligand in panels (A - B).

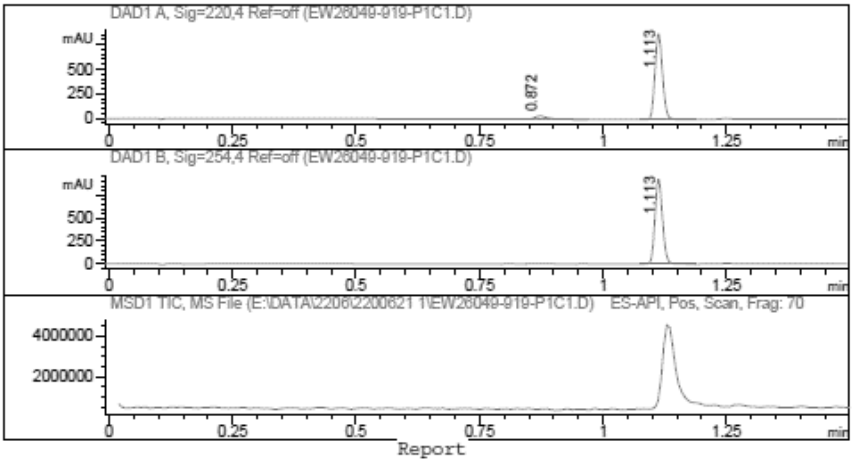
3 Appendix

3.1 QC Spectra for Compounds

^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert-butyl(dimethyl)silyl]oxymethyl] tetrahydrofuran-2-yl]purin-6-amine **(42)**



LCMS 9-[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert-butyl(dimethyl)silyl]oxymethyl] tetrahydrofuran-2-yl]purin-6-amine **(42)**



Report

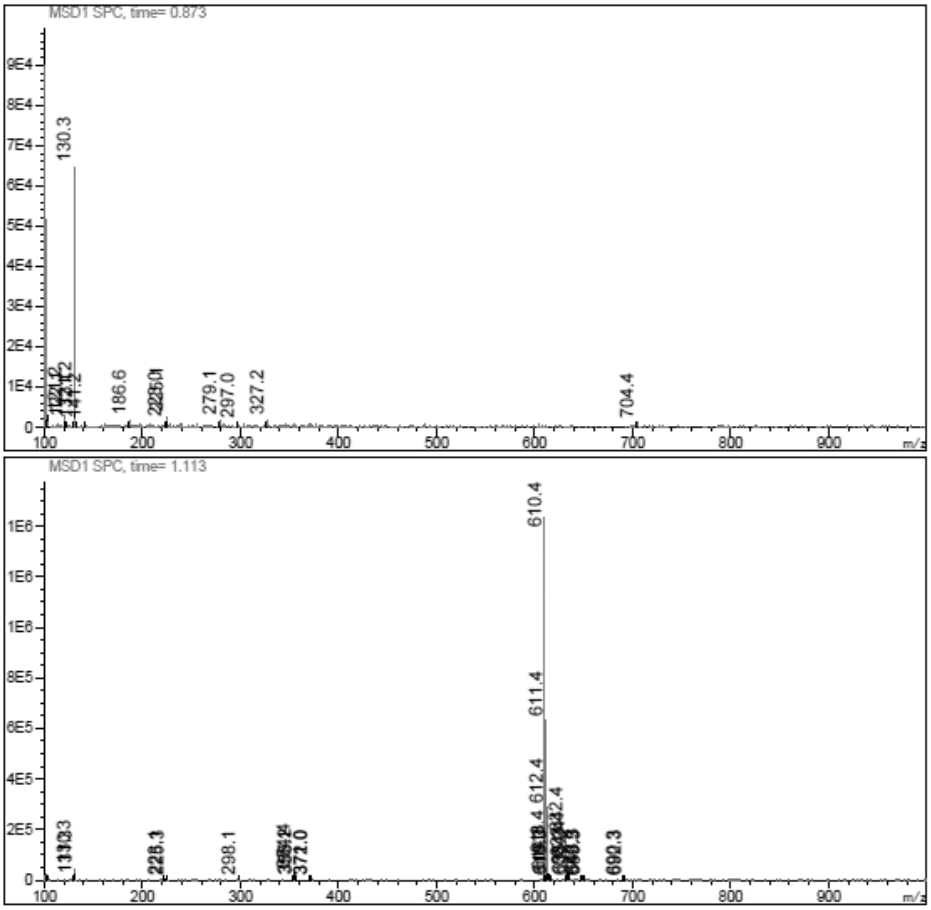
==========

Signal 1 : DAD1 A, Sig=220,4 Ref=off

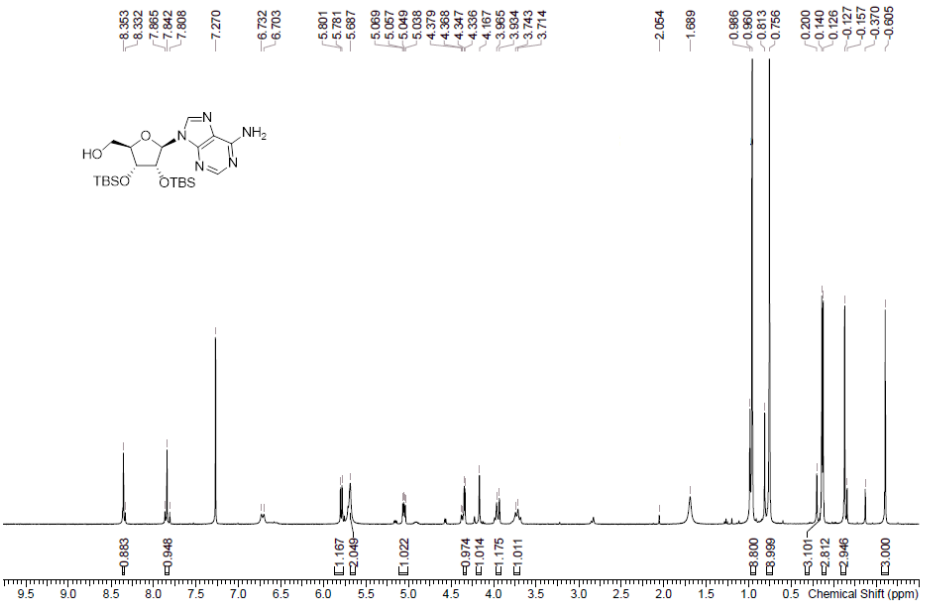
#	Meas. Ret.	Height	Width	Area	Area %
1	0.872	31.677	0.030	66.044	6.676
2	1.113	871.994	0.016	923.297	93.324

Signal 2 : DAD1 B, Sig=254,4 Ref=off

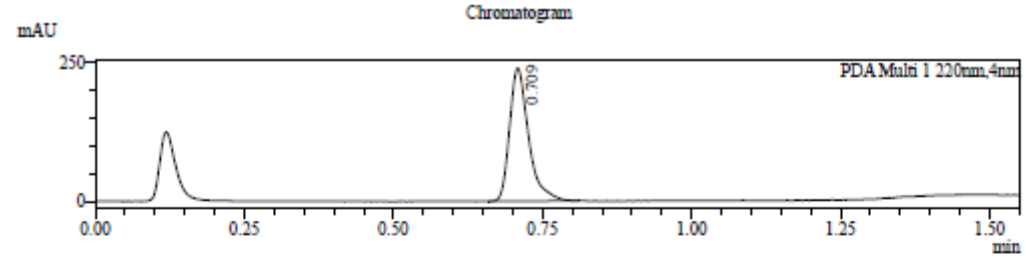
#	Meas. Ret.	Height	Width	Area	Area %
1	1.113	928.441	0.016	978.312	100.000

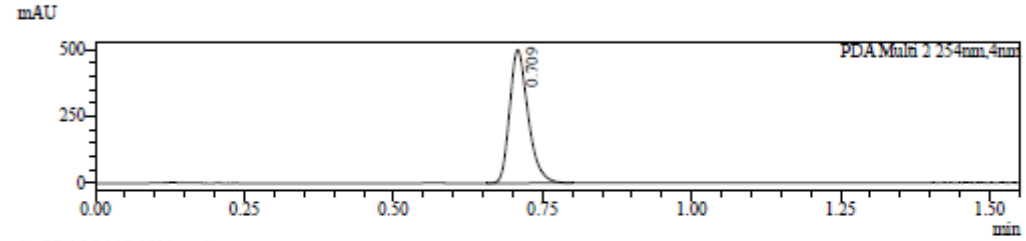


^{1}H NMR [(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy] tetrahydrofuran-2yl] methanol **(43)**

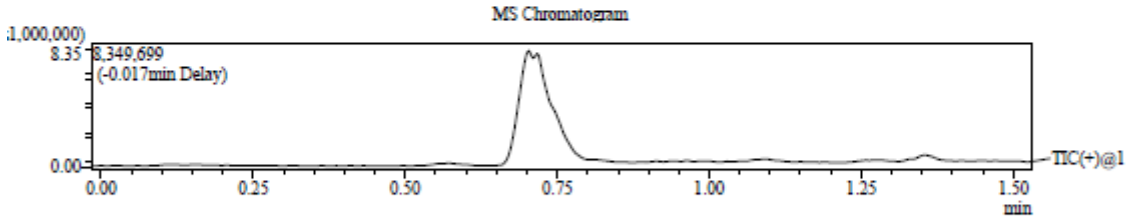


LCMS [(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy] tetrahydrofuran-2yl]methanol **(43)**





1 PDA Multi 1 / 220nm,4nm
2 PDA Multi 2 / 254nm,4nm



Integration Result

Peak Table

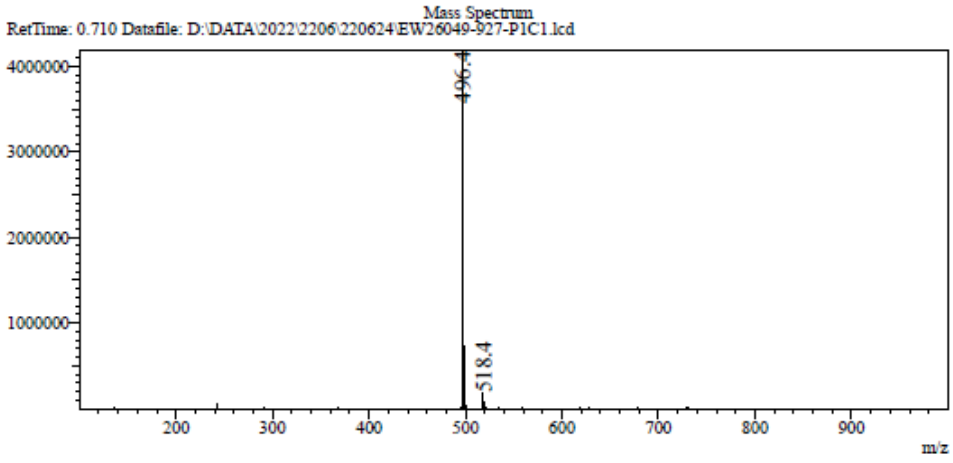
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.709	239309	100.000	0.057	531891	100.000

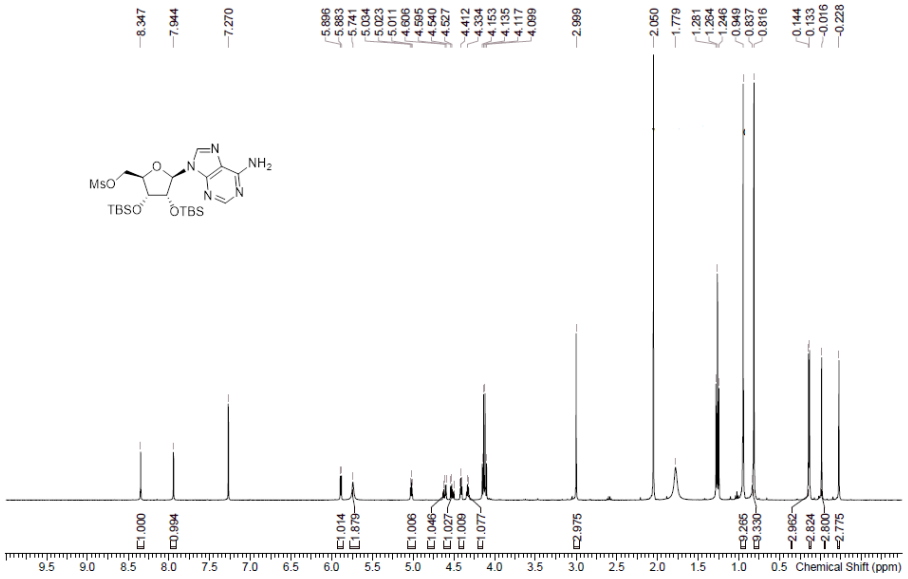
Peak Table

PDA Ch2 254nm

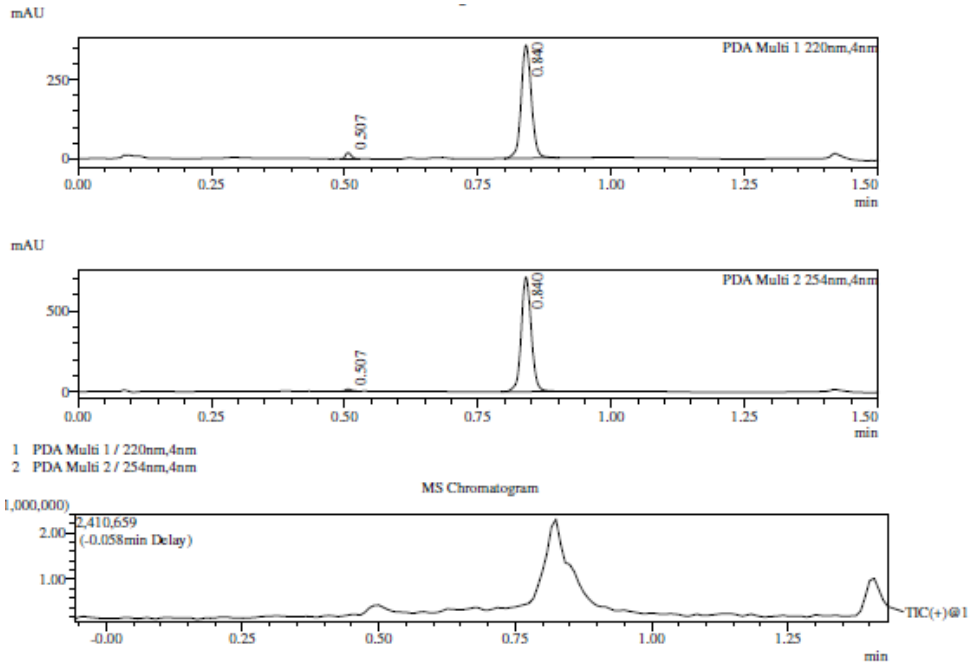
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.709	499610	100.000	0.056	1076670	100.000



^{1}H NMR [(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl(dimethyl)silyl] oxy] tetrahydrofuran-2-yl]methyl methanesulfonate **(44)**



LCMS [(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl(dimethyl)silyl] oxy] tetrahydrofuran-2-yl]methyl methanesulfonate **(44)**



Integration Result

Peak Table

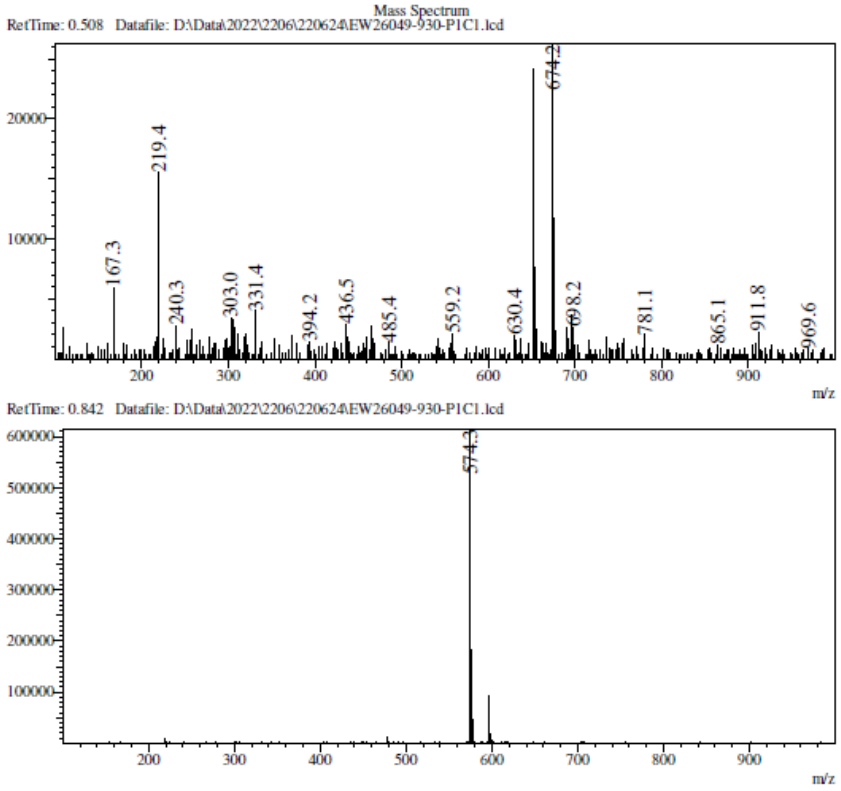
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.507	19707	5.230	0.022	14520	2.952
2	0.840	357123	94.770	0.036	477346	97.048

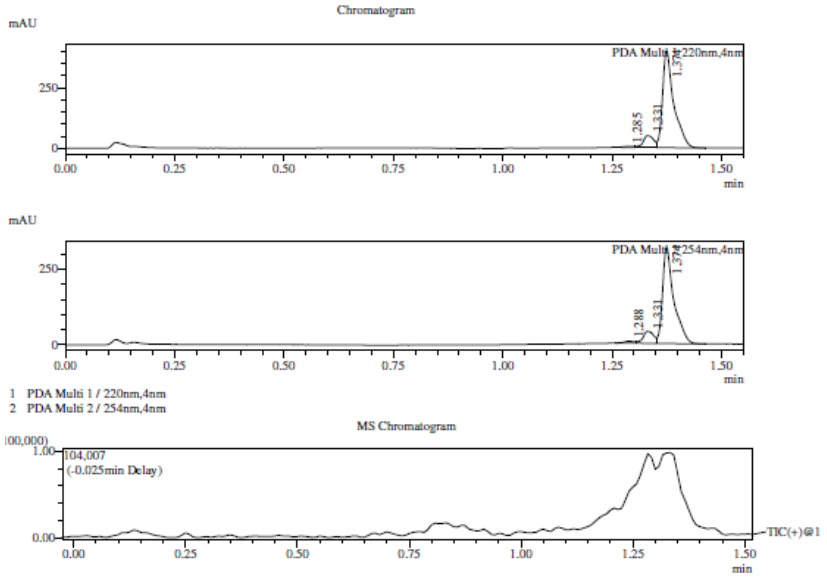
Peak Table

PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.507	13212	1.825	0.022	9833	1.046
2	0.840	710668	98.175	0.035	930380	98.954



LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl (dimethyl)silyl]oxy] tetrahydrofuran-2-yl]purin-6-amine **(45a)**



Integration Result

Peak Table

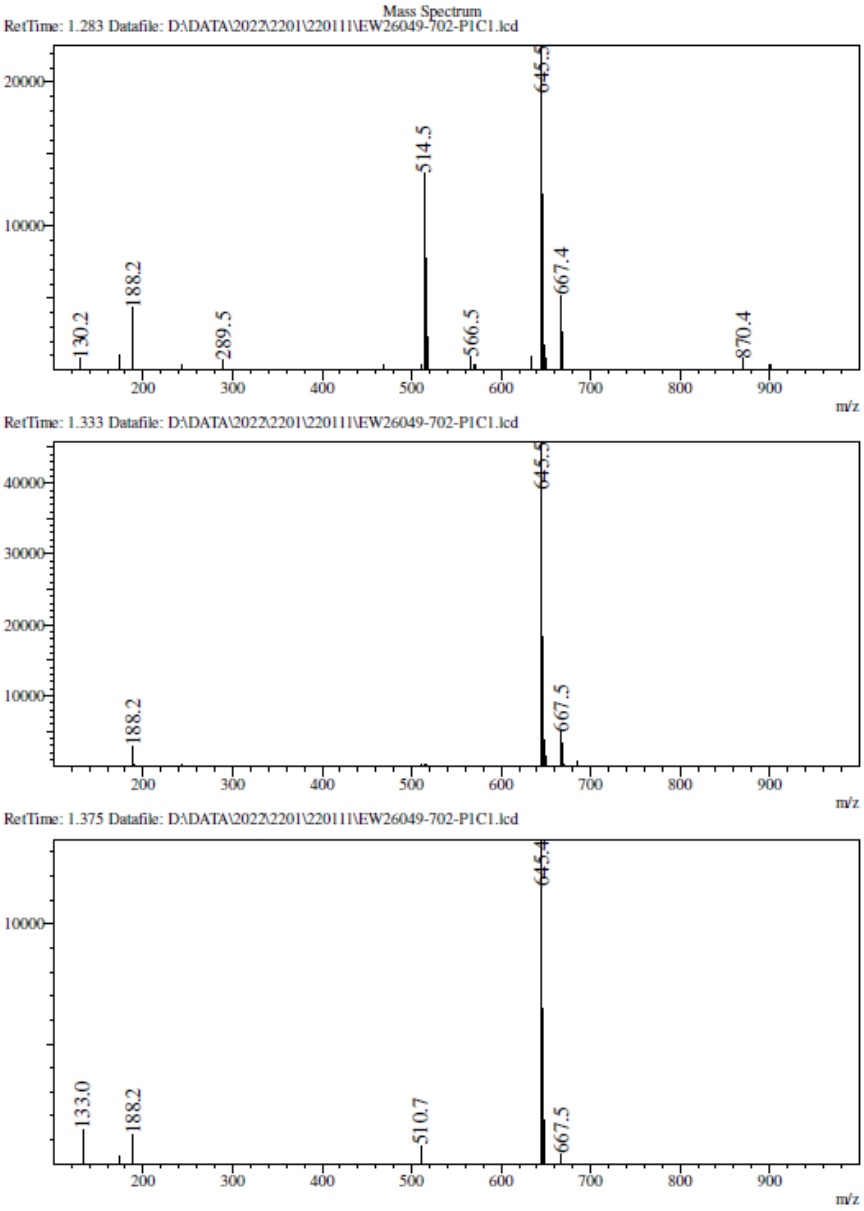
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.285	4147	0.911	0.405	6479	0.800
2	1.331	49389	10.849	0.047	81089	10.013
3	1.374	401722	88.241	0.043	722269	89.187

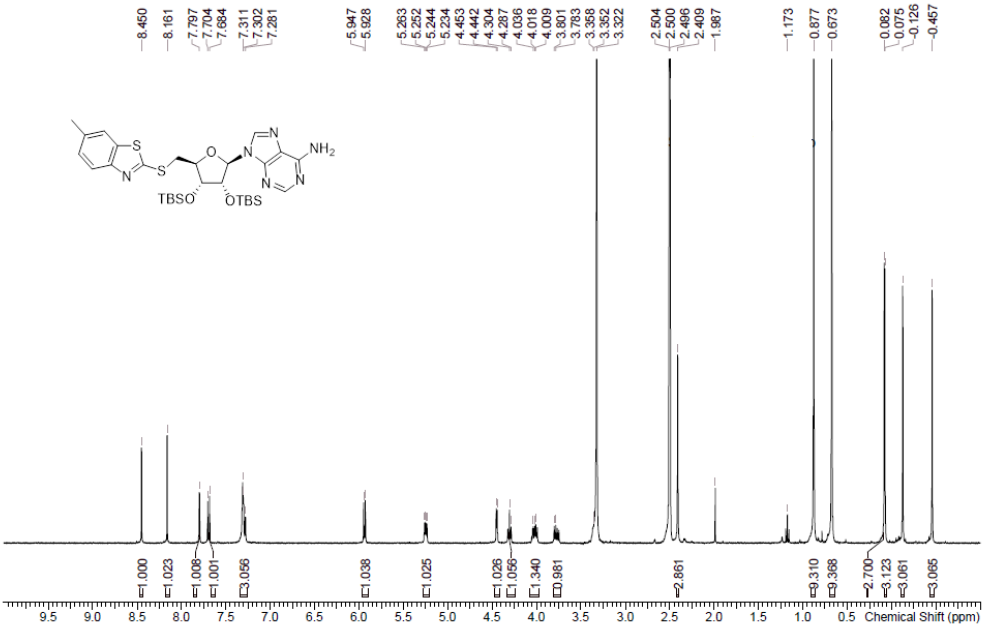
Peak Table

PDA Ch2 254nm

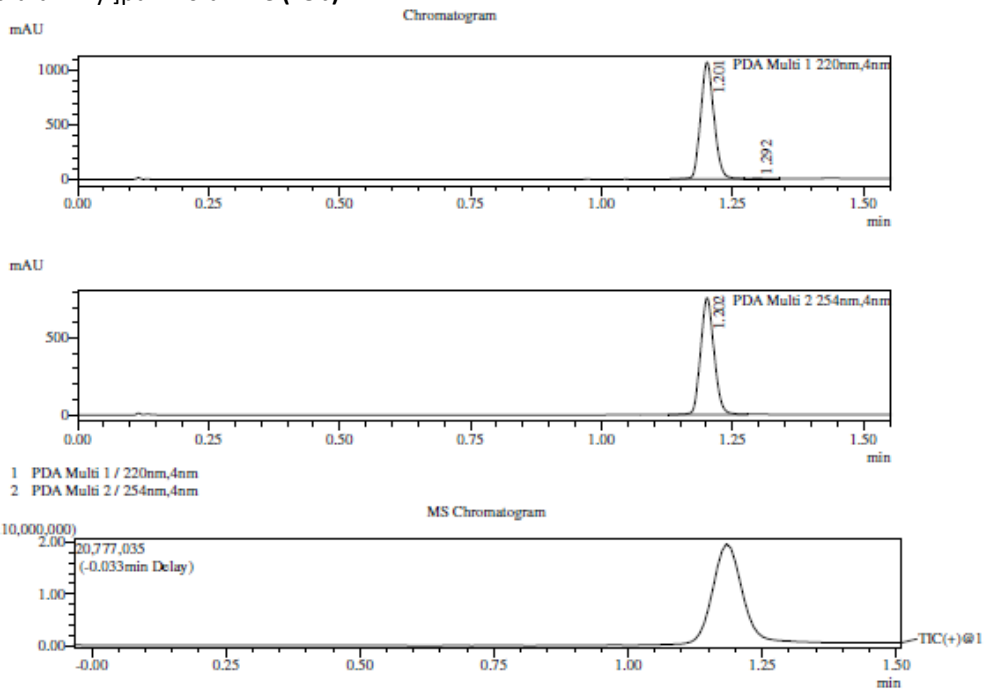
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.288	6516	1.781	0.068	10327	1.585
2	1.331	39941	10.919	0.048	66355	10.182
3	1.374	319349	87.300	0.043	575034	88.234


Mass Spectrum
RetTime: 1.283 Datafile: D:\DATA\2022\2201\220111\EW26049-702-P1C1.lcd
20000
10000
645.5
514.5
667.4
188.2
130.2
289.5
566.5
870.4
200
300
400
500
600
700
800
900
m/z
RetTime: 1.333 Datafile: D:\DATA\2022\2201\220111\EW26049-702-P1C1.lcd
40000
30000
20000
10000
645.5
188.2
667.5
200
300
400
500
600
700
800
900
m/z
RetTime: 1.375 Datafile: D:\DATA\2022\2201\220111\EW26049-702-P1C1.lcd
10000
645.4
133.0
188.2
510.7
667.5
200
300
400
500
600
700
800
900
m/z

^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[(6- methyl-1,3-benzothiazol-2-yl)sulfanylmethyl] tetrahydrofuran-2-yl]purin-6-amine **(45b)**



LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[(6- methyl-1,3-benzothiazol-2-yl)sulfanylmethyl] tetrahydrofuran-2-yl]purin-6-amine **(45b)**



Integration Result

Peak Table

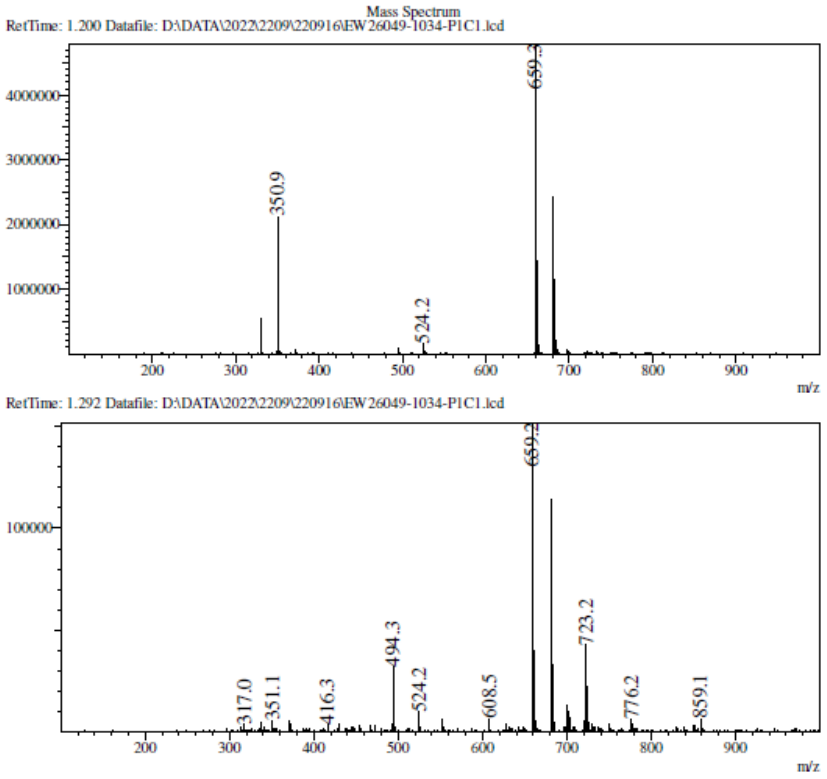
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.201	1071362	99.630	0.049	1905861	99.448
2	1.292	3975	0.370	0.080	10573	0.552

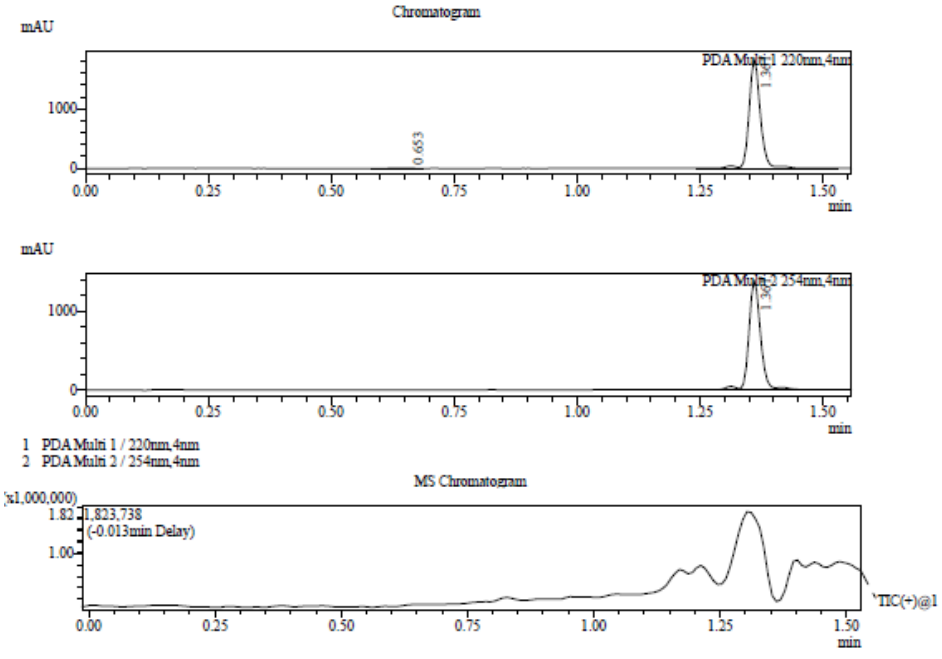
Peak Table

PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.202	760491	100.000	0.049	1363581	100.000



LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]-5- [(5-methyl-1,3-benzothiazol-2yl)sulfanylmethyl] tetrahydrofuran-2-yl]purin-6-amine **(45c)**



Integration Result

Peak Table

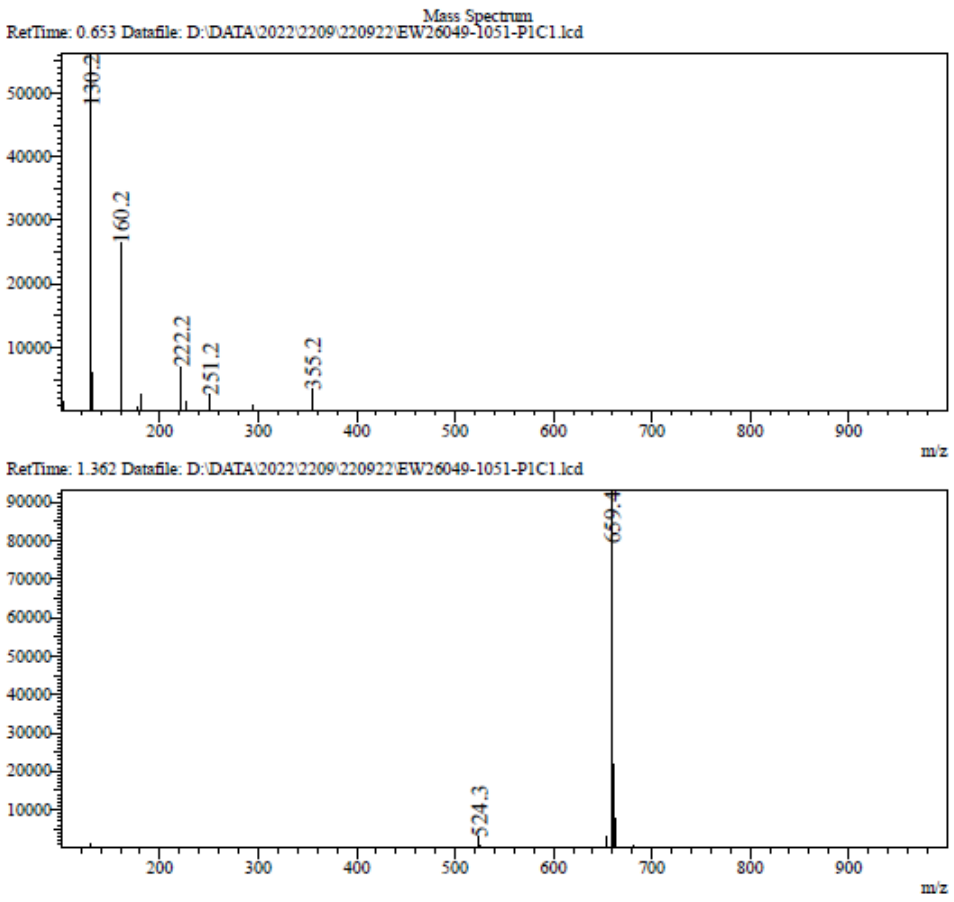
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.653	2093	0.113	0.096	5952	0.203
2	1.361	1853171	99.887	0.048	2928174	99.797

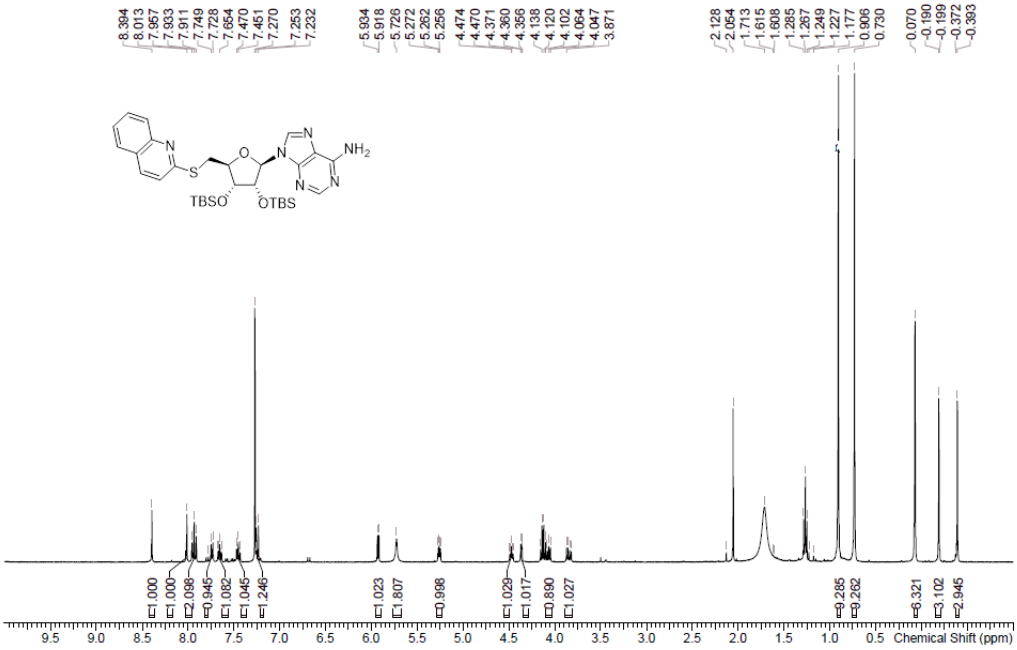
Peak Table

PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.361	1401706	100.000	0.049	2307954	100.000

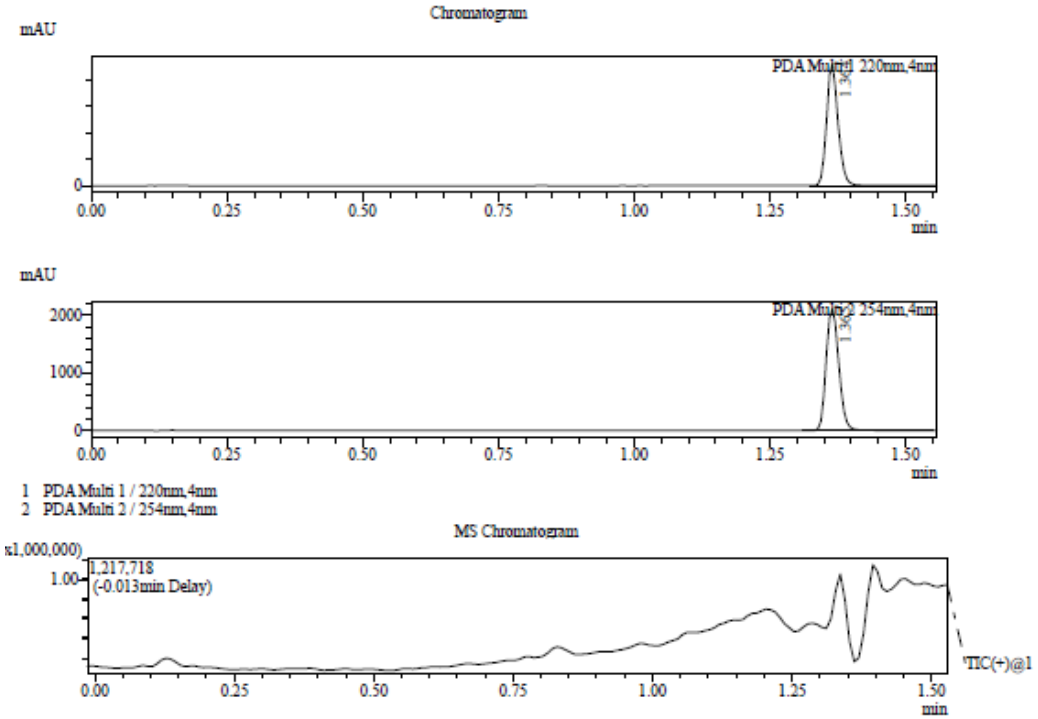


^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]-5-(2-quinolylsulfanylmethyl) tetrahydrofuran-2-yl]purin-6-amine **(45d)**



LCMS 9-[(2R,3R,4R,5S)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- [(6-methyl-2-quinolyl) sulfanylmethyl]

tetrahydrofuran-2-yl]purin-6-amine **(45e)**



Integration Result

Peak Table

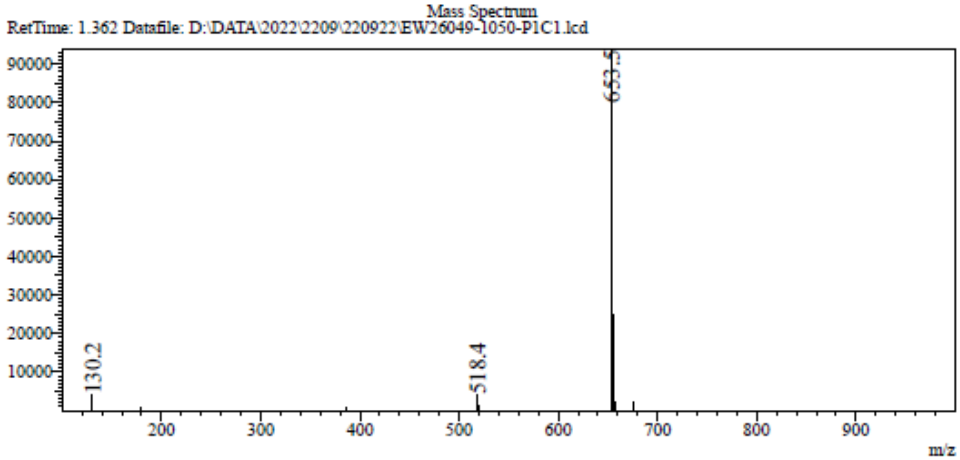
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.364	2289479	100.000	0.045	3372238	100.000

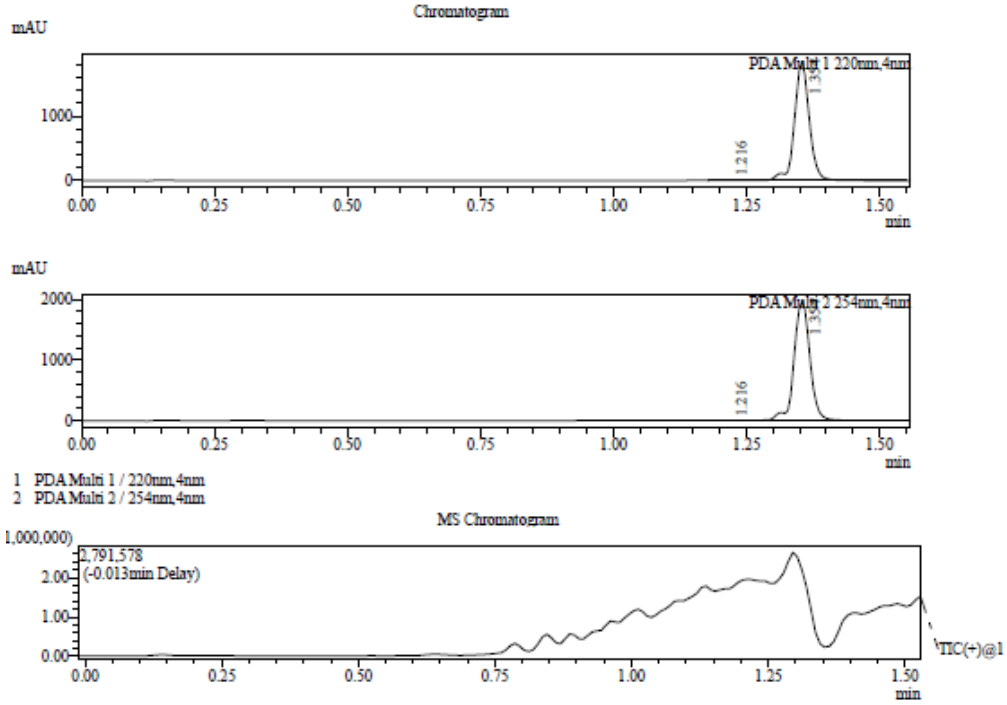
Peak Table

PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.365	2112825	100.000	0.050	3448768	100.000



LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[(7 -methyl-2-quinolyl)sulfanyl methyl]tetrahydrofuran-2-yl]purin-6-amine **(45f)**



Integration Result

Peak Table

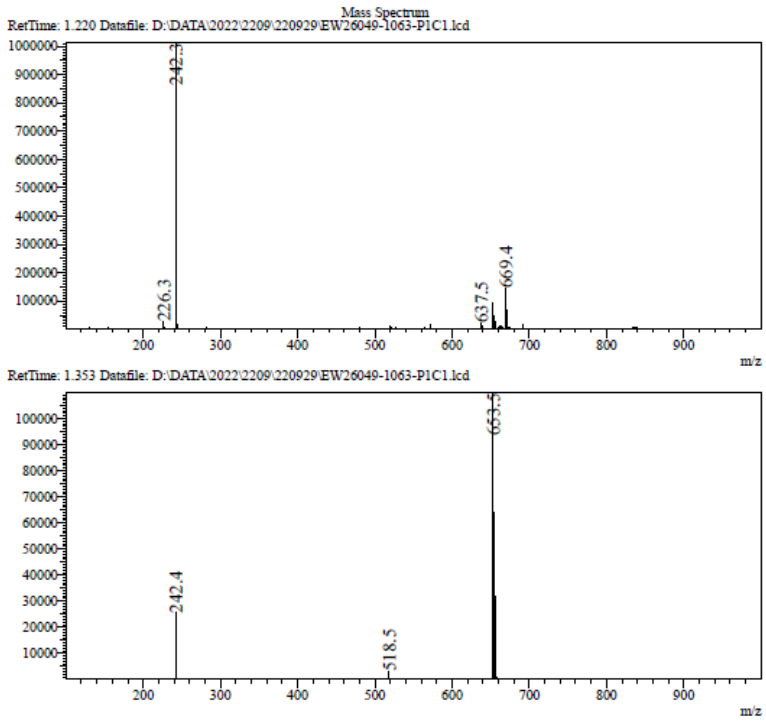
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.216	4330	0.234	0.087	11400	0.318
2	1.354	1843472	99.766	0.058	3568278	99.682

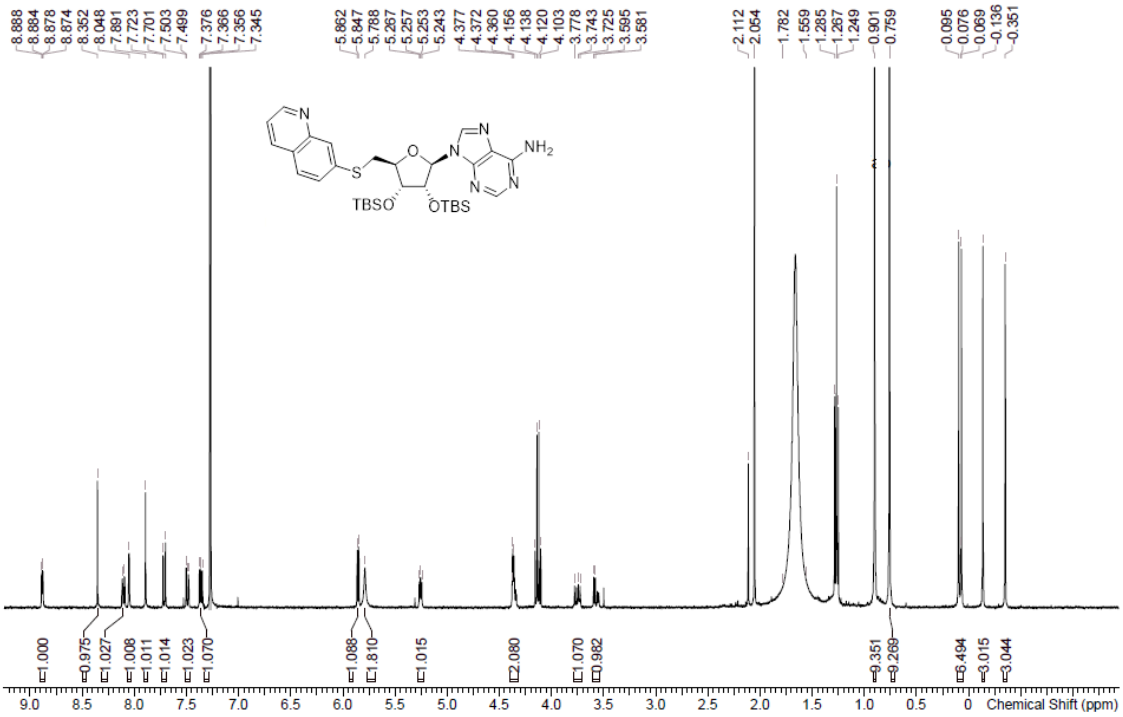
Peak Table

PDA Ch2 254nm

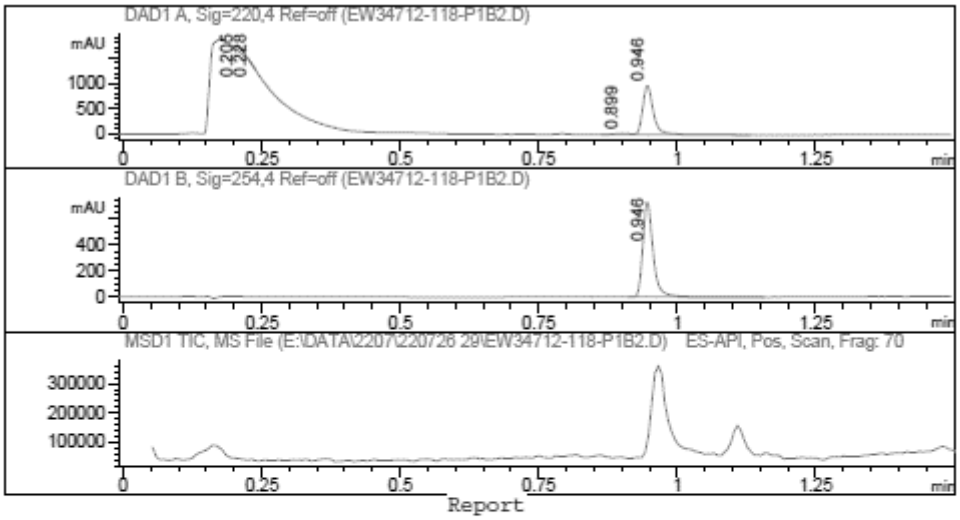
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.216	2462	0.125	0.165	8051	0.196
2	1.354	1964935	99.875	0.061	4098328	99.804



^{1}H NMR 9-((2R,3R,4R,5S)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-((quinolin-7-ylthio)methyl) tetrahydrofuran-2-yl)-9H-purin-6-amine **(45g)**



LCMS 9-((2R,3R,4R,5S)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-((quinolin-7-ylthio)methyl) tetrahydrofuran-2-yl)-9H-purin-6-amine **(45g)**



Report

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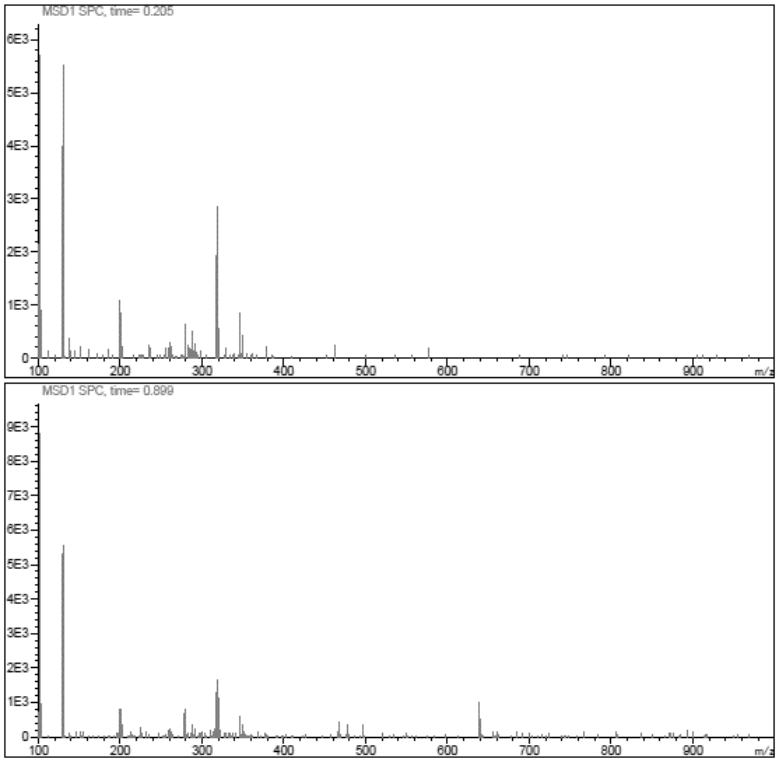
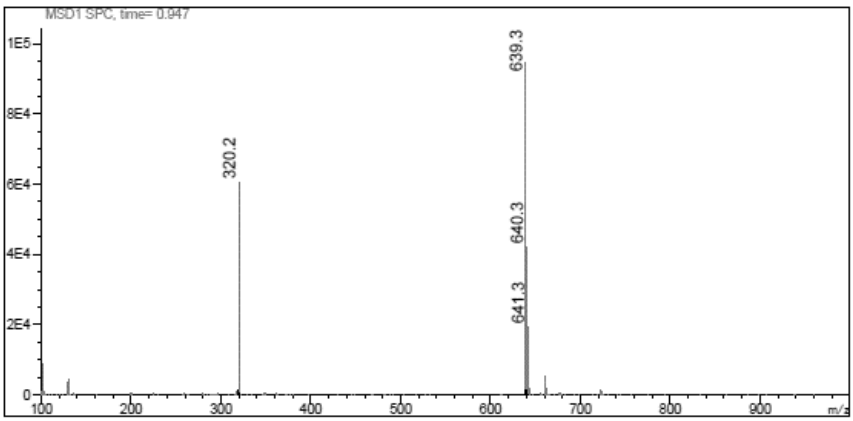
Signal 1 : DAD1 A, Sig=220,4 Ref=off

#	Meas. Ret.	Height	Width	Area	Area %
1	0.205	56.491	0.020	71.408	5.091
2	0.228	21.645	0.007	8.642	0.616
3	0.899	18.134	0.028	33.545	2.392
4	0.946	964.954	0.021	1289.056	91.901

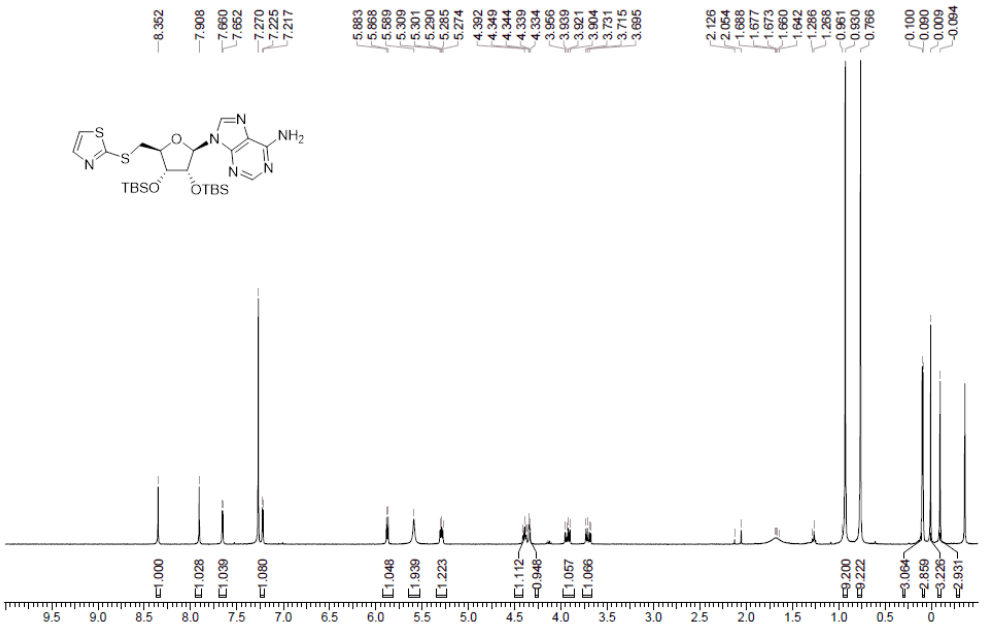
Signal 2 : DAD1 B, Sig=254,4 Ref=off

#	Meas. Ret.	Height	Width	Area	Area %
1	0.946	728.104	0.020	940.752	100.000

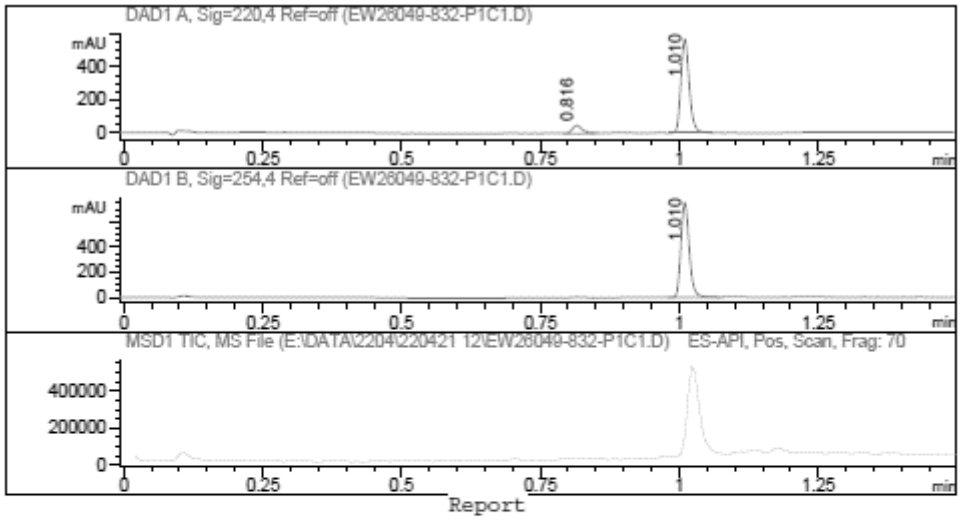




^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (thiazol-2-ylsulfanylmethyl) tetrahydrofuran-2-yl]purin-6-amine **(45h)**



LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (thiazol-2-ylsulfanylmethyl) tetrahydrofuran-2-yl]purin-6-amine **(45h)**



Report

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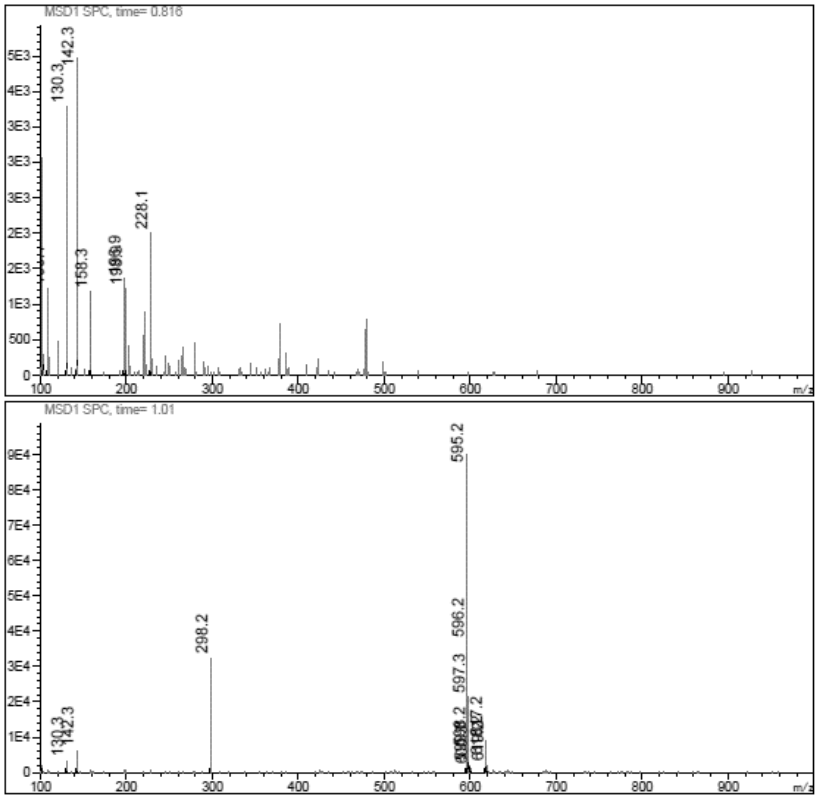
Signal 1 : DAD1 A, Sig=220,4 Ref=off

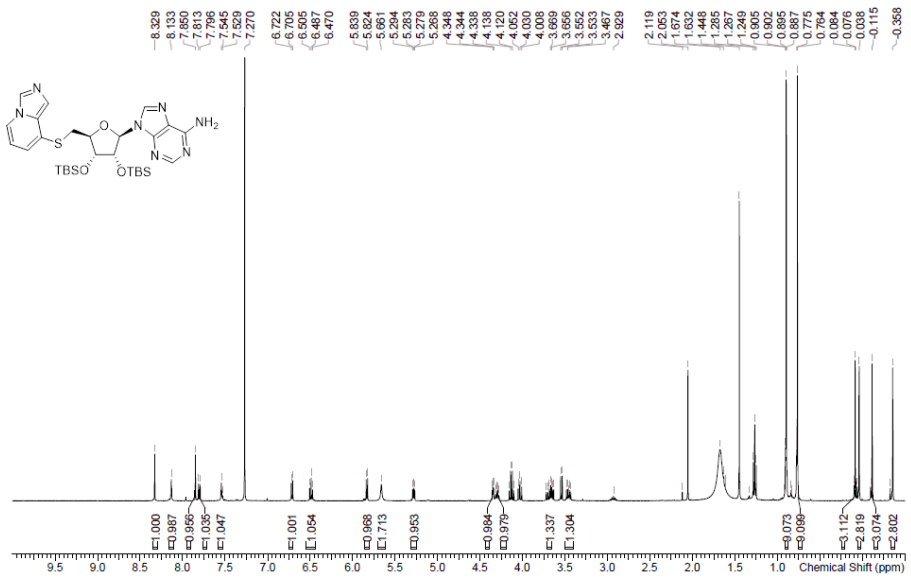
#	Meas. Ret.	Height	Width	Area	Area %
1	0.816	48.042	0.019	60.401	9.113
2	1.010	576.954	0.016	602.418	90.887

Signal 2 : DAD1 B, Sig=254,4 Ref=off

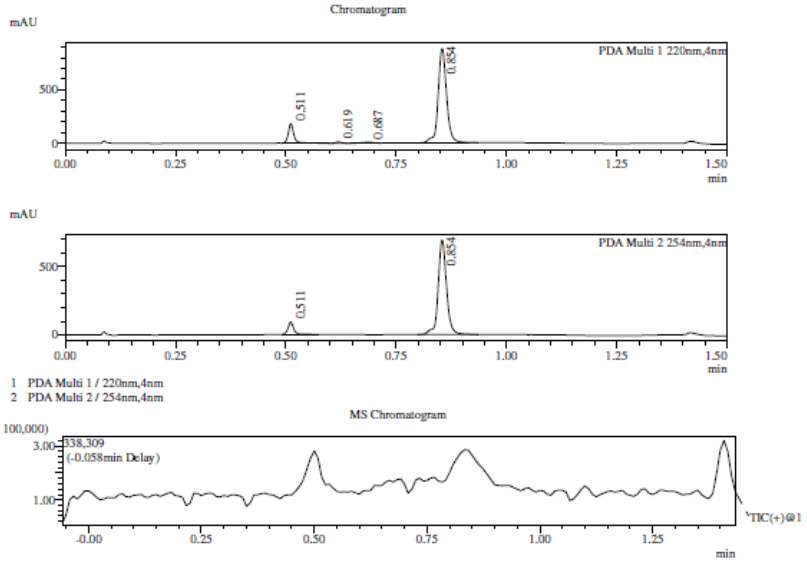
#	Meas. Ret.	Height	Width	Area	Area %
1	1.010	759.583	0.016	784.489	100.000



^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (imidazo[1,5-a]pyridin-8-ylsulfanylmethyl)tetrahydrofuran-2-yl]purin-6-amine **(45i)**



LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (imidazo[1,5-a]pyridin-8-ylsulfanylmethyl)tetrahydrofuran-2-yl]purin-6-amine **(45i)**



Integration Result

Peak Table

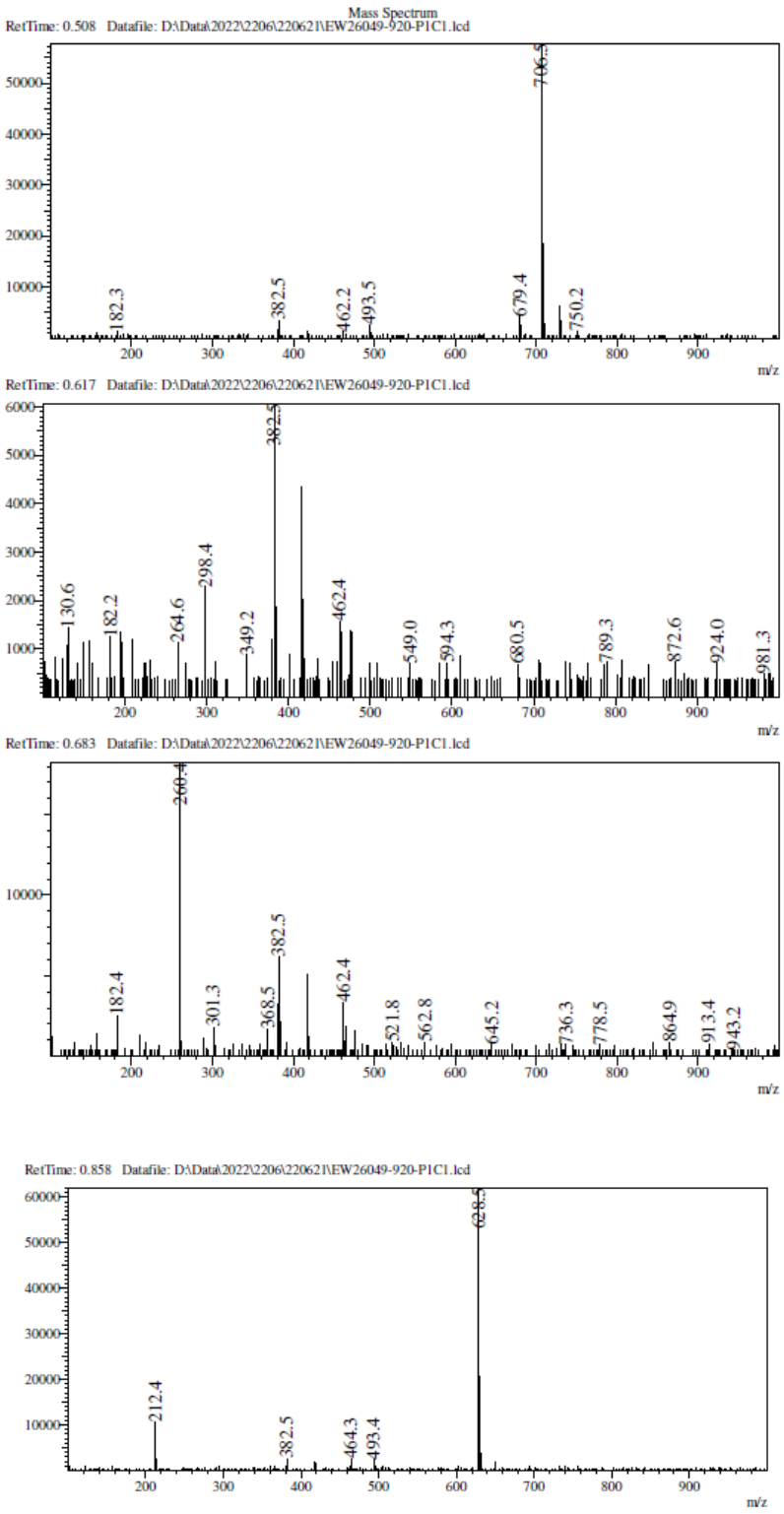
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.511	183504	16.951	0.024	167988	12.251
2	0.619	12630	1.167	0.030	13184	0.961
3	0.687	9897	0.914	0.050	17364	1.266
4	0.854	876552	80.969	0.035	1172720	85.522

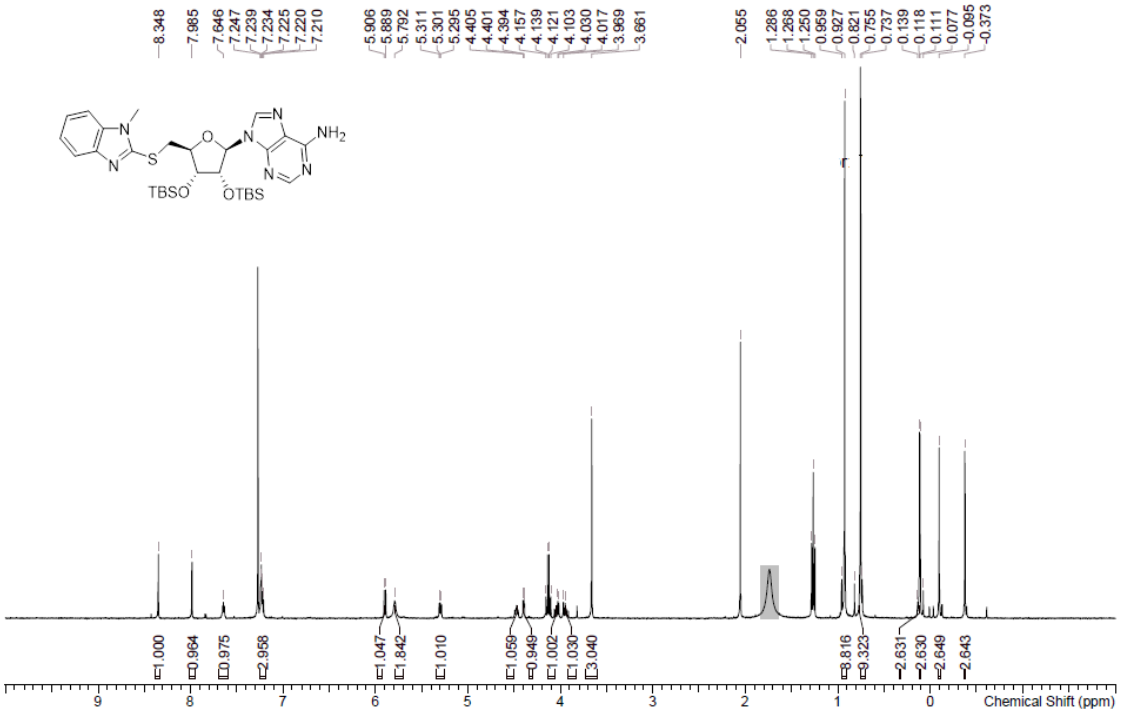
Peak Table

PDA Ch2 254nm

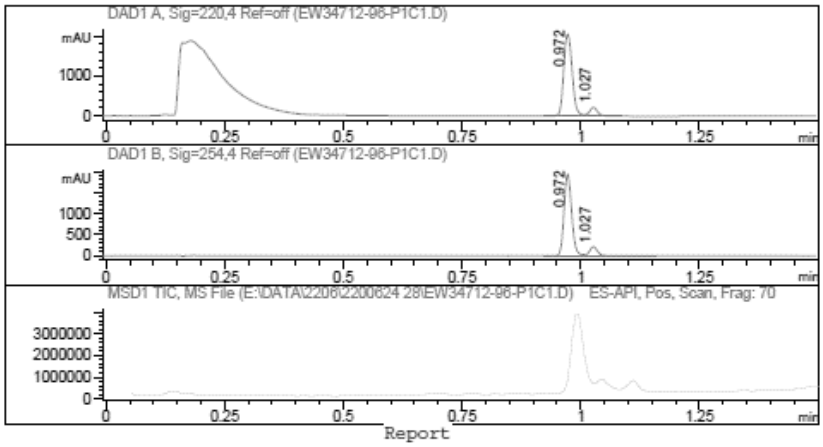
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.511	92065	11.781	0.025	86936	8.655
2	0.854	689417	88.219	0.034	917488	91.345


Mass Spectrum
RetTime: 0.508 Datafile: D:\Data\2022\2206\220621\EW26049-920-P1C1.lcd
706.5
182.3
382.5
462.2
493.5
679.4
750.2
m/z
RetTime: 0.617 Datafile: D:\Data\2022\2206\220621\EW26049-920-P1C1.lcd
382.5
130.6
182.2
264.6
298.4
349.2
462.4
549.0
594.3
680.5
789.3
872.6
924.0
981.3
m/z
RetTime: 0.683 Datafile: D:\Data\2022\2206\220621\EW26049-920-P1C1.lcd
260.4
182.4
301.3
368.5
382.5
462.4
521.8
562.8
645.2
736.3
778.5
864.9
913.4
943.2
m/z
RetTime: 0.858 Datafile: D:\Data\2022\2206\220621\EW26049-920-P1C1.lcd
628.5
212.4
382.5
464.3
493.4
m/z

^{1}H NMR 9-((2R,3R,4R,5S)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-(((1-methyl-1H-benzo[d]imidazol-2-yl)thio)methyl)tetrahydrofuran-2-yl)-9H-purin-6-amine **(45j)**



LCMS 9-((2R,3R,4R,5S)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-(((1-methyl-1H-benzo[d]imidazol-2-yl)thio)methyl)tetrahydrofuran-2-yl)-9H-purin-6-amine **(45j)**



Report

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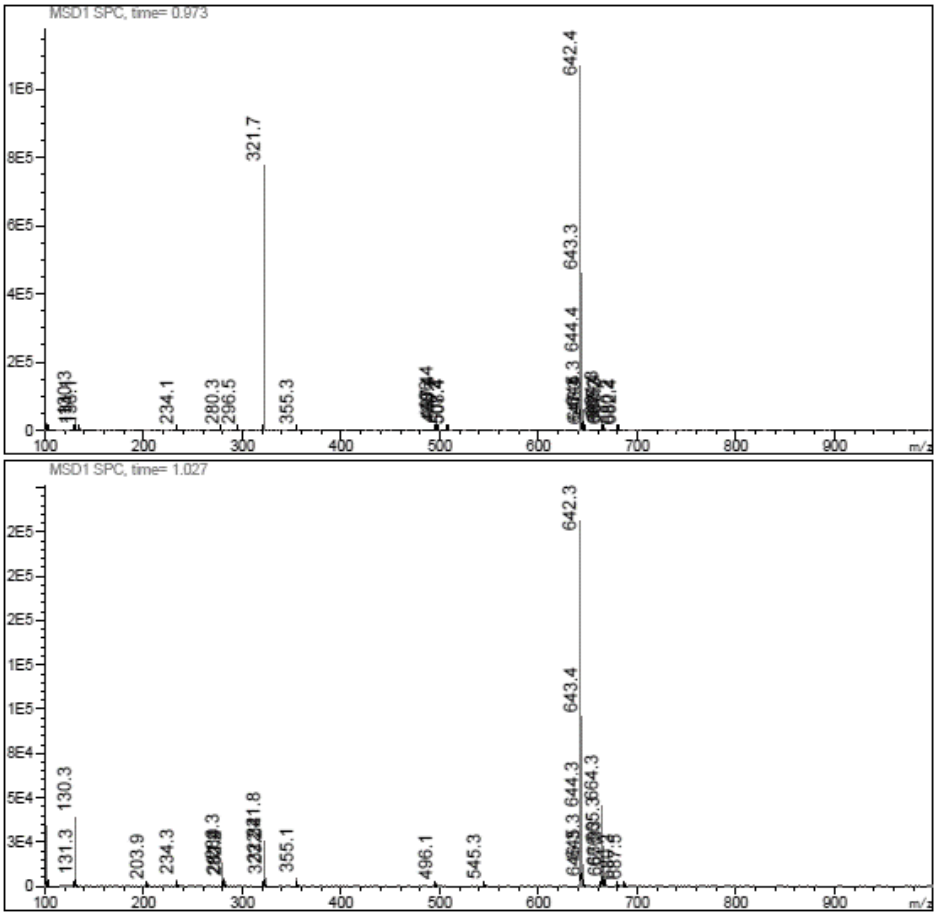
Signal 1 : DAD1 A, Sig=220,4 Ref=off

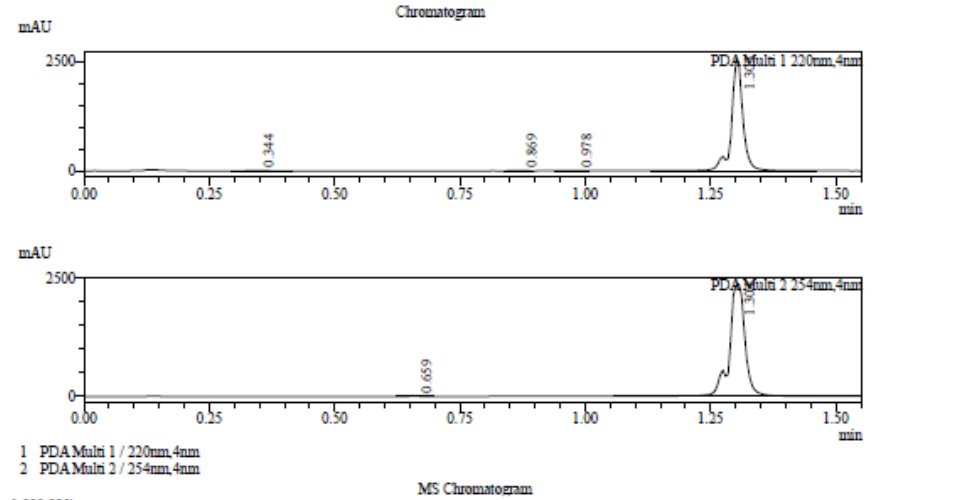
#	Meas. Ret.	Height	Width	Area	Area %
1	0.972	2073.677	0.020	2568.364	90.738
2	1.027	220.629	0.018	262.159	9.262

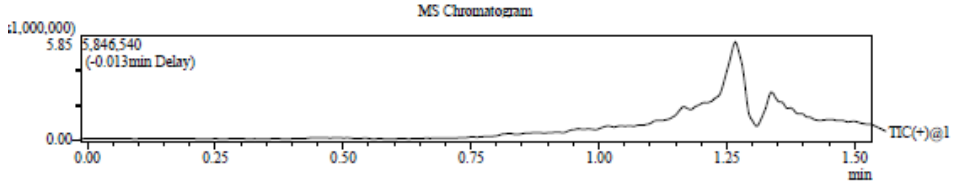
Signal 2 : DAD1 B, Sig=254,4 Ref=off

#	Meas. Ret.	Height	Width	Area	Area %
1	0.972	1939.357	0.018	2162.180	89.326
2	1.027	214.098	0.018	258.357	10.674


MSD1 SPC, time= 0.973
642.4
321.7
643.3
644.4
234.1
280.3
296.5
355.3
MSD1 SPC, time= 1.027
642.3
643.4
644.3
130.3
131.3
203.9
234.3
355.1
496.1
545.3

LCMS 9-((2R,3R,4R,5S)-5-((Benzo[d]oxazol-2-ylthio)methyl)-3,4-bis((tertbutyldimethylsilyl) oxy)tetrahydrofuran-2-yl)-9H-purin-6-amine **(45k)**





Integration Result

Peak Table

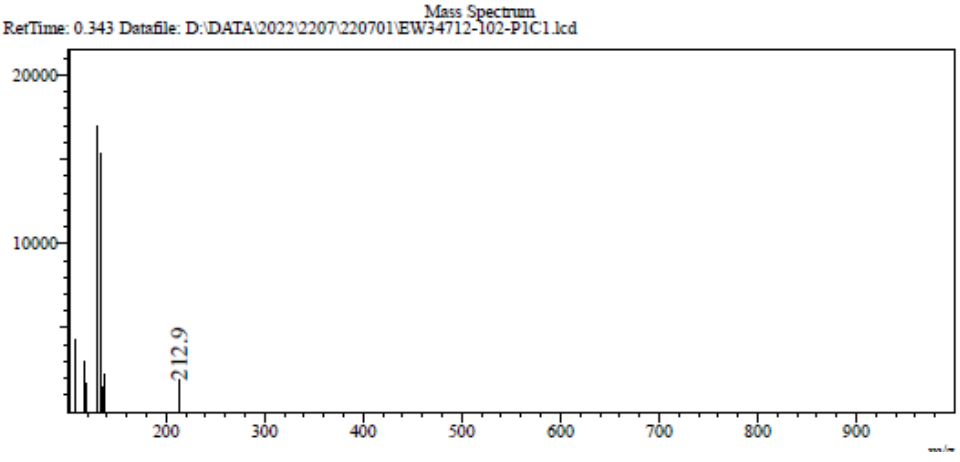
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.344	1963	0.077	0.100	6715	0.164
2	0.869	2955	0.115	0.045	5135	0.125
3	0.978	4117	0.160	0.064	8736	0.213
4	1.303	2556725	99.648	0.043	4076287	99.498

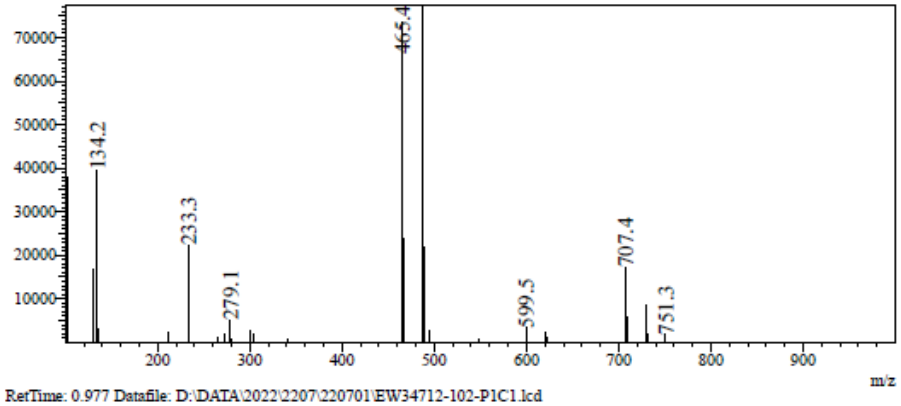
Peak Table

PDA Ch2 254nm

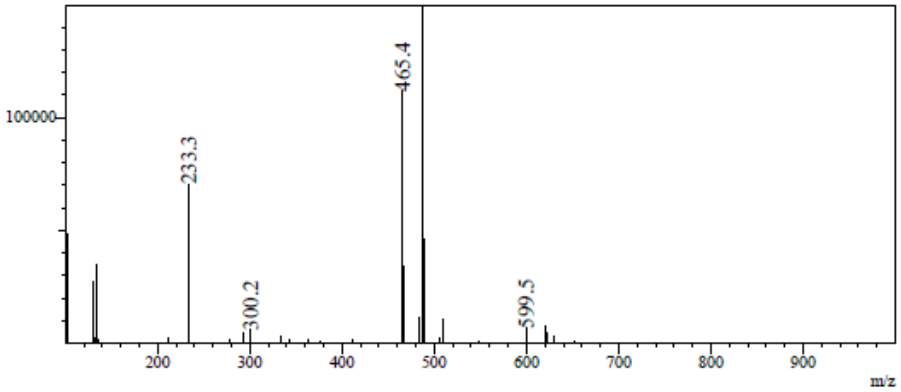
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.659	4142	0.174	0.044	6144	0.119
2	1.304	2375088	99.826	0.059	5163276	99.881



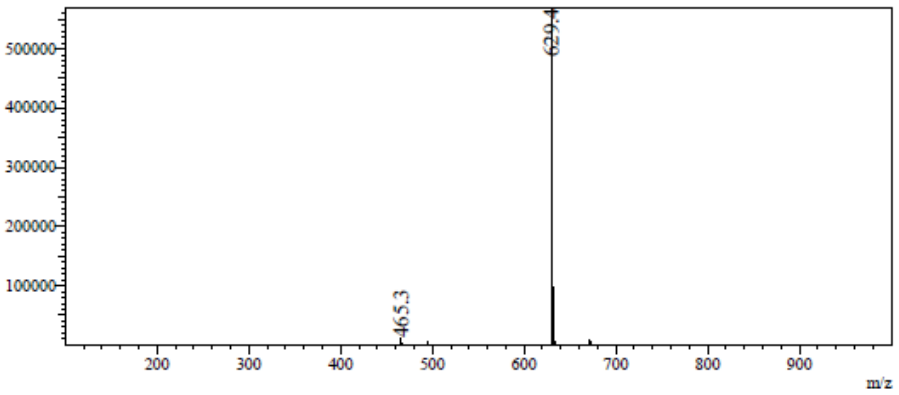
RetTime: 0.870 Datafile: D:\DATA\2022\2207\220701\EW34712-102-P1C1.lcd



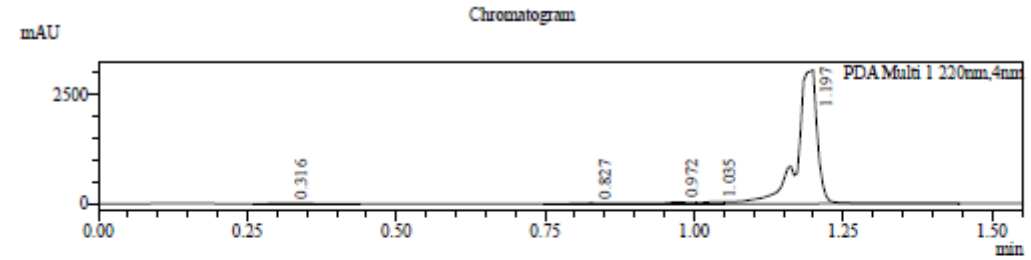
RetTime: 0.977 Datafile: D:\DATA\2022\2207\220701\EW34712-102-P1C1.lcd

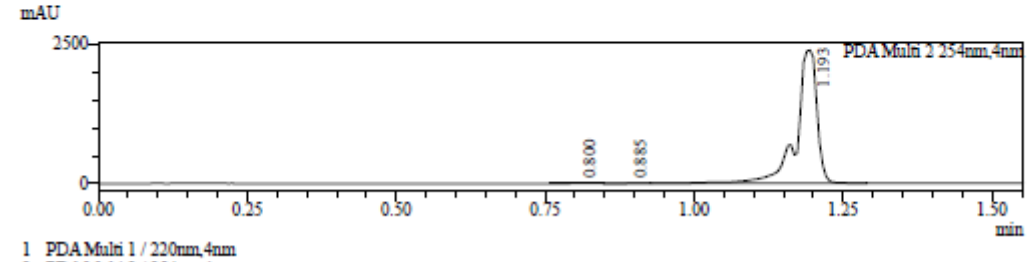


RetTime: 1.303 Datafile: D:\DATA\2022\2207\220701\EW34712-102-P1C1.lcd

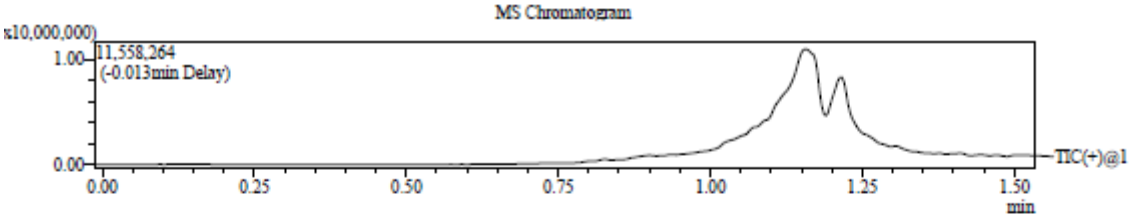


LCMS 9-((2R,3R,4R,5S)-5-(((1H-Benzo[d]imidazol-2-yl)thio)methyl)-3,4-bis((tertbutyldimethyl silyl)oxy)tetrahydrofuran-2-yl)-9H-purin-6-amine **(45l)**





1 PDA Multi 1 / 220nm,4nm
2 PDA Multi 2 / 254nm,4nm



Integration Result

Peak Table

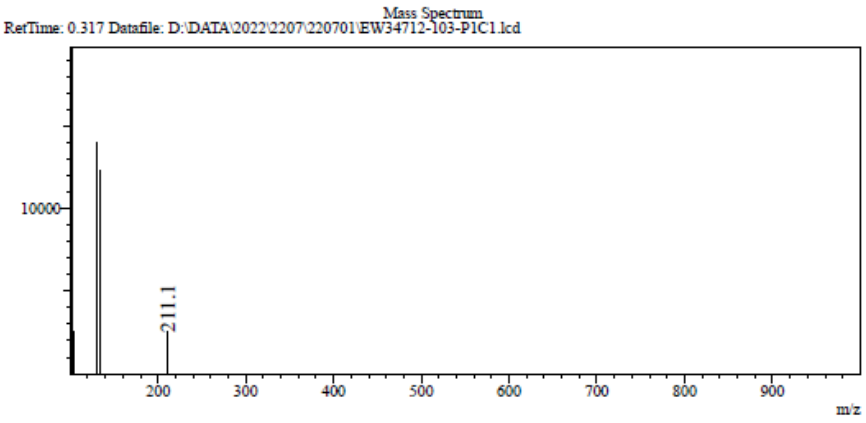
PDA Ch1 220nm

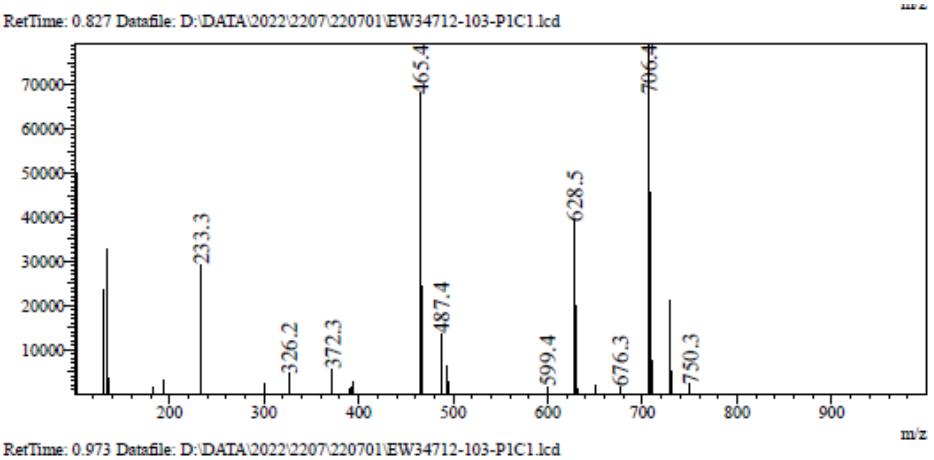
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.316	5662	0.179	0.109	21695	0.281
2	0.827	17028	0.540	0.045	37134	0.481
3	0.972	35702	1.132	0.087	138947	1.798
4	1.035	41918	1.329	0.230	95377	1.235
5	1.197	3054270	96.820	0.224	7432714	96.206

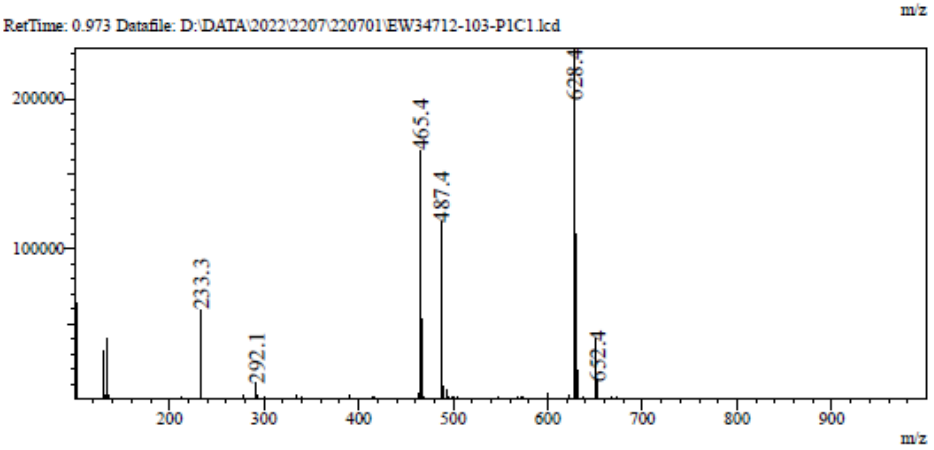
Peak Table

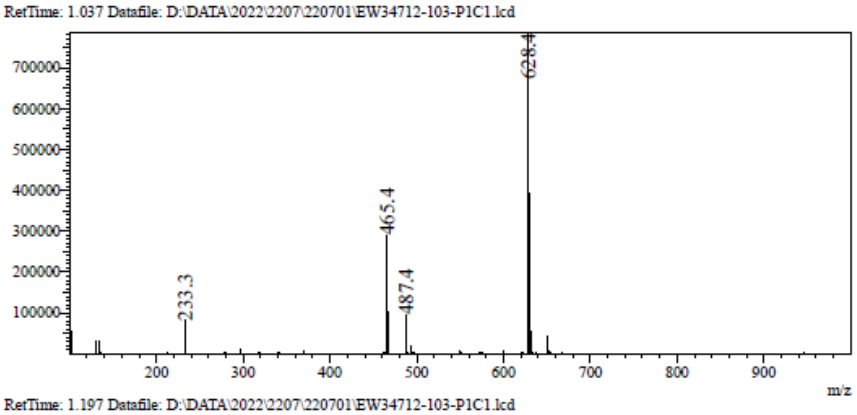
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.800	9089	0.379	0.091	17746	0.303
2	0.885	5920	0.247	0.258	23826	0.407
3	1.193	2384951	99.375	0.059	5815172	99.290




RetTime: 0.827 Datafile: D:\DATA\2022\2207\220701\EW34712-103-P1C1.lcd
70000
60000
50000
40000
30000
20000
10000
233.3
326.2
372.3
465.4
487.4
599.4
628.5
676.3
706.4
750.3
200
300
400
500
600
700
800
900
m/z


RetTime: 0.973 Datafile: D:\DATA\2022\2207\220701\EW34712-103-P1C1.lcd
200000
100000
233.3
292.1
465.4
487.4
628.4
652.4
200
300
400
500
600
700
800
900
m/z


RetTime: 1.037 Datafile: D:\DATA\2022\2207\220701\EW34712-103-P1C1.lcd
700000
600000
500000
400000
300000
200000
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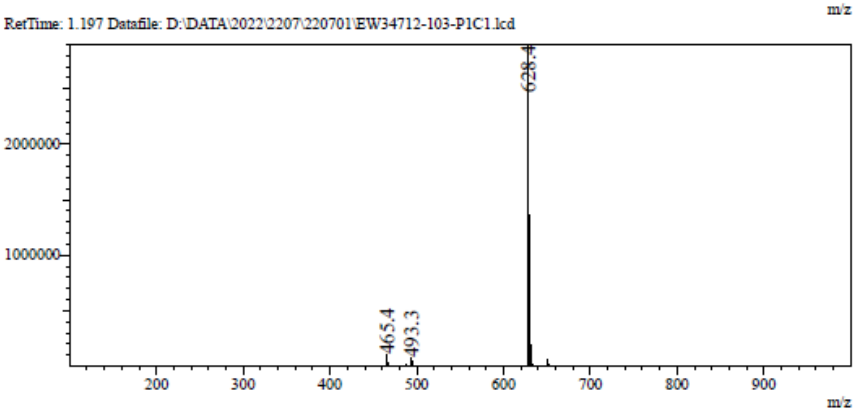
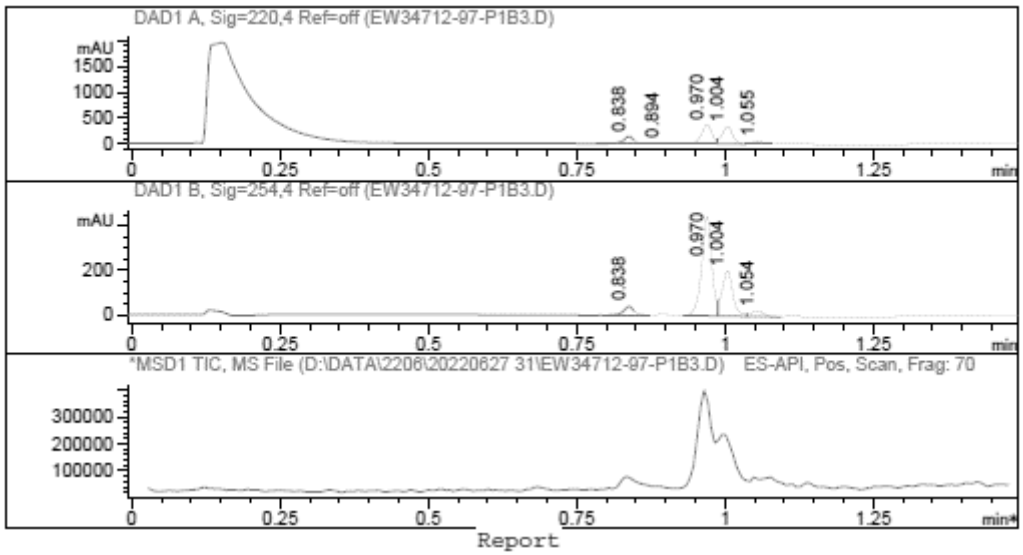
465.4
487.4
628.4
200
300
400
500
600
700
800
900
m/z


RetTime: 1.197 Datafile: D:\DATA\2022\2207\220701\EW34712-103-P1C1.lcd
2000000
1000000
465.4
493.3
628.4
200
300
400
500
600
700
800
900
m/z

LCMS 9-((2R,3R,4R,5S)-5-(((1H-Indazol-7-yl)thio)methyl)-3,4-bis((tert-butyldimethylsilyl)oxy) tetrahydrofuran-2-yl)-9H-purin-6-amine **(45m)**



Report

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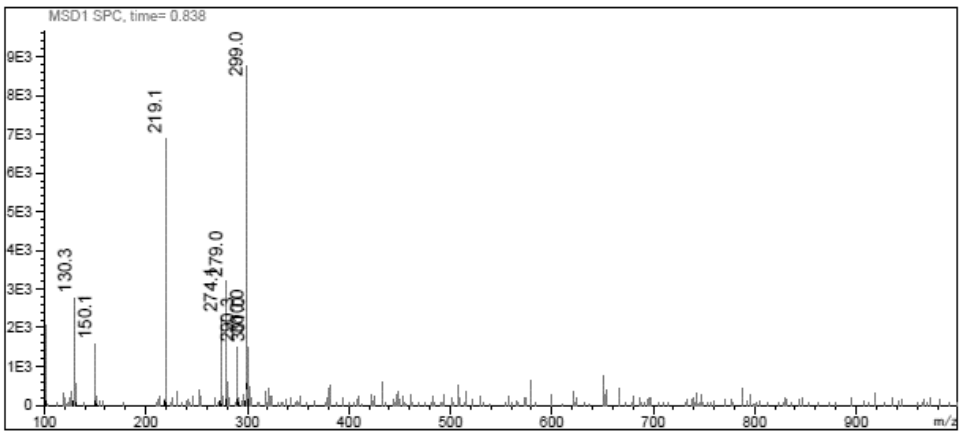
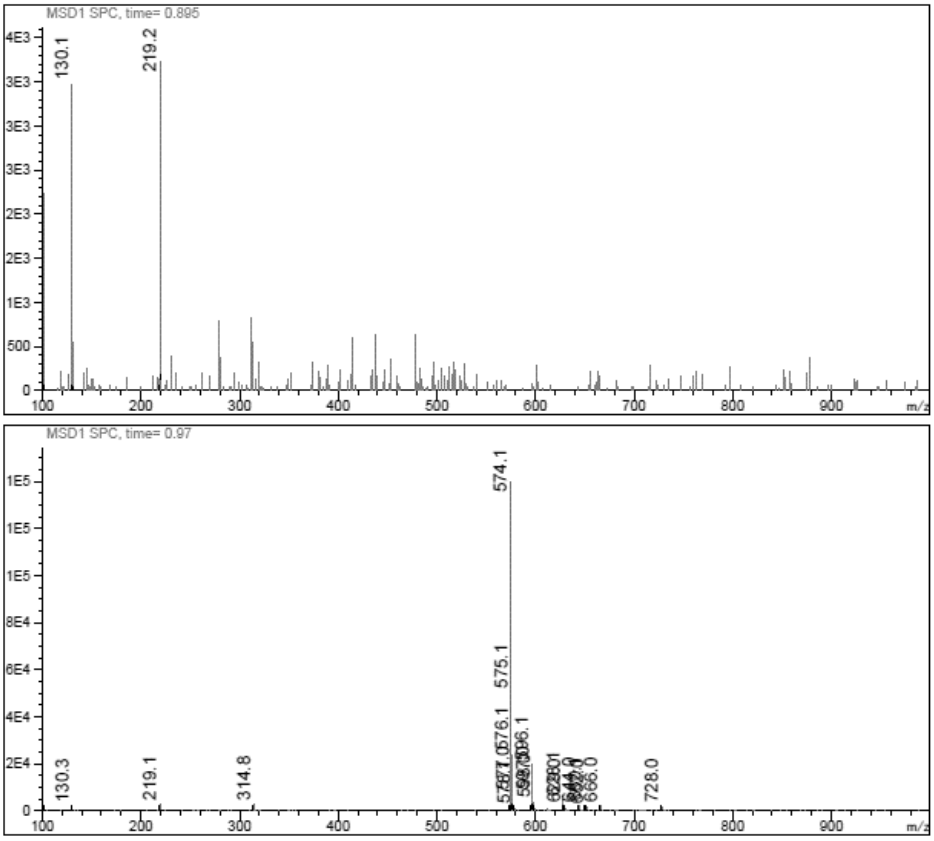
Signal 1 : DAD1 A, Sig=220,4 Ref=off

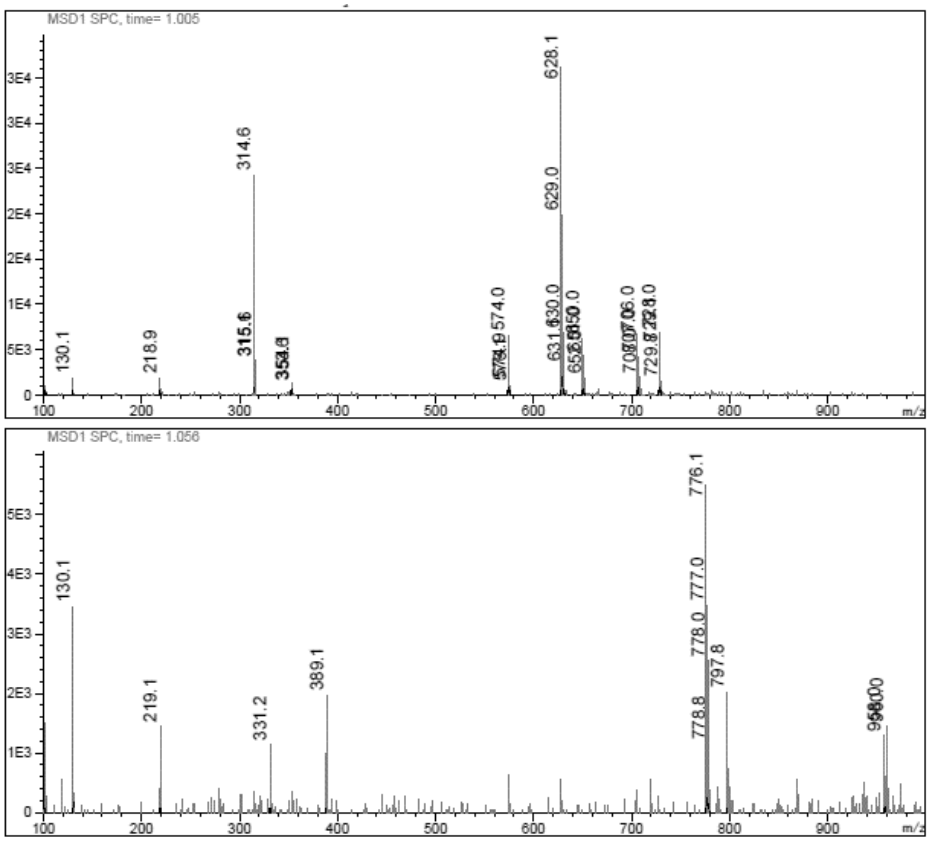
#	Meas. Ret.	Height	Width	Area	Area %
1	0.838	135.808	0.019	168.799	14.768
2	0.894	24.034	0.021	34.284	2.999
3	0.970	372.911	0.018	443.779	38.825
4	1.004	343.672	0.019	425.769	37.249
5	1.055	46.438	0.022	70.403	6.159

Signal 2 : DAD1 B, Sig=254,4 Ref=off

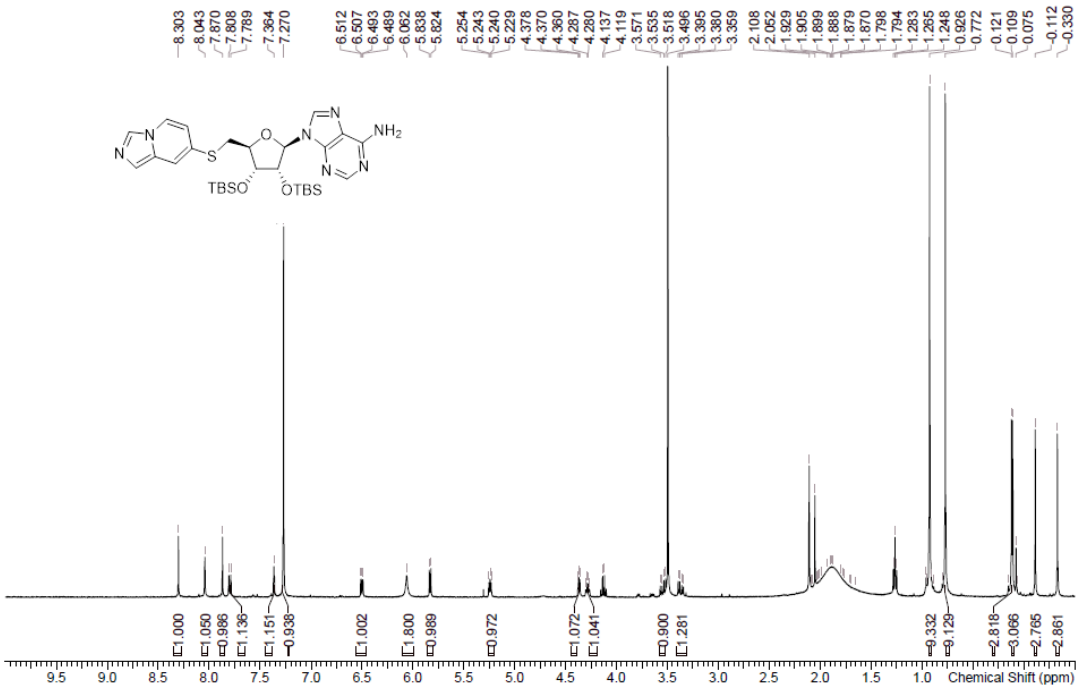
#	Meas. Ret.	Height	Width	Area	Area %
1	0.838	39.049	0.019	49.638	5.668
2	0.970	446.271	0.018	532.231	60.779
3	1.004	203.776	0.019	257.435	29.398
4	1.054	24.235	0.022	36.381	4.155



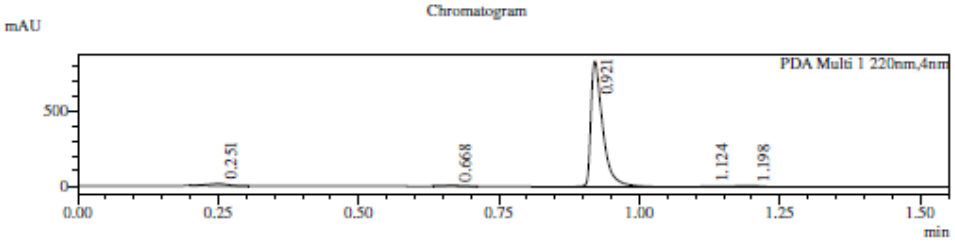

MSD1 SPC, time= 0.895
130.1
219.2
MSD1 SPC, time= 0.97
574.1
575.1
130.3
219.1
314.8
728.0

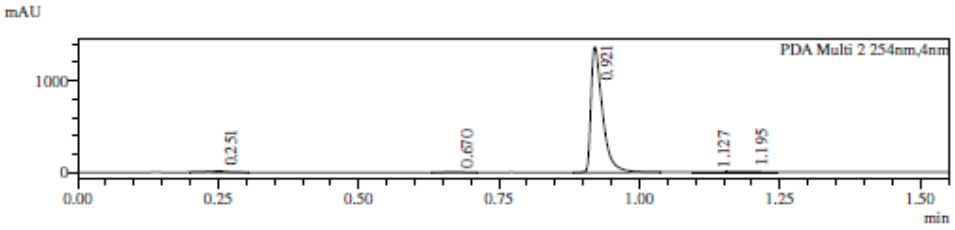

MSD1 SPC, time= 1.005
628.1
314.6
629.0
130.1
218.9
315.6
574.0
MSD1 SPC, time= 1.056
776.1
777.0
778.0
130.1
219.1
331.2
389.1
797.8

^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]-5-(imidazo [1,5-a]pyridin-7-ylsulfanylmethyl)tetrahydrofuran-2-yl]purin-6-amine **(45n)**

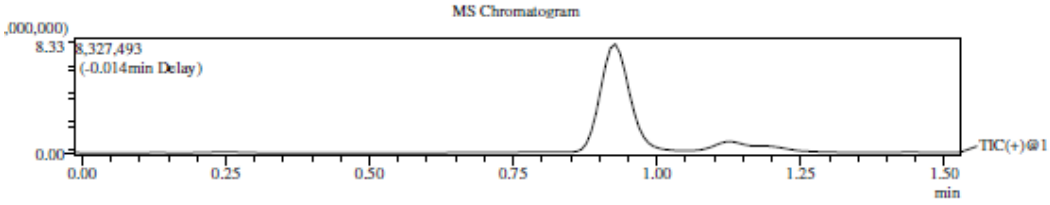


LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]-5-(imidazo [1,5-a]pyridin-7-ylsulfanylmethyl)tetrahydrofuran-2-yl]purin-6-amine **(45n)**





1 PDA Multi 1 / 220nm,4nm
2 PDA Multi 2 / 254nm,4nm



Integration Result

Peak Table

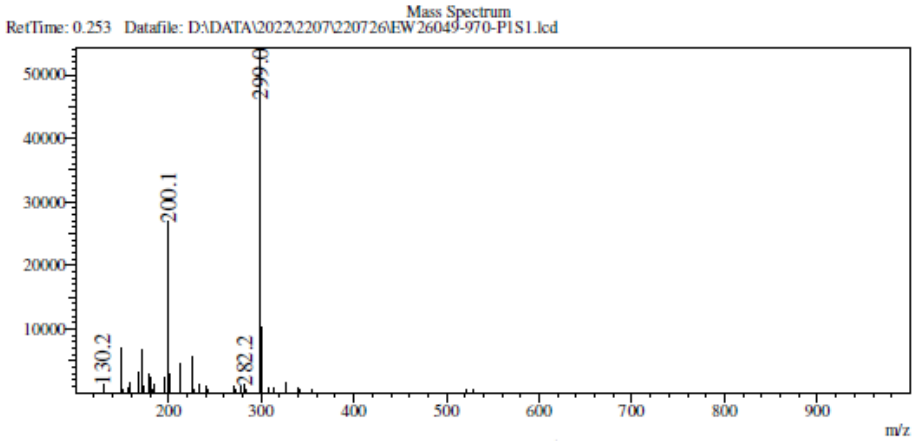
PDA Ch1 220nm

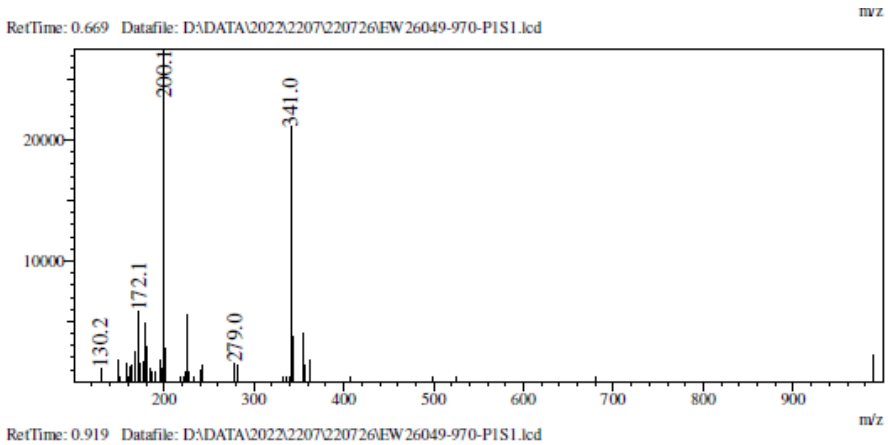
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.251	14041	1.628	0.068	34180	2.610
2	0.668	4342	0.504	0.069	11039	0.843
3	0.921	833221	96.636	0.038	1232865	94.145
4	1.124	3272	0.380	0.286	15568	1.189
5	1.198	7355	0.853	0.096	15891	1.213

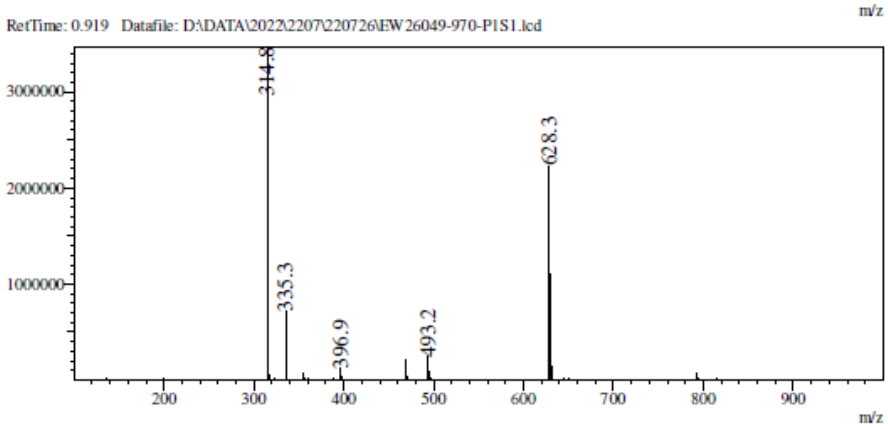
Peak Table

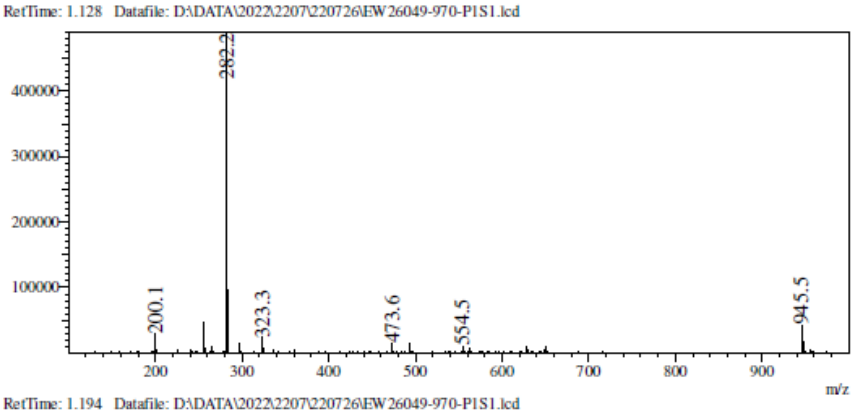
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.251	11948	0.858	0.068	29469	1.451
2	0.670	3903	0.280	0.068	10322	0.508
3	0.921	1367846	98.179	0.037	1960629	96.540
4	1.127	2830	0.203	0.000	8108	0.399
5	1.195	6695	0.481	0.109	22376	1.102




m/z
RetTime: 0.669 Datafile: D:\DATA\2022\2207\220726\EW26049-970-P1S1.lcd
200.1
341.0
172.1
279.0
130.2
20000
10000
200
300
400
500
600
700
800
900
m/z


RetTime: 0.919 Datafile: D:\DATA\2022\2207\220726\EW26049-970-P1S1.lcd
314.8
628.3
335.3
396.9
493.2
3000000
2000000
1000000
200
300
400
500
600
700
800
900
m/z


RetTime: 1.128 Datafile: D:\DATA\2022\2207\220726\EW26049-970-P1S1.lcd
282.2
200.1
323.3
473.6
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945.5
400000
300000
200000
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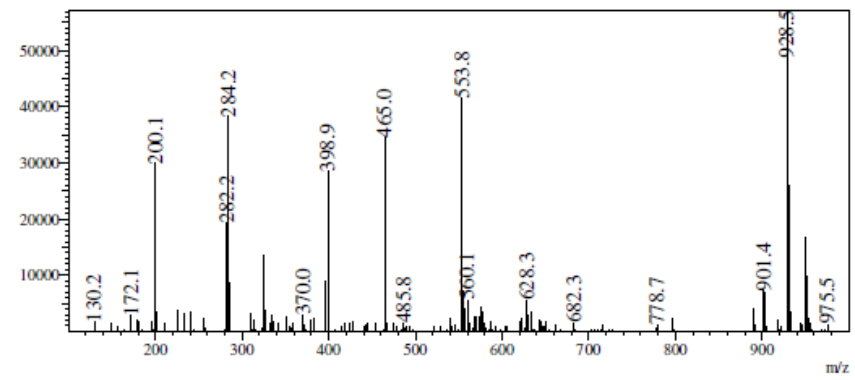
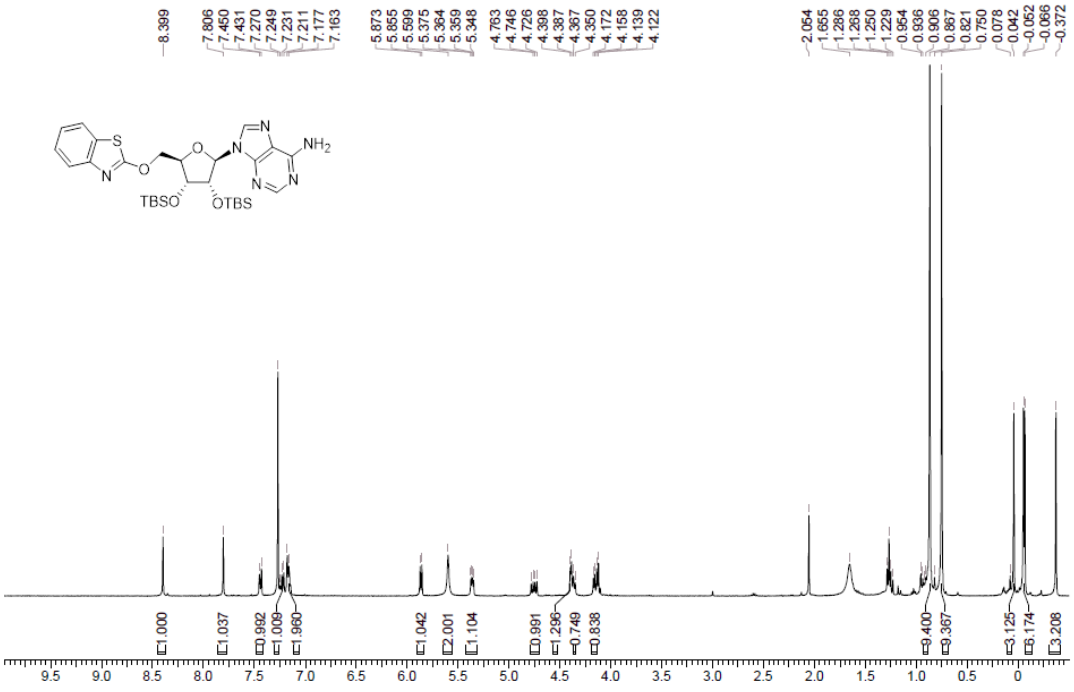
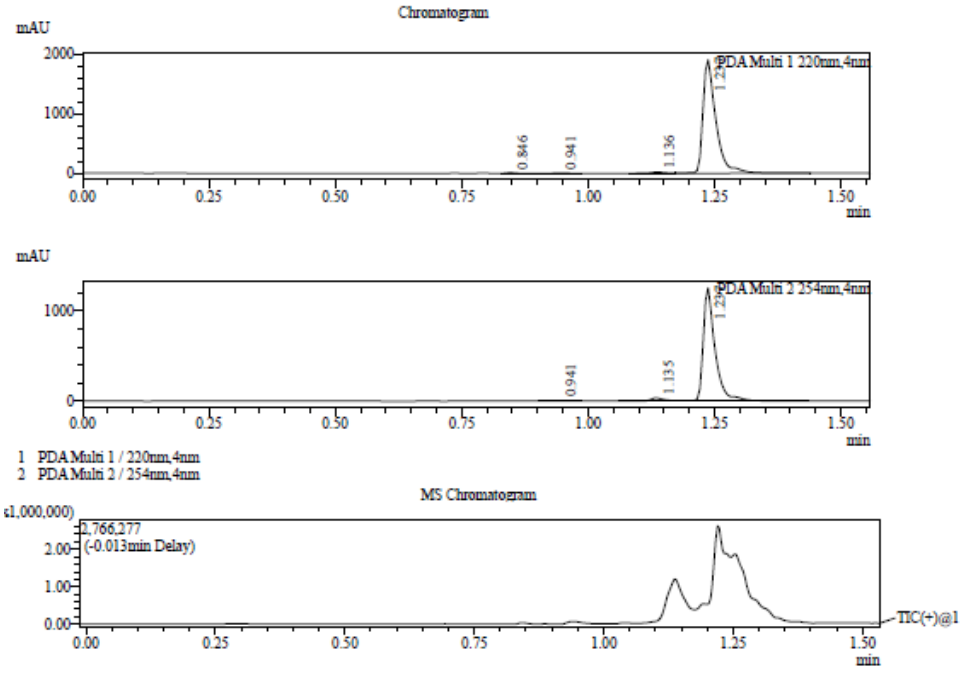
200
300
400
500
600
700
800
900
m/z


RetTime: 1.194 Datafile: D:\DATA\2022\2207\220726\EW26049-970-P1S1.lcd
284.2
200.1
398.9
465.0
553.8
928.5
282.2
130.2
172.1
370.0
485.8
560.1
628.3
682.3
778.7
901.4
975.5
50000
40000
30000
20000
10000
200
300
400
500
600
700
800
900
m/z

[1]H NMR 9-[(2*R*,3*R*,4*R*,5*R*)-5-(1,3-Benzothiazol-2-yloxymethyl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]purin-6-amine **(45o)**



LCMS 9-[(2*R*,3*R*,4*R*,5*R*)-5-(1,3-Benzothiazol-2-yloxymethyl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]purin-6-amine **(45o)**



Integration Result

Peak Table

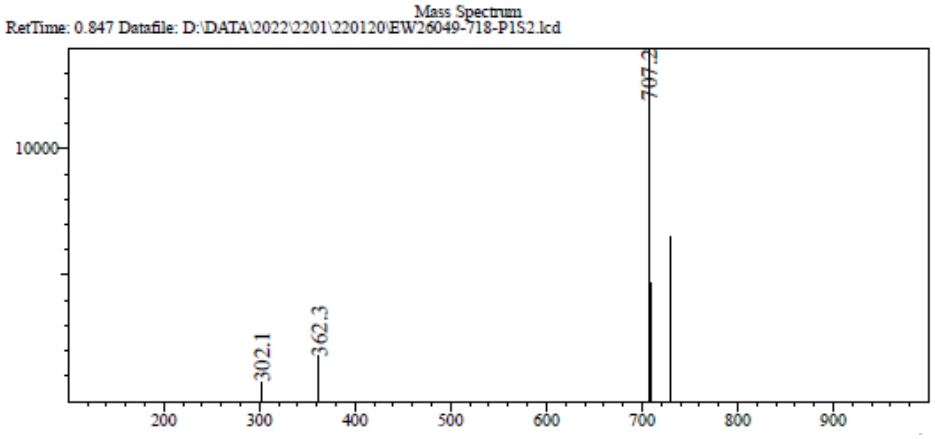
PDA Ch1 220nm

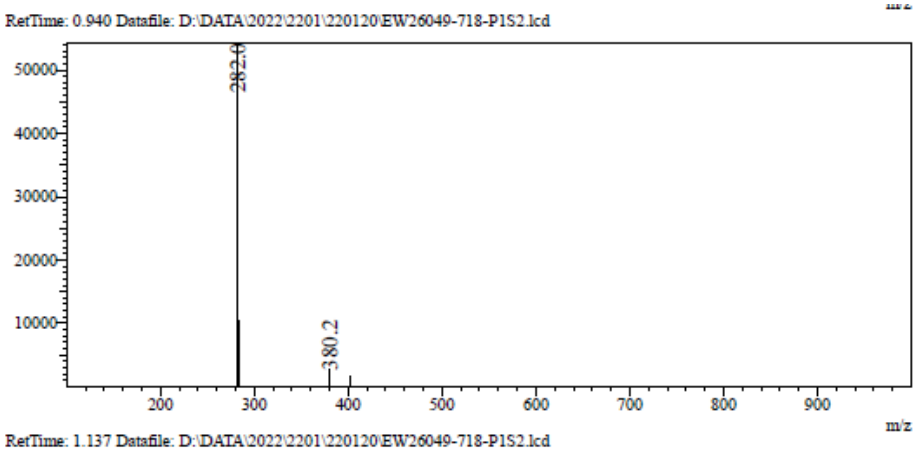
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.846	10568	0.545	0.029	12036	0.353
2	0.941	6503	0.336	0.042	9611	0.282
3	1.136	19149	0.988	0.055	36774	1.077
4	1.237	1901544	98.131	0.049	3355166	98.289

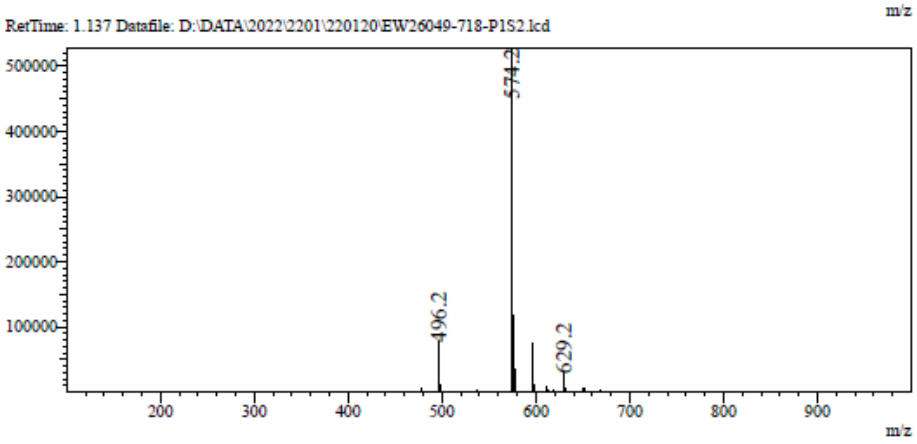
Peak Table

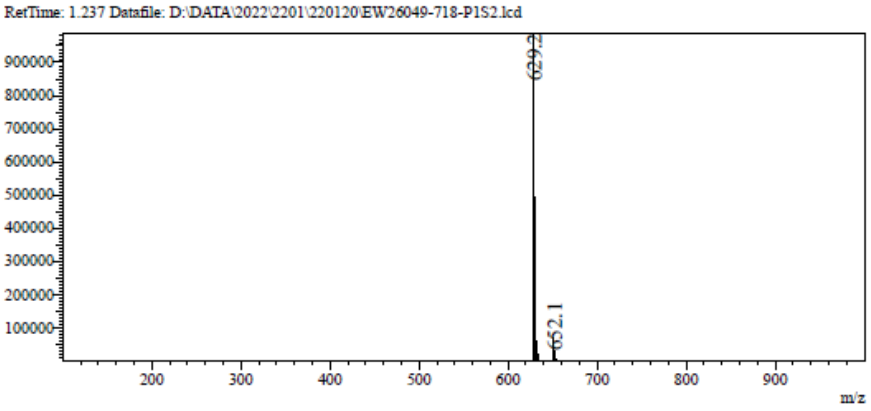
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.941	3443	0.266	0.042	5125	0.244
2	1.135	34723	2.680	0.050	62322	2.970
3	1.237	1257587	97.055	0.044	2030859	96.786

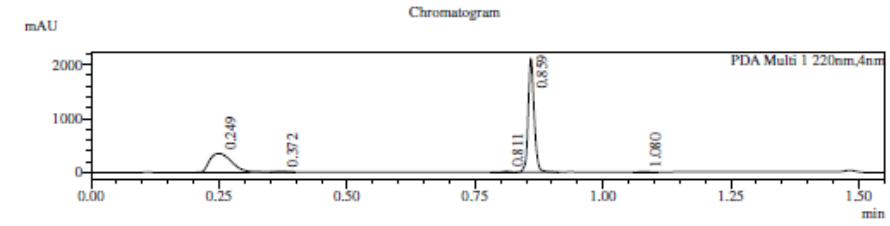


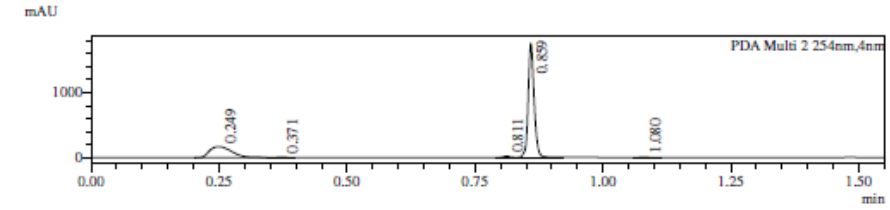

RetTime: 0.940 Datafile: D:\DATA\2022\2201\220120\EW26049-718-P1S2.lcd
282.0
380.2
m/z


RetTime: 1.137 Datafile: D:\DATA\2022\2201\220120\EW26049-718-P1S2.lcd
574.2
496.2
629.2
m/z

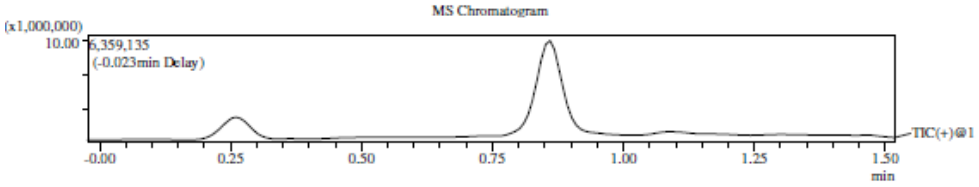

RetTime: 1.237 Datafile: D:\DATA\2022\2201\220120\EW26049-718-P1S2.lcd
629.2
652.1
m/z

LCMS *N*-[[(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy] tetrahydrofuran-2-yl]methyl]-1,3-benzothiazol-2-amine **(45p)**





1 PDA Multi 1 / 220nm,4nm
2 PDA Multi 2 / 254nm,4nm



Integration Result

Peak Table

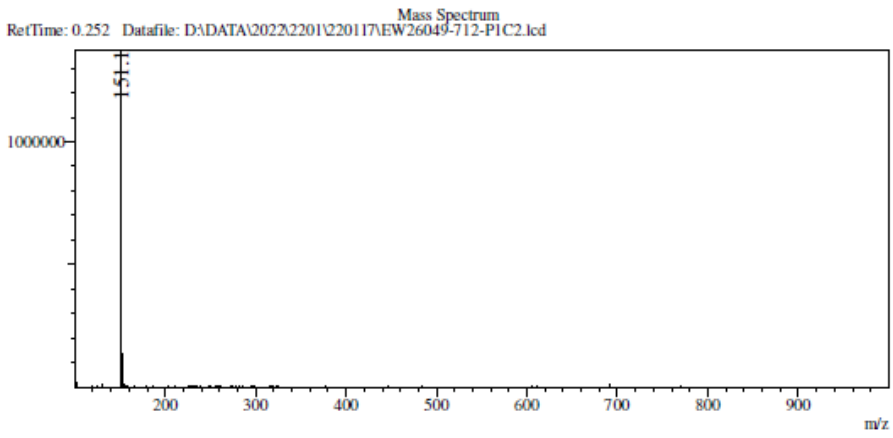
PDA Ch1 220nm

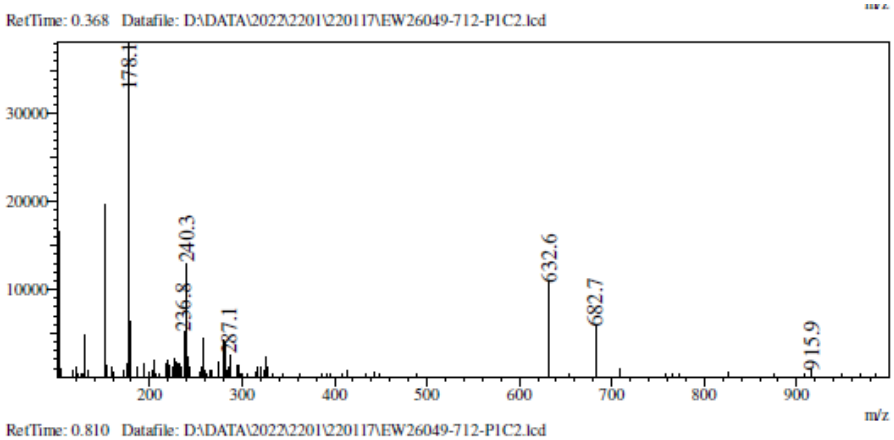
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.249	351253	14.042	0.077	1063423	37.939
2	0.372	9852	0.394	0.029	10096	0.360
3	0.811	18509	0.740	0.027	18464	0.659
4	0.859	2115149	84.559	0.023	1705112	60.832
5	1.080	6626	0.265	0.024	5869	0.209

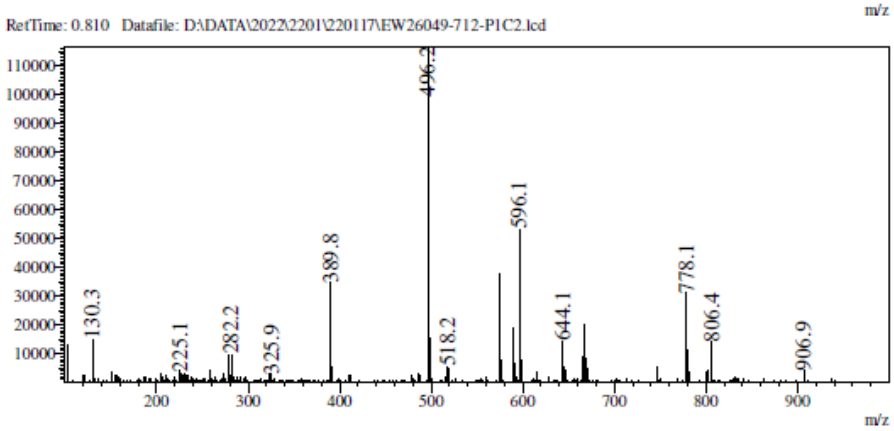
Peak Table

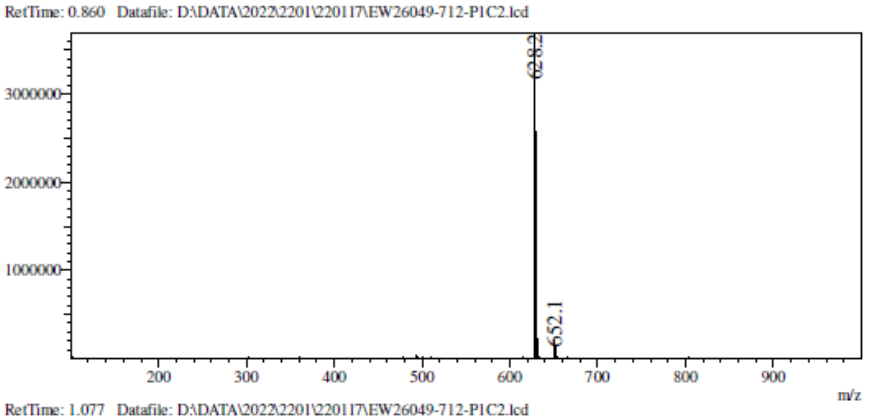
PDA Ch2 254nm

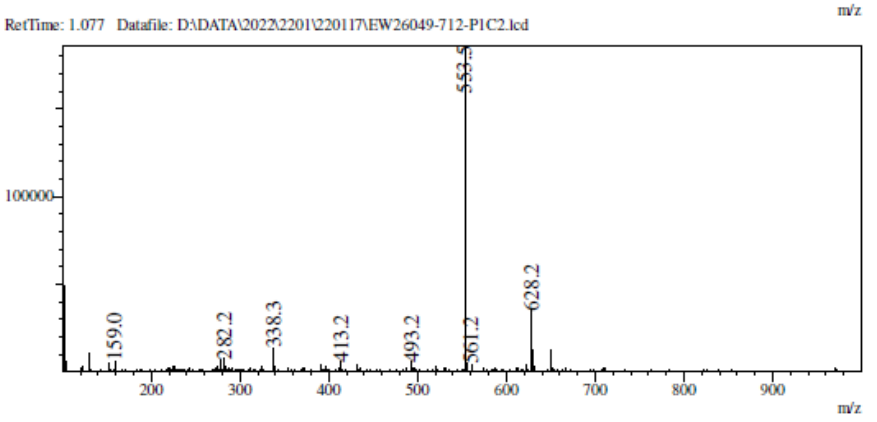
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.249	167094	8.561	0.077	501190	25.976
2	0.371	4869	0.249	0.035	7309	0.379
3	0.811	20137	1.032	0.026	18101	0.938
4	0.859	1753802	89.852	0.023	1397283	72.419
5	1.080	5984	0.307	0.025	5547	0.288



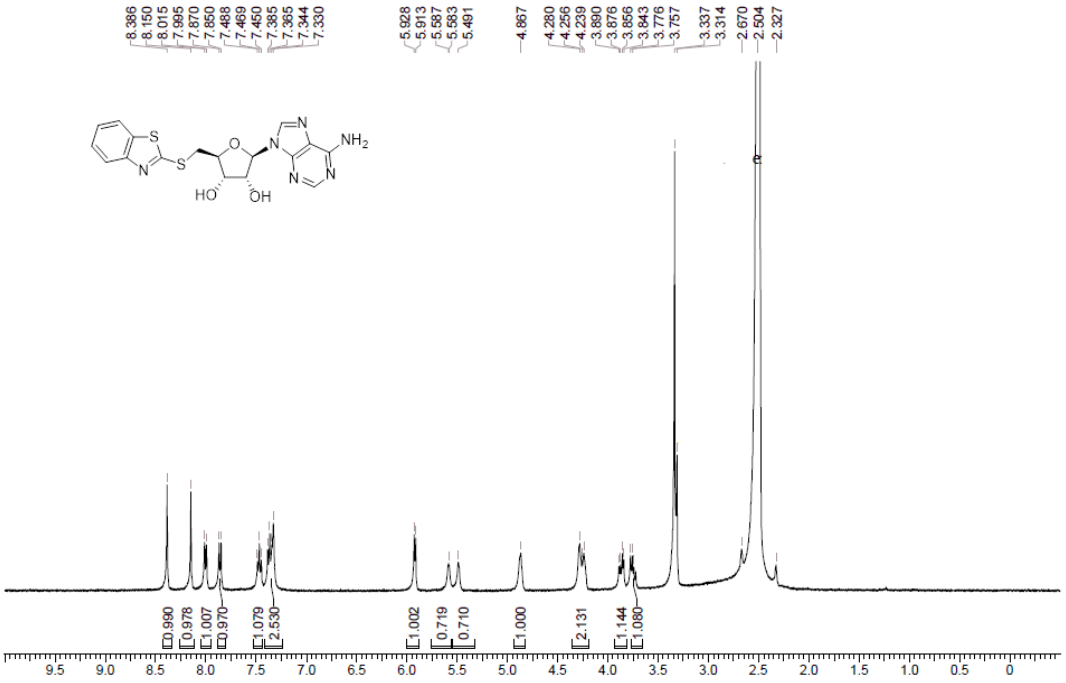

RetTime: 0.368 Datafile: D:\DATA\2022\2201\220117\EW26049-712-P1C2.lcd
178.1
240.3
236.8
287.1
632.6
682.7
915.9
m/z


RetTime: 0.810 Datafile: D:\DATA\2022\2201\220117\EW26049-712-P1C2.lcd
496.2
596.1
389.8
778.1
130.3
225.1
282.2
325.9
518.2
644.1
806.4
906.9
m/z

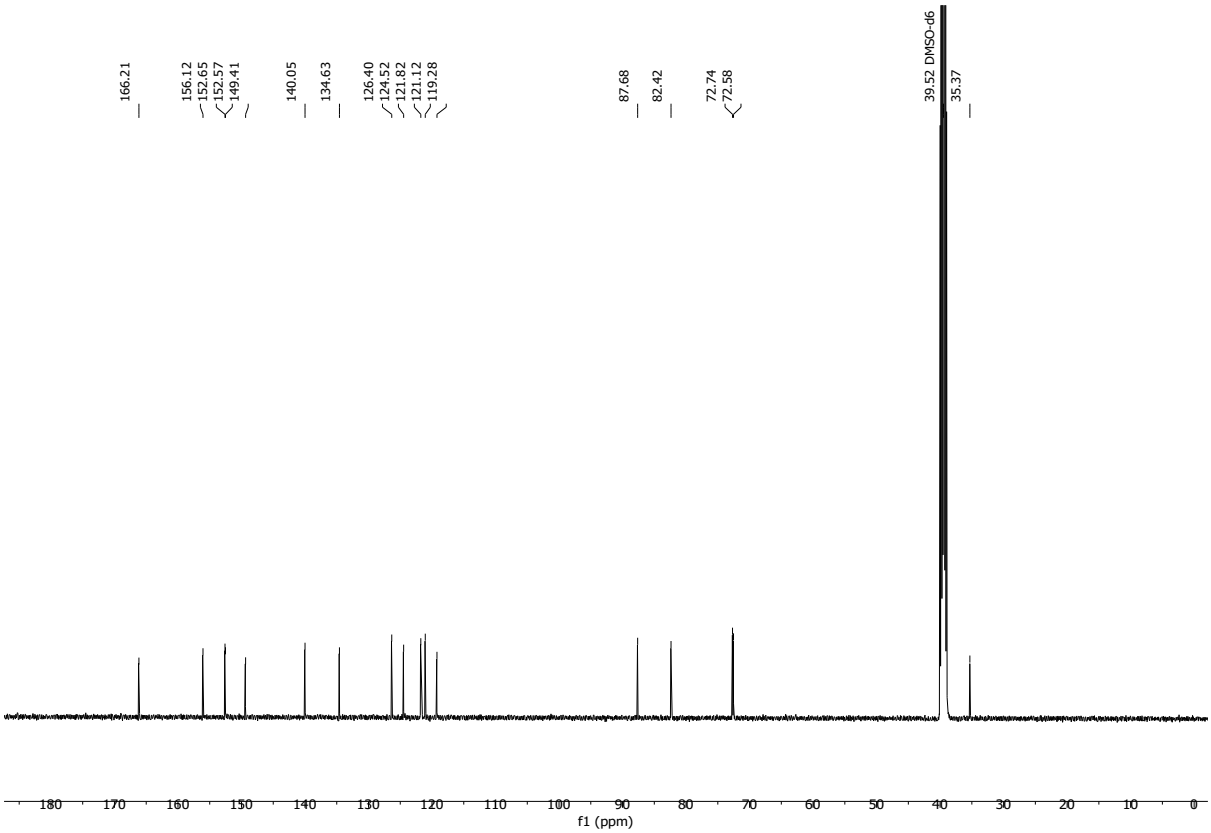

RetTime: 0.860 Datafile: D:\DATA\2022\2201\220117\EW26049-712-P1C2.lcd
628.2
652.1
m/z


RetTime: 1.077 Datafile: D:\DATA\2022\2201\220117\EW26049-712-P1C2.lcd
553.5
628.2
159.0
282.2
338.3
413.2
493.2
561.2
m/z

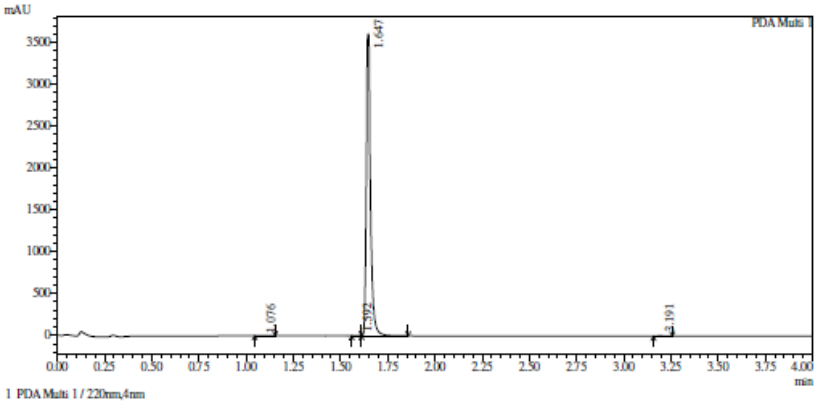
^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(1)**



^{13}C NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(1)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(1)**

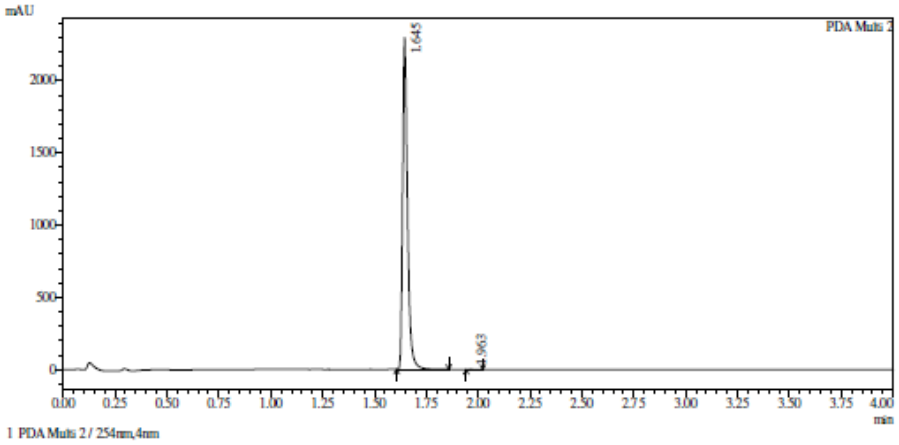


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.076	0.070	0.000	1021	2906	0.051
2	1.592	0.090	6.453	601	1368	0.024
3	1.647	0.036	0.869	3609456	5666061	99.744
4	3.191	0.050	35.904	5442	10272	0.181
Total				3616520	5680607	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.645	0.044	0.000	2297104	3741542	99.968
2	1.963	0.051	6.742	596	1183	0.032
Total				2297700	3742726	100.000

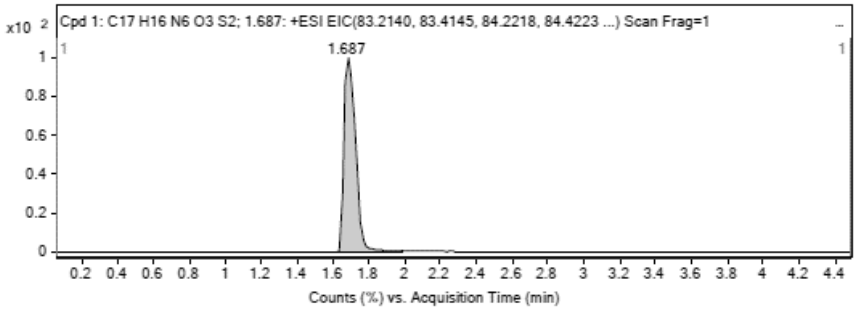
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(1)**

Compound Table

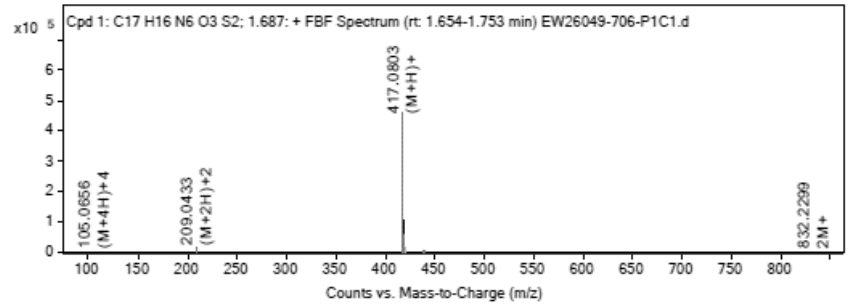
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C17 H16 N6 O3 S2; 1.687	97.92	1.73	C17 H16 N6 O3 S2	1.687	416.0725	416.0733

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
417.0803	1.687	416.0733	C17 H16 N6 O3 S2	416.0725	1.73	Find by Formula

Compound Chromatograms



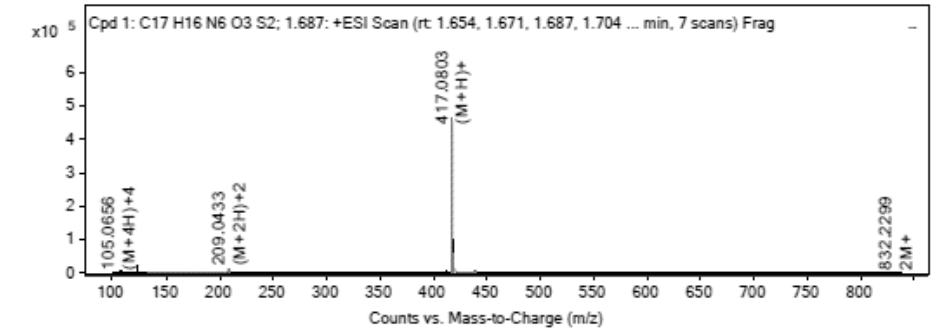
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
105.0656	4	462.41	(M+4H)+4
208.1331	2	393.25	M+2
209.0433	2	11833.25	(M+2H)+2
209.5443	2	2876.12	(M+2H)+2
210.0417	2	1317.21	(M+2H)+2
417.0803	1	460341.03	(M+H)+
418.0823	1	102473.61	(M+H)+
419.0779	1	51885.25	(M+H)+
439.0625	1	2859.47	(M+Na)+
440.0637	1	622.13	(M+Na)+

MS Zoomed Spectrum

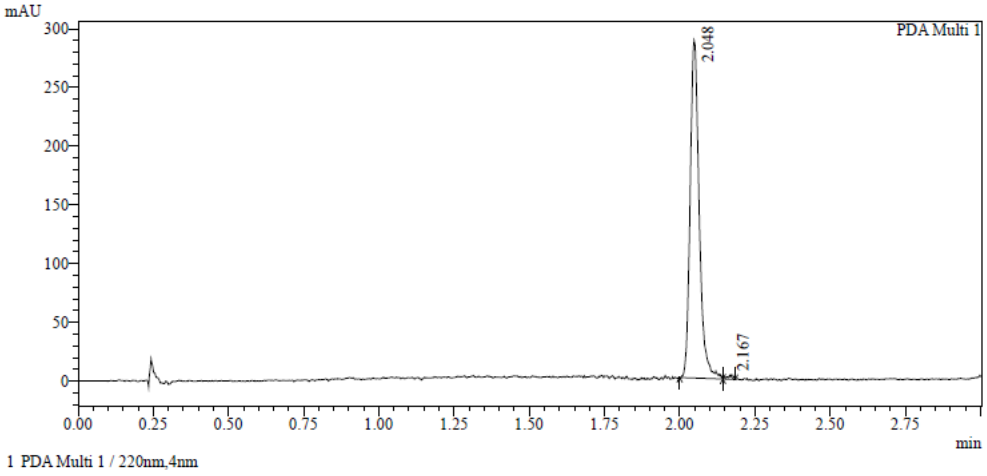


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
105.0656	4	462.41	(M+4H)+4	-382.52
208.1331	2	393.25	M+2	-468.11
209.0433	2	11833.25	(M+2H)+2	1.16
209.5443	2	2876.12	(M+2H)+2	2.16
210.0417	2	1317.21	(M+2H)+2	4.41
417.0803	1	460341.03	(M+H)+	-1.14
418.0823	1	102473.61	(M+H)+	0.02
419.0779	1	51885.25	(M+H)+	0.07
439.0625	1	2859.47	(M+Na)+	-1.59
440.0637	1	622.13	(M+Na)+	1.32

--- End Of Report ---

SFC (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(1)**



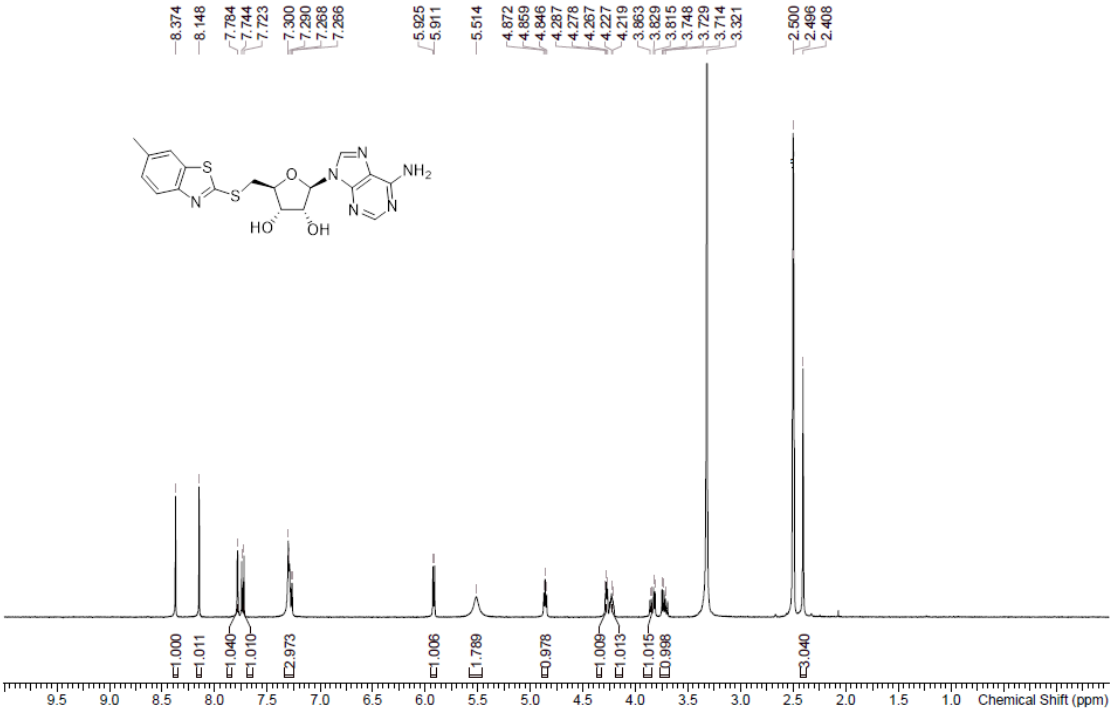
Integration Results

PeakTable

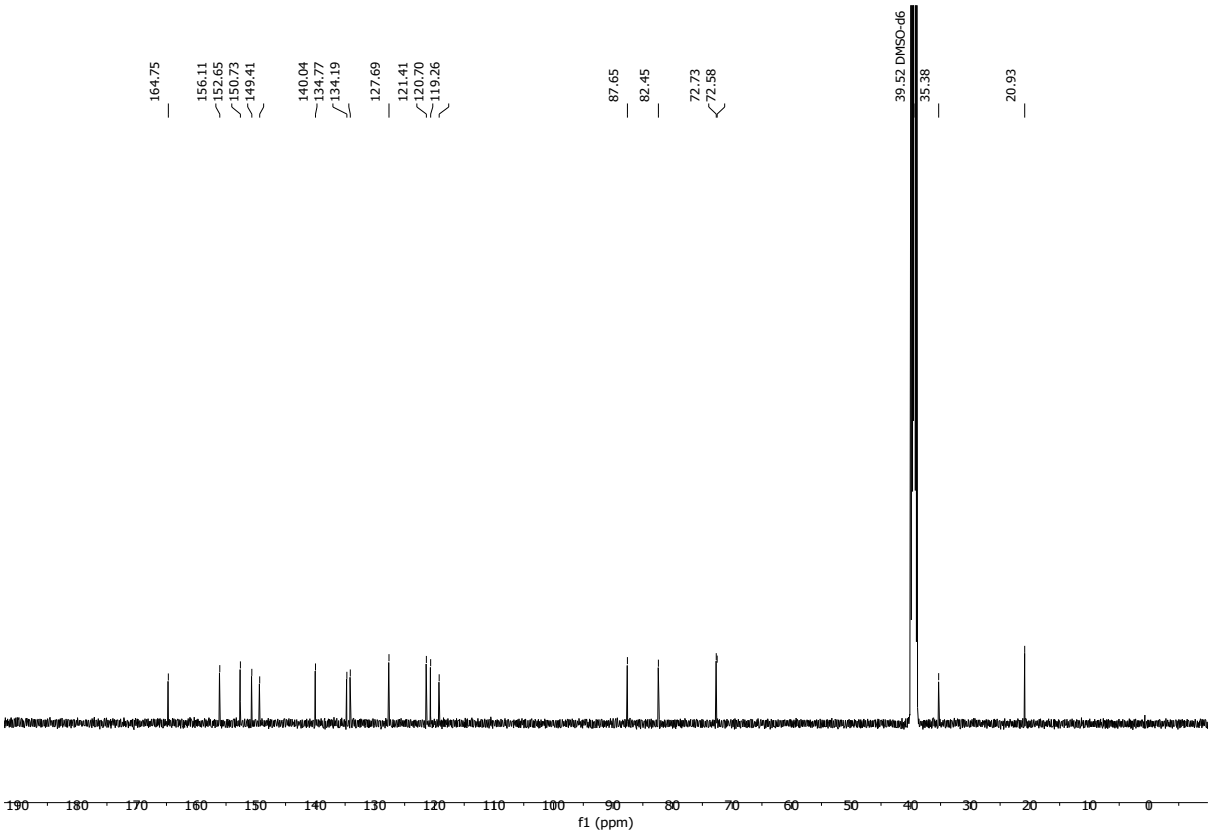
PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	2.048	0.057	0.000	276739	603800	99.391
2	2.167	0.034	2.579	2385	3697	0.609
Total				279124	607496	100.000

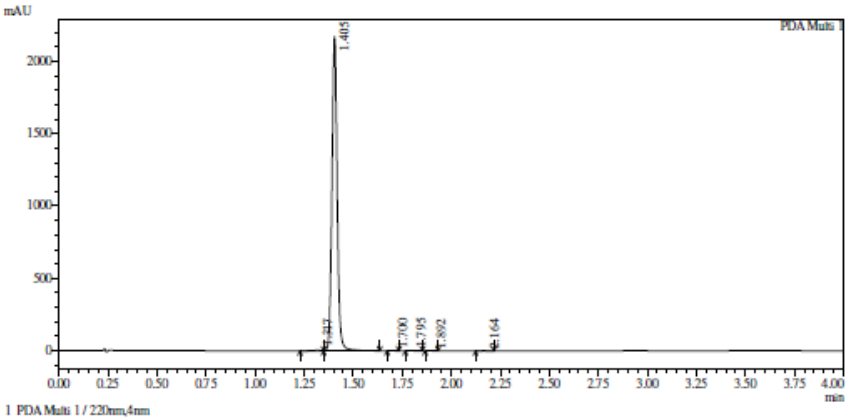
^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-[(6-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol **(2)**



^{13}C NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-[(6-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol **(2)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-[(6-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol **(2)**

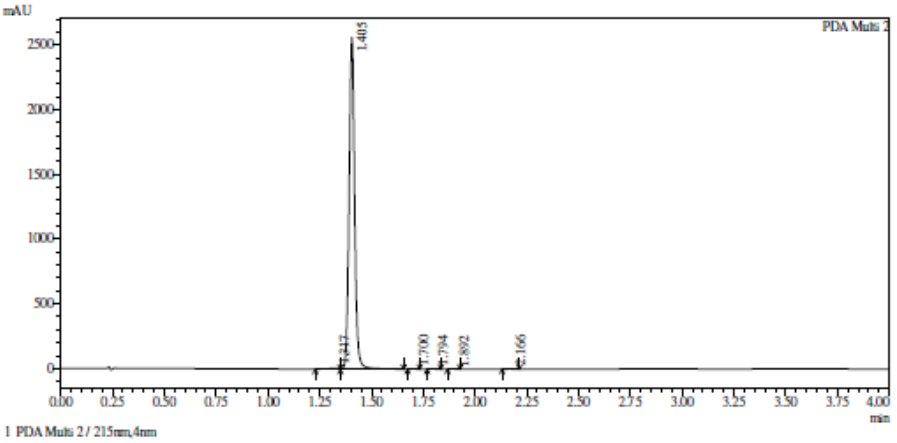


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.317	0.126	0.000	4624	17873	0.438
2	1.405	0.049	0.999	2174873	4050027	99.268
3	1.700	0.045	6.315	1309	2157	0.053
4	1.795	0.052	1.960	1584	3148	0.077
5	1.892	0.041	2.099	1749	2600	0.064
6	2.164	0.069	4.957	1614	4085	0.100
Total				2185753	4079890	100.000



Integration result

PeakTable

PDA Ch2 215nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.317	0.117	0.000	5693	21767	0.451
2	1.405	0.049	1.062	2563316	4790990	99.355
3	1.700	0.045	6.302	988	1627	0.034
4	1.794	0.050	1.977	1090	1938	0.040
5	1.892	0.040	2.172	1766	2558	0.053
6	2.166	0.065	5.216	1329	3189	0.066
Total				2574182	4822069	100.000

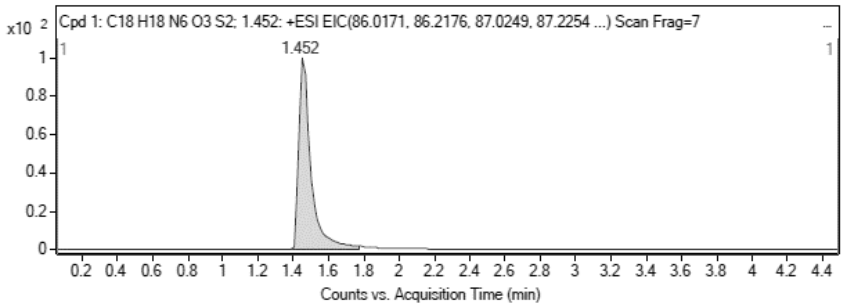
HRMS (2R,3R,4S,5S)-2-(6-aminopurin-9-yl)-5-[(6-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol **(2)**

Compound Table

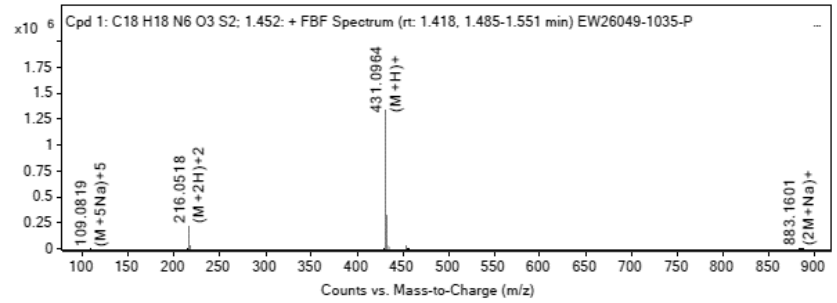
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C18 H18 N6 O3 S2; 1.452	97.44	1.66	C18 H18 N6 O3 S2	1.452	430.0882	430.0889

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
216.0518	1.452	430.0889	C18 H18 N6 O3 S2	430.0882	1.66	Find by Formula

Compound Chromatograms



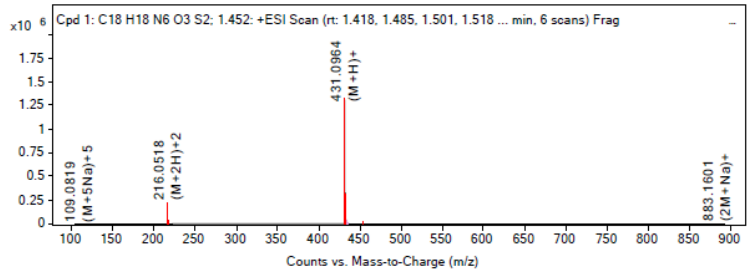
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
216.0518	2	220369.45	(M+2H)+2
216.553	2	53893.43	(M+2H)+2
217.0509	2	26690.65	(M+2H)+2
431.0964	1	1321847.88	(M+H)+
432.0981	1	325651.41	(M+H)+
433.0936	1	158972.36	(M+H)+
453.0764	1	25026.08	(M+Na)+
454.0789	1	6208.18	(M+Na)+
455.0758	1	3294.22	(M+Na)+
883.1601	1	1169.77	(2M+Na)+

MS Zoomed Spectrum

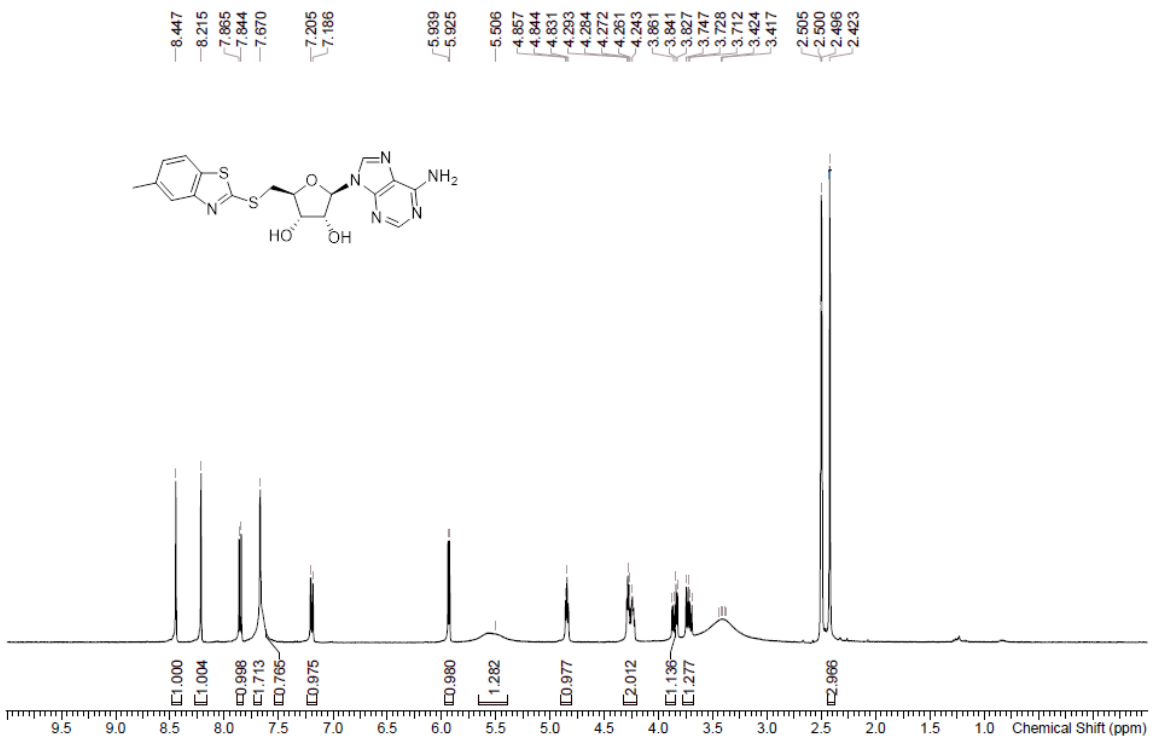


MS Spectrum Peak List

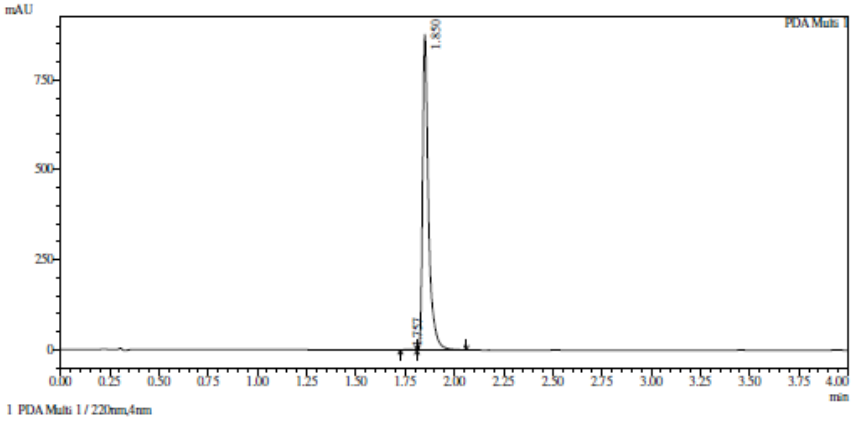
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
216.0518	2	220369.45	(M+2H)+2	-1.9
216.553	2	53893.43	(M+2H)+2	-1.66
217.0509	2	26690.65	(M+2H)+2	-2.08
431.0964	1	1321847.88	(M+H)+	-2.29
432.0981	1	325651.41	(M+H)+	-0.16
433.0936	1	158972.36	(M+H)+	0.18
453.0764	1	25026.08	(M+Na)+	2.22
454.0789	1	6208.18	(M+Na)+	2.23
455.0758	1	3294.22	(M+Na)+	-0.31
883.1601	1	1169.77	(2M+Na)+	6.17

--- End Of Report ---

^{1}H NMR 2R,3R,4S,5S)-2-(6-aminopurin-9-yl)-5-[(5-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol **(3)**



HPLC 2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-[(5-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol **(3)**

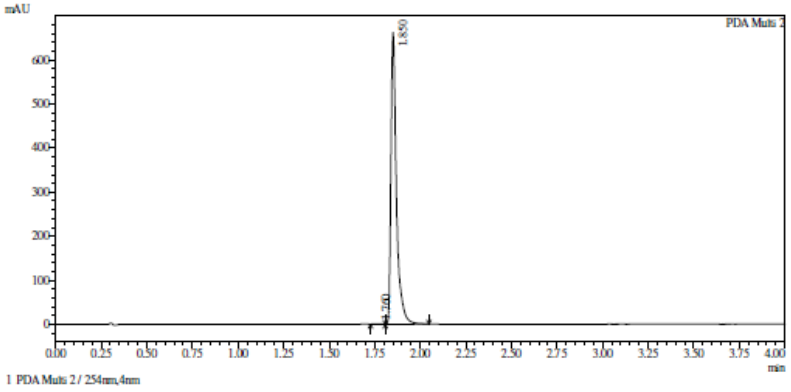


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.757	0.077	0.000	1117	3310	0.180
2	1.850	0.051	1.447	877291	1840677	99.820
Total				878408	1843987	100.000



1 PDA Multi 2 / 254nm,4nm

Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.760	0.073	0.000	830	2335	0.167
2	1.850	0.051	1.451	662072	1395294	99.833
Total				662902	1397629	100.000

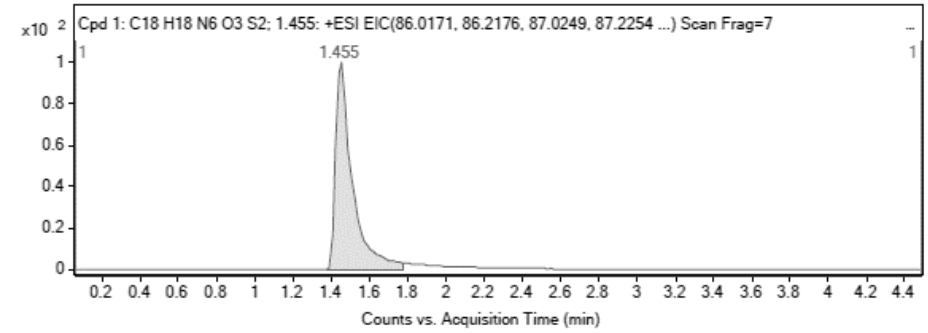
HPLC 2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-[(5-methyl-1,3-benzothiazol -2-yl)sulfanylmethyl] tetrahydrofuran-3,4-diol **(3)**

Compound Table

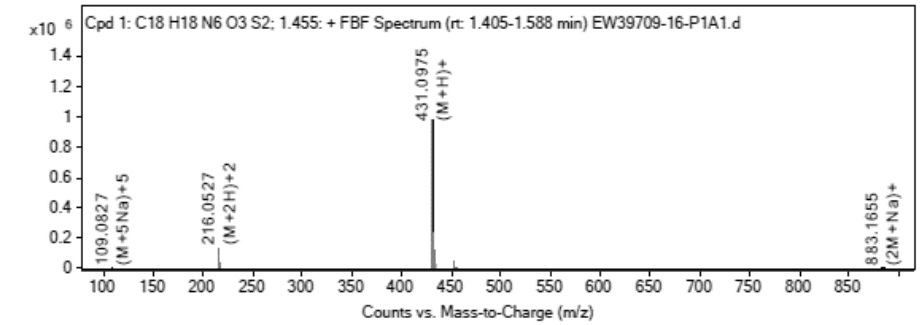
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C18 H18 N6 O3 S2; 1.455	97.84	4.46	C18 H18 N6 O3 S2	1.455	430.0882	430.0901

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
453.0779	1.455	430.0901	C18 H18 N6 O3 S2	430.0882	4.46	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

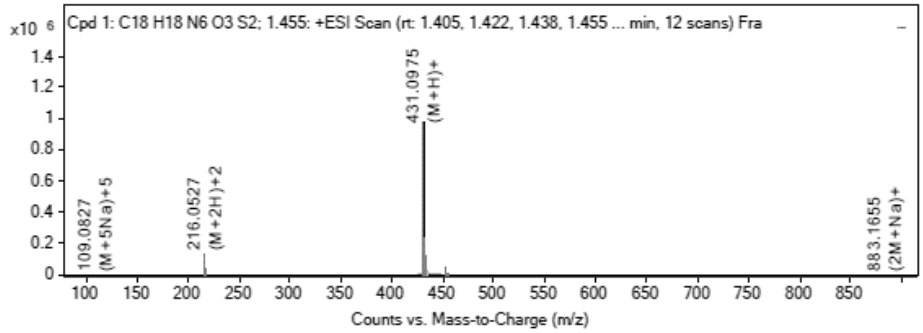


MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
216.0527	2	131618.92	(M+2H)+2
216.5539	2	31740.88	(M+2H)+2

217.0517	2	16412.5	(M+2H)+2
431.0975	1	981331.69	(M+H)+
432.0993	1	237460.64	(M+H)+
433.0948	1	115323.02	(M+H)+
453.0779	1	46647.75	(M+Na)+
454.0804	1	11184.8	(M+Na)+
455.0761	1	5599.68	(M+Na)+
883.1655	1	4335.82	(2M+Na)+

MS Zoomed Spectrum

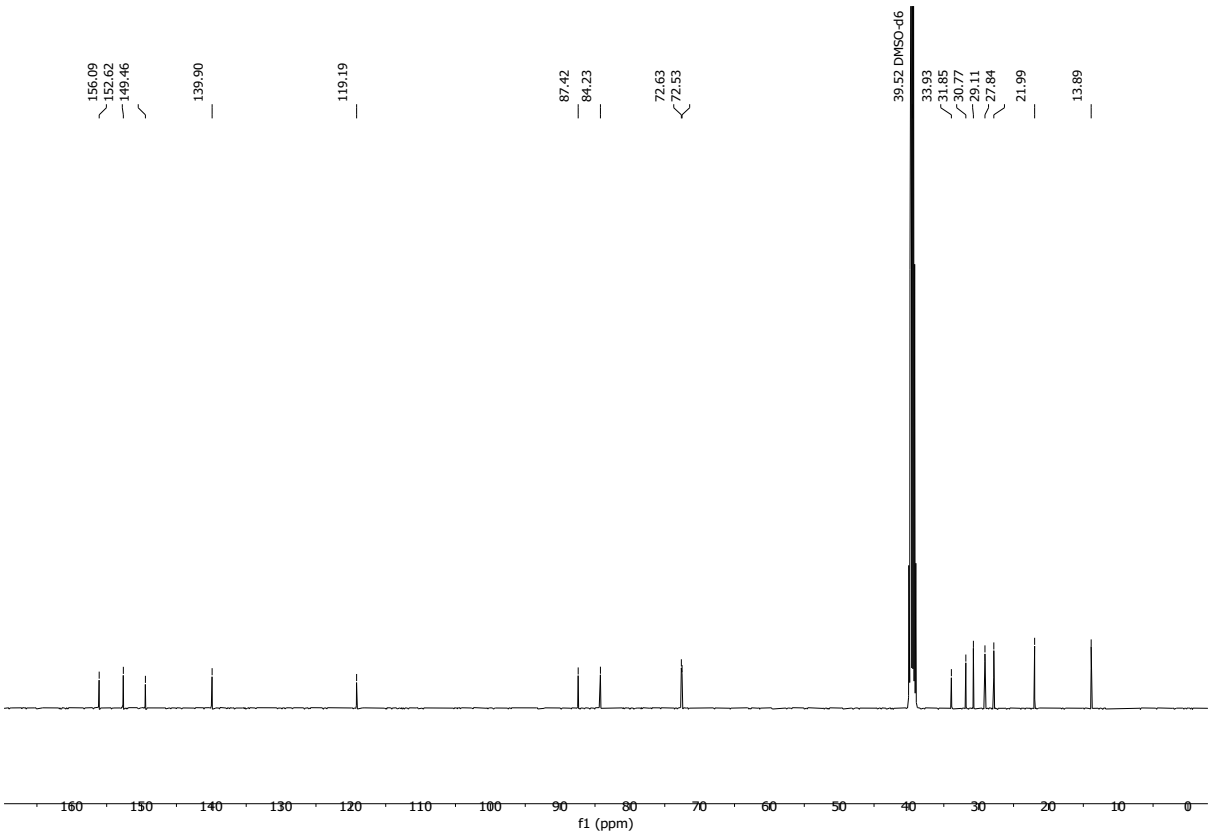


MS Spectrum Peak List

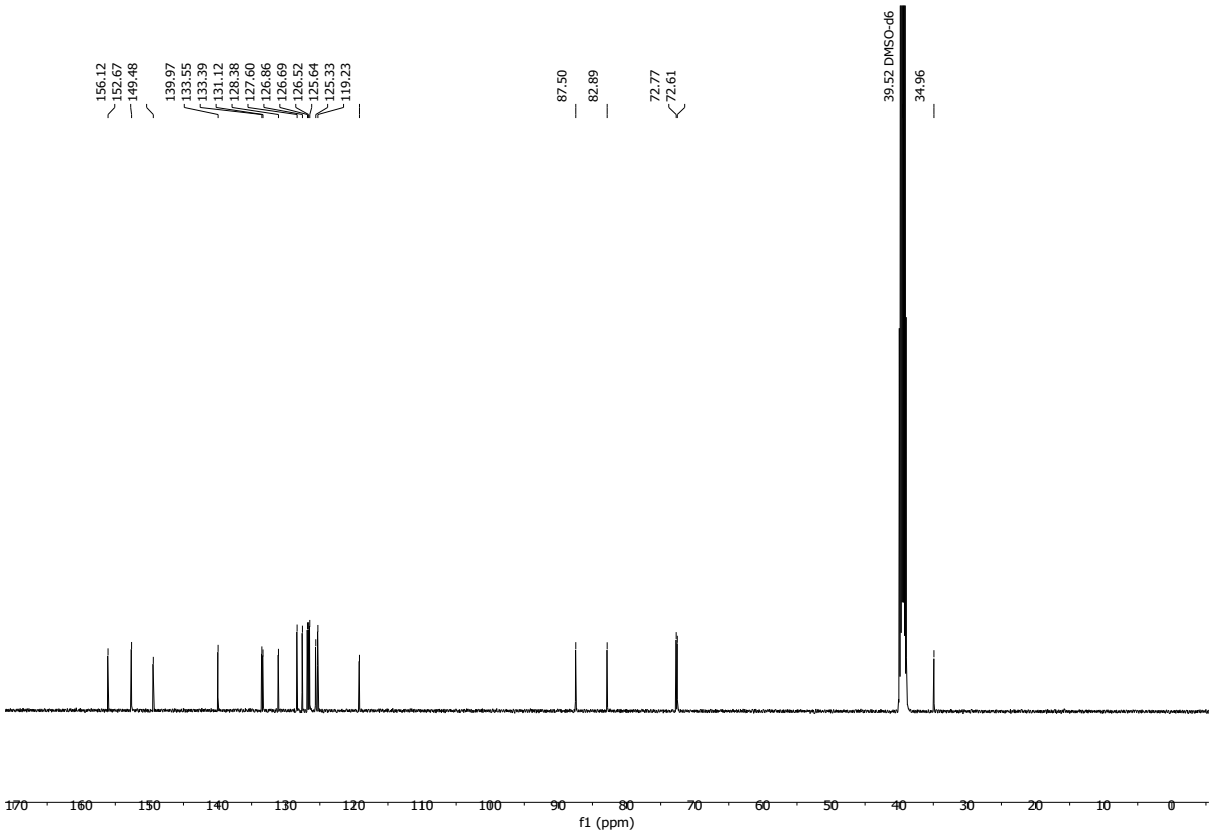
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
216.0527	2	131618.92	(M+2H)+2	-6.37
216.5539	2	31740.88	(M+2H)+2	-5.74
217.0517	2	16412.5	(M+2H)+2	-5.75
431.0975	1	981331.69	(M+H)+	-4.85
432.0993	1	237460.64	(M+H)+	-2.93
433.0948	1	115323.02	(M+H)+	-2.45
453.0779	1	46647.75	(M+Na)+	-1.08
454.0804	1	11184.8	(M+Na)+	-1.02
455.0761	1	5599.68	(M+Na)+	-0.94
883.1655	1	4335.82	(2M+Na)+	0.07

— End Of Report —

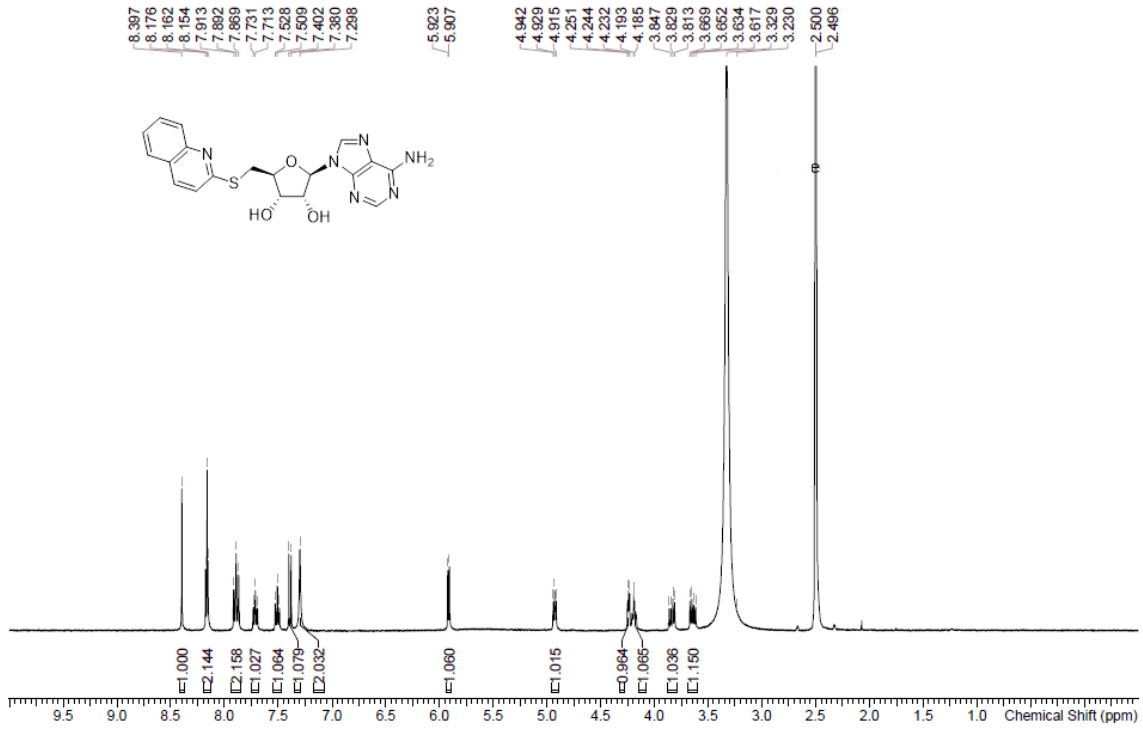
^{13}C NMR (2R,3R,4S,5S)-2-(6-amino-9H-purin-9-yl)-5-((hexylthio)methyl)tetrahydrofuran-3,4-diol **(4)**



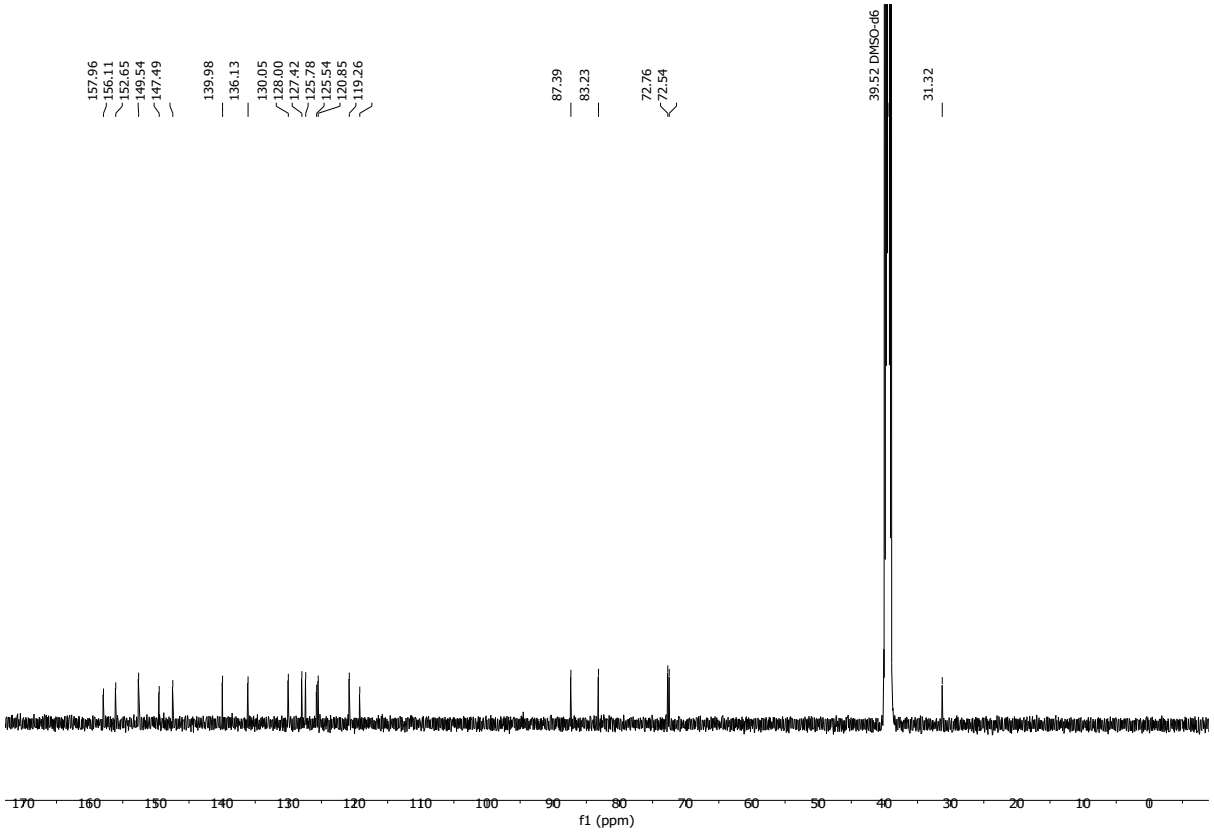
^{13}C NMR (2R,3R,4S,5S)-2-(6-amino-9H-purin-9-yl)-5-((naphthalen-2-ylthio)methyl)tetrahydrofuran-3,4-diol **(6)**



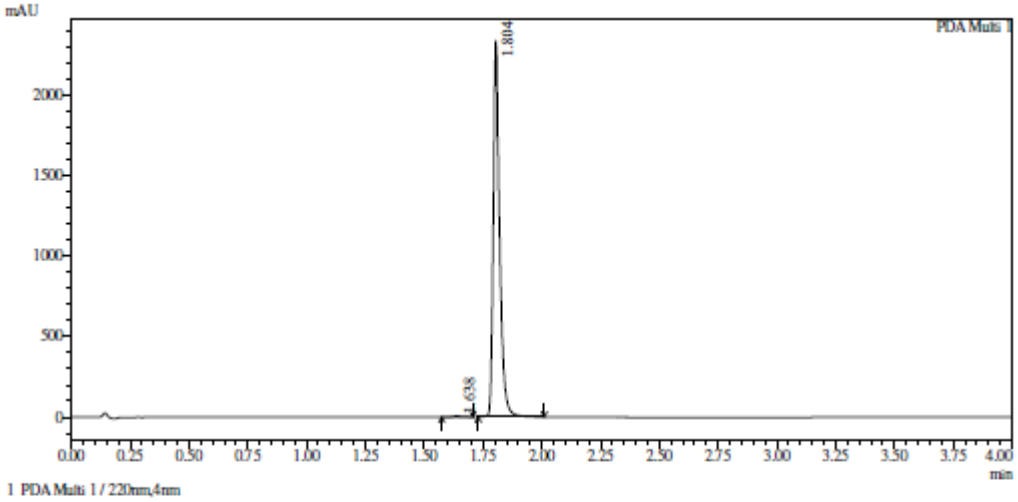
^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(2-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol **(7)**



^{13}C NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(2-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol **(7)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(2-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol **(7)**

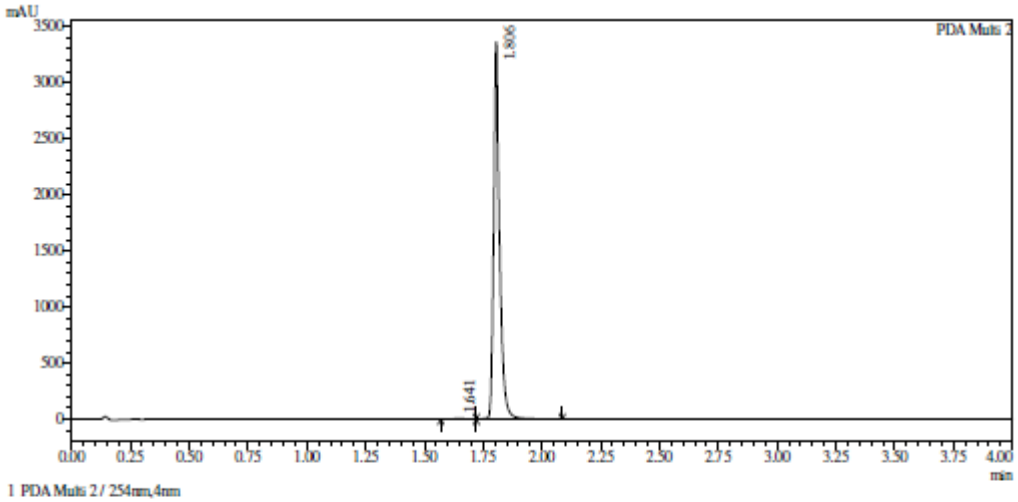


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.638	0.073	0.000	5837	16239	0.370
2	1.804	0.047	2.782	2342534	4378211	99.630
Total				2348370	4394450	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.641	0.139	0.000	5120	23930	0.406
2	1.806	0.042	1.820	3360897	5864740	99.594
Total				3366017	5888670	100.000

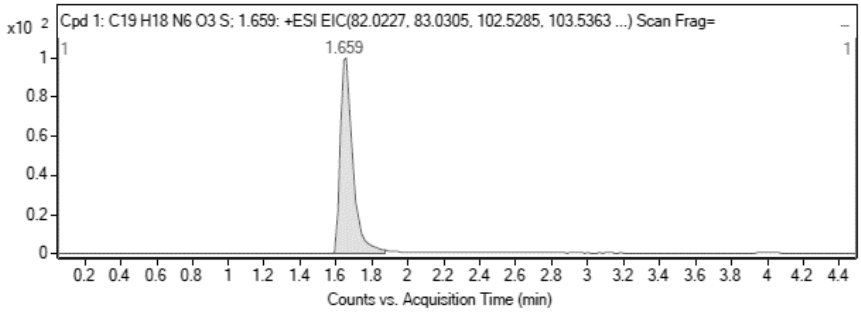
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(6-aminopurin-9-yl)-5-(2-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol **(7)**

Compound Table

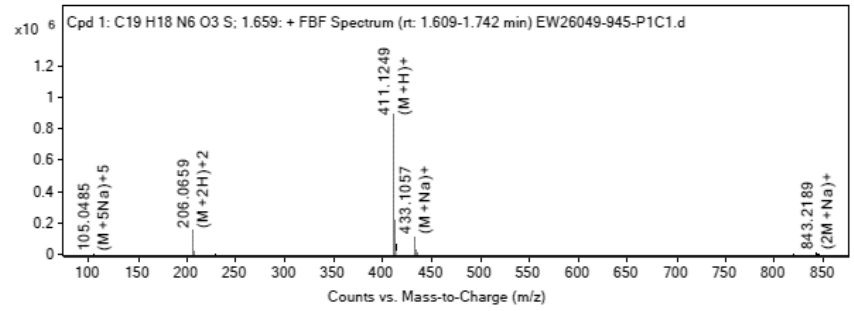
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C19 H18 N6 O3 S; 1.659	99.01	2.99	C19 H18 N6 O3 S	1.659	410.1161	410.1173

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
433.1057	1.659	410.1173	C19 H18 N6 O3 S	410.1161	2.99	Find by Formula

Compound Chromatograms



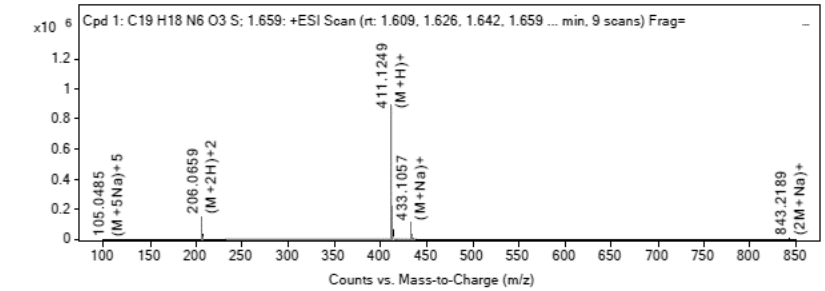
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
206.0659	2	152511.06	(M+2H)+2
206.5671	2	37882.84	(M+2H)+2
207.0661	2	12751.92	(M+2H)+2
411.1249	1	894294.31	(M+H)+
412.1269	1	214500.81	(M+H)+
413.1242	1	65846.22	(M+H)+
433.1057	1	111117.71	(M+Na)+
434.1083	1	25837.89	(M+Na)+
435.1059	1	8540.43	(M+Na)+
843.2189	1	7718.13	(2M+Na)+

MS Zoomed Spectrum

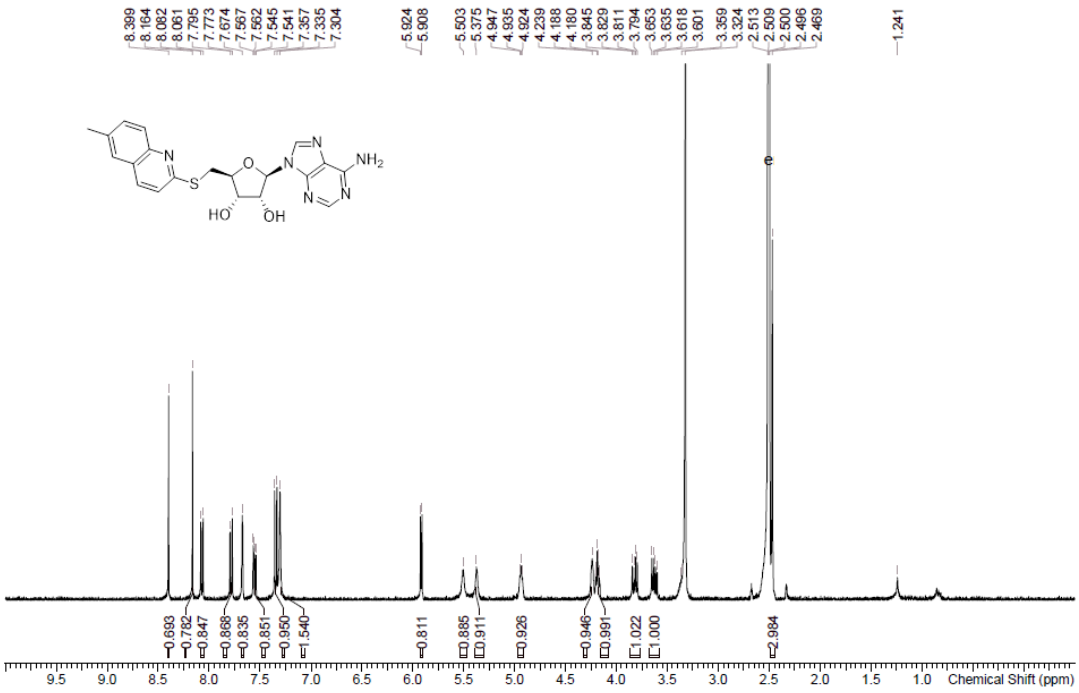


MS Spectrum Peak List

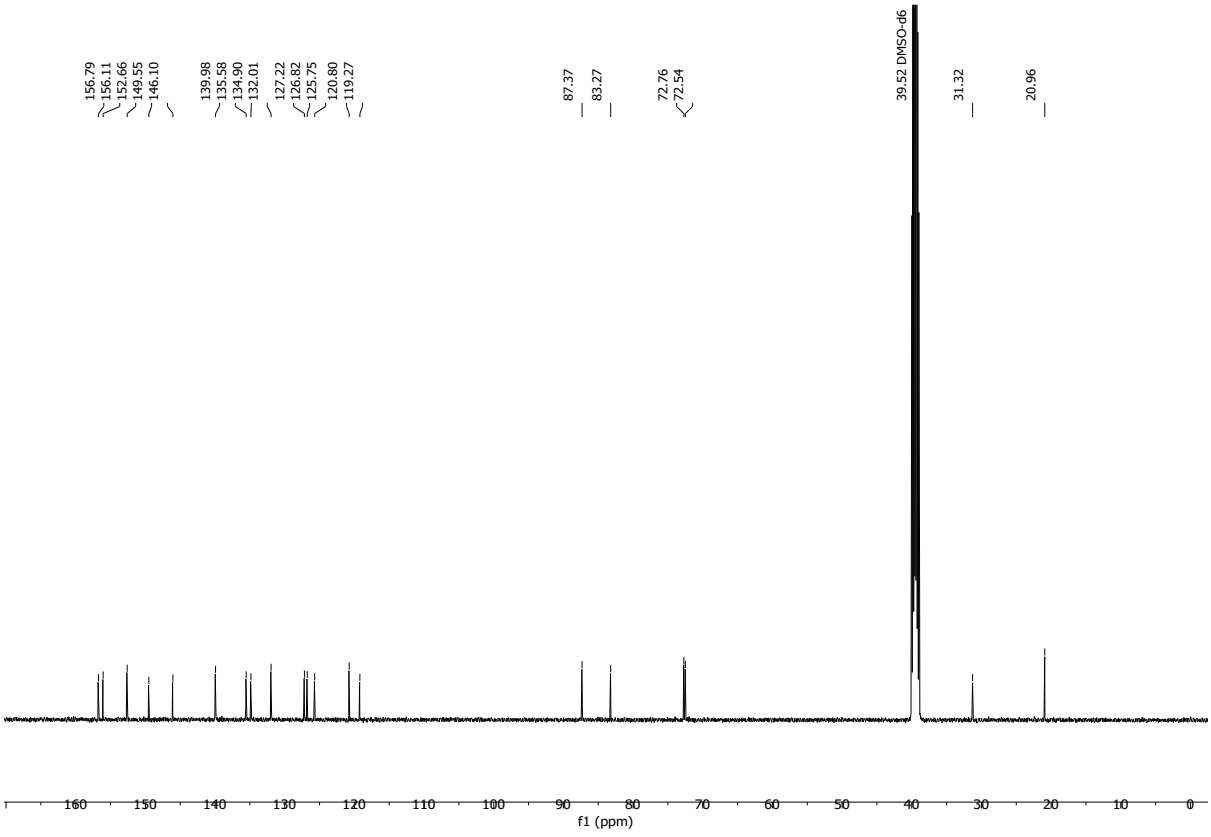
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
206.0659	2	152511.06	(M+2H)+2	-2.54
206.5671	2	37882.84	(M+2H)+2	-2.14
207.0661	2	12751.92	(M+2H)+2	-4.07
411.1249	1	894294.31	(M+H)+	-3.68
412.1269	1	214500.81	(M+H)+	-2.04
413.1242	1	65846.22	(M+H)+	-2.58
433.1057	1	111117.71	(M+Na)+	-0.9
434.1083	1	25837.89	(M+Na)+	-0.65
435.1059	1	8540.43	(M+Na)+	-1.88
843.2189	1	7718.13	(2M+Na)+	3.03

--- End Of Report ---

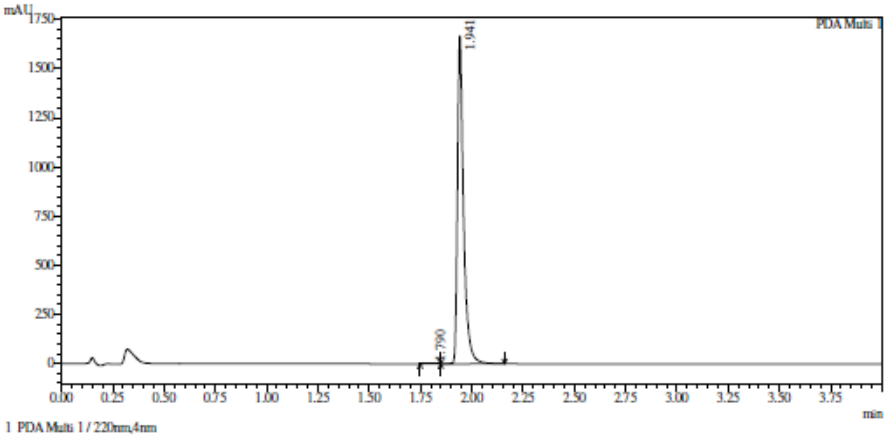
^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(6-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol **(8)**



^{13}C NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(6-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol **(8)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(6-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol **(8)**

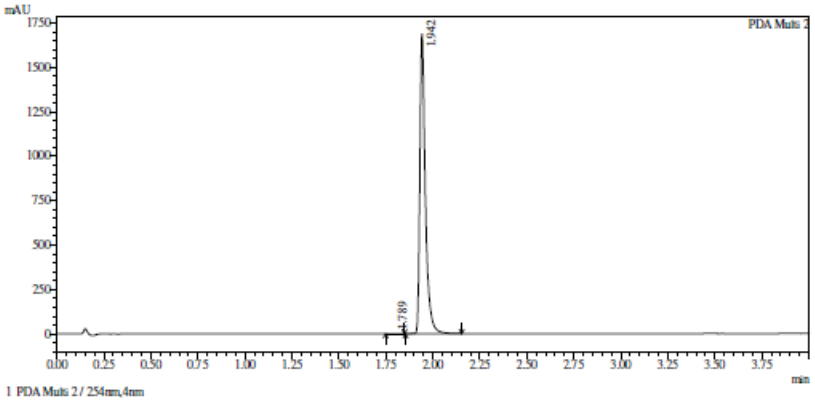


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.790	0.087	0.000	1481	4733	0.137
2	1.941	0.052	2.190	1668135	3439618	99.863
Total				1669616	3444350	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.789	0.087	0.000	1574	4811	0.140
2	1.942	0.051	2.211	1688326	3438317	99.860
Total				1689900	3443128	100.000

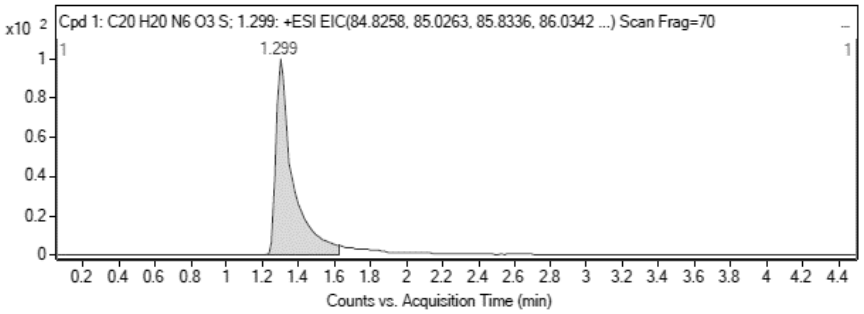
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(6-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol **(8)**

Compound Table

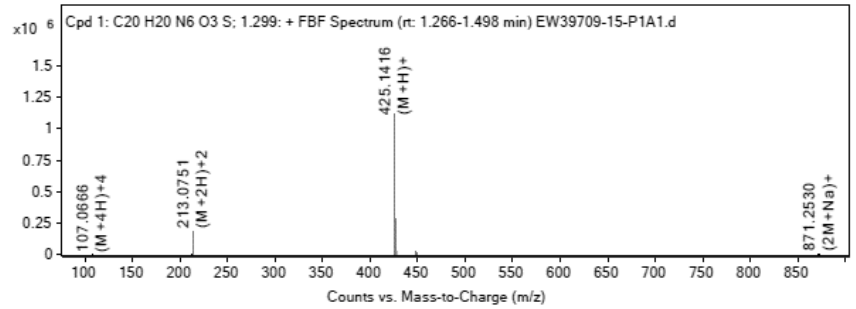
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C20 H20 N6 O3 S; 1.299	96.21	5.97	C20 H20 N6 O3 S	1.299	424.1318	424.1343

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
447.1219	1.299	424.1343	C20 H20 N6 O3 S	424.1318	5.97	Find by Formula

Compound Chromatograms



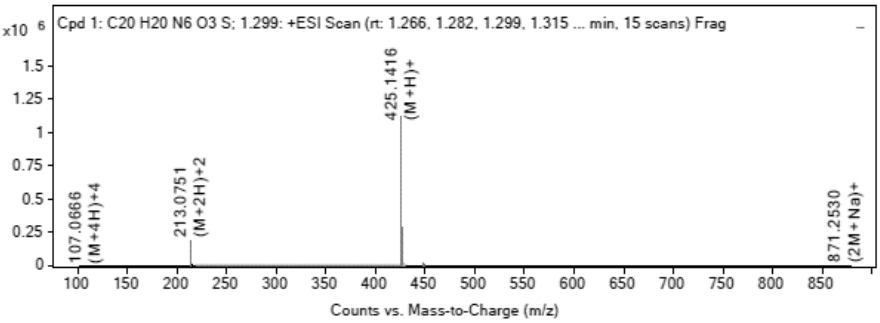
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
213.0751	2	186816.16	(M+2H)+2
213.5762	2	47819.52	(M+2H)+2
214.0748	2	15425.82	(M+2H)+2
425.1416	1	1121128.88	(M+H)+
426.1435	1	287162.13	(M+H)+
427.1407	1	88244.41	(M+H)+
447.1219	1	20542.54	(M+Na)+
448.1245	1	5157.79	(M+Na)+
449.1234	1	1794.27	(M+Na)+
871.253	1	1756.87	(2M+Na)+

MS Zoomed Spectrum

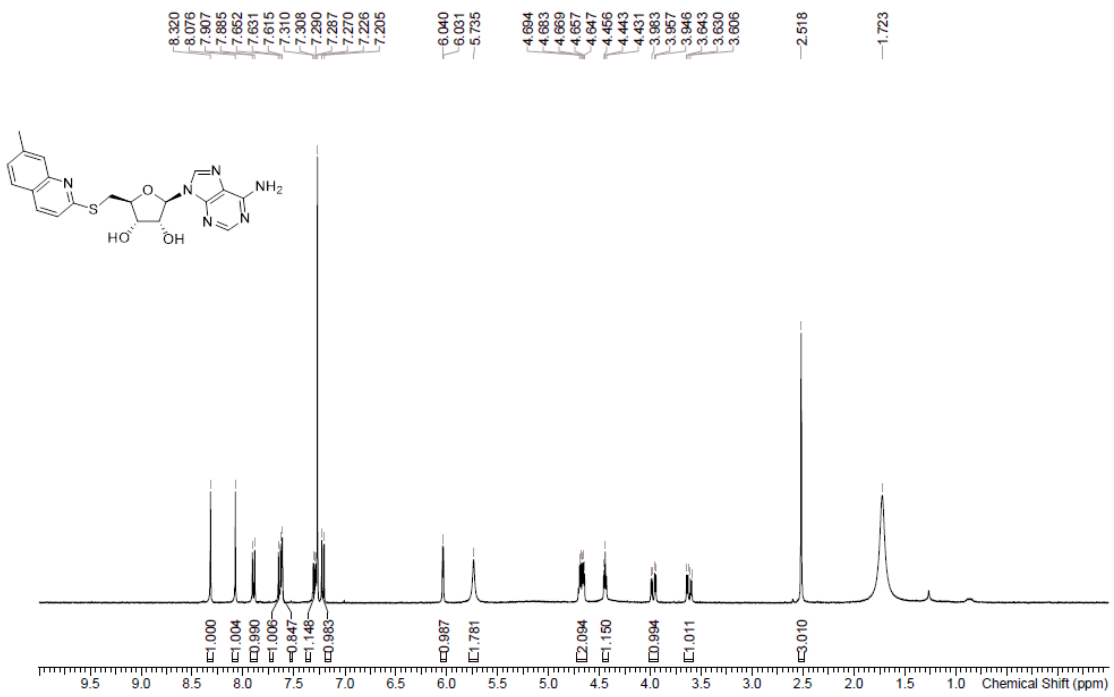


MS Spectrum Peak List

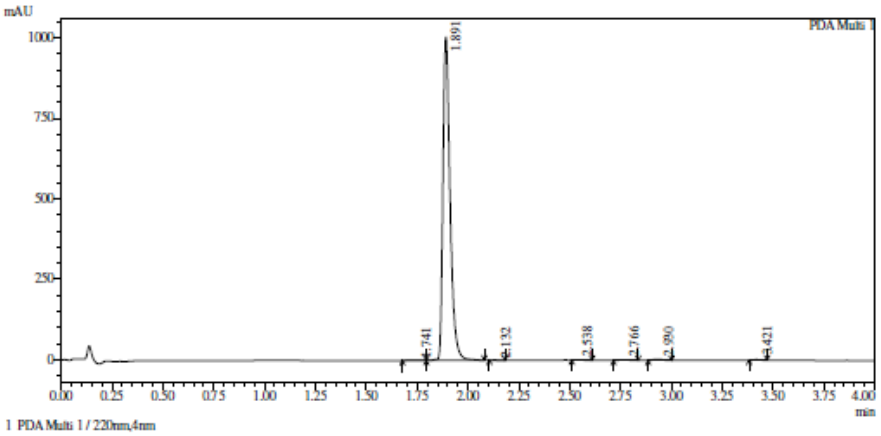
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
213.0751	2	186816.16	(M+2H)+2	-8.98
213.5762	2	47819.52	(M+2H)+2	-7.74
214.0748	2	15425.82	(M+2H)+2	-7.85
425.1416	1	1121128.88	(M+H)+	-6.06
426.1435	1	287162.13	(M+H)+	-4.13
427.1407	1	88244.41	(M+H)+	-3.86
447.1219	1	20542.54	(M+Na)+	-2.12
448.1245	1	5157.79	(M+Na)+	-1.78
449.1234	1	1794.27	(M+Na)+	-5.35
871.253	1	1756.87	(2M+Na)+	-0.26

--- End Of Report ---

^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(7-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol **(9)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(7-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol **(9)**

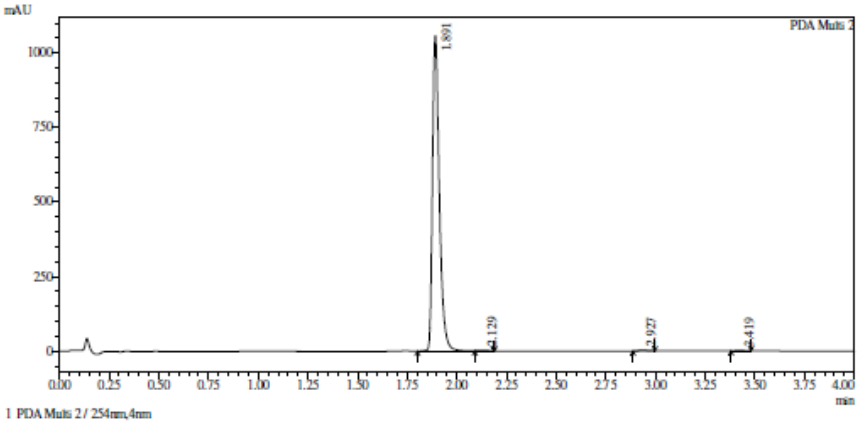


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.741	0.117	0.000	1219	5083	0.206
2	1.891	0.063	1.672	1003302	2440310	99.011
3	2.132	0.055	4.099	803	1649	0.067
4	2.538	0.076	6.182	688	1950	0.079
5	2.766	0.107	2.495	1213	4380	0.178
6	2.930	0.080	1.764	2718	7986	0.324
7	3.421	0.064	6.814	1339	3335	0.135
Total				1011282	2464694	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.891	0.062	0.000	1057931	2545001	99.417
2	2.129	0.058	3.965	893	1942	0.076
3	2.927	0.079	11.690	2620	7715	0.301
4	3.419	0.070	6.602	1987	5268	0.206
Total				1063431	2559927	100.000

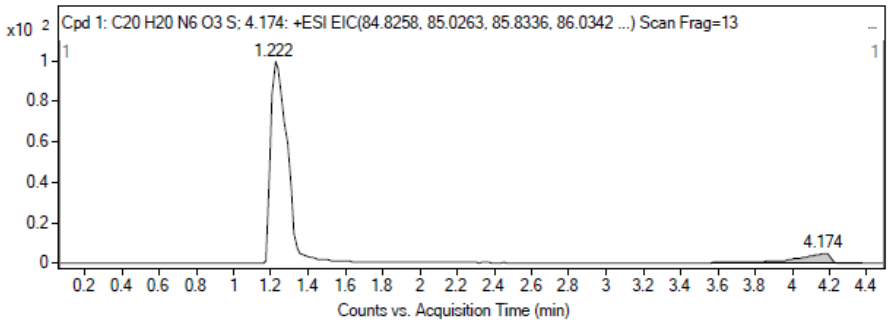
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-[(7-methyl-2-quinolyl) sulfanylmethyl] tetrahydrofuran-3,4-diol **(9)**

Compound Table

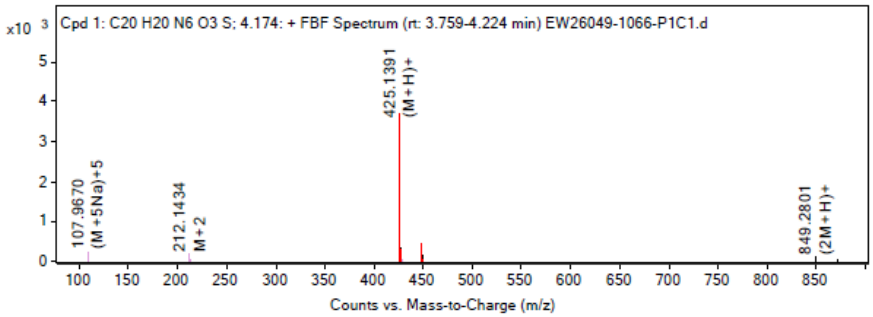
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C20 H20 N6 O3 S; 4.174	97.42	-11.9	C20 H20 N6 O3 S	4.174	424.1318	424.1267

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
425.1391	4.174	424.1267	C20 H20 N6 O3 S	424.1318	-11.9	Find by Formula

Compound Chromatograms



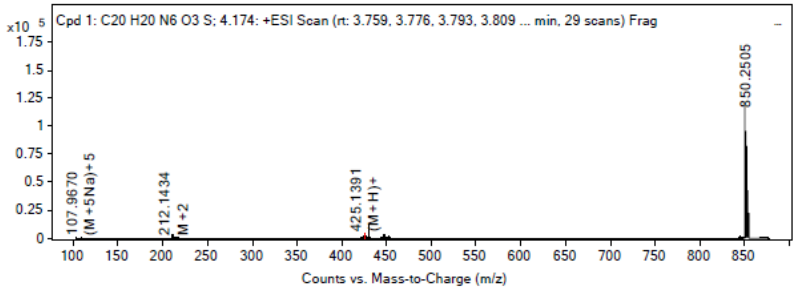
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
107.967	5	240.43	(M+5Na)+5
212.1434	2	163.47	M+2
425.1391	1	3628.15	(M+H)+
426.1412	1	989.4	(M+H)+
427.14	1	342.28	(M+H)+
447.1164	1	408.88	(M+Na)+
448.1233	1	158.47	(M+Na)+
848.2738	1	102.45	2M+
849.2801	1	114.34	(2M+H)+
871.2689	1	67.29	(2M+Na)+

MS Zoomed Spectrum

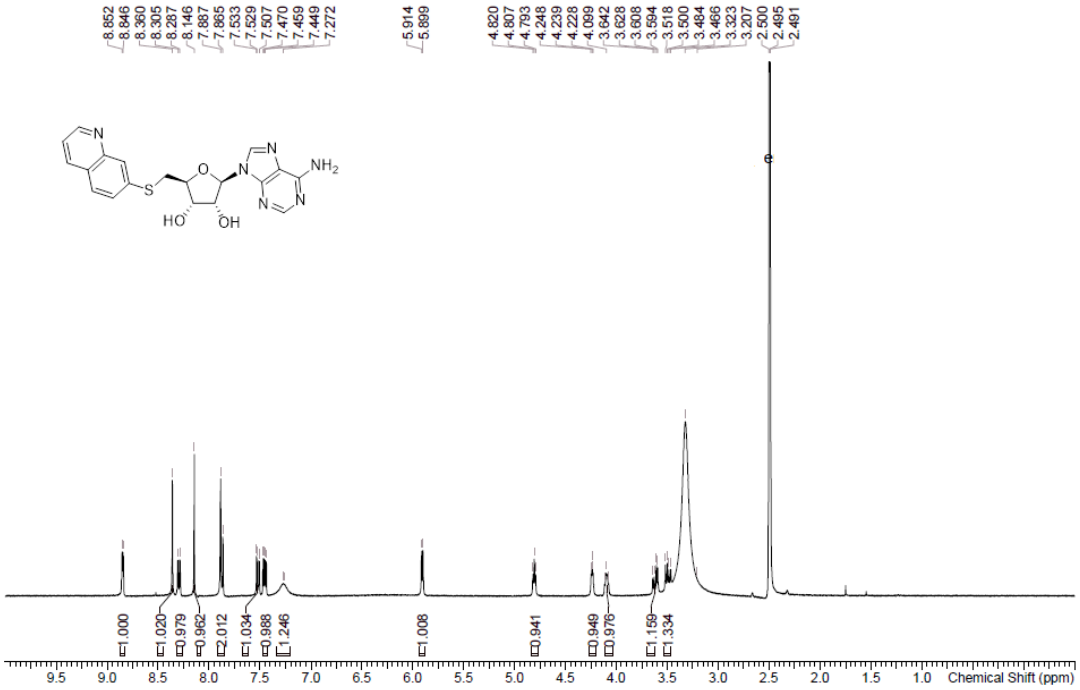


MS Spectrum Peak List

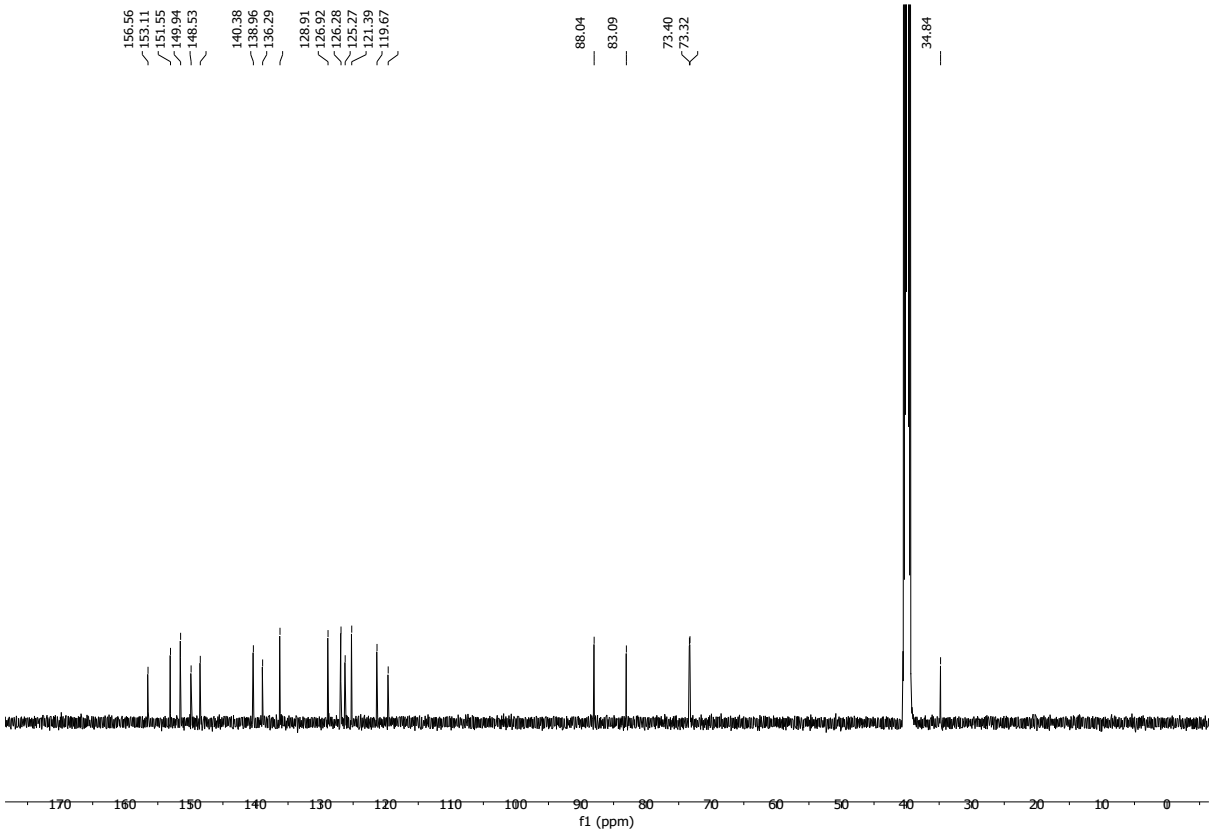
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
107.967	5	240.43	(M+5Na)+5	454.94
212.1434	2	163.47	M+2	-368.17
425.1391	1	3628.15	(M+H)+	-0.11
426.1412	1	989.4	(M+H)+	1.22
427.14	1	342.28	(M+H)+	-2.29
447.1164	1	408.88	(M+Na)+	10.15
448.1233	1	158.47	(M+Na)+	0.95
848.2738	1	102.45	2M+	-12.73
849.2801	1	114.34	(2M+H)+	-10.95
871.2689	1	67.29	(2M+Na)+	-18.5

--- End Of Report ---

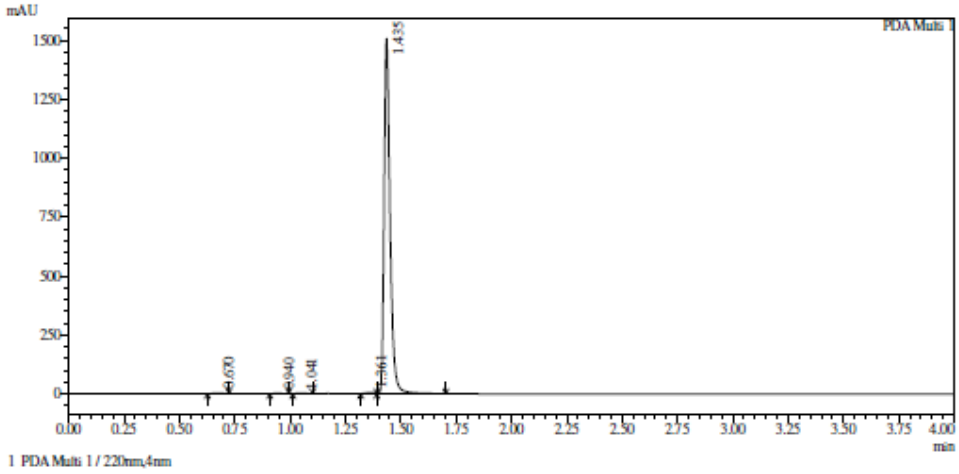
^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(7-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol **(10)**



^{13}C NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(7-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol **(10)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(7-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol **(10)**

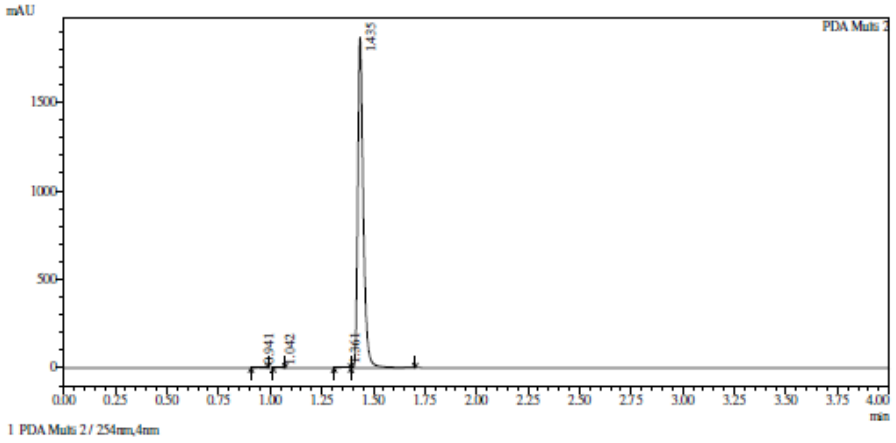


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.670	0.072	0.000	2617	6767	0.237
2	0.940	0.067	3.905	1108	2773	0.097
3	1.041	0.059	1.598	2104	4841	0.169
4	1.361	0.093	4.222	4233	12102	0.424
5	1.435	0.049	1.049	1506546	2830566	99.073
Total				1516608	2857049	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.941	0.068	0.000	664	1662	0.047
2	1.042	0.050	1.698	875	1539	0.044
3	1.361	0.093	4.481	4539	12849	0.367
4	1.435	0.049	1.049	1867227	3483963	99.541
Total				1873304	3500014	100.000

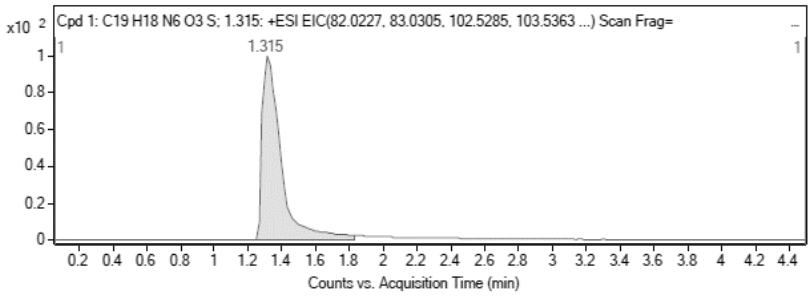
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(7-quinolylsulfanylmethyl) tetrahydrofuran-3,4-diol **(10)**

Compound Table

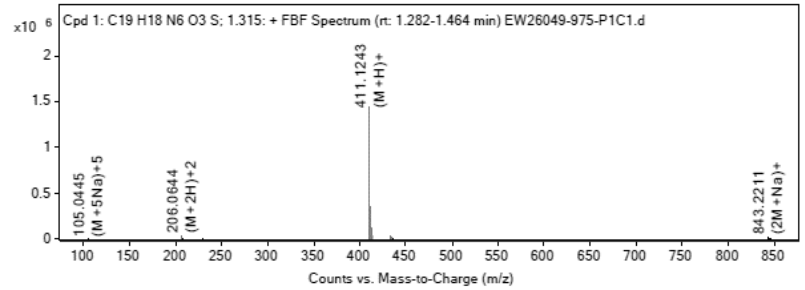
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C19 H18 N6 O3 S; 1.315	98.62	1.32	C19 H18 N6 O3 S	1.315	410.1161	410.1167

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
433.1046	1.315	410.1167	C19 H18 N6 O3 S	410.1161	1.32	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

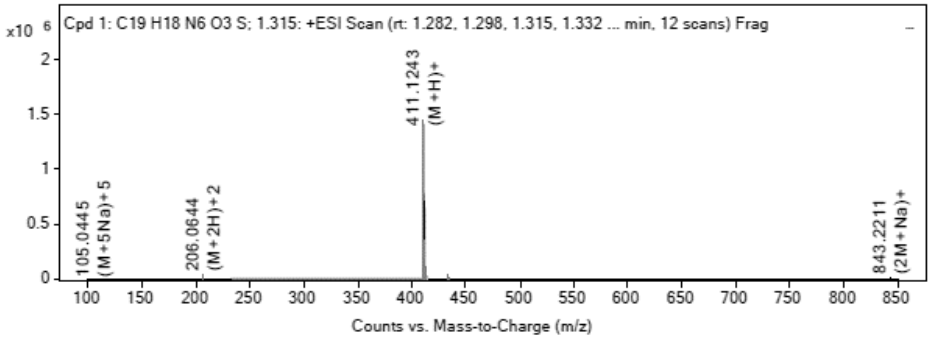


MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
206.0644	2	34937	(M+2H)+2
206.5657	2	8542.68	(M+2H)+2

411.1243	1	1438607.63	(M+H)+
412.1261	1	356487.84	(M+H)+
413.1232	1	108992.29	(M+H)+
433.1046	1	34449.09	(M+Na)+
434.1074	1	8316.24	(M+Na)+
843.2211	1	18047.82	(2M+Na)+
844.2238	1	8722.7	(2M+Na)+
845.2147	1	5844.32	(2M+Na)+

MS Zoomed Spectrum

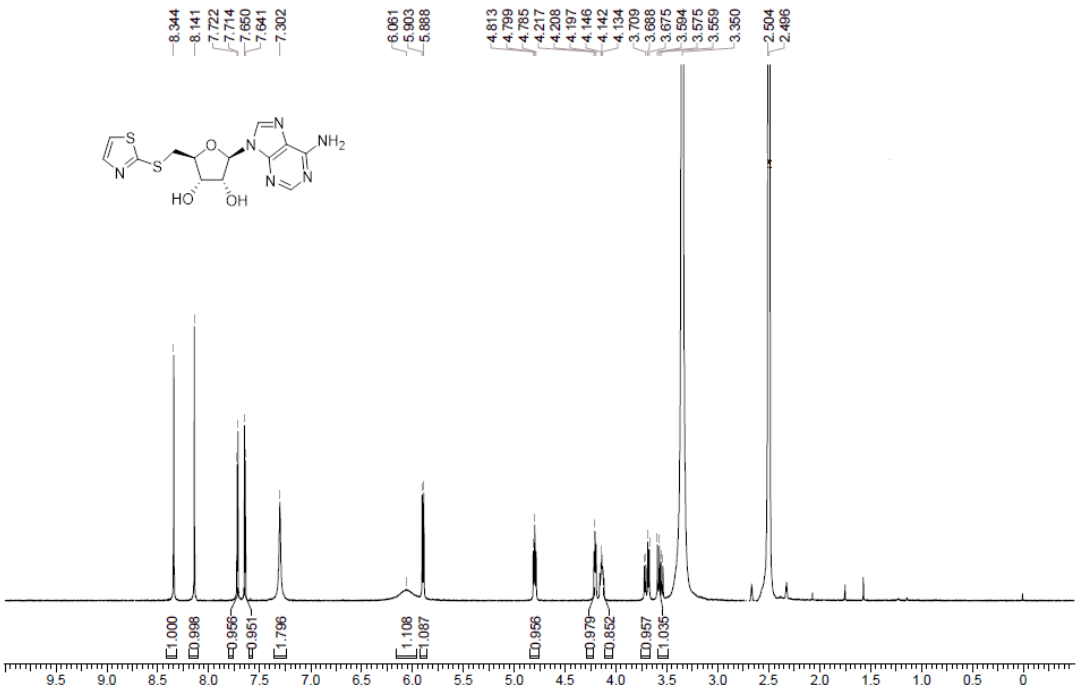


MS Spectrum Peak List

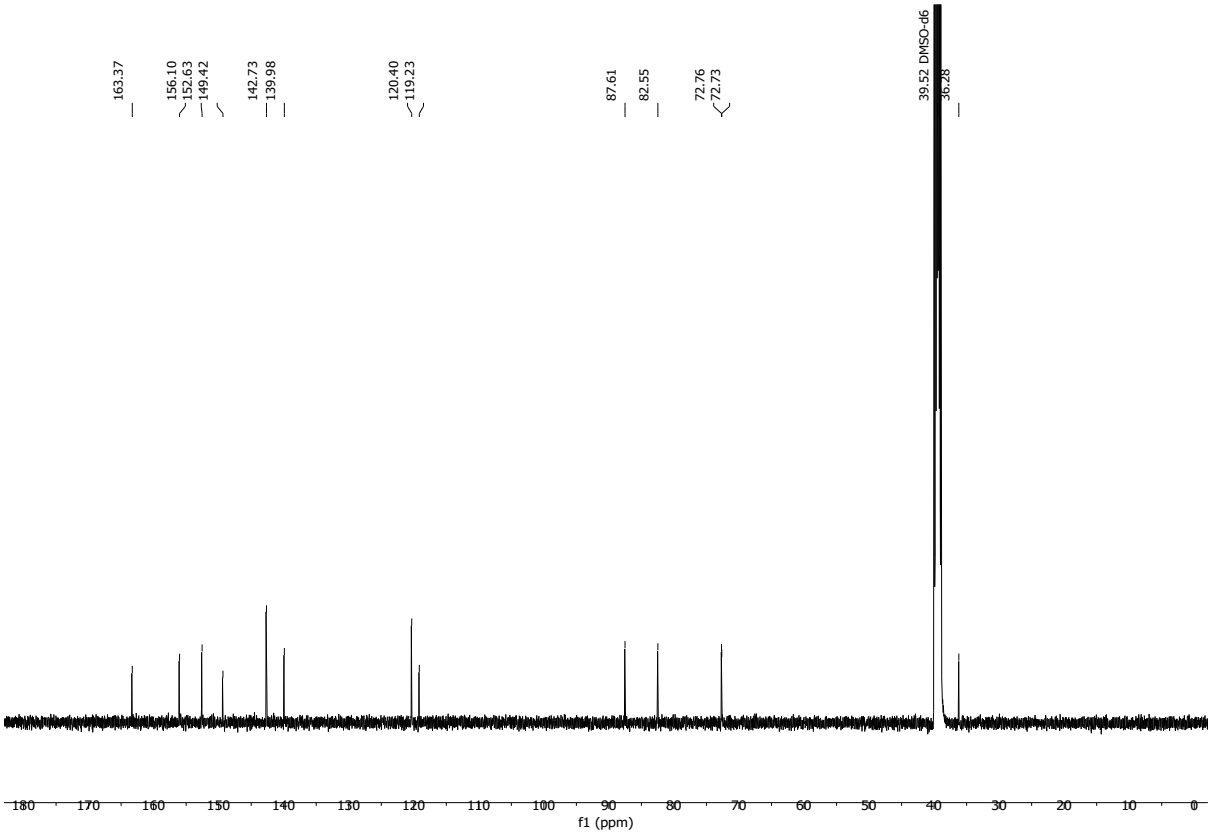
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
206.0644	2	34937	(M+2H)+2	4.35
206.5657	2	8542.68	(M+2H)+2	4.79
411.1243	1	1438607.63	(M+H)+	-2.11
412.1261	1	356487.84	(M+H)+	-0.17
413.1232	1	108992.29	(M+H)+	-0.01
433.1046	1	34449.09	(M+Na)+	1.59
434.1074	1	8316.24	(M+Na)+	1.33
843.2211	1	18047.82	(2M+Na)+	0.36
844.2238	1	8722.7	(2M+Na)+	0.35
845.2147	1	5844.32	(2M+Na)+	9.43

--- End Of Report ---

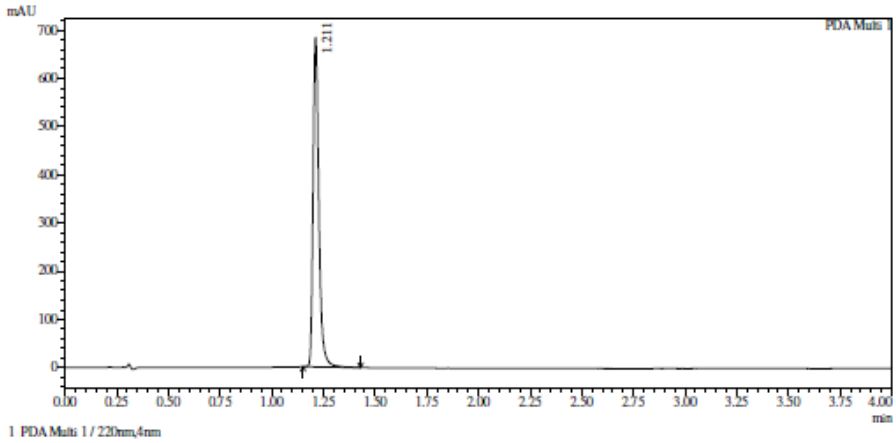
^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(thiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(11)**



^{13}C NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(thiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(11)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(thiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(11)**

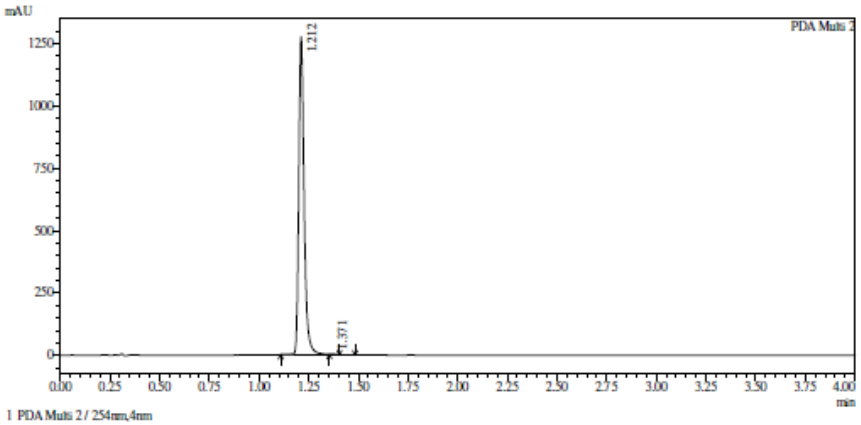


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.211	0.050	0.000	683586	1329817	100.000
Total				683586	1329817	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.212	0.049	0.000	1275983	2410010	99.930
2	1.371	0.040	3.611	1169	1685	0.070
Total				1277152	2411695	100.000

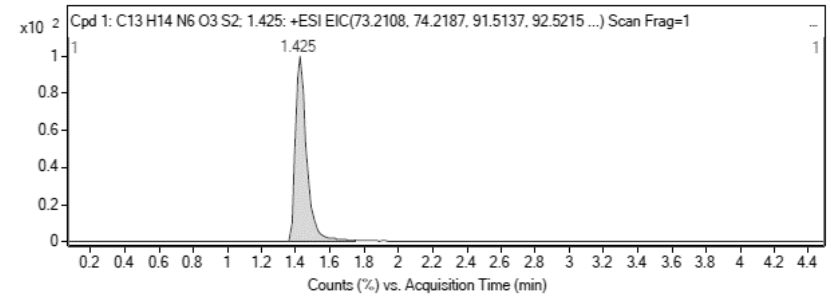
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(thiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(11)**

Compound Table

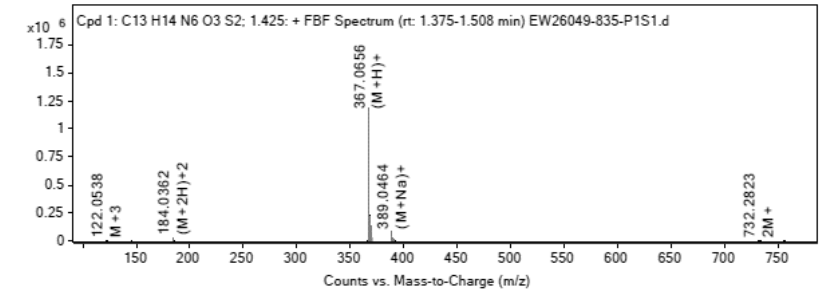
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C13 H14 N6 O3 S2; 1.425	99.58	3.92	C13 H14 N6 O3 S2	1.425	366.0569	366.0583

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
389.0464	1.425	366.0583	C13 H14 N6 O3 S2	366.0569	3.92	Find by Formula

Compound Chromatograms



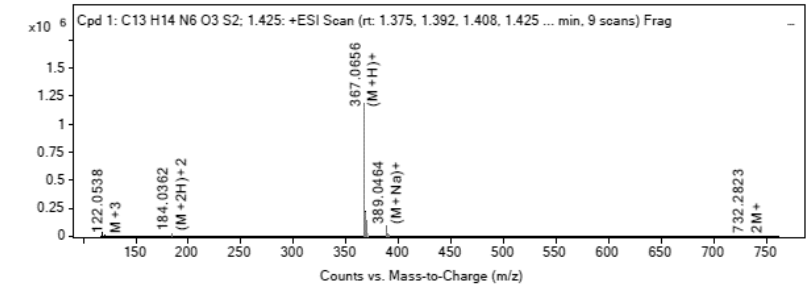
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
184.0362	2	21635.29	(M+2H)+2
184.5373	2	4148.75	(M+2H)+2
185.0347	2	2450.13	(M+2H)+2
367.0656	1	1184609	(M+H)+
368.0671	1	219750.53	(M+H)+
369.0624	1	127705.57	(M+H)+
389.0464	1	82741.53	(M+Na)+
390.0484	1	15333.03	(M+Na)+
391.0439	1	8879.48	(M+Na)+
392.0455	1	1312.33	(M+Na)+

MS Zoomed Spectrum



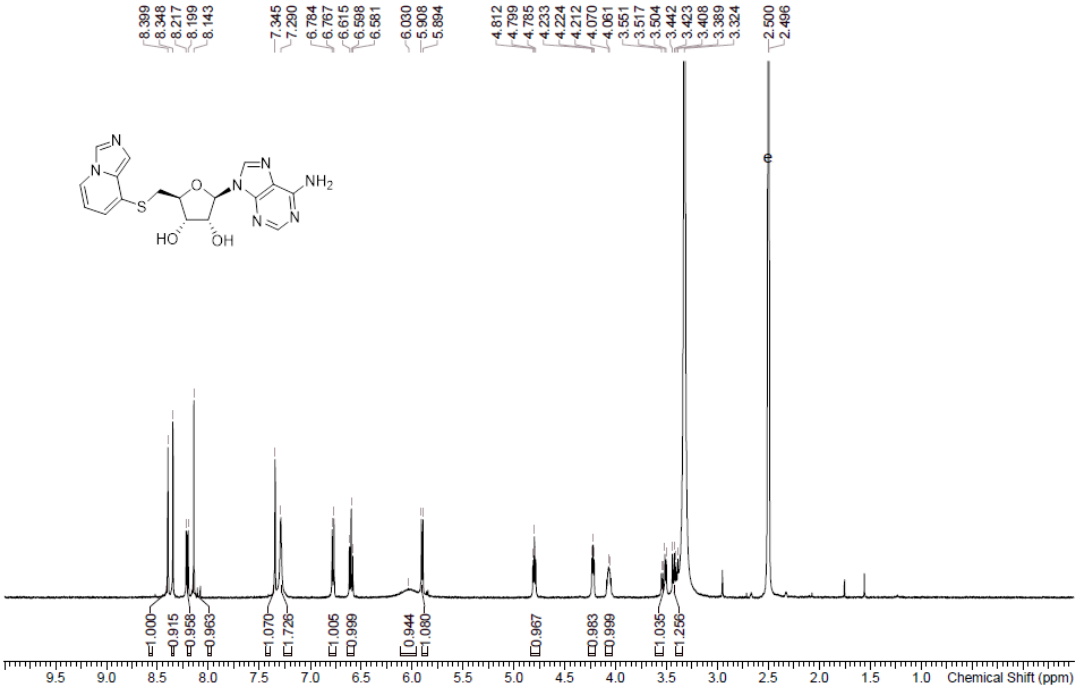
MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
184.0362	2	21635.29	(M+2H)+2	-2.65
184.5373	2	4148.75	(M+2H)+2	-2.41
185.0347	2	2450.13	(M+2H)+2	-1.07
367.0656	1	1184609	(M+H)+	-3.99
368.0671	1	219750.53	(M+H)+	-1.93
369.0624	1	127705.57	(M+H)+	-1.93
389.0464	1	82741.53	(M+Na)+	-0.72
390.0484	1	15333.03	(M+Na)+	-0.02
391.0439	1	8879.48	(M+Na)+	-0.86
392.0455	1	1312.33	(M+Na)+	-0.66

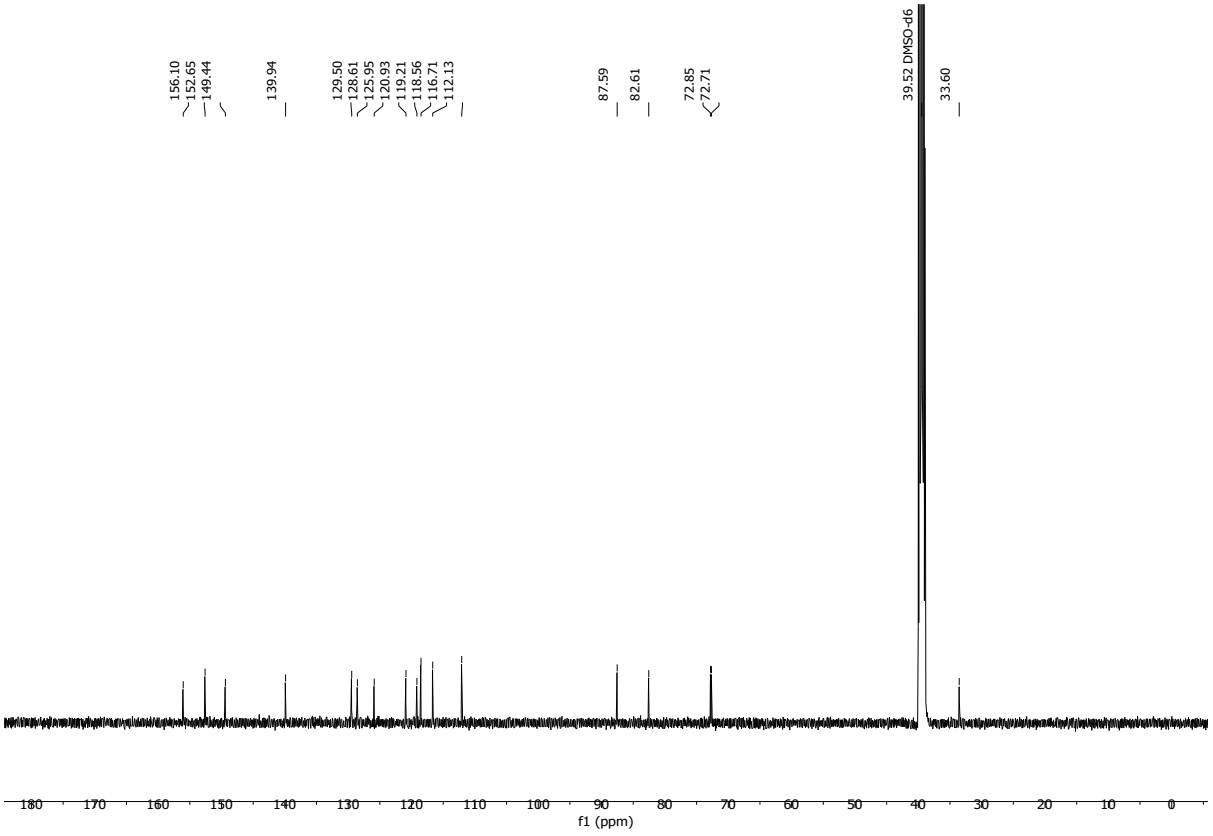
--- End Of Report ---

^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridin-8- ylsulfanylmethyl) tetrahydrofuran-3,4-

diol **(12)**

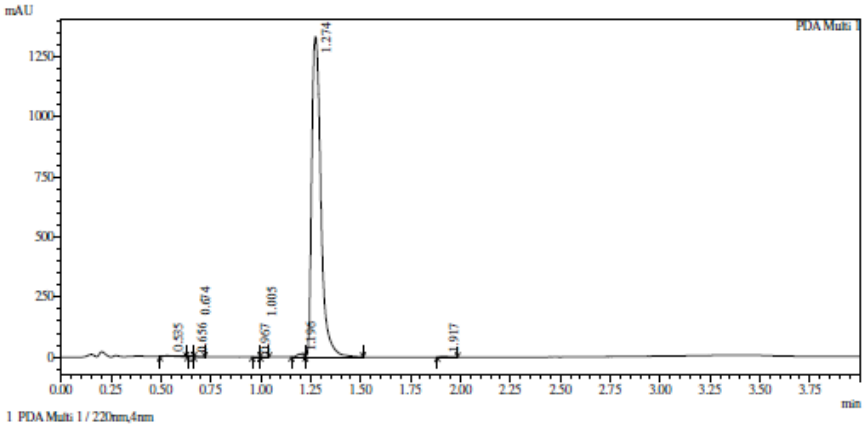


^{13}C NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridin-8- ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(12)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridin-8- ylsulfanylmethyl) tetrahydrofuran-3,4-diol

(12)

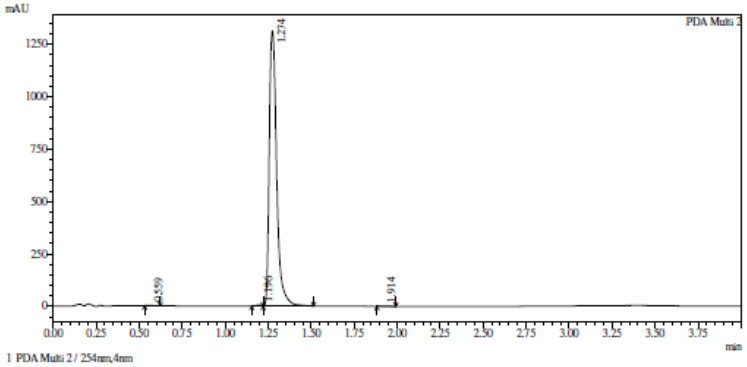


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.535	0.109	0.000	4051	14907	0.346
2	0.656	0.044	1.582	1156	1387	0.032
3	0.674	0.052	0.365	1362	2175	0.050
4	0.967	0.085	4.255	428	1002	0.023
5	1.005	0.048	0.569	571	1063	0.025
6	1.196	0.065	3.382	12166	26572	0.616
7	1.274	0.076	1.101	1333985	4254352	98.614
8	1.917	0.084	8.073	4127	12668	0.294
Total				1357846	4314127	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.559	0.098	0.000	1360	4519	0.114
2	1.196	0.070	7.620	4743	10395	0.263
3	1.274	0.073	1.085	1314521	3939312	99.509
4	1.914	0.072	8.819	1563	4516	0.114
Total				1322187	3958742	100.000

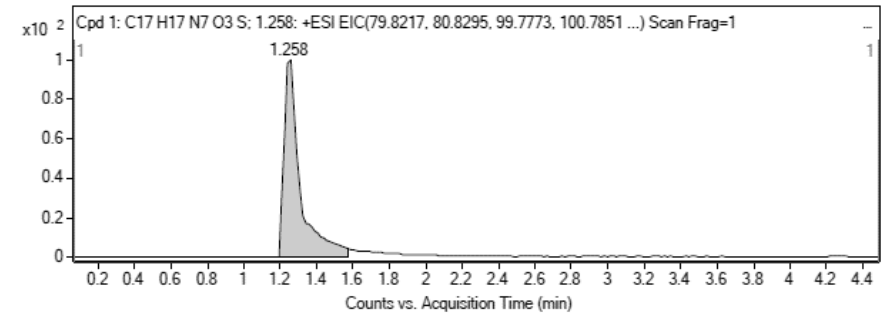
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridin-8- ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(12)**

Compound Table

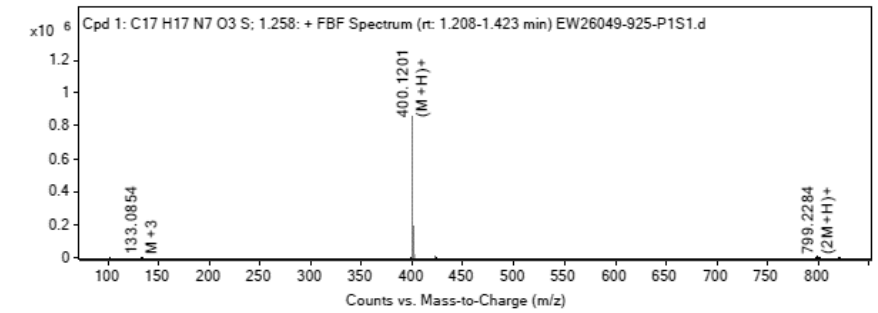
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C17 H17 N7 O3 S; 1.258	94.79	3.11	C17 H17 N7 O3 S	1.258	399.1114	399.1126

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
400.1201	1.258	399.1126	C17 H17 N7 O3 S	399.1114	3.11	Find by Formula

Compound Chromatograms



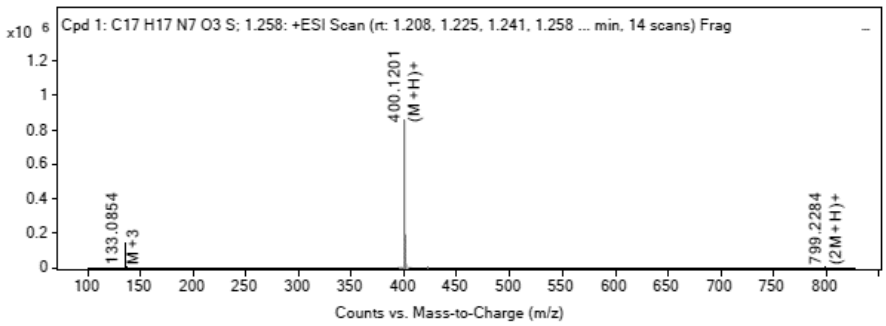
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
399.1109	1	3222.74	M+
400.1201	1	858207.69	(M+H)+
401.1218	1	189835.05	(M+H)+
402.1186	1	59762.9	(M+H)+
422.1006	1	3575.11	(M+Na)+
799.2284	1	5936.94	(2M+H)+
800.2299	1	2762.15	(2M+H)+
801.2293	1	1206.66	(2M+H)+
821.2113	1	3012.22	(2M+Na)+
822.2126	1	1454.71	(2M+Na)+

MS Zoomed Spectrum

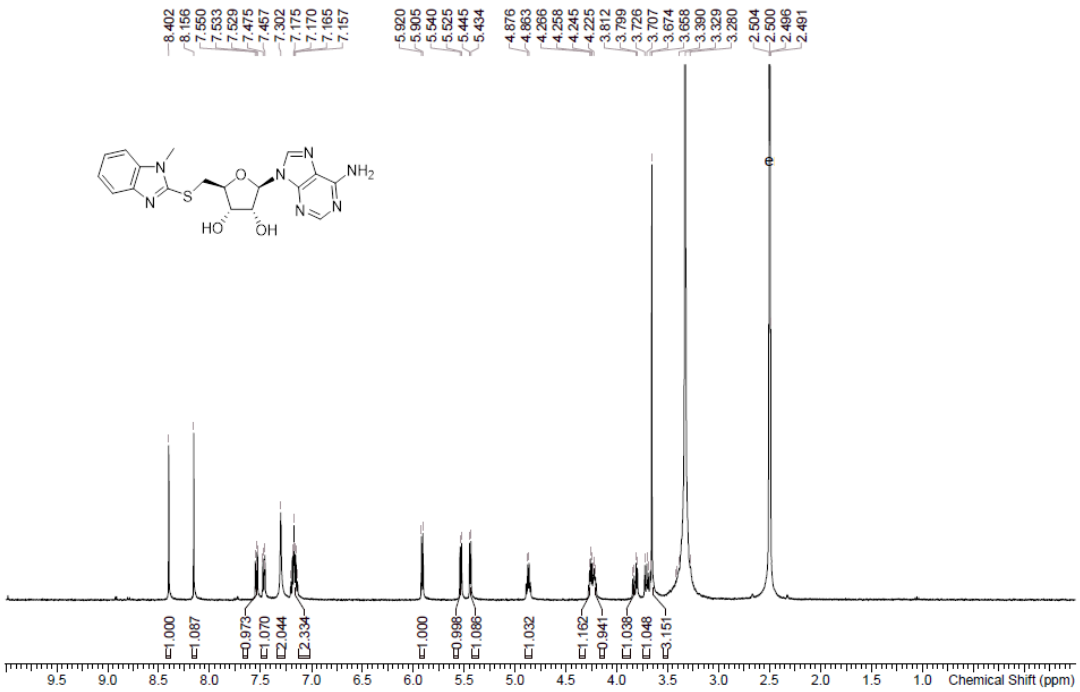


MS Spectrum Peak List

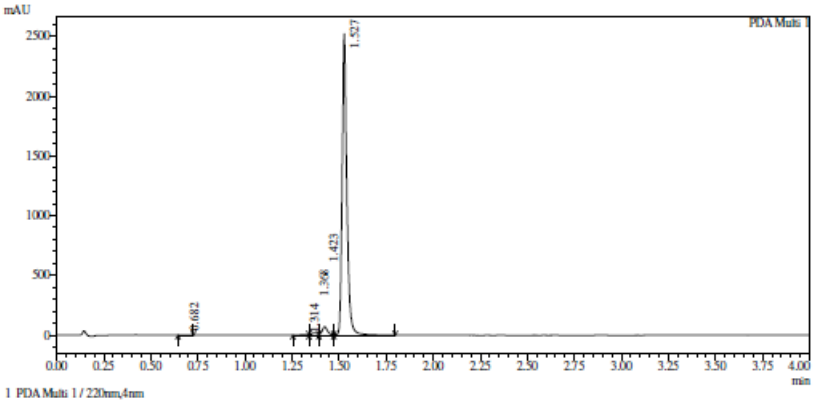
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
399.1109	1	3222.74	M+	-0.26
400.1201	1	858207.69	(M+H)+	-3.55
401.1218	1	189835.05	(M+H)+	-1.66
402.1186	1	59762.9	(M+H)+	-1.45
422.1006	1	3575.11	(M+Na)+	0.02
799.2284	1	5936.94	(2M+H)+	2.01
800.2299	1	2762.15	(2M+H)+	3.26
801.2293	1	1206.66	(2M+H)+	1.77
821.2113	1	3012.22	(2M+Na)+	0.8
822.2126	1	1454.71	(2M+Na)+	2.23

--- End Of Report ---

^{1}H NMR (2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-(((1-methyl-1H-benzo[d]imidazol-2-yl)thio) methyl)tetrahydrofuran-3,4-diol **(13)**



HPLC (2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-(((1-methyl-1H-benzo[d]imidazol-2-yl)thio) methyl)tetrahydrofuran-3,4-diol **(13)**

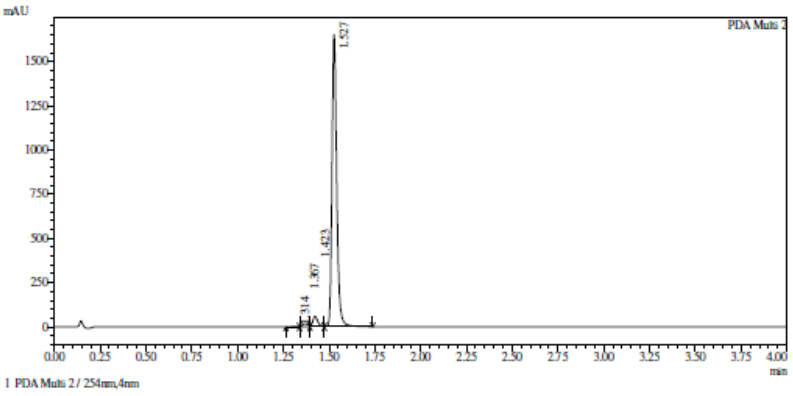


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.682	0.067	0.000	939	2273	0.050
2	1.314	0.078	8.709	4803	12506	0.275
3	1.368	0.071	0.718	19126	40212	0.886
4	1.423	0.051	0.896	70026	141471	3.115
5	1.527	0.045	2.160	2521338	4344684	95.674
Total				2616232	4541146	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.314	0.076	0.000	3112	7581	0.244
2	1.367	0.062	0.775	18220	37337	1.200
3	1.423	0.051	0.978	58517	116609	3.747
4	1.527	0.047	2.118	1650937	2950694	94.810
Total				1730786	3112221	100.000

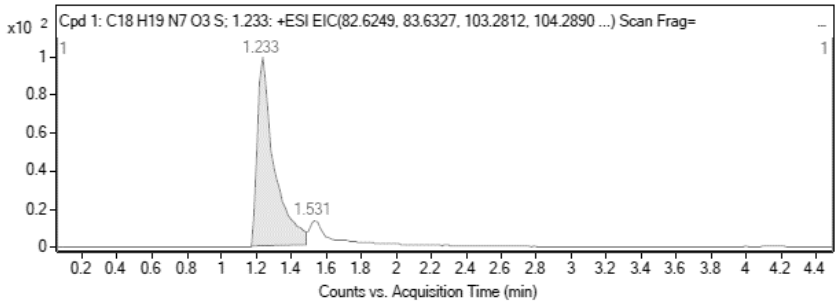
HRMC (2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-(((1-methyl-1H-benzo[d]imidazol-2-yl)thio) methyl)tetrahydrofuran-3,4-diol **(13)**

Compound Table

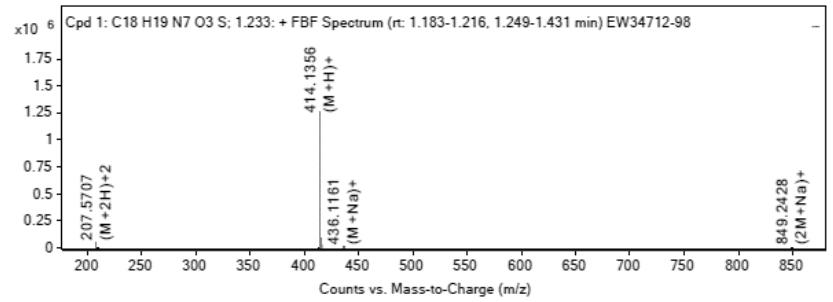
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C18 H19 N7 O3 S; 1.233	99.59	2.51	C18 H19 N7 O3 S	1.233	413.127	413.128

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
207.5707	1.233	413.128	C18 H19 N7 O3 S	413.127	2.51	Find by Formula

Compound Chromatograms



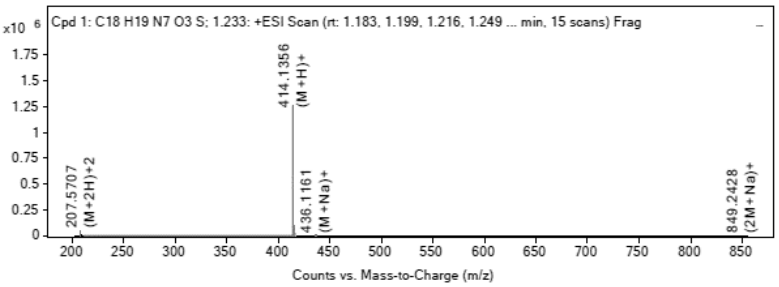
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
207.5707	2	47508.82	(M+2H)+2
208.0721	2	11656.19	(M+2H)+2
208.5706	2	3979.88	(M+2H)+2
413.1211	1	776.37	M+
414.1356	1	1260667.75	(M+H)+
415.1374	1	296669.78	(M+H)+
416.1342	1	92065.24	(M+H)+
436.1161	1	7755.8	(M+Na)+
437.119	1	1760.48	(M+Na)+
849.2428	1	1189.16	(2M+Na)+

MS Zoomed Spectrum

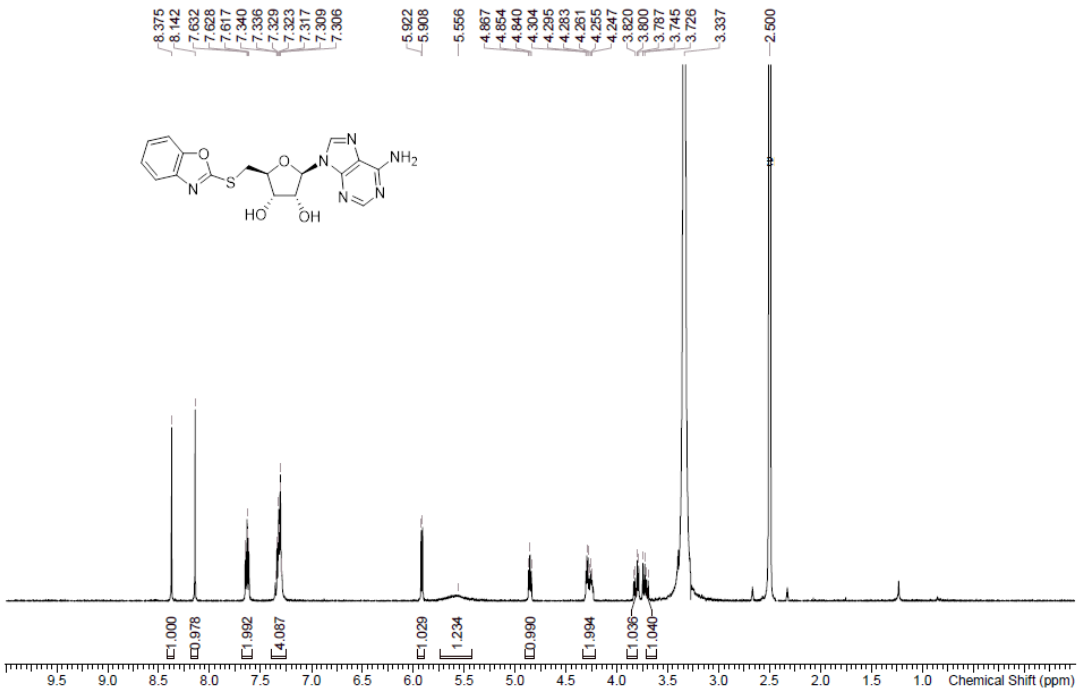


MS Spectrum Peak List

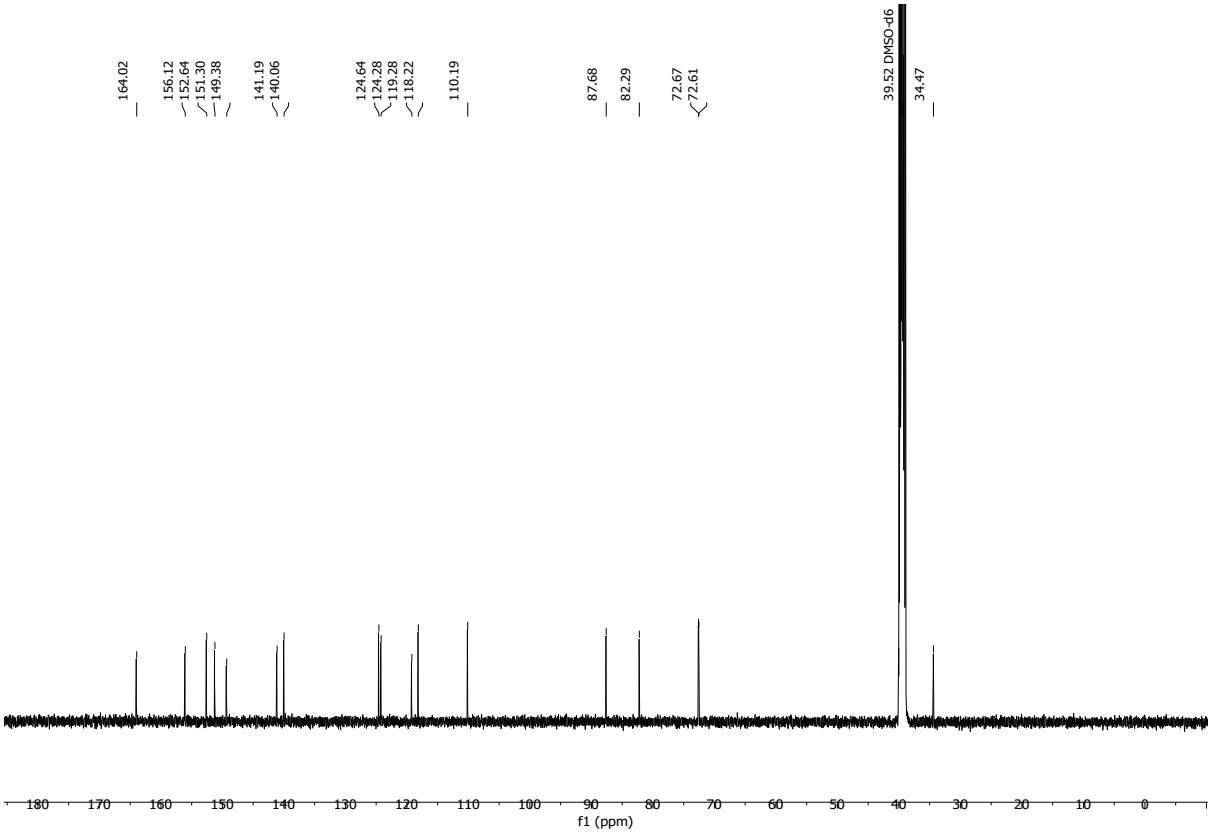
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
207.5707	2	47508.82	(M+2H)+2	0.23
208.0721	2	11656.19	(M+2H)+2	-0.21
208.5706	2	3979.88	(M+2H)+2	-0.14
413.1211	1	776.37	M+	12.98
414.1356	1	1260667.75	(M+H)+	-3.07
415.1374	1	296669.78	(M+H)+	-1.32
416.1342	1	92065.24	(M+H)+	-0.76
436.1161	1	7755.8	(M+Na)+	0.32
437.119	1	1760.48	(M+Na)+	-0.41
849.2428	1	1189.16	(2M+Na)+	0.54

--- End Of Report ---

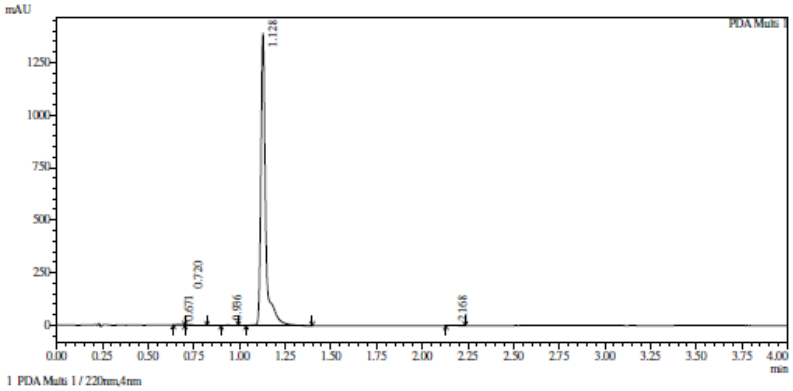
^{1}H NMR (2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-((benzo[d]oxazol-2-ylthio)methyl) tetrahydrofuran-3,4-diol **(14)**



^{13}C NMR (2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-((benzo[d]oxazol-2-ylthio)methyl) tetrahydrofuran-3,4-diol **(14)**



HPLC (2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-((benzo[d]oxazol-2-ylthio)methyl) tetrahydrofuran-3,4-diol **(14)**

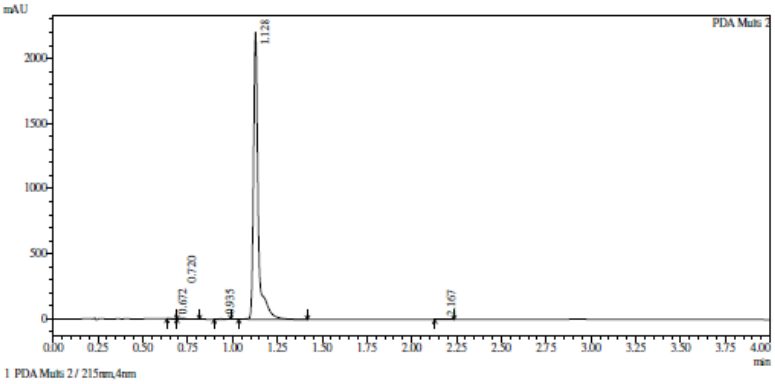


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.671	0.000	0.000	1265	3992	0.155
2	0.720	0.067	0.000	3067	6431	0.250
3	0.936	0.054	3.568	2280	4941	0.192
4	1.128	0.043	3.958	1390751	2548165	99.230
5	2.168	0.067	19.003	1747	4407	0.172
Total				1399110	2567936	100.000



Integration result

PeakTable

PDA Ch2 215nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.672	0.000	0.000	2448	5476	0.134
2	0.720	0.112	0.000	5950	14812	0.362
3	0.935	0.052	2.631	3477	6898	0.169
4	1.128	0.043	4.079	2202921	4060572	99.237
5	2.167	0.067	18.840	1561	4054	0.099
Total				2216357	4091810	100.000

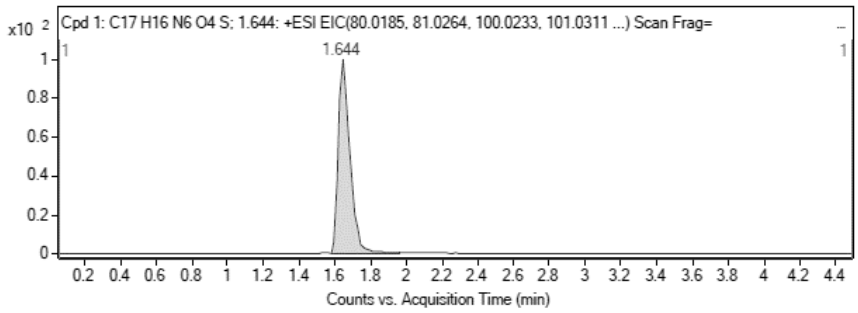
HRMS (2R,3R,4S,5S)-2-(6-Amino-9H-purin-9-yl)-5-((benzo[d]oxazol-2-ylthio)methyl) tetrahydrofuran-3,4-diol **(14)**

Compound Table

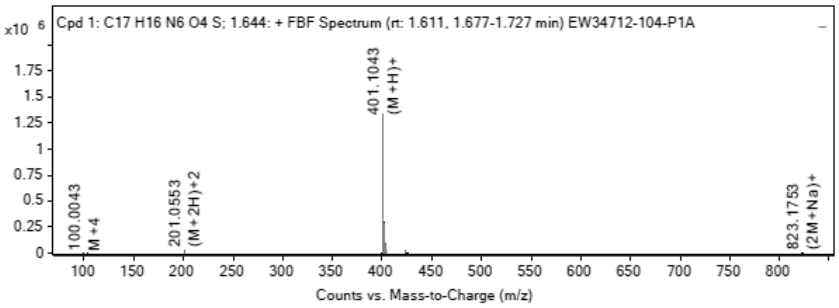
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C17 H16 N6 O4 S; 1.644	98.19	3.31	C17 H16 N6 O4 S	1.644	400.0954	400.0967

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
423.0844	1.644	400.0967	C17 H16 N6 O4 S	400.0954	3.31	Find by Formula

Compound Chromatograms



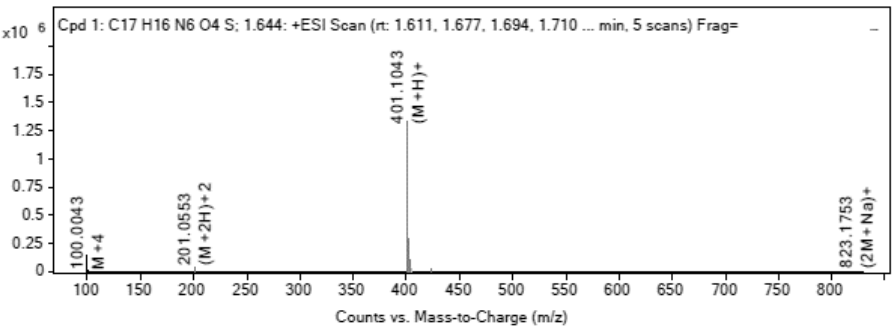
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
201.0553	2	29501.22	(M+2H)+2
201.5566	2	7101.29	(M+2H)+2
202.055	2	2179.13	(M+2H)+2
401.1043	1	1335291.75	(M+H)+
402.106	1	292246.5	(M+H)+
403.1028	1	95815.08	(M+H)+
423.0844	1	24024.24	(M+Na)+
424.0863	1	5721.87	(M+Na)+
425.0841	1	2038.85	(M+Na)+
823.1753	1	392.42	(2M+Na)+

MS Zoomed Spectrum

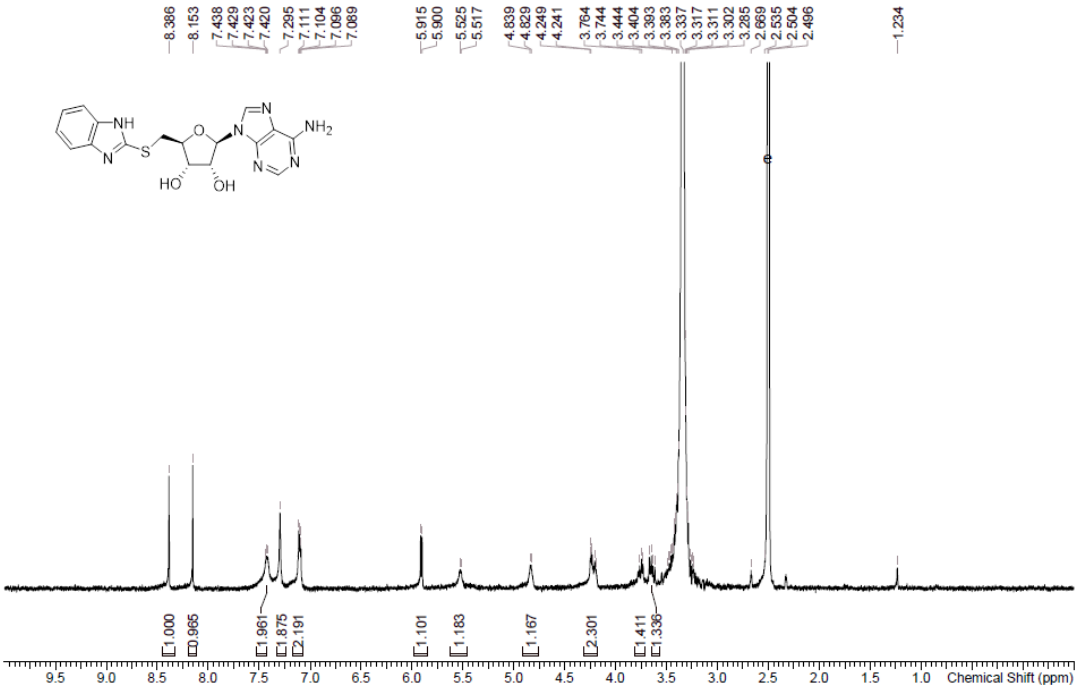


MS Spectrum Peak List

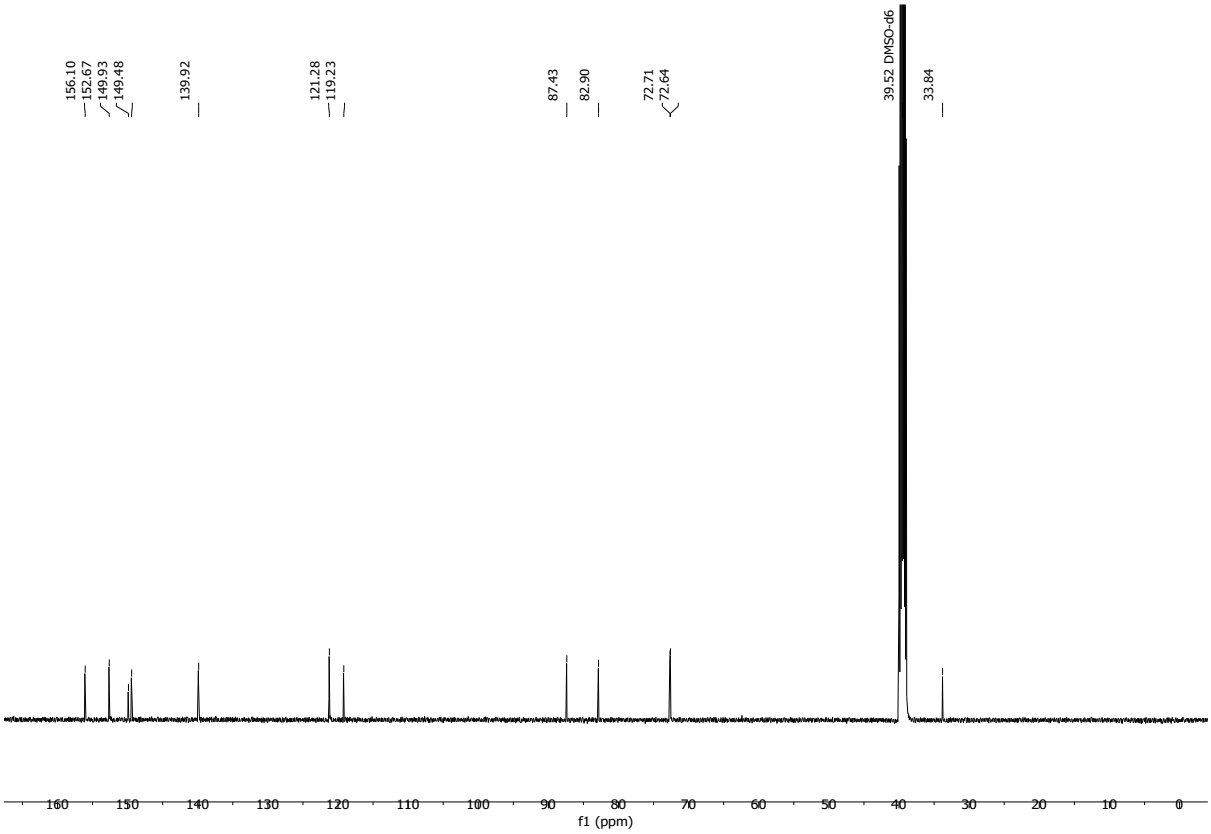
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
201.0553	2	29501.22	(M+2H)+2	-1.44
201.5566	2	7101.29	(M+2H)+2	-1.69
202.055	2	2179.13	(M+2H)+2	-1.23
401.1043	1	1335291.75	(M+H)+	-4
402.106	1	292246.5	(M+H)+	-1.96
403.1028	1	95815.08	(M+H)+	-1.54
423.0844	1	24024.24	(M+Na)+	0.46
424.0863	1	5721.87	(M+Na)+	2.22
425.0841	1	2038.85	(M+Na)+	0.04
823.1753	1	392.42	(2M+Na)+	5.64

--- End Of Report ---

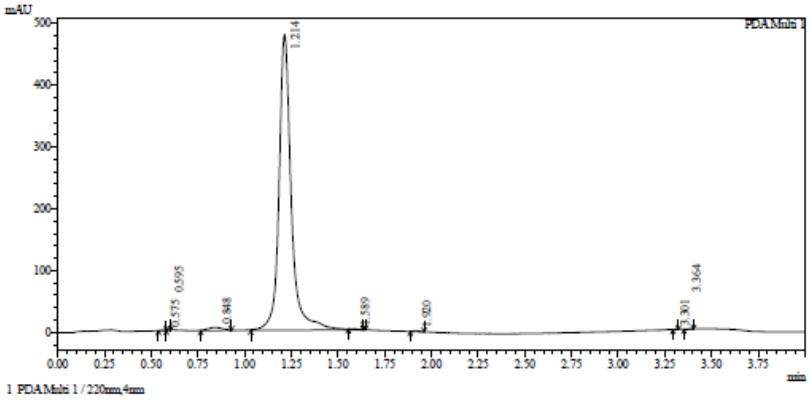
^{1}H NMR (2S,3S,4R,5R)-2-(((1H-Benzo[d]imidazol-2-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl) tetrahydrofuran-3,4-diol **(15)**



^{13}C NMR (2S,3S,4R,5R)-2-(((1H-Benzo[d]imidazol-2-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl) tetrahydrofuran-3,4-diol **(15)**



HPLC (2S,3S,4R,5R)-2-(((1H-Benzo[d]imidazol-2-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl) tetrahydrofuran-3,4-diol **(15)**

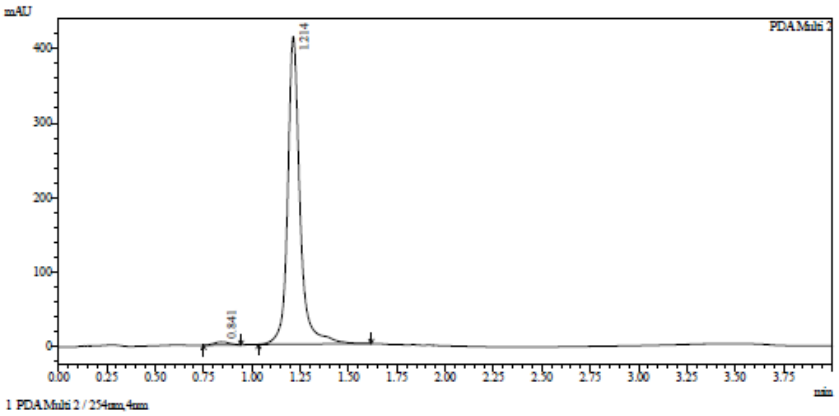


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.575	0.057	0.000	886	1572	0.071
2	0.595	0.064	0.332	951	1130	0.051
3	0.848	0.143	2.449	4925	27014	1.212
4	1.214	0.106	2.932	479310	2190445	98.284
5	1.589	0.047	4.891	1010	1949	0.087
6	1.920	0.054	6.520	1639	3246	0.146
7	3.301	0.087	19.565	890	1420	0.064
8	3.364	0.119	0.610	673	1915	0.086
Total				490283	2228692	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.841	0.151	0.000	4303	23862	1.292
2	1.214	0.105	2.923	412225	1822897	98.708
Total				416528	1846759	100.000

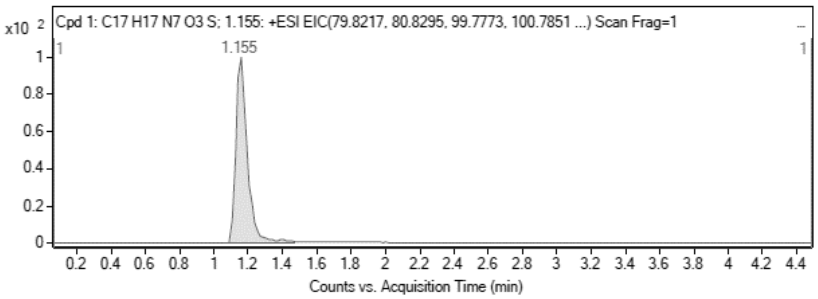
HRMC (2S,3S,4R,5R)-2-(((1H-Benzo[d]imidazol-2-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl) tetrahydrofuran-3,4-diol **(15)**

Compound Table

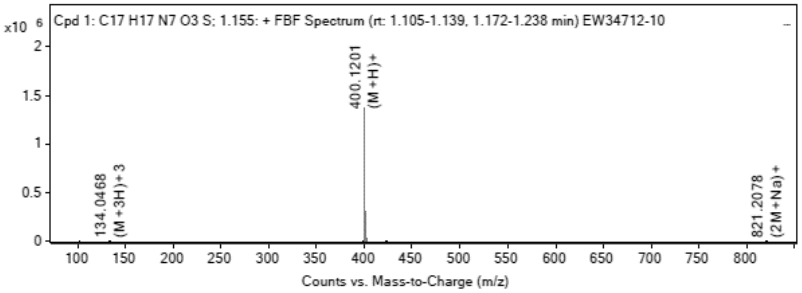
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C17 H17 N7 O3 S; 1.155	95.02	3.16	C17 H17 N7 O3 S	1.155	399.1114	399.1126

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
400.1201	1.155	399.1126	C17 H17 N7 O3 S	399.1114	3.16	Find by Formula

Compound Chromatograms



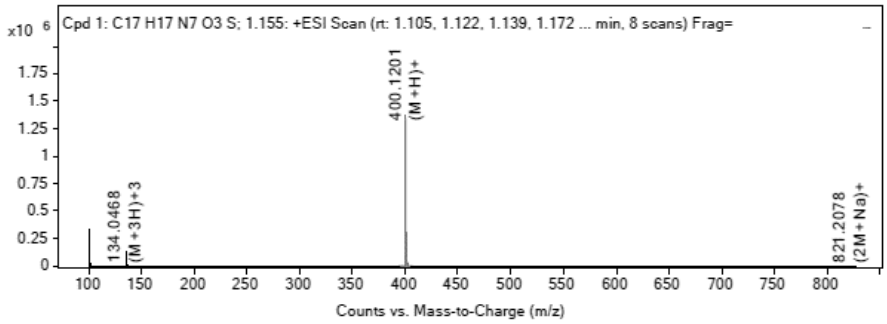
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
133.073	3	289.63	M+3
134.0468	3	4387.62	(M+3H)+3
399.1109	1	298.95	M+
400.1201	1	1368297	(M+H)+
401.1218	1	306489.69	(M+H)+
402.1186	1	94816.95	(M+H)+
403.119	1	15879.96	(M+H)+
422.1008	1	3490.26	(M+Na)+
423.1031	1	772.61	(M+Na)+
821.2078	1	325.2	(2M+Na)+

MS Zoomed Spectrum

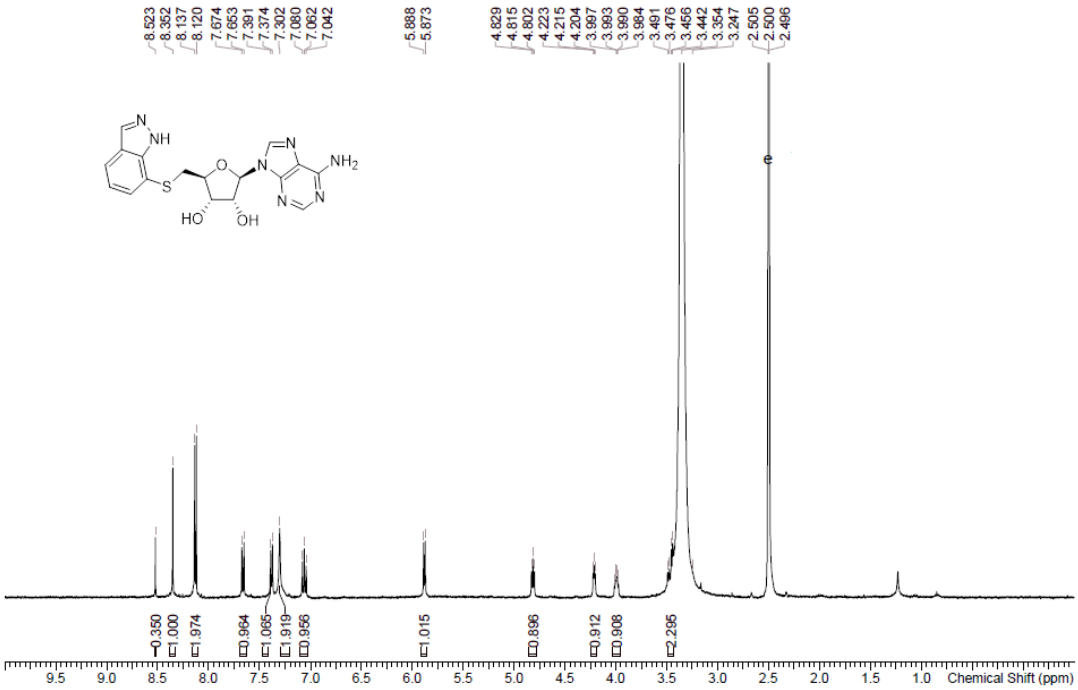


MS Spectrum Peak List

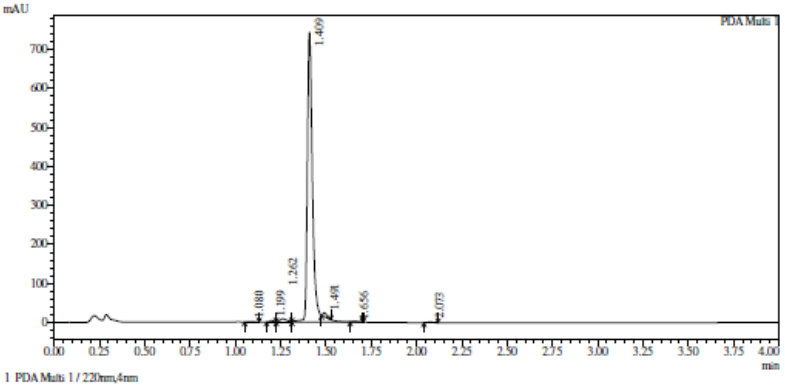
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
133.073	3	289.63	M+3	-274.01
134.0468	3	4387.62	(M+3H)+3	-17.76
399.1109	1	298.95	M+	-0.34
400.1201	1	1368297	(M+H)+	-3.63
401.1218	1	306489.69	(M+H)+	-1.52
402.1186	1	94816.95	(M+H)+	-1.44
403.119	1	15879.96	(M+H)+	0.23
422.1008	1	3490.26	(M+Na)+	-0.5
423.1031	1	772.61	(M+Na)+	-0.09
821.2078	1	325.2	(2M+Na)+	5

--- End Of Report ---

^{1}H NMR (2S,3S,4R,5R)-2-(((1H-Indazol-7-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl)tetrahydrofuran-3,4-diol **(16)**



HPLC (2S,3S,4R,5R)-2-(((1H-Indazol-7-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl)tetrahydrofuran-3,4-diol **(16)**

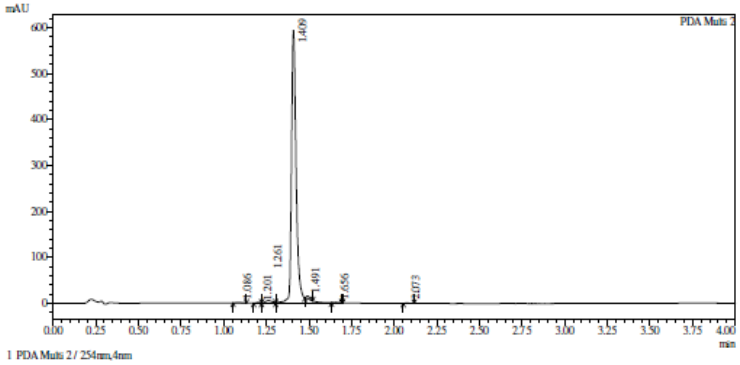


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.080	0.061	0.000	1226	2823	0.182
2	1.199	0.045	2.235	3697	6006	0.387
3	1.262	0.073	1.066	8161	23077	1.487
4	1.409	0.050	2.389	744300	1498579	96.580
5	1.491	0.038	1.874	10411	14230	0.917
6	1.656	0.047	3.855	1963	3486	0.225
7	2.073	0.052	8.426	1868	3448	0.222
Total				771627	1551649	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.086	0.065	0.000	776	1792	0.151
2	1.201	0.051	1.988	1362	2224	0.187
3	1.261	0.072	0.973	5489	15103	1.270
4	1.409	0.048	2.451	593115	1158941	97.489
5	1.491	0.037	1.918	5790	7794	0.656
6	1.656	0.047	3.933	1109	1904	0.160
7	2.073	0.046	9.012	592	1041	0.088
Total				608233	1188798	100.000

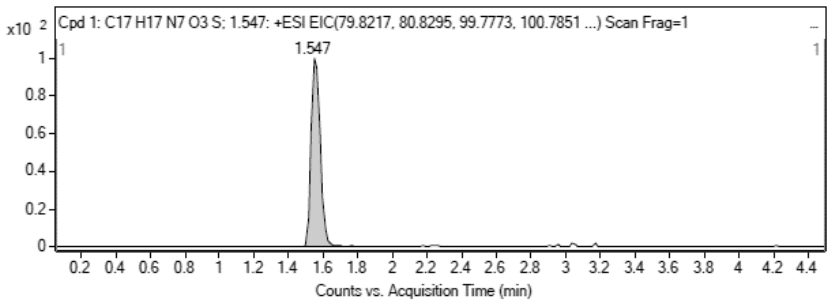
HRMC (2S,3S,4R,5R)-2-(((1H-Indazol-7-yl)thio)methyl)-5-(6-amino-9H-purin-9-yl)tetrahydrofuran-3,4-diol **(16)**

Compound Table

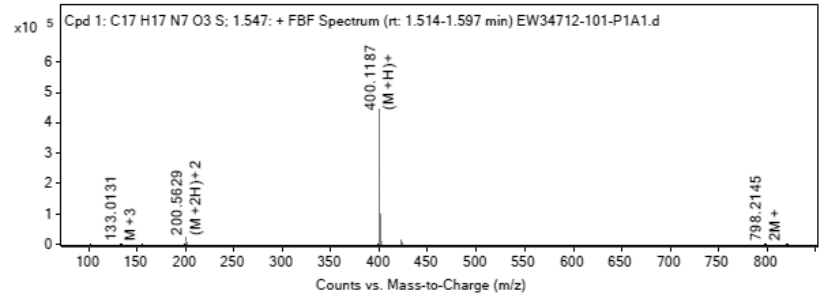
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C17 H17 N7 O3 S; 1.547	99.21	-0.76	C17 H17 N7 O3 S	1.547	399.1114	399.1111

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
400.1187	1.547	399.1111	C17 H17 N7 O3 S	399.1114	-0.76	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

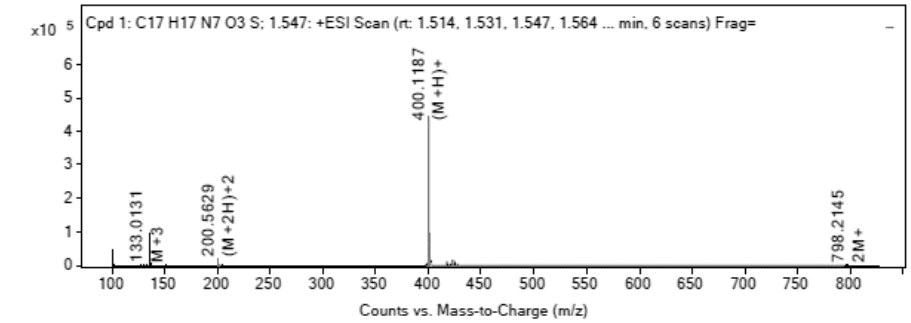


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
133.0131	3	1616.92	M+3
200.5629	2	20456.9	(M+2H)+2

201.0662	2	5054.11 (M+2H)+2
400.1187	1	444134.88 (M+H)+
401.1209	1	94815.27 (M+H)+
402.1177	1	29685.77 (M+H)+
422.0997	1	12629.72 (M+Na)+
423.1028	1	2998.7 (M+Na)+
424.0982	1	1082.64 (M+Na)+
798.2145	1	1554.26 2M+

MS Zoomed Spectrum

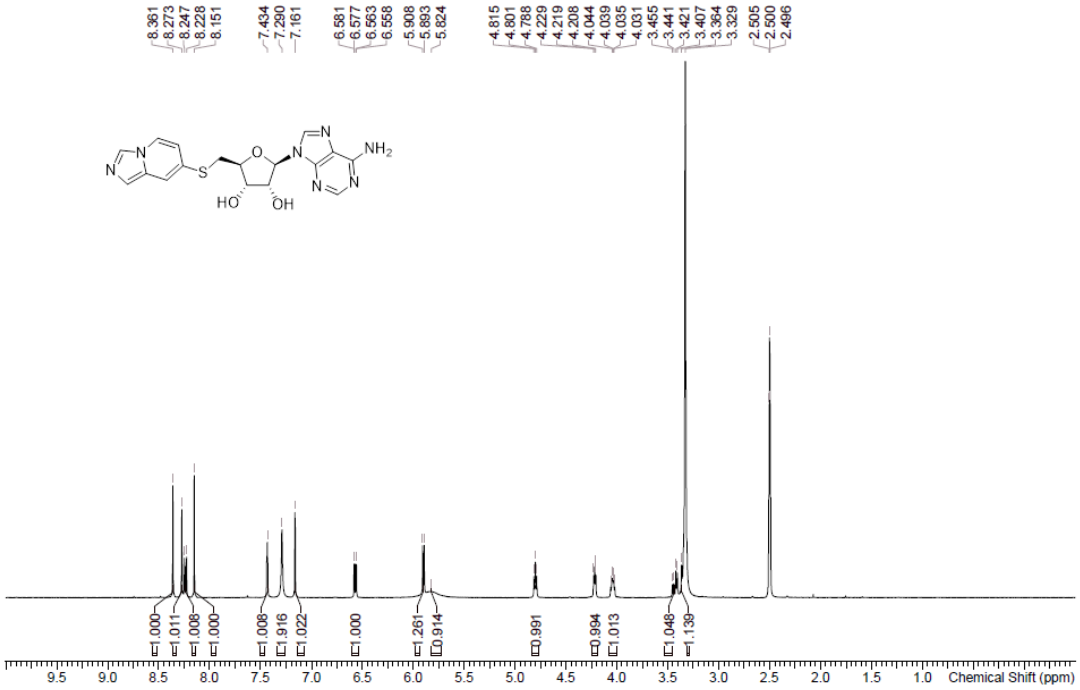


MS Spectrum Peak List

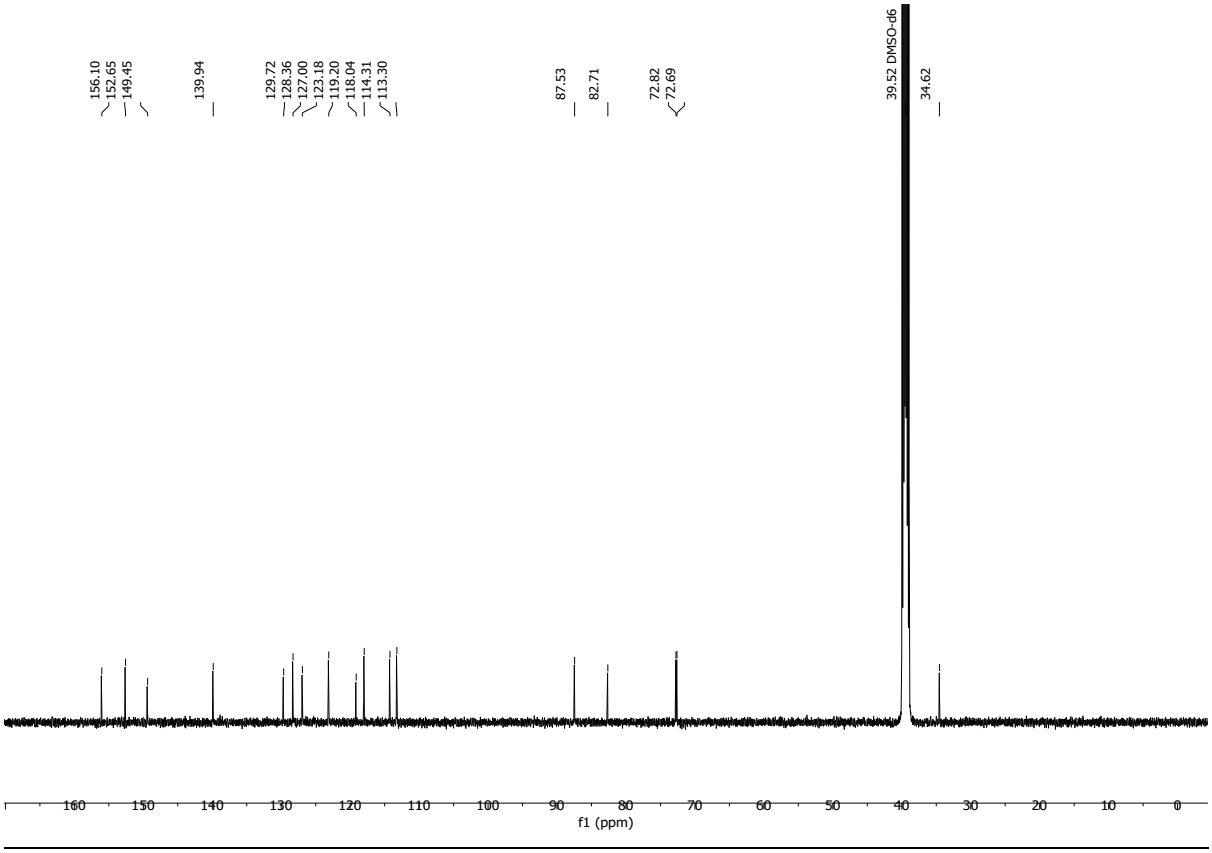
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
133.0131	3	1616.92	M+3	176.69
200.5629	2	20456.9	(M+2H)+2	0.42
201.0662	2	5054.11	(M+2H)+2	-9.98
400.1187	1	444134.88	(M+H)+	-0.28
401.1209	1	94815.27	(M+H)+	0.71
402.1177	1	29685.77	(M+H)+	0.86
422.0997	1	12629.72	(M+Na)+	2.06
423.1028	1	2998.7	(M+Na)+	0.66
424.0982	1	1082.64	(M+Na)+	4.25
798.2145	1	1554.26	2M+	9.57

--- End Of Report ---

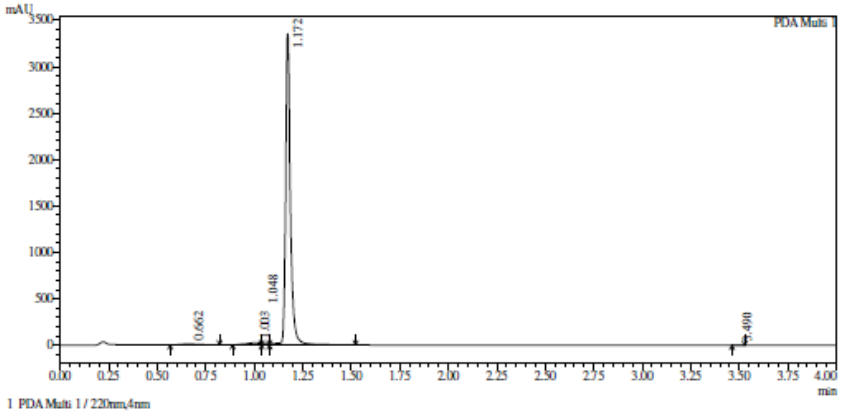
^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridine-7-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(17)**



^{13}C NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridine-7-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(17)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridine-7-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(17)**

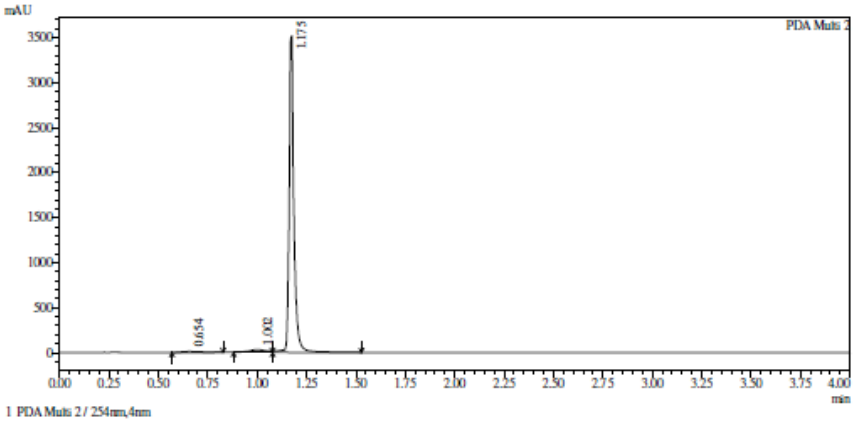


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.662	0.163	0.000	10342	62083	1.037
2	1.003	0.153	2.158	22221	109086	1.822
3	1.048	0.364	0.174	15616	33664	0.562
4	1.172	0.040	0.613	3348987	5781359	96.557
5	3.490	0.057	47.911	647	1296	0.022
Total				3397813	5987488	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.654	0.180	0.000	10105	68263	1.112
2	1.002	0.143	2.149	31580	184359	3.004
3	1.175	0.036	1.929	3516010	5885093	95.884
Total				3557695	6137715	100.000

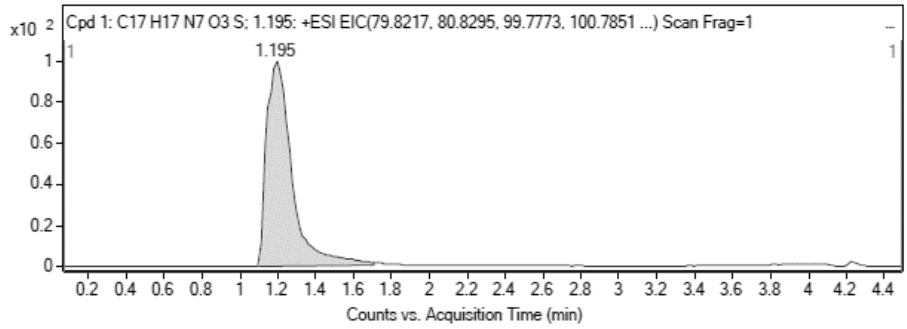
HRMC (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(imidazo[1,5-a]pyridine-7-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(17)**

Compound Table

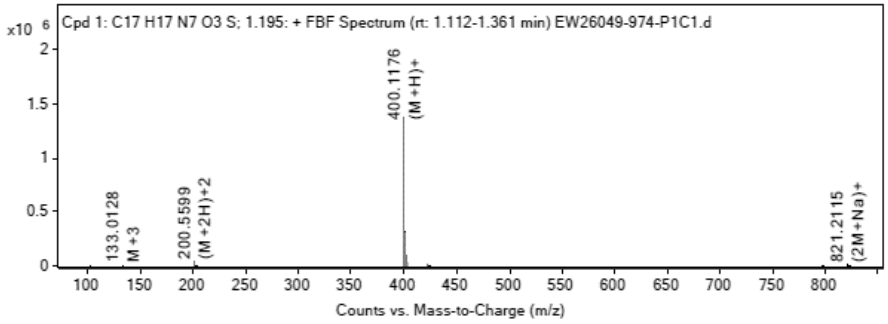
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C17 H17 N7 O3 S; 1.195	94.54	-3.76	C17 H17 N7 O3 S	1.195	399.1114	399.1099

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
400.1176	1.195	399.1099	C17 H17 N7 O3 S	399.1114	-3.76	Find by Formula

Compound Chromatograms



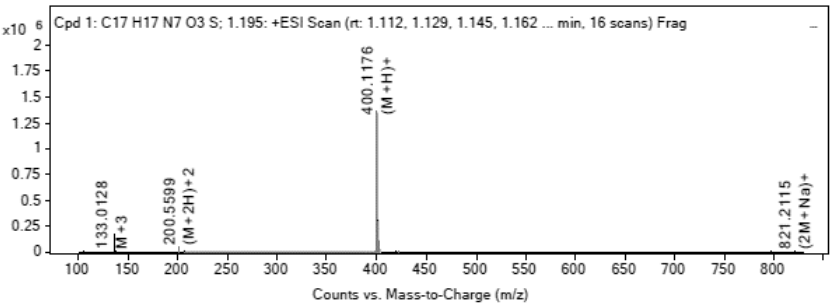
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
200.5599	2	44219.67	(M+2H)+2
201.0621	2	9302.93	(M+2H)+2
399.1079	1	11667.74	M+
400.1176	1	1360646.63	(M+H)+
401.1193	1	313413.34	(M+H)+
402.1162	1	98309.98	(M+H)+
422.0981	1	11562.54	(M+Na)+
798.2137	1	4018.8	2M+
821.2115	1	11299.91	(2M+Na)+
822.2134	1	4923.16	(2M+Na)+

MS Zoomed Spectrum

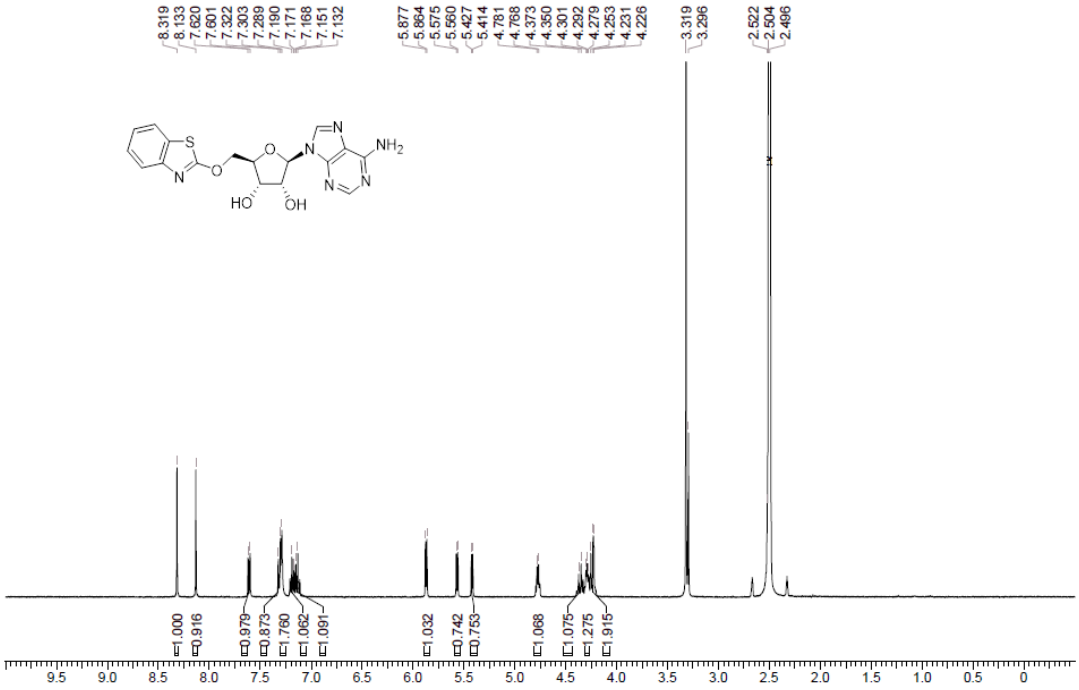


MS Spectrum Peak List

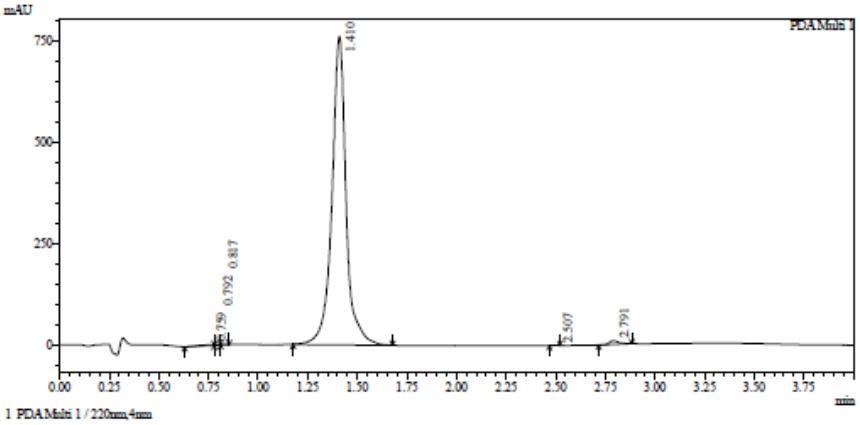
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
200.5599	2	44219.67	(M+2H)+2	15.39
201.0621	2	9302.93	(M+2H)+2	10.72
399.1079	1	11667.74	M+	7.3
400.1176	1	1360646.63	(M+H)+	2.64
401.1193	1	313413.34	(M+H)+	4.58
402.1162	1	98309.98	(M+H)+	4.55
422.0981	1	11562.54	(M+Na)+	5.94
798.2137	1	4018.8	2M+	10.64
821.2115	1	11299.91	(2M+Na)+	0.54
822.2134	1	4923.16	(2M+Na)+	1.25

--- End Of Report ---

^{1}H NMR (2*R*,3*R*,4*S*,5*R*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-yloxymethyl)tetrahydrofuran-3,4-diol **(23)**



HPLC (2*R*,3*R*,4*S*,5*R*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-yloxymethyl)tetrahydrofuran-3,4-diol **(23)**

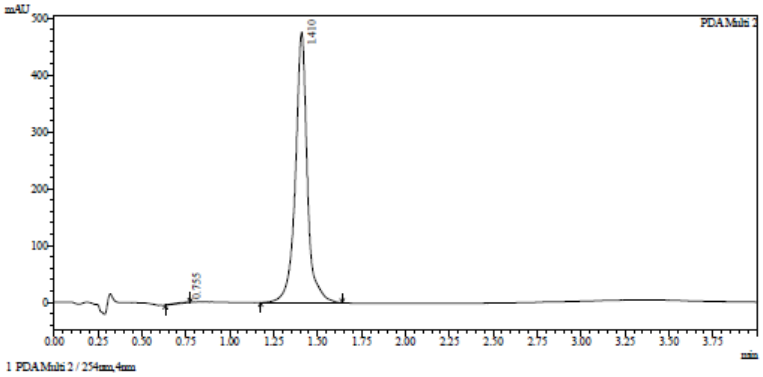


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.759	0.152	0.000	1900	11739	0.305
2	0.792	0.081	0.287	1500	2633	0.069
3	0.817	0.094	0.290	952	1554	0.040
4	1.410	0.119	5.568	763684	3795218	98.755
5	2.507	0.042	13.607	531	1082	0.028
6	2.791	0.087	4.386	9091	30844	0.803
Total				777658	3843069	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.755	0.156	0.000	771	6723	0.299
2	1.410	0.114	4.858	476220	2243465	99.701
Total				476991	2250188	100.000

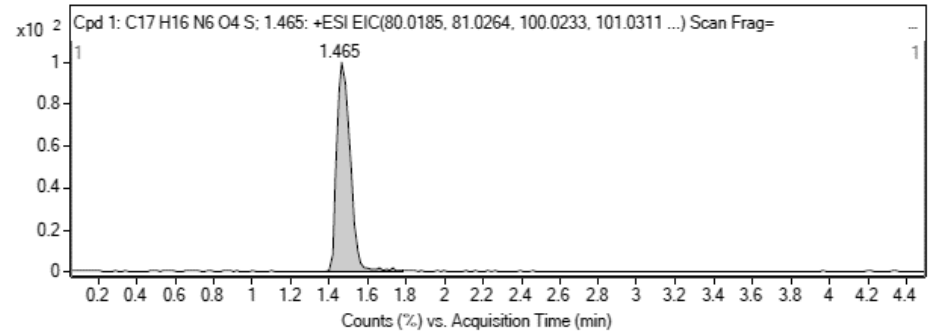
HRMC (2*R*,3*R*,4*S*,5*R*)-2-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-yloxymethyl)tetrahydrofuran-3,4-diol **(23)**

Compound Table

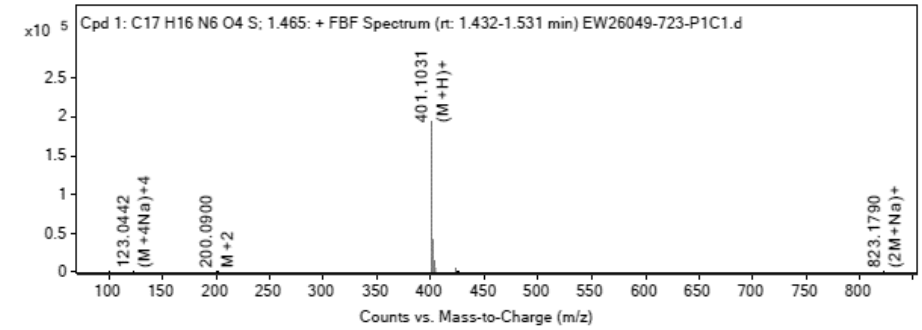
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C17 H16 N6 O4 S; 1.465	98.84	1.31	C17 H16 N6 O4 S	1.465	400.0954	400.0959

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
401.1031	1.465	400.0959	C17 H16 N6 O4 S	400.0954	1.31	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

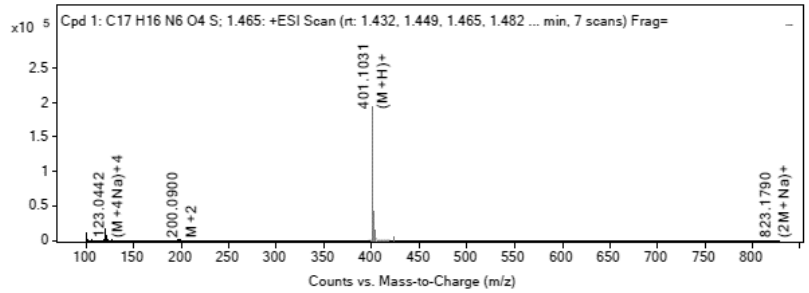


MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
123.0442	4	88.43	(M+4Na)+4
200.09	2	86.06	M+2

201.1037	2	70.64	(M+2H)+2
401.1031	1	193524	(M+H)+
402.1054	1	41576.28	(M+H)+
403.1031	1	14133.26	(M+H)+
423.0849	1	4287.03	(M+Na)+
424.0883	1	1036.19	(M+Na)+
425.0861	1	340.45	(M+Na)+
823.179	1	99.71	(2M+Na)+

MS Zoomed Spectrum

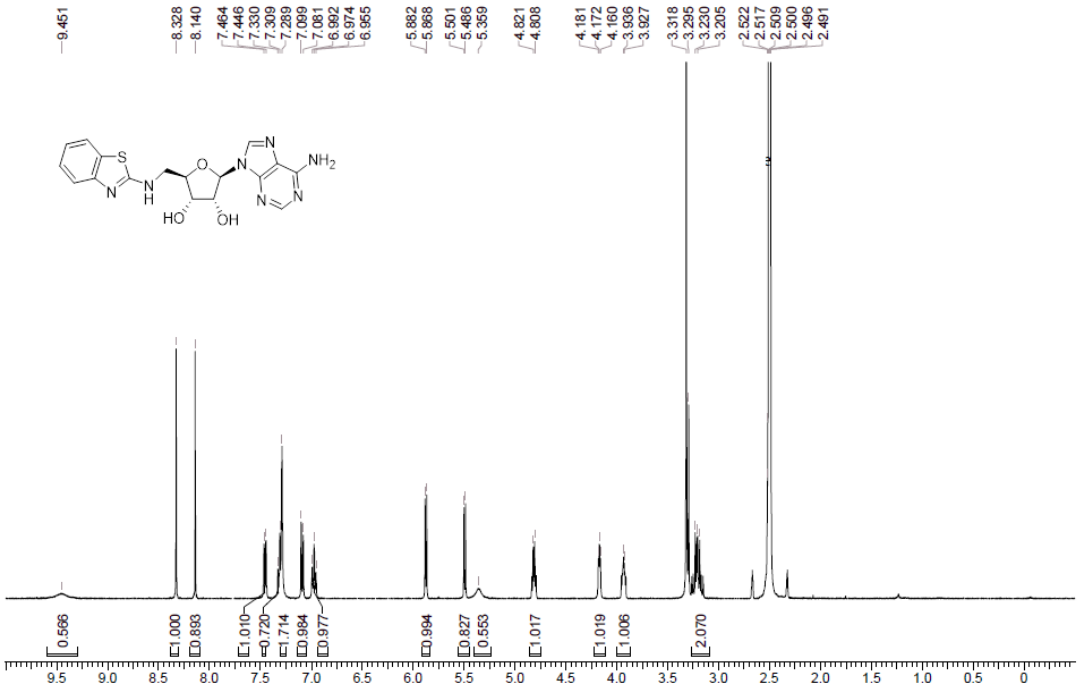


MS Spectrum Peak List

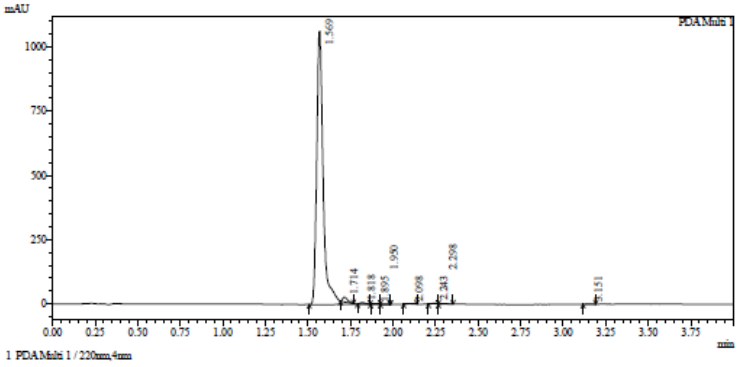
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
123.0442	4	88.43	(M+4Na)+4	-253.41
200.09	2	86.06	M+2	-214.23
201.1037	2	70.64	(M+2H)+2	-242.4
401.1031	1	193524	(M+H)+	-1.17
402.1054	1	41576.28	(M+H)+	-0.27
403.1031	1	14133.26	(M+H)+	-2.29
423.0849	1	4287.03	(M+Na)+	-0.78
424.0883	1	1036.19	(M+Na)+	-2.6
425.0861	1	340.45	(M+Na)+	-4.68
823.179	1	99.71	(2M+Na)+	1.15

— End Of Report —

^{1}H NMR 2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(1,3-benzothiazol-2-ylamino)methyl] tetrahydrofuran-3,4-diol **(24)**



HPLC 2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(1,3-benzothiazol-2-ylamino)methyl] tetrahydrofuran-3,4-diol **(24)**

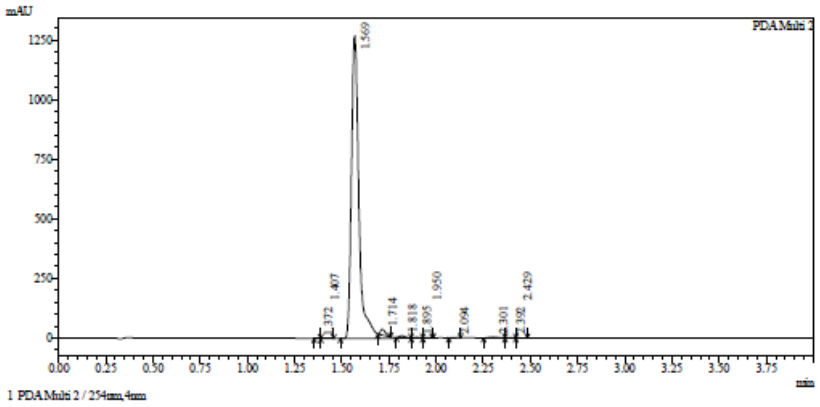


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.569	0.066	0.000	1063984	2852502	97.489
2	1.714	0.053	2.433	18519	35180	1.202
3	1.818	0.055	1.902	5814	11667	0.399
4	1.895	0.051	1.450	1468	2728	0.093
5	1.950	0.049	1.098	663	1069	0.037
6	2.098	0.066	2.587	2040	4651	0.159
7	2.243	0.059	2.323	3383	6906	0.236
8	2.298	0.101	0.686	2277	7191	0.246
9	3.151	0.063	10.388	1743	4079	0.139
Total				1099891	2925974	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.372	0.052	0.000	705	1086	0.030
2	1.407	0.076	0.549	795	1746	0.048
3	1.569	0.068	2.267	1269004	3549920	97.422
4	1.714	0.051	2.442	25467	45291	1.243
5	1.818	0.057	1.920	8014	16255	0.446
6	1.895	0.050	1.445	2257	4291	0.118
7	1.950	0.044	1.165	747	1247	0.034
8	2.094	0.054	2.954	1593	3019	0.083
9	2.301	0.101	2.674	3897	14466	0.397
10	2.392	0.205	0.592	1664	4689	0.129
11	2.429	0.824	0.073	1111	1831	0.050
Total				1315256	3643841	100.000

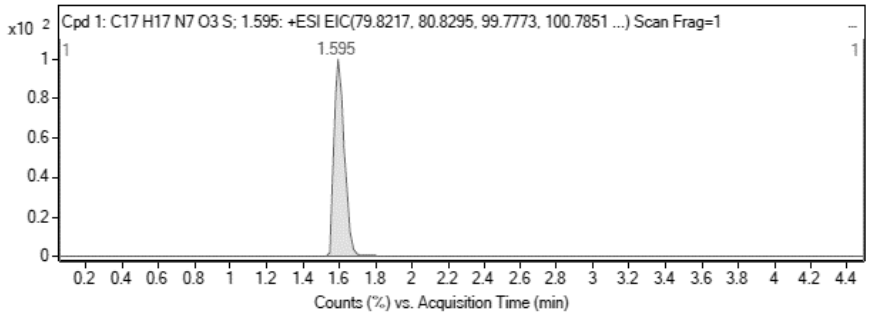
HRMC 2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(1,3-benzothiazol-2-ylamino)methyl] tetrahydrofuran-3,4-diol **(24)**

Compound Table

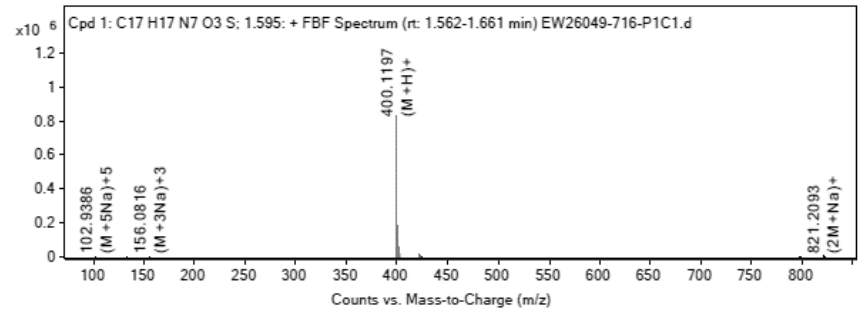
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C17 H17 N7 O3 S; 1.595	98.29	2.05	C17 H17 N7 O3 S	1.595	399.1114	399.1122

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
422.1002	1.595	399.1122	C17 H17 N7 O3 S	399.1114	2.05	Find by Formula

Compound Chromatograms



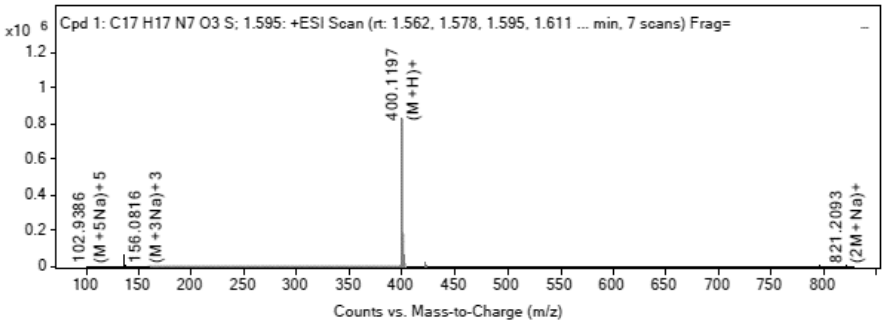
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
399.1116	1	7979.15	M+
400.1197	1	831777.56	(M+H)+
401.1214	1	183561.86	(M+H)+
402.1183	1	57424.29	(M+H)+
422.1002	1	22912.8	(M+Na)+
423.1037	1	5037.99	(M+Na)+
424.1011	1	1867.23	(M+Na)+
798.216	1	1916.53	2M+
821.2093	1	5269.97	(2M+Na)+
822.2124	1	2410.98	(2M+Na)+

MS Zoomed Spectrum

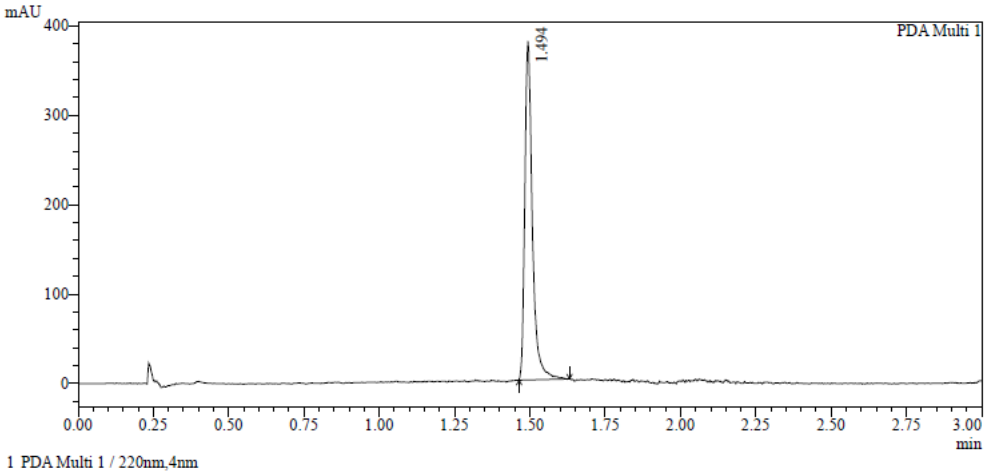


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
399.1116	1	7979.15	M+	-2.06
400.1197	1	831777.56	(M+H)+	-2.54
401.1214	1	183561.86	(M+H)+	-0.65
402.1183	1	57424.29	(M+H)+	-0.79
422.1002	1	22912.8	(M+Na)+	0.84
423.1037	1	5037.99	(M+Na)+	-1.34
424.1011	1	1867.23	(M+Na)+	-2.79
798.216	1	1916.53	2M+	7.71
821.2093	1	5269.97	(2M+Na)+	3.15
822.2124	1	2410.98	(2M+Na)+	2.44

--- End Of Report ---

SFC 2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(1,3-benzothiazol-2-ylamino)methyl] tetrahydrofuran-3,4-diol **(24)**



1 PDA Multi 1 / 220nm,4nm

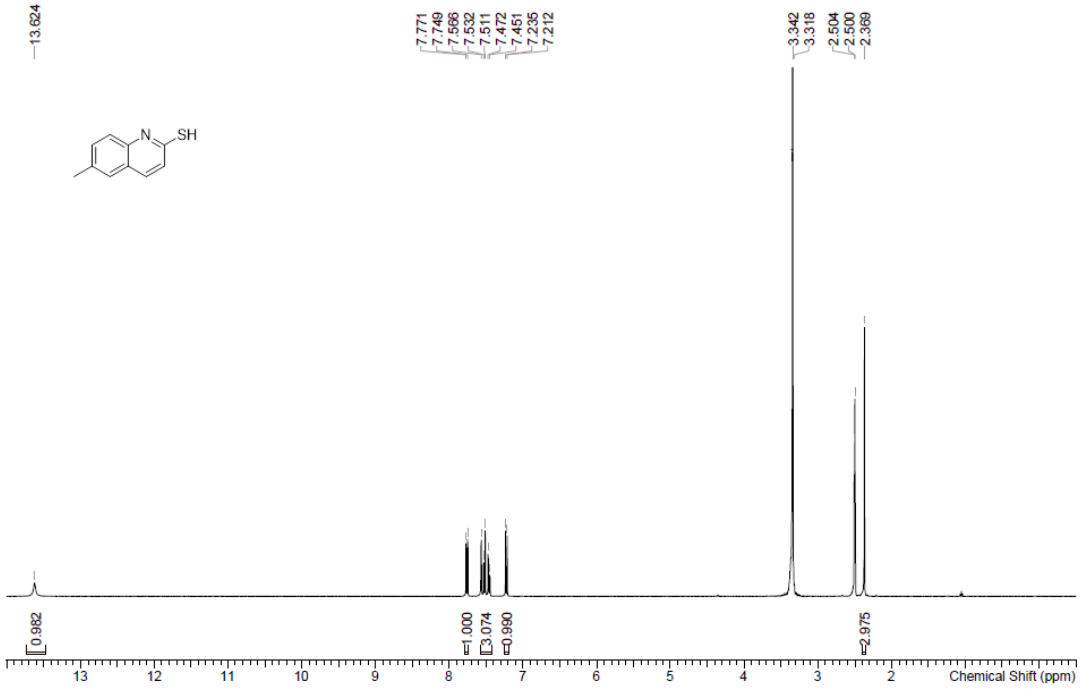
Integration Results

PeakTable

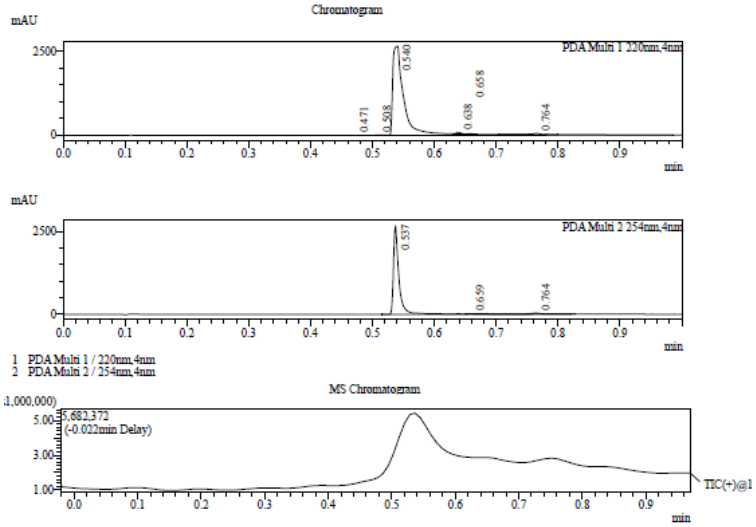
PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.494	0.048	0.000	370703	662295	100.000
Total				370703	662295	100.000

^{1}H NMR 6-Methylquinoline-2-thiol **(73)**



LCMS 6-Methylquinoline-2-thiol **(73)**



Integration Result

Peak Table

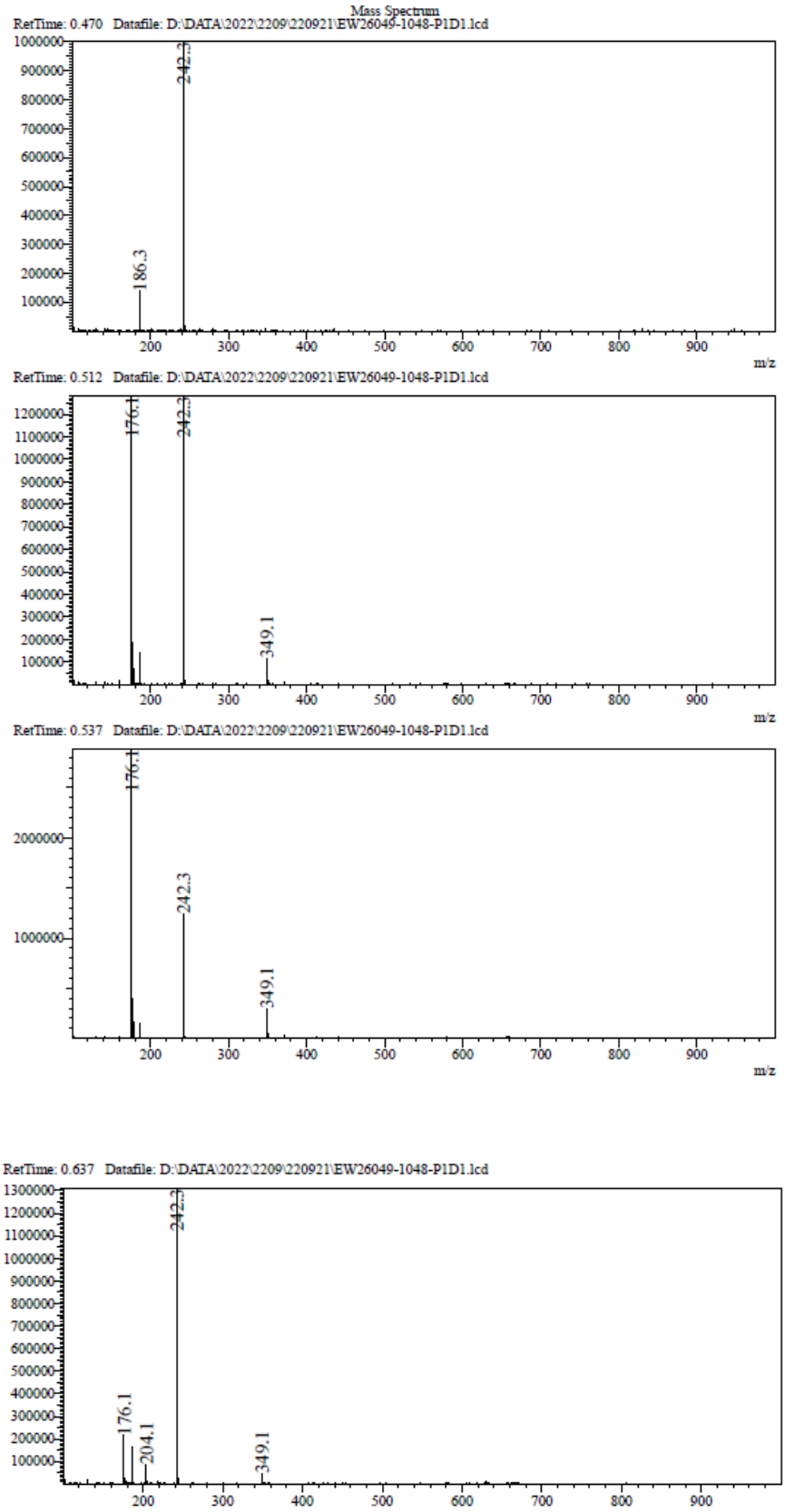
PDA Ch1 220nm

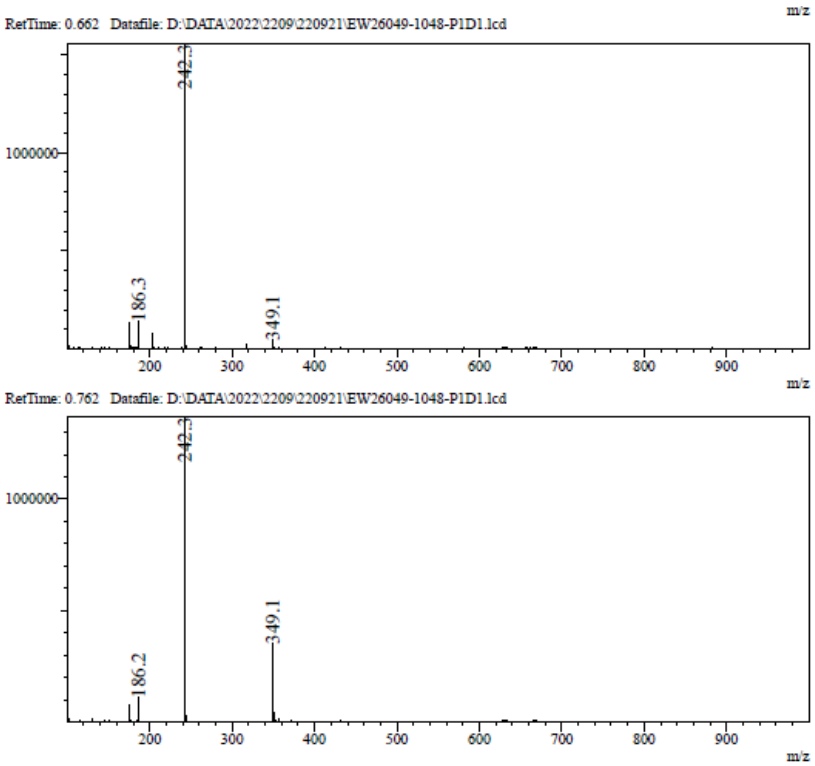
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.471	3720	0.134	0.069	10372	0.280
2	0.508	14380	0.517	0.021	11374	0.307
3	0.540	2661842	95.668	0.027	3610215	97.363
4	0.638	49637	1.784	0.016	25549	0.689
5	0.658	14118	0.507	0.015	6852	0.185
6	0.764	38669	1.390	0.026	43637	1.177

Peak Table

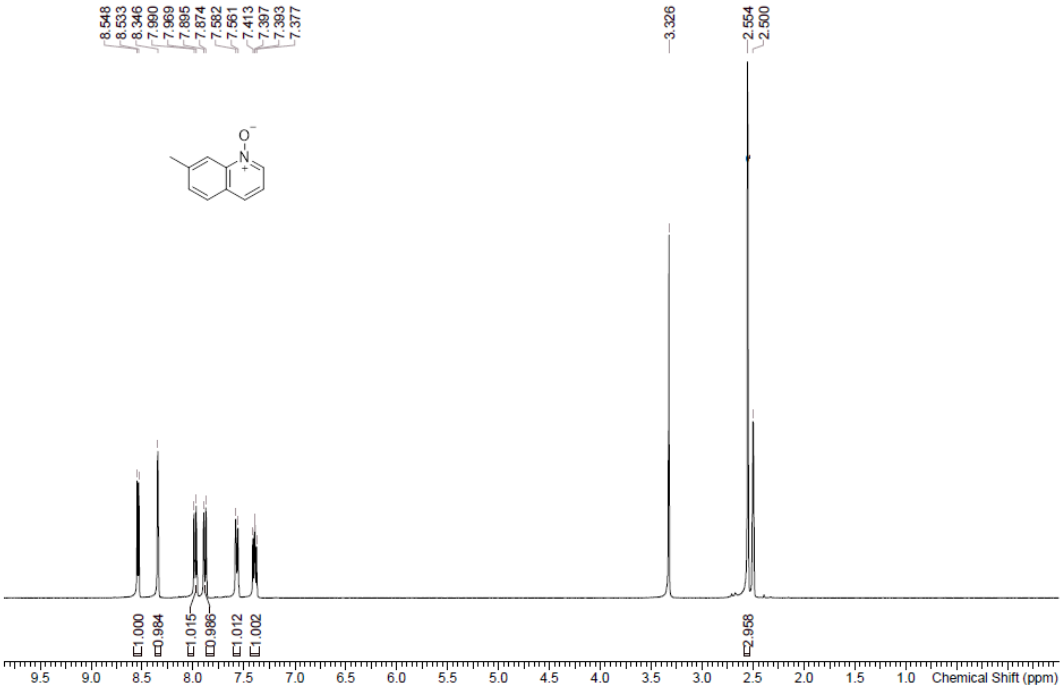
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.537	2687593	98.323	0.016	1699781	97.208
2	0.659	9647	0.353	0.016	5595	0.320
3	0.764	36192	1.324	0.026	43228	2.472

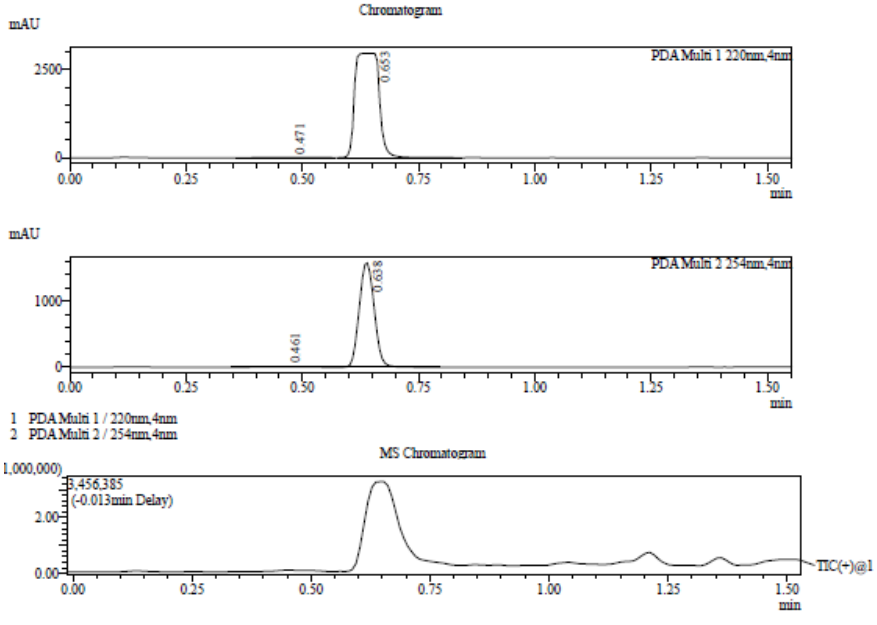

Mass Spectrum
RetTime: 0.470 Datafile: D:\DATA\2022\2209\220921\EW26049-1048-P1D1.lcd
242.3
186.3
m/z
RetTime: 0.512 Datafile: D:\DATA\2022\2209\220921\EW26049-1048-P1D1.lcd
176.1
242.3
349.1
m/z
RetTime: 0.537 Datafile: D:\DATA\2022\2209\220921\EW26049-1048-P1D1.lcd
176.1
242.3
349.1
m/z
RetTime: 0.637 Datafile: D:\DATA\2022\2209\220921\EW26049-1048-P1D1.lcd
242.3
176.1
204.1
349.1



^{1}H NMR 7-Methyl-1-oxido-quinolin-1-ium **(75)**



LCMS 7-Methyl-1-oxido-quinolin-1-ium **(75)**



Integration Result

Peak Table

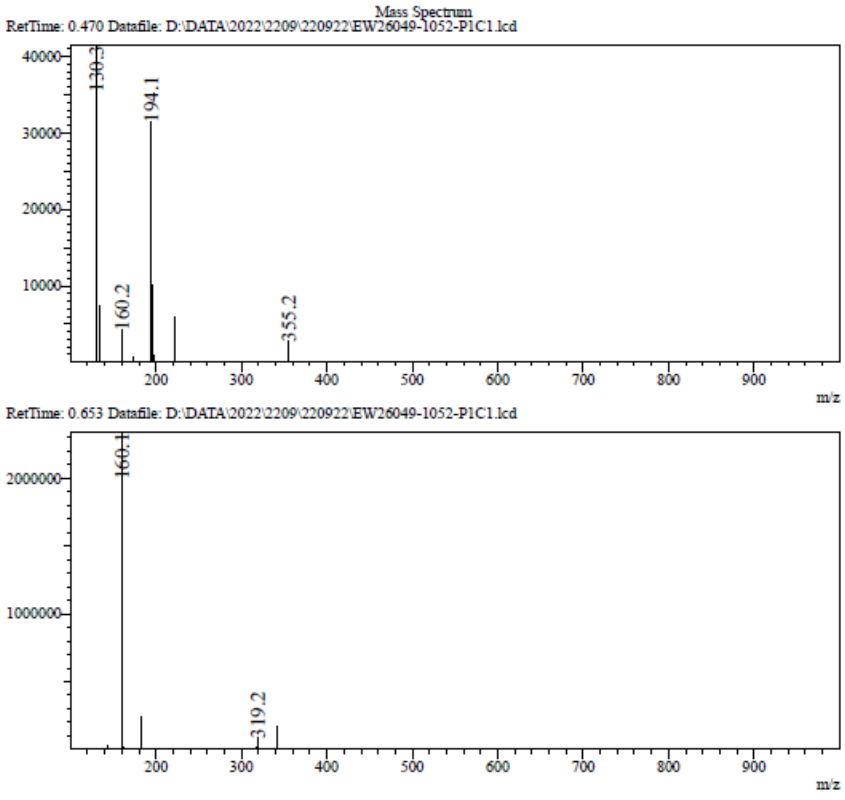
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.471	11394	0.384	0.181	73212	0.688
2	0.653	2959336	99.616	0.080	10567329	99.312

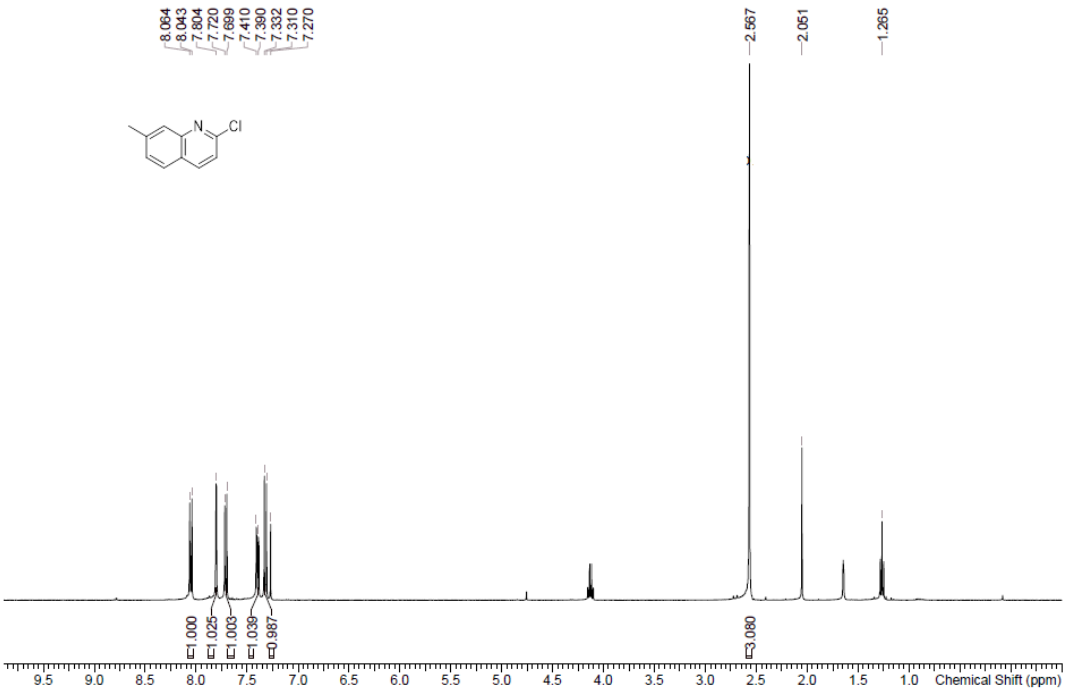
Peak Table

PDA Ch2 254nm

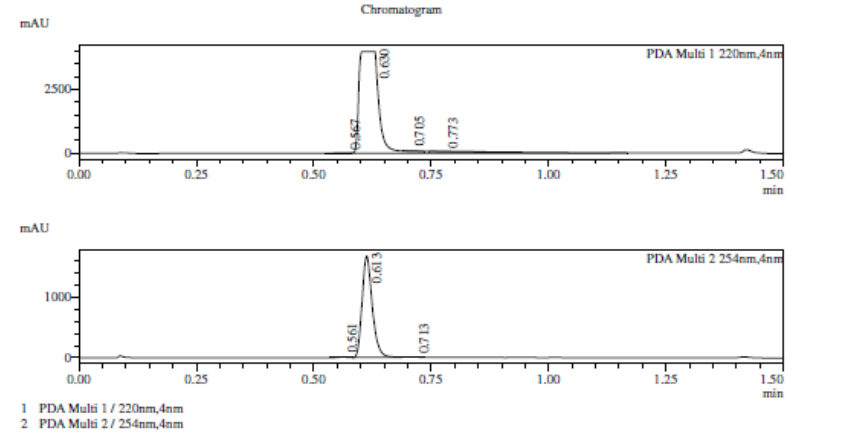
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.461	4803	0.304	0.181	30554	0.859
2	0.638	1573636	99.696	0.068	3524642	99.141



^{1}H NMR 2-Chloro-7-methyl-quinoline **(76)**



LCMS 2-Chloro-7-methyl-quinoline **(76)**



Integration Result

Peak Table

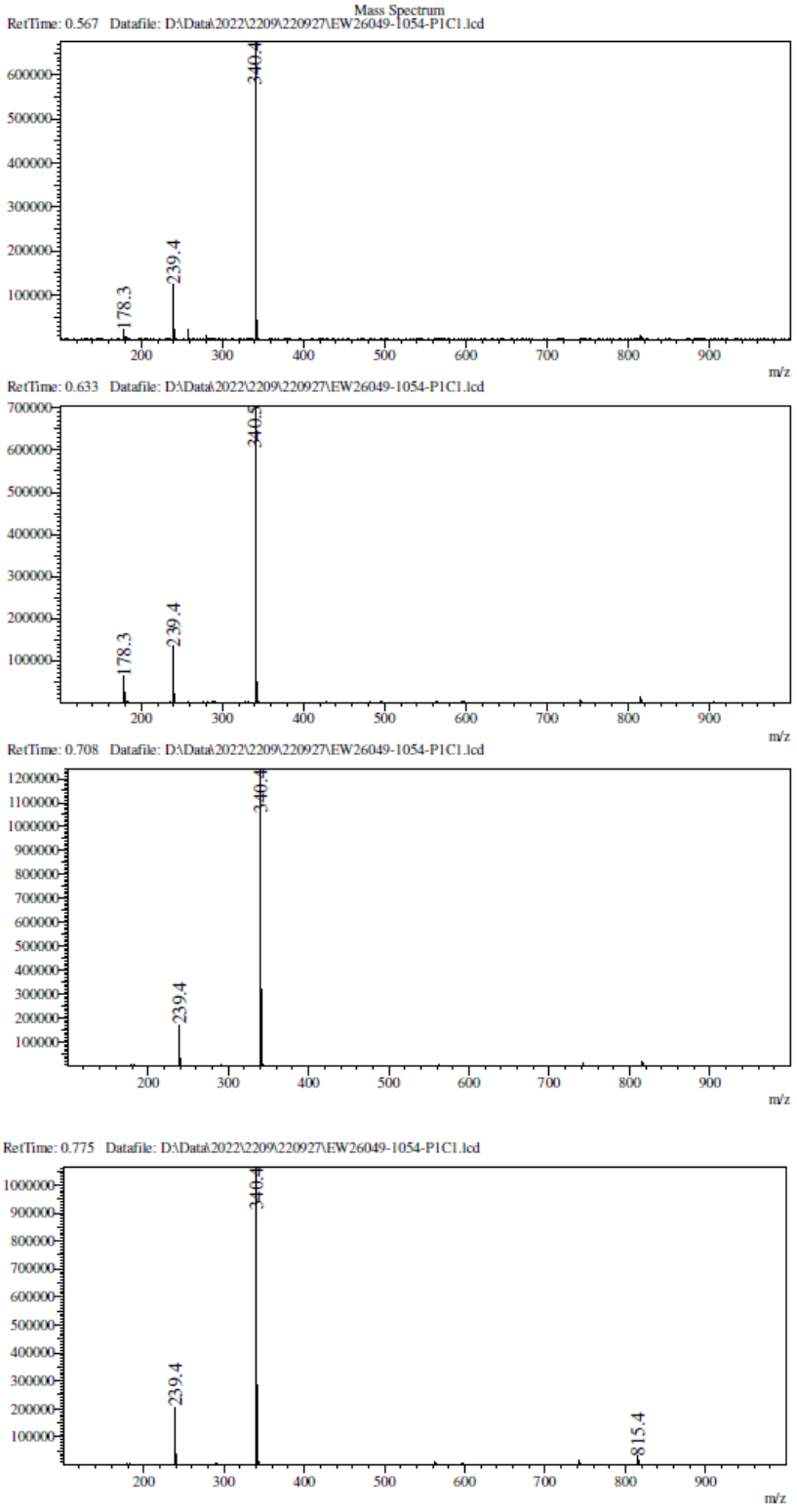
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.567	13962	0.347	0.057	22856	0.187
2	0.630	3986957	99.198	0.056	12179344	99.510
3	0.705	14429	0.359	0.037	18133	0.148
4	0.773	3833	0.095	0.117	18990	0.155

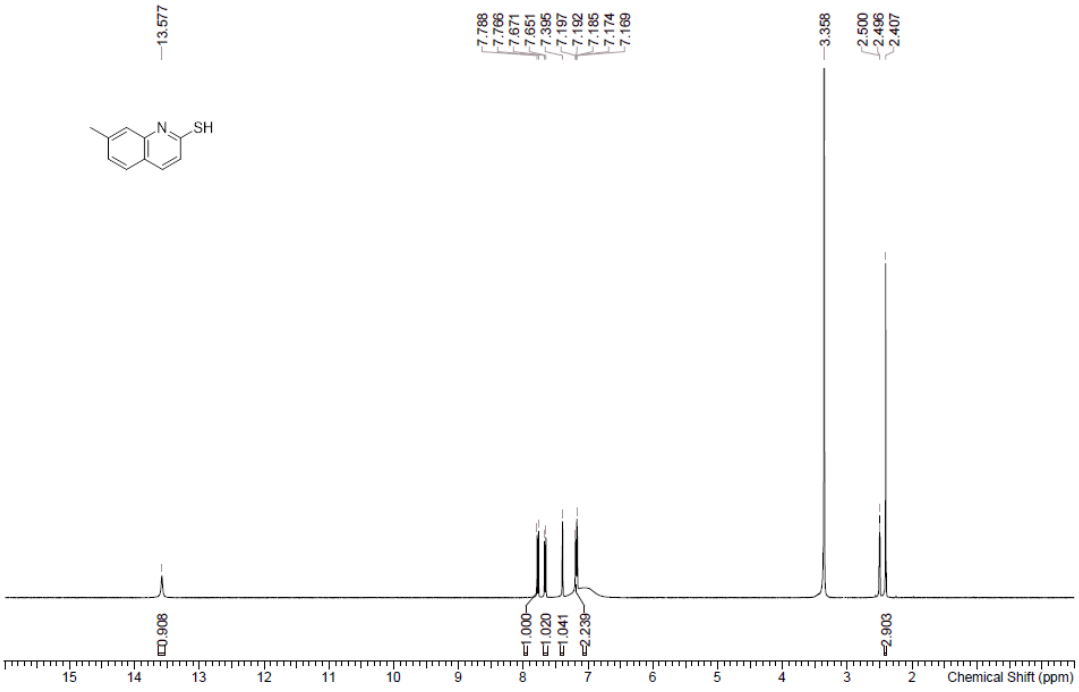
Peak Table

PDA Ch2 254nm

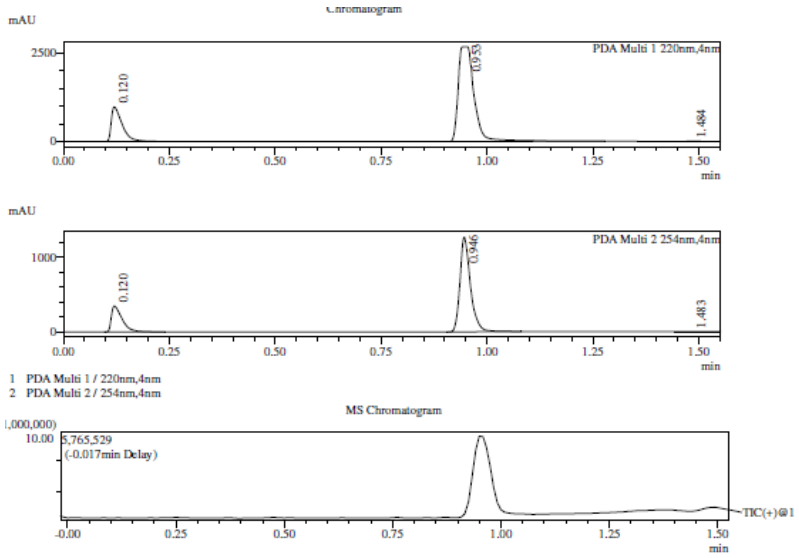
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.561	6277	0.373	0.037	8222	0.323
2	0.613	1675305	99.438	0.041	2528900	99.403
3	0.713	3188	0.189	0.084	6962	0.274


Mass Spectrum
RetTime: 0.567 Datafile: D:\Data\2022\2209\220927\EW26049-1054-P1C1.lcd
340.4
239.4
178.3
m/z
RetTime: 0.633 Datafile: D:\Data\2022\2209\220927\EW26049-1054-P1C1.lcd
340.5
239.4
178.3
m/z
RetTime: 0.708 Datafile: D:\Data\2022\2209\220927\EW26049-1054-P1C1.lcd
340.4
239.4
m/z
RetTime: 0.775 Datafile: D:\Data\2022\2209\220927\EW26049-1054-P1C1.lcd
340.4
239.4
815.4
m/z

^{1}H NMR 7-Methylquinoline-2-thiol **(77)**



LCMS 7-Methylquinoline-2-thiol **(77)**



Integration Result

Peak Table

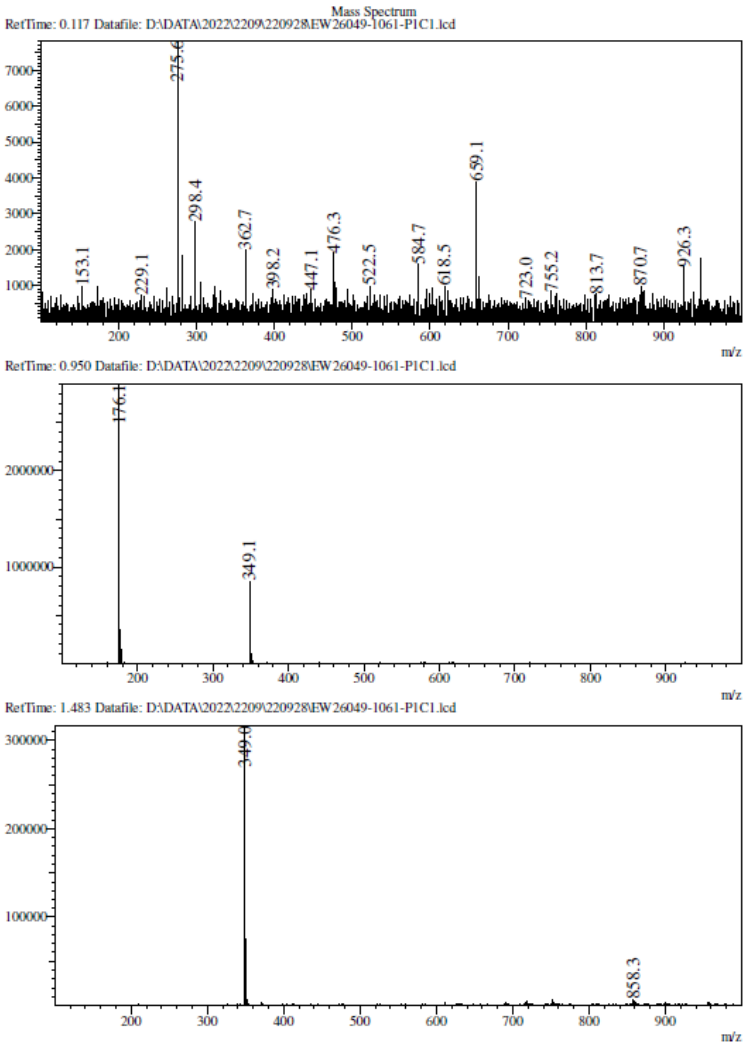
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.120	981276	26.708	0.047	1764832	20.097
2	0.953	2689178	73.192	0.056	7008323	79.806
3	1.484	3677	0.100	0.067	8559	0.097

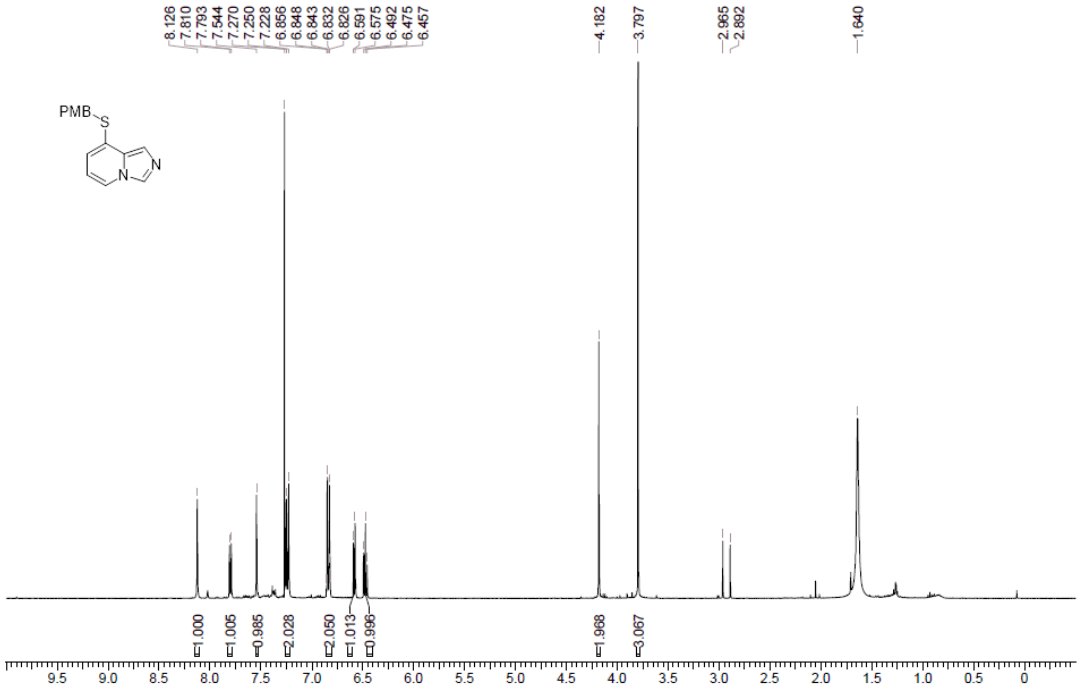
Peak Table

PDA Ch2 254nm

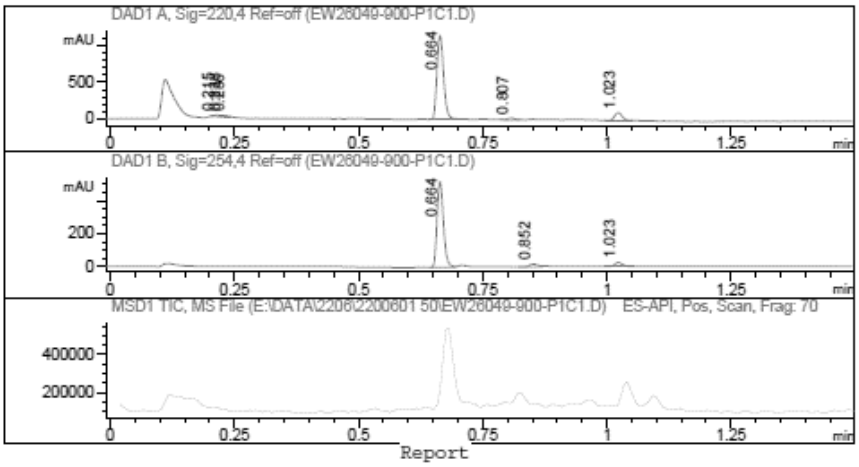
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.120	346312	21.394	0.047	616222	21.838
2	0.946	1268178	78.343	0.045	2191839	77.676
3	1.483	4260	0.263	0.082	13710	0.486


Mass Spectrum
RetTime: 0.117 Datafile: D:\DATA\2022\2209\220928\EW26049-1061-P1C1.lcd
275.4
298.4
362.7
398.2
447.1
476.3
522.5
584.7
618.5
699.1
723.0
755.2
813.7
870.7
926.3
153.1
229.1
m/z
RetTime: 0.950 Datafile: D:\DATA\2022\2209\220928\EW26049-1061-P1C1.lcd
176.1
349.1
m/z
RetTime: 1.483 Datafile: D:\DATA\2022\2209\220928\EW26049-1061-P1C1.lcd
349.0
858.3
m/z

^{1}H NMR 8-[(4-methoxyphenyl)methylsulfanyl]imidazo[1,5-a]pyridine **(79)**



LCMS 8-[(4-methoxyphenyl)methylsulfanyl]imidazo[1,5-a]pyridine **(79)**



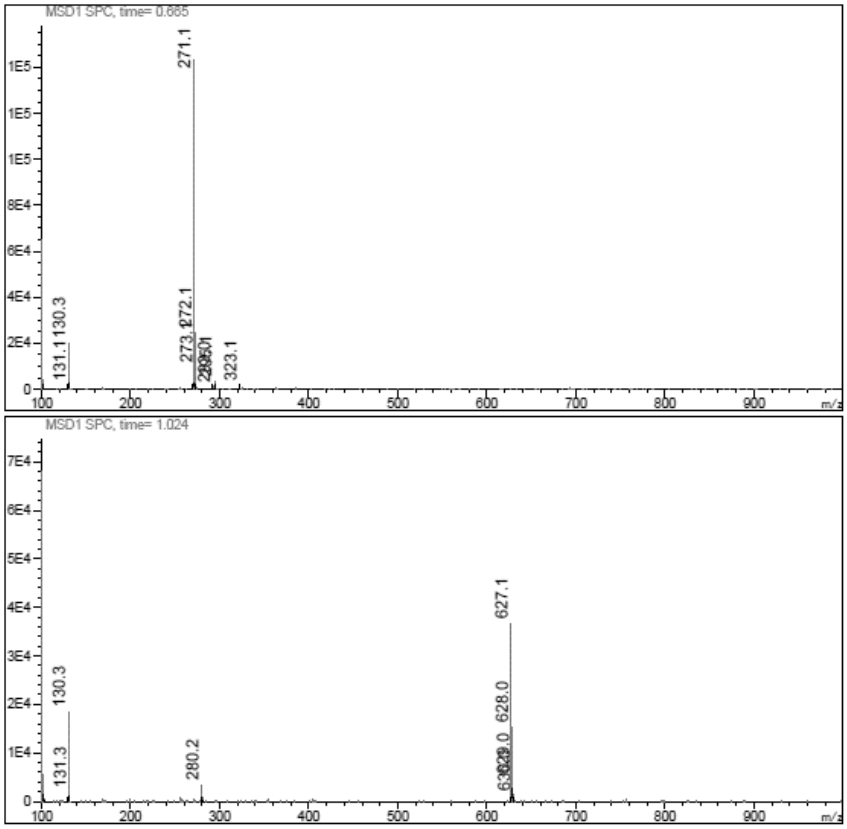
Report

Signal 1 : DAD1 A, Sig=220,4 Ref=off

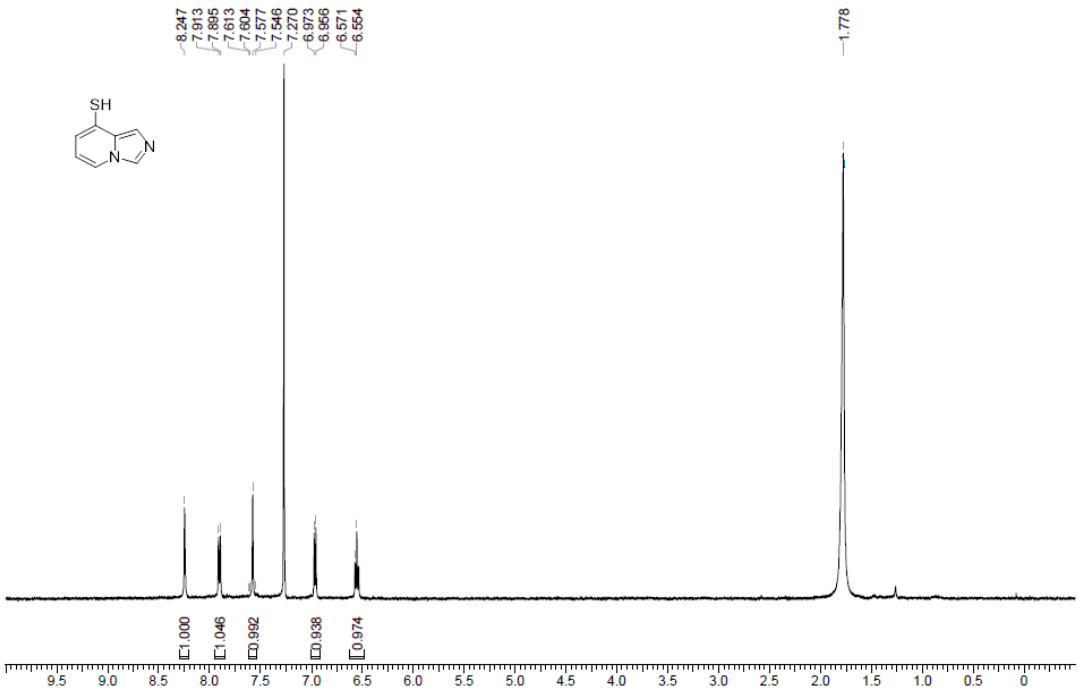
#	Meas. Ret.	Height	Width	Area	Area %
1	0.215	20.078	0.016	22.199	1.759
2	0.228	19.674	0.008	9.549	0.757
3	0.236	15.687	0.008	7.158	0.567
4	0.664	1152.937	0.014	1074.950	85.184
5	0.807	22.970	0.015	22.046	1.747
6	1.023	111.341	0.017	126.014	9.986

Signal 2 : DAD1 B, Sig=254,4 Ref=off

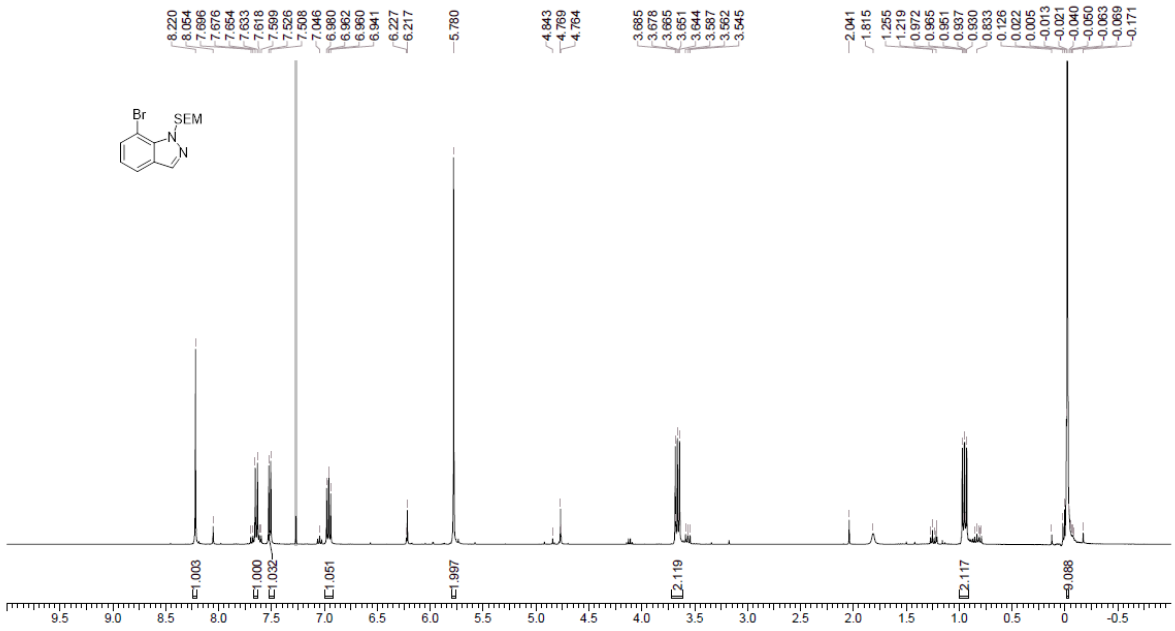
#	Meas. Ret.	Height	Width	Area	Area %
1	0.664	521.269	0.014	465.063	91.003
2	0.852	17.640	0.017	19.793	3.873
3	1.023	24.565	0.016	26.185	5.124



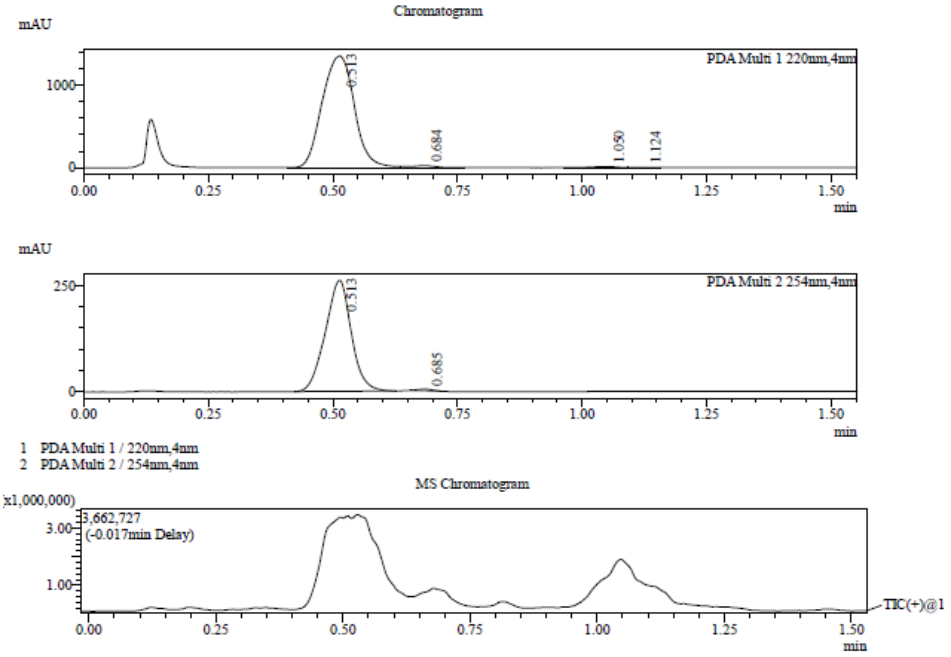
^{1}H NMR Imidazo[1,5-a]pyridine-8-thiol **(80)**



^{1}H NMR 7-Bromo-1-((2-(trimethylsilyl)ethoxy)methyl)-1H-indazole **(82)**



LCMS 7-Bromo-1-((2-(trimethylsilyl)ethoxy)methyl)-1H-indazole **(82)**



Integration Result

Peak Table

PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.513	1348759	97.208	0.114	6057321	97.814
2	0.684	22531	1.624	0.243	81431	1.315
3	1.050	12340	0.889	0.094	44505	0.719
4	1.124	3866	0.279	0.106	9442	0.152

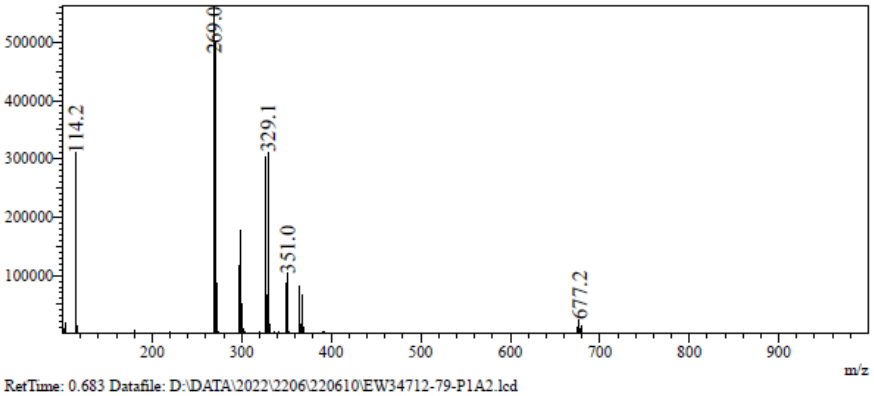
Peak Table

PDA Ch2 254nm

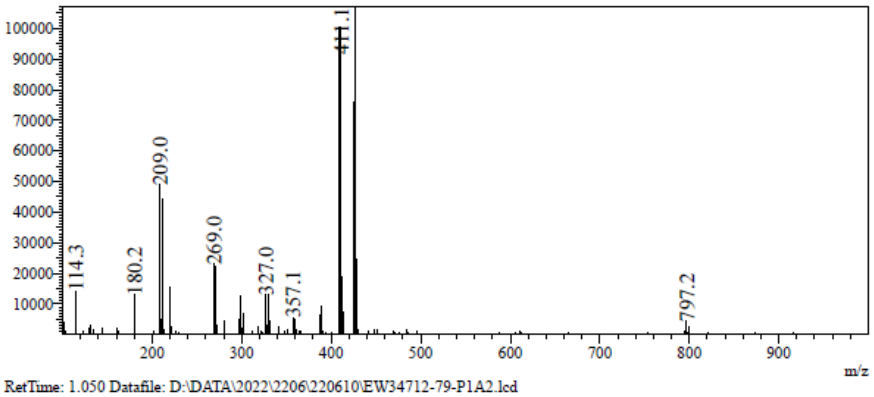
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.513	260850	98.559	0.097	949349	99.188
2	0.685	3814	1.441	0.059	7770	0.812

Mass Spectrum

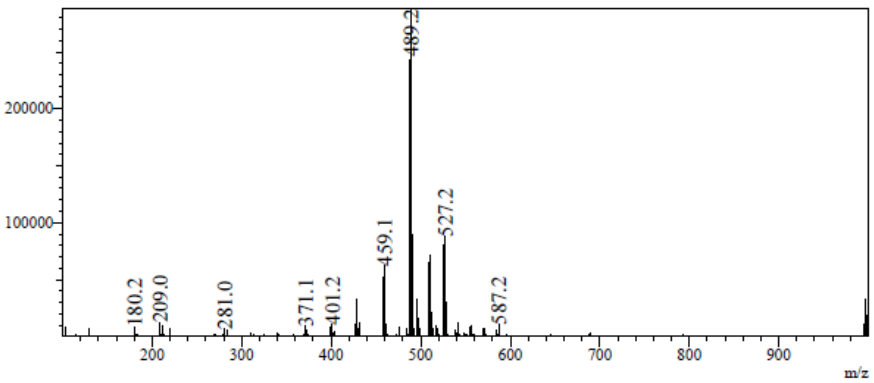
RetTime: 0.513 Datafile: D:\DATA\2022\2206\220610\EW34712-79-P1A2.lcd



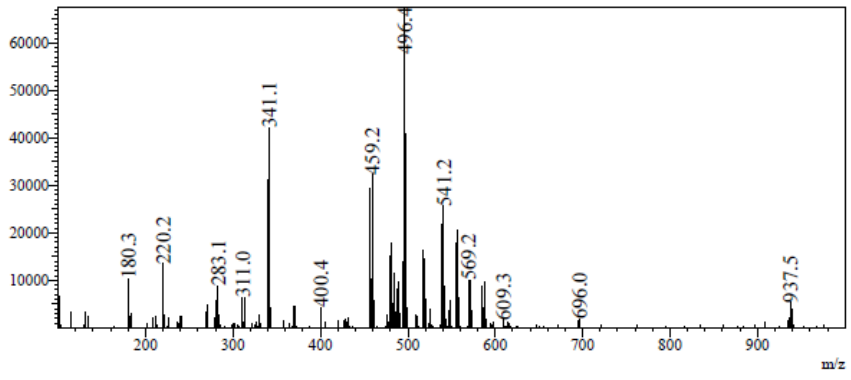
RetTime: 0.683 Datafile: D:\DATA\2022\2206\220610\EW34712-79-P1A2.lcd



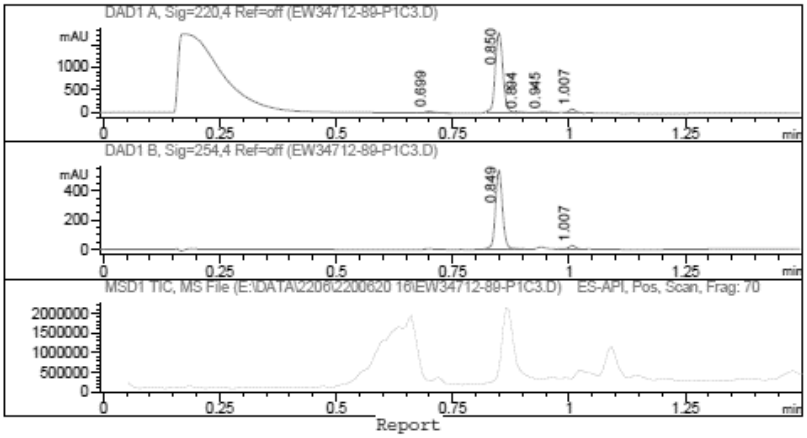
RetTime: 1.050 Datafile: D:\DATA\2022\2206\220610\EW34712-79-P1A2.lcd



RetTime: 1.123 Datafile: D:\DATA\2022\2206\220610\EW34712-79-P1A2.lcd



LCMS S7-((4-Methoxybenzyl)thio)-1H-indazole **(84)**



Report

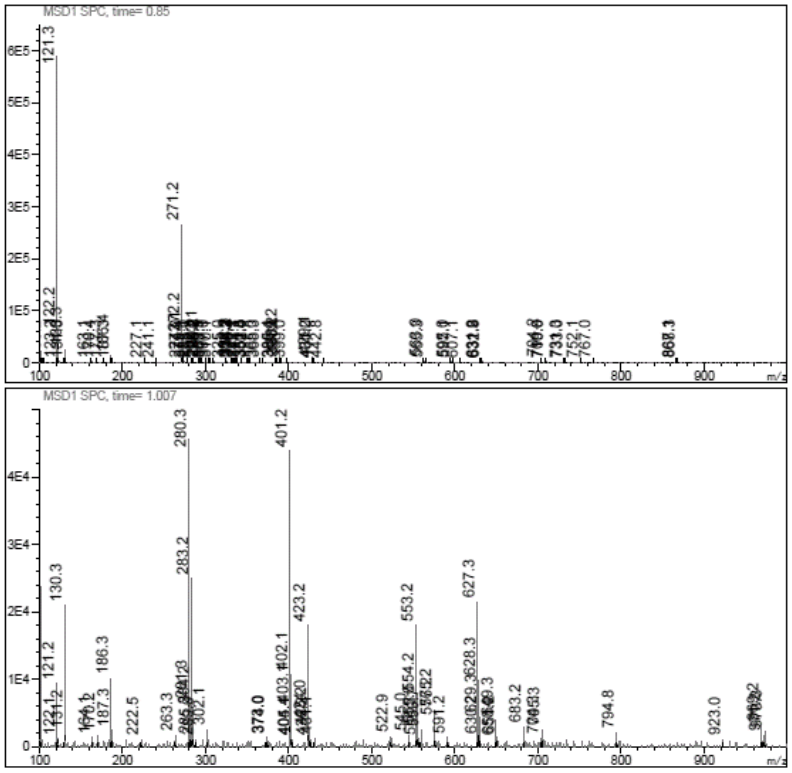
==========

Signal 1 : DAD1 A, Sig=220,4 Ref=off

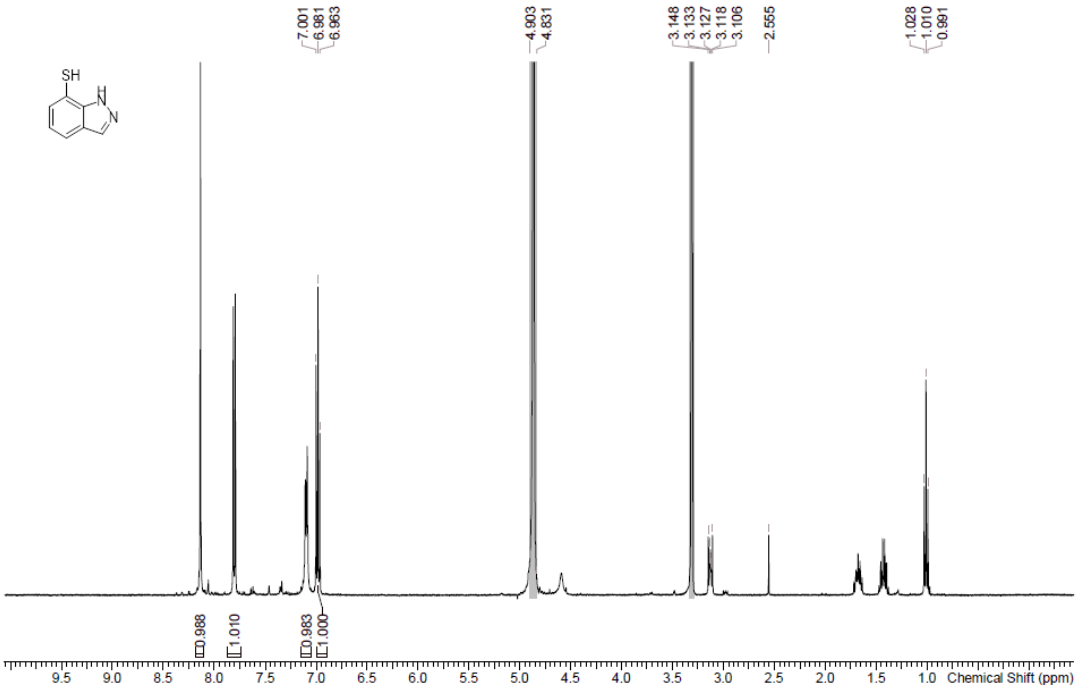
#	Meas. Ret.	Height	Width	Area	Area %
1	0.699	35.876	0.018	44.023	1.989
2	0.850	1777.898	0.018	2030.185	91.741
3	0.894	20.543	0.016	23.058	1.042
4	0.945	23.152	0.021	31.548	1.426
5	1.007	83.924	0.015	84.138	3.802

Signal 2 : DAD1 B, Sig=254,4 Ref=off

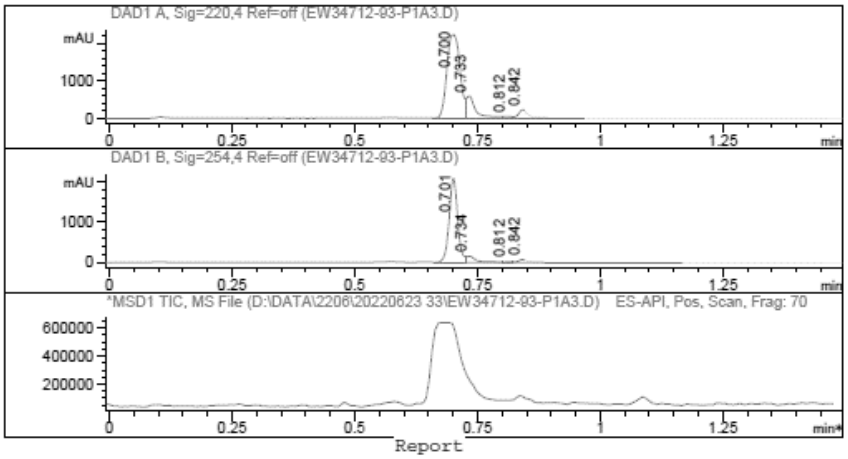
#	Meas. Ret.	Height	Width	Area	Area %
1	0.849	543.465	0.016	572.278	95.748
2	1.007	24.332	0.016	25.413	4.252



^{1}H NMR 1H-Indazole-7-thiol **(85)**



LCMS 1H-Indazole-7-thiol **(85)**



Report

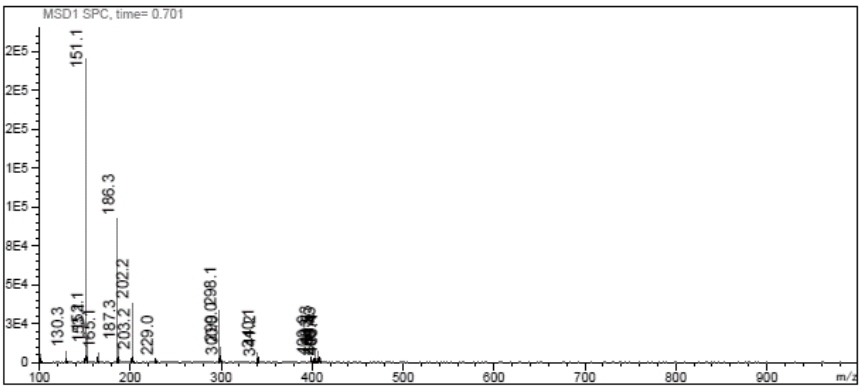
==========

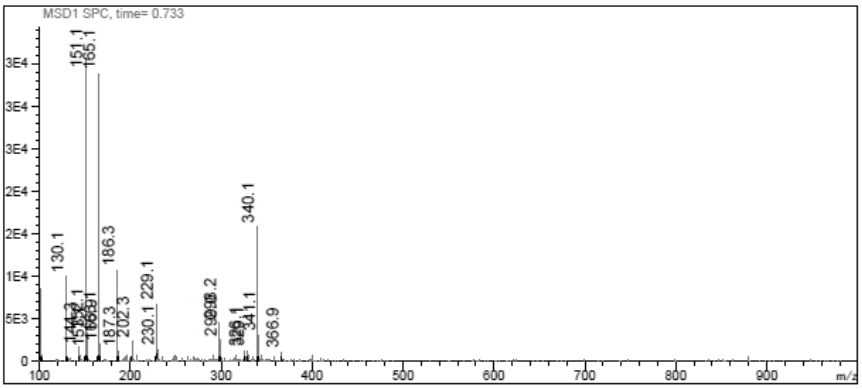
Signal 1 : DAD1 A, Sig=220,4 Ref=off

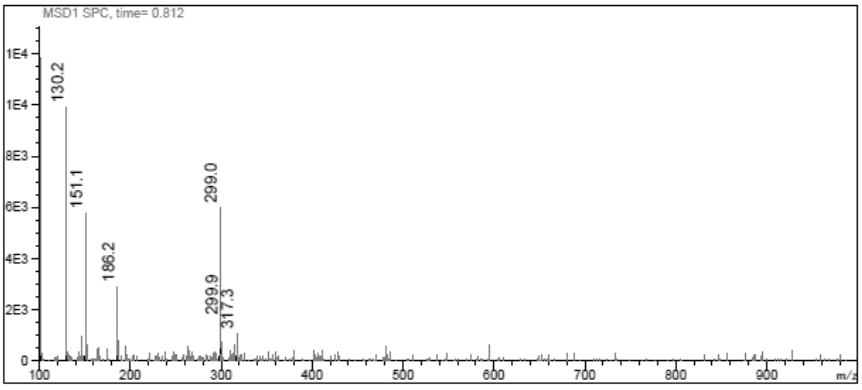
#	Meas. Ret.	Height	Width	Area	Area %
1	0.700	2242.561	0.030	4175.400	76.974
2	0.733	594.393	0.020	825.402	15.216
3	0.812	51.604	0.016	57.294	1.056
4	0.842	230.986	0.022	366.334	6.753

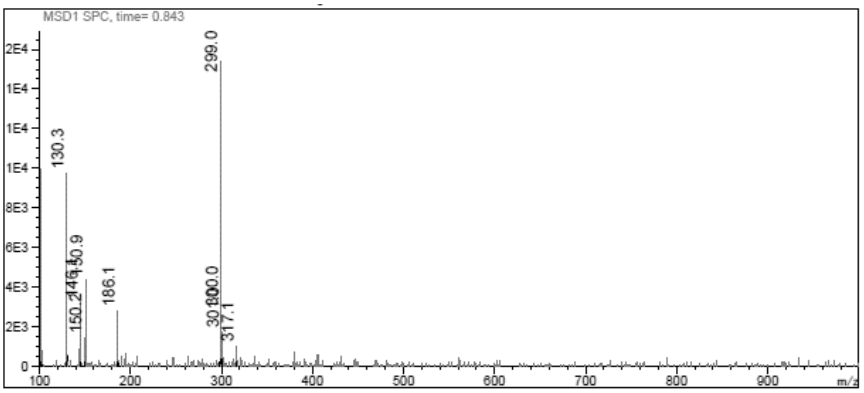
Signal 2 : DAD1 B, Sig=254,4 Ref=off

#	Meas. Ret.	Height	Width	Area	Area %
1	0.701	2089.253	0.019	2522.999	83.574
2	0.734	157.495	0.021	230.486	7.635
3	0.812	20.125	0.017	23.690	0.785
4	0.842	74.143	0.042	241.720	8.007

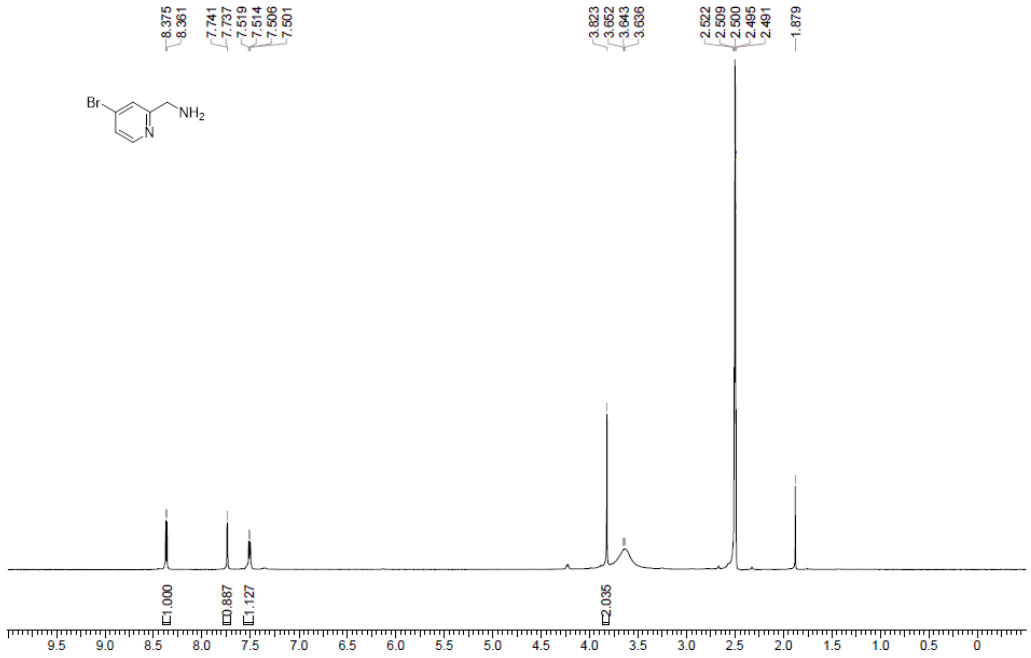

MSD1 SPC, time= 0.701
151.1
186.3
130.3
202.2
229.0
298.1
340.1


MSD1 SPC, time= 0.733
151.1
165.1
130.1
186.3
340.1
230.1
229.1
202.3
366.9


MSD1 SPC, time= 0.812
130.2
151.1
299.0
186.2
299.9
317.3

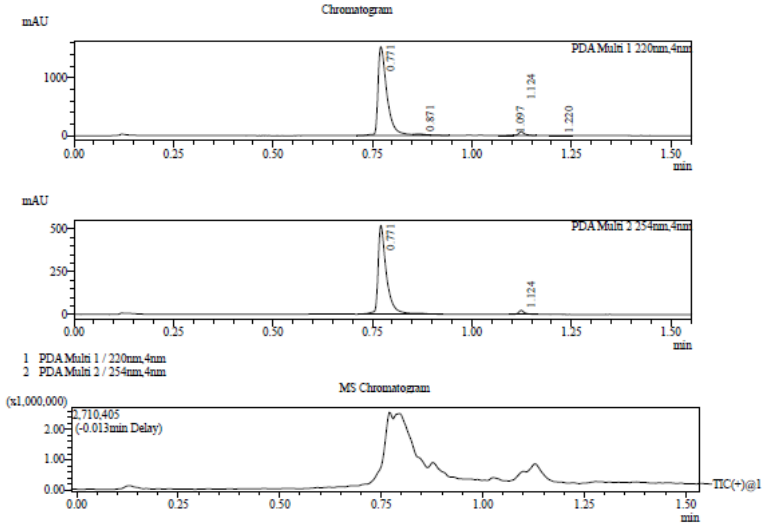

MSD1 SPC, time= 0.843
299.0
130.3
186.1
317.1

^{1}H NMR (4-Bromo-2-pyridyl)methanamine **(87)**



LCMS (4-Bromo-2-pyridyl)methanamine **(87)**

Compound ID : 1
Sample ID : EW26049-913-P1C1
Injection Vol : 5ul
Location : vial64
Acq Method : D:\method\0-60CD_R_220&254_POS.lcm
Org DataFile : D:\DATA\2022\2206\220614\EW26049-913-P1C1.lc
Injection Date : 2022-06-14 18:01:25
Instrument :LCMS-O 15-105



Integration Result

Peak Table

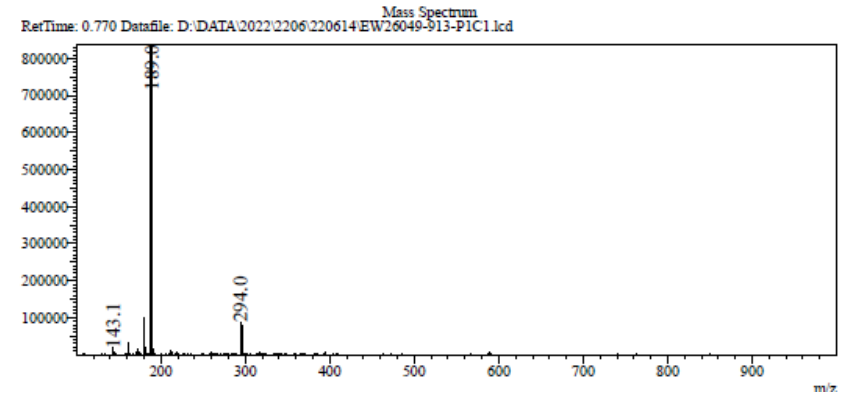
PDA Ch1 220nm

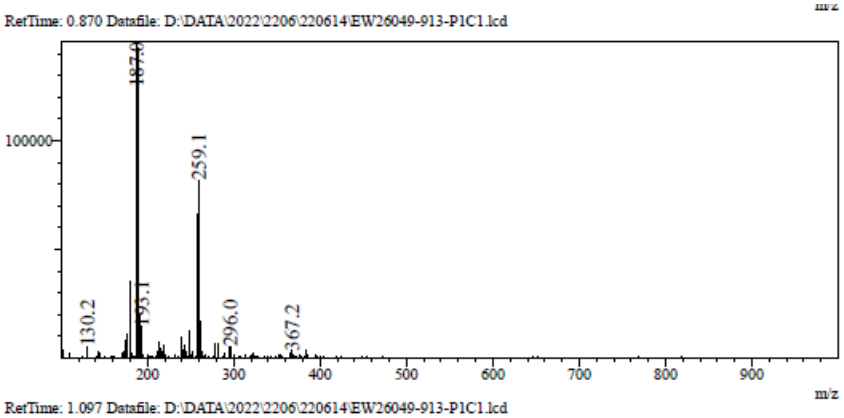
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.771	1532626	94.715	0.040	2414874	96.401
2	0.871	9480	0.586	0.035	11159	0.445
3	1.097	5905	0.365	0.067	7198	0.287
4	1.124	66608	4.116	0.026	66713	2.663
5	1.220	3524	0.218	0.040	5076	0.203

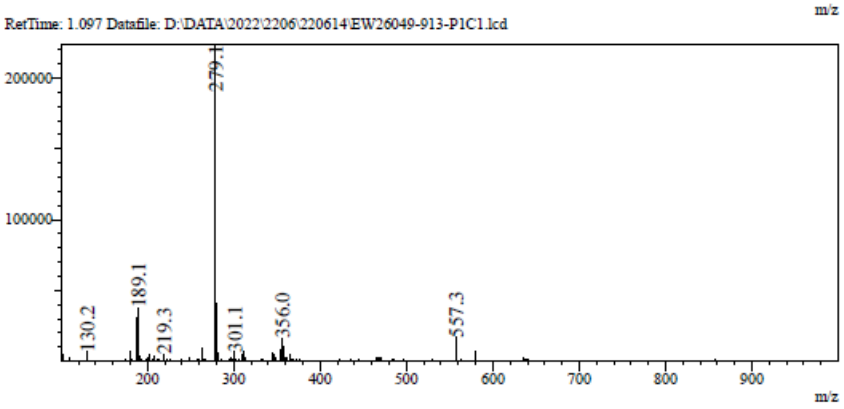
Peak Table

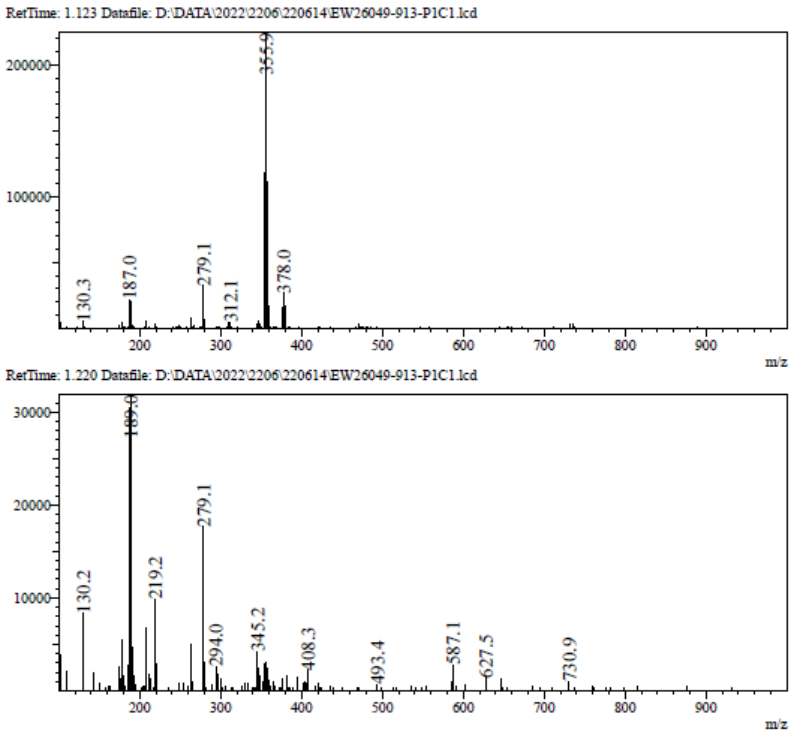
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.771	518067	95.740	0.037	764959	97.058
2	1.124	23054	4.260	0.026	23189	2.942

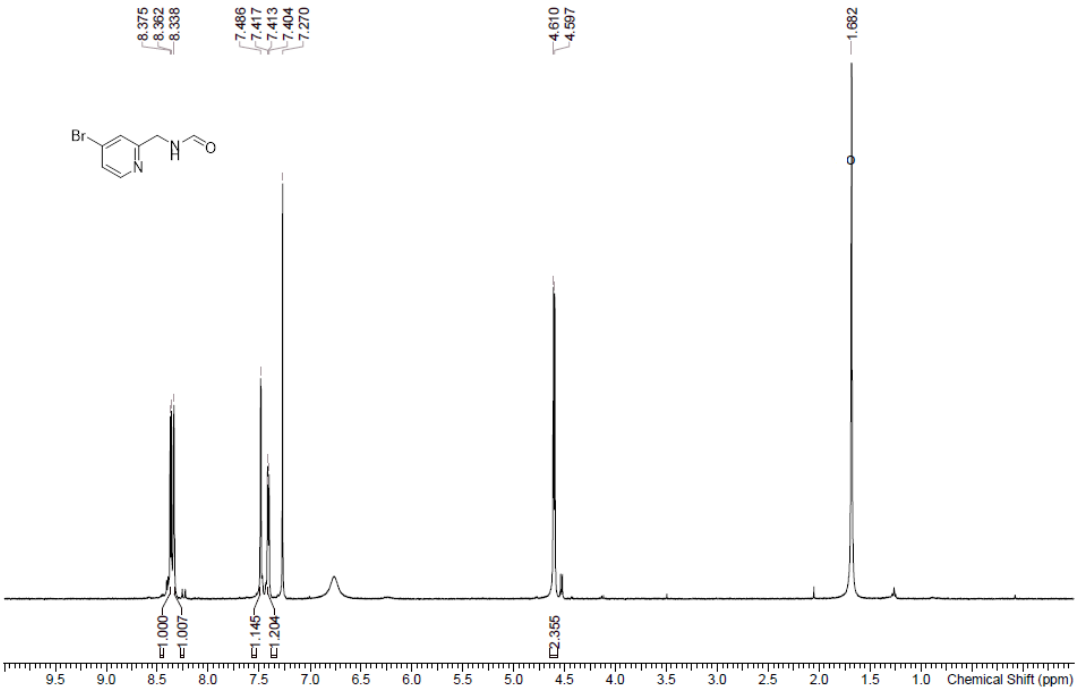

Mass Spectrum
RetTime: 0.770 Datafile: D:\DATA\2022\2206\220614\EW26049-913-P1C1.lcd
800000
700000
600000
500000
400000
300000
200000
100000
189.0
143.1
294.0
200
300
400
500
600
700
800
900
m/z


RetTime: 0.870 Datafile: D:\DATA\2022\2206\220614\EW26049-913-P1C1.lcd
100000
187.0
259.1
130.2
195.1
296.0
367.2
200
300
400
500
600
700
800
900
m/z

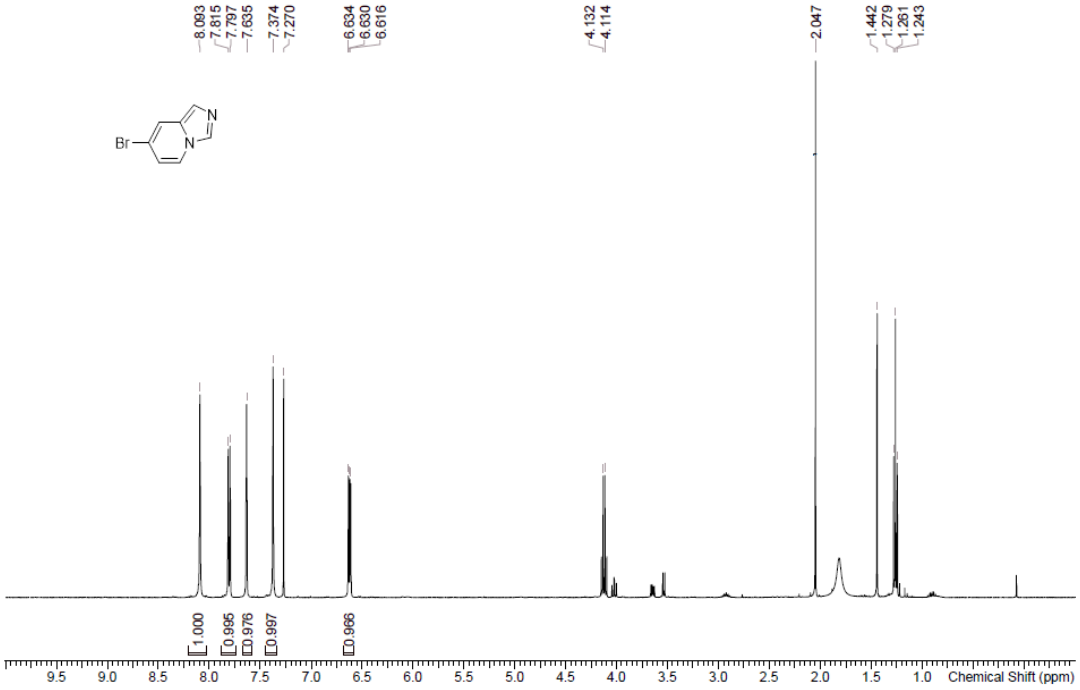

RetTime: 1.097 Datafile: D:\DATA\2022\2206\220614\EW26049-913-P1C1.lcd
200000
100000
279.1
189.1
130.2
219.3
301.1
356.0
557.3
200
300
400
500
600
700
800
900
m/z



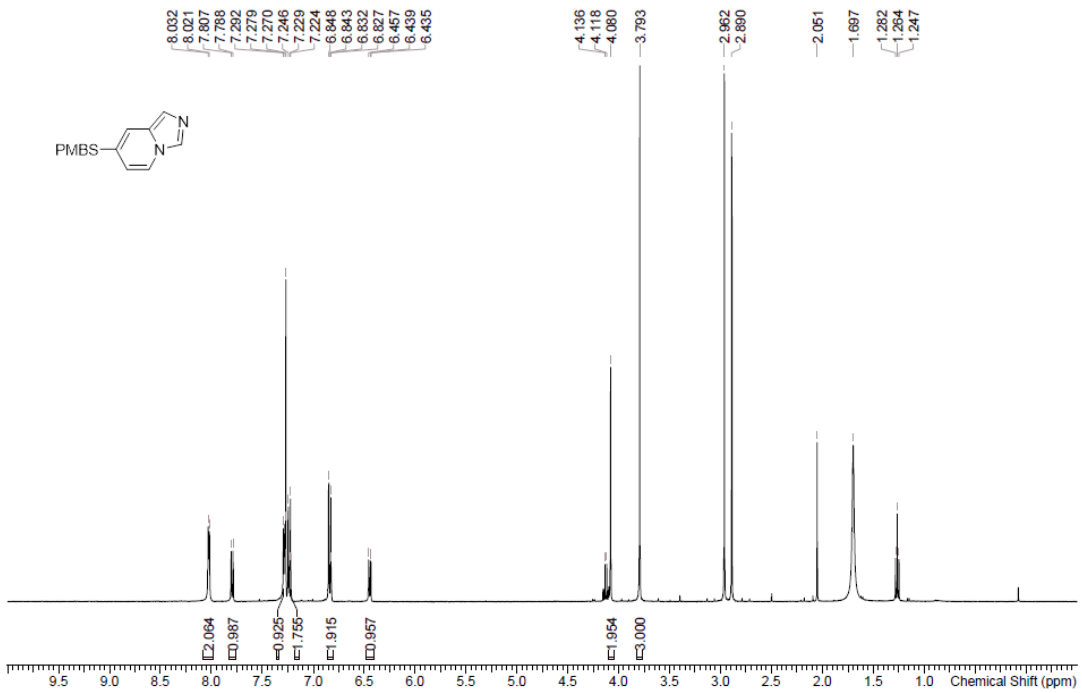
^{1}H NMR N-[(4-Bromo-2-pyridyl)methyl]formamide **(88)**



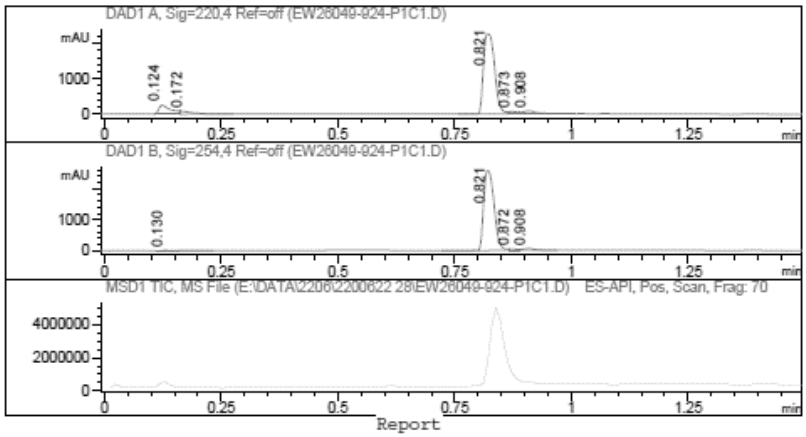
^{1}H NMR 7-Bromoimidazo[1,5-a]pyridine **(89)**



^{1}H NMR 7-[(4-Methoxyphenyl)methylsulfanyl]imidazo[1,5-a]pyridine **(90)**



LCMS 7-[(4-Methoxyphenyl)methylsulfanyl]imidazo[1,5-a]pyridine **(90)**



Report

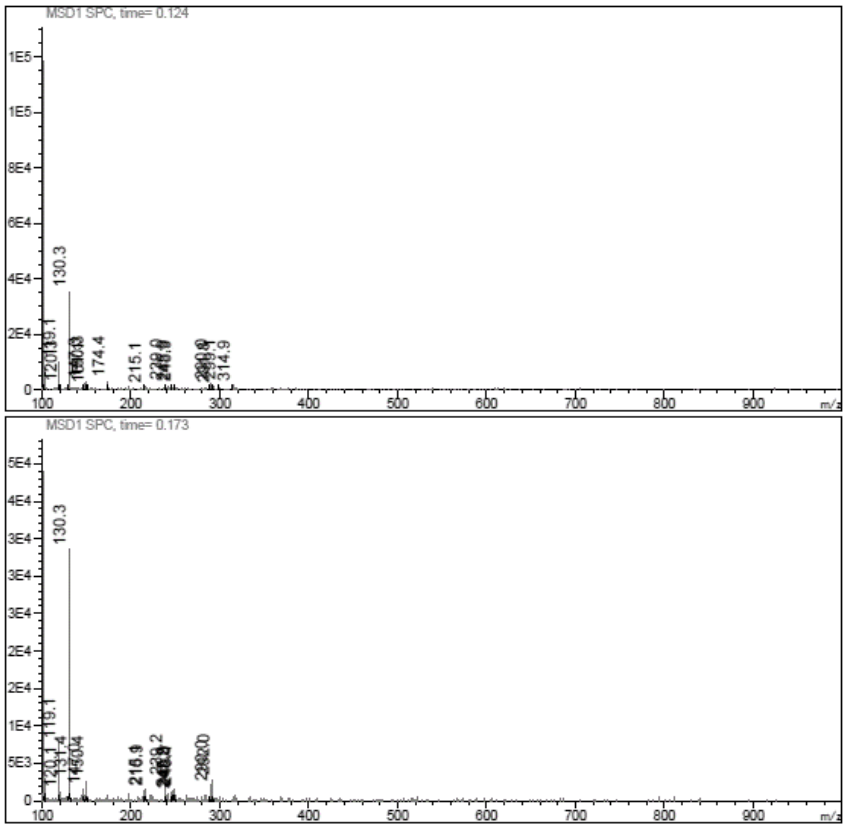
==========

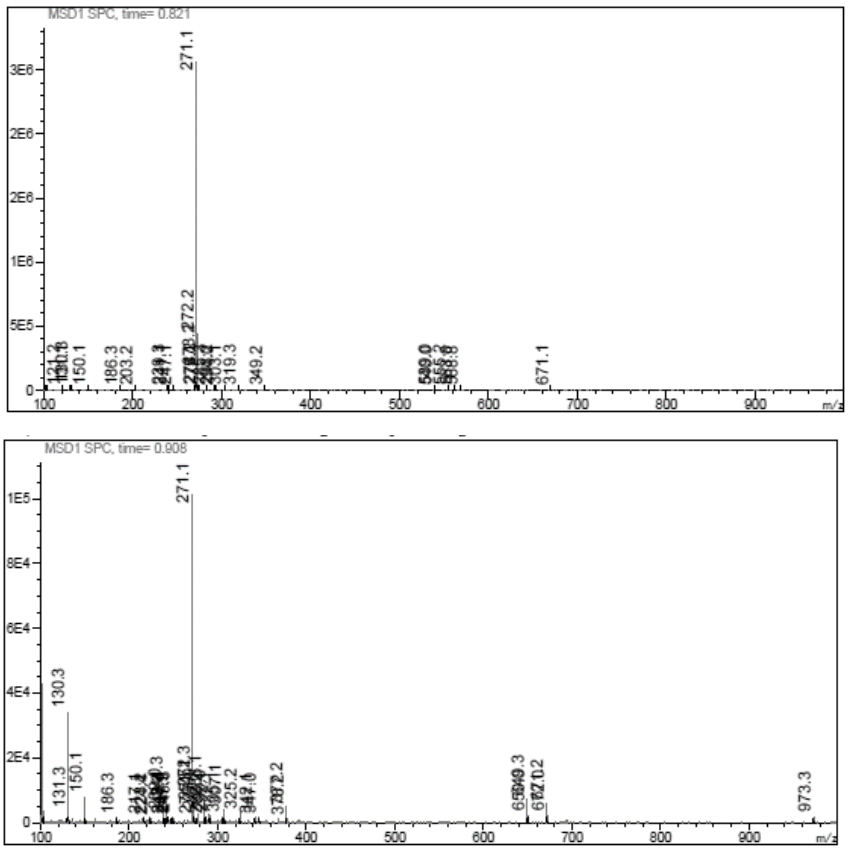
Signal 1 : DAD1 A, Sig=220,4 Ref=off

#	Meas. Ret.	Height	Width	Area	Area %
1	0.124	253.178	0.025	447.109	9.825
2	0.172	69.786	0.032	161.664	3.552
3	0.821	2268.042	0.027	3732.992	82.027
4	0.873	57.333	0.019	75.903	1.668
5	0.908	78.055	0.025	133.251	2.928

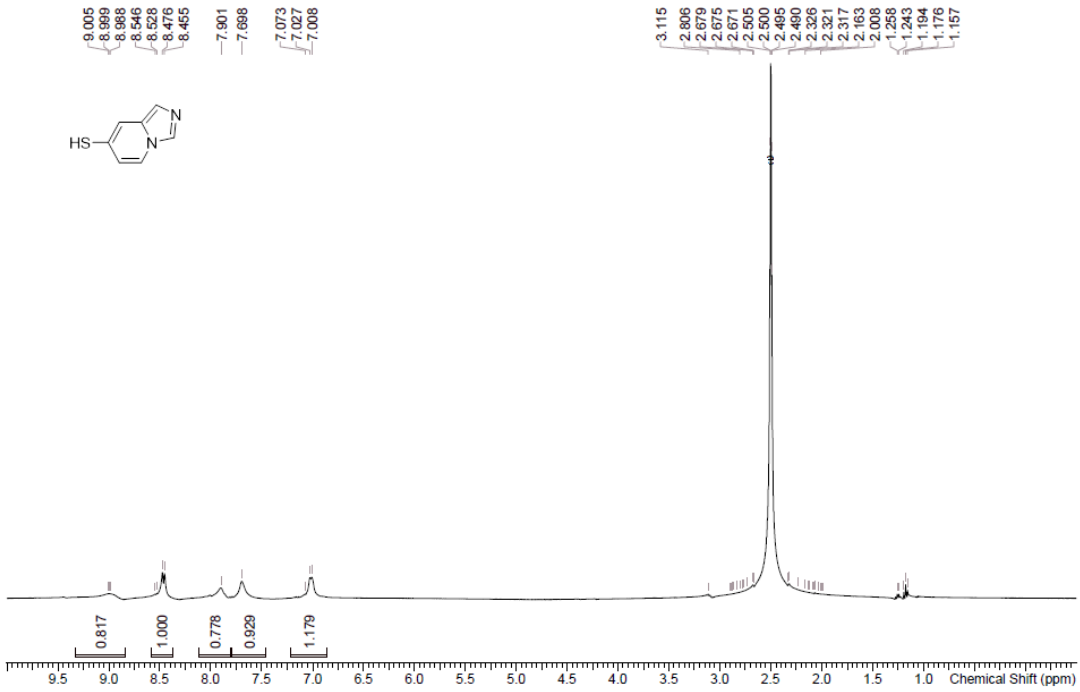
Signal 2 : DAD1 B, Sig=254,4 Ref=off

#	Meas. Ret.	Height	Width	Area	Area %
1	0.130	16.372	0.045	56.535	1.344
2	0.821	2578.774	0.025	3990.766	94.887
3	0.872	44.519	0.018	53.897	1.281
4	0.908	55.745	0.027	104.626	2.488

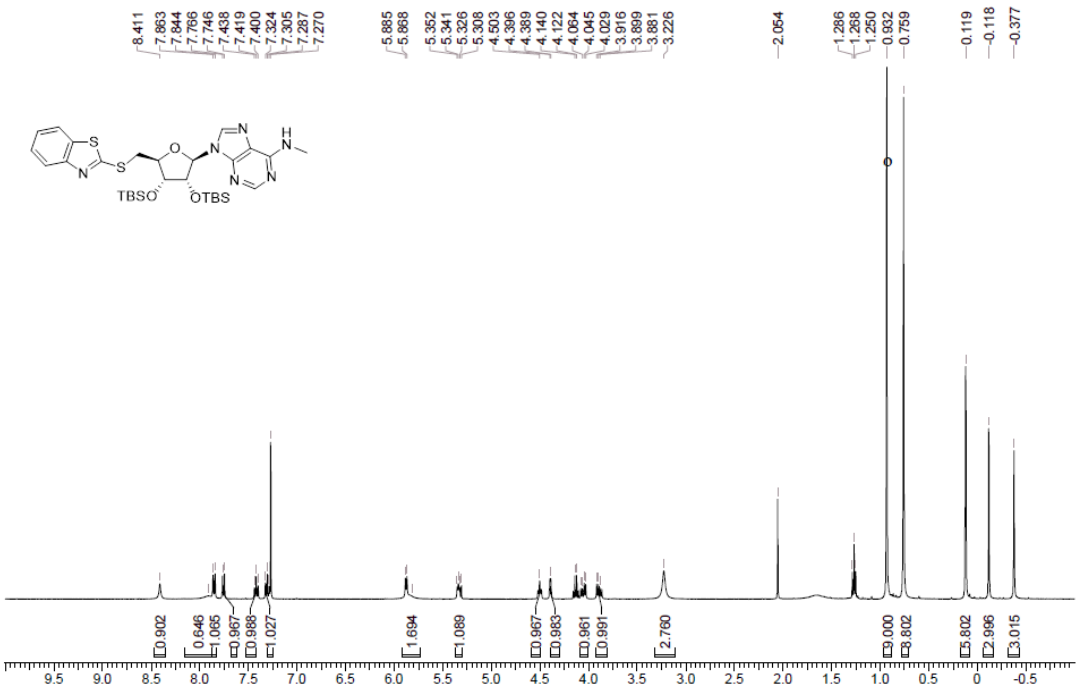




[1]H NMR Imidazo[1,5-a]pyridine-7-thiol **(91)**



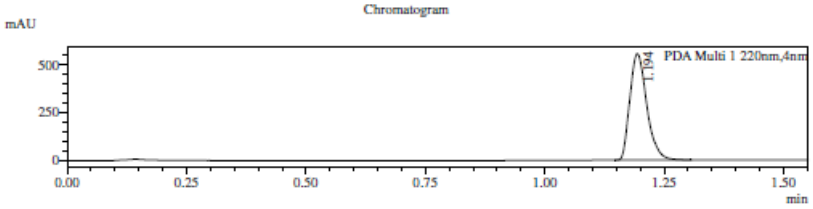
^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*-methyl-purin-6-amine **(93)**

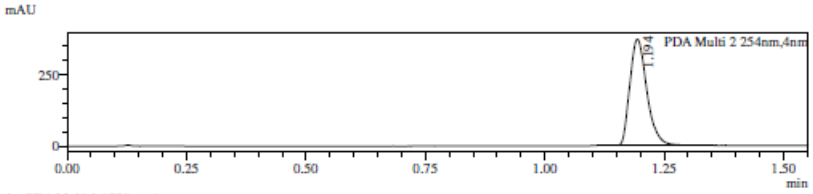


LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*-methyl-purin-6-amine **(93)**

Compound ID : 1
Sample ID : EW26049-722-P1S1
Injection Vol : 5ul
Location : vial84
Acq Method : D:\method\50-100CD_R_220&254_POS.lcm
Org DataFile : D:\DATA\2022\2201\220121\EW26049-722-P1S1.lc
Injection Date : 2022-01-21 19:30:41
Instrument :LCMS-W

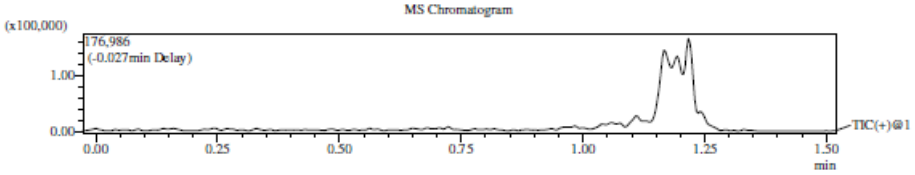
Chromatogram





1 PDA Multi 1 / 220nm,4nm
2 PDA Multi 2 / 254nm,4nm

MS Chromatogram



Integration Result

Peak Table

PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.194	555080	100.000	0.065	1369531	100.000

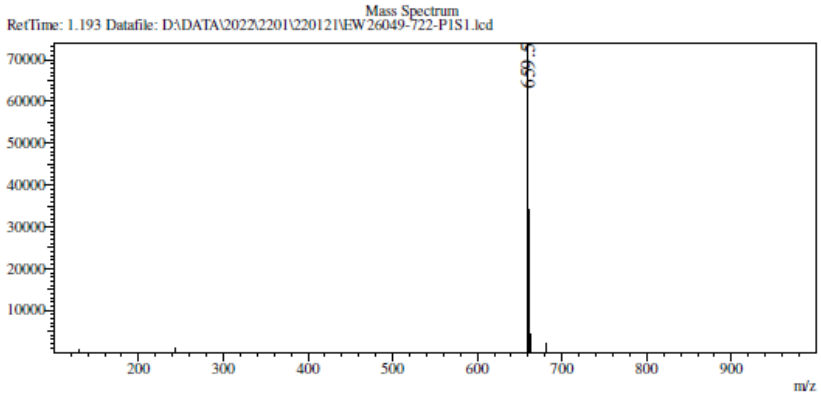
Peak Table

PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.194	372151	100.000	0.065	919959	100.000

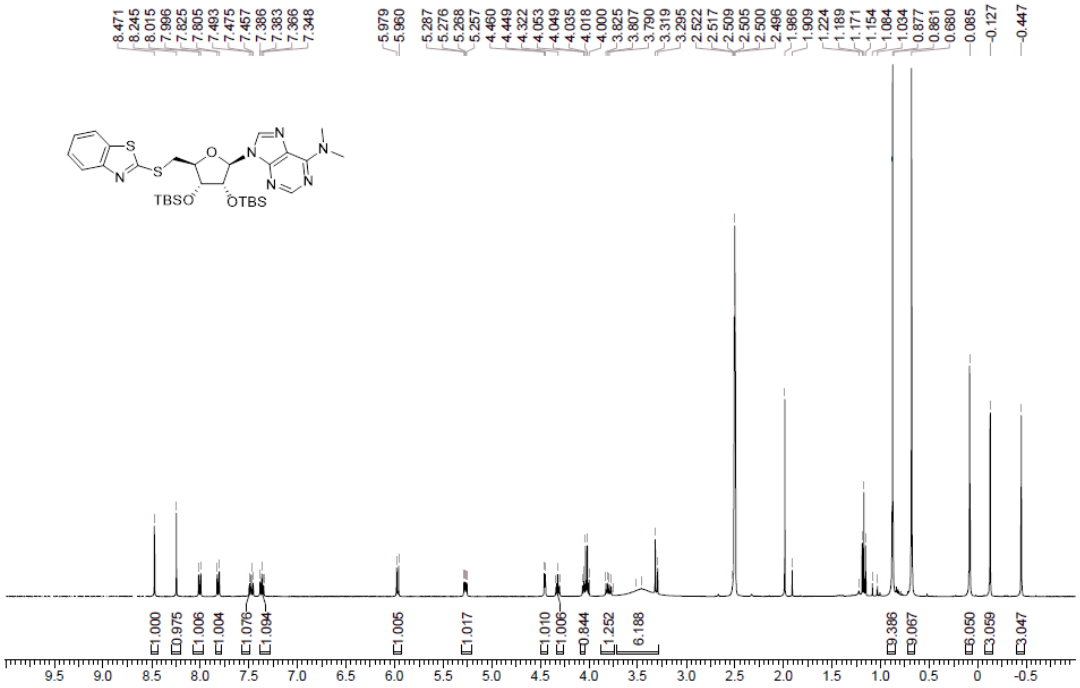
Mass Spectrum

RetTime: 1.193 Datafile: D:\DATA\2022\2201\220121\EW26049-722-P1S1.lcd

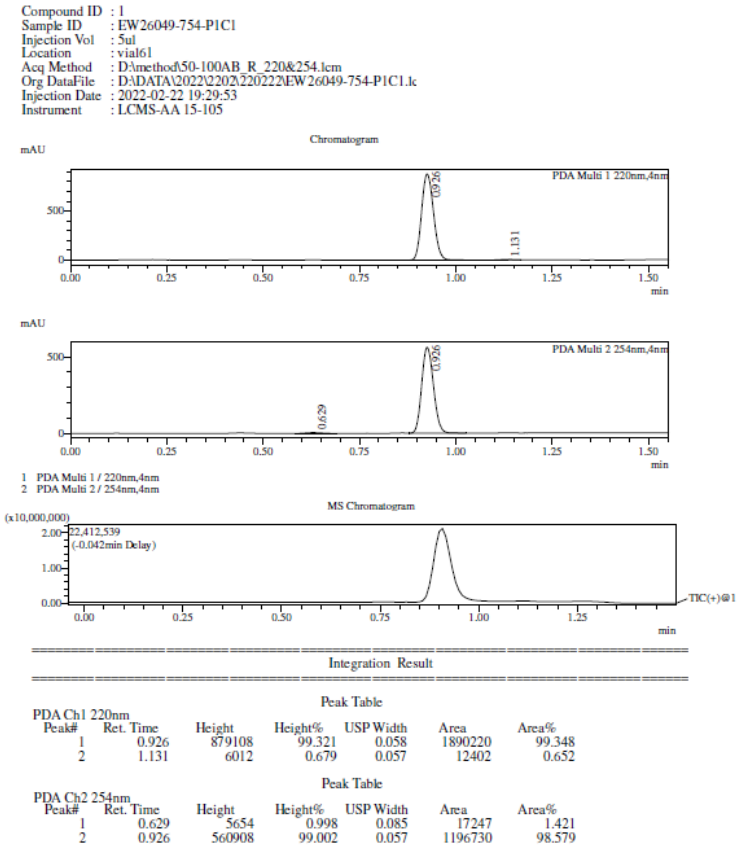


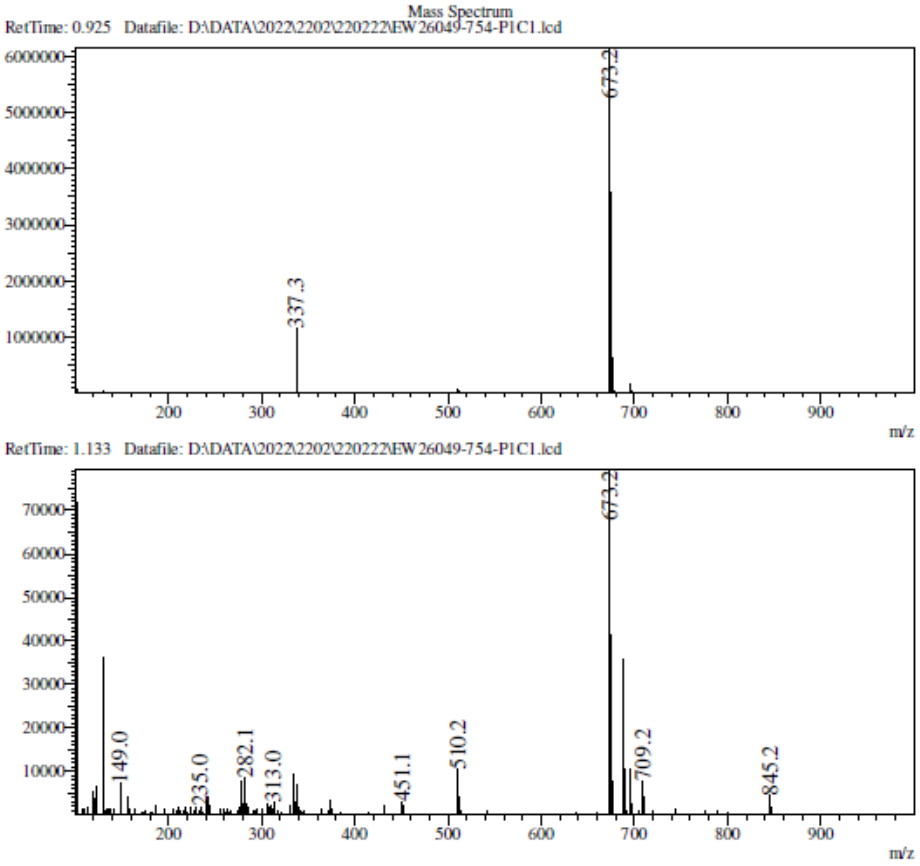
^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl(dimethyl)

silyl]oxy]tetrahydrofuran-2-yl]-*N*,*N*-dimethyl-purin-6-amine **(94)**

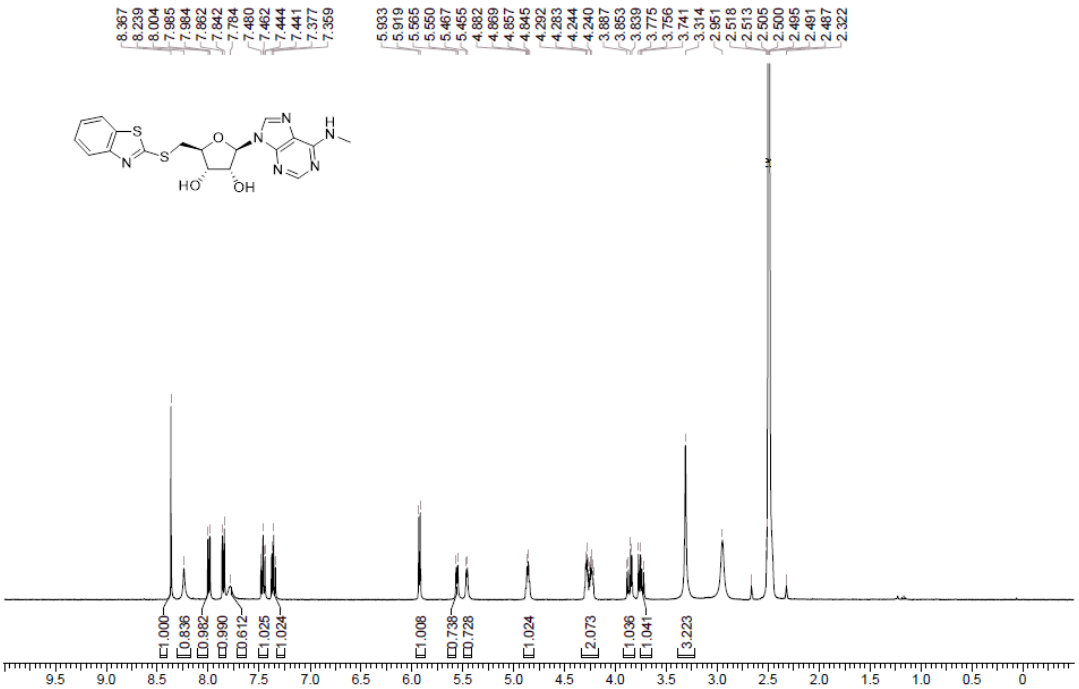


LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis[[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*,*N*-dimethyl-purin-6-amine **(94)**

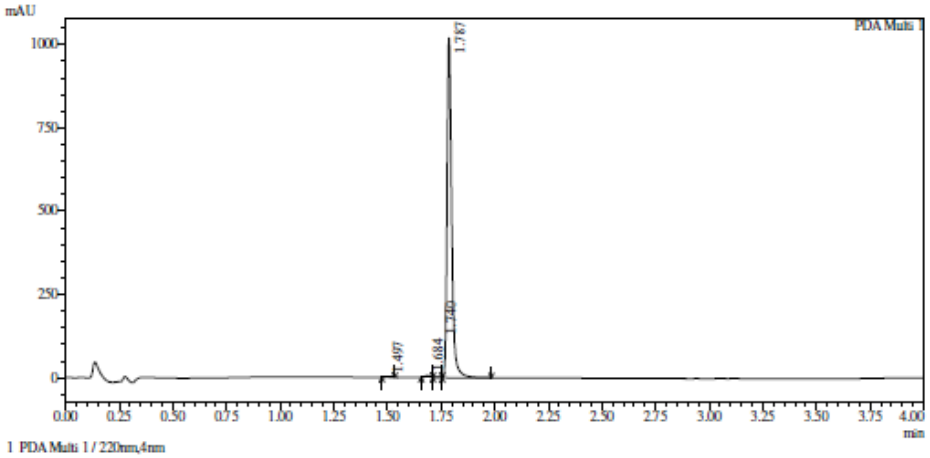




^{1}H NMR (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5-[6-(methylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(18)**



HPLC (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5-[6-(methylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(18)**

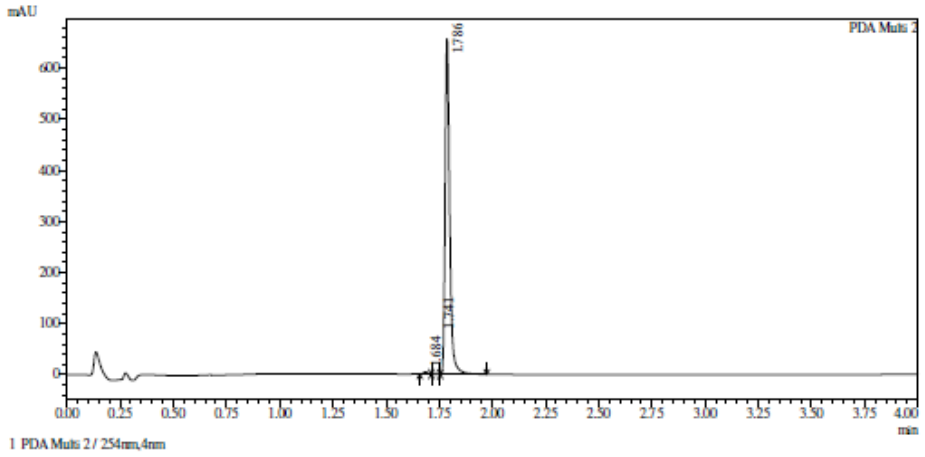


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.497	0.043	0.000	926	1468	0.095
2	1.684	0.039	4.558	5830	8404	0.541
3	1.740	0.104	0.779	2140	4374	0.282
4	1.787	0.039	0.651	1020359	1538690	99.083
Total				1029255	1552936	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.684	0.039	0.000	4448	6454	0.647
2	1.741	0.109	0.764	1359	2765	0.277
3	1.786	0.039	0.617	656410	988544	99.076
Total				662217	997762	100.000

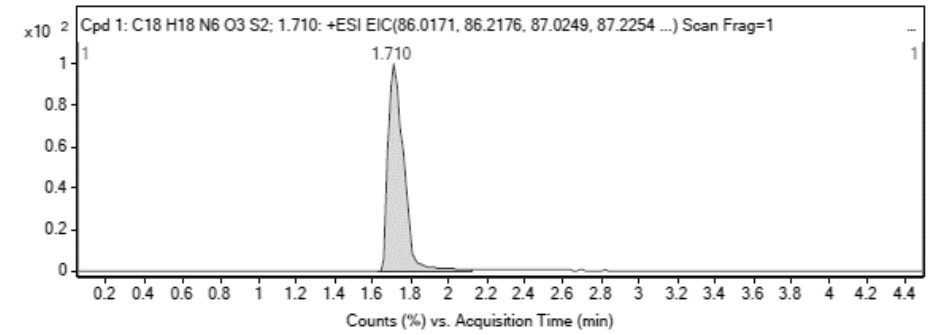
HRMS (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5-[6-(methylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(18)**

Compound Table

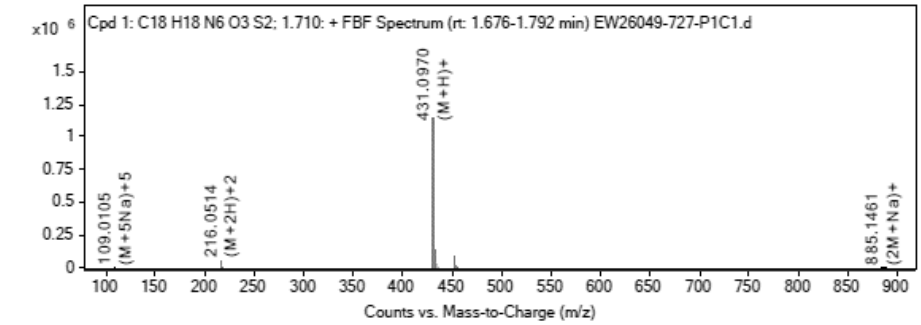
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C18 H18 N6 O3 S2; 1.710	98.27	2.08	C18 H18 N6 O3 S2	1.71	430.0882	430.0891

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
216.0514	1.71	430.0891	C18 H18 N6 O3 S2	430.0882	2.08	Find by Formula

Compound Chromatograms



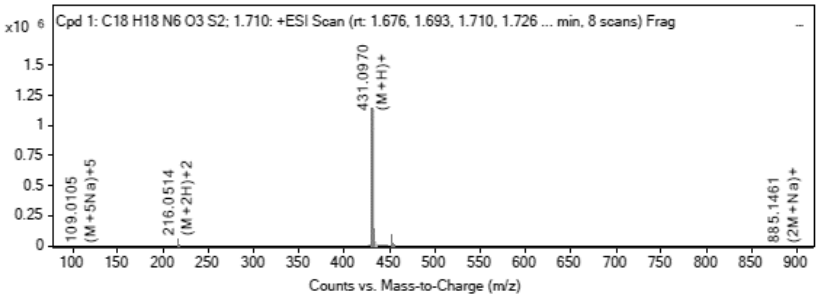
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
216.0514	2	57524.63	(M+2H)+2
216.5526	2	13759.6	(M+2H)+2
217.0505	2	7395.06	(M+2H)+2
431.097	1	1132331.75	(M+H)+
432.0982	1	283200.53	(M+H)+
433.0938	1	136242.98	(M+H)+
453.0772	1	94407.89	(M+Na)+
454.0789	1	21746.32	(M+Na)+
455.0751	1	11364.44	(M+Na)+
885.1461	1	3790.71	(2M+Na)+

MS Zoomed Spectrum

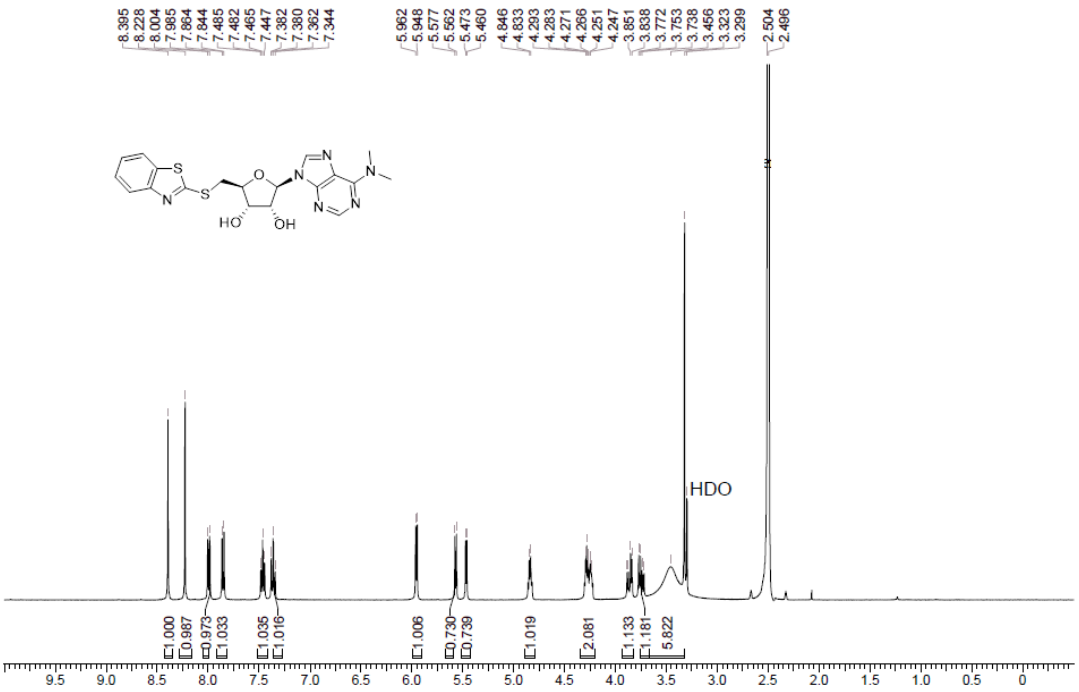


MS Spectrum Peak List

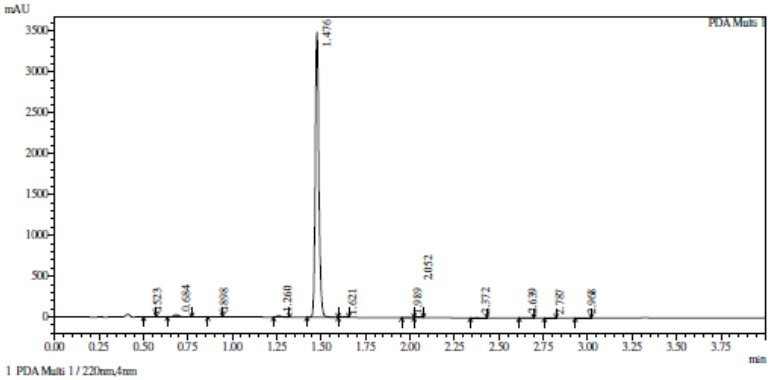
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
216.0514	2	57524.63	(M+2H)+2	-0.26
216.5526	2	13759.6	(M+2H)+2	0.28
217.0505	2	7395.06	(M+2H)+2	-0.19
431.097	1	1132331.75	(M+H)+	-3.48
432.0982	1	283200.53	(M+H)+	-0.41
433.0938	1	136242.98	(M+H)+	-0.35
453.0772	1	94407.89	(M+Na)+	0.51
454.0789	1	21746.32	(M+Na)+	2.23
455.0751	1	11364.44	(M+Na)+	1.23
885.1461	1	3790.71	(2M+Na)+	21.47

--- End Of Report ---

^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(19)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(19)**

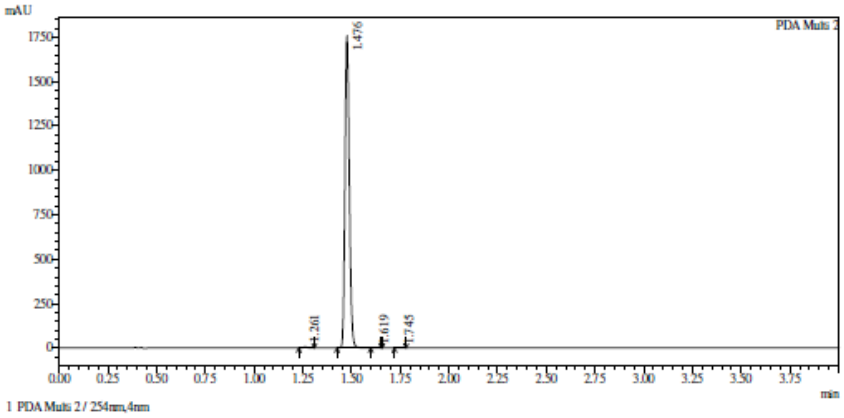


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.523	0.045	0.000	2666	4485	0.090
2	0.684	0.056	3.175	26727	56430	1.133
3	0.898	0.067	3.500	1261	3054	0.061
4	1.260	0.042	6.707	14542	22571	0.453
5	1.476	0.035	5.636	3490065	4874839	97.901
6	1.621	0.043	3.685	1262	1941	0.039
7	1.989	0.048	8.087	1557	2687	0.054
8	2.052	0.046	1.353	880	1408	0.028
9	2.372	0.080	5.084	1178	3370	0.068
10	2.639	0.069	3.604	653	1759	0.035
11	2.787	0.051	2.479	942	1788	0.036
12	2.968	0.063	3.170	2024	5009	0.101
Total				3543758	4979342	100.000



1 PDA Multi 2 / 254nm,4nm

Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.261	0.042	0.000	6344	9836	0.358
2	1.476	0.042	5.087	1758970	2734198	99.560
3	1.619	0.042	3.388	746	1125	0.041
4	1.745	0.045	2.918	674	1111	0.040
Total				1766734	2746270	100.000

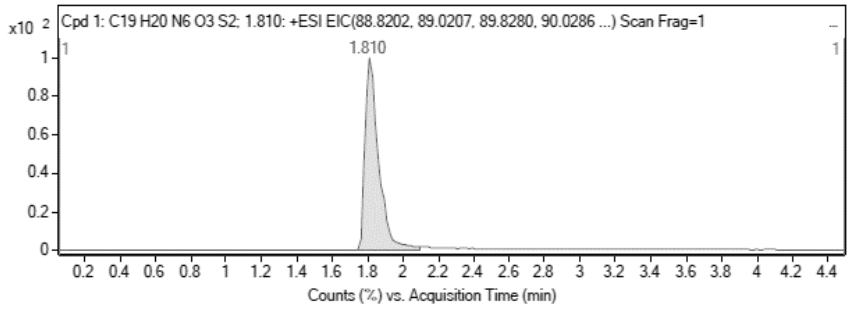
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(6-Aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) tetrahydrofuran-3,4-diol **(19)**

Compound Table

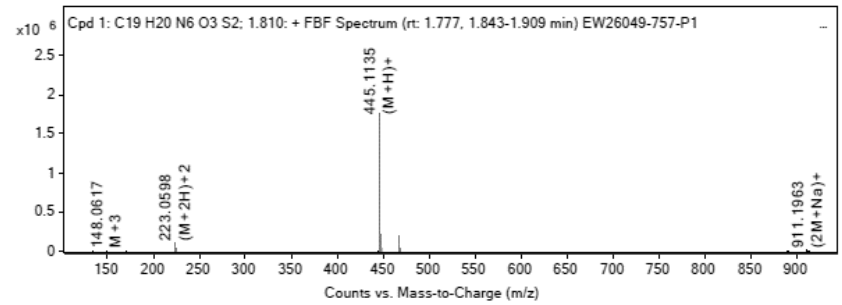
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C19 H20 N6 O3 S2; 1.810	96.37	6.14	C19 H20 N6 O3 S2	1.81	444.1038	444.1066

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
223.0598	1.81	444.1066	C19 H20 N6 O3 S2	444.1038	6.14	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

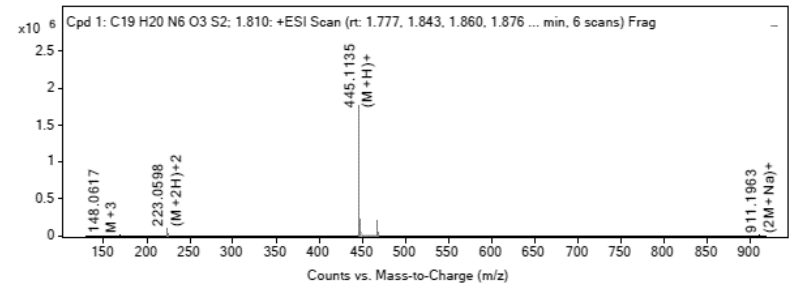


MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
223.0598	2	97239.34	(M+2H)+2
223.5612	2	24231.24	(M+2H)+2

224.0591	2	12233.51 (M+2H)+2
445.1135	1	1760436.13 (M+H)+
446.1153	1	444699.91 (M+H)+
447.1109	1	214511.19 (M+H)+
467.0945	1	200039.48 (M+Na)+
468.0965	1	47714.09 (M+Na)+
469.0922	1	23735.76 (M+Na)+
911.1963	1	11867.88 (2M+Na)+

MS Zoomed Spectrum

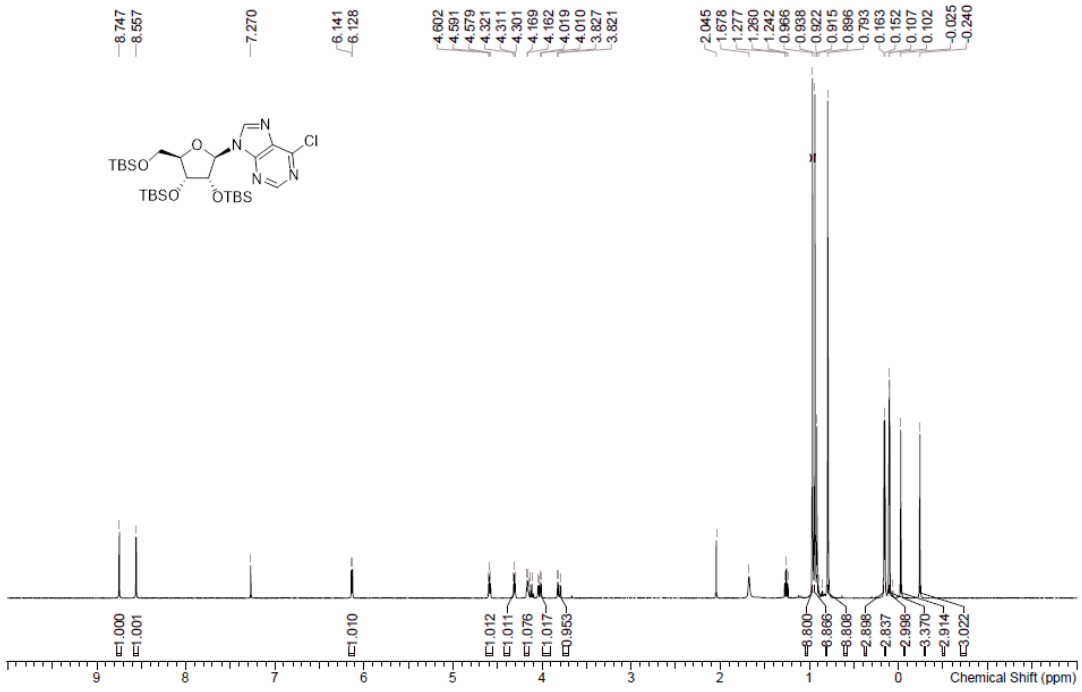


MS Spectrum Peak List

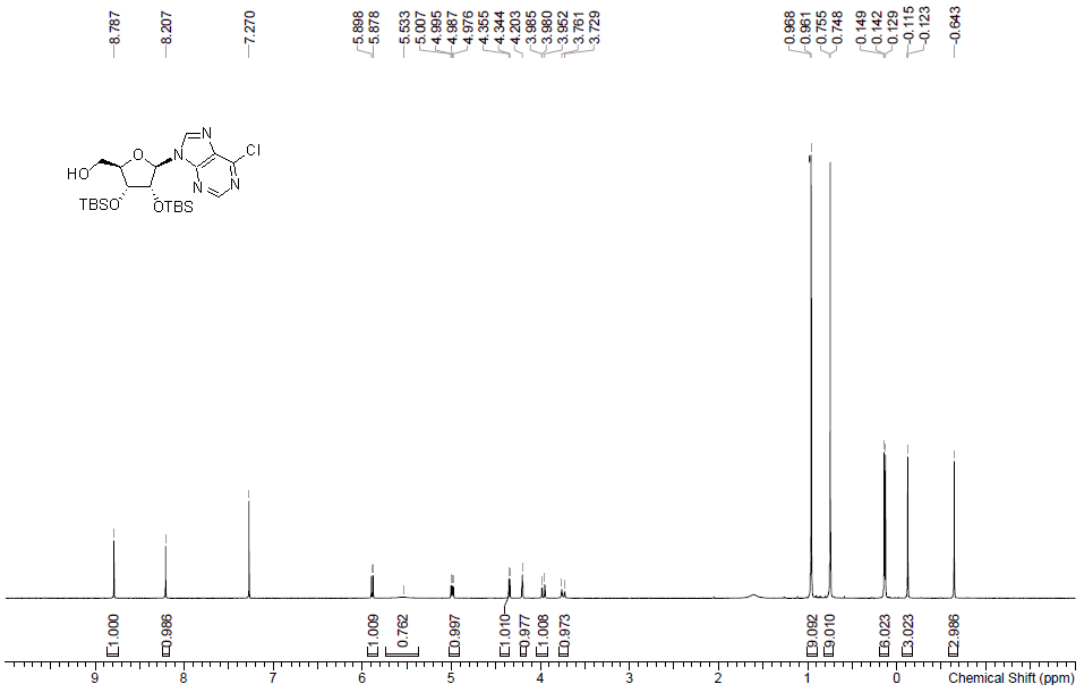
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
223.0598	2	97239.34	(M+2H)+2	-2.8
223.5612	2	24231.24	(M+2H)+2	-3.37
224.0591	2	12233.51	(M+2H)+2	-3.03
445.1135	1	1760436.13	(M+H)+	-5.43
446.1153	1	444699.91	(M+H)+	-3.55
447.1109	1	214511.19	(M+H)+	-3.17
467.0945	1	200039.48	(M+Na)+	-3.19
468.0965	1	47714.09	(M+Na)+	-1.8
469.0922	1	23735.76	(M+Na)+	-1.55
911.1963	1	11867.88	(2M+Na)+	0.64

— End Of Report —

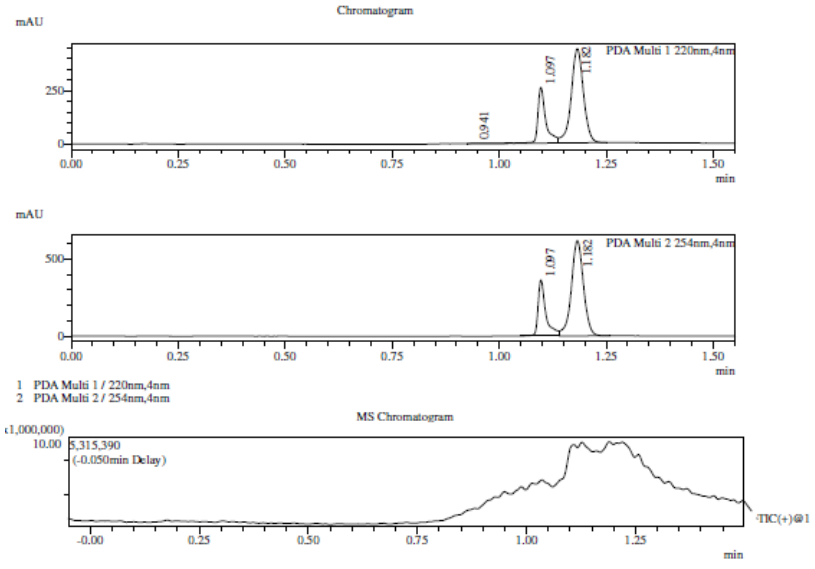
^{1}H NMR [(2*R*,3*R*,4*R*,5*R)*-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-(6- chloropurin-9-yl) tetrahydrofuran-2-yl]methoxy-tert-butyl-dimethyl-silane **(96)**



^{1}H NMR [(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (6-chloropurin-9-yl)tetrahydrofuran-2-yl]methanol **(46)**



LCMS [(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (6-chloropurin-9-yl)tetrahydrofuran-2-yl]methanol **(46)**



Integration Result

Peak Table

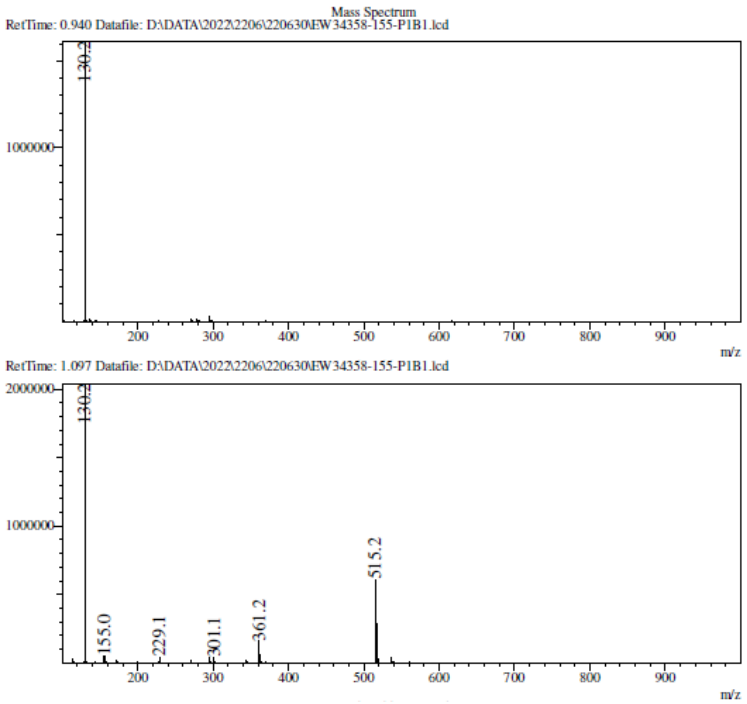
PDA Ch1 220nm

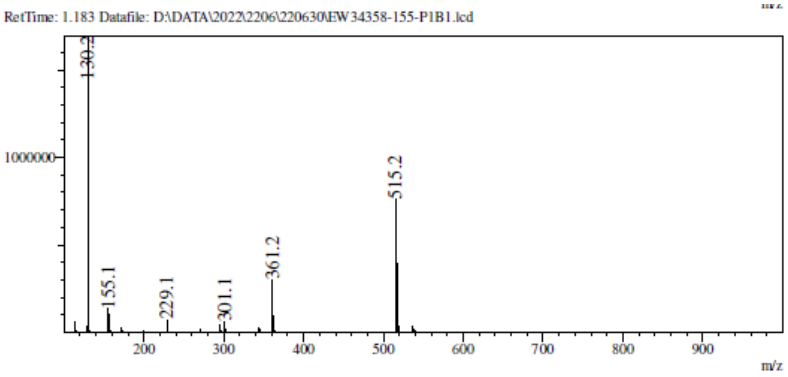
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.941	2690	0.382	0.084	14131	1.160
2	1.097	261386	37.121	0.031	330533	27.132
3	1.182	440076	62.497	0.052	873570	71.708

Peak Table

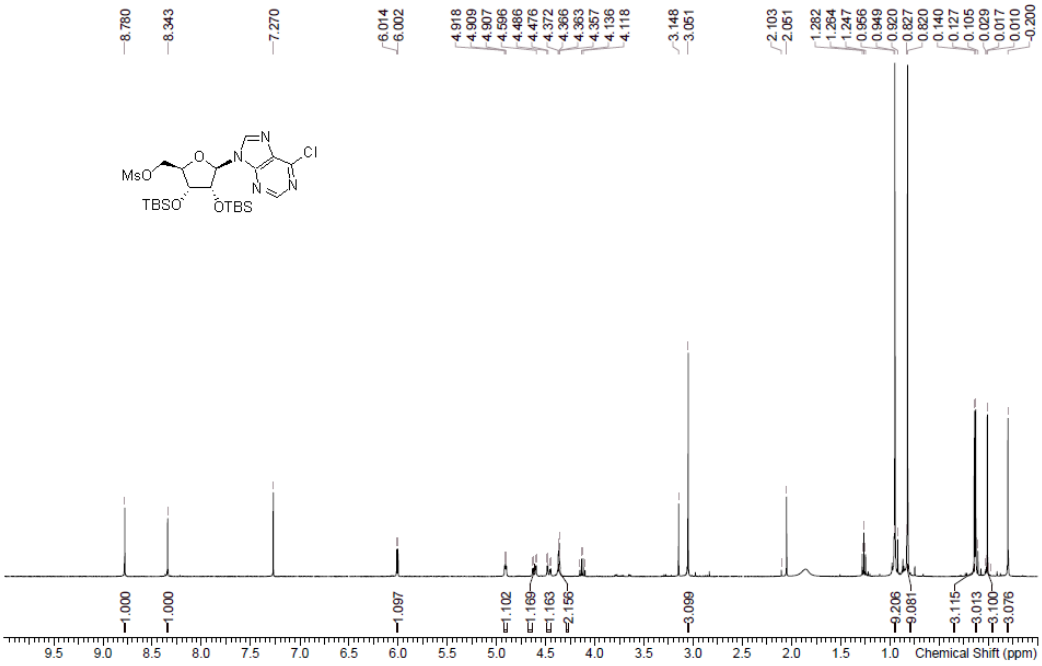
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.097	361984	37.089	0.031	452505	27.211
2	1.182	614003	62.911	0.052	1210427	72.789

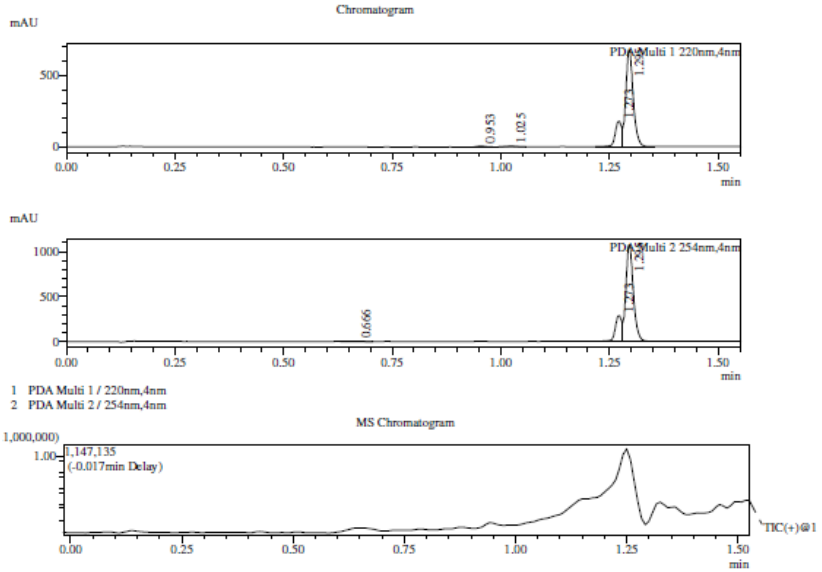

Mass Spectrum
RetTime: 0.940 Datafile: D:\DATA\2022\2206\220630\EW34358-155-P1B1.lcd
130.2
1000000
200
300
400
500
600
700
800
900
m/z
RetTime: 1.097 Datafile: D:\DATA\2022\2206\220630\EW34358-155-P1B1.lcd
2000000
130.2
1000000
515.2
155.0
229.1
301.1
361.2
200
300
400
500
600
700
800
900
m/z


RetTime: 1.183 Datafile: D:\DATA\2022\2206\220630\EW34358-155-P1B1.lcd
130.2
1000000
515.2
155.1
229.1
301.1
361.2
200
300
400
500
600
700
800
900
m/z

^{1}H NMR [(2R,3R,4R,5R)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (6-chloropurin-9-yl)tetrahydrofuran-2-yl]methyl methanesulfonate **(97)**



LCMS [(2R,3R,4R,5R)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (6-chloropurin-9-yl)tetrahydrofuran-2-yl]methyl methanesulfonate **(97)**



Integration Result

Peak Table

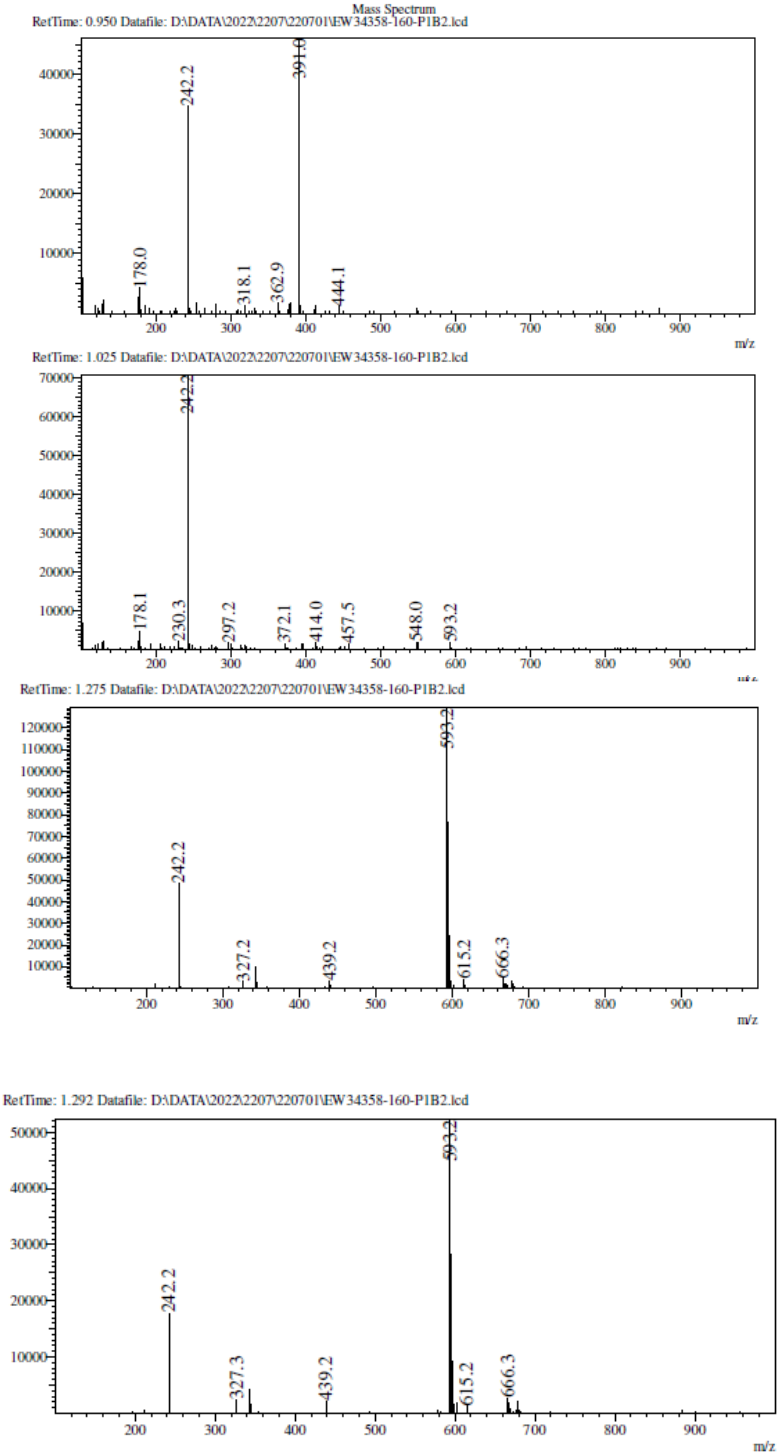
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.953	5887	0.681	0.035	7556	0.763
2	1.025	4975	0.576	0.043	7642	0.771
3	1.273	176648	20.435	0.053	183282	18.499
4	1.295	676946	78.309	0.032	792270	79.967

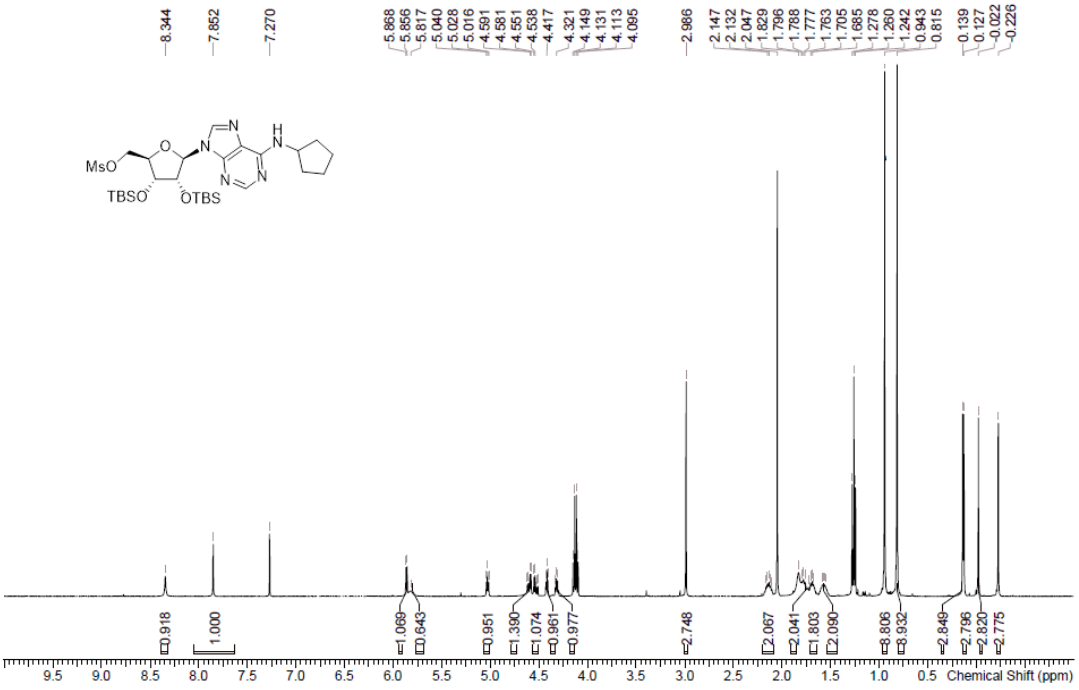
Peak Table

PDA Ch2 254nm

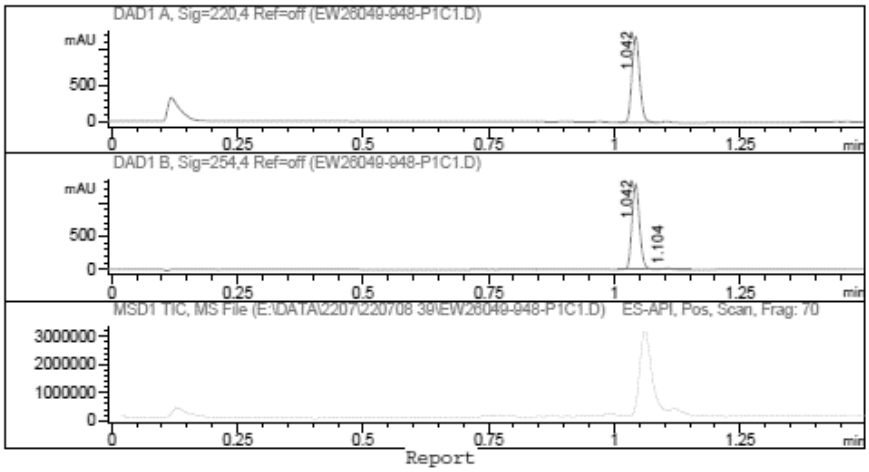
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.666	3744	0.275	0.071	8982	0.570
2	1.273	287287	21.079	0.039	294613	18.706
3	1.295	1071906	78.647	0.032	1271330	80.723


Mass Spectrum
RefTime: 0.950 Datafile: D:\DATA\2022\2207\220701\EW34358-160-P1B2.lcd
242.2
391.0
178.0
318.1
362.9
444.1
m/z
RefTime: 1.025 Datafile: D:\DATA\2022\2207\220701\EW34358-160-P1B2.lcd
242.2
178.1
230.3
297.2
372.1
414.0
457.5
548.0
593.2
RefTime: 1.275 Datafile: D:\DATA\2022\2207\220701\EW34358-160-P1B2.lcd
593.2
242.2
327.2
439.2
615.2
666.3
m/z
RefTime: 1.292 Datafile: D:\DATA\2022\2207\220701\EW34358-160-P1B2.lcd
593.2
242.2
327.3
439.2
615.2
666.3
m/z

^{1}H NMR [(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[6- (cyclopentylamino)purin-9-yl]tetrahydrofuran-2-yl]methyl methanesulfonate **(98a)**

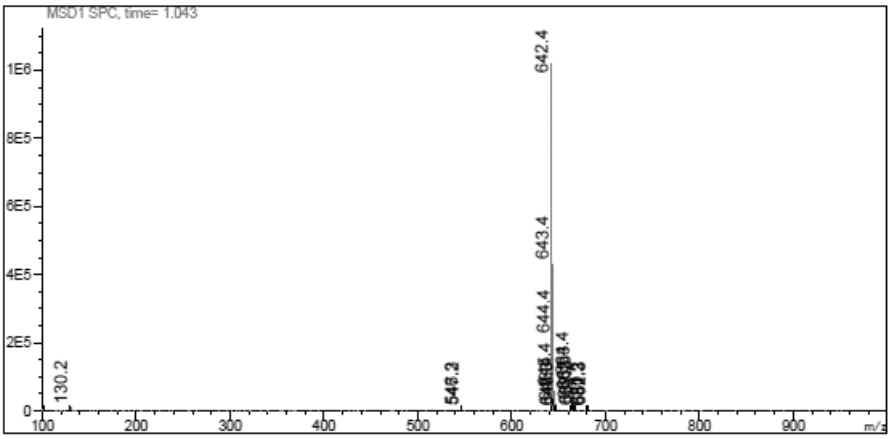


LCMS [(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[6- (cyclopentylamino)purin-9-yl]tetrahydrofuran-2-yl]methyl methanesulfonate **(98a)**

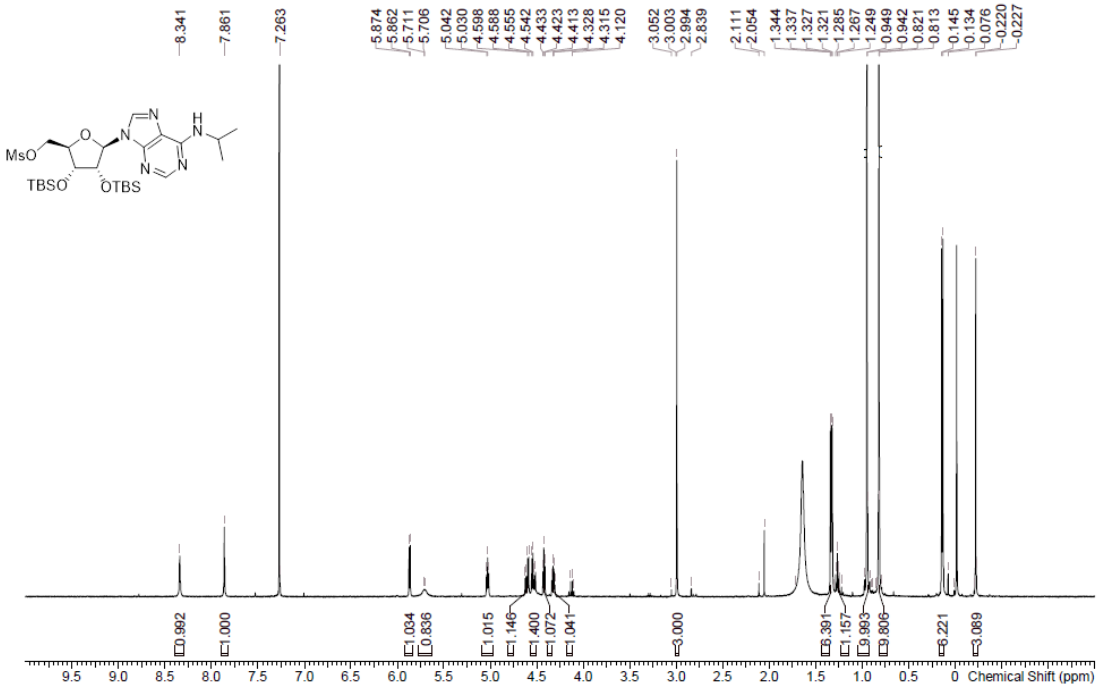


Report

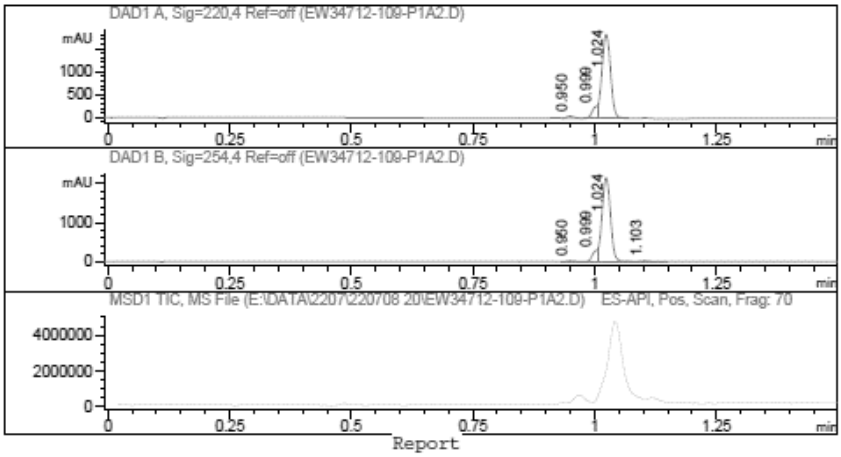
```
==================================================================
  Signal 1 : DAD1 A, Sig=220,4 Ref=off
   #  Meas. Ret.   Height    Width       Area       Area %
  ----------------------------------------------------------
    1      1.042   1193.730   0.017        1272.045 100.000
  ----------------------------------------------------------


  Signal 2 : DAD1 B, Sig=254,4 Ref=off
   #  Meas. Ret.   Height    Width       Area       Area %
  ----------------------------------------------------------
    1      1.042   1282.981   0.017        1355.217  98.286
    2      1.104     19.359   0.018          23.638   1.714
  ----------------------------------------------------------
```



^{1}H NMR ((2R,3R,4R,5R)-3,4-bis((tert-butyldimethylsilyl)oxy)-5-(6-(isopropylamino)-9H-purin-9-yl)tetrahydrofuran-2-yl)methyl methanesulfonate **(98b)**



LCMS ((2R,3R,4R,5R)-3,4-bis((tert-butyldimethylsilyl)oxy)-5-(6-(isopropylamino)-9H-purin-9-yl)tetrahydrofuran-2-yl)methyl methanesulfonate **(98b)**



Report

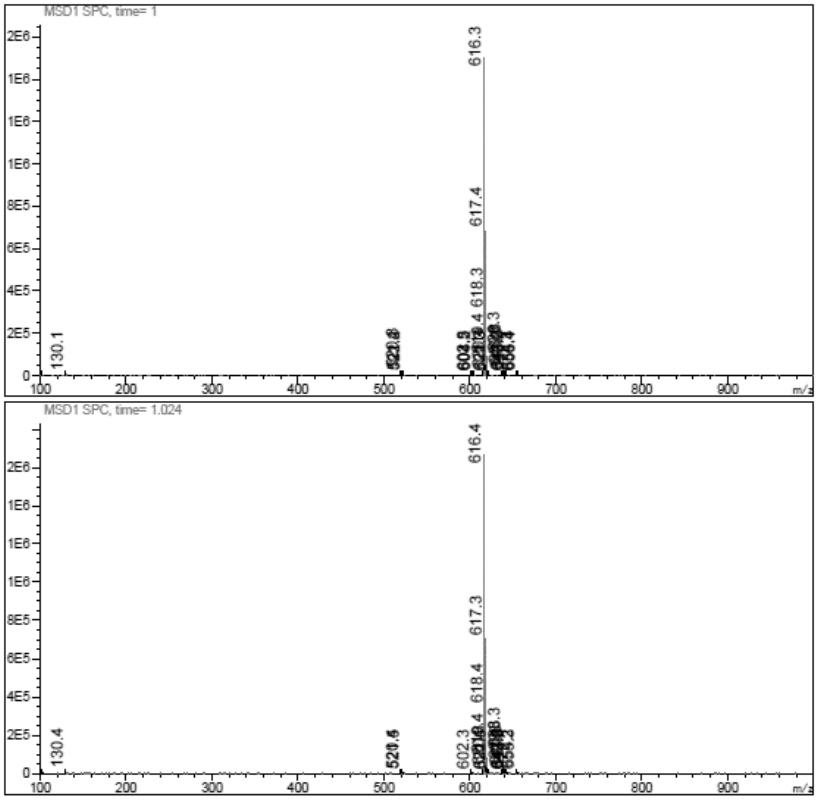
==========

Signal 1 : DAD1 A, Sig=220,4 Ref=off

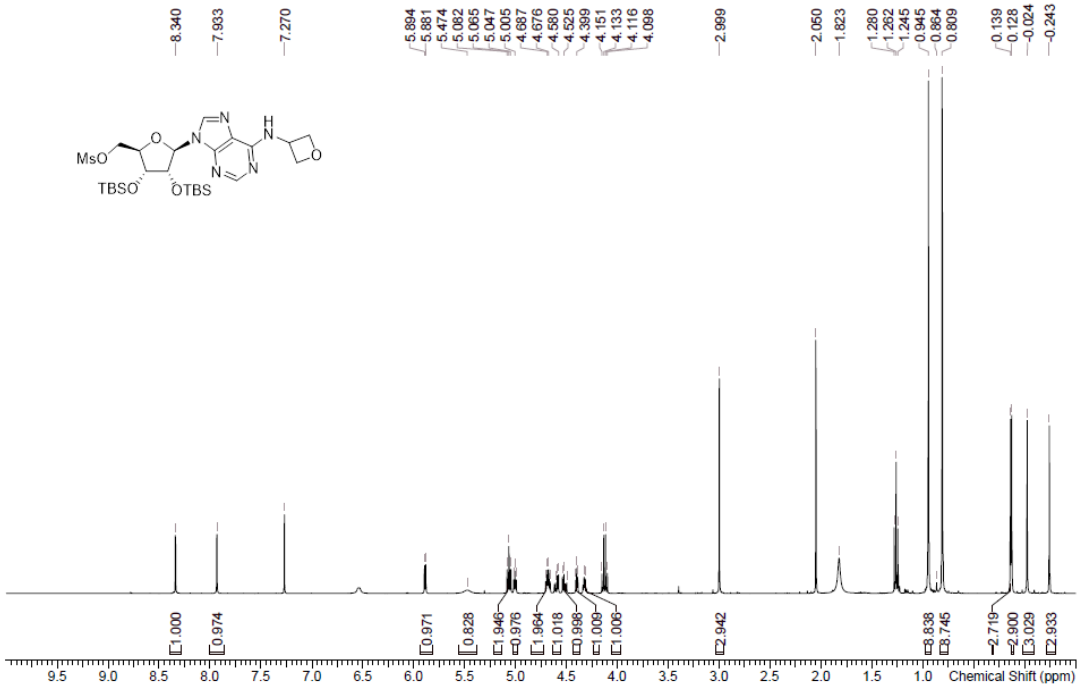
#	Meas. Ret.	Height	Width	Area	Area %
1	0.950	45.902	0.015	46.440	1.855
2	0.999	229.513	0.012	181.405	7.246
3	1.024	1824.052	0.020	2275.589	90.899

Signal 2 : DAD1 B, Sig=254,4 Ref=off

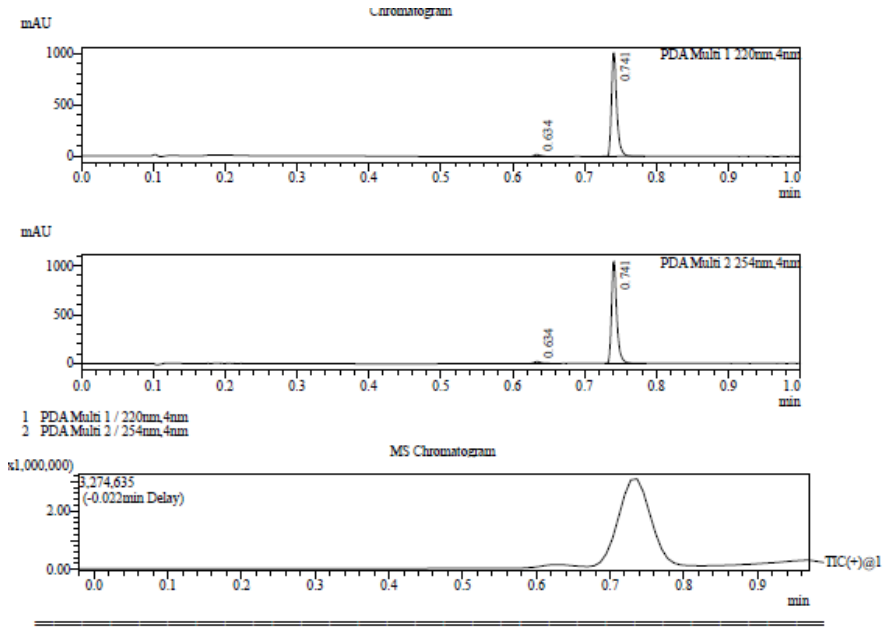
#	Meas. Ret.	Height	Width	Area	Area %
1	0.950	19.879	0.016	20.378	0.707
2	0.999	251.896	0.012	197.907	6.865
3	1.024	2149.022	0.019	2637.716	91.503
4	1.103	21.182	0.019	26.654	0.925



^{1}H NMR [(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[6-(oxetan -3-ylamino)purin-9-yl]tetrahydrofuran-2-yl]methyl methanesulfonate **(98c)**



LCMS [(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[6-(oxetan -3-ylamino)purin-9-yl]tetrahydrofuran-2-yl]methyl methanesulfonate **(98c)**



Integration Result

Peak Table

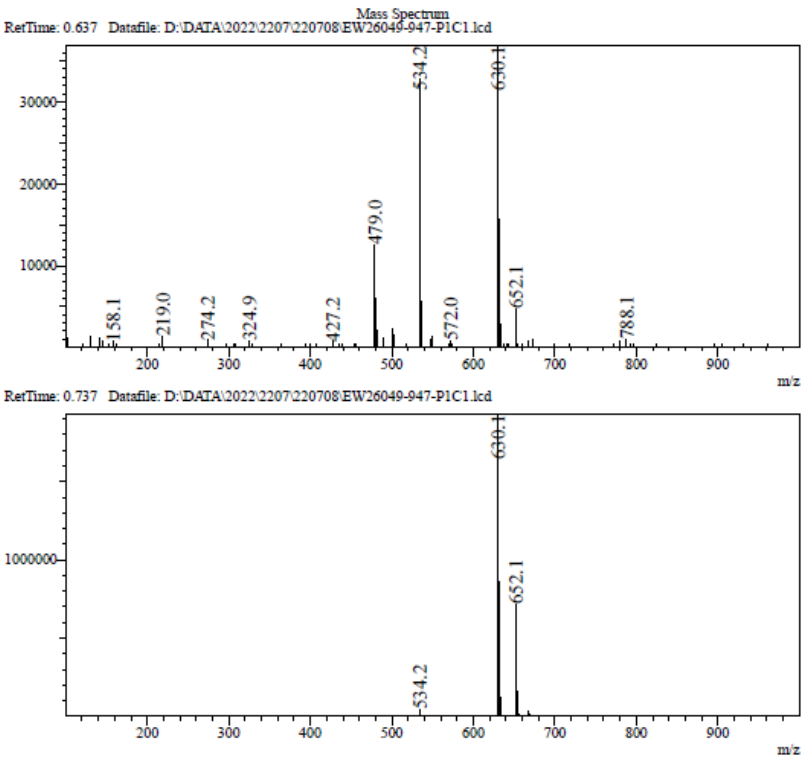
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.634	21291	2.064	0.018	12874	2.408
2	0.741	1010192	97.936	0.015	521661	97.592

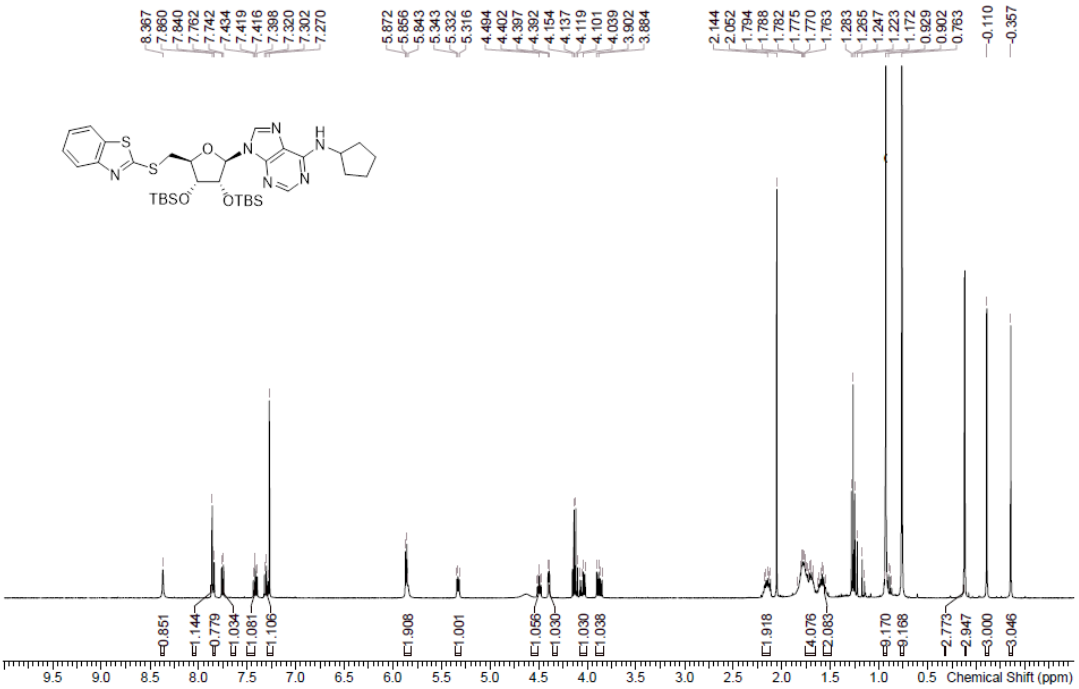
Peak Table

PDA Ch2 254nm

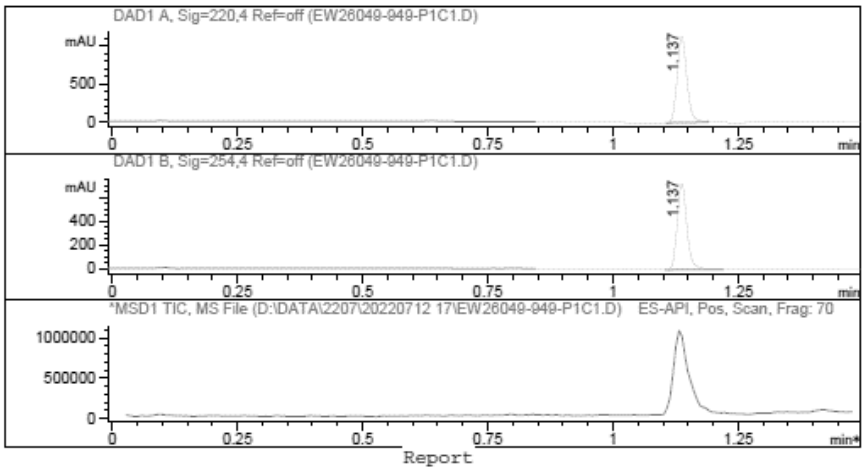
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.634	19927	1.871	0.019	13277	2.449
2	0.741	1045336	98.129	0.014	528851	97.551



^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*-cyclopentyl-purin-6-amine **(99a)**

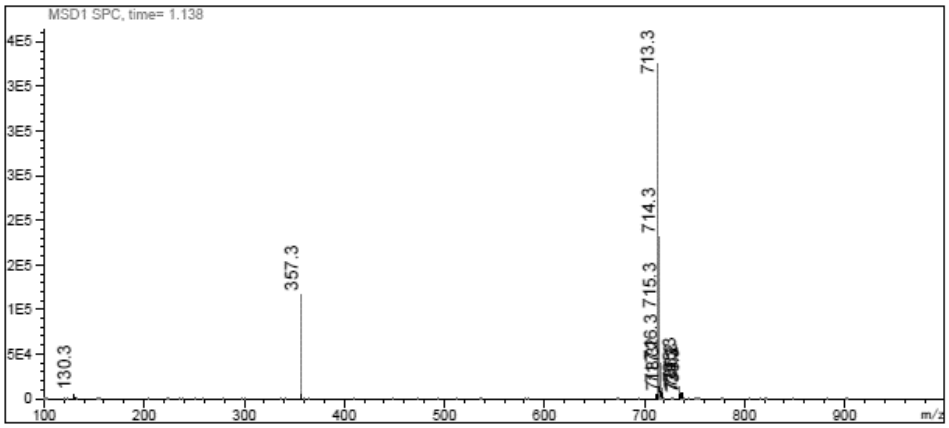


LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*-cyclopentyl-purin-6-amine **(99a)**

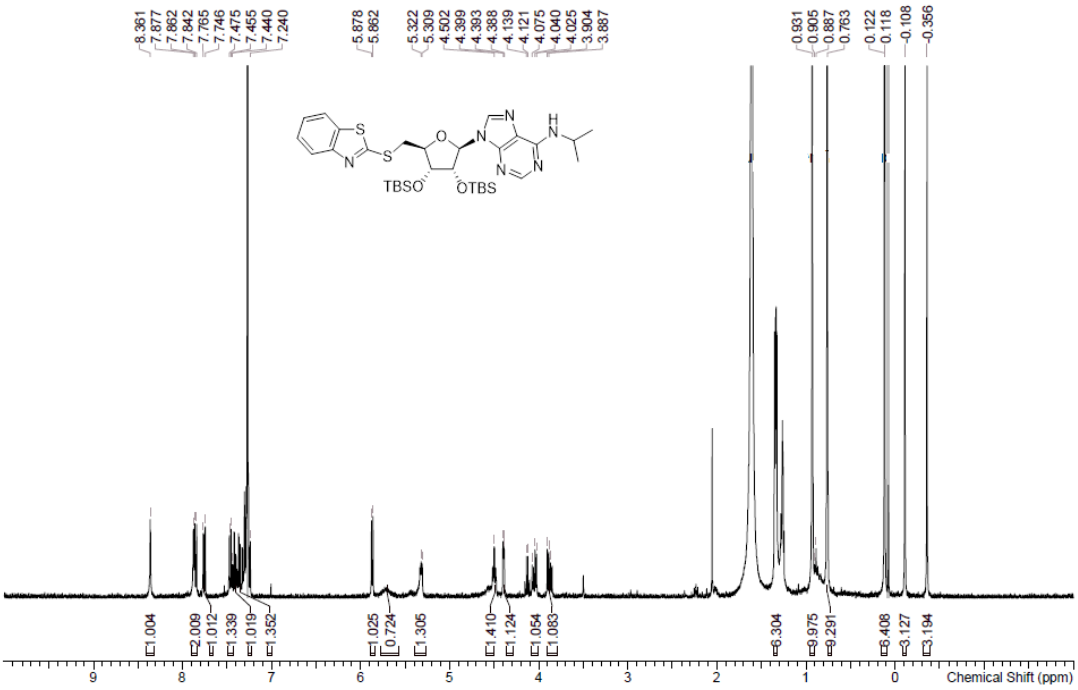


Report

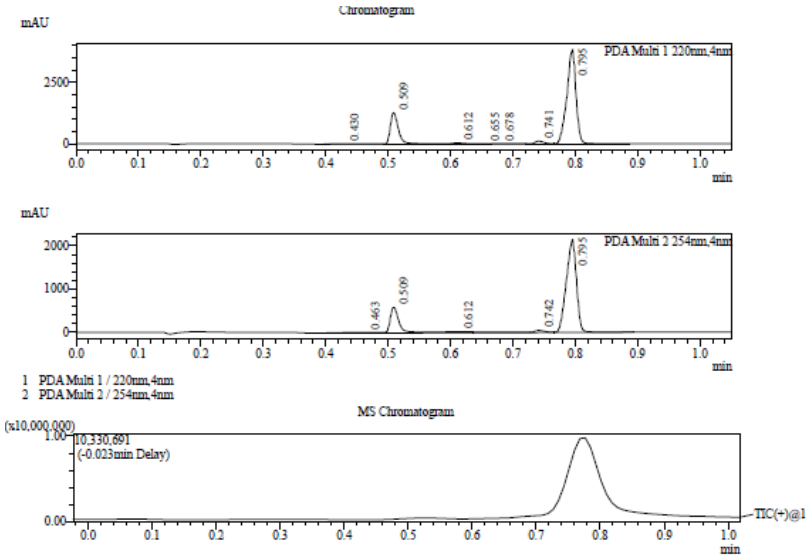
```
==================================================================
   Signal 1 : DAD1 A, Sig=220,4 Ref=off
    #  Meas. Ret.   Height    Width       Area       Area %
   ------------------------------------------------------------
     1      1.137   1146.083   0.021        1555.363 100.000
   ------------------------------------------------------------


   Signal 2 : DAD1 B, Sig=254,4 Ref=off
    #  Meas. Ret.   Height    Width       Area       Area %
   ------------------------------------------------------------
     1      1.137    733.089   0.021         991.781 100.000
   ------------------------------------------------------------
```



^{1}H NMR 9-((2R,3R,4R,5S)-5-((Benzo[d]thiazol-2-ylthio)methyl)-3,4-bis((tert-butyldimethylsilyl) oxy)tetrahydrofuran-2-yl)-N-isopropyl-9H-purin-6-amine **(99b)**



LCMS 9-((2R,3R,4R,5S)-5-((Benzo[d]thiazol-2-ylthio)methyl)-3,4-bis((tert-butyldimethylsilyl) oxy)tetrahydrofuran-2-yl)-N-isopropyl-9H-purin-6-amine **(99b)**



Integration Result

Peak Table

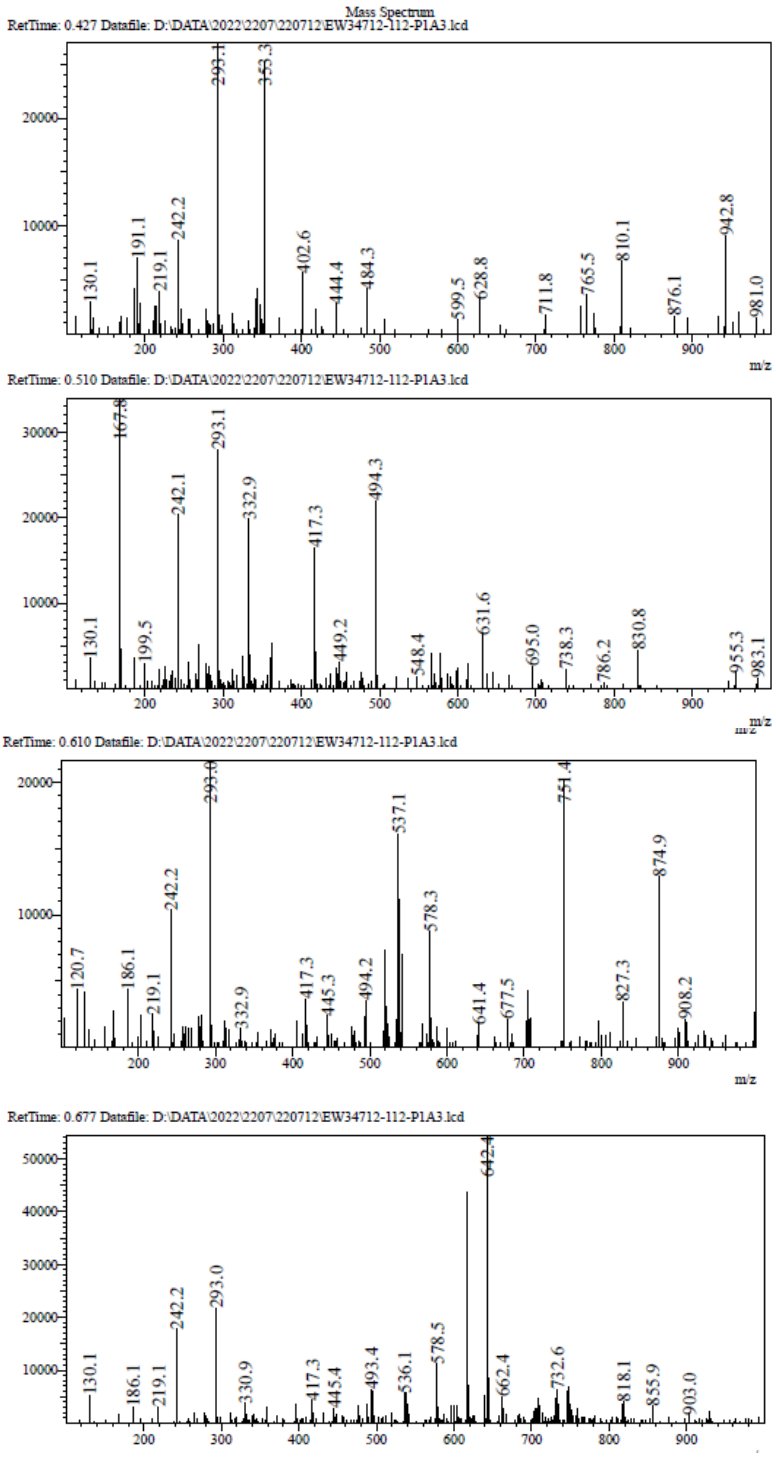
PDA Ch1 220nm

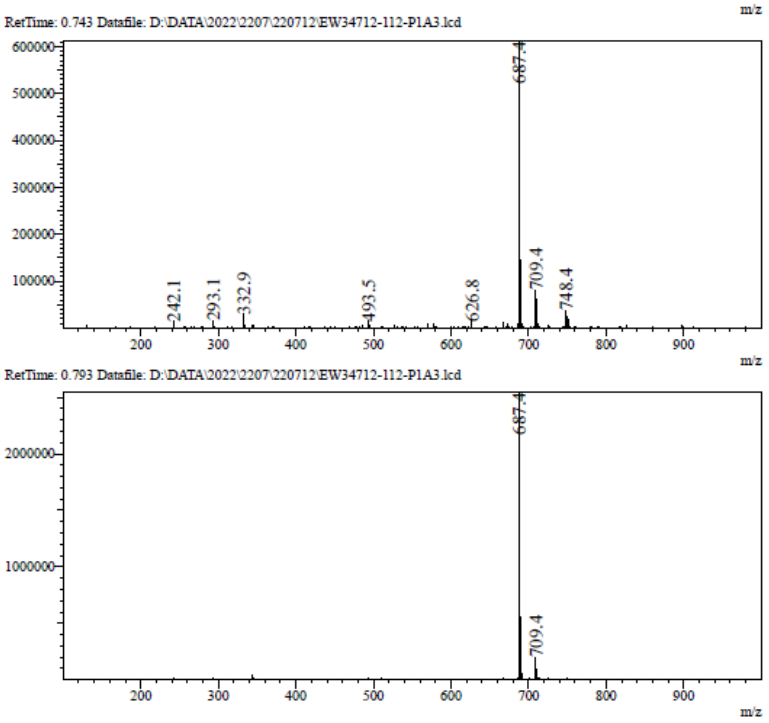
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.430	4972	0.096	0.168	21712	0.411
2	0.509	1251280	24.182	0.022	1155805	21.852
3	0.612	37196	0.719	0.040	65123	1.231
4	0.655	8850	0.171	0.701	11215	0.212
5	0.678	7442	0.144	0.152	21279	0.402
6	0.741	111391	2.153	0.025	114920	2.173
7	0.795	3753388	72.536	0.025	3899128	73.719

Peak Table

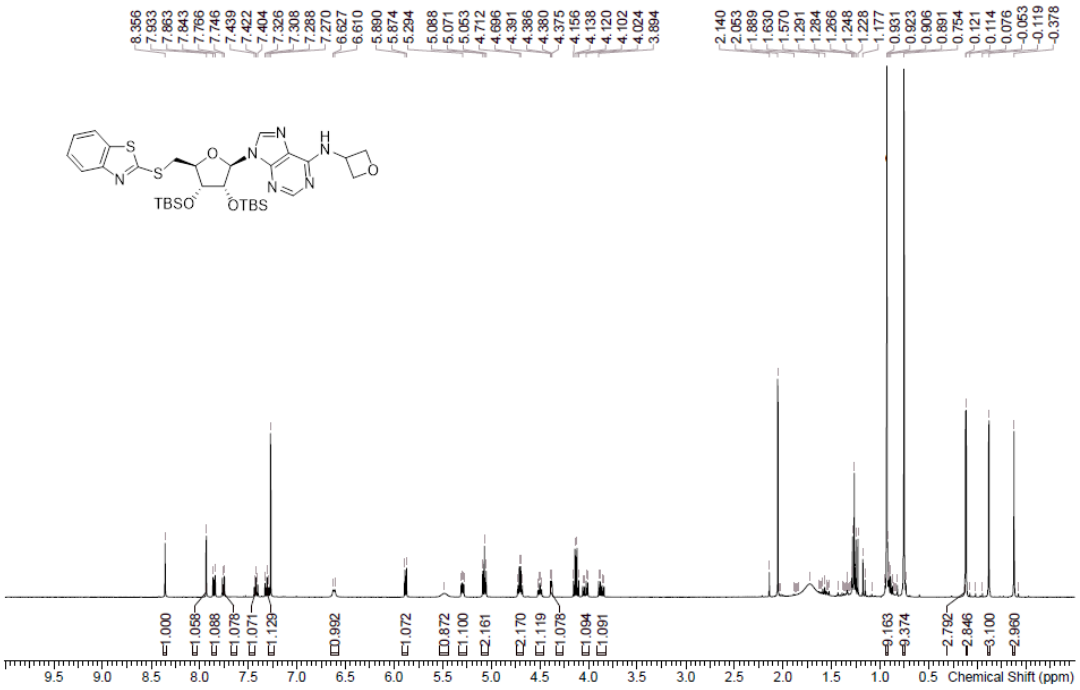
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.463	14669	0.530	0.322	73035	2.229
2	0.509	586325	21.186	0.023	649717	19.830

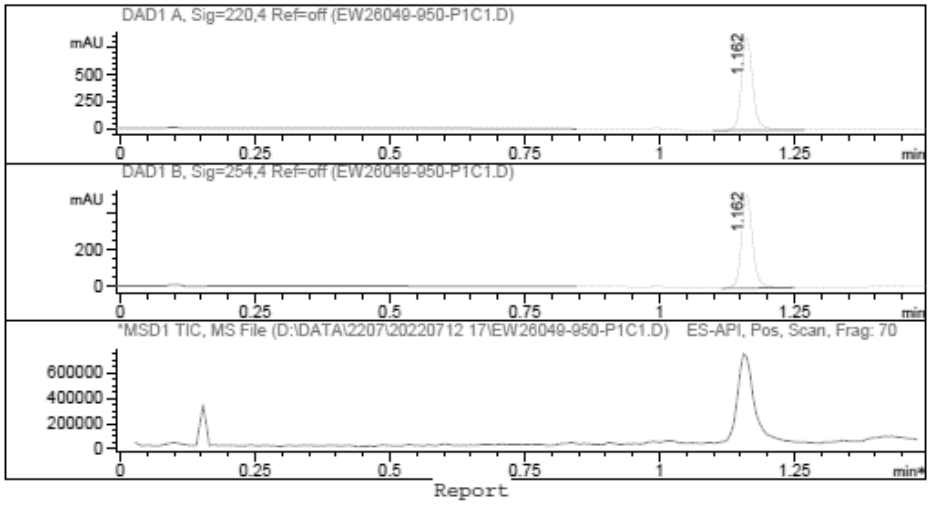

Mass Spectrum
RetTime: 0.427 Datafile: D:\DATA\2022\2207\220712\EW34712-112-P1A3.lcd
RetTime: 0.510 Datafile: D:\DATA\2022\2207\220712\EW34712-112-P1A3.lcd
RetTime: 0.610 Datafile: D:\DATA\2022\2207\220712\EW34712-112-P1A3.lcd
RetTime: 0.677 Datafile: D:\DATA\2022\2207\220712\EW34712-112-P1A3.lcd
m/z



^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*-(oxetan-3-yl)purin-6-amine **(99c)**



LCMS 9-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]-*N*-(oxetan-3-yl)purin-6-amine **(99c)**



Report

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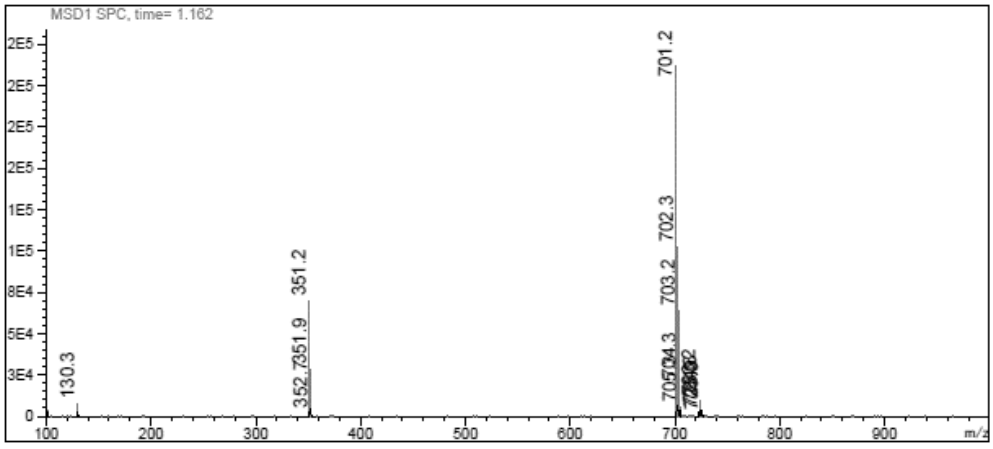
Signal 1 : DAD1 A, Sig=220,4 Ref=off

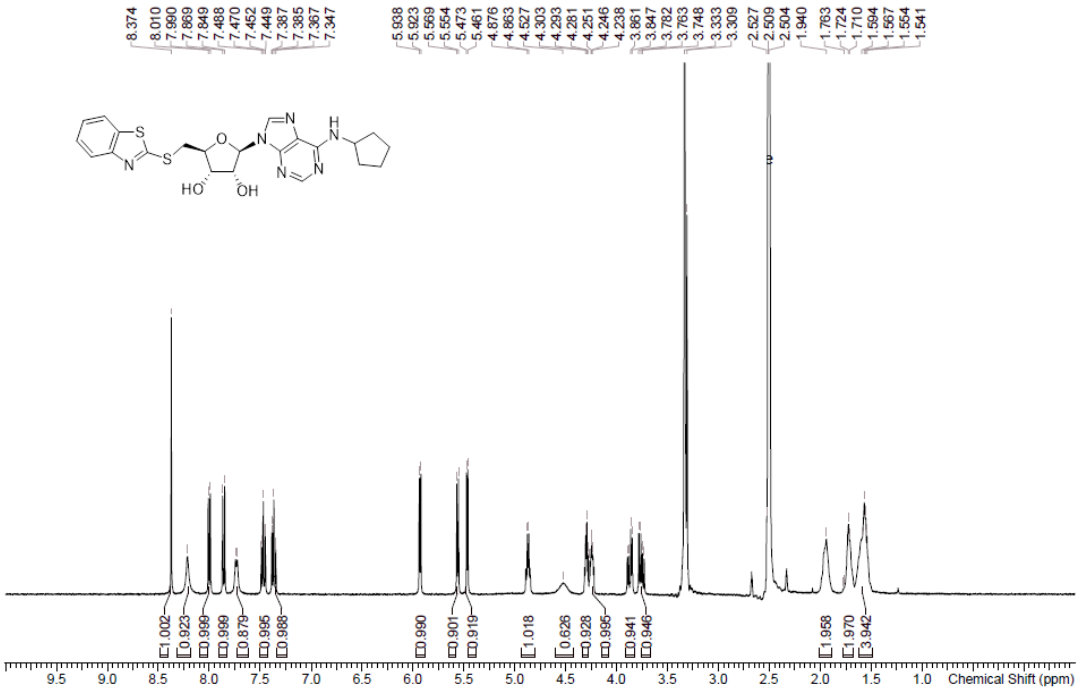
#	Meas. Ret.	Height	Width	Area	Area %
1	1.162	861.984	0.022	1249.093	100.000

Signal 2 : DAD1 B, Sig=254,4 Ref=off

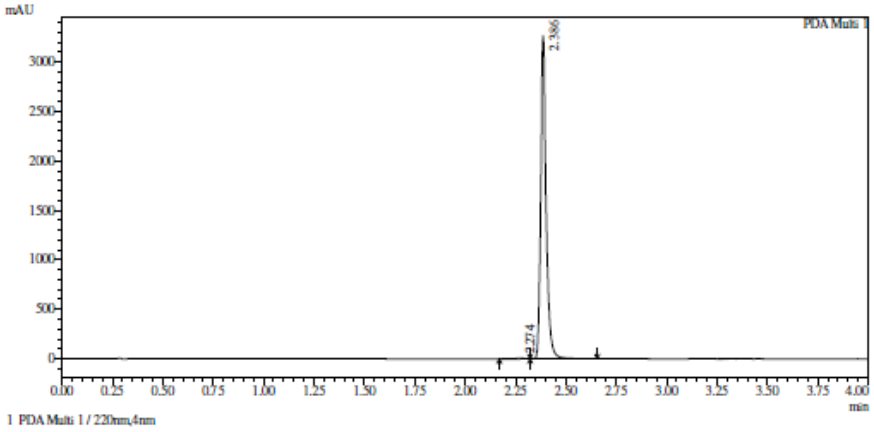
#	Meas. Ret.	Height	Width	Area	Area %
1	1.162	504.668	0.022	724.241	100.000



^{1}H NMR (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5- [6-(cyclopentylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(20)**



HPLC (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5- [6-(cyclopentylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(20)**

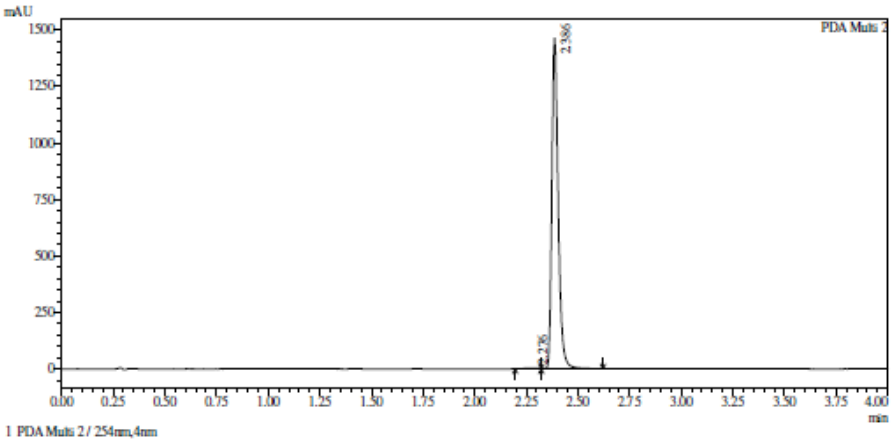


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	2.274	0.306	0.000	5003	26154	0.427
2	2.386	0.044	0.643	3267417	6099750	99.573
Total				3272420	6125904	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	2.276	0.156	0.000	2919	13658	0.434
2	2.386	0.056	1.040	1463094	3132168	99.566
Total				1466014	3145826	100.000

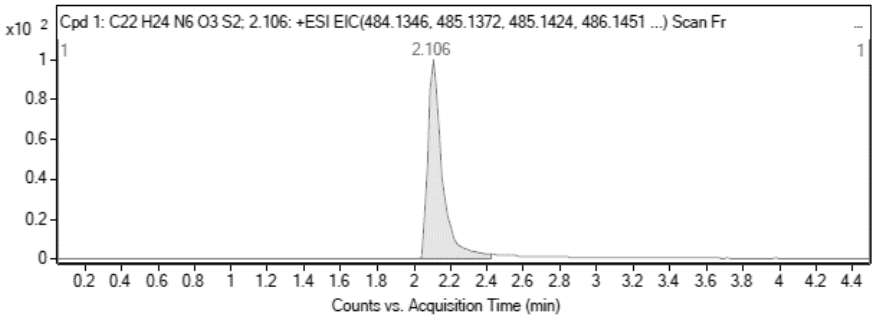
HRMS (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5- [6-(cyclopentylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(20)**

Compound Table

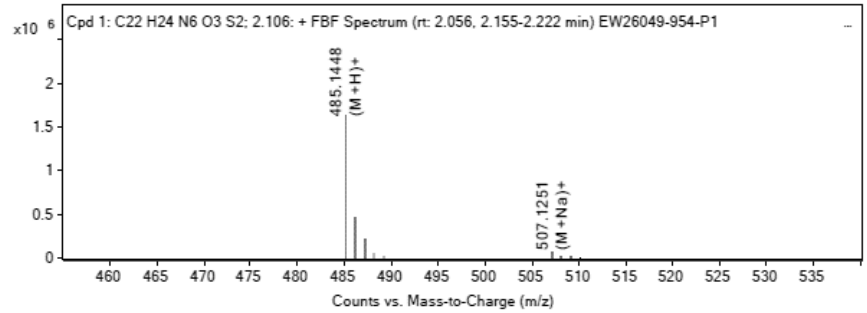
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C22 H24 N6 O3 S2; 2.106	98.42	4.38	C22 H24 N6 O3 S2	2.106	484.1351	484.1373

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
507.1251	2.106	484.1373	C22 H24 N6 O3 S2	484.1351	4.38	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

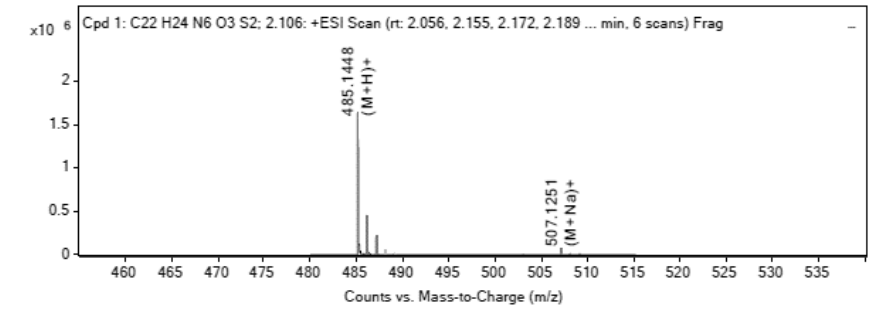


MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
485.1448	1	1631015	(M+H)+
486.1466	1	455562.72	(M+H)+

487.1428	1	205090.11	(M+H)+
507.1251	1	62494.4	(M+Na)+
508.1276	1	17014.72	(M+Na)+
509.1246	1	8084.87	(M+Na)+
510.1248	1	1715.72	(M+Na)+

MS Zoomed Spectrum

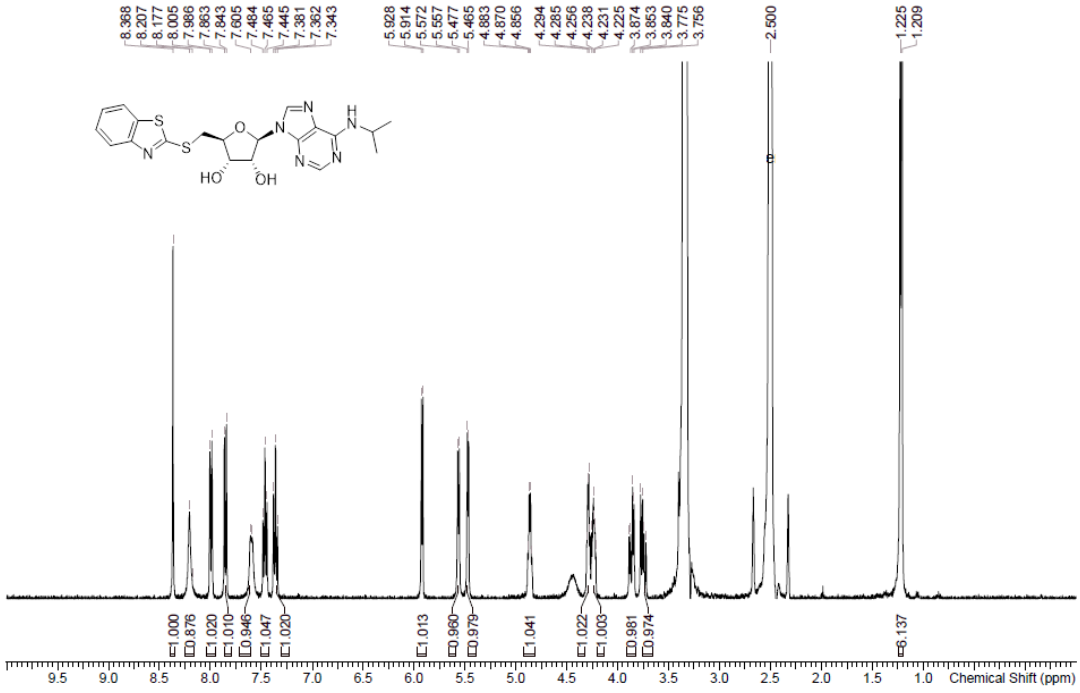


MS Spectrum Peak List

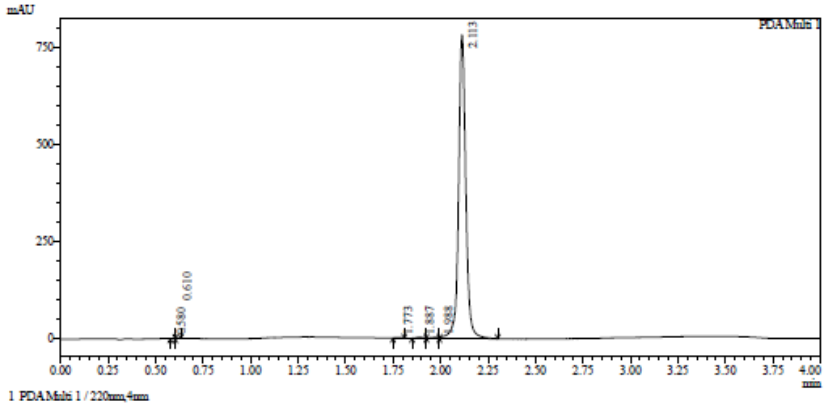
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
485.1448		1631001.66		-4.98
485.1448	1	1631015	(M+H)+	-5
486.1466	1	455562.72	(M+H)+	-3.23
487.1428	1	205090.11	(M+H)+	-3.13
507.1251	1	62494.4	(M+Na)+	-1.57
508.1276	1	17014.72	(M+Na)+	-1.18
509.1246	1	8084.87	(M+Na)+	-2.67
510.1248	1	1715.72	(M+Na)+	-0.75

— End Of Report —

^{1}H NMR (2S,3S,4R,5R)-2-((benzo[d]thiazol-2-ylthio)methyl)-5-(6-(isopropylamino)-9H-purin-9-yl)tetrahydrofuran-3,4-diol **(21)**



HPLC (2S,3S,4R,5R)-2-((benzo[d]thiazol-2-ylthio)methyl)-5-(6-(isopropylamino)-9H-purin-9-yl)tetrahydrofuran-3,4-diol **(21)**

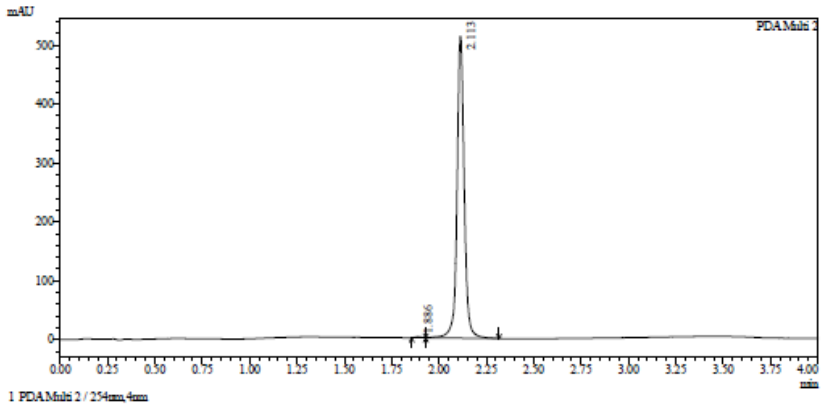


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.580	0.105	0.000	1047	1749	0.084
2	0.610	0.083	0.322	1237	1869	0.090
3	1.773	0.070	15.234	1507	3648	0.175
4	1.887	0.071	1.620	2577	6517	0.312
5	1.988	0.112	1.106	3452	8442	0.405
6	2.113	0.066	1.399	781817	2063561	98.934
Total				791636	2085786	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.886	0.065	0.000	1655	3797	0.278
2	2.113	0.066	3.452	513140	1359565	99.722
Total				514794	1363362	100.000

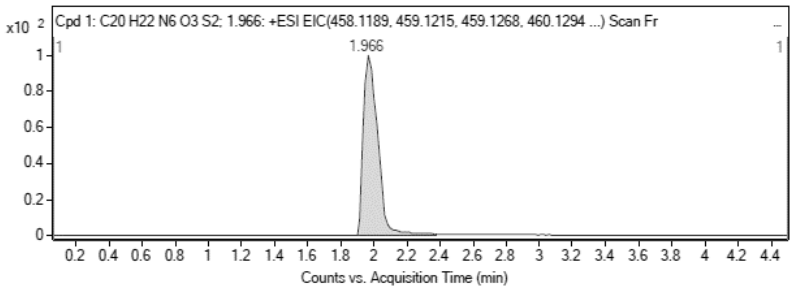
HRMS (2S,3S,4R,5R)-2-((benzo[d]thiazol-2-ylthio)methyl)-5-(6-(isopropylamino)-9H-purin-9-yl)tetrahydrofuran-3,4-diol **(21)**

Compound Table

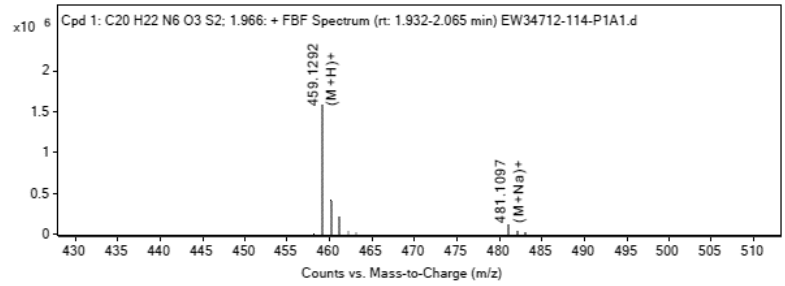
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C20 H22 N6 O3 S2: 1.966	96.29	4.56	C20 H22 N6 O3 S2	1.966	458.1195	458.1216

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
481.1097	1.966	458.1216	C20 H22 N6 O3 S2	458.1195	4.56	Find by Formula

Compound Chromatograms



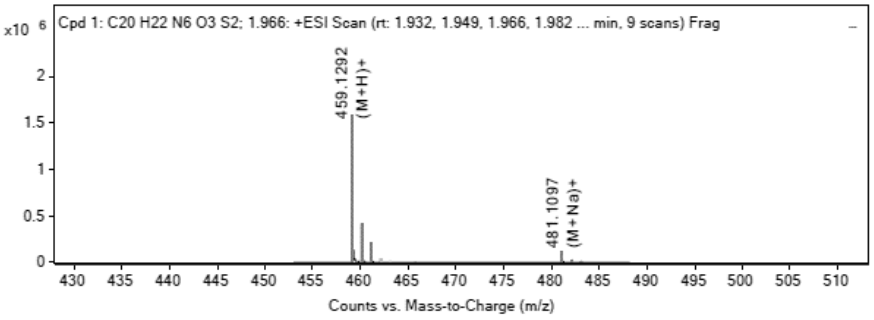
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
458.1155	1	571.2	M+
459.1292	1	1586056	(M+H)+
460.131	1	420726.25	(M+H)+
461.1268	1	196635.44	(M+H)+
481.1097	1	117045.18	(M+Na)+
482.1119	1	29380.34	(M+Na)+
483.1077	1	13929.76	(M+Na)+

MS Zoomed Spectrum

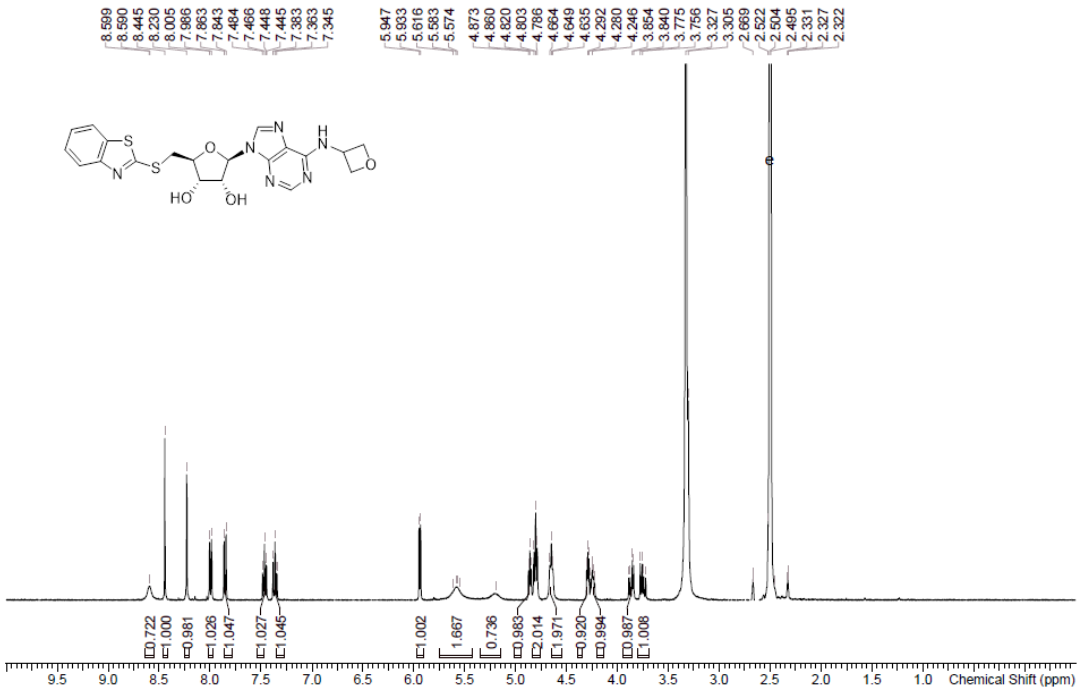


MS Spectrum Peak List

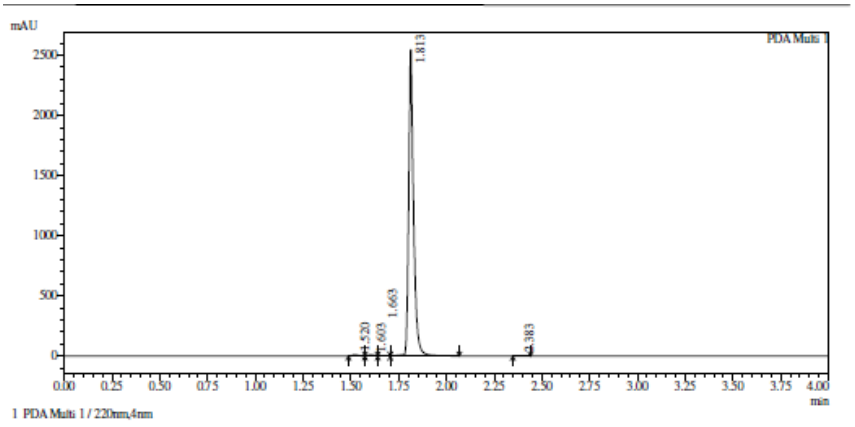
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
458.1155	1	571.2	M+	7.41
459.1292		1585992.68		-5.27
459.1292	1	1586056	(M+H)+	-5.28
460.131	1	420726.25	(M+H)+	-3.45
461.1268	1	196635.44	(M+H)+	-3.17
481.1097	1	117045.18	(M+Na)+	-2.09
482.1119	1	29380.34	(M+Na)+	-1.17
483.1077	1	13929.76	(M+Na)+	-0.94

--- End Of Report ---

^{1}H NMR (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5- [6-(oxetan-3-ylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(22)**



HPLC (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5- [6-(oxetan-3-ylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(22)**

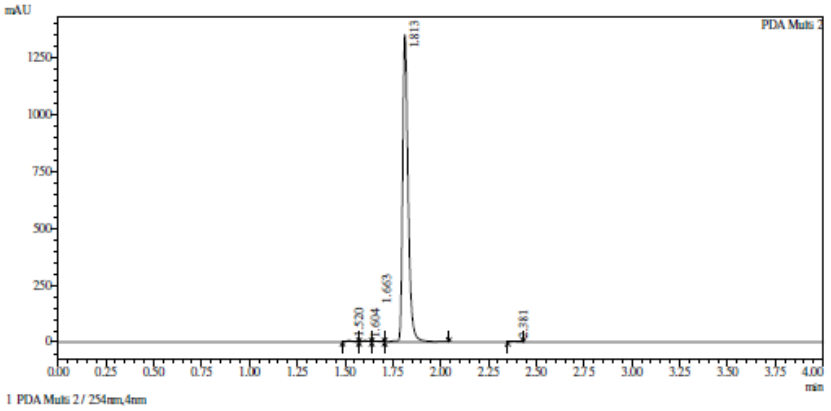


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.520	0.052	0.000	11404	22626	0.494
2	1.603	0.057	1.524	11345	24466	0.534
3	1.663	0.107	0.719	4431	11797	0.258
4	1.813	0.046	1.966	2546174	4515952	98.617
5	2.383	0.065	10.284	1856	4454	0.097
Total				2575210	4579296	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.520	0.052	0.000	6786	13329	0.487
2	1.604	0.057	1.530	6548	13936	0.509
3	1.663	0.097	0.776	2985	7865	0.287
4	1.813	0.052	2.010	1352967	2699705	98.628
5	2.381	0.062	9.987	1058	2433	0.089
Total				1370343	2737267	100.000

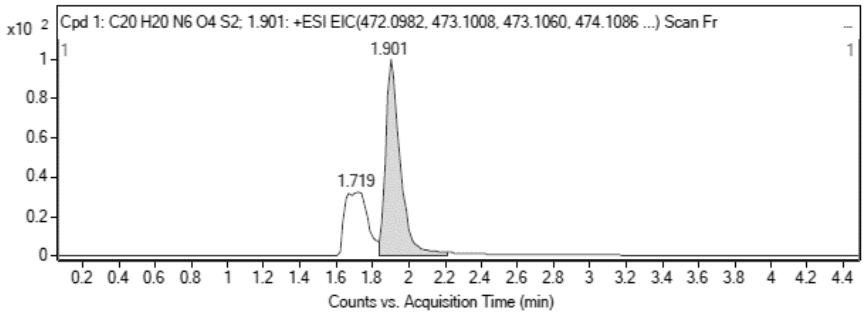
HRMC (2*S*,3*S*,4*R*,5*R*)-2-(1,3-Benzothiazol-2-ylsulfanylmethyl)-5- [6-(oxetan-3-ylamino)purin-9-yl]tetrahydrofuran-3,4-diol **(22)**

Compound Table

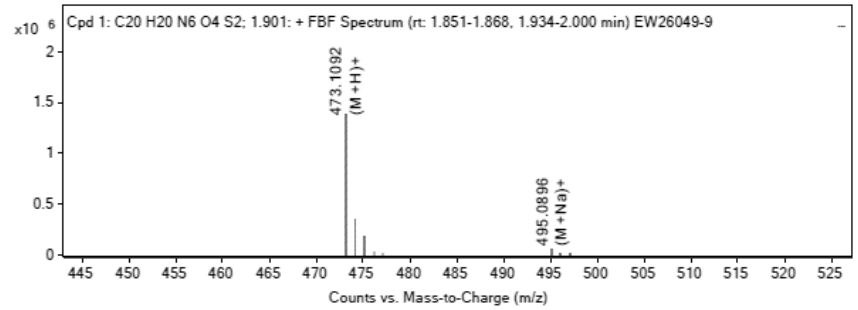
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C20 H20 N6 O4 S2; 1.901	93.11	6.11	C20 H20 N6 O4 S2	1.901	472.0987	472.1016

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
495.0896	1.901	472.1016	C20 H20 N6 O4 S2	472.0987	6.11	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

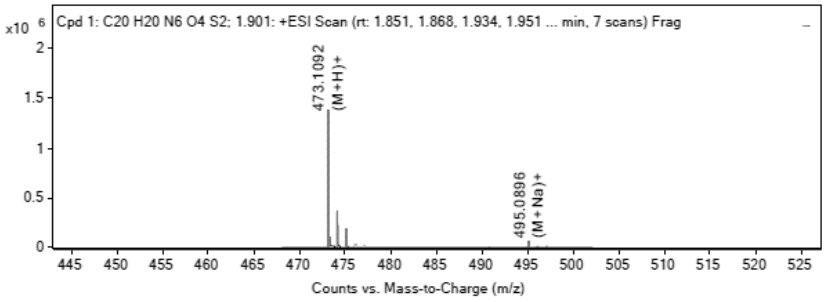


MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
473.1092	1	1384917.88	(M+H)+
474.111	1	352973.34	(M+H)+

475.1069	1	170793.89 (M+H)+
495.0896	1	61714.53 (M+Na)+
496.0916	1	15825.19 (M+Na)+
497.0886	1	7490.06 (M+Na)+

MS Zoomed Spectrum

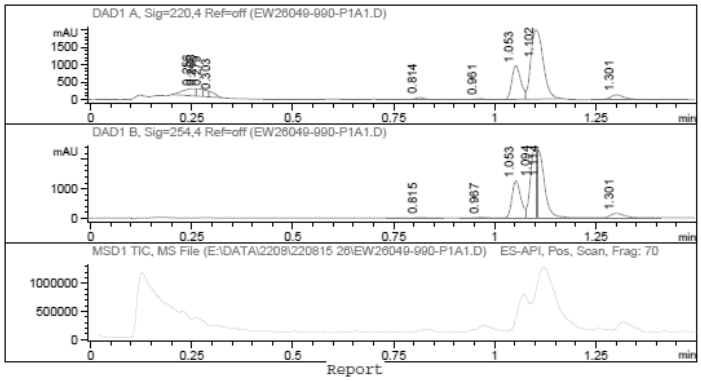


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
473.1092		1384897.09		-6.7
473.1092	1	1384917.88	(M+H)+	-6.71
474.111	1	352973.34	(M+H)+	-5.04
475.1069	1	170793.89	(M+H)+	-4.72
495.0896	1	61714.53	(M+Na)+	-3.24
496.0916	1	15825.19	(M+Na)+	-2.05
497.0886	1	7490.06	(M+Na)+	-3.94

--- End Of Report ---

LCMS (2*S*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (6-chloropurin-9-yl)tetrahydrofuran-2-carbaldehyde **(47)**



Report

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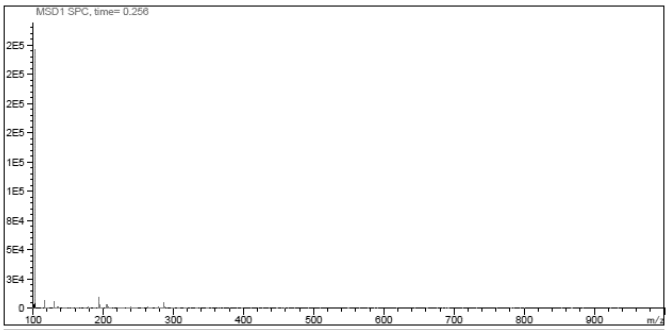
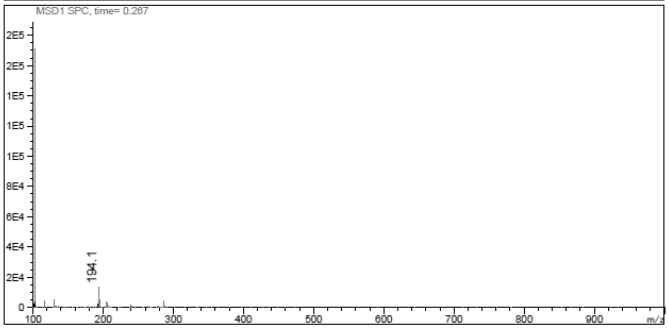
Signal 1 : DAD1 A, Sig=220,4 Ref=off

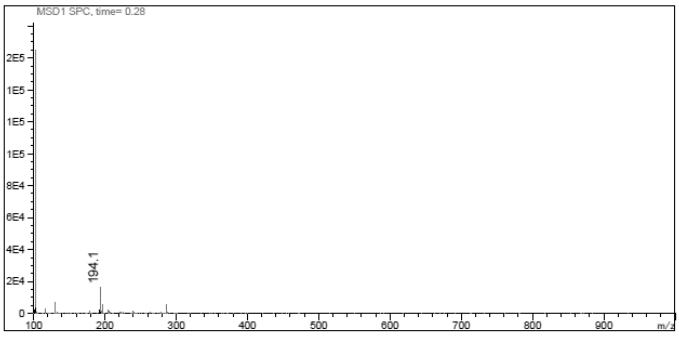
#	Meas. Ret.	Height	Width	Area	Area %
1	0.256	210.044	0.037	459.425	6.435
2	0.266	211.443	0.015	206.461	2.892
3	0.279	191.610	0.014	159.638	2.236
4	0.303	130.858	0.018	160.967	2.255
5	0.814	55.720	0.022	79.615	1.115
6	0.961	23.491	0.025	37.717	0.528
7	1.053	961.657	0.023	1471.560	20.611
8	1.102	1981.939	0.033	4216.002	59.051
9	1.301	136.826	0.038	348.233	4.877

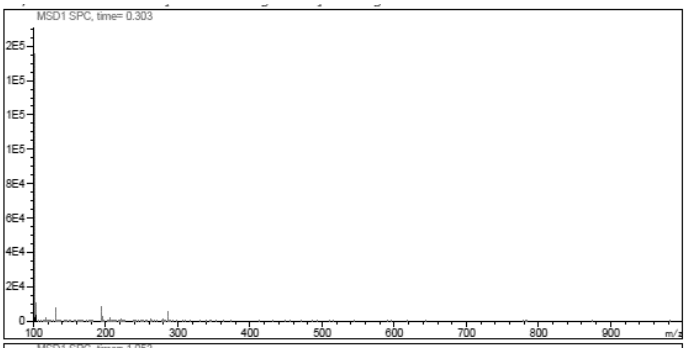
Signal 2 : DAD1 B, Sig=254,4 Ref=off

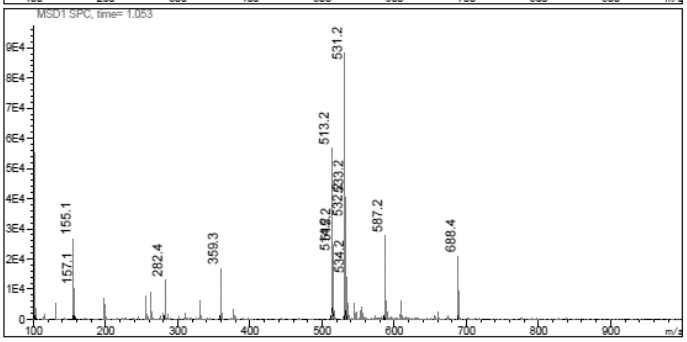
#	Meas. Ret.	Height	Width	Area	Area %
1	0.815	17.101	0.033	39.699	0.519
2	0.967	23.487	0.026	42.230	0.552
3	1.053	1259.189	0.023	1903.633	24.898
4	1.094	2148.858	0.017	2478.554	32.418
5	1.114	2063.032	0.022	2772.413	36.261
6	1.301	153.644	0.039	409.161	5.352

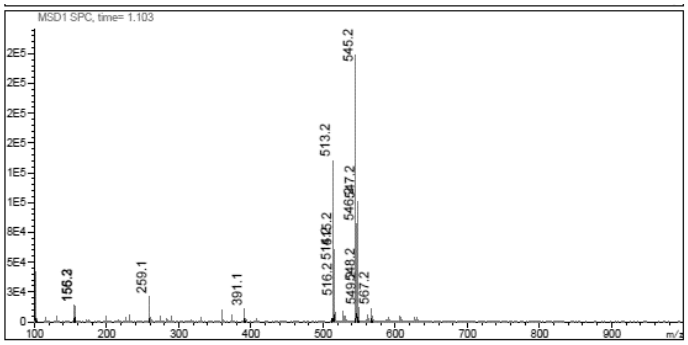

MSD1 SPC, time= 0.256


MSD1 SPC, time= 0.267
194.1

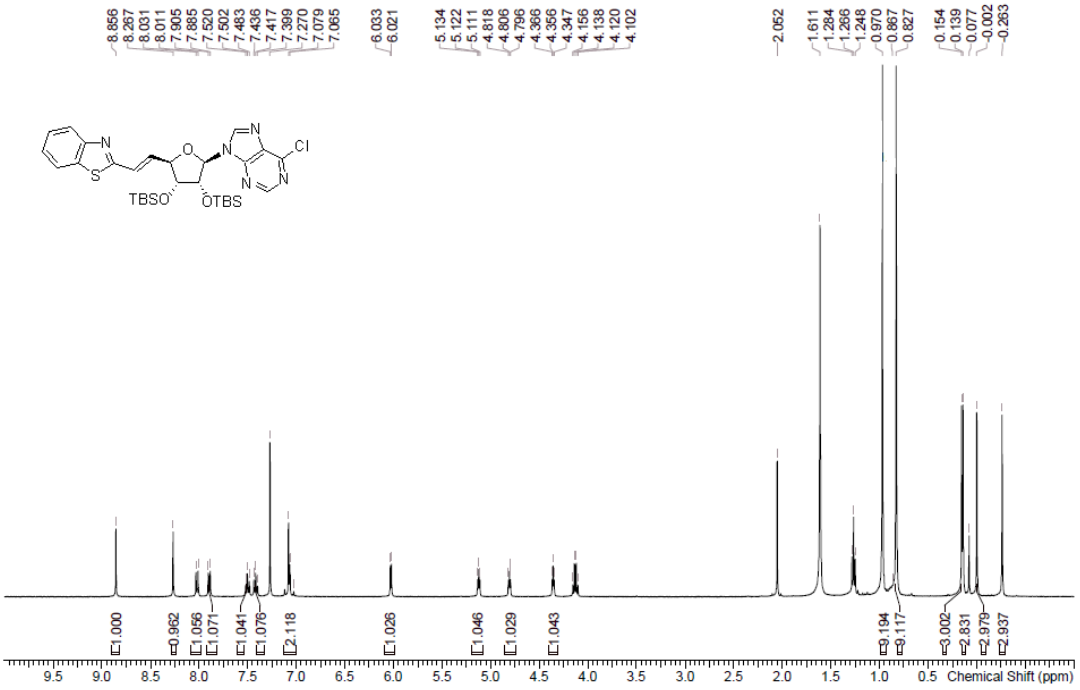

MSD1 SPC, time= 0.28
194.1


MSD1 SPC, time= 0.303

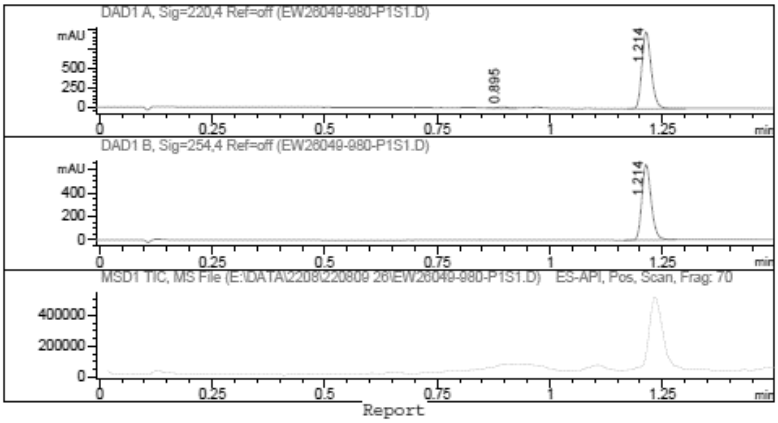

MSD1 SPC, time= 1.053
531.2
513.2
587.2
688.4
155.1
157.1
282.4
359.3



^{1}H NMR [(2*R*,3*R*,4*R*,5*R*)-2-[(*E*)-2-(1,3-Benzothiazol-2-yl)vinyl]-4-[tert-butyl (dimethyl)silyl]oxy-5-(6-chloropurin-9-yl)tetrahydrofuran-3-yl]oxy-tert-butyl-dimethyl-silane **(48)**



LCMS [(2*R*,3*R*,4*R*,5*R*)-2-[(*E*)-2-(1,3-Benzothiazol-2-yl)vinyl]-4-[tert-butyl (dimethyl)silyl]oxy-5-(6-chloropurin-9-yl)tetrahydrofuran-3-yl]oxy-tert-butyl-dimethyl-silane **(48)**



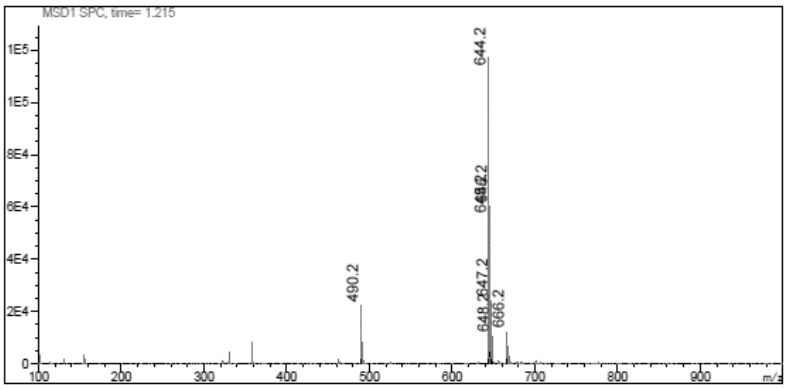
Report

Signal 1 : DAD1 A, Sig=220,4 Ref=off

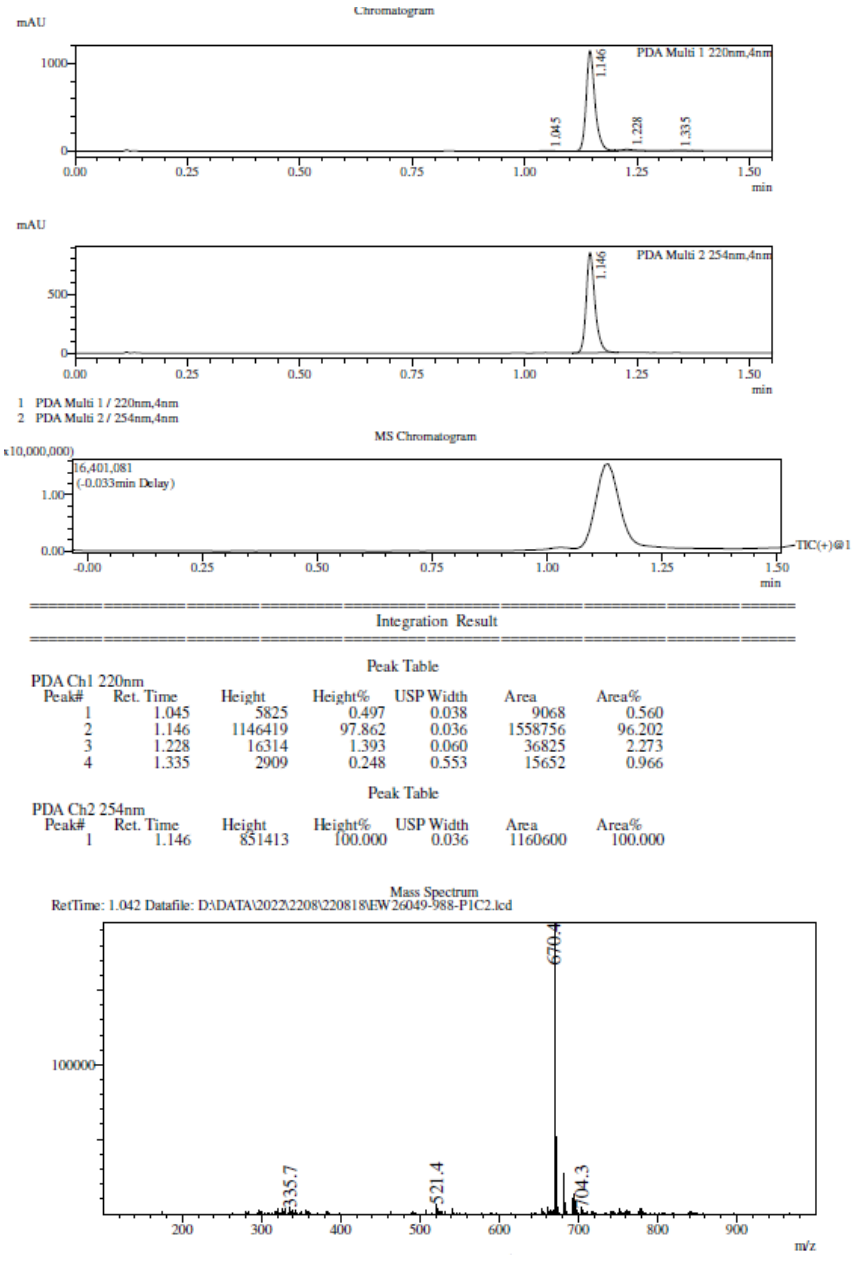
#	Meas. Ret.	Height	Width	Area	Area %
1	0.895	15.259	0.028	29.316	2.000
2	1.214	987.105	0.022	1436.830	98.000

Signal 2 : DAD1 B, Sig=254,4 Ref=off

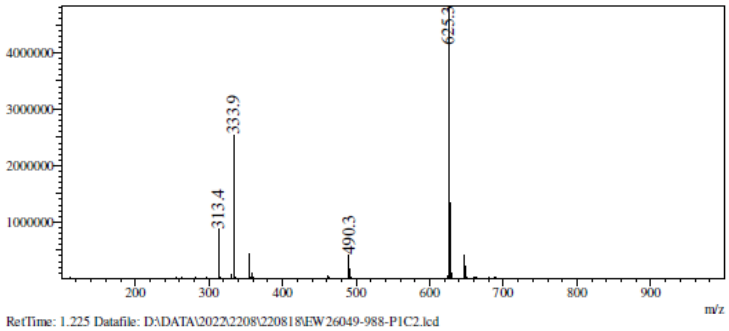
#	Meas. Ret.	Height	Width	Area	Area %
1	1.214	641.980	0.022	923.254	100.000



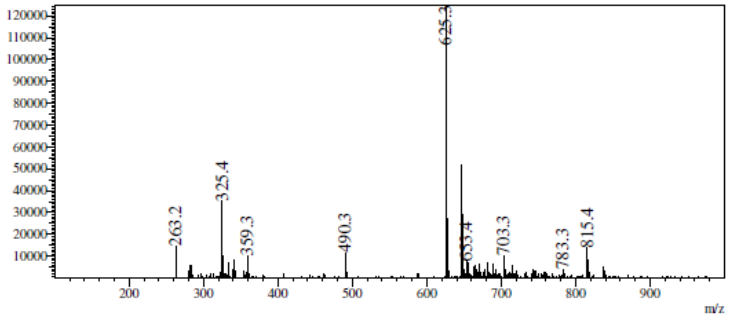
LCMS 9-[(2*R*,3*R*,4*R*,5*R*)-5-[(*E*)-2-(1,3-Benzothiazol-2-yl)vinyl]-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]purin-6-amine **(49)**



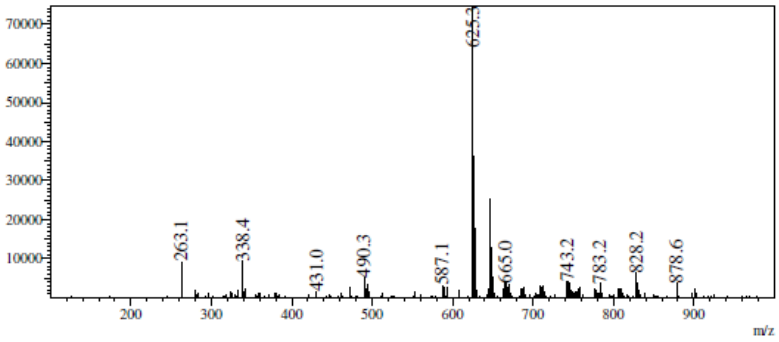
RetTime: 1.142 Datafile: D:\DATA\2022\2208\220818\EW26049-988-P1C2.lcd



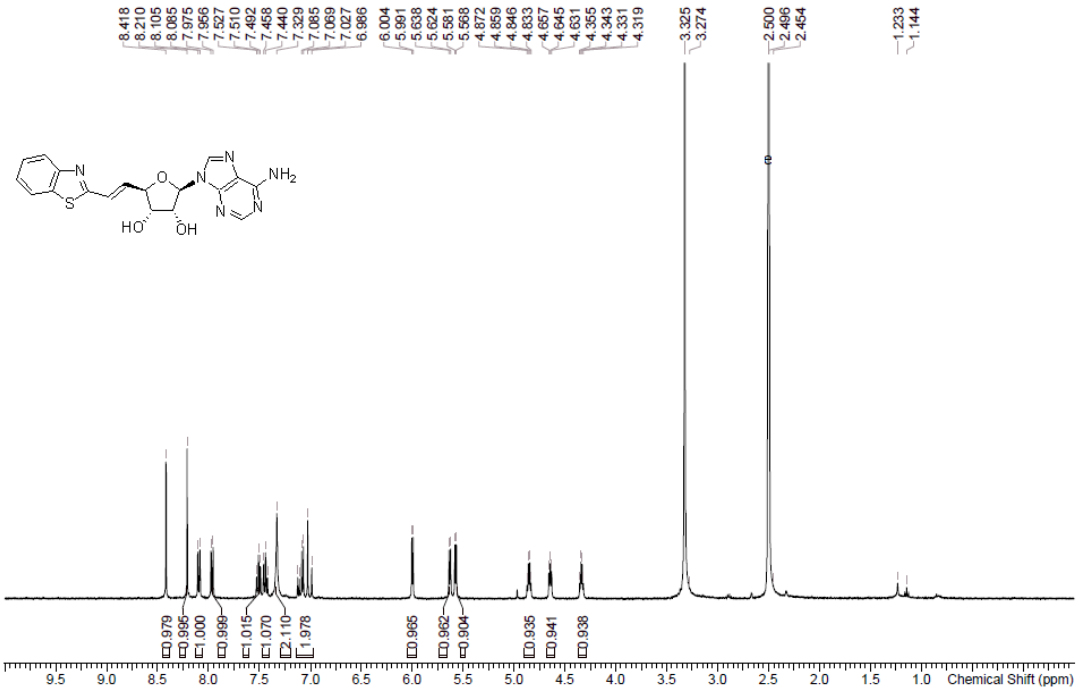
RetTime: 1.225 Datafile: D:\DATA\2022\2208\220818\EW26049-988-P1C2.lcd



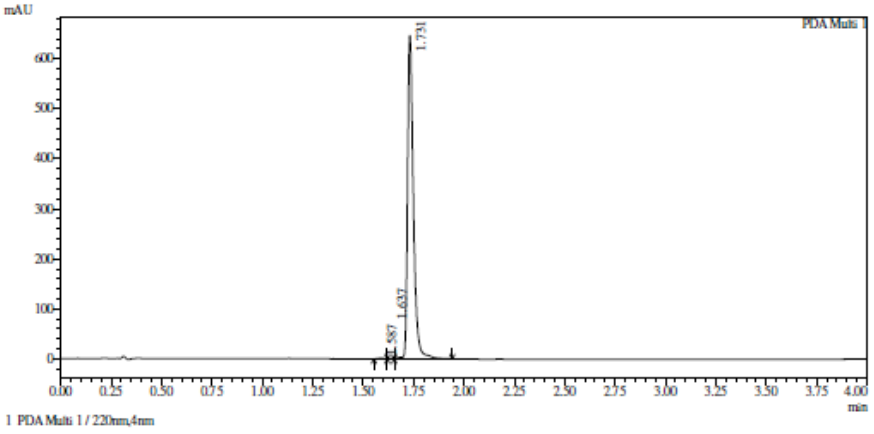
RetTime: 1.333 Datafile: D:\DATA\2022\2208\220818\EW26049-988-P1C2.lcd



^{1}H NMR (2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(*E*)-2-(1,3-benzothiazol-2-yl) vinyl]tetrahydrofuran-3,4-diol **(33)**



HPLC (2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(*E*)-2-(1,3-benzothiazol-2-yl) vinyl]tetrahydrofuran-3,4-diol **(33)**

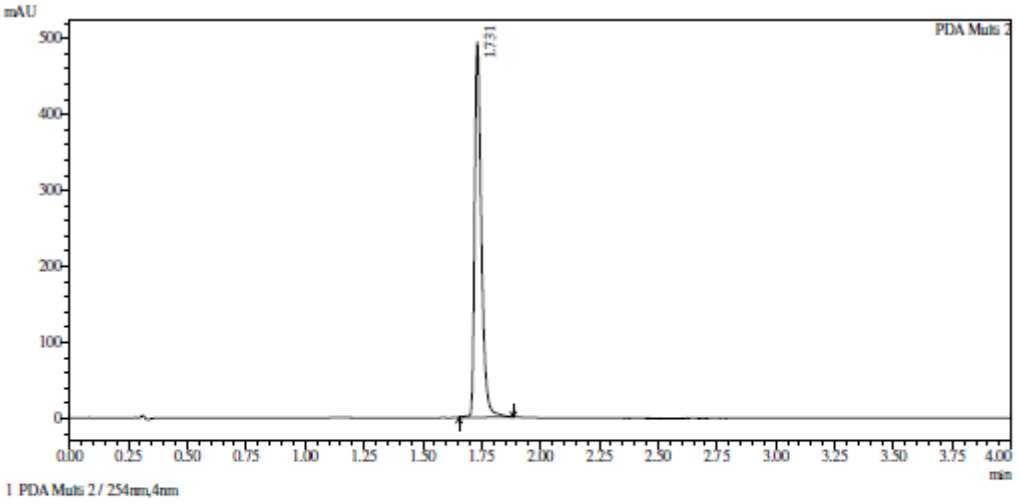


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.587	0.053	0.000	1563	3091	0.237
2	1.637	0.100	0.662	1055	1736	0.133
3	1.731	0.051	1.238	647135	1300375	99.630
Total				649752	1305202	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.731	0.051	0.000	494603	984589	100.000
Total				494603	984589	100.000

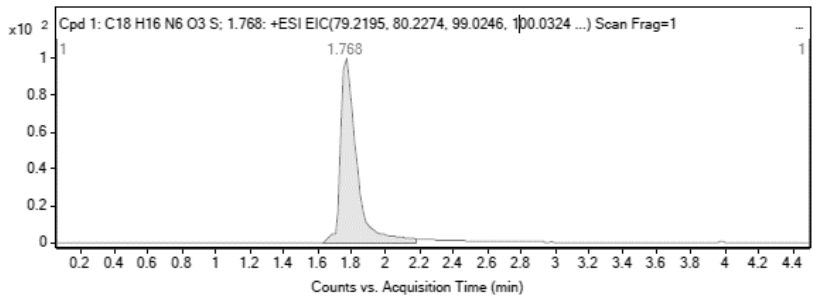
HRMC (2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[(*E*)-2-(1,3-benzothiazol-2-yl) vinyl]tetrahydrofuran-3,4-diol **(33)**

Compound Table

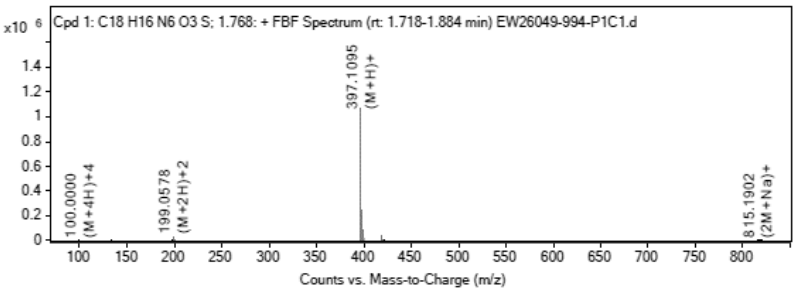
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C18 H16 N6 O3 S; 1.768	99.29	3.28	C18 H16 N6 O3 S	1.768	396.1005	396.1018

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
419.0899	1.768	396.1018	C18 H16 N6 O3 S	396.1005	3.28	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

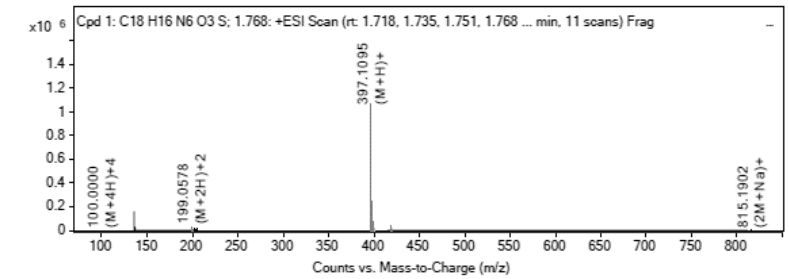


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
199.0578	2	29187.99	(M+2H)+2
199.559	2	7087.75	(M+2H)+2

397.1095	1	1066689	(M+H)+
398.1113	1	248296.41	(M+H)+
399.108	1	76921.66	(M+H)+
419.0899	1	38582.68	(M+Na)+
420.0924	1	8908.7	(M+Na)+
815.1902	1	8208.4	(2M+Na)+
816.1932	1	3695.78	(2M+Na)+
817.1763	1	4415.6	(2M+Na)+

MS Zoomed Spectrum

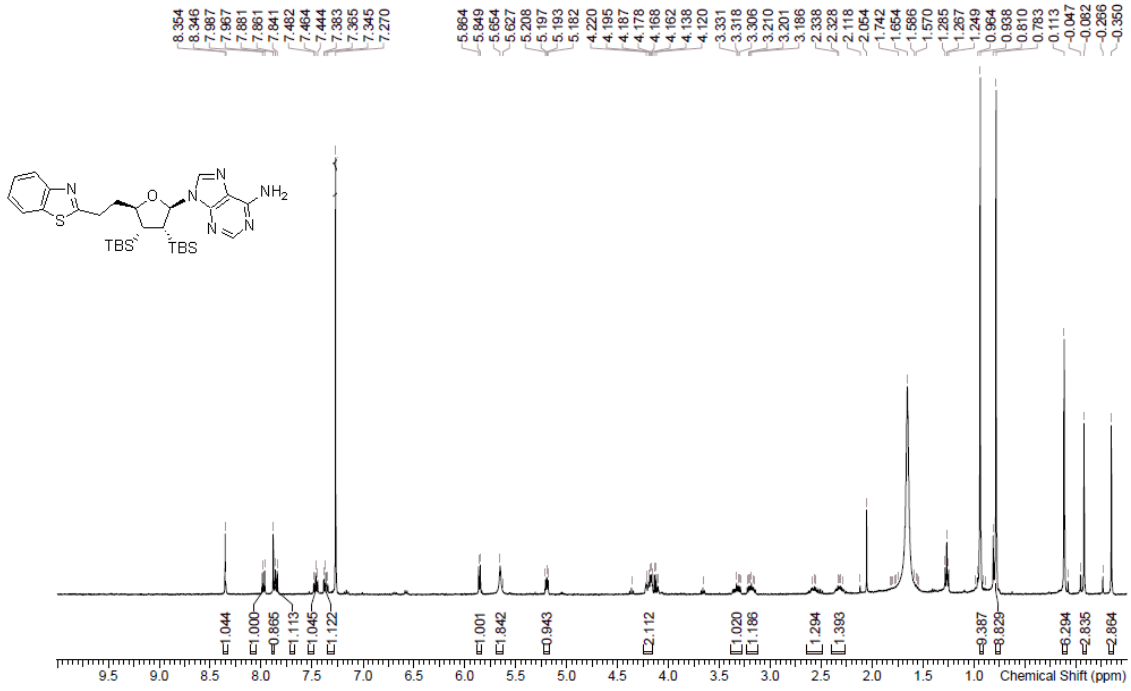


MS Spectrum Peak List

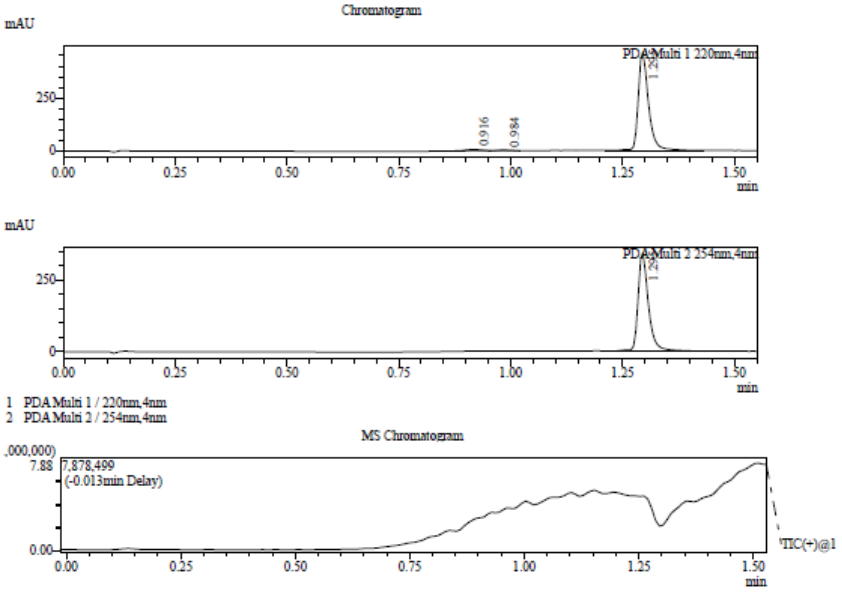
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
199.0578	2	29187.99	(M+2H)+2	-1.63
199.559	2	7087.75	(M+2H)+2	-0.81
397.1095	1	1066689	(M+H)+	-4.46
398.1113	1	248296.41	(M+H)+	-2.35
399.108	1	76921.66	(M+H)+	-1.72
419.0899	1	38582.68	(M+Na)+	-0.45
420.0924	1	8908.7	(M+Na)+	-0.26
815.1902	1	8208.4	(2M+Na)+	-0.06
816.1932	1	3695.78	(2M+Na)+	-0.5
817.1763	1	4415.6	(2M+Na)+	18.15

— End Of Report —

^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*R*)-5-[2-(1,3-Benzothiazol-2-yl)ethyl]-3,4-bis [[tert-butyl(dimethyl)silyl]oxy] tetrahydrofuran-2-yl]purin-6-amine **(50)**



LCMS 9-[(2*R*,3*R*,4*R*,5*R*)-5-[2-(1,3-Benzothiazol-2-yl)ethyl]-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]purin-6-amine **(50)**



Integration Result

Peak Table

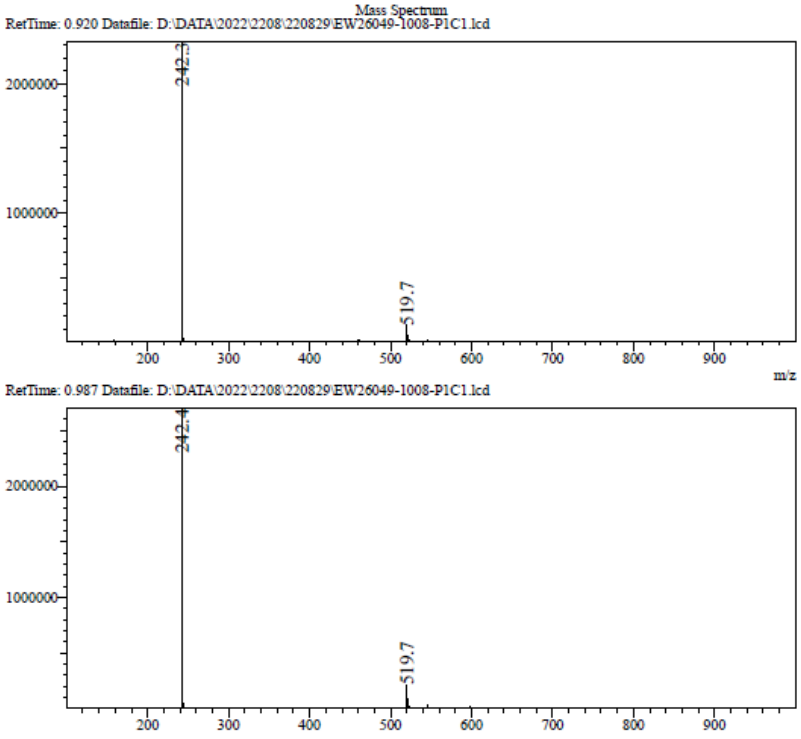
PDA Ch1 220nm

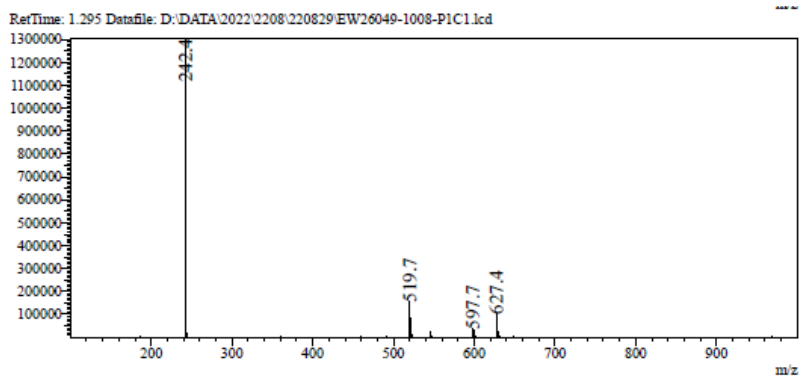
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.916	6607	1.397	0.081	18435	2.442
2	0.984	3107	0.657	0.055	5752	0.762
3	1.295	463329	97.947	0.046	730841	96.797

Peak Table

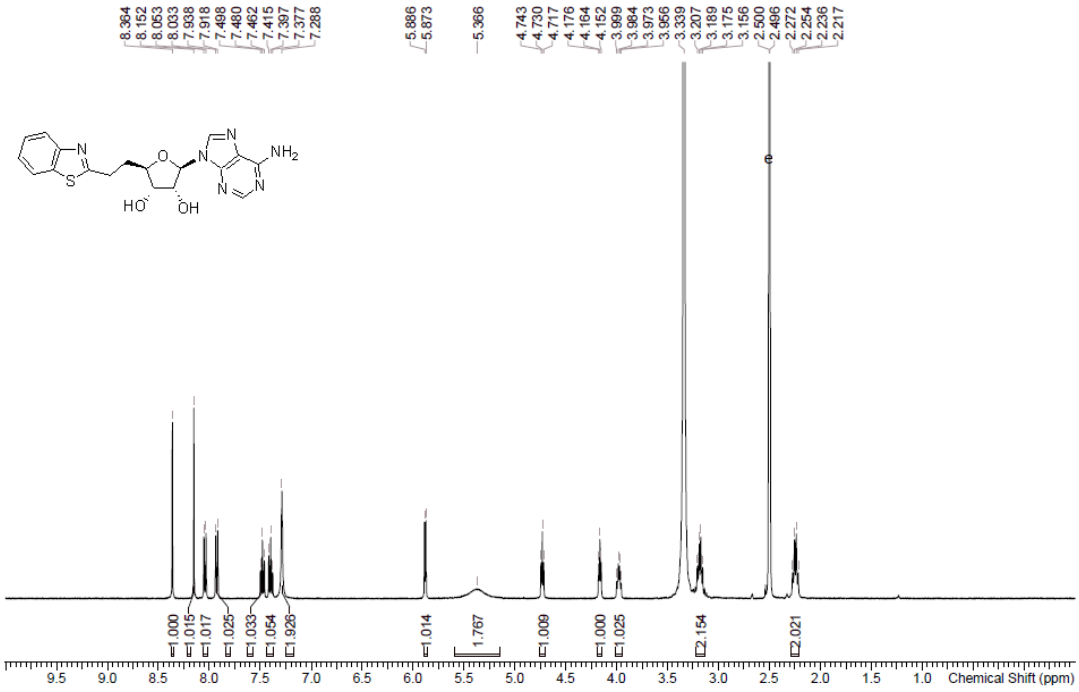
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.295	342660	100.000	0.046	547623	100.000

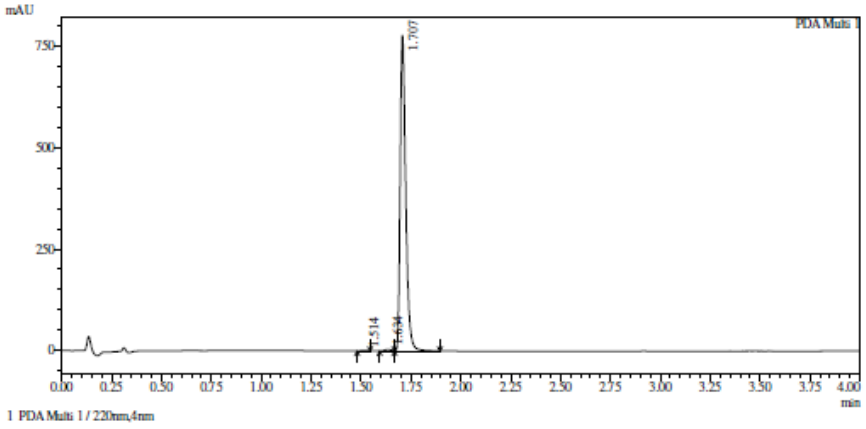




^{1}H NMR (2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[2-(1,3-benzothiazol-2-yl) ethyl]tetrahydrofuran-3,4-diol **(25)**



HPLC (2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[2-(1,3-benzothiazol-2-yl) ethyl]tetrahydrofuran-3,4-diol **(25)**

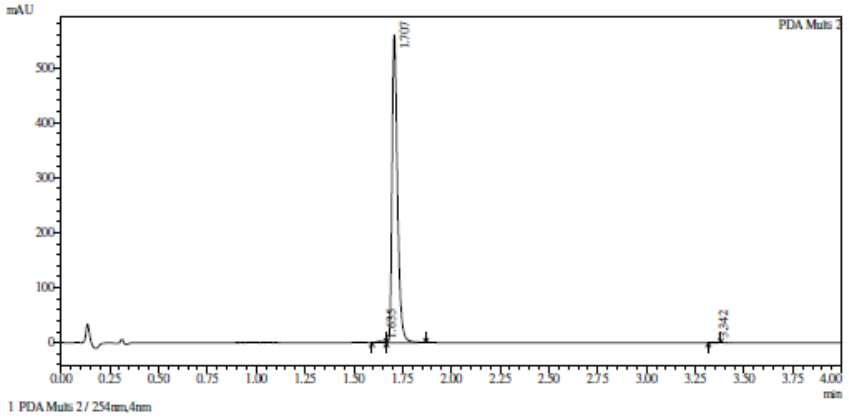


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.514	0.103	0.000	1264	3218	0.211
2	1.634	0.077	1.345	3528	9421	0.618
3	1.707	0.051	1.137	778638	1511865	99.171
Total				783431	1524505	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.635	0.077	0.000	2550	6858	0.629
2	1.707	0.051	1.122	559197	1081077	99.229
3	3.342	0.052	31.750	822	1547	0.142
Total				562570	1089482	100.000

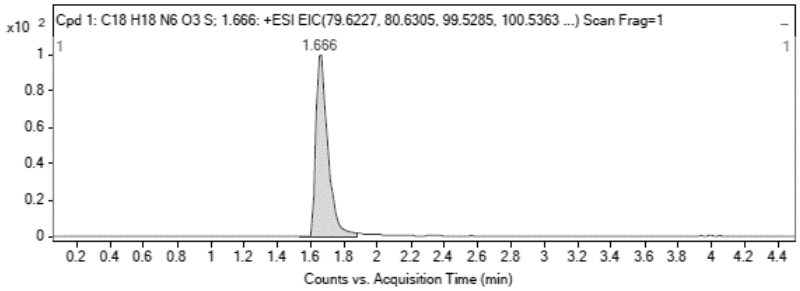
HRMC (2*R*,3*R*,4*S*,5*R*)-2-(6-Aminopurin-9-yl)-5-[2-(1,3-benzothiazol-2-yl) ethyl]tetrahydrofuran-3,4-diol **(25)**

Compound Table

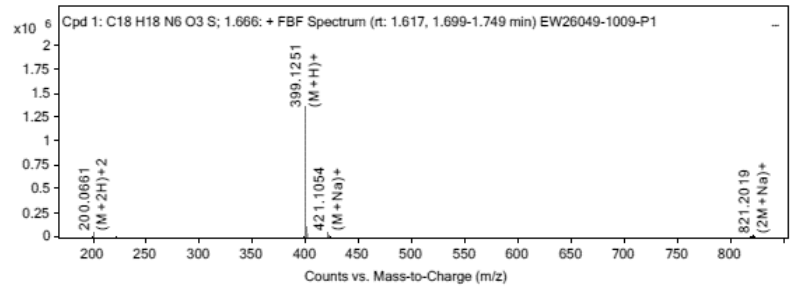
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C18 H18 N6 O3 S; 1.666	99.11	3.22	C18 H18 N6 O3 S	1.666	398.1161	398.1174

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
421.1054	1.666	398.1174	C18 H18 N6 O3 S	398.1161	3.22	Find by Formula

Compound Chromatograms



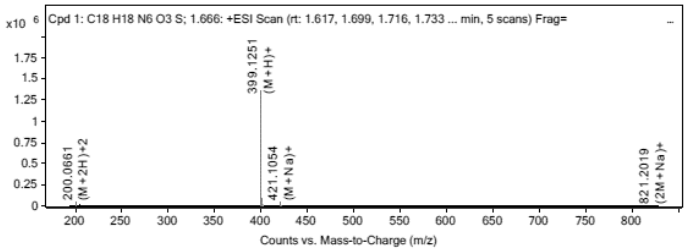
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
200.0661	2	38145.5	(M+2H)+2
200.5672	2	8738.28	(M+2H)+2
201.0661	2	3324.03	(M+2H)+2
399.1251	1	1358144.75	(M+H)+
400.1268	1	316680.78	(M+H)+
401.1235	1	98099.39	(M+H)+
421.1054	1	43094.38	(M+Na)+
422.1076	1	9586.86	(M+Na)+
819.2206	1	5366.74	(2M+Na)+
821.2019	1	6874.68	(2M+Na)+

MS Zoomed Spectrum

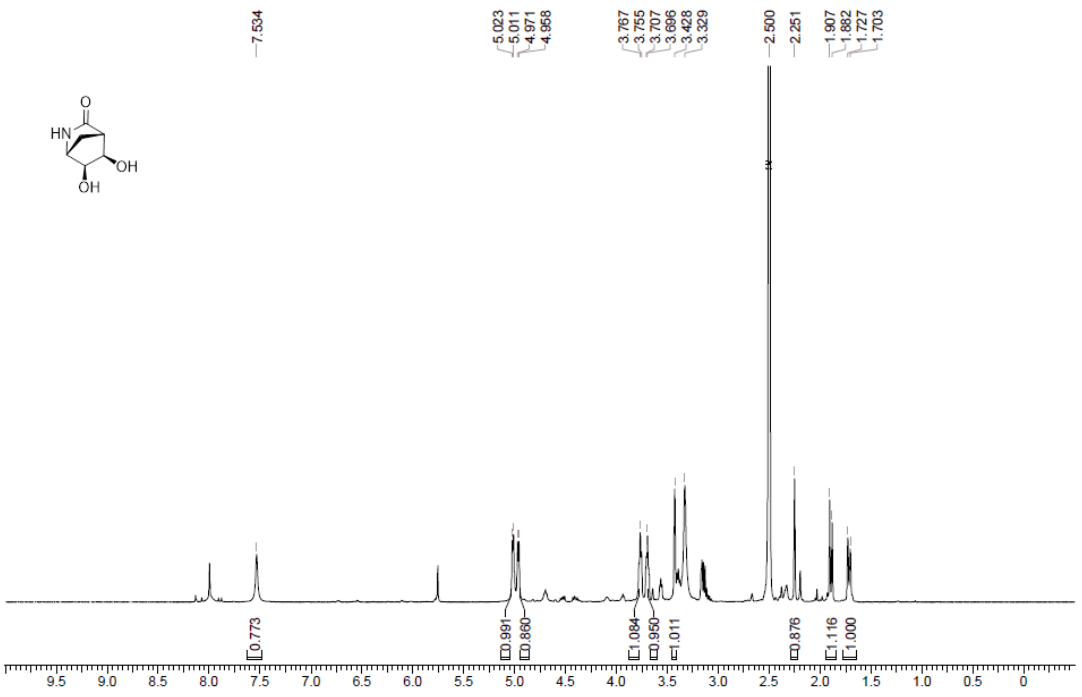


MS Spectrum Peak List

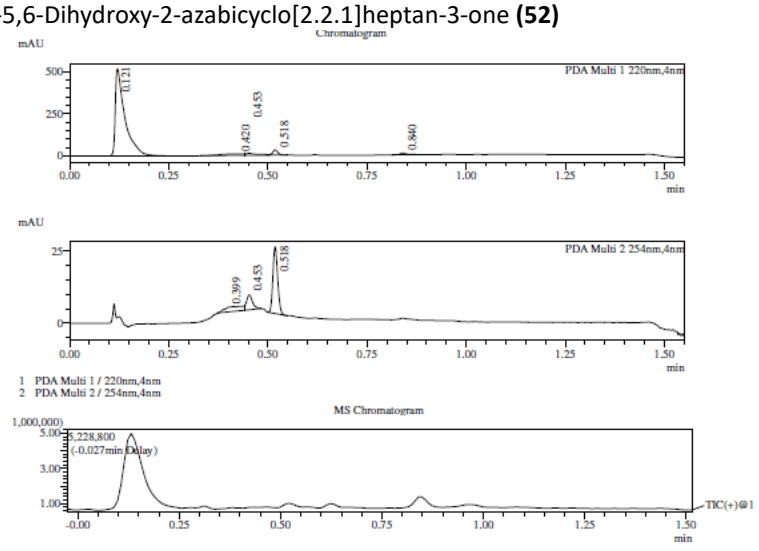
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
200.0661	2	38145.5	(M+2H)+2	-3.6
200.5672	2	8738.28	(M+2H)+2	-2.95
201.0661	2	3324.03	(M+2H)+2	-5.06
399.1251	1	1358144.75	(M+H)+	-4.29
400.1268	1	316680.78	(M+H)+	-1.97
401.1235	1	98099.39	(M+H)+	-1.39
421.1054	1	43094.38	(M+Na)+	-0.12
422.1076	1	9586.86	(M+Na)+	0.96
819.2206	1	5366.74	(2M+Na)+	1.06
821.2019	1	6874.68	(2M+Na)+	25

--- End Of Report ---

^{1}H NMR (1*R*,4*S*,5*R*,6*S*)-5,6-Dihydroxy-2-azabicyclo[2.2.1]heptan-3-one **(52)**



LCMS (1*R*,4*S*,5*R*,6*S*)-5,6-Dihydroxy-2-azabicyclo[2.2.1]heptan-3-one **(52)**



Integration Result

Peak Table

PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.121	516265	89.294	0.041	872473	89.391
2	0.420	9172	1.586	0.193	37956	3.889
3	0.453	11901	2.058	0.060	24618	2.522
4	0.518	30231	5.229	0.026	27963	2.865
5	0.840	10592	1.832	0.030	13011	1.333

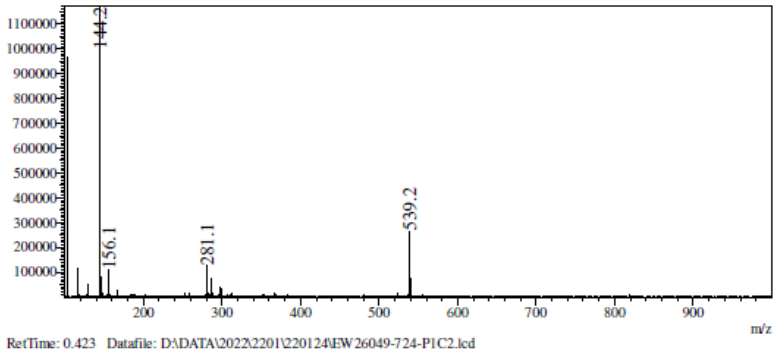
Peak Table

PDA Ch2 254nm

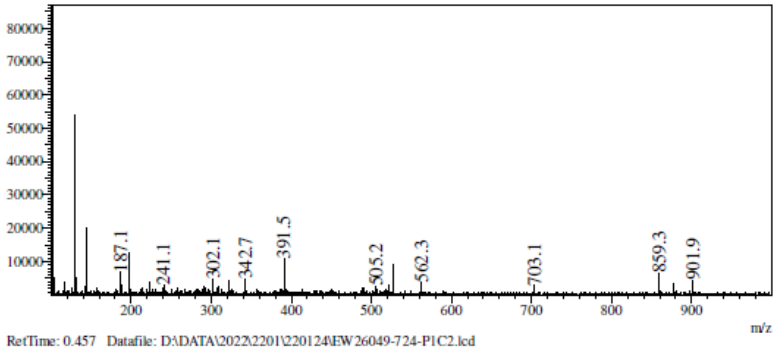
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.399	1629	5.432	0.241	5179	17.148
2	0.453	5198	17.334	0.031	5330	17.648
3	0.518	23161	77.234	0.025	19693	65.203

Mass Spectrum

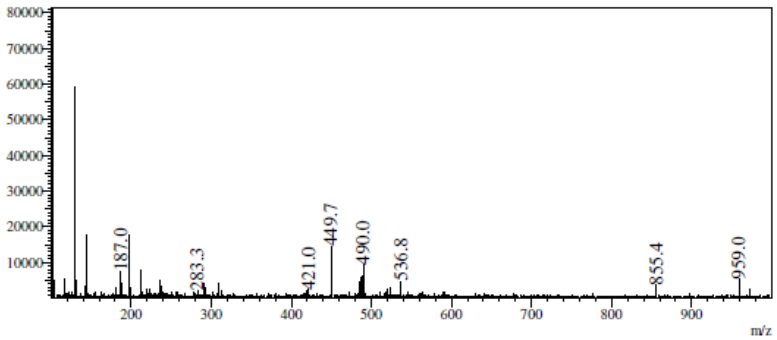
RetTime: 0.123 Datafile: D:\DATA\2022\2201\220124\EW26049-724-P1C2.lcd



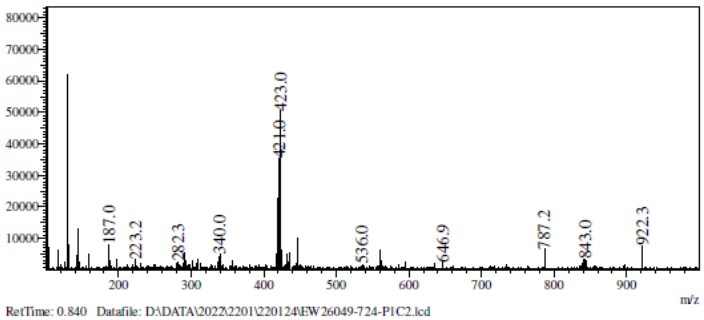
RetTime: 0.423 Datafile: D:\DATA\2022\2201\220124\EW26049-724-P1C2.lcd



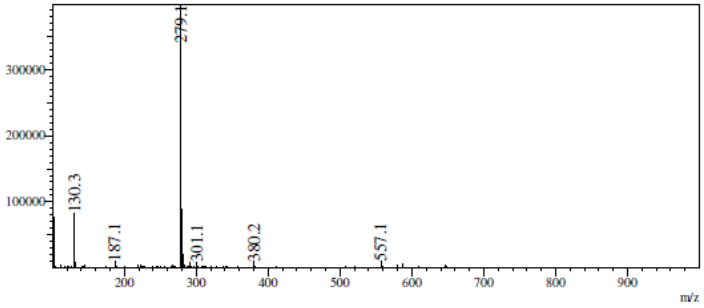
RetTime: 0.457 Datafile: D:\DATA\2022\2201\220124\EW26049-724-P1C2.lcd



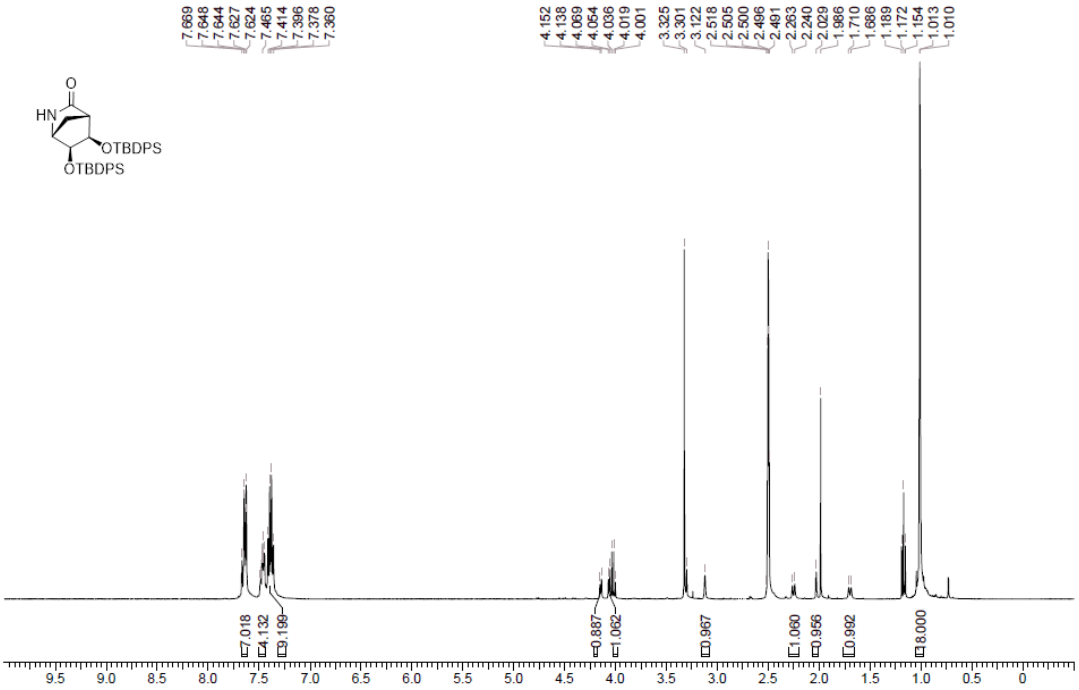
RetTime: 0.515 Datafile: D:\DATA\2022\2201\220124\EW26049-724-P1C2.lcd



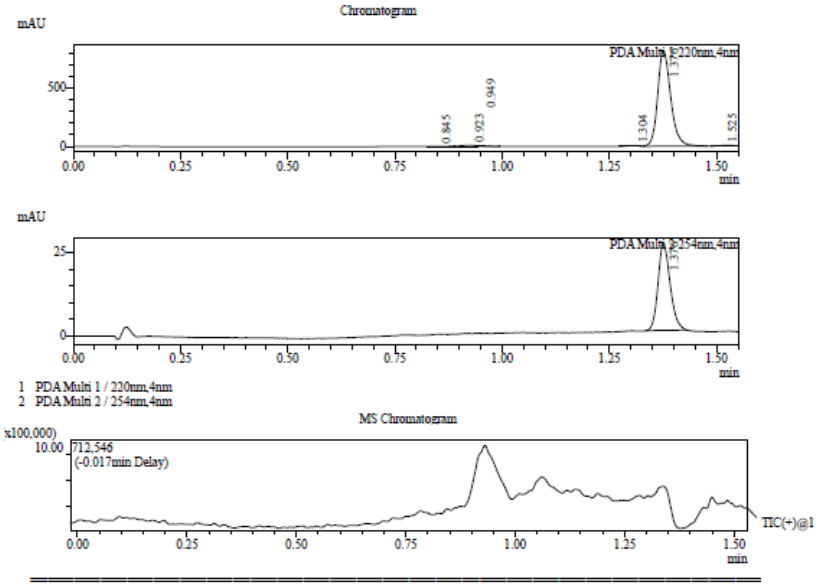
RetTime: 0.840 Datafile: D:\DATA\2022\2201\220124\EW26049-724-P1C2.lcd



^{1}H NMR (1*R*,4*S*,5*R*,6*S*)-5,6-Bis[[tert-butyl(diphenyl)silyl]oxy]-2-azabicyclo [2.2.1]heptan-3-one **(53)**



LCMS (1*R*,4*S*,5*R*,6*S*)-5,6-Bis[[tert-butyl(diphenyl)silyl]oxy]-2-azabicyclo [2.2.1]heptan-3-one **(53)**



Integration Result

Peak Table

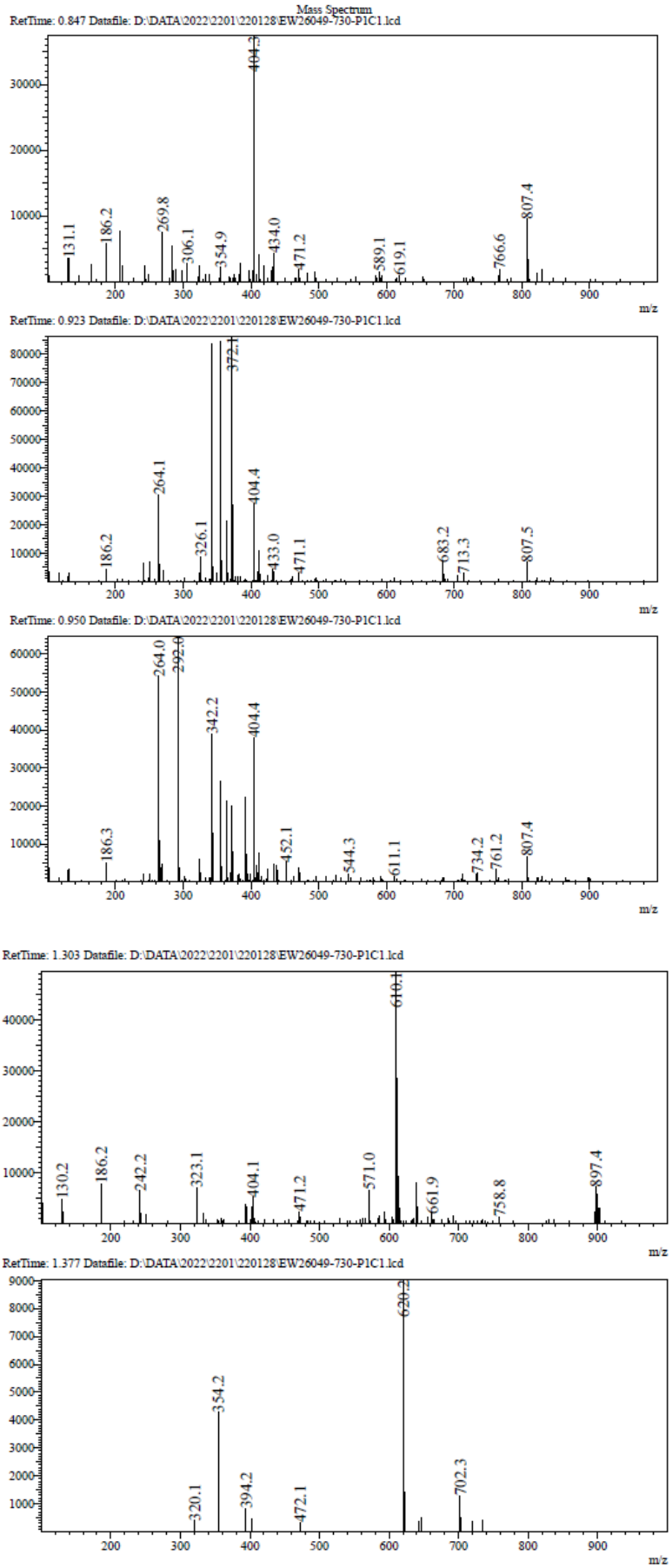
PDA Ch1 220nm

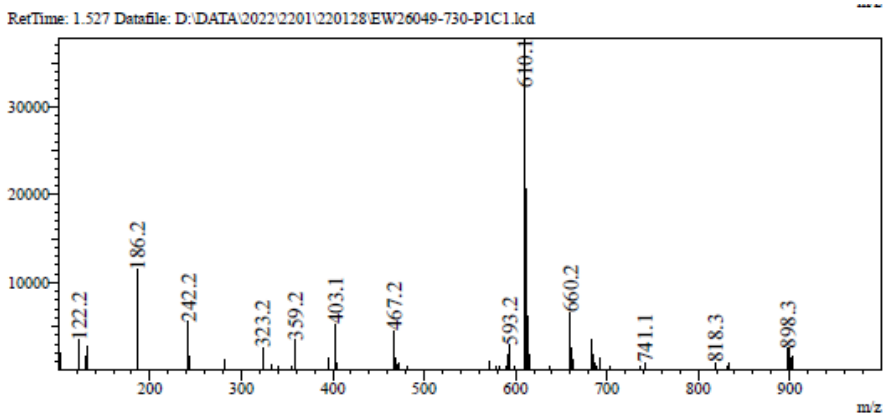
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.845	1696	0.201	0.056	6157	0.346
2	0.923	10582	1.254	0.084	24960	1.403
3	0.949	7345	0.870	0.113	9285	0.522
4	1.304	5284	0.626	0.058	9768	0.549
5	1.376	814867	96.569	0.055	1720930	96.738
6	1.525	4041	0.479	0.051	7855	0.442

Peak Table

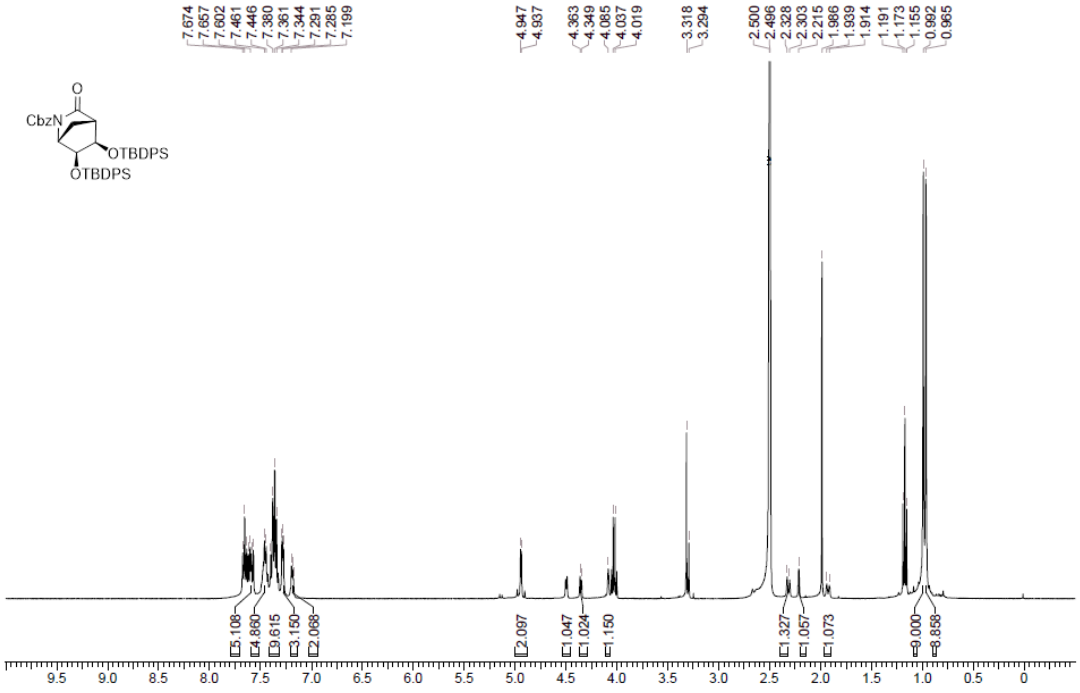
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.376	26015	100.000	0.052	51285	100.000

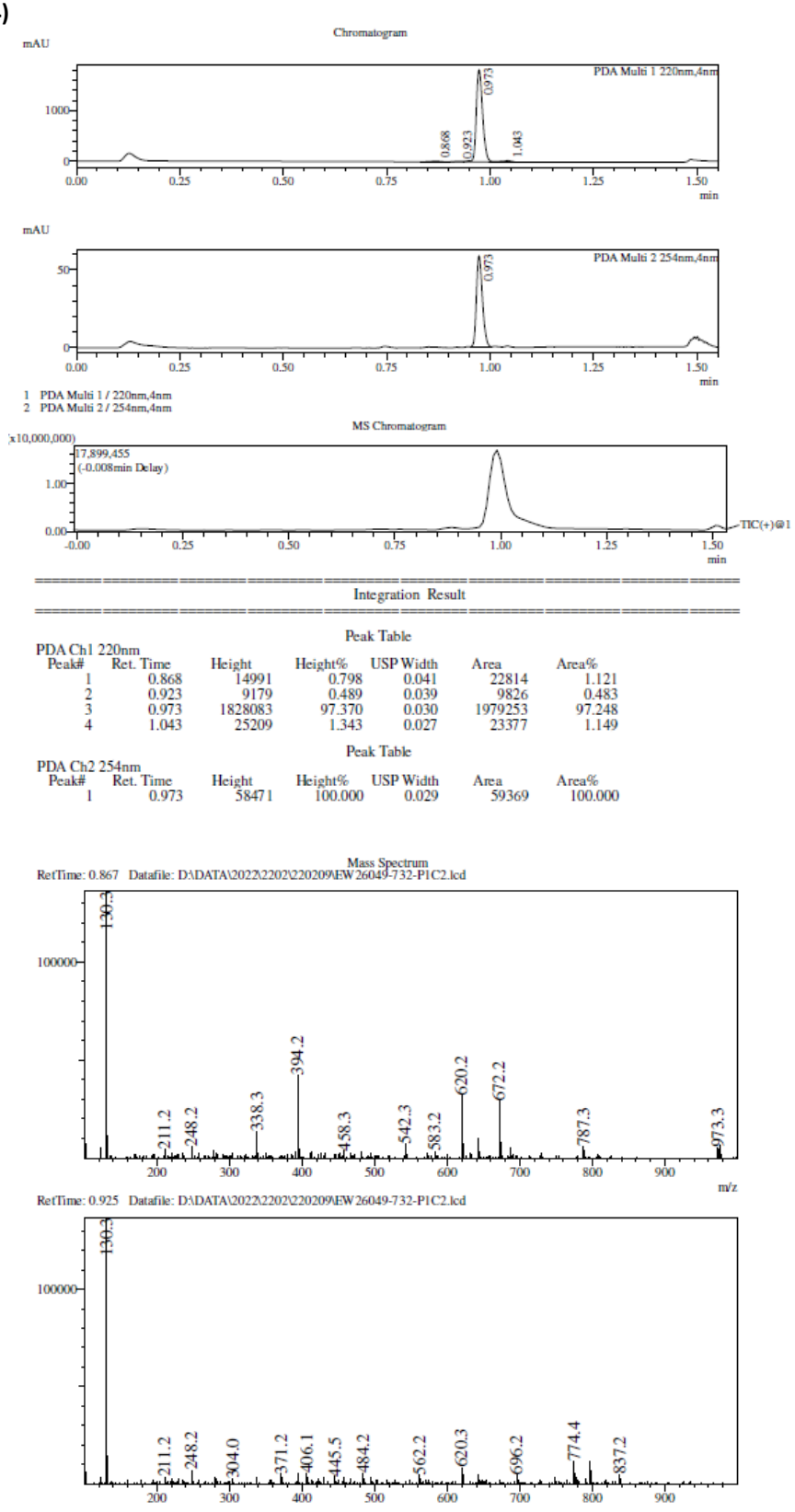

Mass Spectrum
RetTime: 0.847 Datafile: D:\DATA\2022\2201\220128\EW26049-730-P1C1.lcd
404.2
131.1
186.2
269.8
306.1
354.9
434.0
471.2
589.1
619.1
766.6
807.4
m/z
RetTime: 0.923 Datafile: D:\DATA\2022\2201\220128\EW26049-730-P1C1.lcd
372.1
264.1
404.4
186.2
326.1
433.0
471.1
683.2
713.3
807.5
m/z
RetTime: 0.950 Datafile: D:\DATA\2022\2201\220128\EW26049-730-P1C1.lcd
264.0
292.0
342.2
404.4
186.3
452.1
544.3
611.1
734.2
761.2
807.4
m/z
RetTime: 1.303 Datafile: D:\DATA\2022\2201\220128\EW26049-730-P1C1.lcd
610.1
130.2
186.2
242.2
323.1
404.1
471.2
571.0
661.9
758.8
897.4
m/z
RetTime: 1.377 Datafile: D:\DATA\2022\2201\220128\EW26049-730-P1C1.lcd
620.2
354.2
320.1
394.2
472.1
702.3
m/z

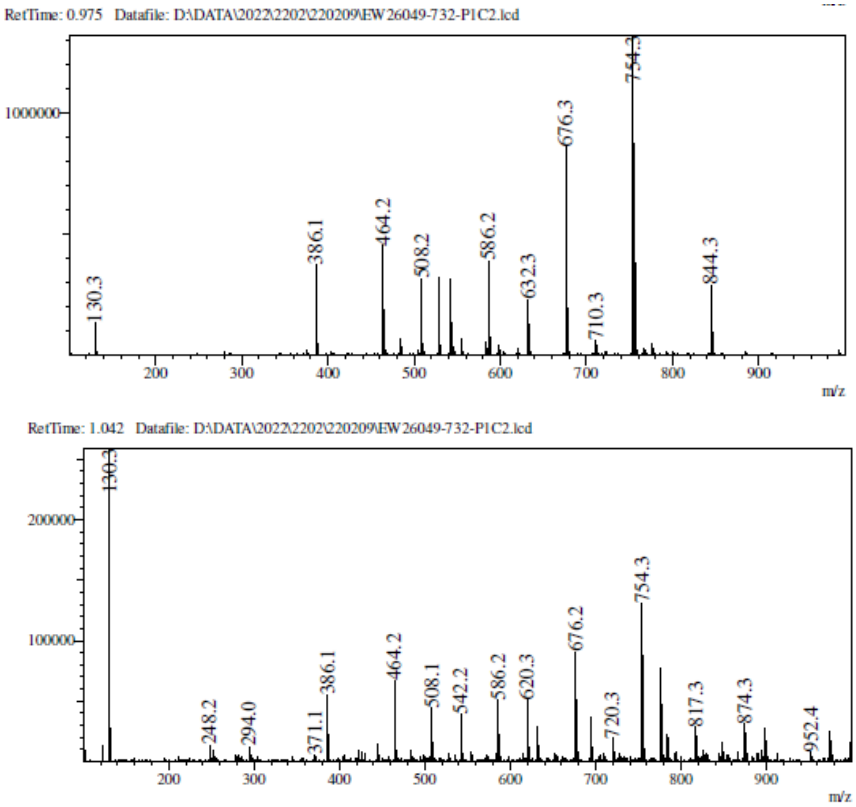


^{1}H NMR Benzyl (1*R*,4*S*,5*R*,6*S*)-5,6-bis[[tert-butyl(diphenyl)silyl]oxy]-3-oxo-2-azabicyclo[2.2.1] heptane-2-carboxylate **(54)**

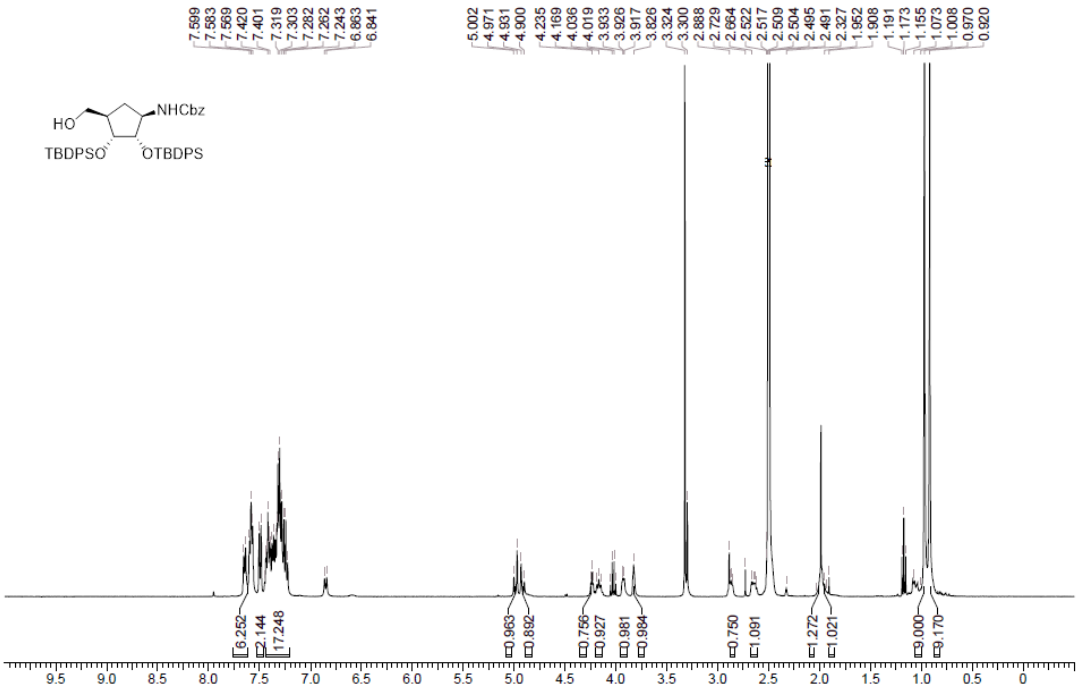


LCMS Benzyl (1*R*,4*S*,5*R*,6*S*)-5,6-bis[[tert-butyl(diphenyl)silyl]oxy]-3-oxo-2-azabicyclo[2.2.1] heptane-2-carboxylate **(54)**

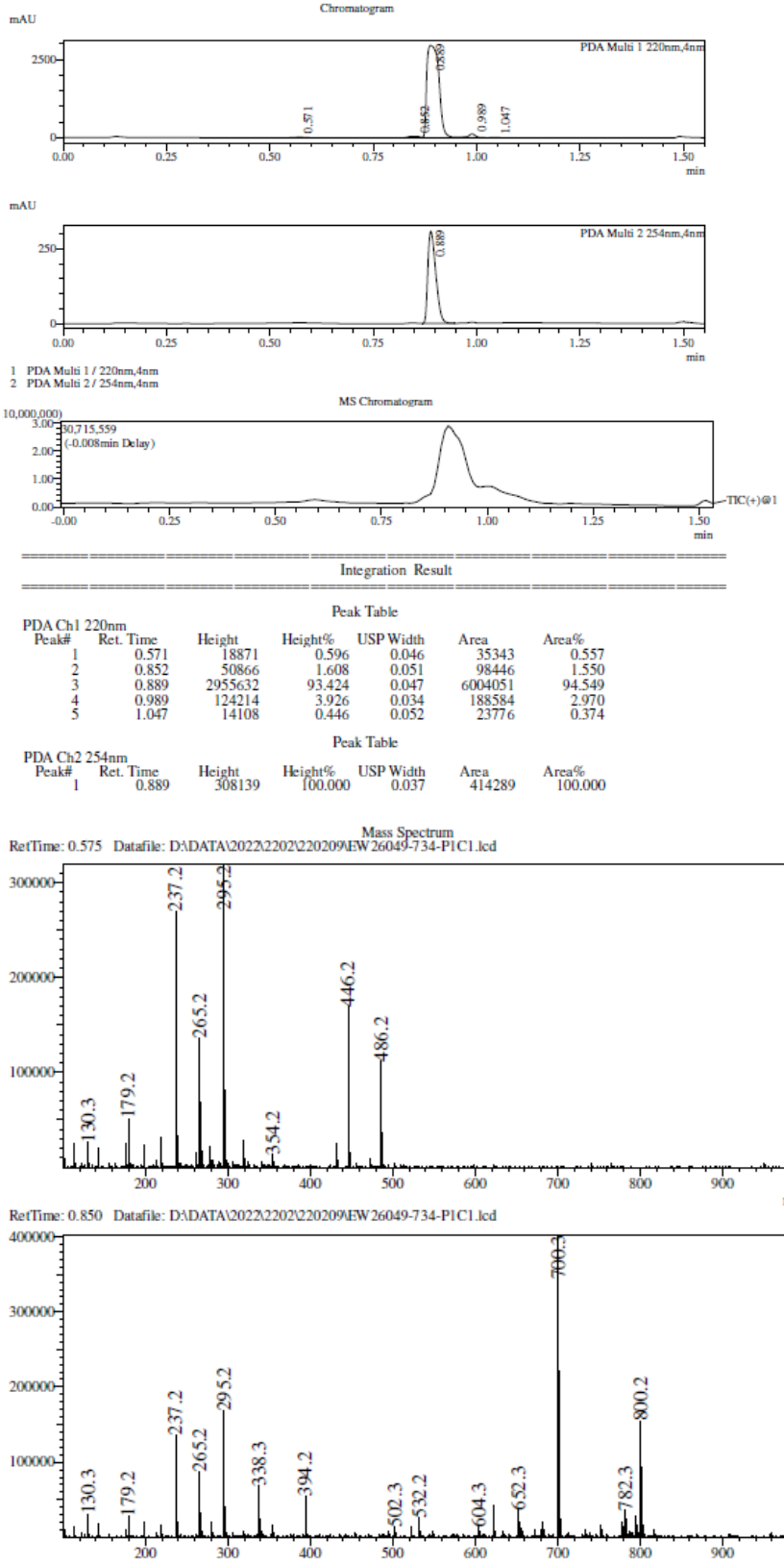


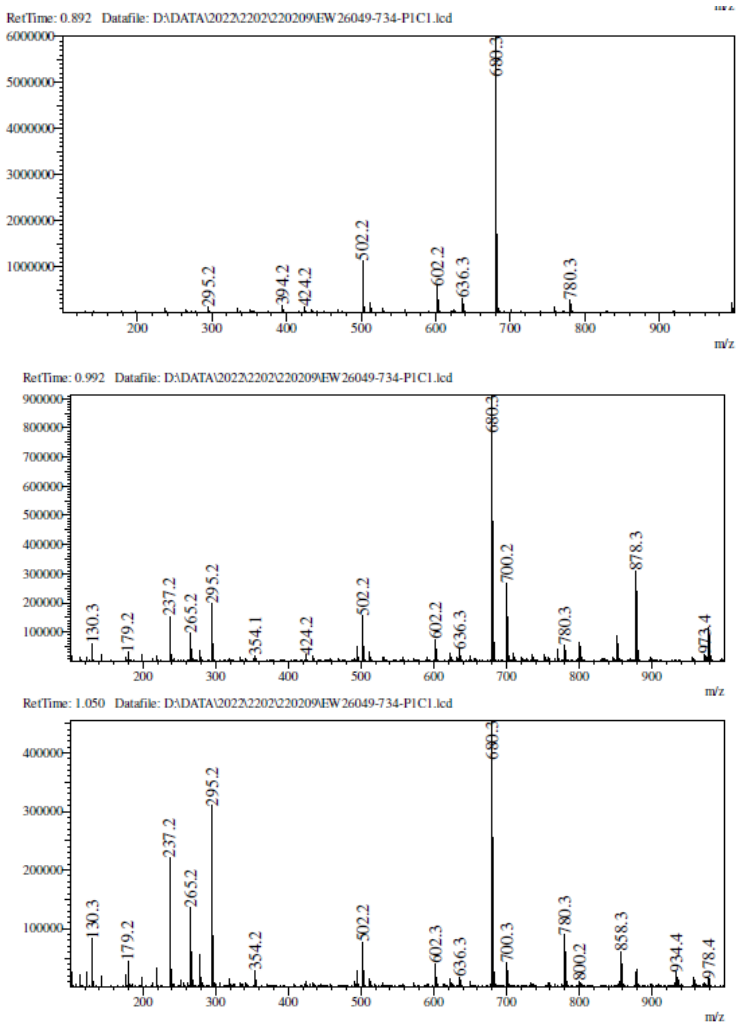


^{1}H NMR Benzyl *N*-[(1*R*,2*S*,3*R*,4*R*)-2,3-bis[[tert-butyl(diphenyl)silyl]oxy]-4 (hydroxymethyl) cyclopentyl]carbamate **(55)**

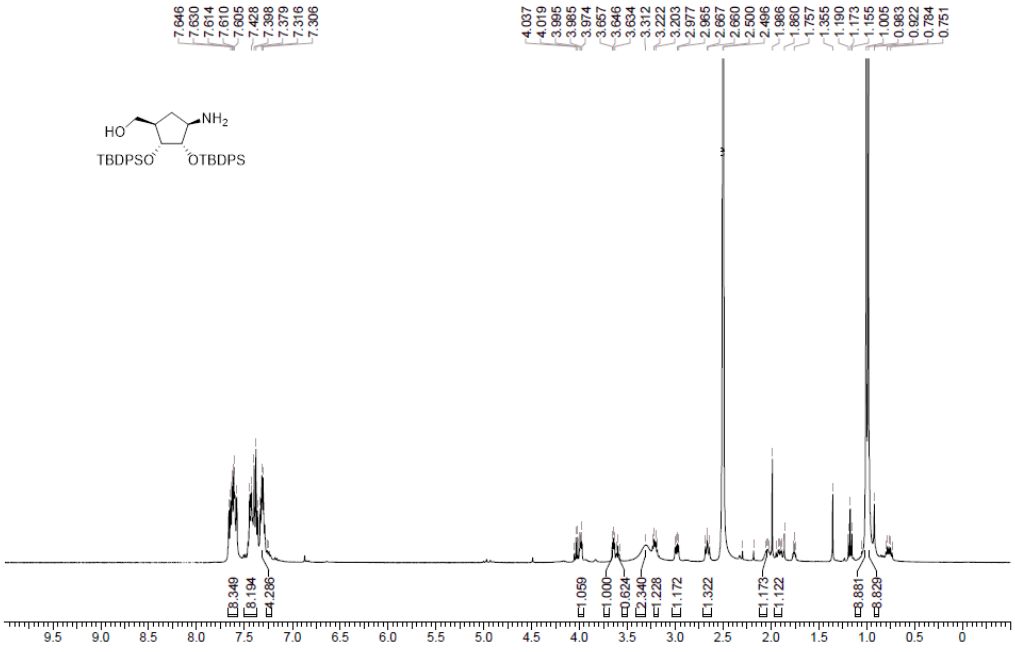


LCMS Benzyl *N*-[(1*R*,2*S*,3*R*,4*R*)-2,3-bis[[tert-butyl(diphenyl)silyl]oxy]-4 (hydroxymethyl) cyclopentyl]carbamate **(55)**

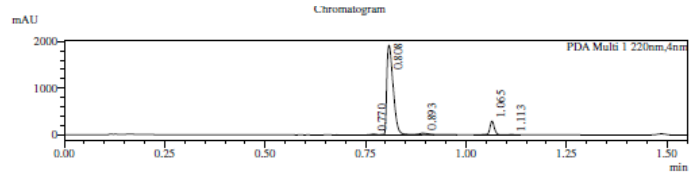


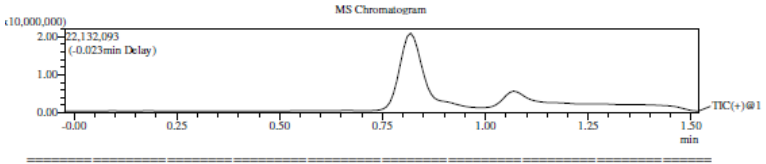


^{1}H NMR [(1*R*,2*R*,3*S*,4*R*)-4-Amino-2,3-bis[[tert-butyl(diphenyl)silyl]oxy] cyclopentyl]methanol **(56)**



LCMS [(1*R*,2*R*,3*S*,4*R*)-4-Amino-2,3-bis[[tert-butyl(diphenyl)silyl]oxy] cyclopentyl]methanol **(56)**





Integration Result

Peak Table

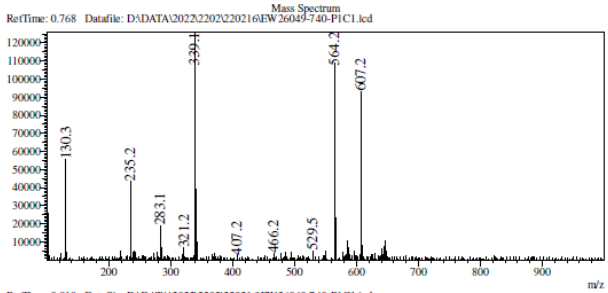
PDA Ch1 220nm

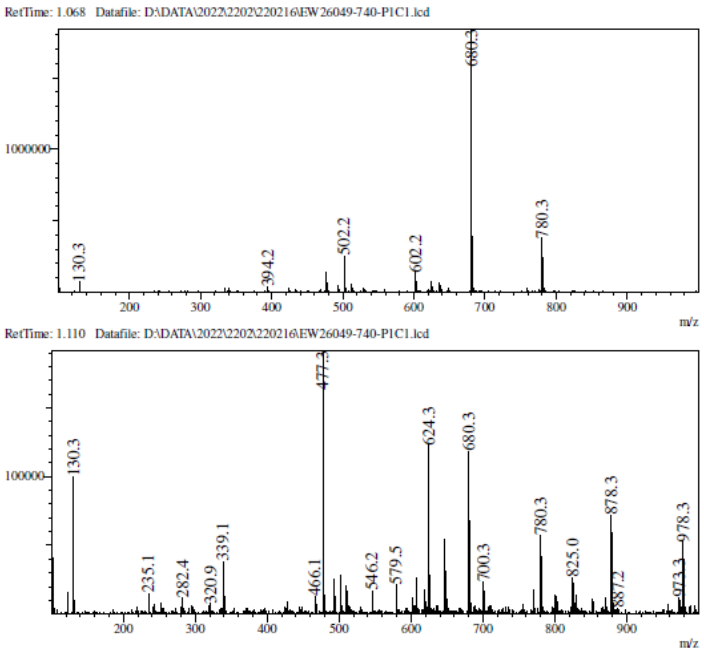
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.770	19528	0.859	0.030	20112	0.815
2	0.808	1921466	84.510	0.030	2165763	87.722
3	0.893	30257	1.331	0.035	38798	1.571
4	1.065	293255	12.898	0.022	233744	9.468
5	1.113	9141	0.402	0.030	10484	0.425

Peak Table

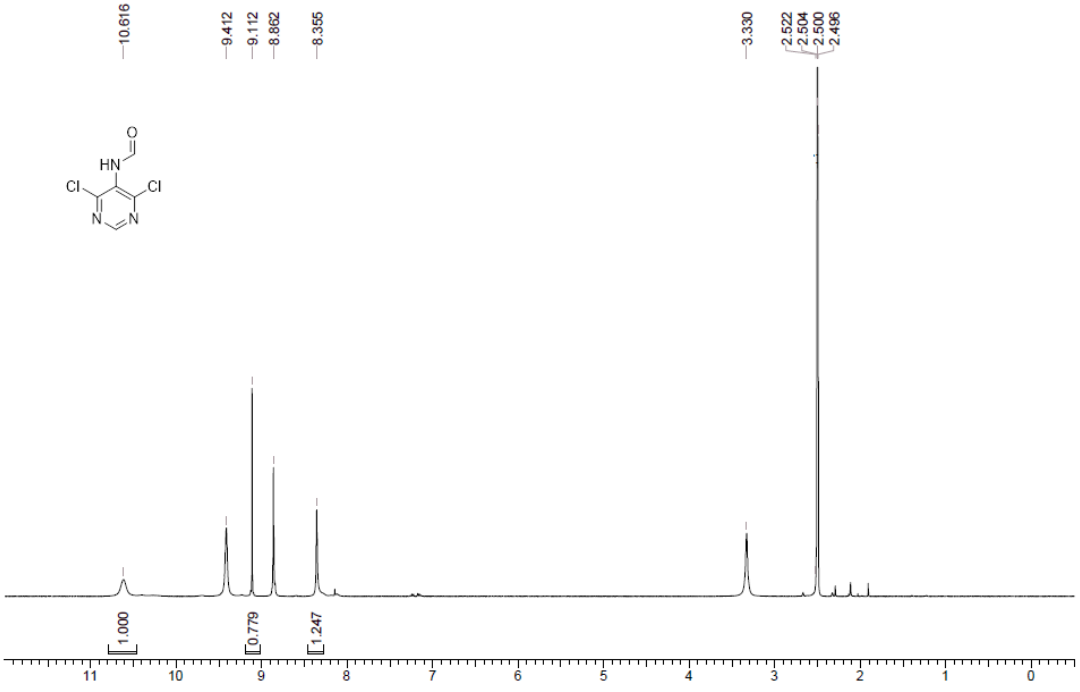
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.771	9727	11.014	0.028	9671	9.771
2	0.808	61503	69.644	0.030	68799	69.509
3	0.857	3740	4.235	0.103	7591	7.670
4	0.888	4137	4.685	0.067	6218	6.282
5	1.065	9204	10.422	0.022	6699	6.768

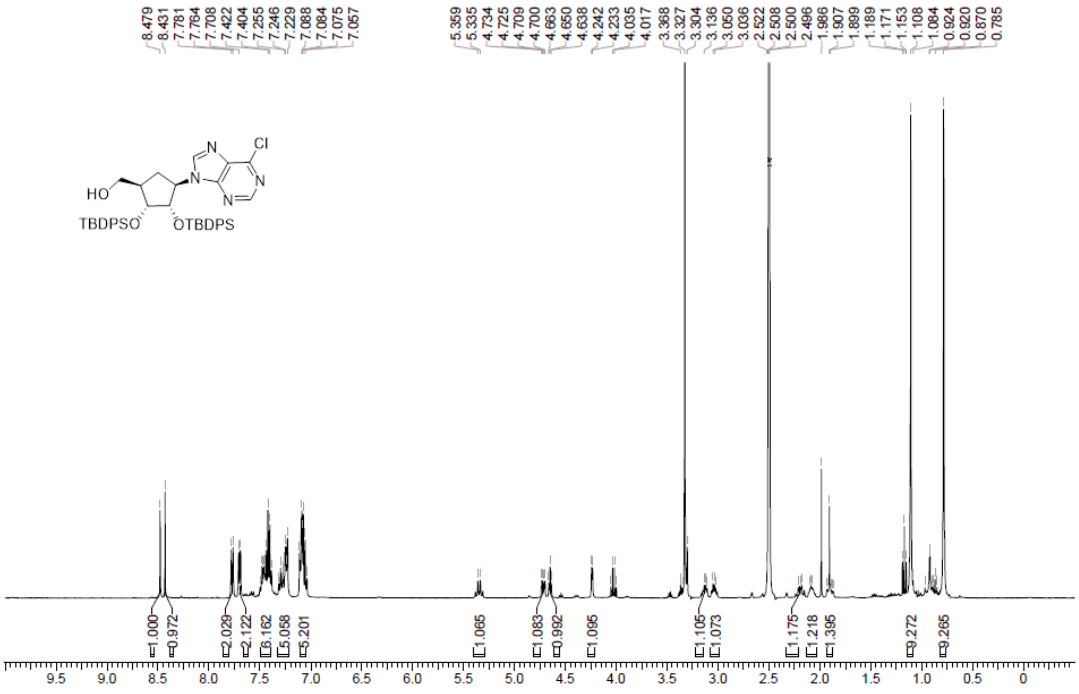




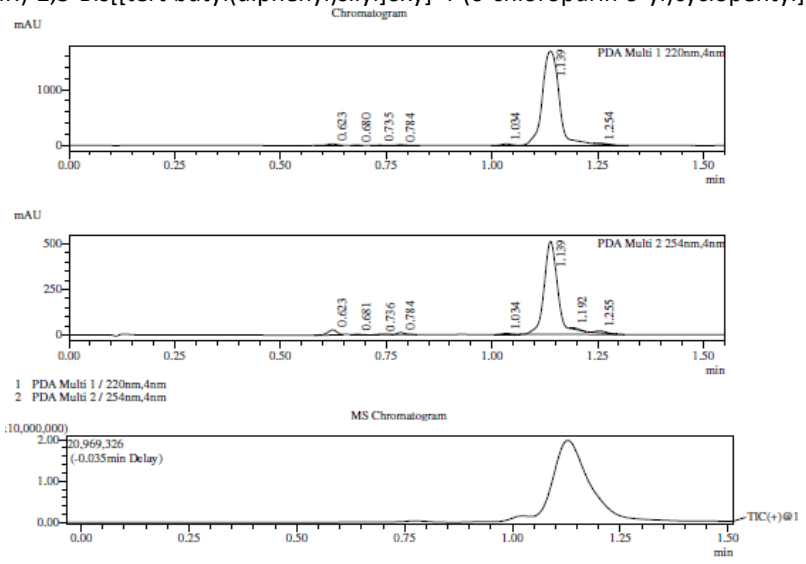
^{1}H NMR *N*-(4,6-dichloropyrimidin-5-yl)formamide **(57a)**



^{1}H NMR [(1*R*,2*R*,3*S*,4*R*)-2,3-Bis[[tert-butyl(diphenyl)silyl]oxy]-4-(6-chloropurin-9-yl)cyclopentyl] methanol **(58a)**



LCMS [(1*R*,2*R*,3*S*,4*R*)-2,3-Bis[[tert-butyl(diphenyl)silyl]oxy]-4-(6-chloropurin-9-yl)cyclopentyl] methanol **(58a)**



Integration Result

Peak Table

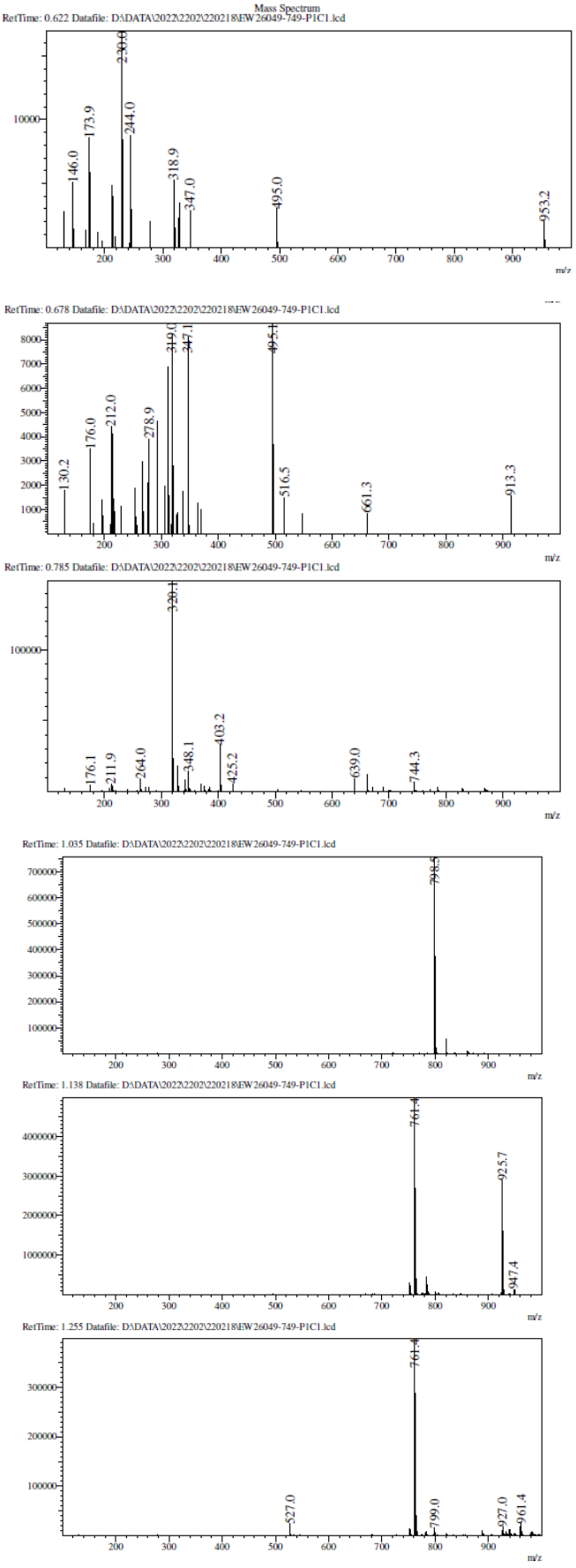
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.623	29126	1.628	0.042	45911	0.938
2	0.680	11007	0.615	0.029	10774	0.220
3	0.735	5426	0.303	0.035	7038	0.144
4	0.784	13591	0.760	0.035	17550	0.358
5	1.034	27123	1.516	0.044	43629	0.891
6	1.139	1691265	94.520	0.064	4752648	97.067
7	1.254	11778	0.658	0.041	18707	0.382

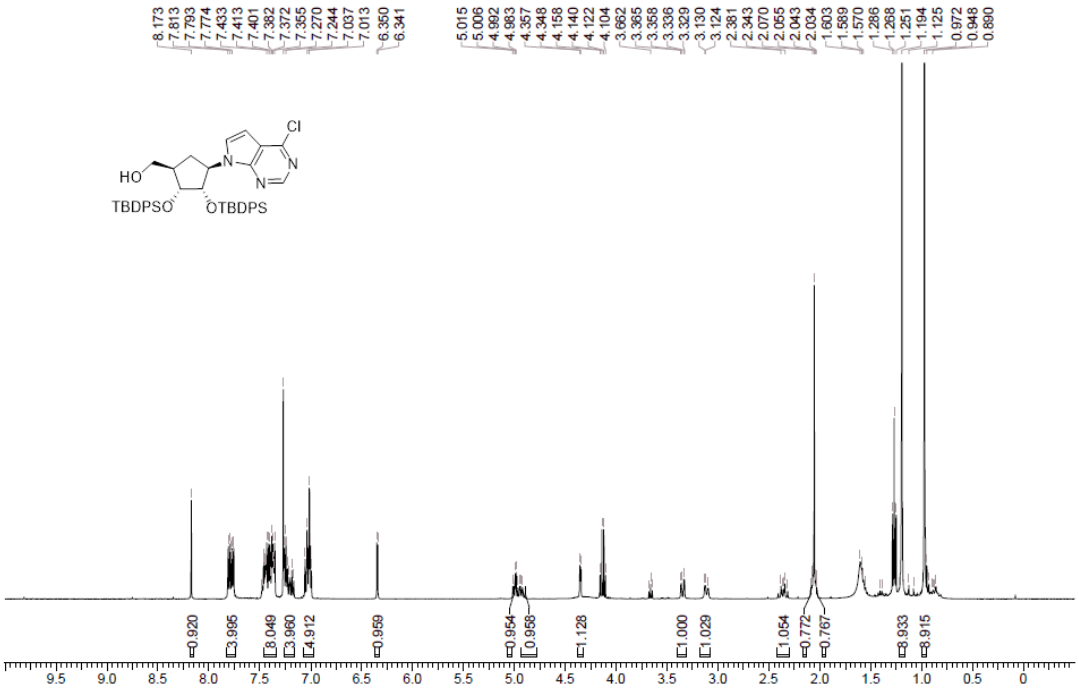
Peak Table

PDA Ch2 254nm

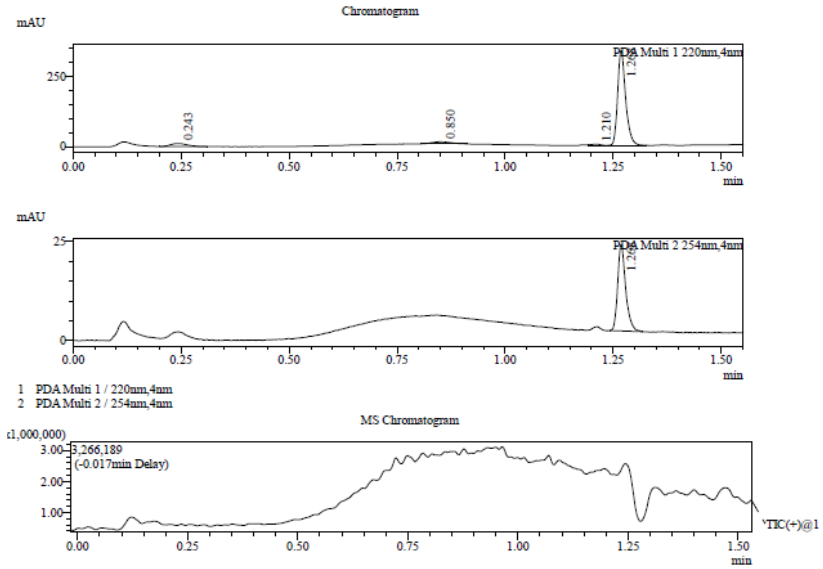
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.623	28614	4.927	0.041	43739	3.358
2	0.681	4593	0.791	0.036	5660	0.435
3	0.736	2859	0.492	0.052	5677	0.436


Mass Spectrum
RetTime: 0.622 Datafile: D\DATA\2022\2202\220218\EW26049-749-P1C1.lcd
10000
146.0
173.9
231.0
244.0
318.9
347.0
495.0
953.2
RetTime: 0.678 Datafile: D\DATA\2022\2202\220218\EW26049-749-P1C1.lcd
8000
7000
6000
5000
4000
3000
2000
1000
130.2
176.0
212.0
278.9
319.0
347.1
495.1
516.5
661.3
913.3
RetTime: 0.785 Datafile: D\DATA\2022\2202\220218\EW26049-749-P1C1.lcd
100000
176.1
211.9
264.0
320.1
348.1
403.2
425.2
639.0
744.3
RetTime: 1.035 Datafile: D\DATA\2022\2202\220218\EW26049-749-P1C1.lcd
700000
600000
500000
400000
300000
200000
100000
798.5
RetTime: 1.138 Datafile: D\DATA\2022\2202\220218\EW26049-749-P1C1.lcd
4000000
3000000
2000000
1000000
761.4
925.7
947.4
RetTime: 1.255 Datafile: D\DATA\2022\2202\220218\EW26049-749-P1C1.lcd
300000
200000
100000
761.4
527.0
799.0
927.0
961.4
200
300
400
500
600
700
800
900
m/z

^{1}H NMR [(1*R*,2*R*,3*S*,4*R*)-2,3-Bis[[tert-butyl(diphenyl)silyl]oxy]-4-(4-chloropyrrolo[2,3-d]pyrimidin-7-yl)cyclopentyl]methanol **(58b)**



LCMS [(1*R*,2*R*,3*S*,4*R*)-2,3-Bis[[tert-butyl(diphenyl)silyl]oxy]-4-(4-chloropyrrolo[2,3-d]pyrimidin-7-yl)cyclopentyl]methanol **(58b)**



Integration Result

Peak Table

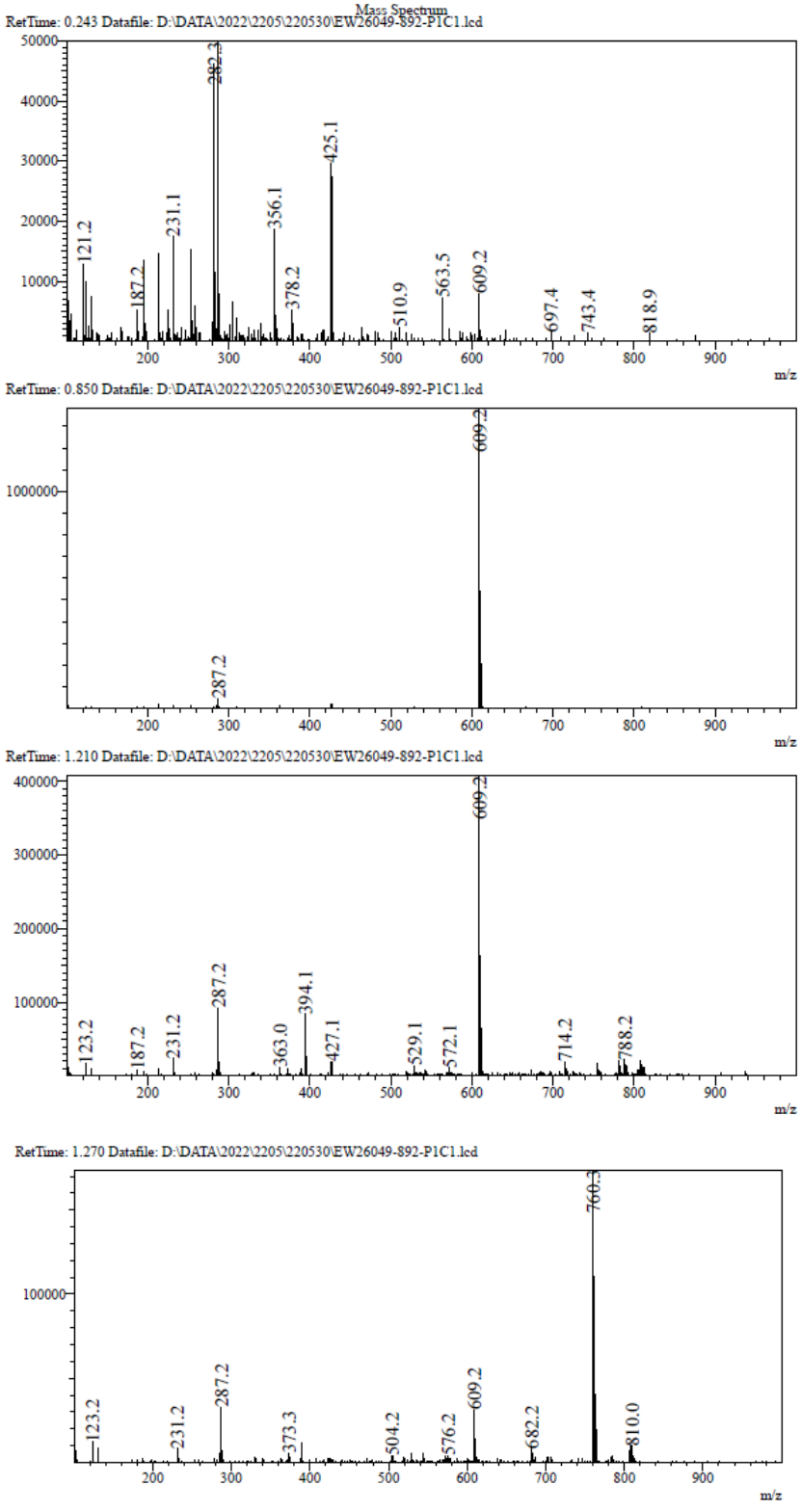
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.243	10742	2.959	0.073	28396	5.729
2	0.850	7754	2.136	0.084	23277	4.696
3	1.210	4749	1.308	0.042	6334	1.278
4	1.268	339802	93.597	0.035	437637	88.297

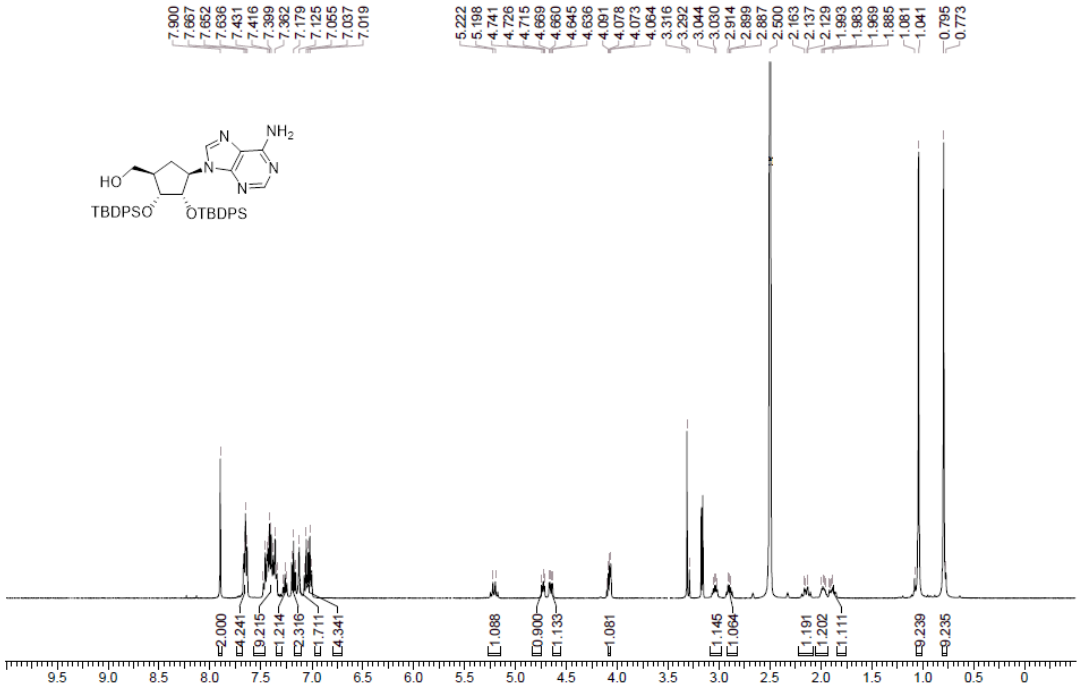
Peak Table

PDA Ch2 254nm

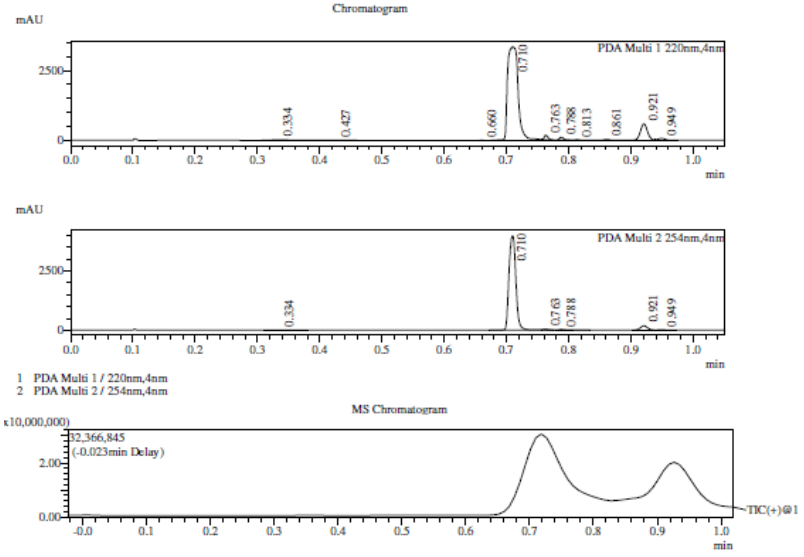
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.268	21948	100.000	0.035	28302	100.000


Mass Spectrum
RetTime: 0.243 Datafile: D:\DATA\2022\2205\220530\EW26049-892-P1C1.lcd
282.3
425.1
231.1
356.1
121.2
187.2
378.2
510.9
563.5
609.2
697.4
743.4
818.9
m/z
RetTime: 0.850 Datafile: D:\DATA\2022\2205\220530\EW26049-892-P1C1.lcd
609.2
287.2
m/z
RetTime: 1.210 Datafile: D:\DATA\2022\2205\220530\EW26049-892-P1C1.lcd
609.2
287.2
394.1
123.2
187.2
231.2
363.0
427.1
529.1
572.1
714.2
788.2
m/z
RetTime: 1.270 Datafile: D:\DATA\2022\2205\220530\EW26049-892-P1C1.lcd
760.3
287.2
609.2
123.2
231.2
373.3
504.2
576.2
682.2
810.0
m/z

^{1}H NMR [(1*R*,2*R*,3*S*,4*R*)-4-(6-Aminopurin-9-yl)-2,3-bis[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl] methanol **(59a)**



LCMS [(1*R*,2*R*,3*S*,4*R*)-4-(6-Aminopurin-9-yl)-2,3-bis[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl] methanol **(59a)**



Integration Result

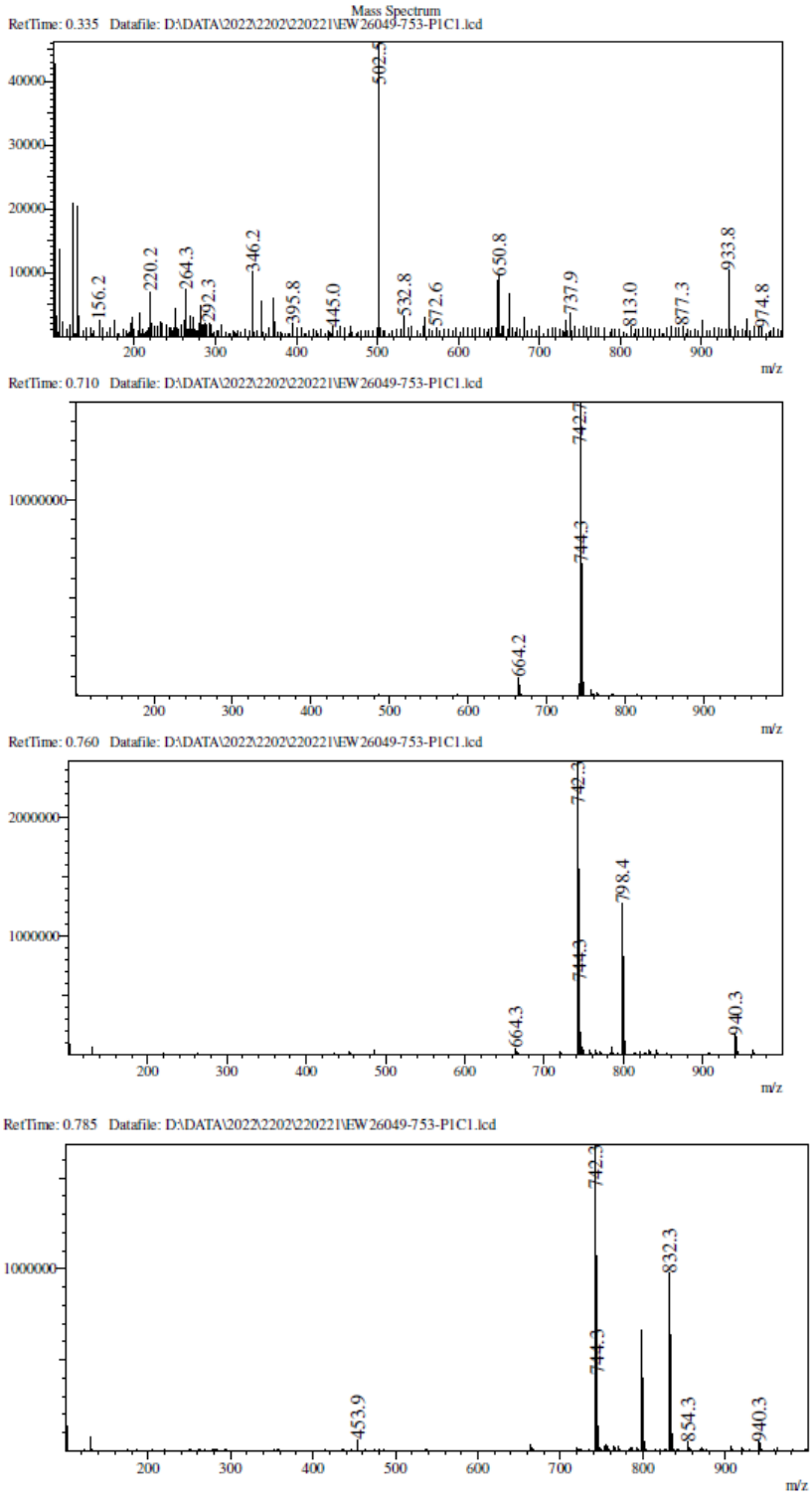
Peak Table

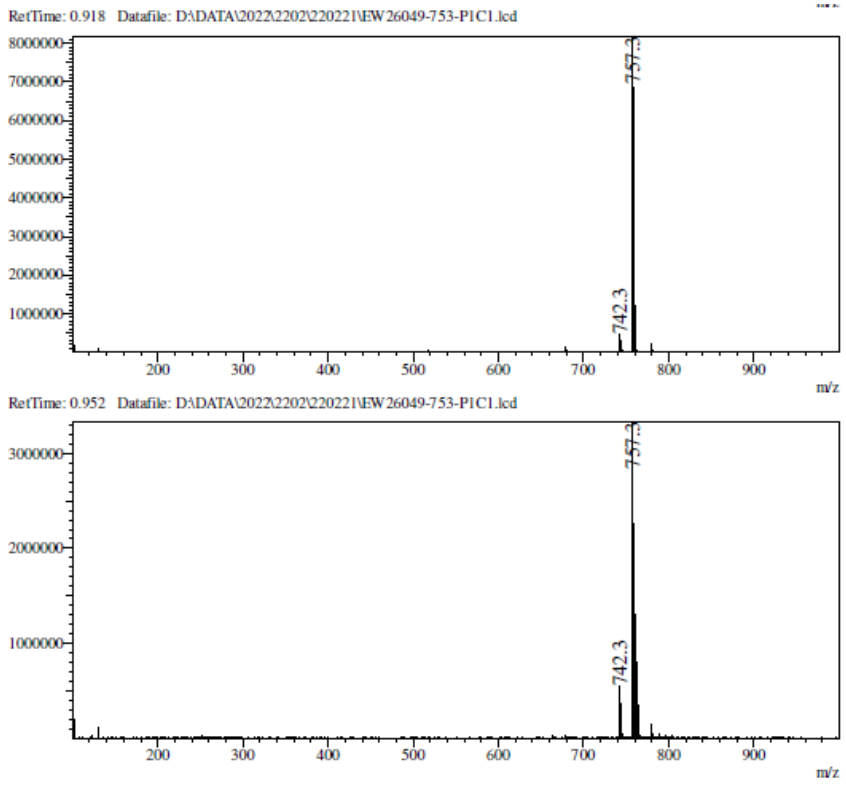
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.334	21694	0.498	0.070	62427	1.288
2	0.427	4895	0.112	0.176	17195	0.355
3	0.660	7537	0.173	0.024	5899	0.122
4	0.710	3345641	76.855	0.025	4058045	83.726
5	0.763	149749	3.440	0.012	65744	1.356
6	0.788	101841	2.339	0.013	52753	1.088
7	0.813	23496	0.540	0.014	11959	0.247
8	0.861	37883	0.870	0.017	25472	0.526
9	0.921	590027	13.554	0.021	485661	10.020
10	0.949	70444	1.618	0.024	61639	1.272

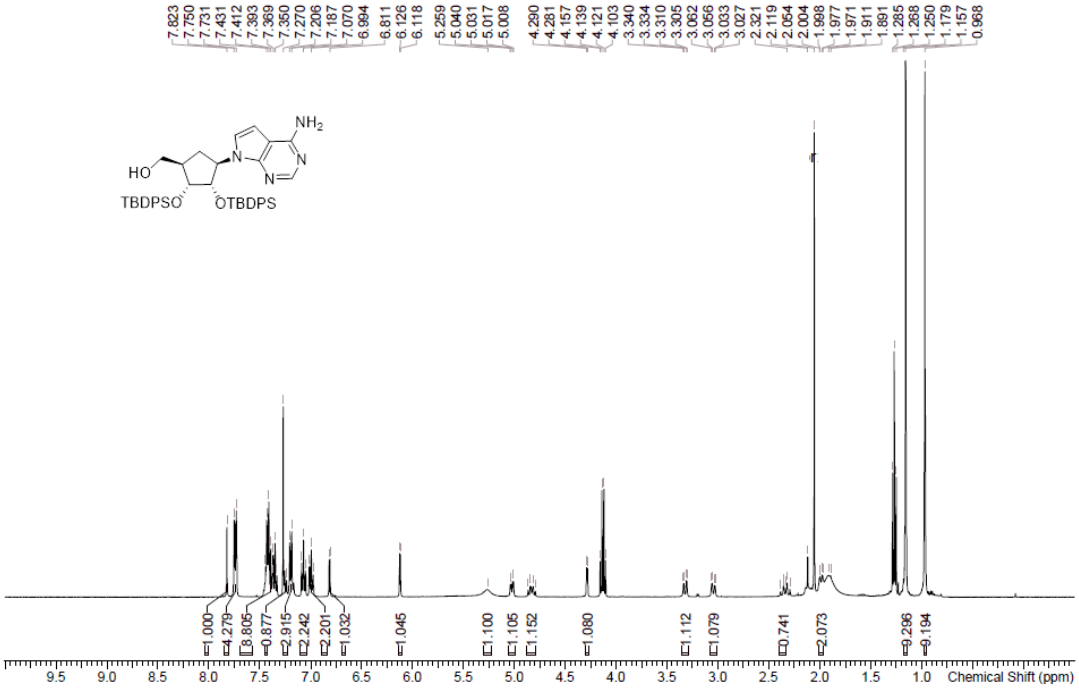
Peak Table

PDA Ch2 254nm

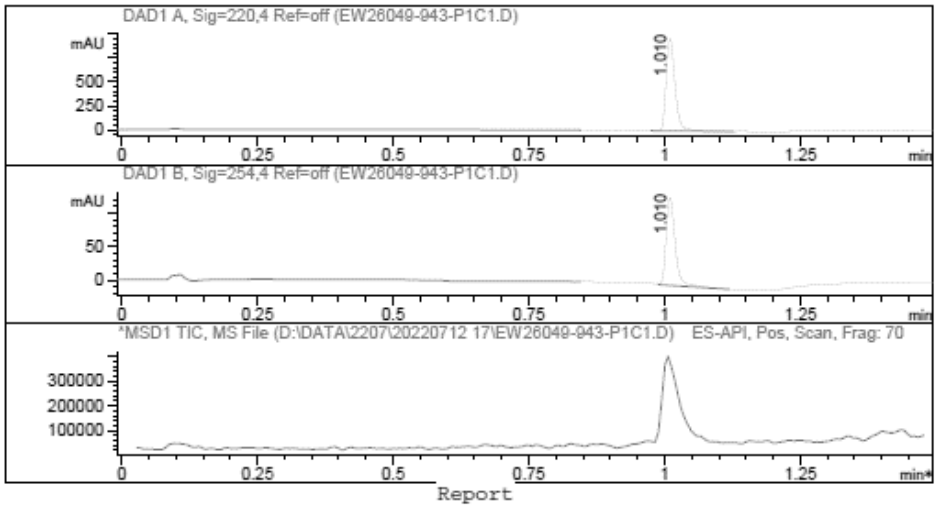

Mass Spectrum
RetTime: 0.335 Datafile: D:\DATA\2022\2202\220221\EW26049-753-P1C1.lcd
40000
30000
20000
10000
156.2
220.2
264.3
292.3
346.2
395.8
445.0
502.5
532.8
572.6
650.8
737.9
813.0
877.3
933.8
974.8
200
300
400
500
600
700
800
900
m/z
RetTime: 0.710 Datafile: D:\DATA\2022\2202\220221\EW26049-753-P1C1.lcd
10000000
664.2
744.3
742.7
200
300
400
500
600
700
800
900
m/z
RetTime: 0.760 Datafile: D:\DATA\2022\2202\220221\EW26049-753-P1C1.lcd
2000000
1000000
664.3
744.3
742.3
798.4
940.3
200
300
400
500
600
700
800
900
m/z
RetTime: 0.785 Datafile: D:\DATA\2022\2202\220221\EW26049-753-P1C1.lcd
1000000
453.9
744.3
742.3
832.3
854.3
940.3
200
300
400
500
600
700
800
900
m/z



^{1}H NMR [(1*R*,2*R*,3*S*,4*R*)-4-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-2,3-bis [[tert-butyl(diphenyl)silyl] oxy]cyclopentyl]methanol **(59b)**



LCMS [(1*R*,2*R*,3*S*,4*R*)-4-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-2,3-bis [[tert-butyl(diphenyl)silyl] oxy]cyclopentyl]methanol **(59b)**



Report

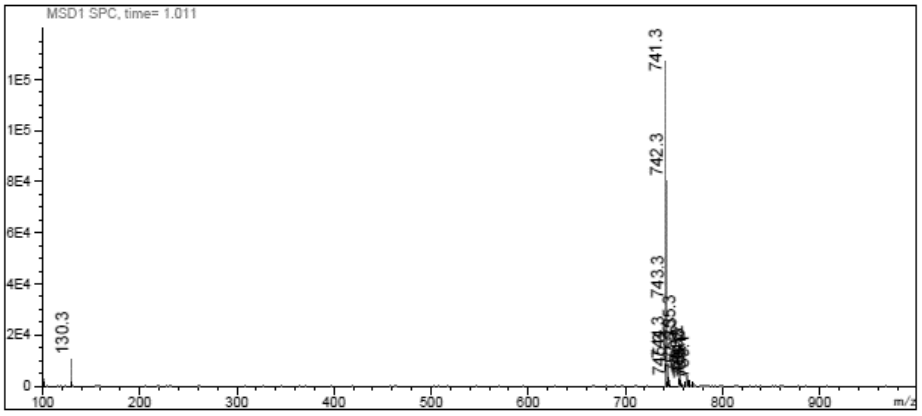
==========

Signal 1 : DAD1 A, Sig=220,4 Ref=off

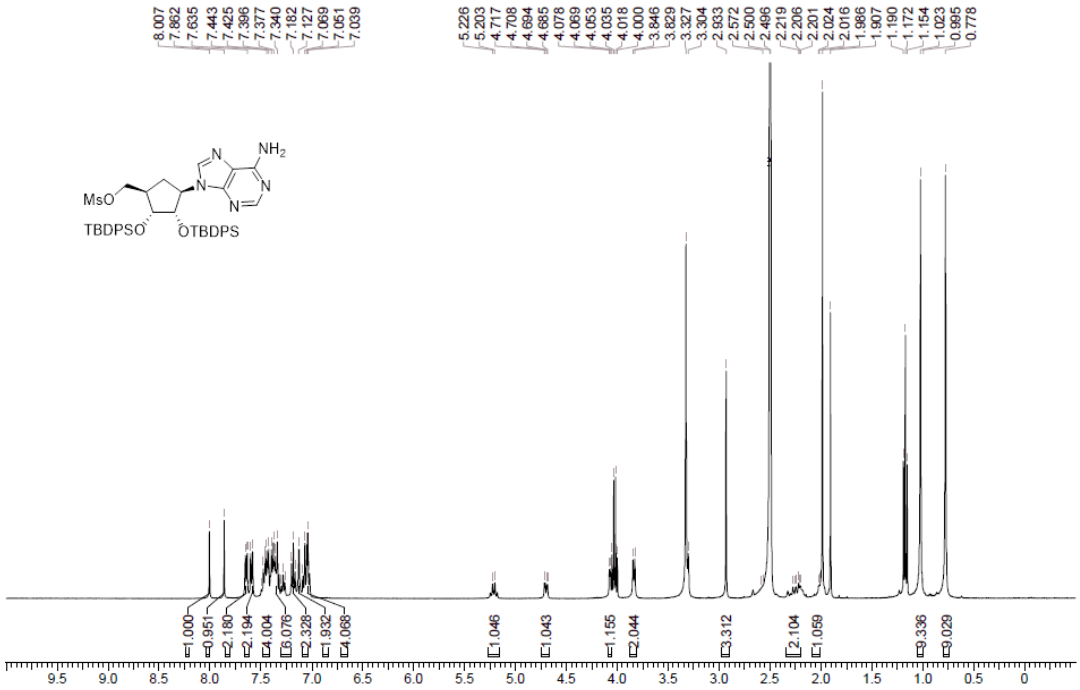
#	Meas. Ret.	Height	Width	Area	Area %
1	1.010	964.532	0.018	1091.277	100.000

Signal 2 : DAD1 B, Sig=254,4 Ref=off

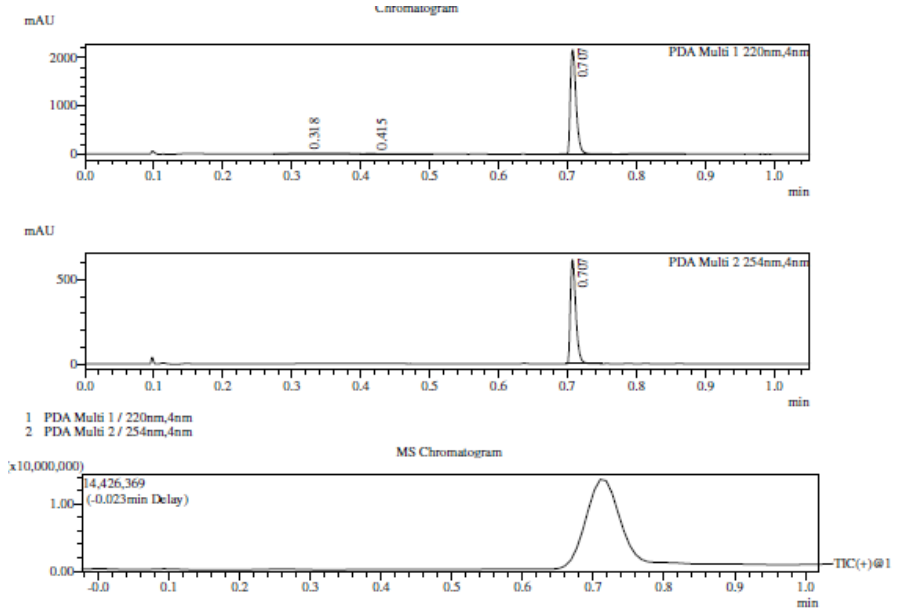
#	Meas. Ret.	Height	Width	Area	Area %
1	1.010	130.812	0.018	151.883	100.000



^{1}H NMR [(1*R*,2*R*,3*S*,4*R*)-4-(6-Aminopurin-9-yl)-2,3-bis[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl] methyl methanesulfonate **(60a)**



LCMS [(1*R*,2*R*,3*S*,4*R*)-4-(6-Aminopurin-9-yl)-2,3-bis[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl] methyl methanesulfonate **(60a)**



Integration Result

Peak Table

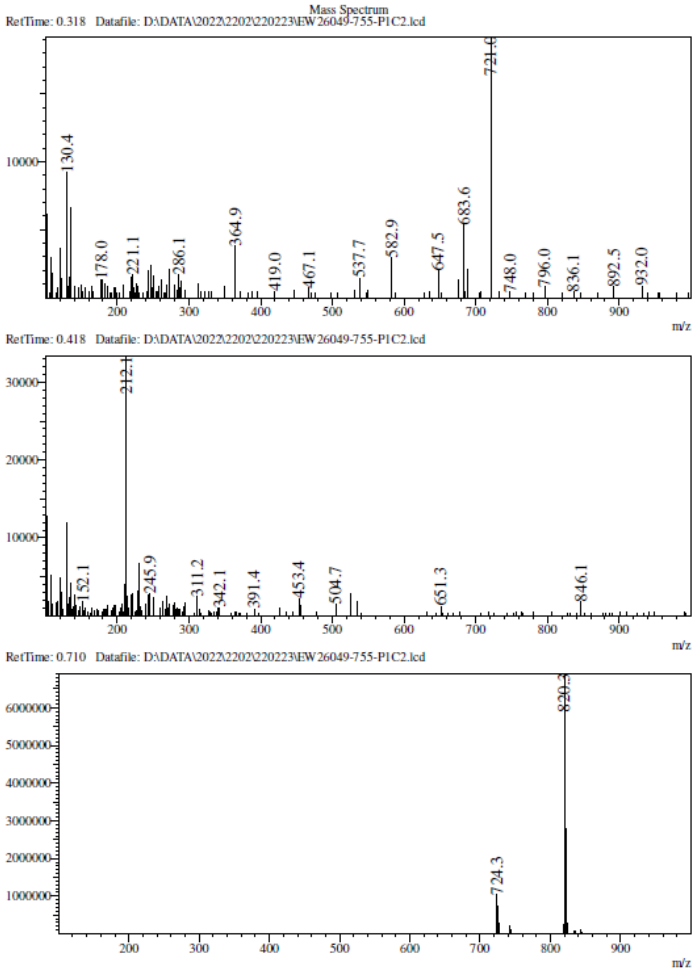
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.318	11191	0.519	0.134	47540	3.601
2	0.415	7737	0.359	0.036	16666	1.262
3	0.707	2135871	99.122	0.015	1255957	95.136

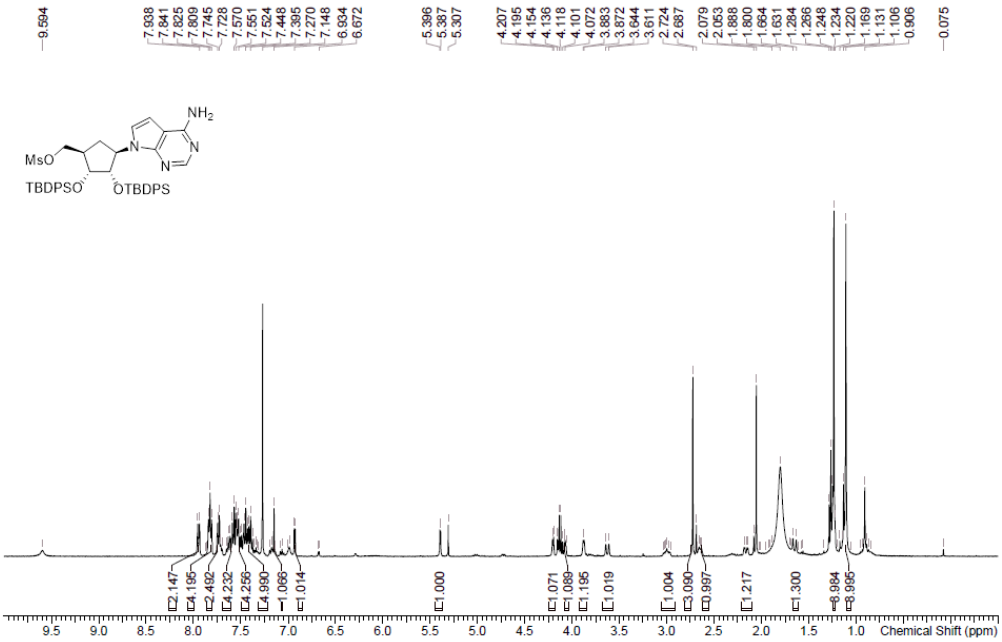
Peak Table

PDA Ch2 254nm

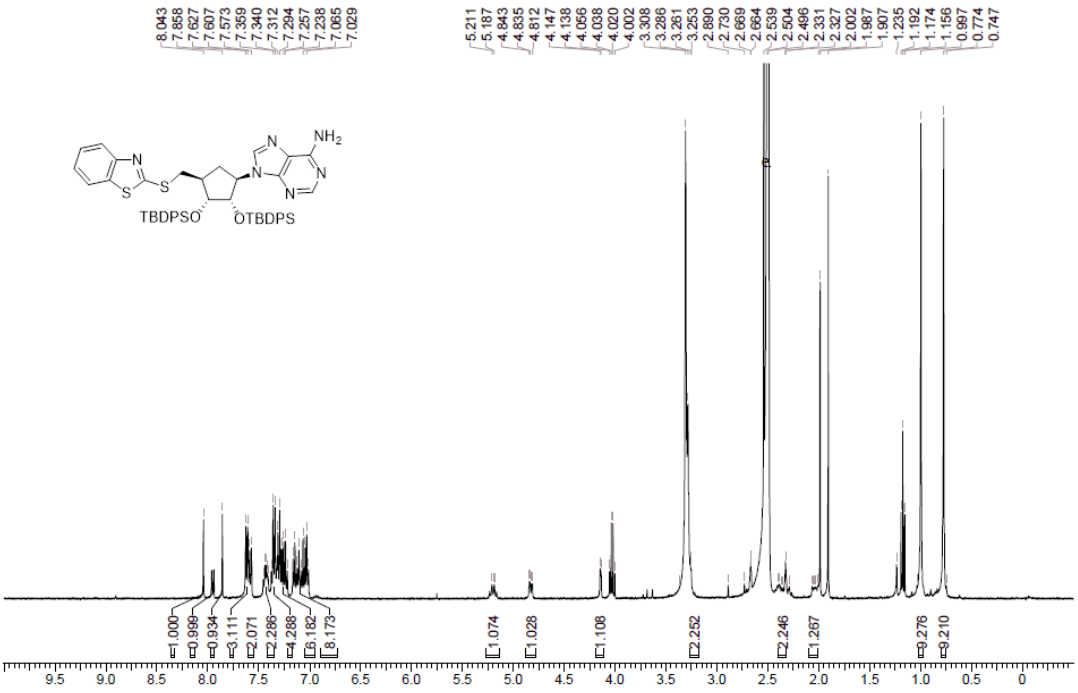
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.707	599679	100.000	0.014	338533	100.000



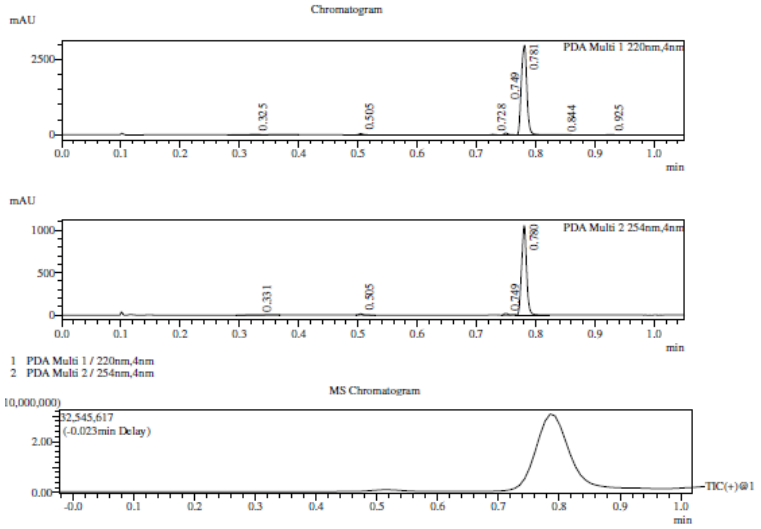
^{1}H NMR [(1*R*,2*R*,3*S*,4*R*)-4-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-2,3-bis [[tert-butyl(diphenyl) silyl]oxy]cyclopentyl]methyl methanesulfonate **(60b)**



^{1}H NMR 9-[(1*R*,2*S*,3*R*,4*S*)-4-(1,3-benzothiazol-2-ylsulfanylmethyl)-2,3- bis[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl]purin-6-amine **(61a)**



LCMS 9-[(1*R*,2*S*,3*R*,4*S*)-4-(1,3-benzothiazol-2-ylsulfanylmethyl)-2,3- bis[[tert-butyl(diphenyl) silyl]oxy]cyclopentyl]purin-6-amine **(61a)**



Integration Result

Peak Table

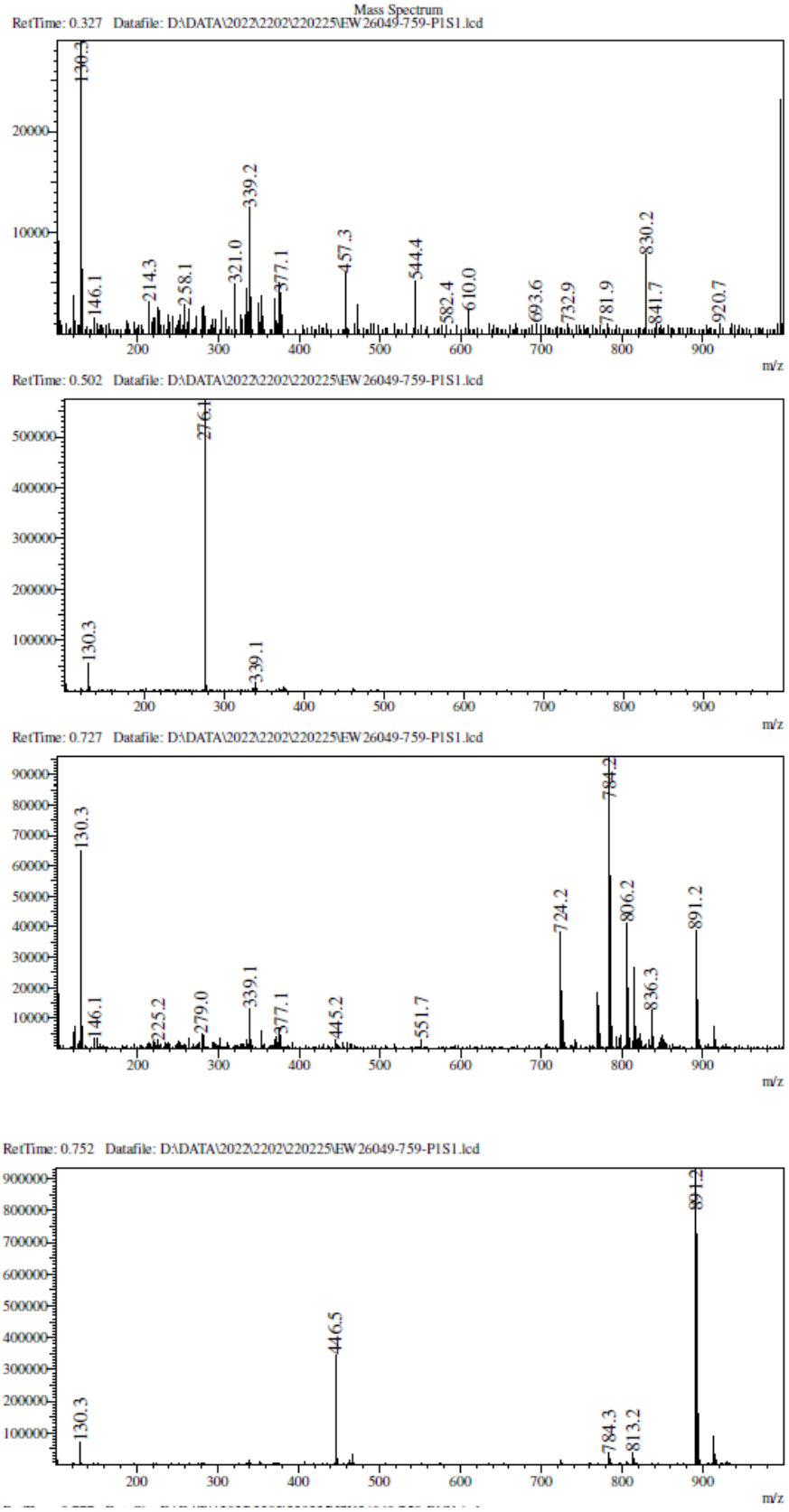
PDA Ch1 220nm

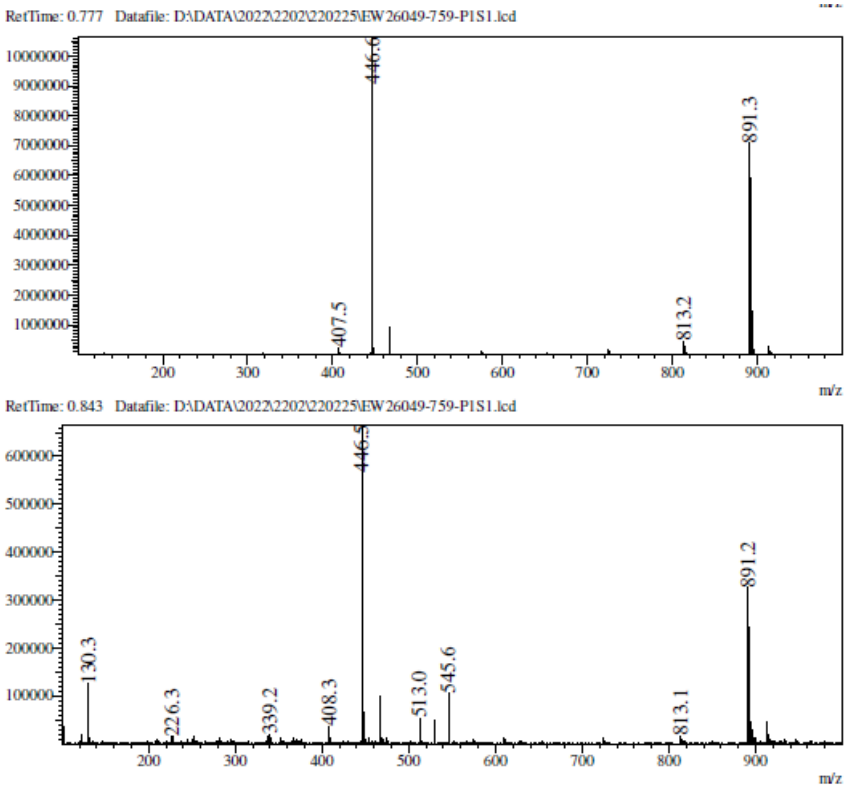
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.325	12737	0.411	0.071	39615	1.932
2	0.505	41596	1.343	0.013	20613	1.005
3	0.728	17178	0.555	0.013	9817	0.479
4	0.749	67089	2.166	0.012	32922	1.606
5	0.781	2947073	95.132	0.017	1928779	94.078
6	0.844	9266	0.299	0.044	13018	0.635
7	0.925	2952	0.095	0.026	5419	0.264

Peak Table

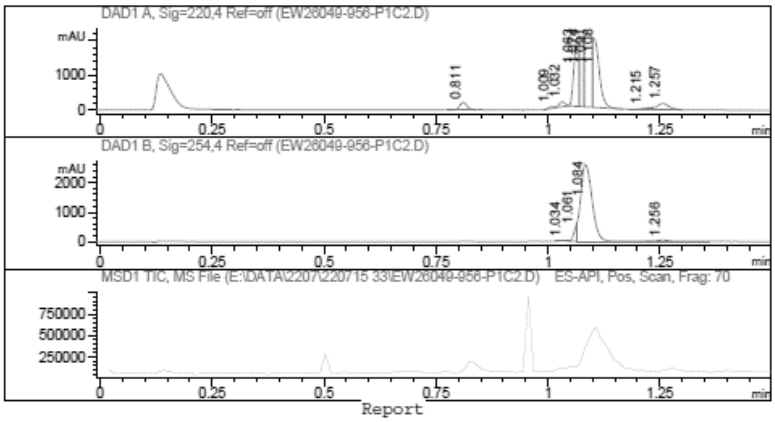
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.331	3717	0.349	0.050	7580	1.199
2	0.505	13047	1.225	0.013	6492	1.026
3	0.749	20319	1.907	0.012	9260	1.464


Mass Spectrum
RetTime: 0.327 Datafile: D:\DATA\2022\2202\220225\EW26049-759-P1S1.lcd
130.3
339.2
321.0
377.1
457.3
544.4
214.3
258.1
146.1
582.4
610.0
693.6
732.9
781.9
830.2
841.7
920.7
m/z
RetTime: 0.502 Datafile: D:\DATA\2022\2202\220225\EW26049-759-P1S1.lcd
276.1
130.3
339.1
m/z
RetTime: 0.727 Datafile: D:\DATA\2022\2202\220225\EW26049-759-P1S1.lcd
784.2
130.3
724.2
806.2
891.2
339.1
836.3
146.1
225.2
279.0
377.1
445.2
551.7
m/z
RetTime: 0.752 Datafile: D:\DATA\2022\2202\220225\EW26049-759-P1S1.lcd
891.2
446.5
130.3
784.3
813.2
m/z



LCMS 7-[(1*R*,2*S*,3*R*,4*S*)-4-(1,3-benzothiazol-2-ylsulfanylmethyl)-2,3-bis [[tert-butyl(diphenyl) silyl]oxy]cyclopentyl]pyrrolo[2,3-d]pyrimidin-4-amine **(61b)**



Report

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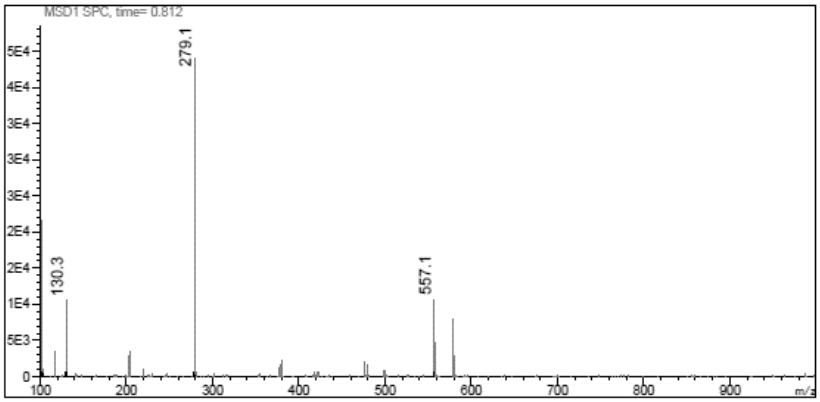
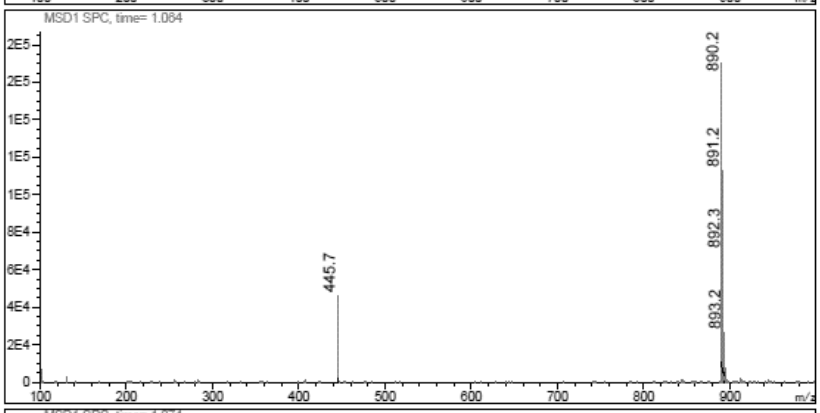
Signal 1 : DAD1 A, Sig=220,4 Ref=off

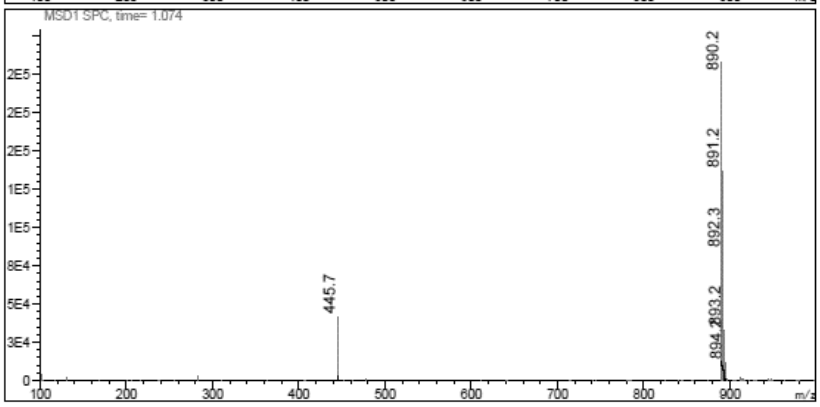
#	Meas. Ret.	Height	Width	Area	Area %
1	0.811	220.230	0.018	251.464	3.125
2	1.009	51.364	0.013	43.223	0.537
3	1.032	138.683	0.016	135.898	1.689
4	1.063	1823.765	0.013	1461.010	18.156
5	1.074	2049.824	0.009	1394.962	17.335
6	1.091	2155.928	0.016	2324.598	28.888
7	1.108	1817.417	0.017	2049.738	25.472
8	1.215	35.014	0.026	66.348	0.825
9	1.257	178.943	0.027	319.715	3.973

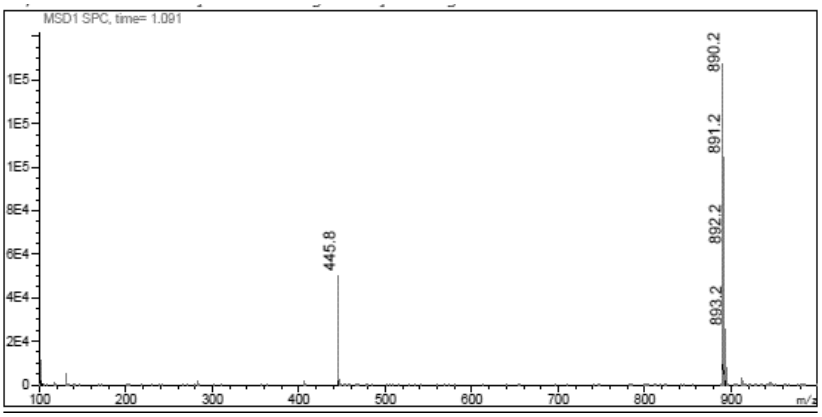
Signal 2 : DAD1 B, Sig=254,4 Ref=off

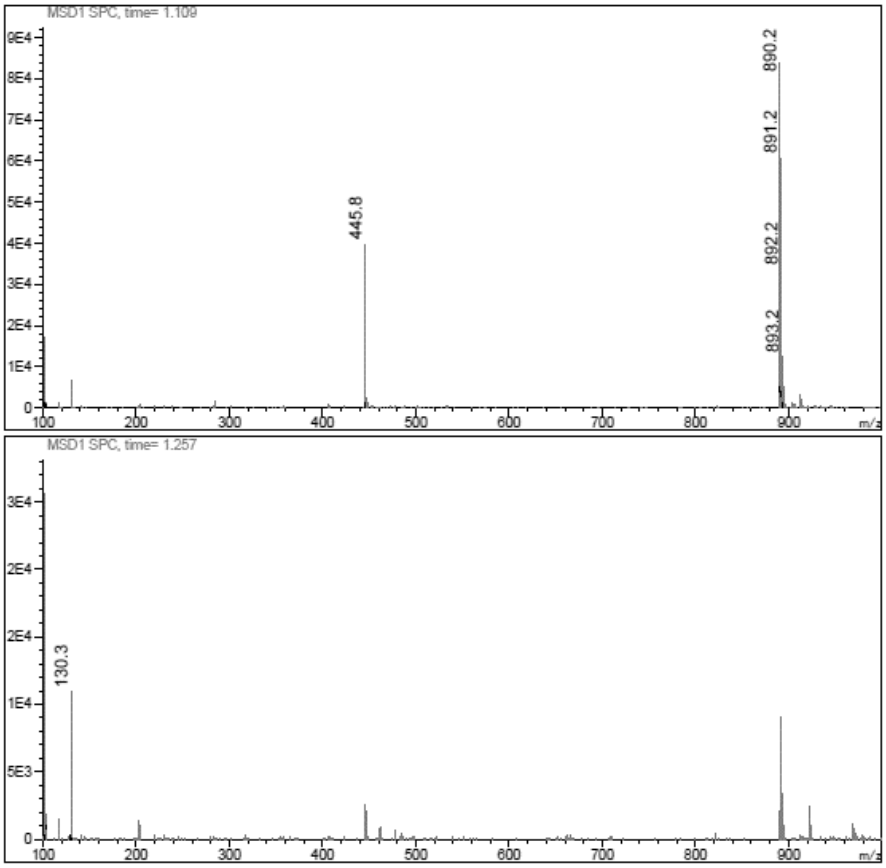
#	Meas. Ret.	Height	Width	Area	Area %
1	1.034	21.738	0.017	23.470	0.467
2	1.061	459.130	0.008	245.248	4.878
3	1.084	2601.377	0.028	4643.146	92.361
4	1.256	44.536	0.036	115.307	2.294


MSD1 SPC, time= 0.812
279.1
130.3
557.1
100
200
300
400
500
600
700
800
900
m/z

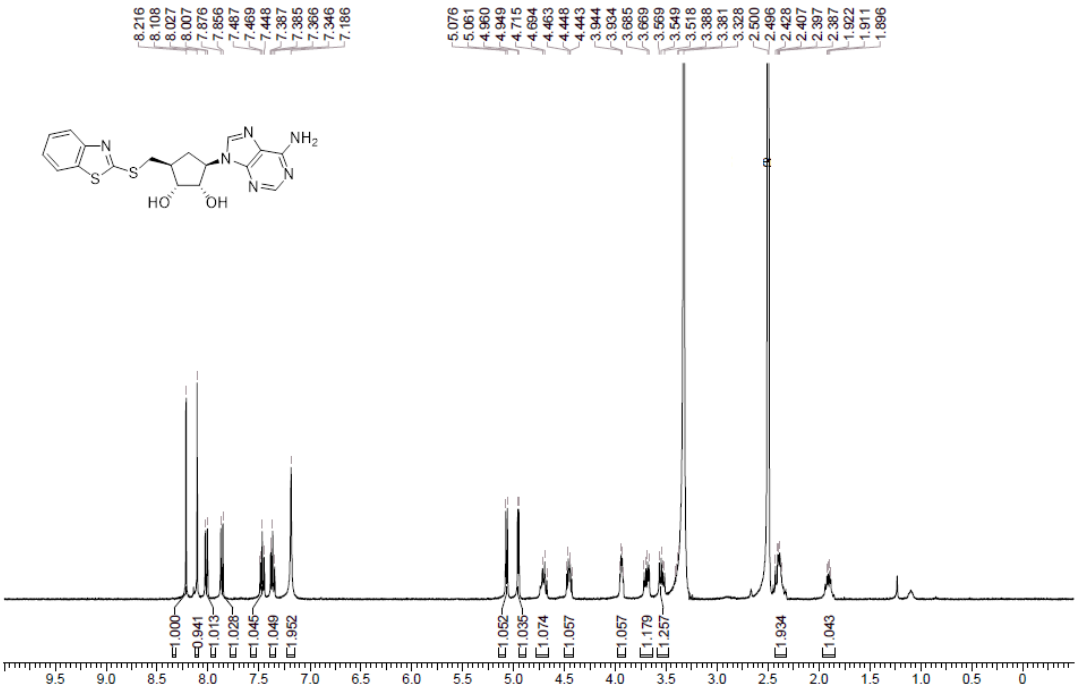

MSD1 SPC, time= 1.084
890.2
891.2
892.3
893.2
445.7
100
200
300
400
500
600
700
800
900
m/z


MSD1 SPC, time= 1.074
890.2
891.2
892.3
893.2
445.7
100
200
300
400
500
600
700
800
900
m/z

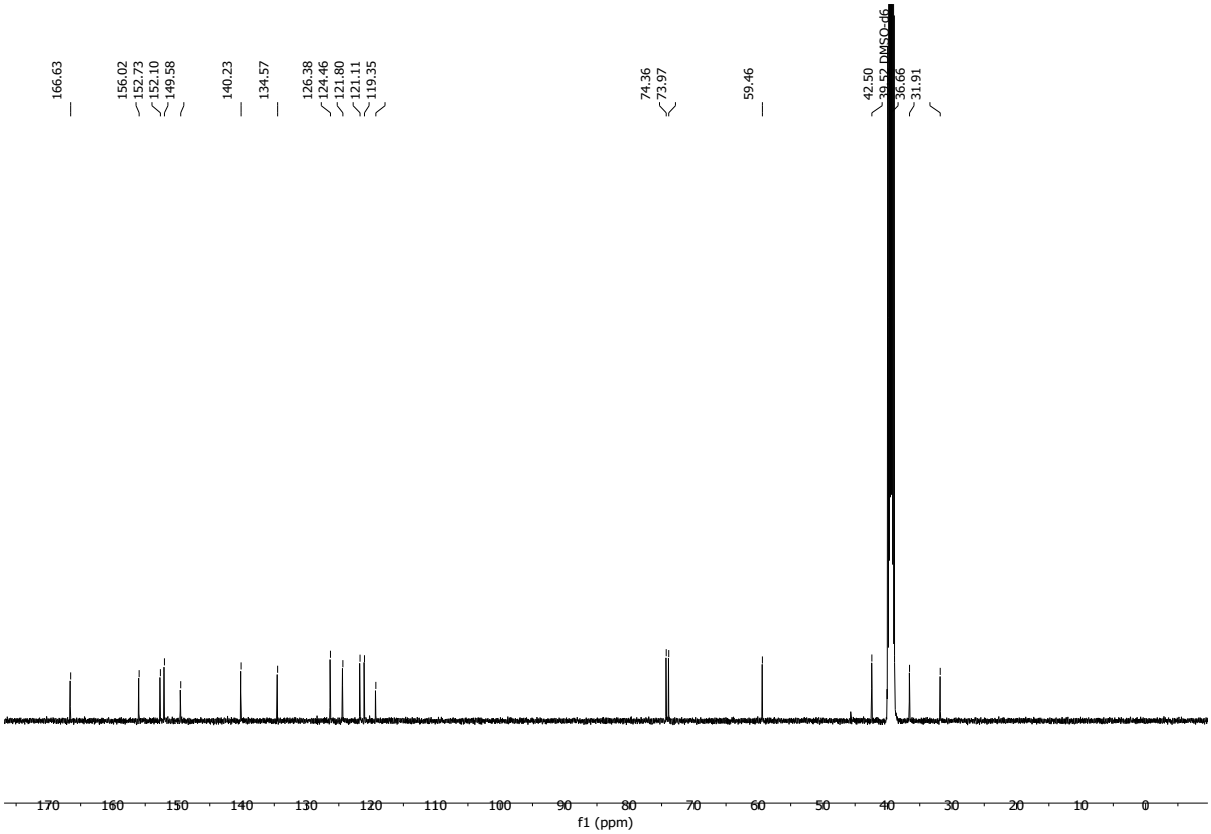

MSD1 SPC, time= 1.091
890.2
891.2
892.2
893.2
445.8
100
200
300
400
500
600
700
800
900
m/z



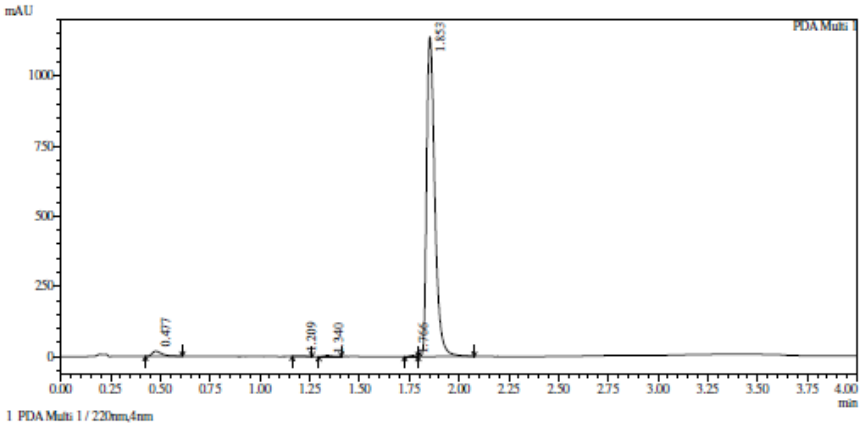
[1]H NMR (1*R*,2*S*,3*R*,5*S*)-3-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) cyclopentane-1,2-diol **(26)**



[13]C NMR (1*R*,2*S*,3*R*,5*S*)-3-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) cyclopentane-1,2-diol **(26)**



HPLC (1*R*,2*S*,3*R*,5*S*)-3-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) cyclopentane-1,2-diol **(26)**

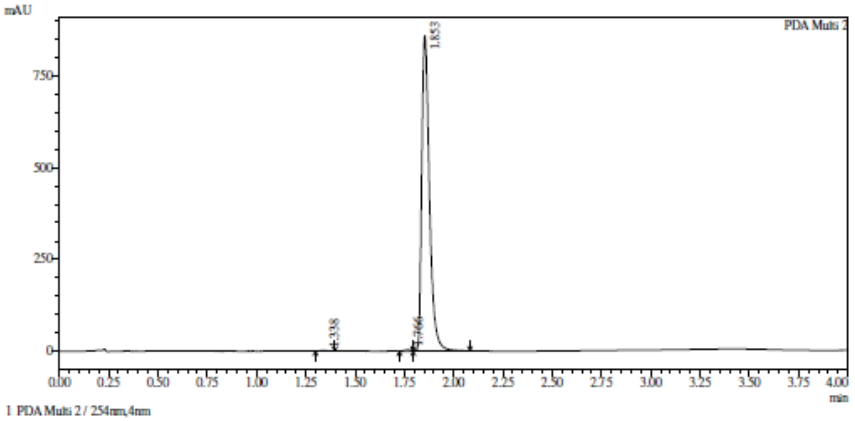


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.477	0.085	0.000	18134	61258	1.834
2	1.209	0.087	8.511	972	3238	0.097
3	1.340	0.073	1.643	3527	9774	0.293
4	1.766	0.150	3.809	3712	9135	0.274
5	1.853	0.072	0.786	1139604	3256019	97.502
Total				1165949	3339423	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.338	0.070	0.000	1558	4177	0.177
2	1.766	0.083	5.598	3563	8857	0.375
3	1.853	0.069	1.142	858441	2350682	99.449
Total				863562	2363716	100.000

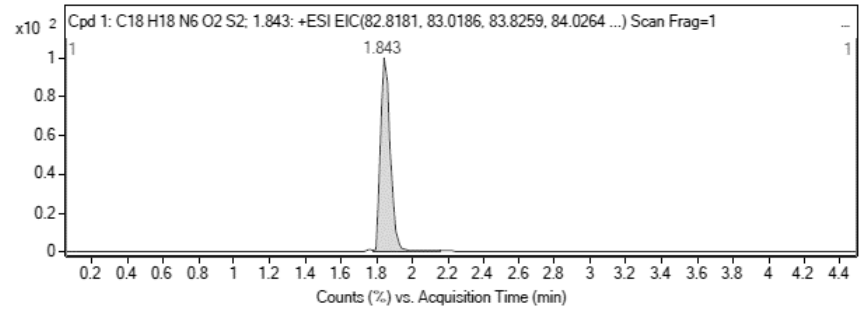
HRMC (1*R*,2*S*,3*R*,5*S*)-3-(6-aminopurin-9-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) cyclopentane-1,2-diol **(26)**

Compound Table

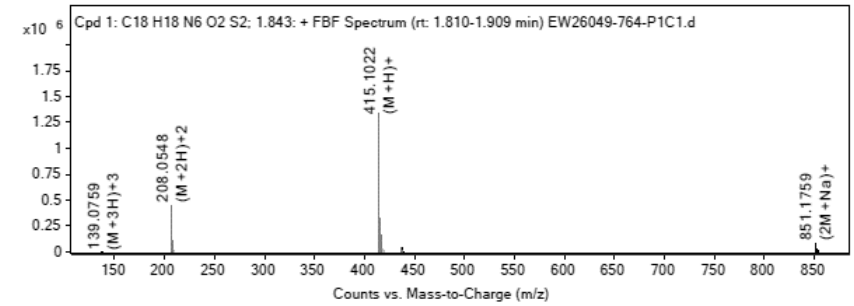
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C18 H18 N6 O2 S2: 1.843	98.45	3.29	C18 H18 N6 O2 S2	1.843	414.0933	414.0946

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
437.0826	1.843	414.0946	C18 H18 N6 O2 S2	414.0933	3.29	Find by Formula

Compound Chromatograms



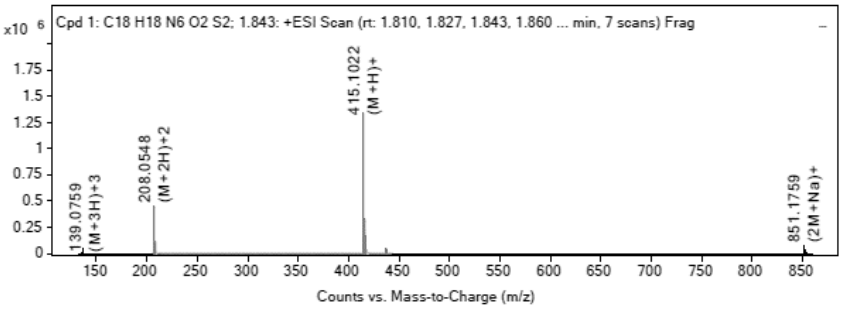
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
208.0548	2	453201.69	(M+2H)+2
208.5559	2	107129.74	(M+2H)+2
209.0536	2	54589.17	(M+2H)+2
415.1022	1	1340788.38	(M+H)+
416.1039	1	324647.41	(M+H)+
417.0994	1	154169.38	(M+H)+
437.0826	1	42784.64	(M+Na)+
851.1759	1	81445.9	(2M+Na)+
852.1782	1	36897.6	(2M+Na)+
853.1748	1	23124.36	(2M+Na)+

MS Zoomed Spectrum

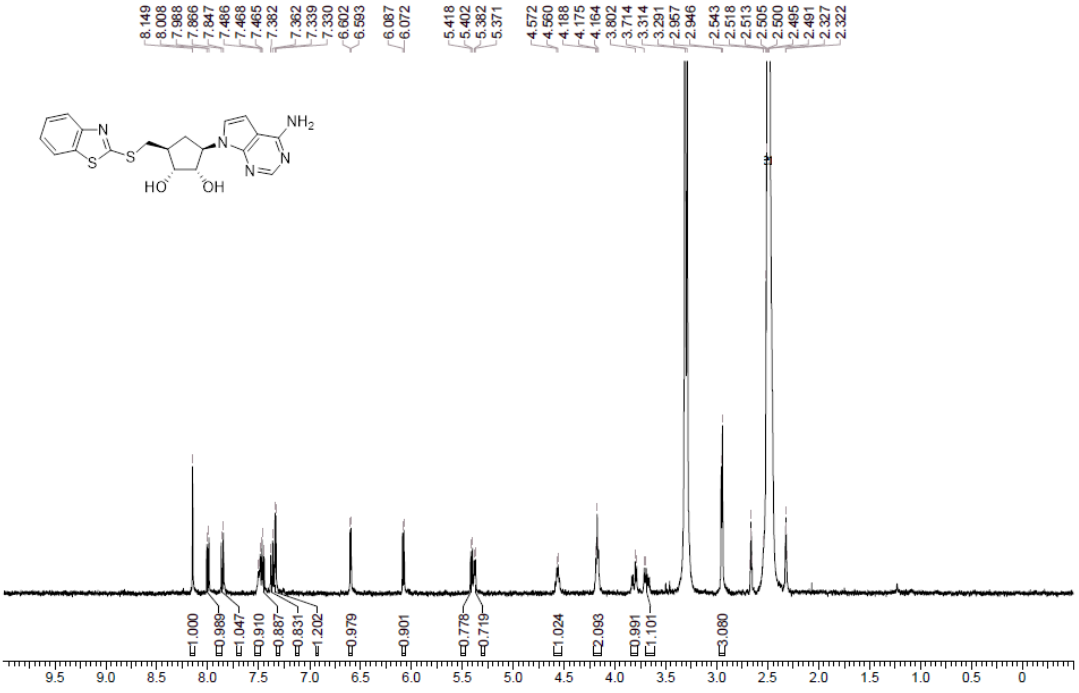


MS Spectrum Peak List

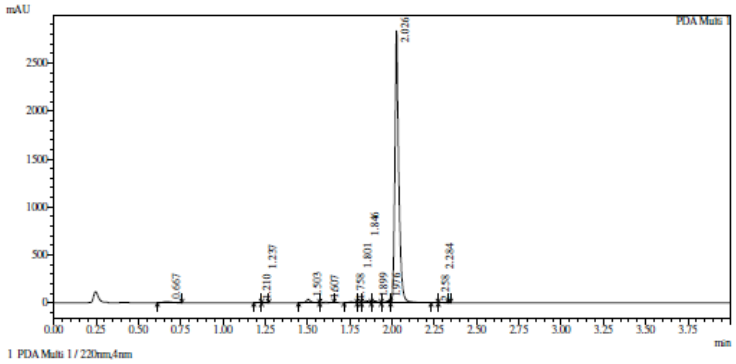
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
208.0548	2	453201.69	(M+2H)+2	-4.05
208.5559	2	107129.74	(M+2H)+2	-3.25
209.0536	2	54589.17	(M+2H)+2	-2.85
415.1022	1	1340788.38	(M+H)+	-4
416.1039	1	324647.41	(M+H)+	-2.04
417.0994	1	154169.38	(M+H)+	-1.77
437.0826	1	42784.64	(M+Na)+	-0.35
851.1759	1	81445.9	(2M+Na)+	-0.17
852.1782	1	36897.6	(2M+Na)+	0.07
853.1748	1	23124.36	(2M+Na)+	0.44

--- End Of Report ---

^{1}H NMR (1*R*,2*S*,3*R*,5*S*)-3-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)cyclopentane-1,2-diol **(28)**



HPLC (1*R*,2*S*,3*R*,5*S*)-3-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)cyclopentane-1,2-diol **(28)**

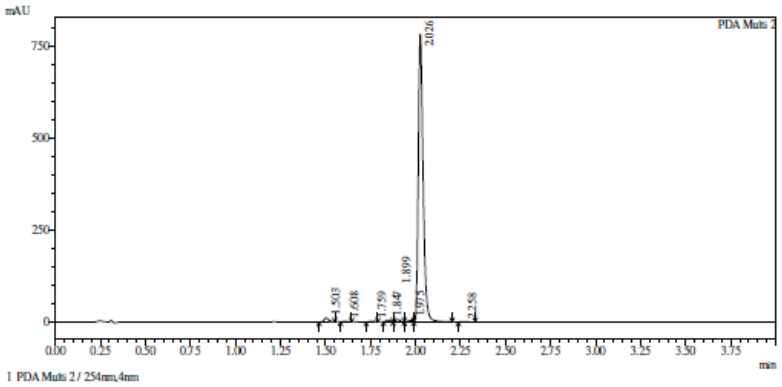


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.667	0.086	0.000	10725	34642	0.722
2	1.210	0.068	7.060	1283	2158	0.045
3	1.237	0.310	0.144	869	1163	0.024
4	1.503	0.047	1.487	34428	61622	1.284
5	1.607	0.046	2.249	5755	9737	0.203
6	1.758	0.058	2.878	9308	20233	0.422
7	1.801	0.221	0.311	2374	3026	0.063
8	1.846	0.050	0.333	21108	38373	0.800
9	1.899	0.051	1.039	19016	35022	0.730
10	1.976	0.070	1.288	20050	37761	0.787
11	2.026	0.041	0.895	2835412	4545369	94.742
12	2.258	0.079	3.878	2674	4127	0.086
13	2.284	0.102	0.289	2500	4376	0.091
Total				2965502	4797608	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.503	0.047	0.000	10837	18901	1.257
2	1.608	0.045	2.296	1779	2827	0.188
3	1.759	0.050	3.178	1918	3515	0.234
4	1.847	0.047	1.813	4866	8135	0.541
5	1.899	0.046	1.118	6456	10951	0.728
6	1.975	0.076	1.243	3751	7379	0.491
7	2.026	0.049	0.813	782552	1449925	96.431
8	2.258	0.076	3.738	606	1949	0.130
Total				812765	1503583	100.000

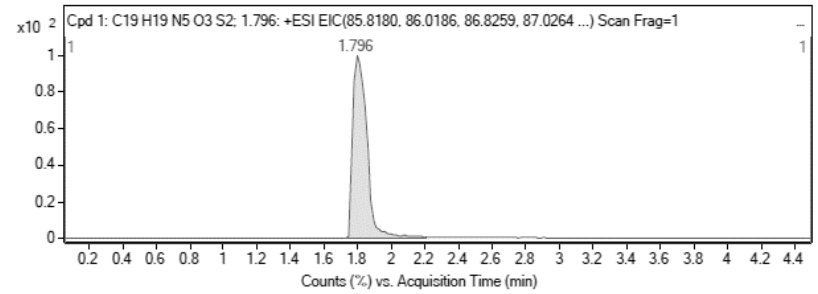
HRMC (1*R*,2*S*,3*R*,5*S*)-3-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)cyclopentane-1,2-diol **(28)**

Compound Table

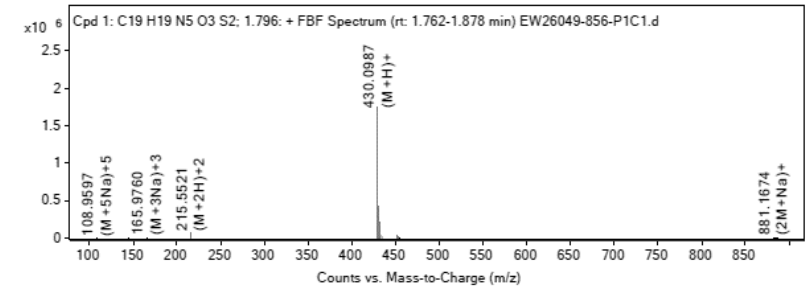
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C19 H19 N5 O3 S2; 1.796	90.28	-4.45	C19 H19 N5 O3 S2	1.796	429.0929	429.091

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
430.0987	1.796	429.091	C19 H19 N5 O3 S2	429.0929	-4.45	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

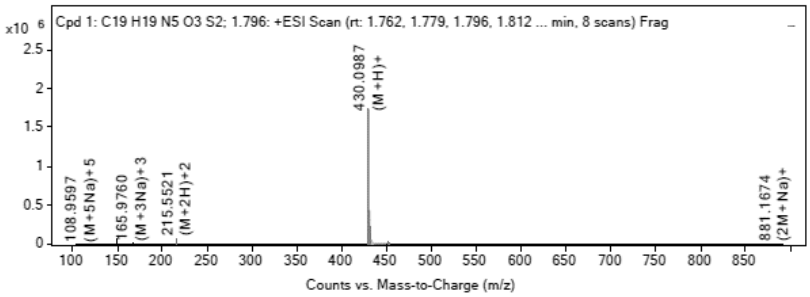


MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
215.5521	2	69571.91	(M+2H)+2
216.0534	2	16955.47	(M+2H)+2

216.5517	2	8361.99 (M+2H)+2
430.0987	1	1749183.63 (M+H)+
431.1005	1	431888.06 (M+H)+
432.0961	1	211083.06 (M+H)+
452.0787	1	29897.41 (M+Na)+
453.0816	1	7462.57 (M+Na)+
454.0776	1	3630.51 (M+Na)+
881.1674	1	5226.82 (2M+Na)+

MS Zoomed Spectrum

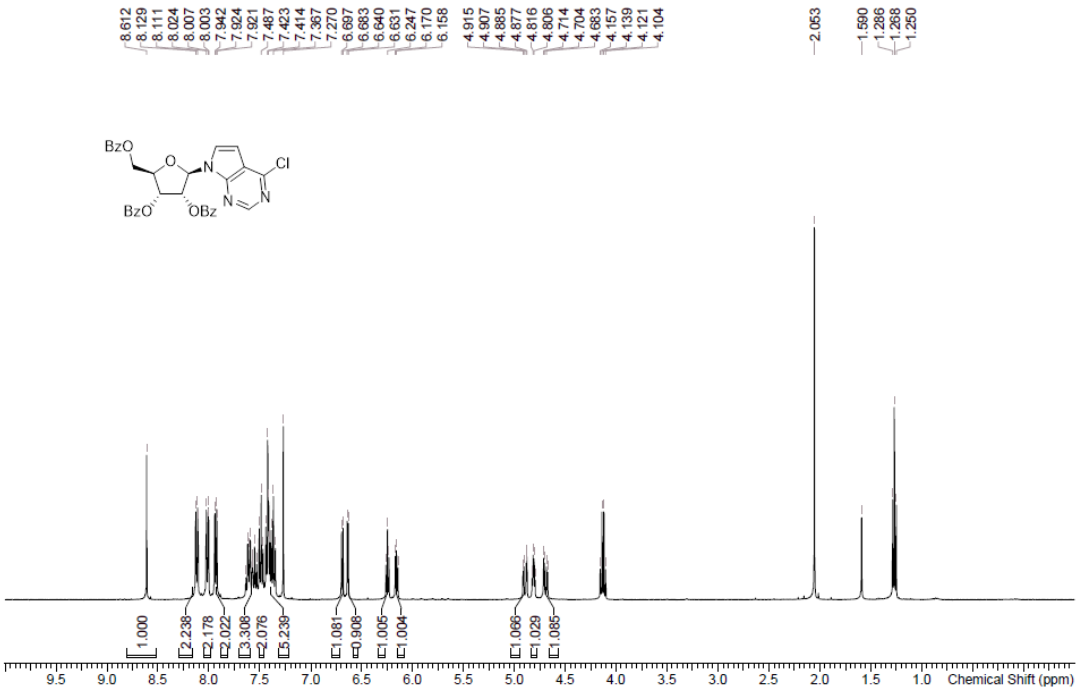


MS Spectrum Peak List

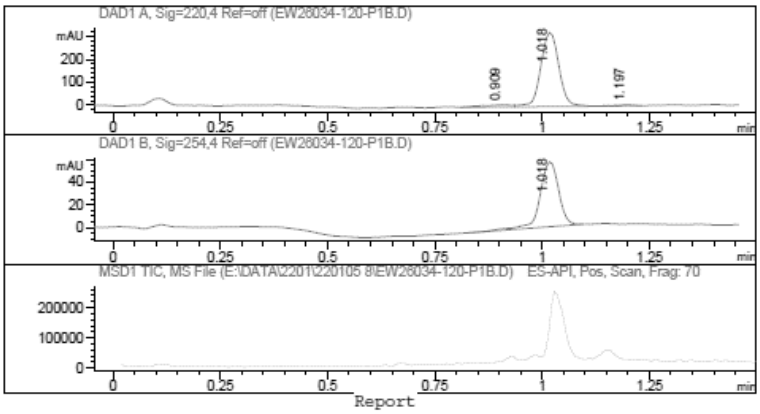
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
215.5521	2	69571.91	(M+2H)+2	7.53
216.0534	2	16955.47	(M+2H)+2	7.88
216.5517	2	8361.99	(M+2H)+2	5.8
430.0987	1	1749183.63	(M+H)+	3.52
431.1005	1	431888.06	(M+H)+	5.48
432.0961	1	211083.06	(M+H)+	5.65
452.0787	1	29897.41	(M+Na)+	7.57
453.0816	1	7462.57	(M+Na)+	7.08
454.0776	1	3630.51	(M+Na)+	6.48
881.1674	1	5226.82	(2M+Na)+	8.76

--- End Of Report ---

^{1}H NMR [(2*R*,3*R*,4*R*,5*R*)-3,4-Dibenzoyloxy-5-(4-chloropyrrolo[2,3-d] pyrimidin-7-yl)tetrahydrofuran-2-yl]methyl benzoate **(101)**



LCMS [(2*R*,3*R*,4*R*,5*R*)-3,4-Dibenzoyloxy-5-(4-chloropyrrolo[2,3-d] pyrimidin-7-yl)tetrahydrofuran-2-yl]methyl benzoate **(101)**



Report

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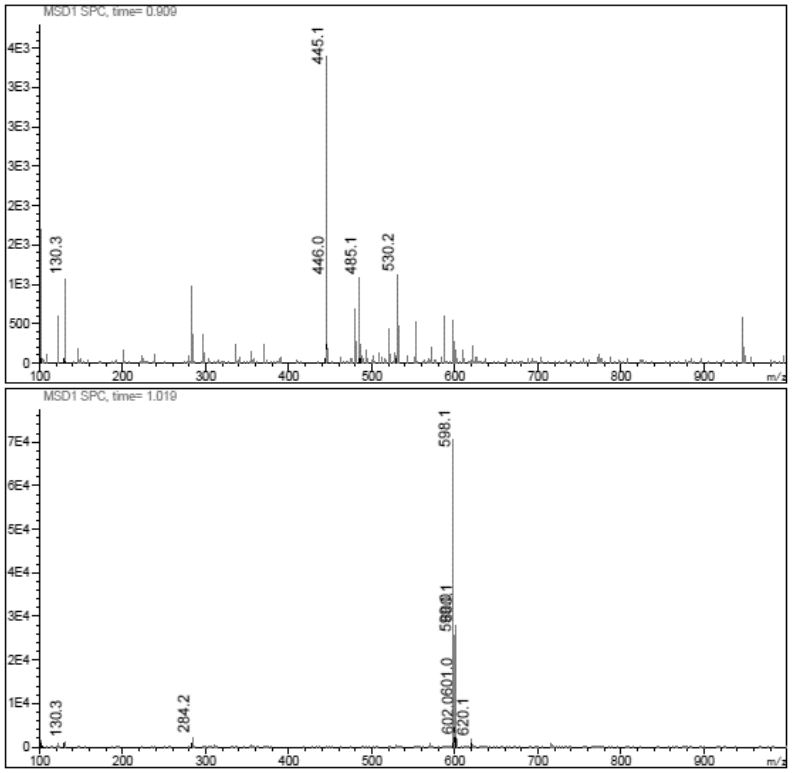
Signal 1 : DAD1 A, Sig=220,4 Ref=off

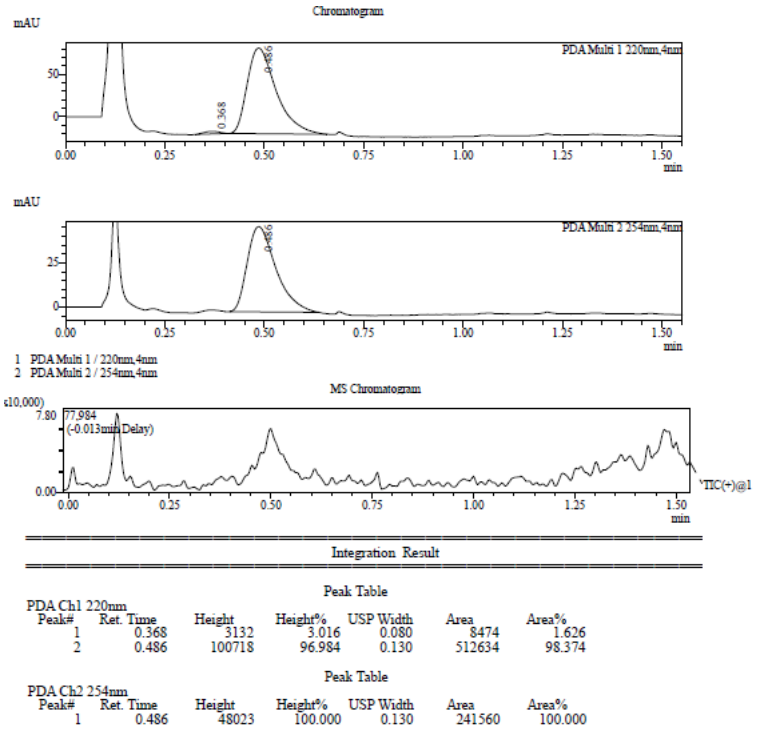
#	Meas. Ret.	Height	Width	Area	Area %
1	0.909	9.563	0.062	44.034	4.364
2	1.018	325.152	0.046	950.210	94.168
3	1.197	4.475	0.049	14.809	1.468

Signal 2 : DAD1 B, Sig=254,4 Ref=off

#	Meas. Ret.	Height	Width	Area	Area %
1	1.018	57.387	0.047	172.272	100.000



LCMS (2*R*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(hydroxymethyl)tetrahydrofuran-3,4-diol **(102)**



Integration Result

Peak Table

PDA Ch1 220nm

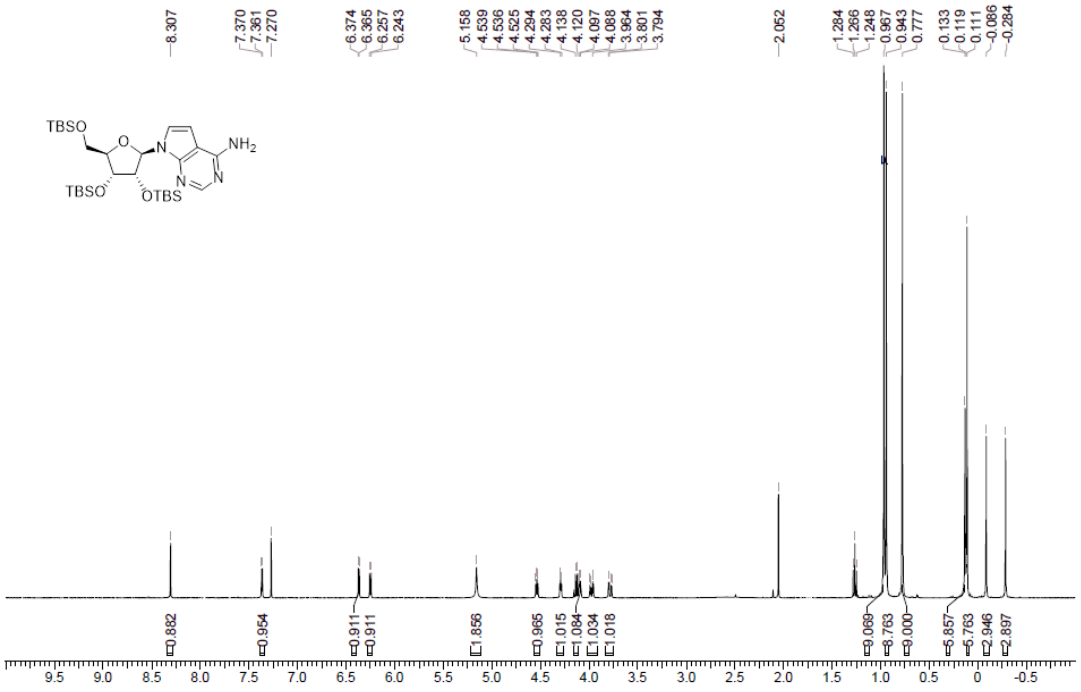
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.368	3132	3.016	0.080	8474	1.626
2	0.486	100718	96.984	0.130	512634	98.374

Peak Table

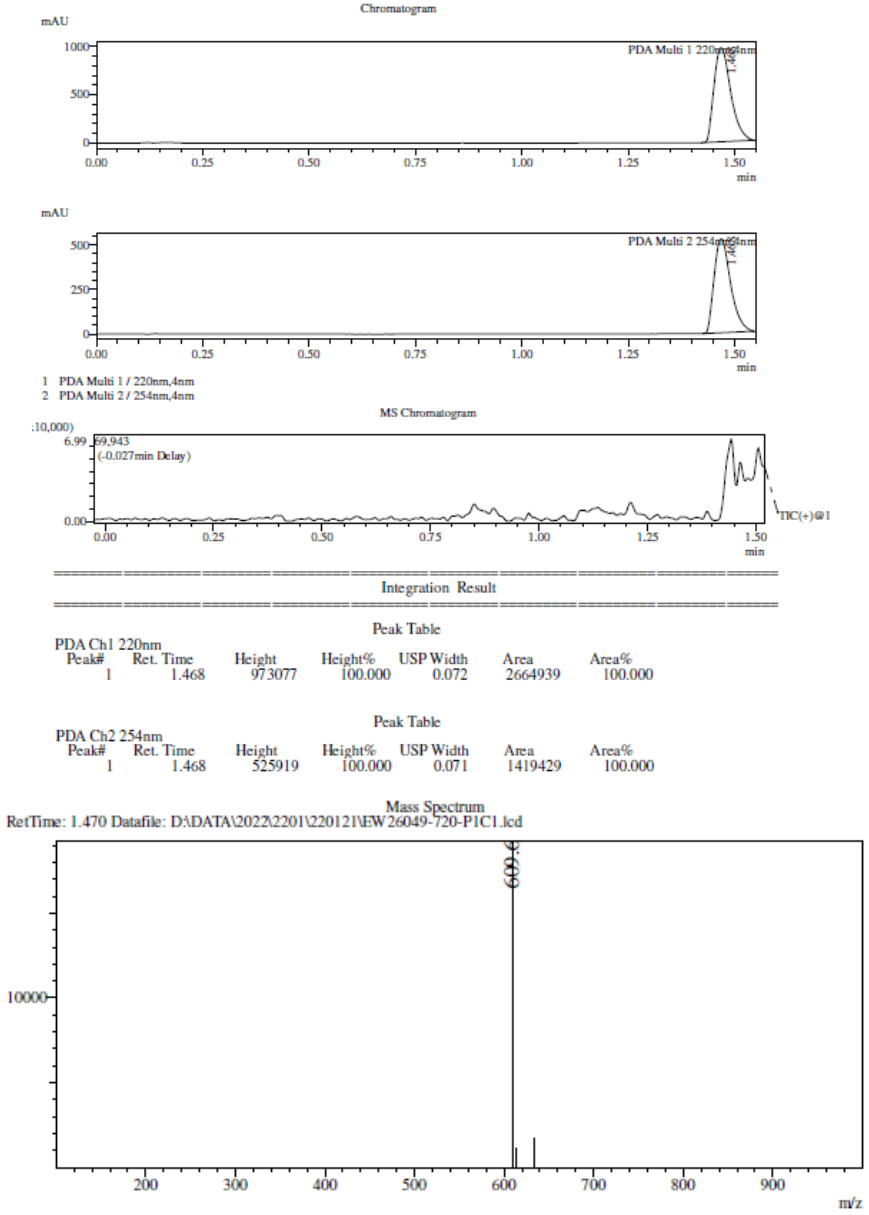
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.486	48023	100.000	0.130	241560	100.000

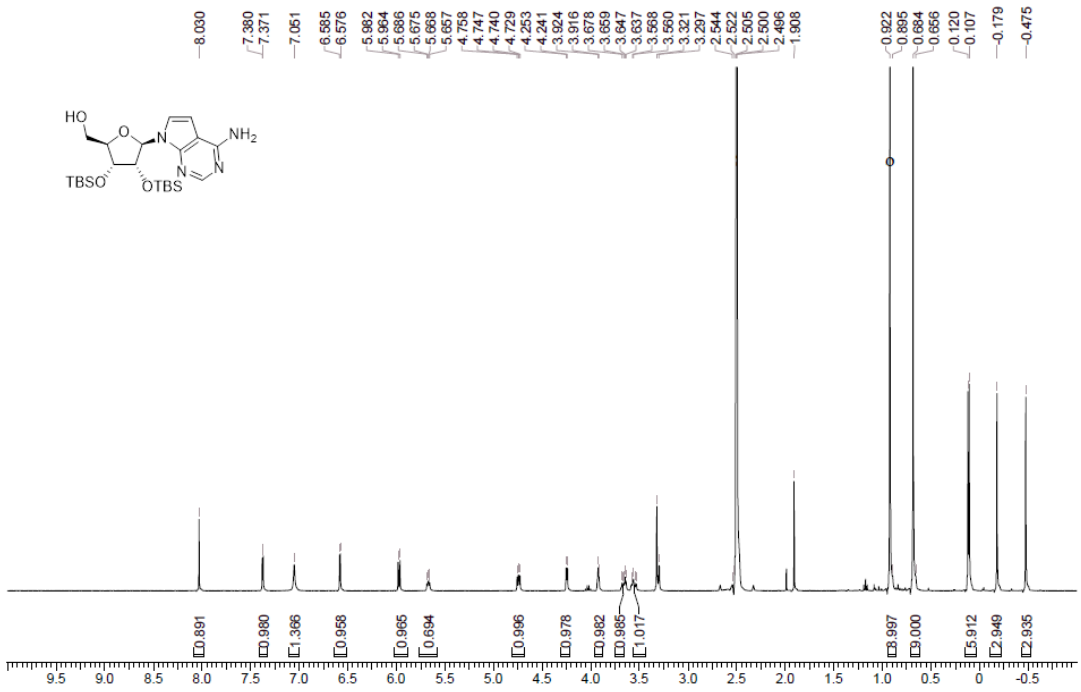
^{1}H NMR 7-[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert-butyl(dimethyl)silyl]oxymethyl]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidin-4-amine **(103)**



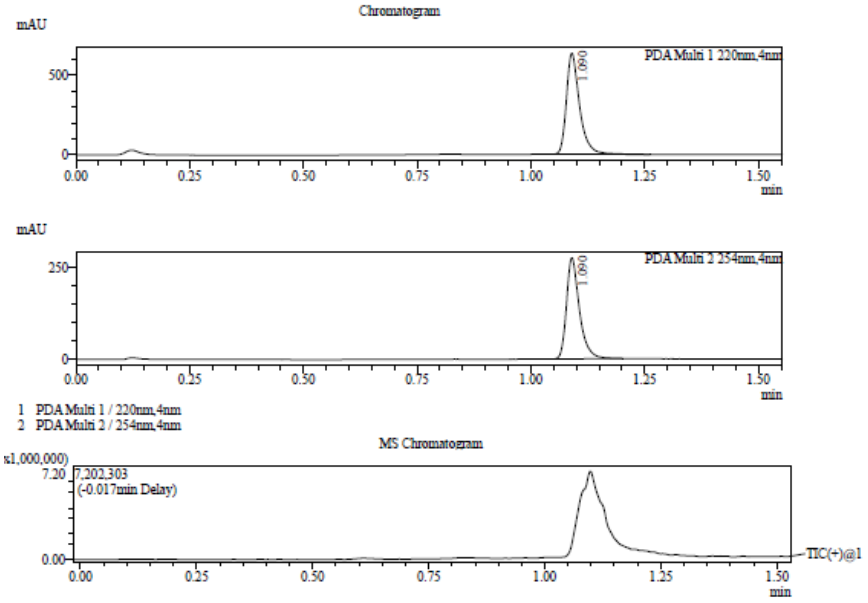
LCMS 7-[(2*R*,3*R*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert- butyl(dimethyl)silyl] oxymethyl]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidin-4-amine **(103)**



^{1}H NMR [(2*R*,3*R*,4*R*,5*R*)-5-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methanol **(104)**



LCMS [(2*R*,3*R*,4*R*,5*R*)-5-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methanol **(104)**



Integration Result

Peak Table

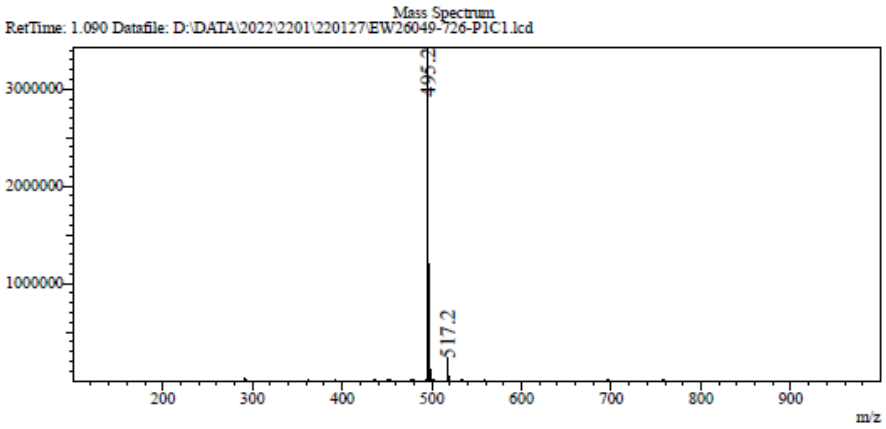
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.090	633282	100.000	0.051	1284214	100.000

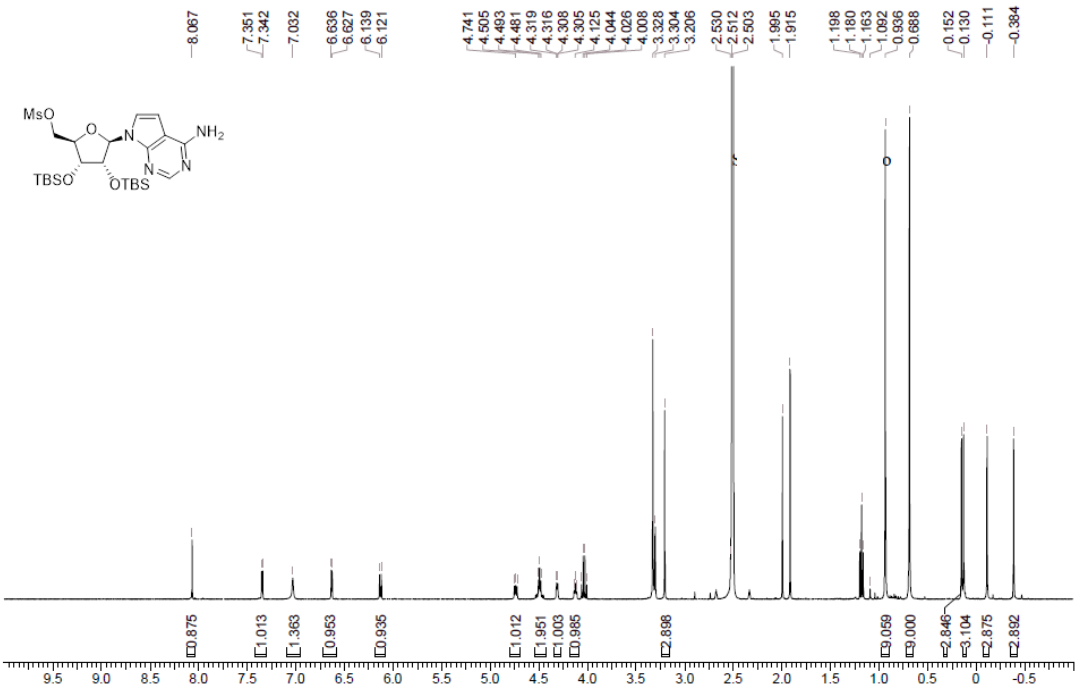
Peak Table

PDA Ch2 254nm

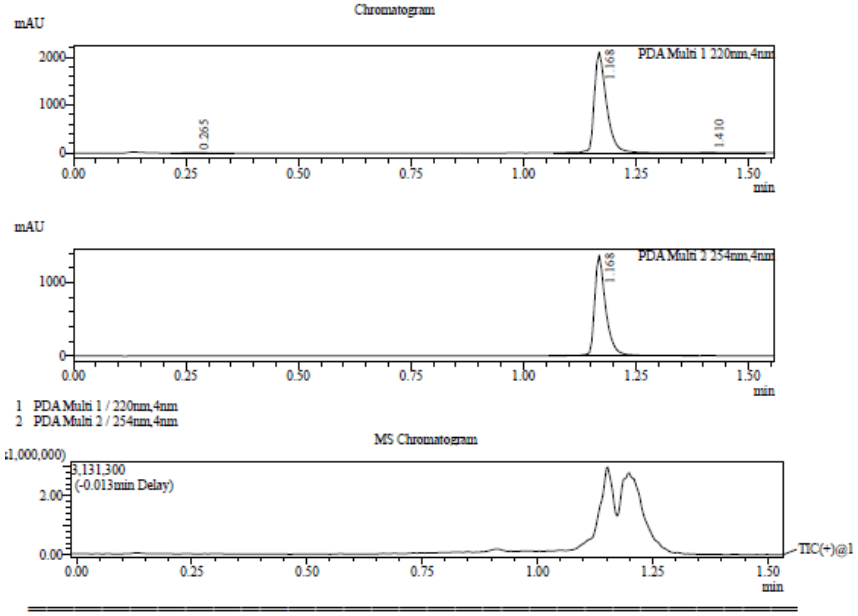
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.090	276360	100.000	0.051	546944	100.000



^{1}H NMR ((2*R*,3*R*,4*R*,5*R*)-5-(4-Amino-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tertbutyldimethylsilyl)oxy)tetrahydrofuran-2-yl)methyl methanesulfonate **(105)**



LCMS ((2*R*,3*R*,4*R*,5*R*)-5-(4-Amino-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tertbutyldimethylsilyl)oxy)tetrahydrofuran-2-yl)methyl methanesulfonate **(105)**



Integration Result

Peak Table

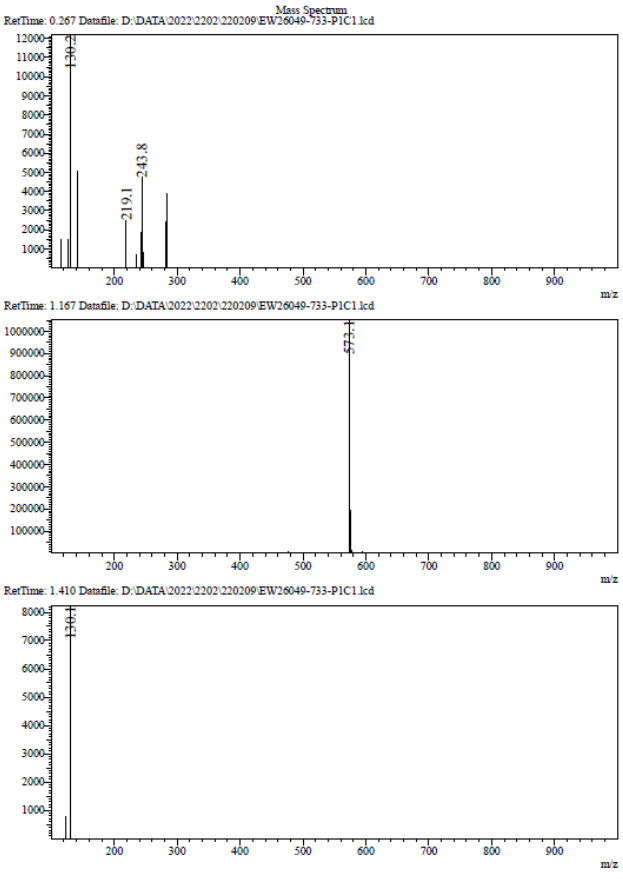
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.265	1812	0.085	0.109	6978	0.174
2	1.168	2107121	99.326	0.055	3978645	99.239
3	1.410	12477	0.588	0.054	23546	0.587

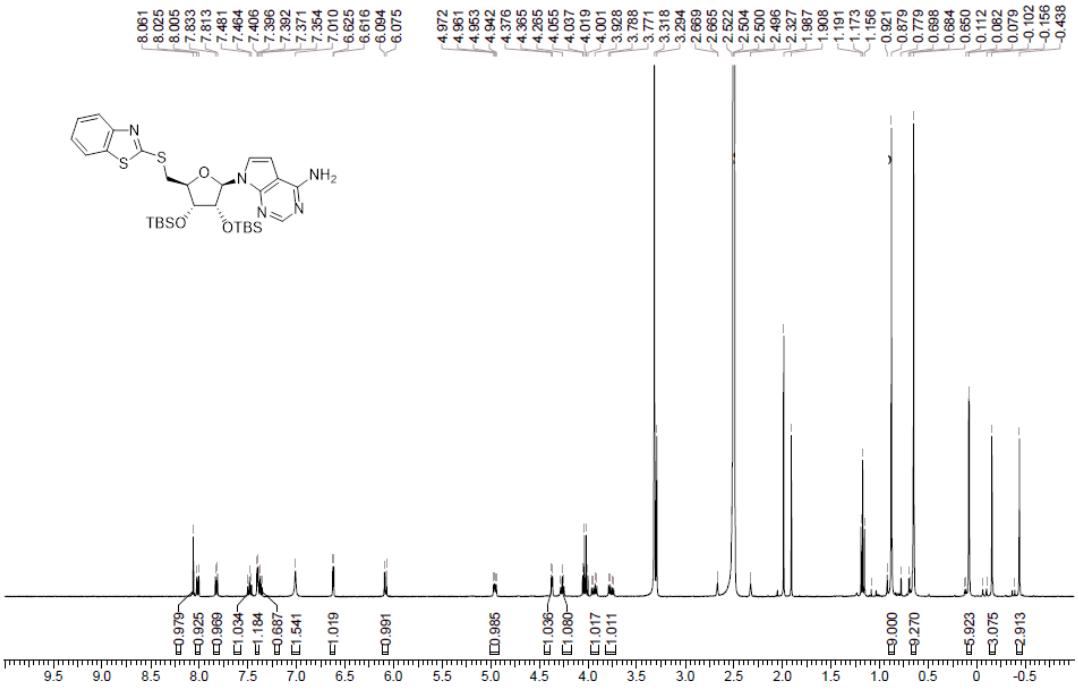
Peak Table

PDA Ch2 254nm

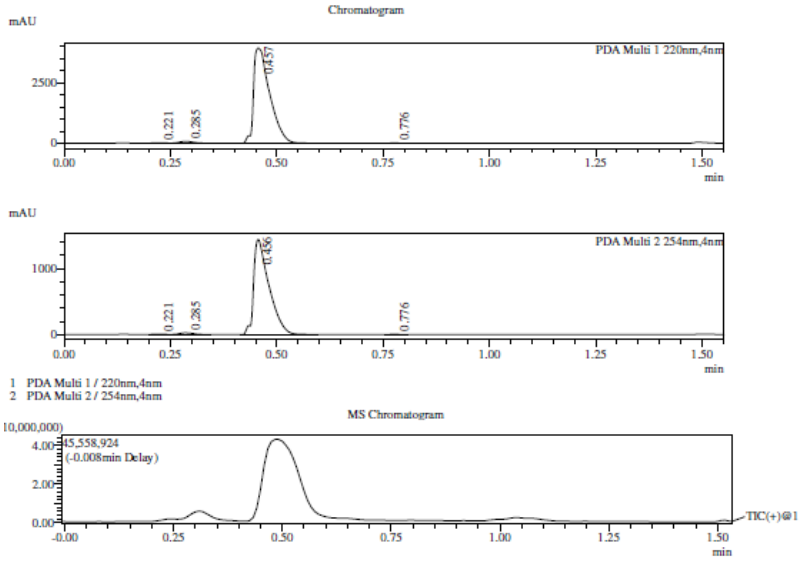
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.168	1375637	100.000	0.049	2339367	100.000



^{1}H NMR 7-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidin-4-amine **(106)**



LCMS 7-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl) silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidin-4-amine **(106)**



Integration Result

Peak Table

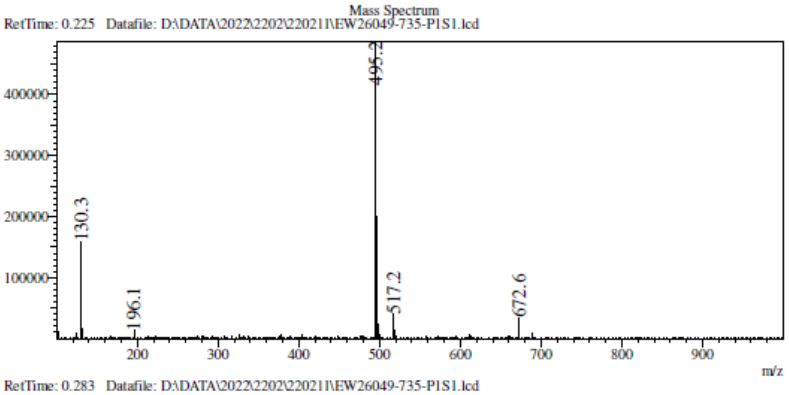
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.221	17634	0.437	0.046	29197	0.275
2	0.285	75571	1.871	0.061	169299	1.596
3	0.457	3934164	97.394	0.063	10396308	97.986
4	0.776	12078	0.299	0.035	15204	0.143

Peak Table

PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.221	5615	0.380	0.043	8592	0.233
2	0.285	24489	1.657	0.060	53694	1.458
3	0.456	1442377	97.588	0.065	3612922	98.119
4	0.776	5546	0.375	0.035	6969	0.189


Mass Spectrum
RetTime: 0.225 Datafile: D:\DATA\2022\2202\220211\EW26049-735-P1S1.lcd
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400000
300000
200000
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517.2
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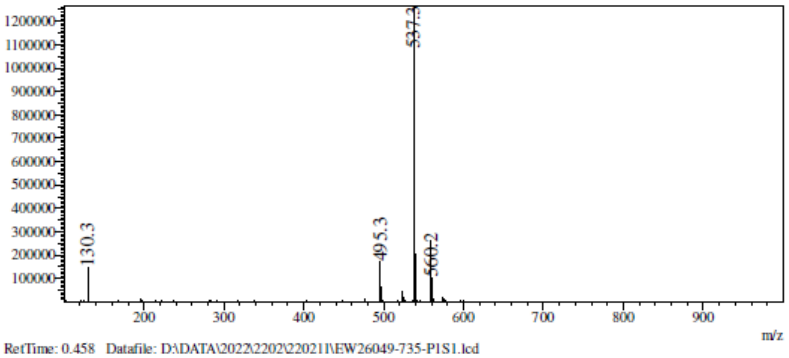
200
300
400
500
600
700
800
900
m/z


RetTime: 0.283 Datafile: D:\DATA\2022\2202\220211\EW26049-735-P1S1.lcd
537.3
1200000
1100000
1000000
900000
800000
700000
600000
500000
400000
300000
200000
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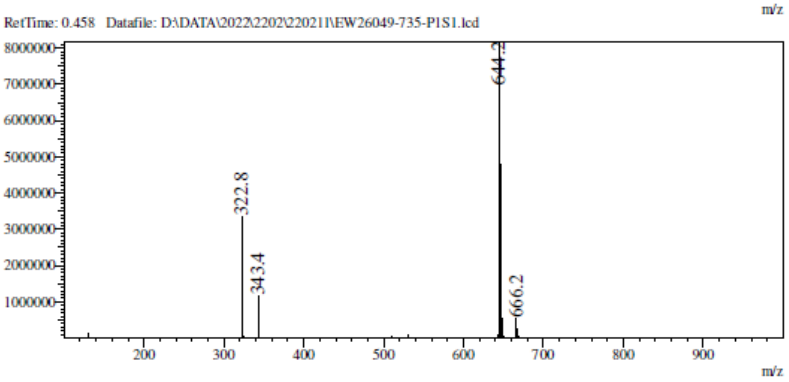
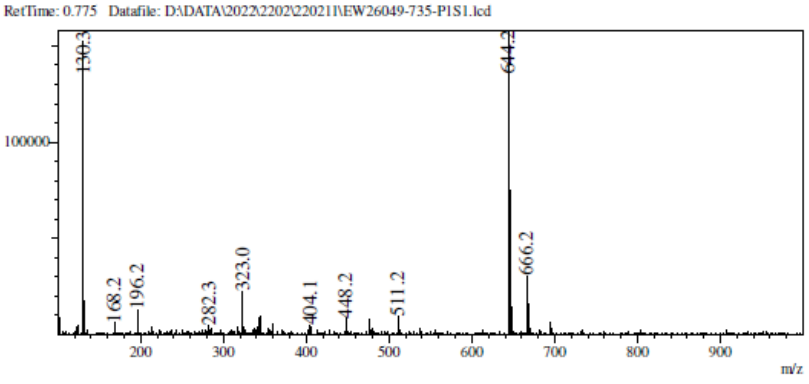
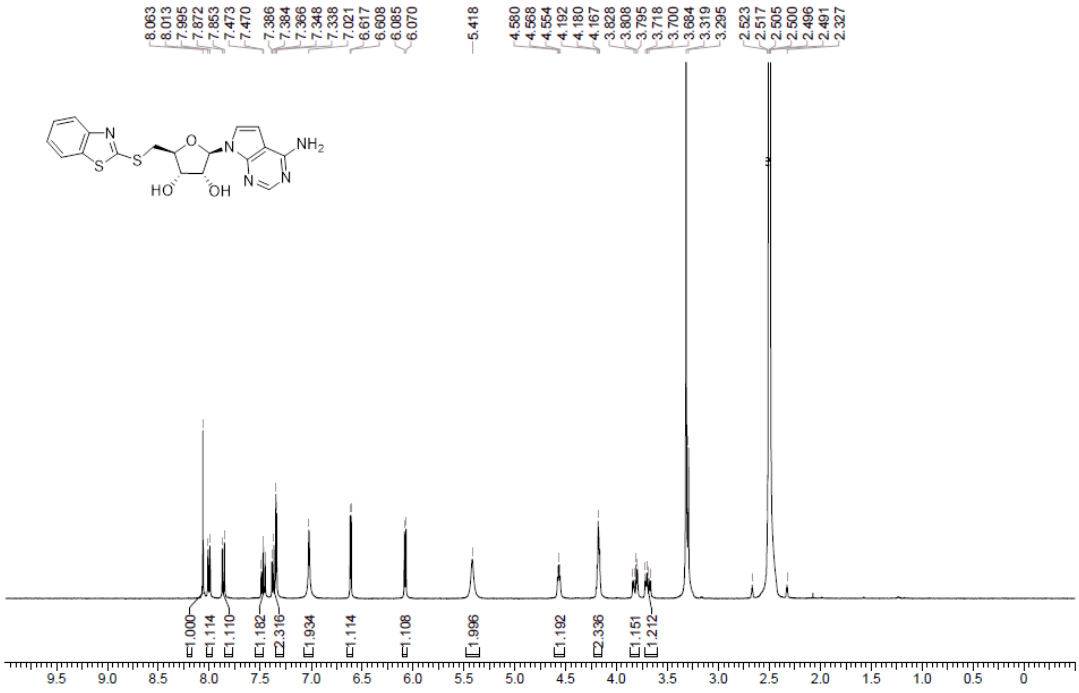
100000
495.3
560.2
200
300
400
500
600
700
800
900
m/z

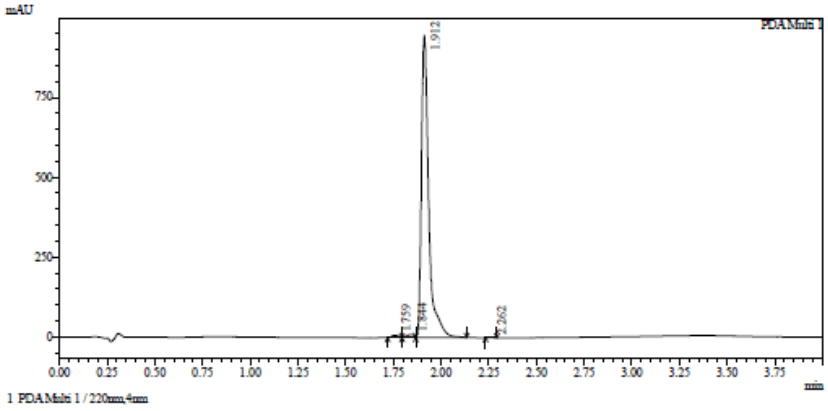

RetTime: 0.458 Datafile: D:\DATA\2022\2202\220211\EW26049-735-P1S1.lcd
644.2
8000000
7000000
6000000
5000000
4000000
322.8
3000000
2000000
343.4
1000000
666.2
200
300
400
500
600
700
800
900
m/z


RetTime: 0.775 Datafile: D:\DATA\2022\2202\220211\EW26049-735-P1S1.lcd
130.3
644.2
100000
666.2
168.2
196.2
282.3
323.0
404.1
448.2
511.2
200
300
400
500
600
700
800
900
m/z

[1] **H NMR** (2*R*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(27)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(27)**

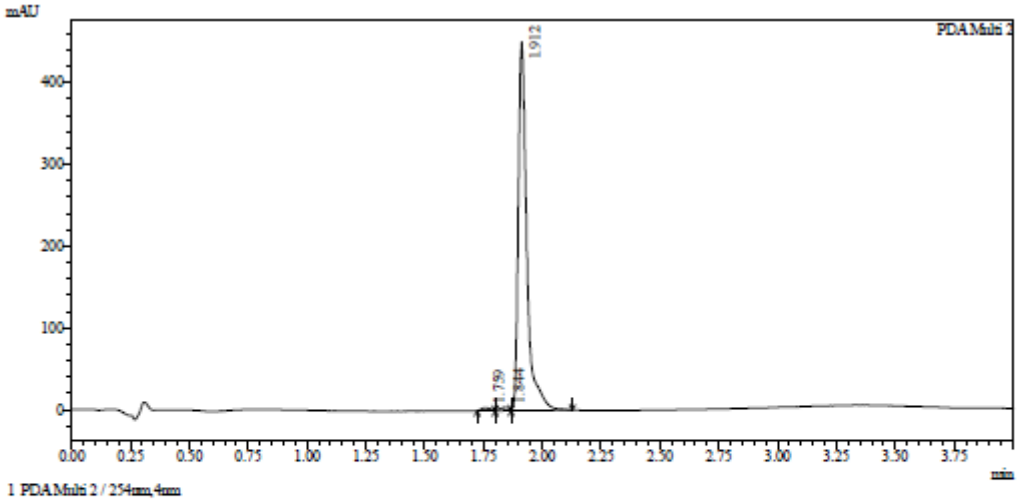


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.759	0.081	0.000	7310	20055	0.779
2	1.844	0.131	0.805	9365	29156	1.133
3	1.912	0.065	0.695	946992	2521889	98.012
4	2.262	0.056	5.755	914	1933	0.075
Total				964581	2573033	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.759	0.078	0.000	3714	10596	0.909
2	1.844	0.170	0.688	3882	11969	1.027
3	1.912	0.063	0.582	450566	1143339	98.065
Total				458161	1165904	100.000

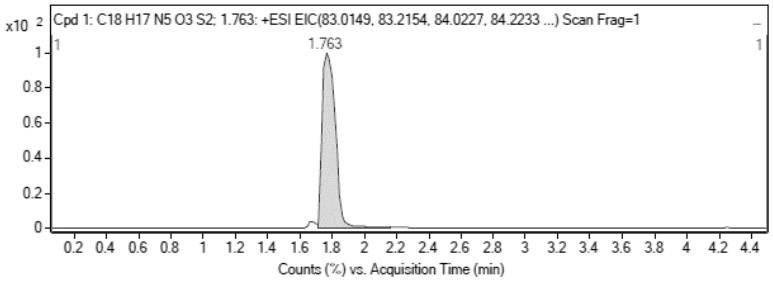
HRMC (2*R*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(27)**

Compound Table

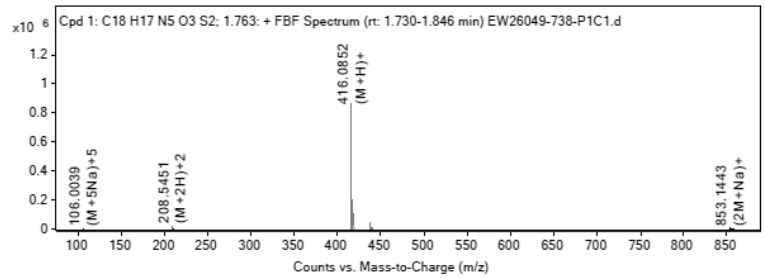
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C18 H17 N5 O3 S2; 1.763	97.21	0.75	C18 H17 N5 O3 S2	1.763	415.0773	415.0776

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
438.0658	1.763	415.0776	C18 H17 N5 O3 S2	415.0773	0.75	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

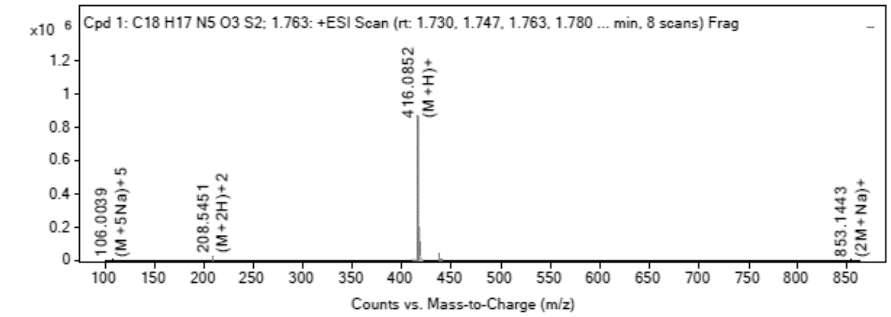


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
208.5451	2	22678.21	(M+2H)+2
209.0469	2	5371.39	(M+2H)+2

209.5444	2	2506.16	(M+2H)+2
416.0852	1	863713.56	(M+H)+
417.0869	1	200761.59	(M+H)+
418.0825	1	99680.85	(M+H)+
438.0658	1	42955.25	(M+Na)+
439.0681	1	9944.64	(M+Na)+
440.0644	1	5401.75	(M+Na)+
853.1443	1	4463.23	(2M+Na)+

MS Zoomed Spectrum

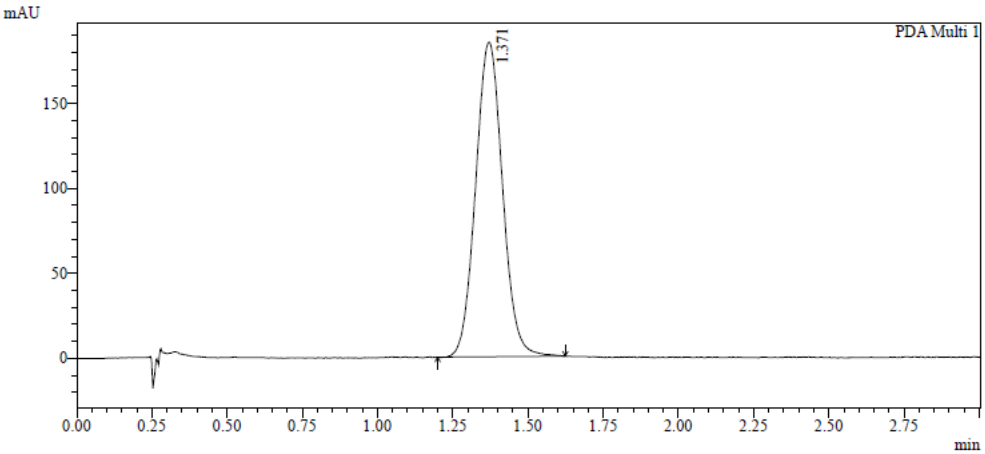


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
208.5451	2	22678.21	(M+2H)+2	3.85
209.0469	2	5371.39	(M+2H)+2	1.74
209.5444	2	2506.16	(M+2H)+2	2.86
416.0852	1	863713.56	(M+H)+	-1.65
417.0869	1	200761.59	(M+H)+	0.7
418.0825	1	99680.85	(M+H)+	0.67
438.0658	1	42955.25	(M+Na)+	1.51
439.0681	1	9944.64	(M+Na)+	2.21
440.0644	1	5401.75	(M+Na)+	0.72
853.1443	1	4463.23	(2M+Na)+	-0.62

--- End Of Report ---

SFC (2*R*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,3-d]pyrimidin-7-yl)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(27)**



1 PDA Multi 1 / 220nm,4nm

Integration Results

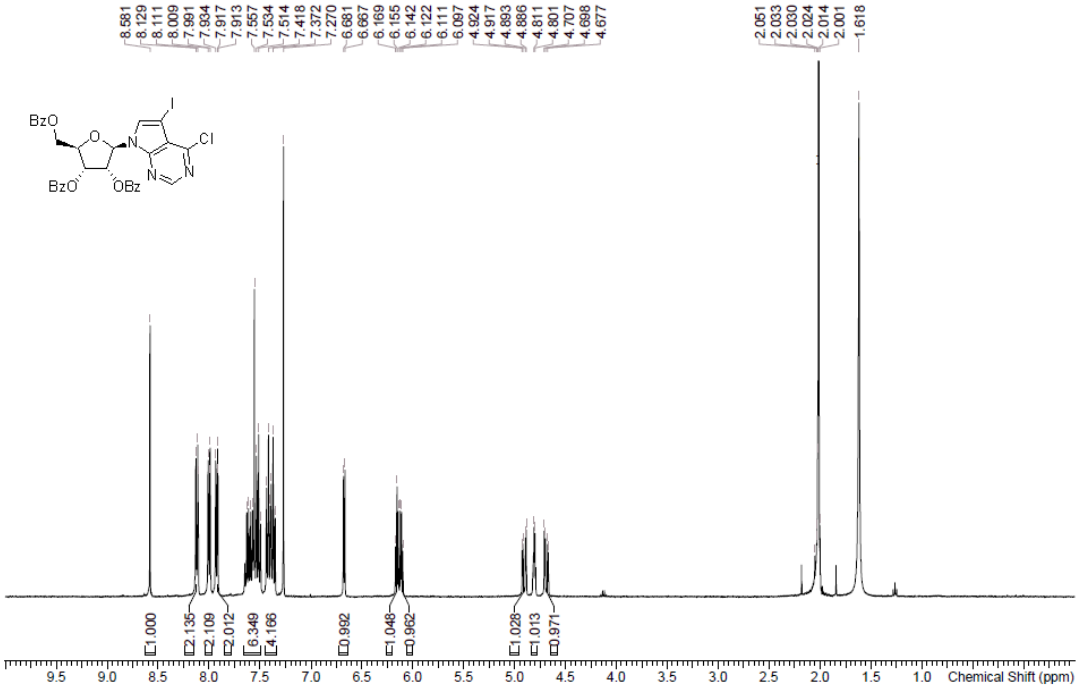
PeakTable

PDA Ch1 220nm

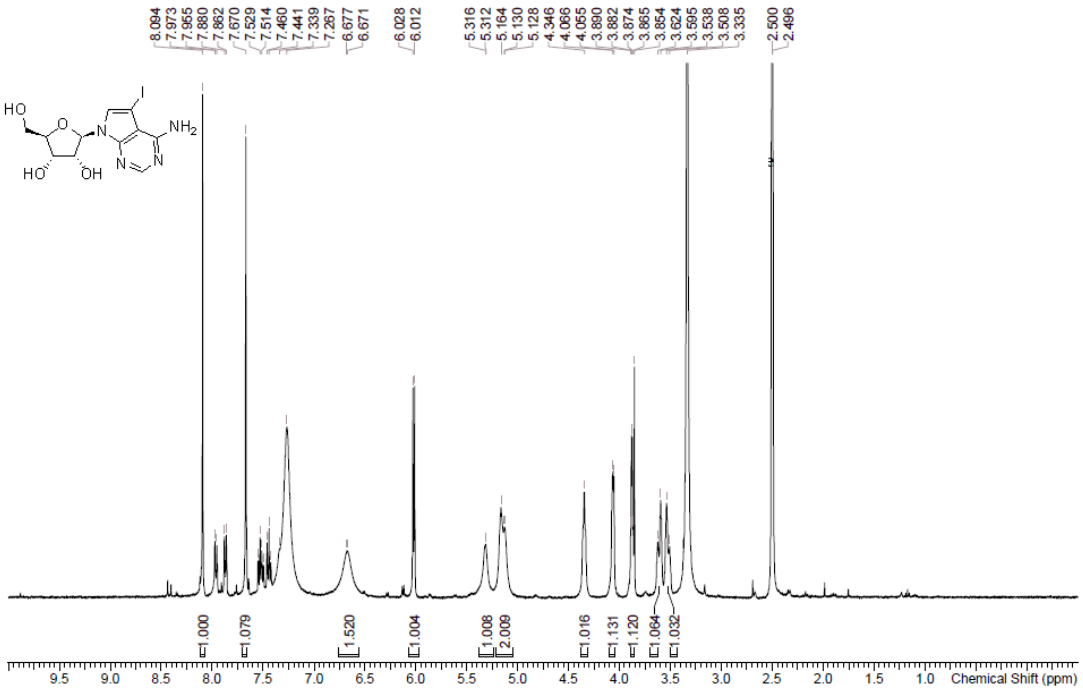
Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.371	0.164	0.000	184561	1155126	100.000
Total				184561	1155126	100.000

^{1}H NMR (2R,3R,4R,5R)-2-((Benzoyloxy)methyl)-5-(4-chloro-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-

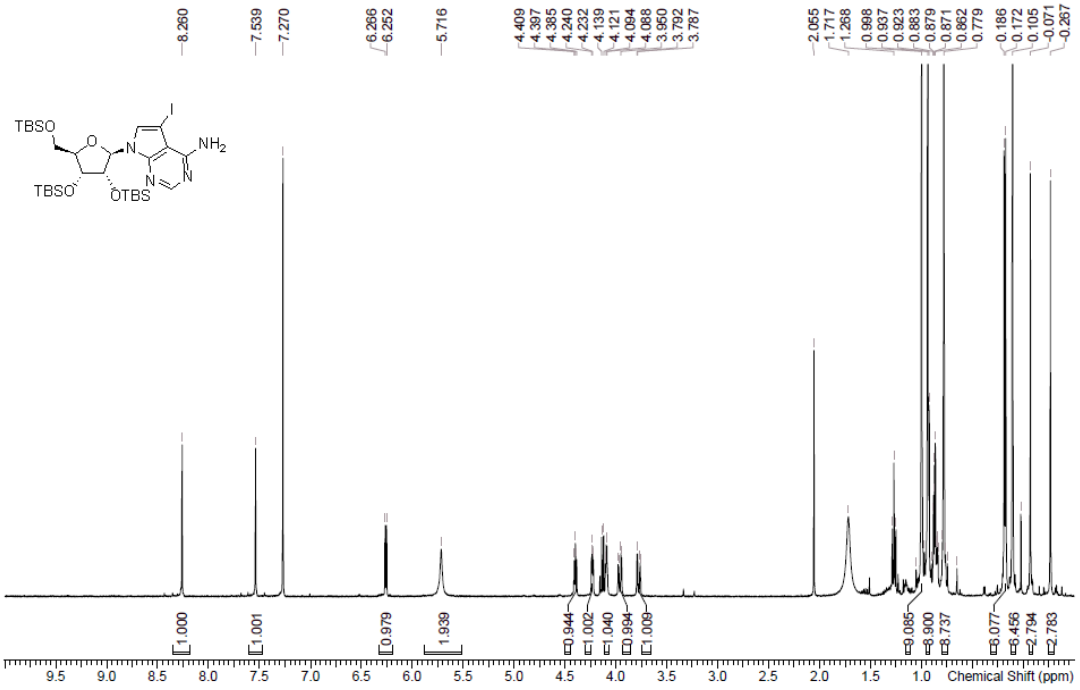
yl)tetrahydrofuran-3,4-diyl dibenzoate **(64)**



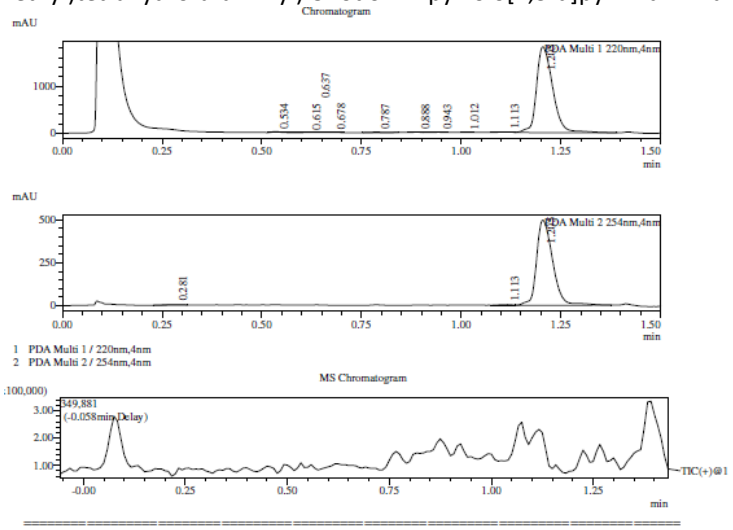
^{1}H NMR (2R,3R,4S,5R)-2-(4-Amino-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-5-(hydroxymethyl)tetrahydrofuran-3,4-diol **(65)**



^{1}H NMR 7-((2R,3R,4R,5R)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-(((tert-butyldimethylsilyl)oxy)methyl)tetrahydrofuran-2-yl)-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-4-amine **(66)**



LCMS 7-((2R,3R,4R,5R)-3,4-Bis((tert-butyldimethylsilyl)oxy)-5-(((tert-butyldimethylsilyl)oxy)methyl)tetrahydrofuran-2-yl)-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-4-amine **(66)**



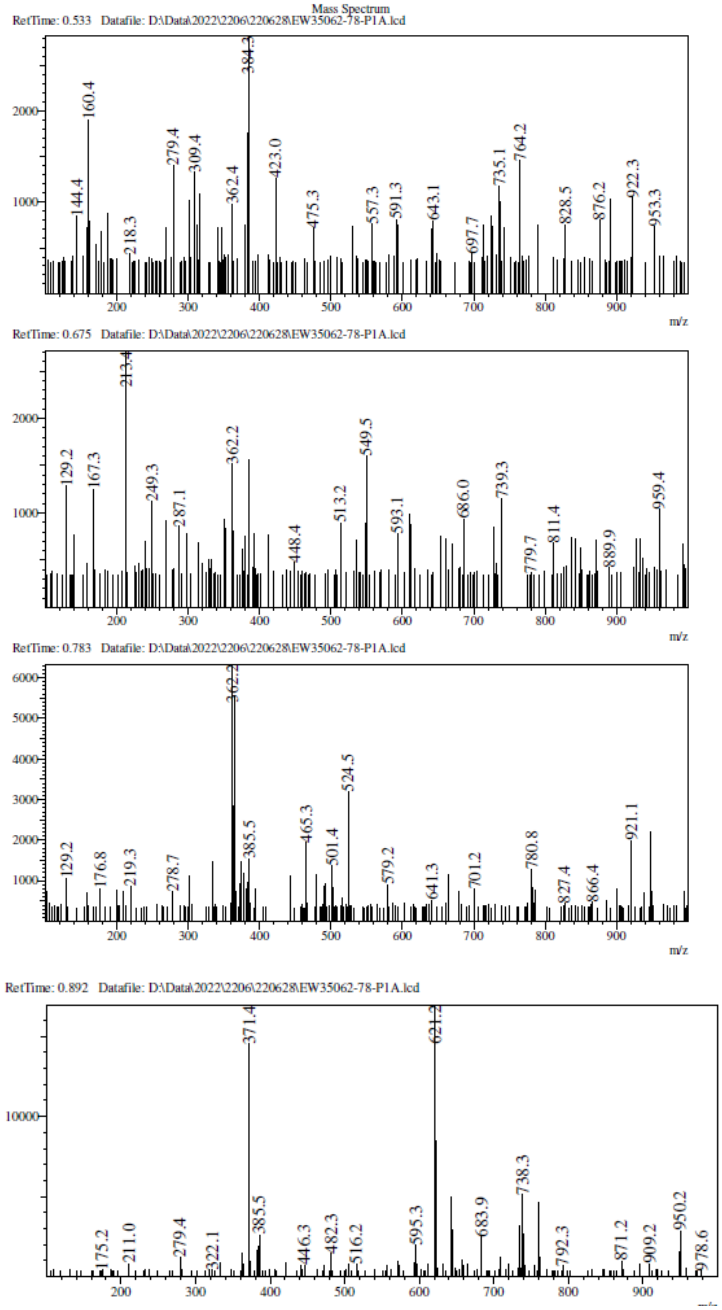
Integration Result

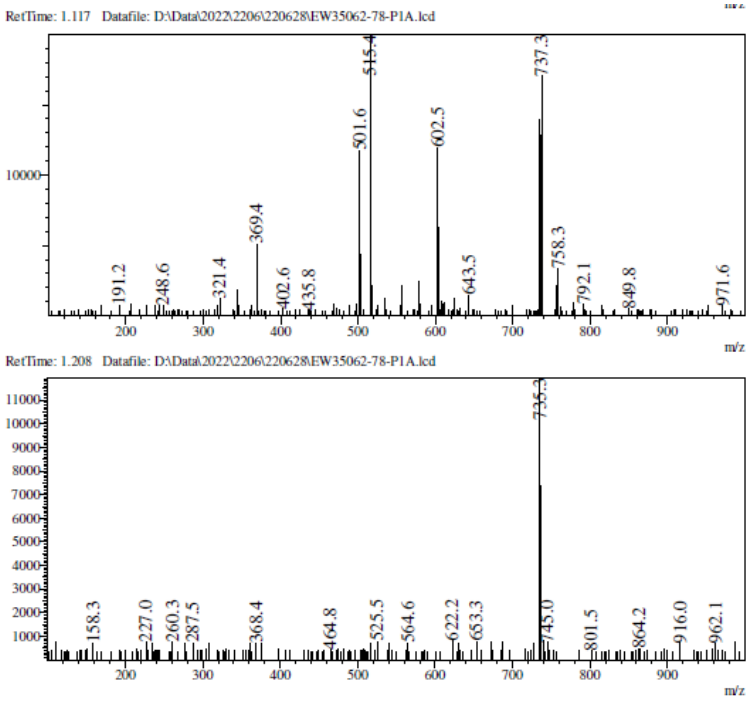
Peak Table

PDA Ch1 220nm

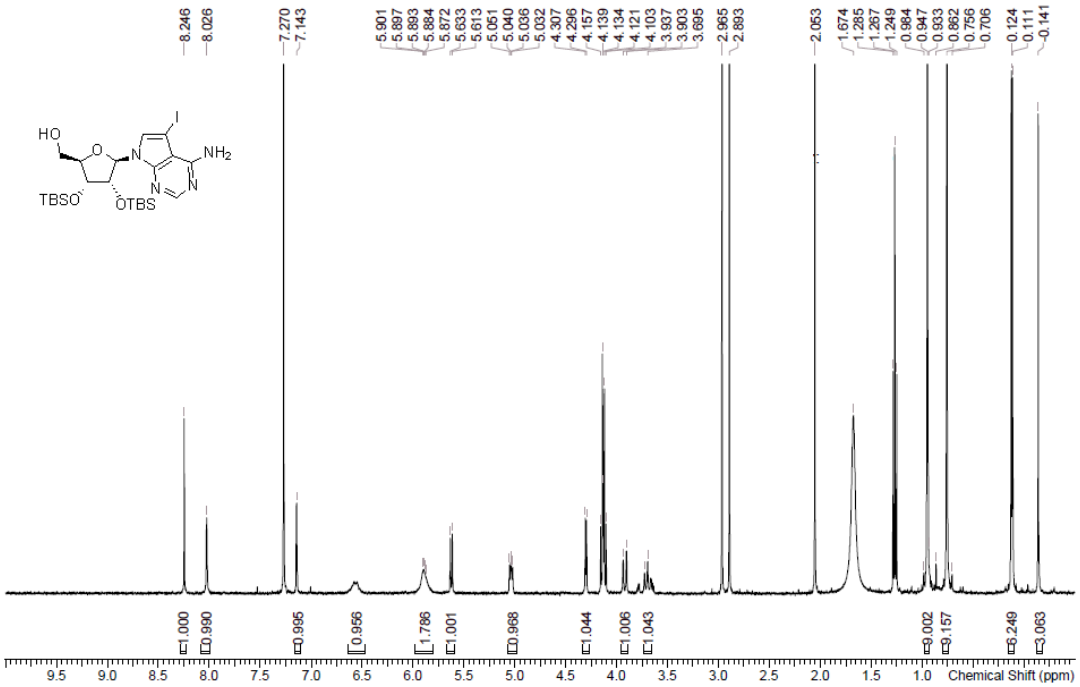
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.534	20708	1.089	0.038	29401	0.558
2	0.615	6303	0.332	0.043	7490	0.142
3	0.637	5420	0.285	0.044	5545	0.105
4	0.678	6402	0.337	0.043	10172	0.193
5	0.787	10380	0.546	0.048	20047	0.380
6	0.888	9099	0.479	0.038	13361	0.253
7	0.943	6160	0.324	0.037	7887	0.150
8	1.012	3665	0.193	0.056	5244	0.099
9	1.113	9734	0.512	0.086	24637	0.467
10	1.205	1823506	95.905	0.072	5149420	97.653

Peak Table

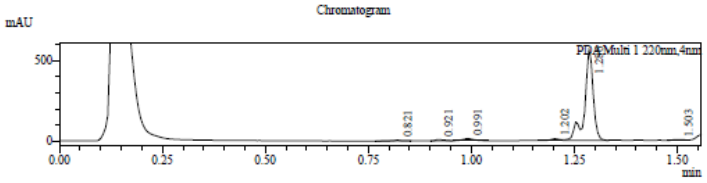

Mass Spectrum
RetTime: 0.533 Datafile: D:\Data\2022\2206\220628\EW35062-78-P1A.lcd
RetTime: 0.675 Datafile: D:\Data\2022\2206\220628\EW35062-78-P1A.lcd
RetTime: 0.783 Datafile: D:\Data\2022\2206\220628\EW35062-78-P1A.lcd
RetTime: 0.892 Datafile: D:\Data\2022\2206\220628\EW35062-78-P1A.lcd
m/z

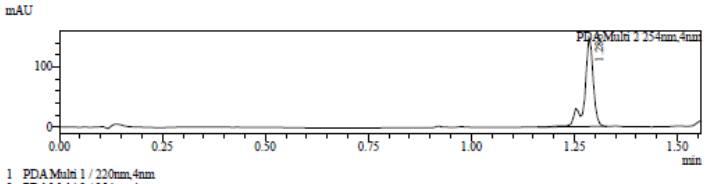


^{1}H NMR ((2R,3R,4R,5R)-5-(4-amino-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)methanol **(67)**

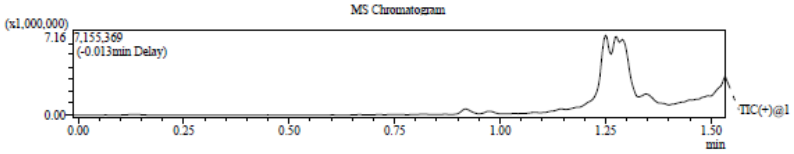


LCMS ((2R,3R,4R,5R)-5-(4-amino-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)methanol **(67)**





1 PDA Multi 1 / 220nm,4nm
2 PDA Multi 2 / 254nm,4nm



Integration Result

Peak Table

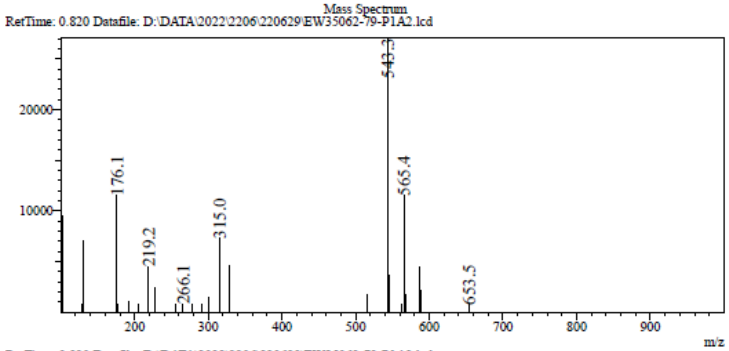
PDA Ch1 220nm

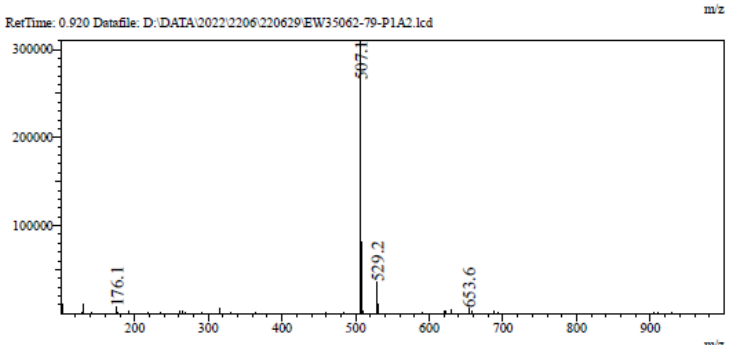
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.821	5537	0.902	0.027	5970	0.672
2	0.921	7829	1.276	0.036	10278	1.157
3	0.991	13491	2.198	0.057	23874	2.687
4	1.202	10525	1.715	0.048	16023	1.803
5	1.286	573201	93.395	0.037	827403	93.115
6	1.503	3154	0.514	0.043	5034	0.566

Peak Table

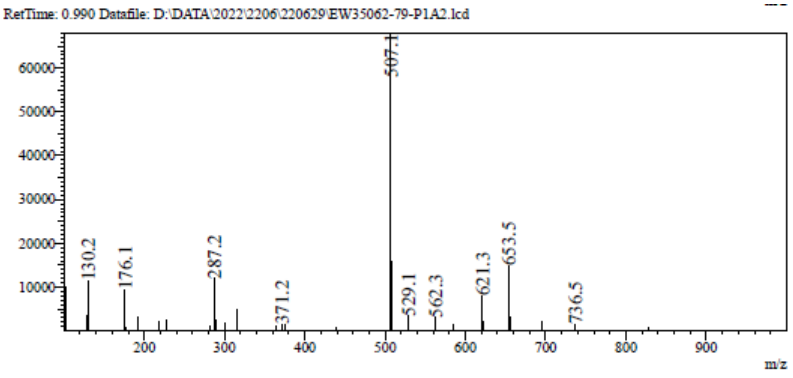
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.286	150263	100.000	0.037	219703	100.000

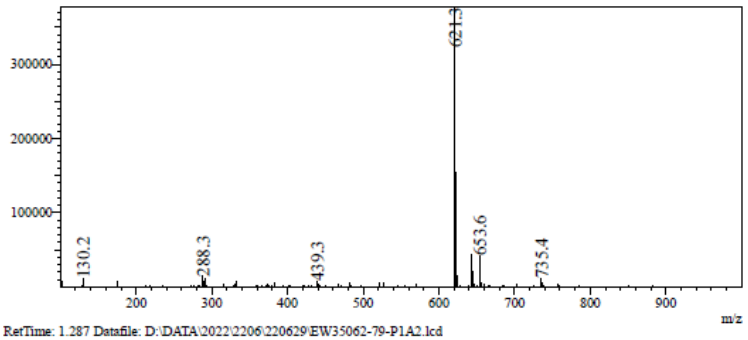




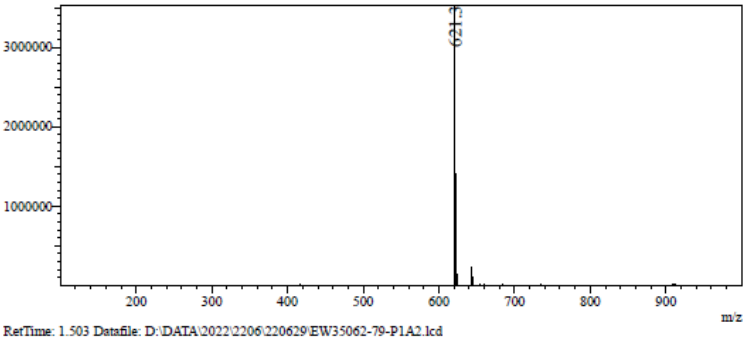
RetTime: 0.990 Datafile: D:\DATA\2022\2206\220629\EW35062-79-P1A2.lcd



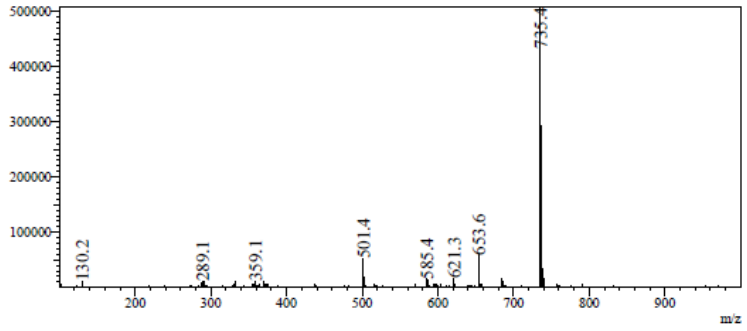
RetTime: 1.203 Datafile: D:\DATA\2022\2206\220629\EW35062-79-P1A2.lcd



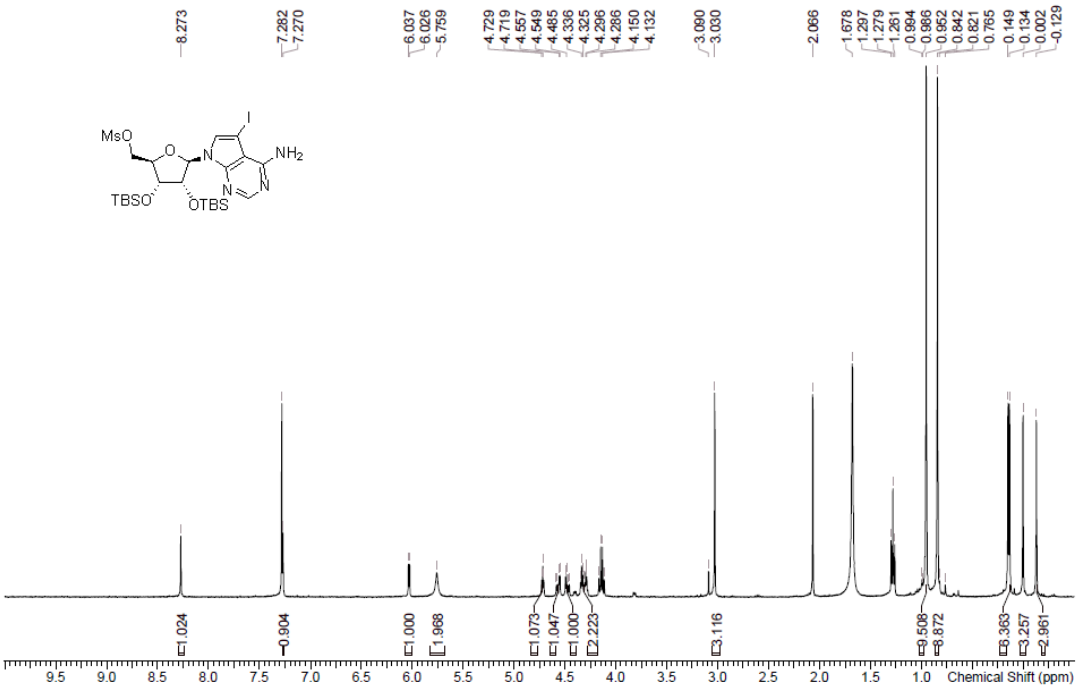
RetTime: 1.287 Datafile: D:\DATA\2022\2206\220629\EW35062-79-P1A2.lcd



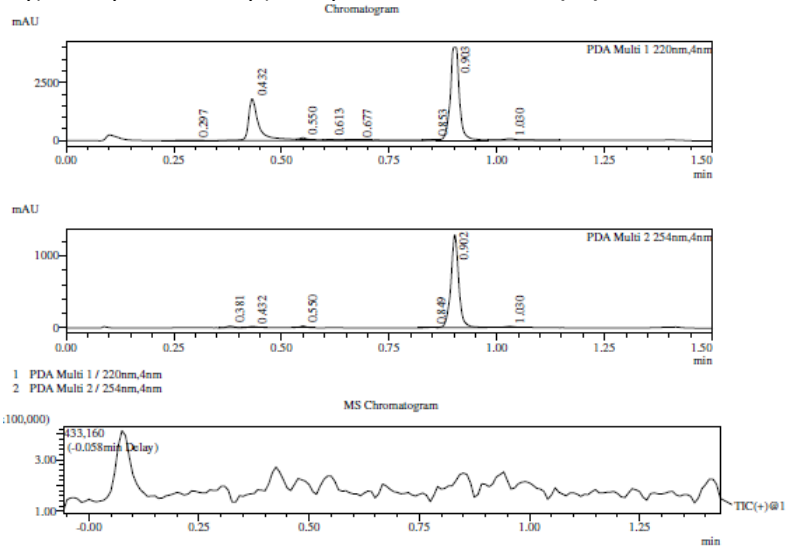
RetTime: 1.503 Datafile: D:\DATA\2022\2206\220629\EW35062-79-P1A2.lcd



^{1}H NMR ((2R,3R,4R,5R)-5-(4-Amino-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)methyl methanesulfonate **(68)**



LCMS ((2R,3R,4R,5R)-5-(4-Amino-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-7-yl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)methyl methanesulfonate **(68)**



Integration Result

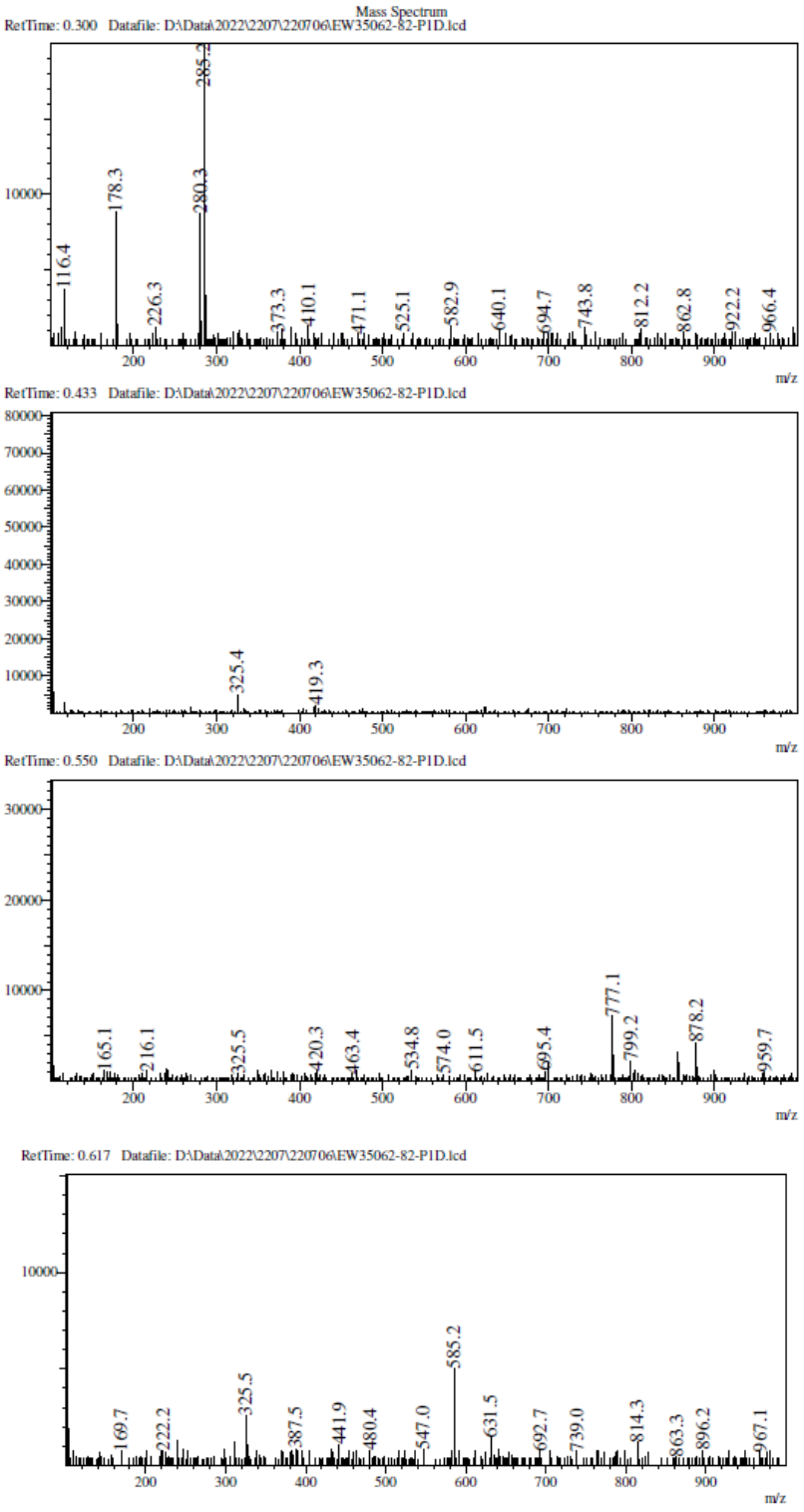
Peak Table

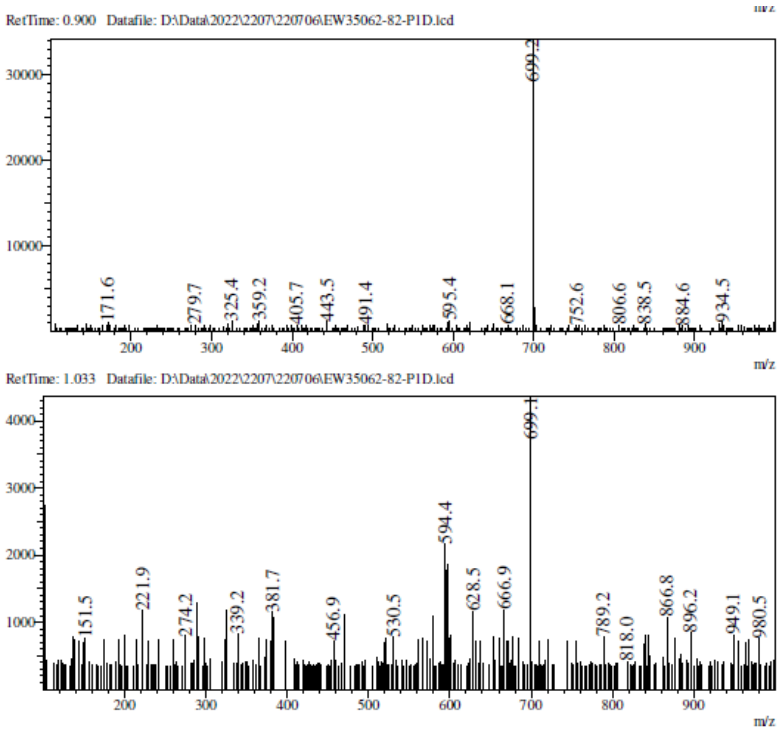
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.297	11446	0.192	0.096	42147	0.439
2	0.432	1788641	30.038	0.037	3424349	35.690
3	0.550	73875	1.241	0.023	57594	0.600
4	0.613	9545	0.160	0.033	13063	0.136
5	0.677	7360	0.124	0.043	10555	0.110
6	0.853	5549	0.093	0.023	6445	0.067
7	0.903	3988438	66.981	0.034	5867584	61.155
8	1.030	69758	1.172	0.044	172835	1.801

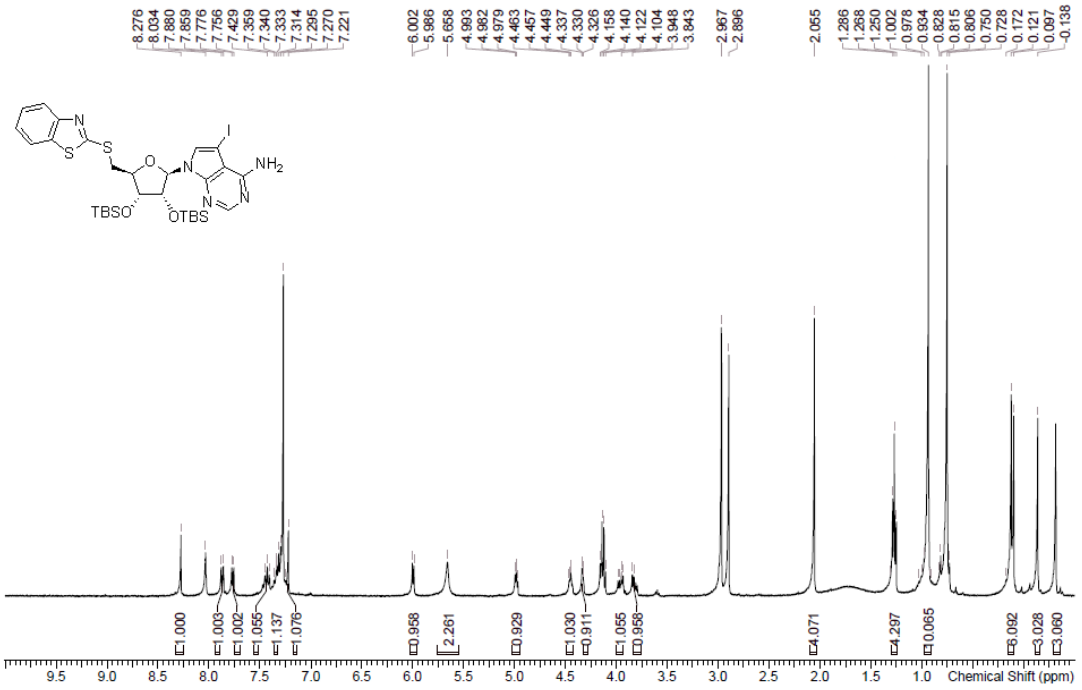
Peak Table

PDA Ch2 254nm

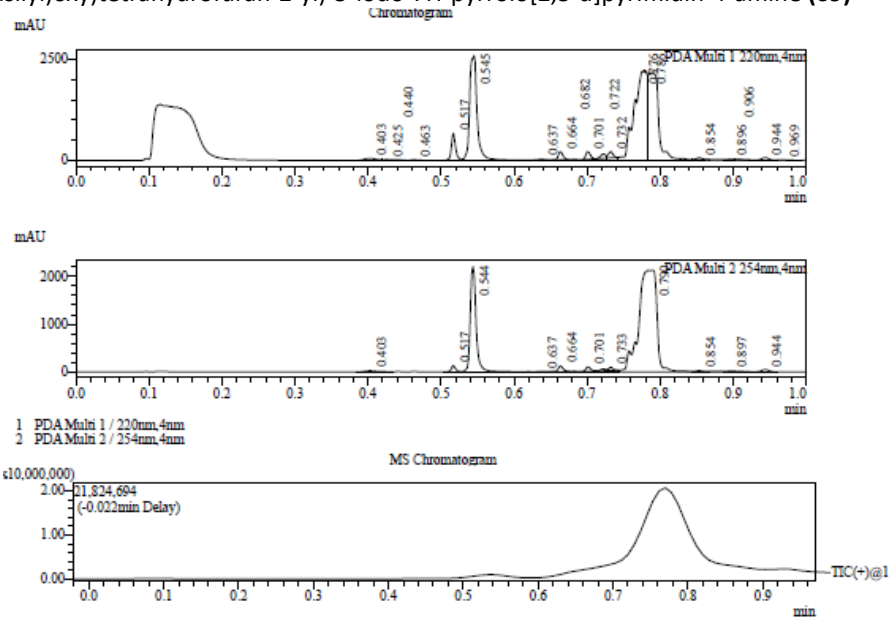

Mass Spectrum
RetTime: 0.300 Datafile: D:\Data\2022\2207\220706\EW35062-82-P1D.lcd
285.2
178.3
280.3
116.4
226.3
373.3
410.1
471.1
525.1
582.9
640.1
694.7
743.8
812.2
862.8
922.2
966.4
10000
200
300
400
500
600
700
800
900
m/z
RetTime: 0.433 Datafile: D:\Data\2022\2207\220706\EW35062-82-P1D.lcd
80000
70000
60000
50000
40000
30000
20000
10000
325.4
419.3
200
300
400
500
600
700
800
900
m/z
RetTime: 0.550 Datafile: D:\Data\2022\2207\220706\EW35062-82-P1D.lcd
30000
20000
10000
165.1
216.1
325.5
420.3
463.4
534.8
574.0
611.5
695.4
777.1
799.2
878.2
959.7
200
300
400
500
600
700
800
900
m/z
RetTime: 0.617 Datafile: D:\Data\2022\2207\220706\EW35062-82-P1D.lcd
10000
169.7
222.2
325.5
387.5
441.9
480.4
547.0
585.2
631.5
692.7
739.0
814.3
863.3
896.2
967.1
200
300
400
500
600
700
800
900
m/z



^{1}H NMR 7-((2R,3R,4R,5S)-5-((Benzo[d]thiazol-2-ylthio)methyl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-4-amine **(69)**



LCMS 7-((2R,3R,4R,5S)-5-((Benzo[d]thiazol-2-ylthio)methyl)-3,4-bis((tert-butyldimethylsilyl)oxy)tetrahydrofuran-2-yl)-5-iodo-7H-pyrrolo[2,3-d]pyrimidin-4-amine **(69)**

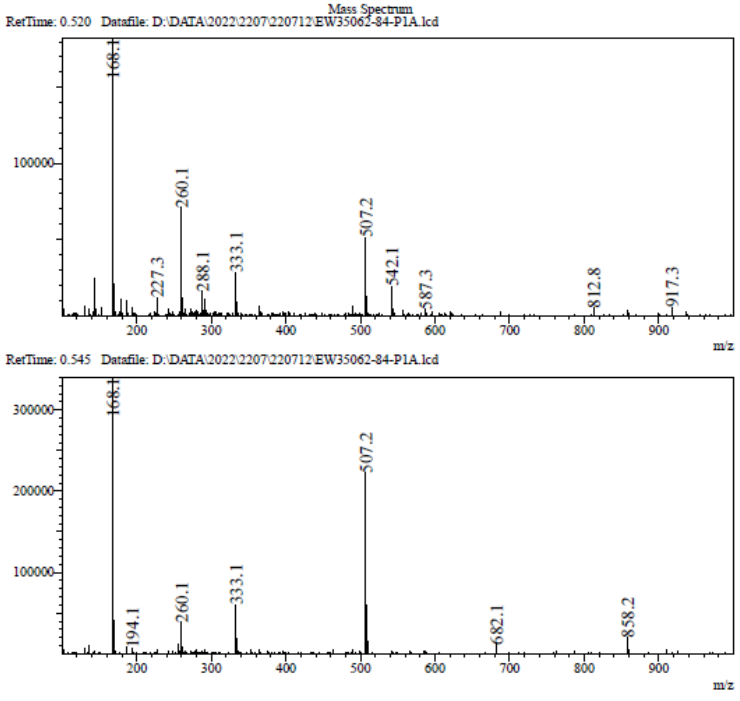


Integration Result

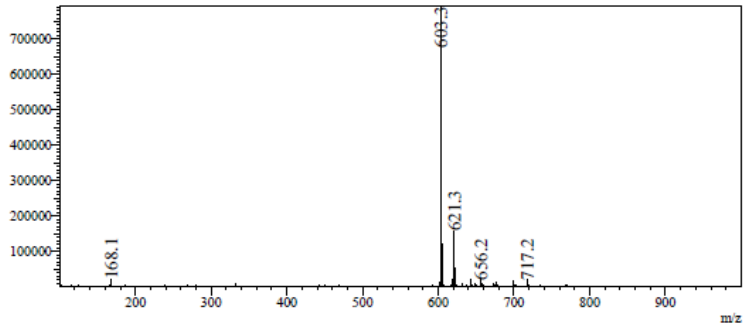
Peak Table

PDA Ch1 220nm

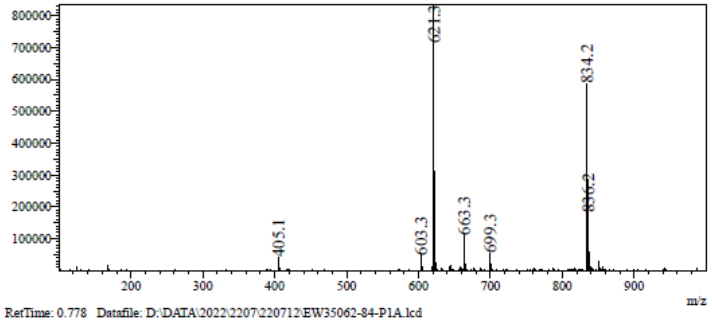
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.403	49851	0.580	0.033	57767	0.749
2	0.425	21355	0.249	0.070	18263	0.237
3	0.440	19696	0.229	0.034	11777	0.153
4	0.463	16567	0.193	0.016	8902	0.115
5	0.517	669022	7.790	0.011	271116	3.517
6	0.545	2594224	30.206	0.018	2024636	26.266
7	0.637	23526	0.274	0.017	13073	0.170
8	0.664	203254	2.367	0.014	95825	1.243
9	0.682	17152	0.200	0.014	8167	0.106
10	0.701	193689	2.255	0.014	85915	1.115
11	0.722	105327	1.226	0.019	52300	0.679
12	0.732	157534	1.834	0.014	68516	0.889
13	0.776	2205382	25.678	0.078	2892441	37.525
14	0.786	2145964	24.986	0.063	1995864	25.893



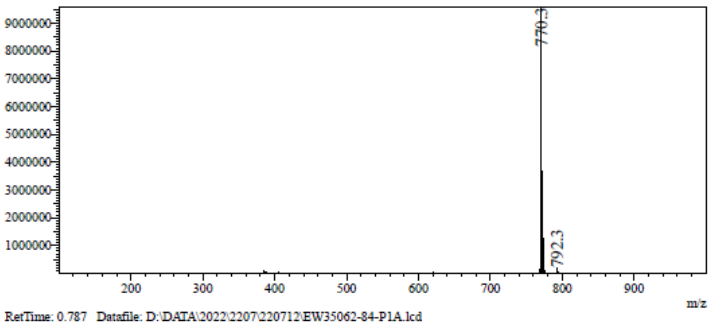
RetTime: 0.662 Datafile: D:\DATA\2022\2207\220712\EW35062-84-P1A.lcd



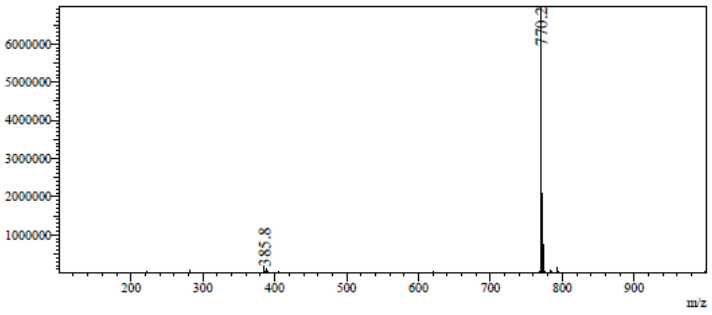
RetTime: 0.703 Datafile: D:\DATA\2022\2207\220712\EW35062-84-P1A.lcd



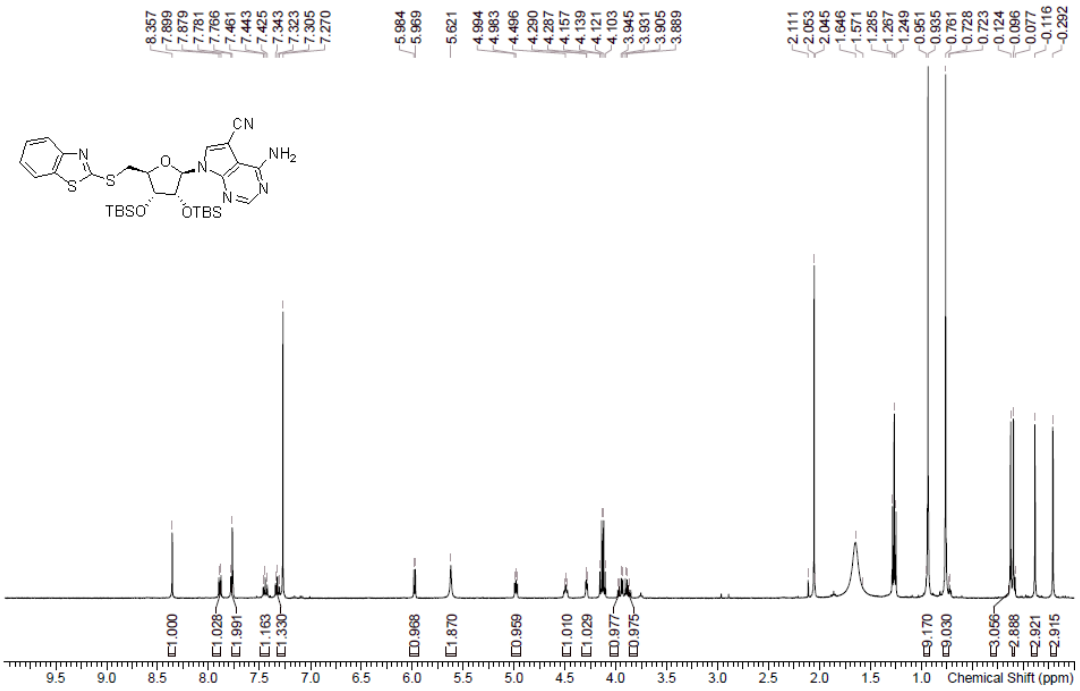
RetTime: 0.778 Datafile: D:\DATA\2022\2207\220712\EW35062-84-P1A.lcd



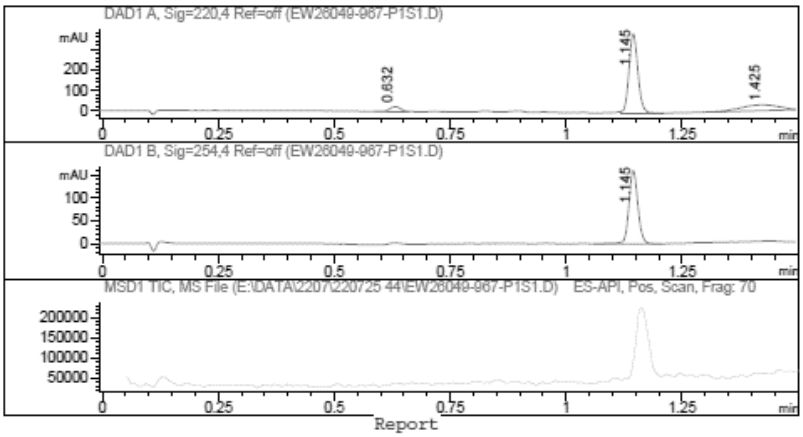
RetTime: 0.787 Datafile: D:\DATA\2022\2207\220712\EW35062-84-P1A.lcd



^{1}H NMR 4-Amino-7-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)- 3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidine-5-carbonitrile **(70)**

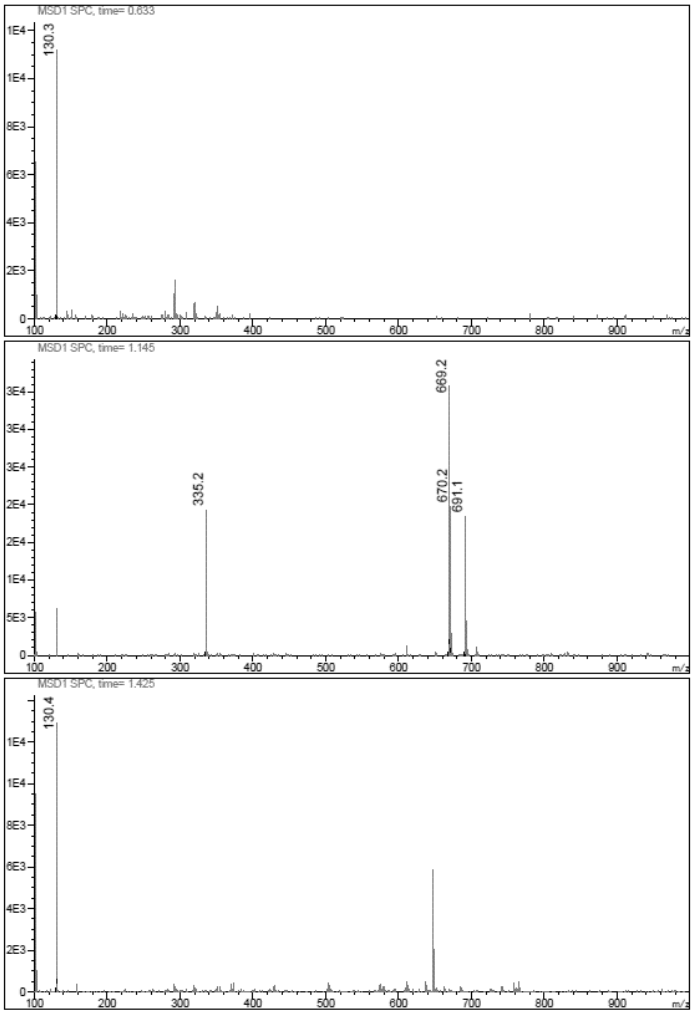


LCMS 4-Amino-7-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)- 3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidine-5-carbonitrile **(70)**

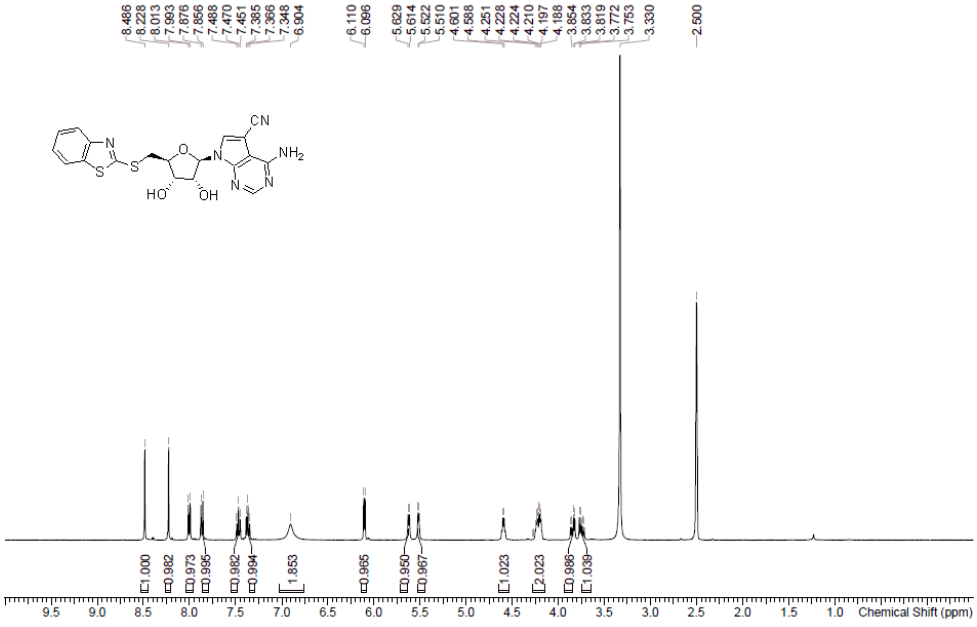


Report

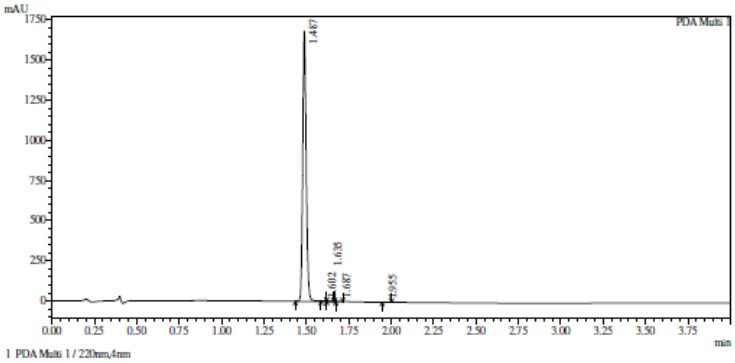
```
==================================================================
Signal 1 : DAD1 A, Sig=220,4 Ref=off
 #  Meas. Ret.   Height    Width       Area       Area %
------------------------------------------------------------
  1      0.632    23.478   0.028         40.938    5.684
  2      1.145   388.943   0.021        520.252   72.234
  3      1.425    28.175   0.068        159.042   22.082
------------------------------------------------------------
Signal 2 : DAD1 B, Sig=254,4 Ref=off
 #  Meas. Ret.   Height    Width       Area       Area %
------------------------------------------------------------
  1      1.145   160.041   0.021        216.532  100.000
------------------------------------------------------------
```



^{1}H NMR 4-Amino-7-[(2*R*,3*R*,4*S*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) -3,4-dihydroxy-tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidine-5-carbonitrile **(29)**



HPLC 4-Amino-7-[(2*R*,3*R*,4*S*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) -3,4-dihydroxy-tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidine-5-carbonitrile **(29)**

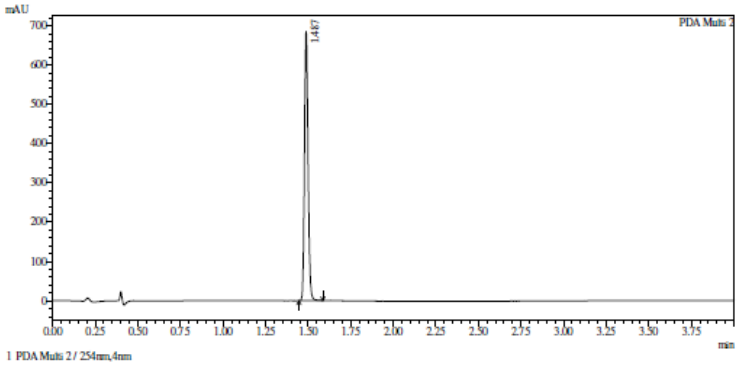


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.487	0.039	0.000	1684535	2406612	99.765
2	1.602	0.037	3.048	1499	1836	0.076
3	1.635	0.048	0.769	1227	1595	0.066
4	1.687	0.035	1.261	940	1093	0.045
5	1.955	0.051	6.204	612	1145	0.047
Total				1688813	2412282	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.487	0.040	0.000	685292	1006213	100.000
Total				685292	1006213	100.000

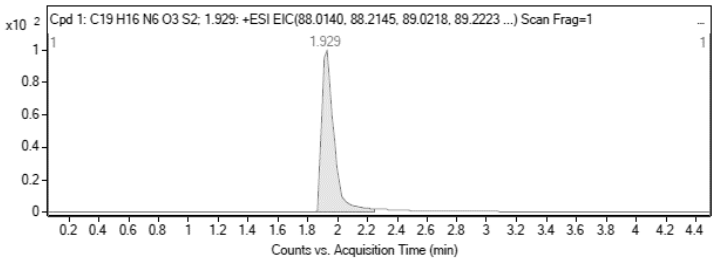
HRMC 4-Amino-7-[(2*R*,3*R*,4*S*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl) -3,4-dihydroxy-tetrahydrofuran-2-yl]pyrrolo[2,3-d]pyrimidine-5-carbonitrile **(29)**

Compound Table

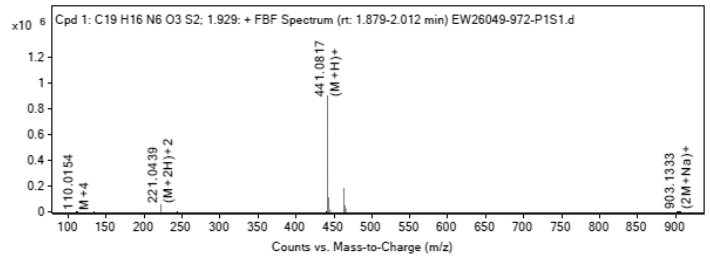
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C19 H16 N6 O3 S2; 1.929	97.19	3.08	C19 H16 N6 O3 S2	1.929	440.0725	440.0739

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
463.0625	1.929	440.0739	C19 H16 N6 O3 S2	440.0725	3.08	Find by Formula

Compound Chromatograms



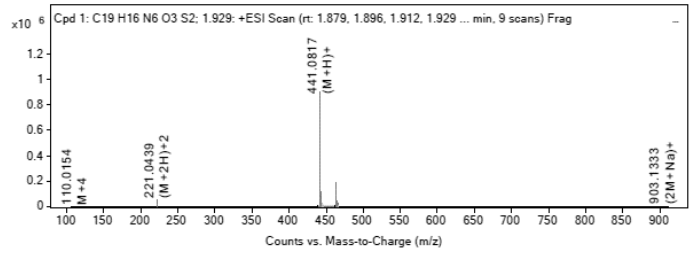
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
221.0439	2	48245.51	(M+2H)+2
221.5454	2	11702.35	(M+2H)+2
222.0334	2	6460.34	(M+2H)+2
440.0802	1	3350.33	M+
441.0817	1	904731.38	(M+H)+
442.0832	1	224744.67	(M+H)+
443.079	1	107433.2	(M+H)+
463.0625	1	183445.64	(M+Na)+
464.0646	1	43487.23	(M+Na)+
465.0608	1	21211.3	(M+Na)+

MS Zoomed Spectrum

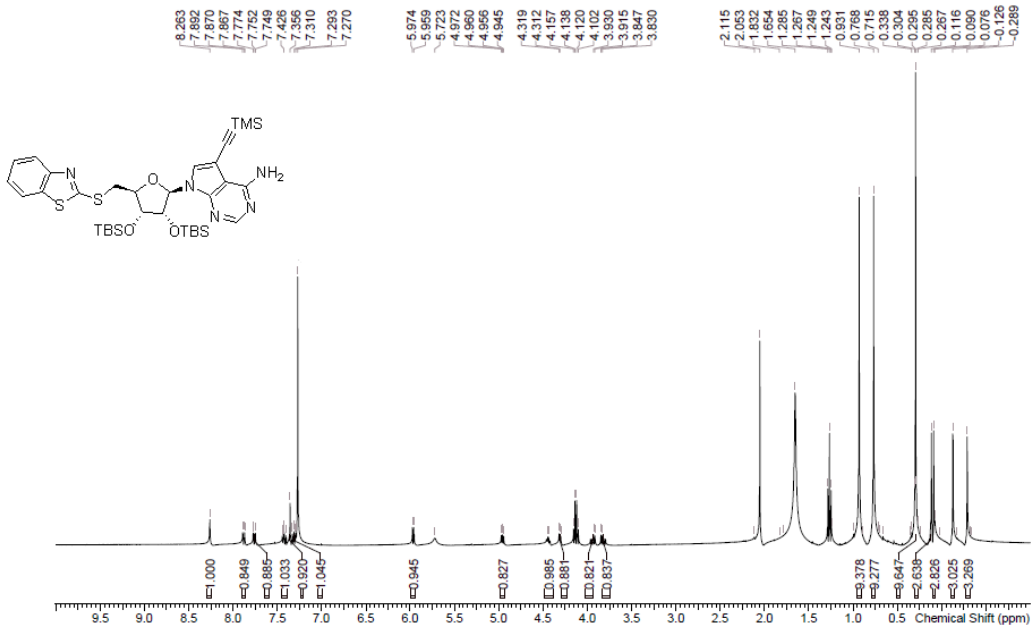


MS Spectrum Peak List

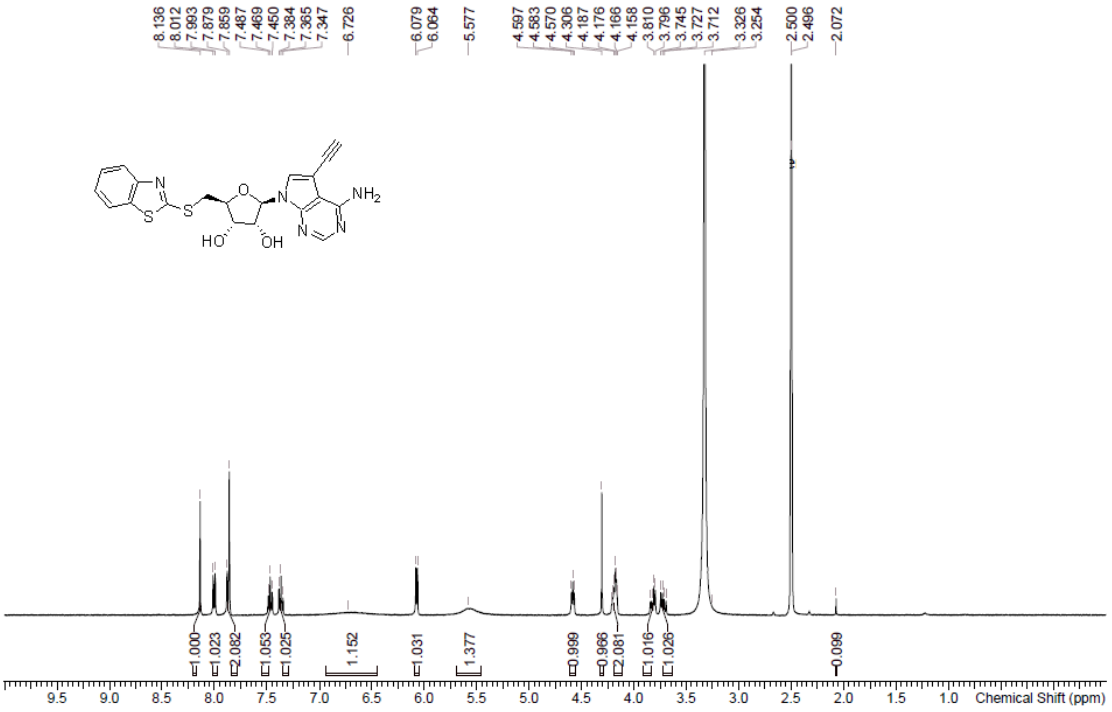
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
221.0439	2	48245.51	(M+2H)+2	-1.52
221.5454	2	11702.35	(M+2H)+2	-2.74
222.0334	2	6460.34	(M+2H)+2	-0.25
440.0802	1	3350.33	M+	-18.6
441.0817	1	904731.38	(M+H)+	-4.36
442.0832	1	224744.67	(M+H)+	-1.98
443.079	1	107433.2	(M+H)+	-1.81
463.0625	1	183445.64	(M+Na)+	-1.6
464.0646	1	43487.23	(M+Na)+	-0.6
465.0608	1	21211.3	(M+Na)+	-1.35

--- End Of Report ---

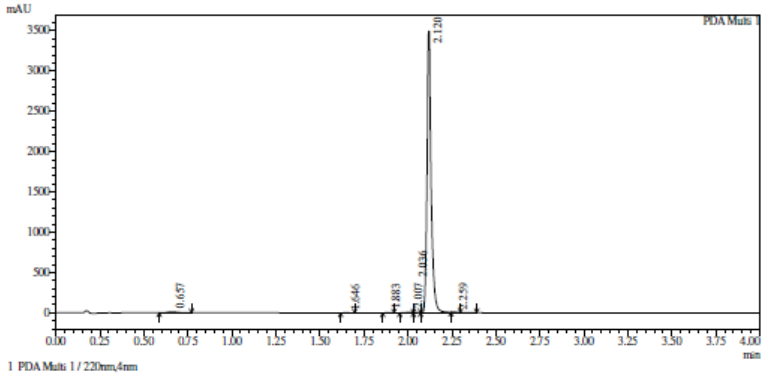
^{1}H NMR 7-[(2*R*,3*R*,4*R*,5*S*)-5-(1,3-benzothiazol-2-ylsulfanylmethyl)-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]-5-(2-trimethylsilylethynyl)pyrrolo[2,3-d]pyrimidin-4-amine **(71)**



^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(4-Amino-5-ethynyl-pyrrolo[2,3-d]pyrimidin-7-yl) -5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(30)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(4-Amino-5-ethynyl-pyrrolo[2,3-d]pyrimidin-7-yl) -5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(30)**

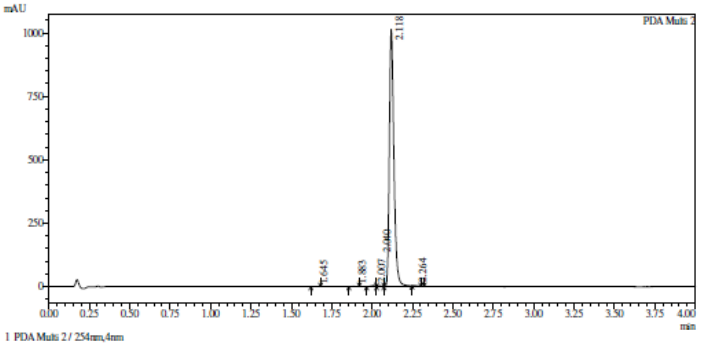


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	0.657	0.109	0.000	12357	51635	0.883
2	1.646	0.054	12.138	1711	3279	0.056
3	1.883	0.047	4.719	1622	2724	0.047
4	2.007	0.081	1.947	8785	19846	0.339
5	2.036	1.134	0.047	6184	11813	0.202
6	2.120	0.038	0.143	3494132	5758487	98.421
7	2.259	0.044	3.413	1880	3102	0.053
Total				3526670	5850885	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.645	0.049	0.000	643	1086	0.054
2	1.883	0.049	4.864	1097	1890	0.094
3	2.007	0.076	1.975	3675	7550	0.377
4	2.040	0.300	0.178	2657	5476	0.273
5	2.118	0.051	0.444	1013408	1985331	99.146
6	2.264	0.043	3.111	760	1091	0.054
Total				1022240	2002424	100.000

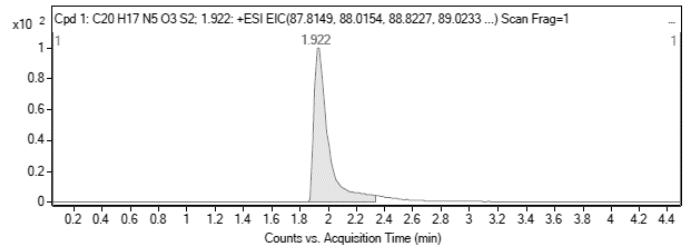
HRMS (2*R*,3*R*,4*S*,5*S*)-2-(4-Amino-5-ethynyl-pyrrolo[2,3-d]pyrimidin-7-yl) -5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(30)**

Compound Table

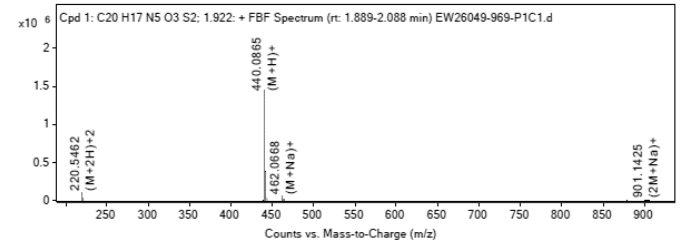
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C20 H17 N5 O3 S2; 1.922	97.93	3.61	C20 H17 N5 O3 S2	1.922	439.0773	439.0789

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
462.0668	1.922	439.0789	C20 H17 N5 O3 S2	439.0773	3.61	Find by Formula

Compound Chromatograms



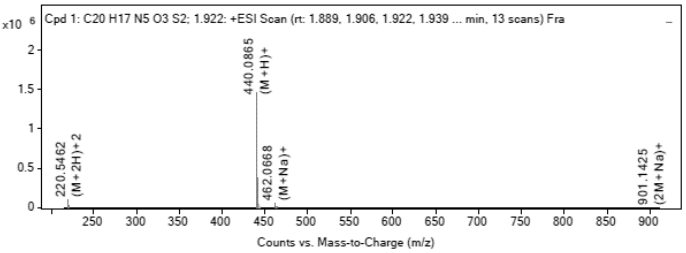
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
220.5462	2	96236.7	(M+2H)+2
221.0477	2	24290.77	(M+2H)+2
221.5456	2	12155.86	(M+2H)+2
440.0865	1	1453699.13	(M+H)+
441.0885	1	383837.03	(M+H)+
442.0842	1	180409.28	(M+H)+
462.0668	1	58040.09	(M+Na)+
463.0695	1	14781.84	(M+Na)+
464.0656	1	7045.21	(M+Na)+
901.1425	1	4713.46	(2M+Na)+

MS Zoomed Spectrum

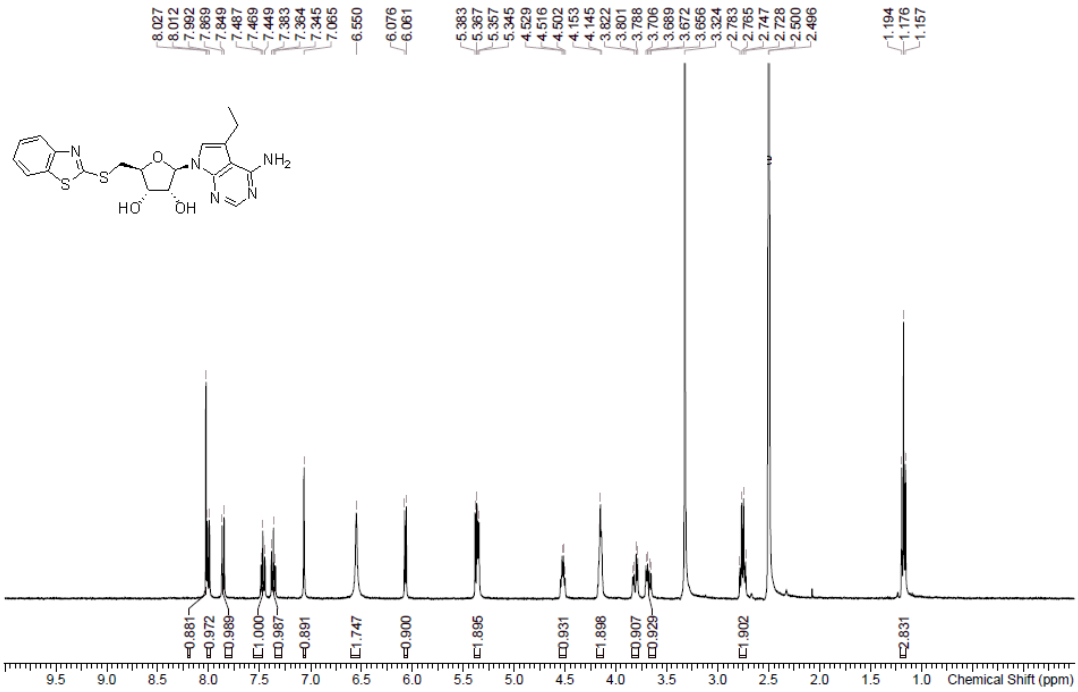


MS Spectrum Peak List

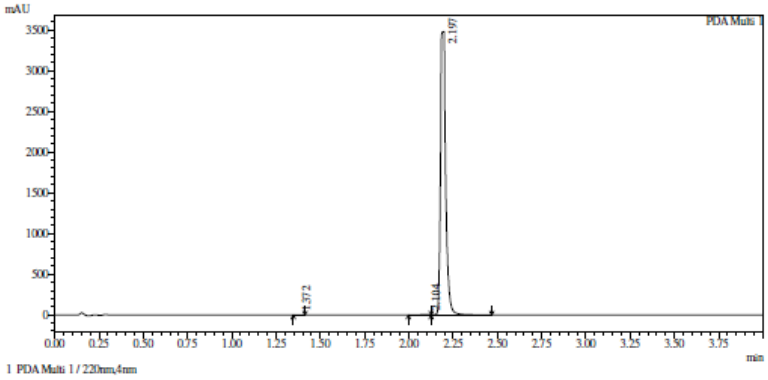
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
220.5462	2	96236.7	(M+2H)+2	-1.42
221.0477	2	24290.77	(M+2H)+2	-2.17
221.5456	2	12155.86	(M+2H)+2	-2.08
440.0865	1	1453699.13	(M+H)+	-4.47
441.0885	1	383837.03	(M+H)+	-2.83
442.0842	1	180409.28	(M+H)+	-2.43
462.0668	1	58040.09	(M+Na)+	-0.64
463.0695	1	14781.84	(M+Na)+	-0.59
464.0656	1	7045.21	(M+Na)+	-1.3
901.1425	1	4713.46	(2M+Na)+	1.38

--- End Of Report ---

^{1}H NMR (2*R*,3*R*,4*S*,5*S*)-2-(4-amino-5-ethyl-pyrrolo[2,3-d]pyrimidin-7-yl) -5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(31)**



HPLC (2*R*,3*R*,4*S*,5*S*)-2-(4-amino-5-ethyl-pyrrolo[2,3-d]pyrimidin-7-yl) -5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(31)**

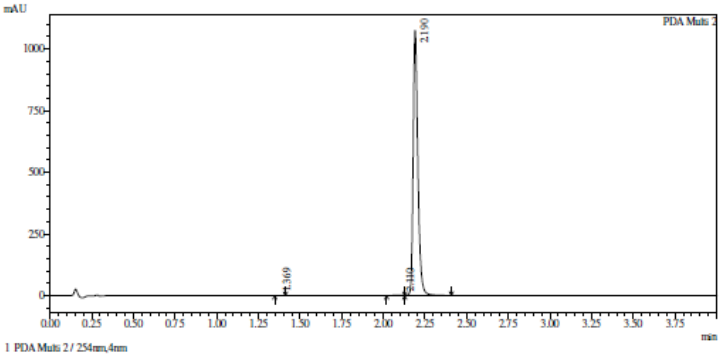


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.372	0.047	0.000	913	1624	0.022
2	2.104	0.179	6.491	4171	20937	0.288
3	2.197	0.043	0.837	3484429	7239225	99.689
Total				3489513	7261786	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.369	0.047	0.000	893	1521	0.072
2	2.110	0.165	6.997	1561	6537	0.308
3	2.190	0.051	0.746	1074831	2113036	99.620
Total				1077285	2121094	100.000

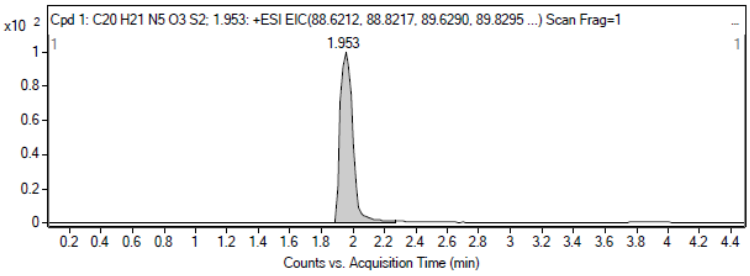
HRMC (2*R*,3*R*,4*S*,5*S*)-2-(4-amino-5-ethyl-pyrrolo[2,3-d]pyrimidin-7-yl) -5-(1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(31)**

Compound Table

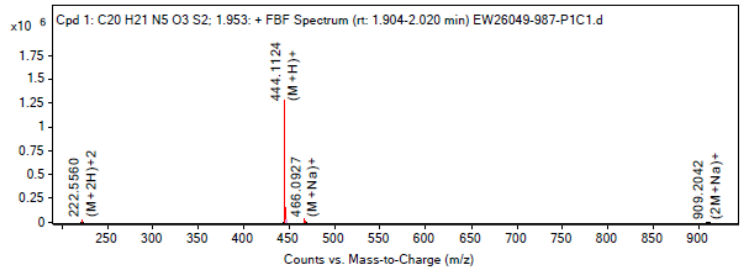
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C20 H21 N5 O3 S2: 1.953	73.38	-8.84	C20 H21 N5 O3 S2	1.953	443.1086	443.1047

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
444.1124	1.953	443.1047	C20 H21 N5 O3 S2	443.1086	-8.84	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

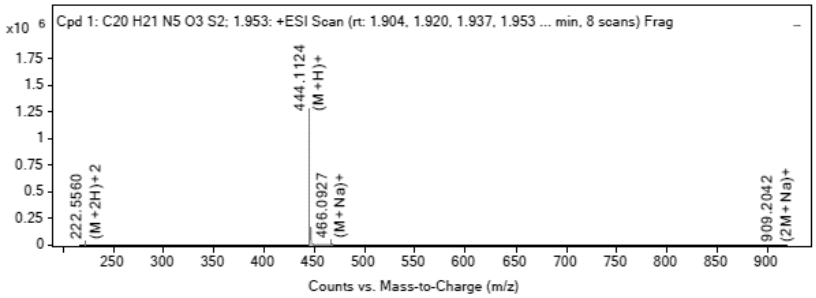


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
222.556	2	28967.12	[M+2H]+2
223.0572	2	7914.94	[M+2H]+2

223.5559	2	3442.76 (M+2H)+2
444.1124	1	1280260.75 (M+H)+
445.1142	1	335900.38 (M+H)+
446.11	1	157567.98 (M+H)+
466.0927	1	41844.73 (M+Na)+
467.0953	1	10632.84 (M+Na)+
468.0918	1	5172.52 (M+Na)+
909.2042	1	5150.29 (2M+Na)+

MS Zoomed Spectrum

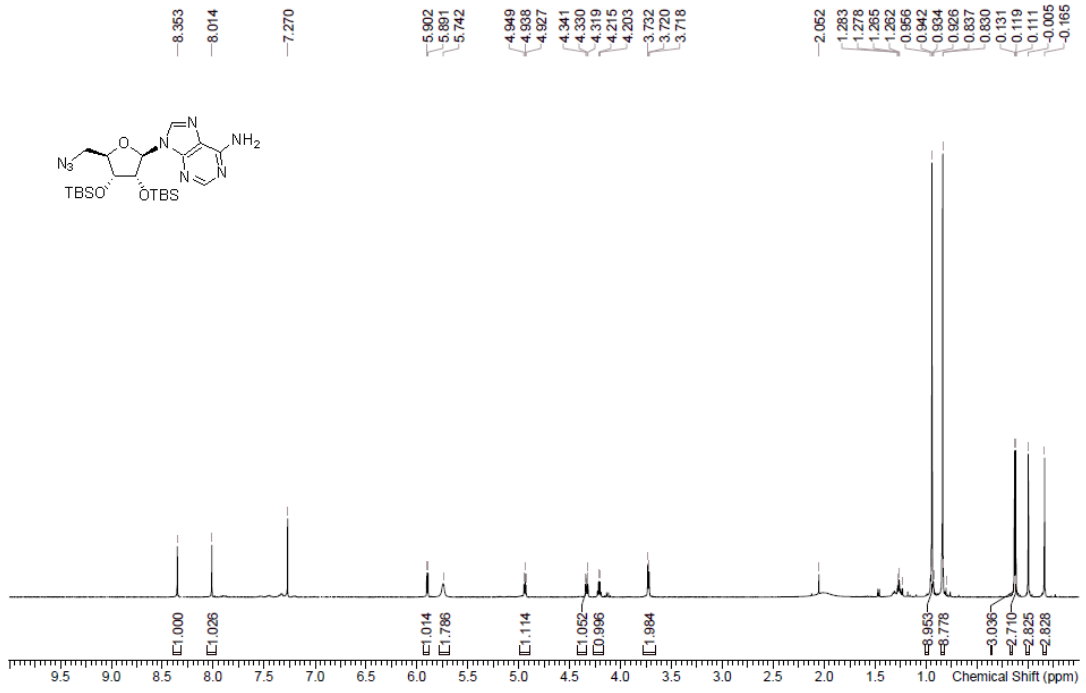


MS Spectrum Peak List

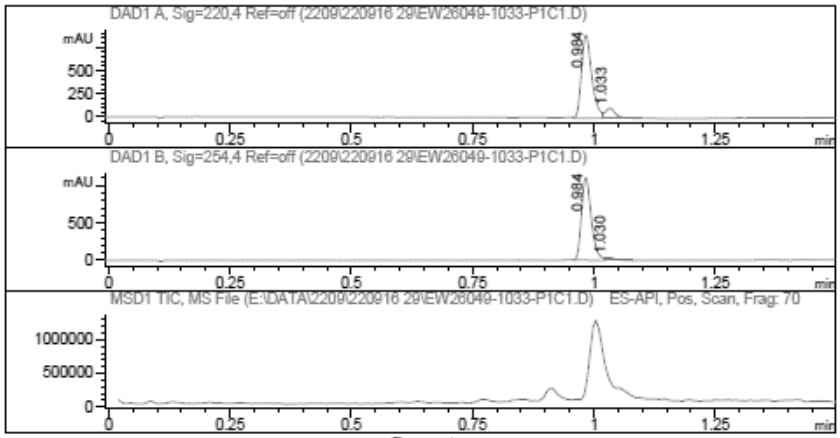
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
222.556	2	28967.12	(M+2H)+2	24.93
223.0572	2	7914.94	(M+2H)+2	25.82
223.5559	2	3442.76	(M+2H)+2	22
444.1124	1	1280260.75	(M+H)+	7.75
445.1142	1	335900.38	(M+H)+	9.7
446.11	1	157567.98	(M+H)+	9.91
466.0927	1	41844.73	(M+Na)+	10.85
467.0953	1	10632.84	(M+Na)+	11.12
468.0918	1	5172.52	(M+Na)+	9.69
909.2042	1	5150.29	(2M+Na)+	2.44

--- End Of Report ---

^{1}H NMR 9-[(2*R*,3*R*,4*R*,5*R*)-5-(azidomethyl)-3,4-bis[[tert-butyl(dimethyl)silyl] oxy]tetrahydrofuran-2-yl]purin-6-amine **(107)**



LCMS 9-[(2*R*,3*R*,4*R*,5*R*)-5-(azidomethyl)-3,4-bis[[tert-butyl(dimethyl)silyl] oxy]tetrahydrofuran-2-yl]purin-6-amine **(107)**



Report

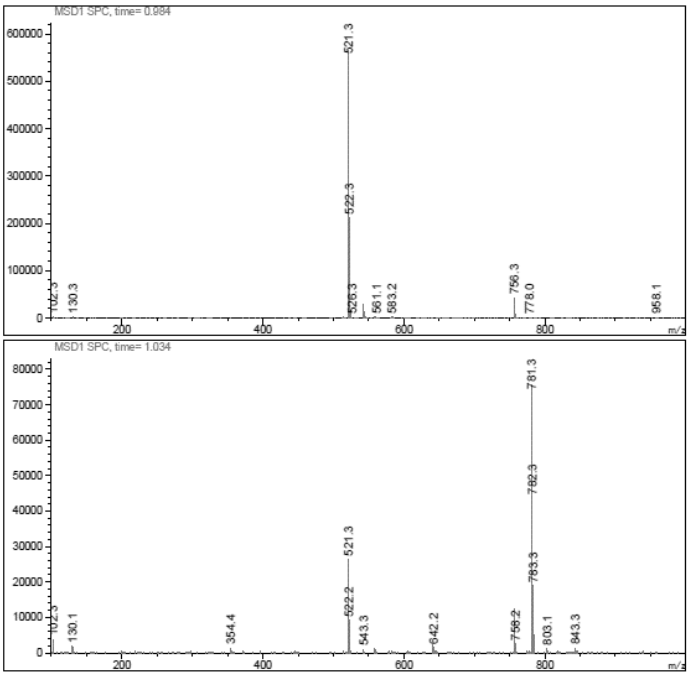
==========

Signal 1 : DAD1 A, Sig=220,4 Ref=off

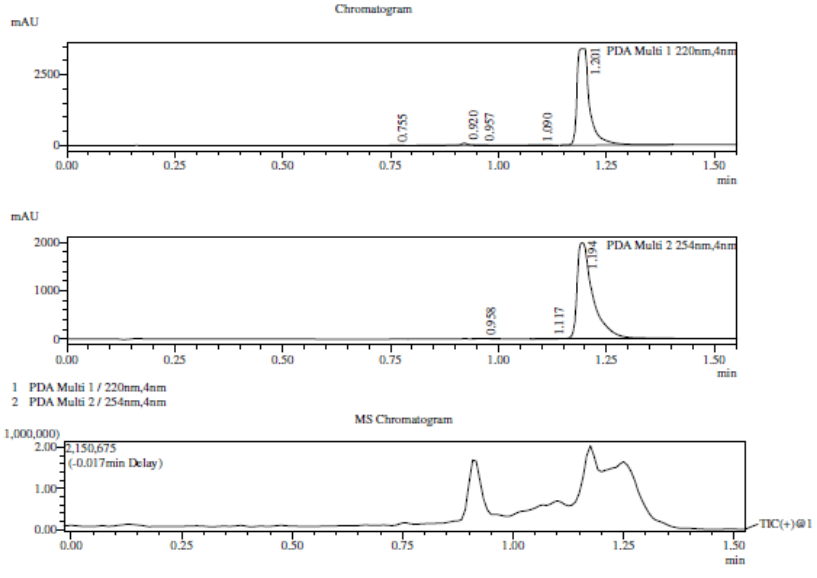
#	Meas. Ret.	Height	Width	Area	Area %
1	0.984	897.489	0.022	1325.514	89.852
2	1.033	107.453	0.021	149.712	10.148

Signal 2 : DAD1 B, Sig=254,4 Ref=off

#	Meas. Ret.	Height	Width	Area	Area %
1	0.984	1102.536	0.021	1545.263	97.180
2	1.030	35.657	0.019	44.847	2.820



LCMS 9-[(2*R*,3*R*,4*R*,5*R)*-5-(Aminomethyl)-3,4-bis[[tert-butyl(dimethyl)silyl] oxy]tetrahydrofuran-2-yl]purin-6-amine **(108)**



Integration Result

Peak Table

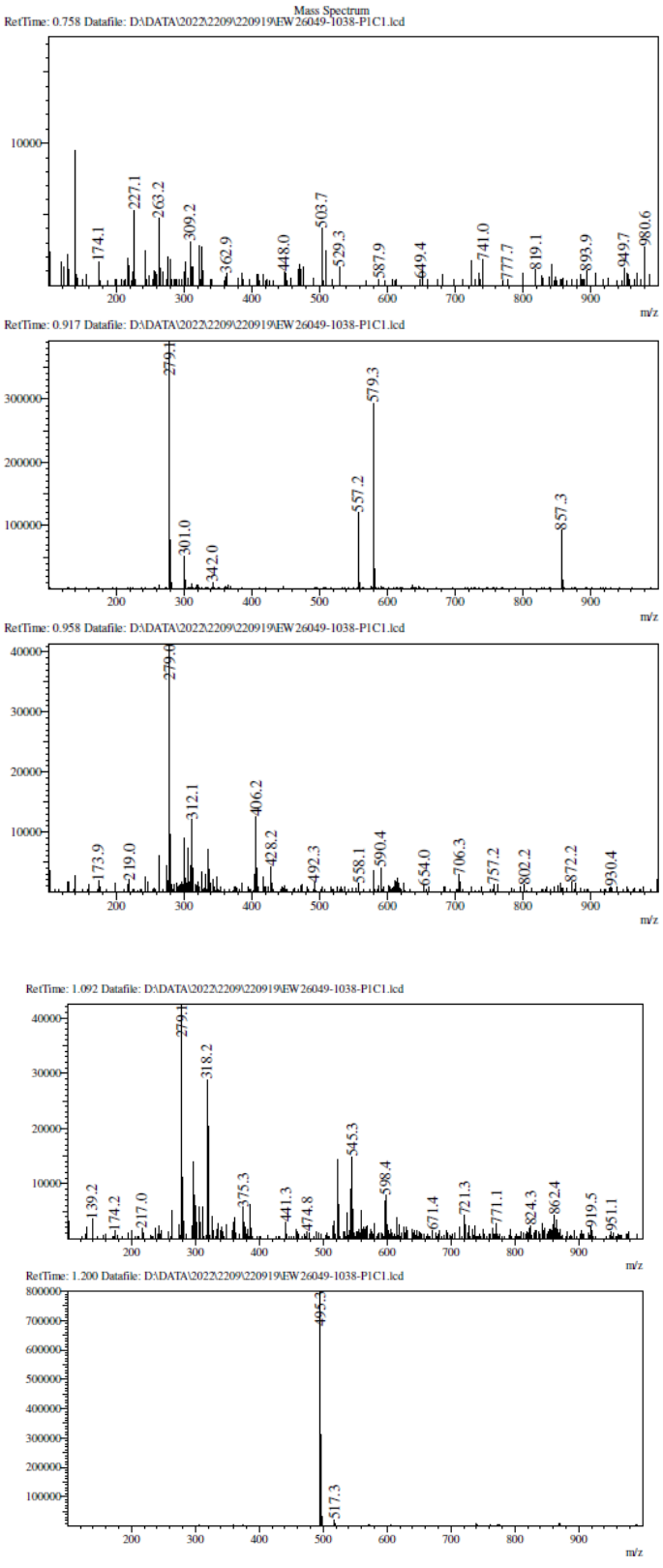
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.755	7103	0.203	0.038	12201	0.173
2	0.920	73487	2.103	0.028	78367	1.113
3	0.957	10037	0.287	0.076	17928	0.255
4	1.090	5979	0.171	0.057	11961	0.170
5	1.201	3397060	97.235	0.040	6918098	98.289

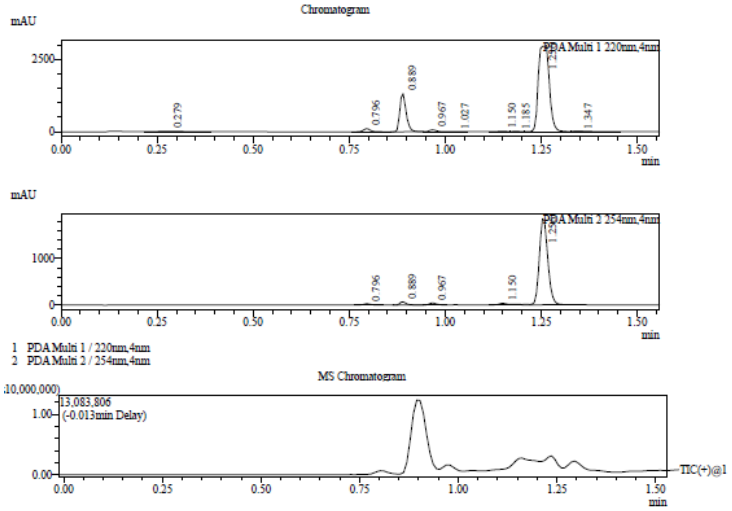
Peak Table

PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.958	4517	0.226	0.050	7996	0.156
2	1.117	4908	0.246	0.042	8461	0.166
3	1.194	1986579	99.528	0.054	5095933	99.678


Mass Spectrum
RetTime: 0.758 Datafile: D\DATA\2022\2209\220919\EW26049-1038-P1C1.lcd
174.1
227.1
263.2
309.2
362.9
448.0
503.7
529.3
587.9
649.4
741.0
777.7
819.1
893.9
949.7
980.6
m/z
RetTime: 0.917 Datafile: D\DATA\2022\2209\220919\EW26049-1038-P1C1.lcd
279.1
301.0
342.0
557.2
579.3
857.3
m/z
RetTime: 0.958 Datafile: D\DATA\2022\2209\220919\EW26049-1038-P1C1.lcd
279.0
173.9
219.0
312.1
406.2
428.2
492.3
558.1
590.4
654.0
706.3
757.2
802.2
872.2
930.4
m/z
RetTime: 1.092 Datafile: D\DATA\2022\2209\220919\EW26049-1038-P1C1.lcd
279.1
318.2
139.2
174.2
217.0
375.3
441.3
474.8
545.3
598.4
671.4
721.3
771.1
824.3
862.4
919.5
951.1
m/z
RetTime: 1.200 Datafile: D\DATA\2022\2209\220919\EW26049-1038-P1C1.lcd
495.3
517.3
m/z

LCMS *N*-[[(2*R*,3*R*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-bis[[tert-butyl (dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methyl]naphthalene-2-sulfonamide **(109)**



Integration Result

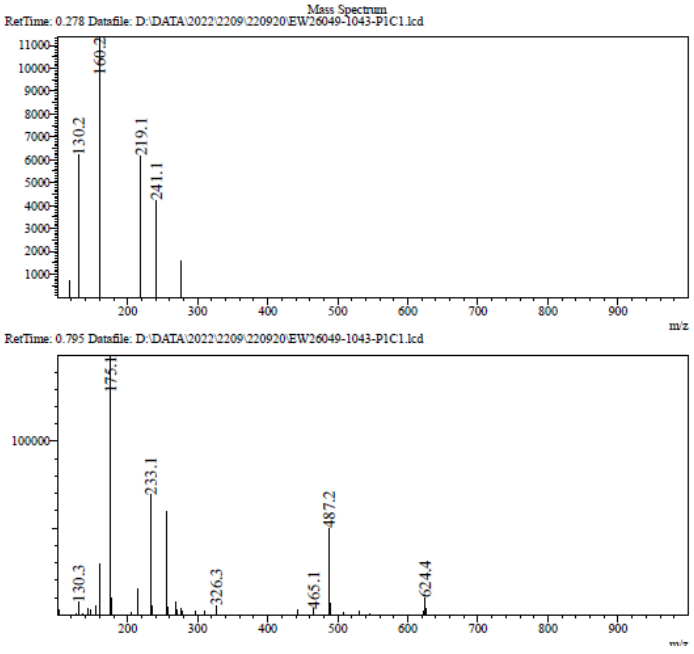
Peak Table

PDA Ch1 220nm

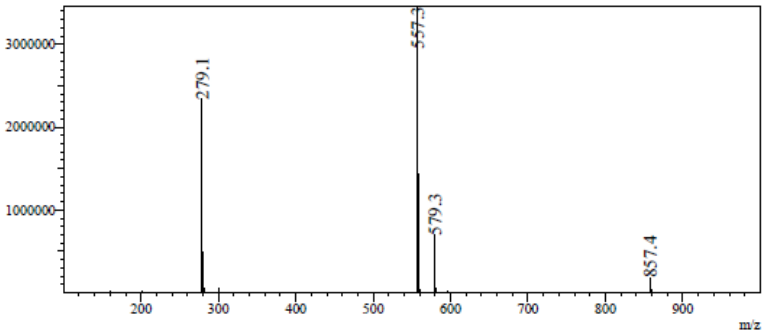
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.279	17989	0.398	0.118	74948	0.956
2	0.796	108998	2.409	0.037	134718	1.718
3	0.889	1327751	29.348	0.034	1531207	19.529
4	0.967	63866	1.412	0.040	83593	1.066
5	1.027	5921	0.131	0.043	8531	0.109
6	1.150	15481	0.342	0.045	22584	0.288
7	1.185	11042	0.244	0.060	17132	0.218
8	1.256	2967055	65.582	0.055	5960097	76.013
9	1.347	6096	0.135	0.042	8056	0.103

Peak Table

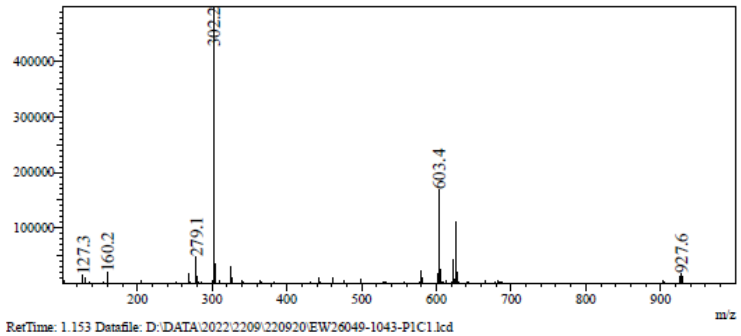
PDA Ch2 254nm



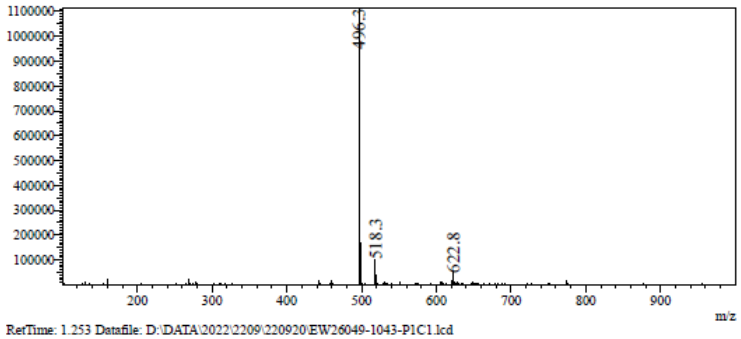
RetTime: 0.887 Datafile: D:\DATA\2022\2209\220920\EW26049-1043-P1C1.lcd



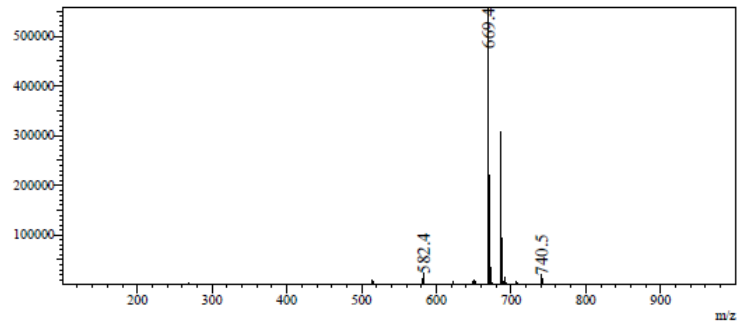
RetTime: 0.970 Datafile: D:\DATA\2022\2209\220920\EW26049-1043-P1C1.lcd



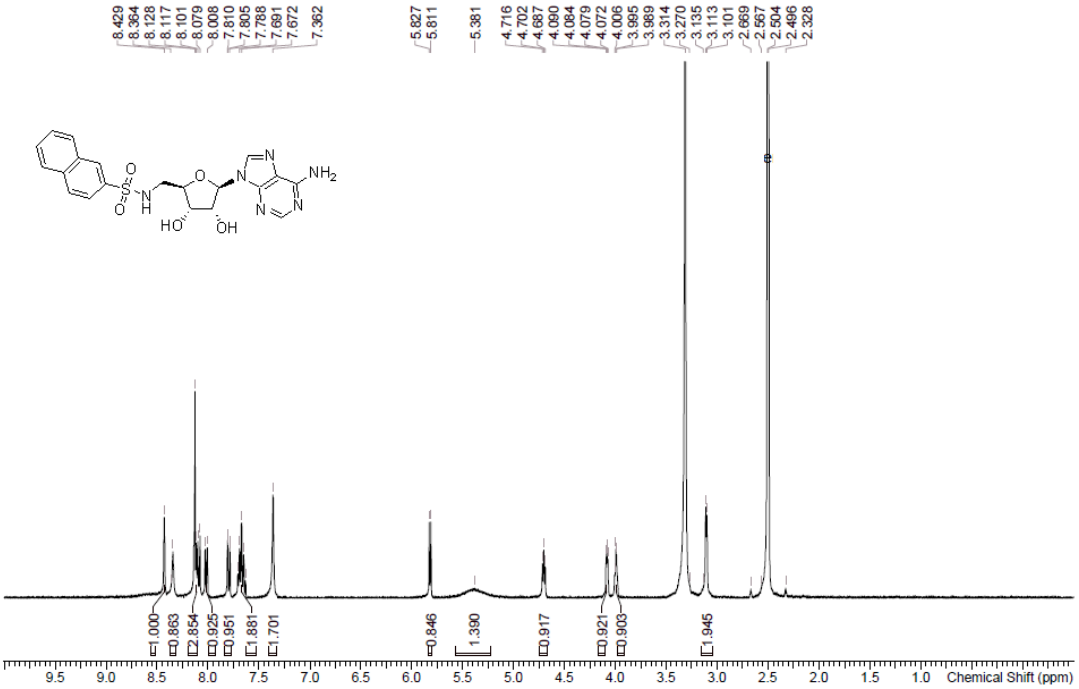
RetTime: 1.153 Datafile: D:\DATA\2022\2209\220920\EW26049-1043-P1C1.lcd



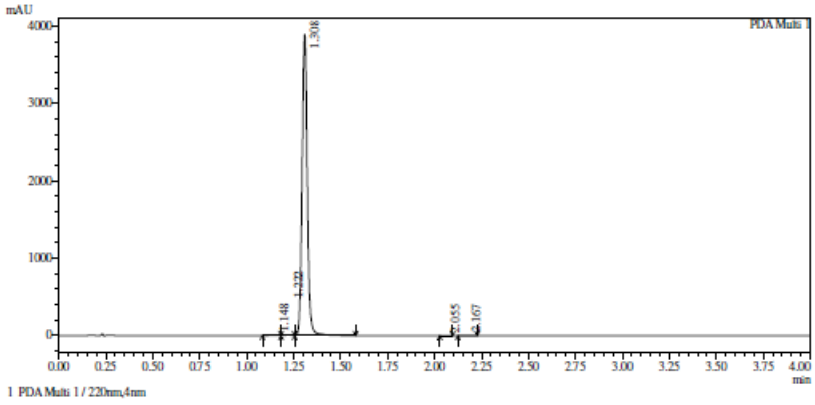
RetTime: 1.253 Datafile: D:\DATA\2022\2209\220920\EW26049-1043-P1C1.lcd



^{1}H NMR *N*-[[(2*R*,3*S*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-dihydroxy-tetrahyd rofuran-2-yl]methyl]naphthalene-2-sulfonamide **(32)**



HPLC *N*-[[(2*R*,3*S*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-dihydroxy-tetrahyd rofuran-2-yl]methyl]naphthalene-2-sulfonamide **(32)**

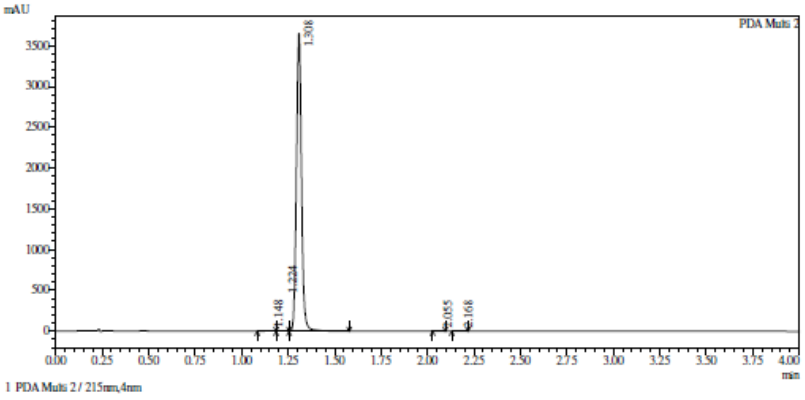


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.148	0.096	0.000	6594	20683	0.274
2	1.222	0.086	0.814	7984	24836	0.329
3	1.308	0.050	1.275	3898289	7490537	99.306
4	2.055	0.043	16.227	1620	2545	0.034
5	2.167	0.076	1.900	1548	4263	0.057
Total				3916035	7542863	100.000



Integration result

PeakTable

PDA Ch2 215nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.148	0.098	0.000	6377	20772	0.296
2	1.224	0.086	0.821	7892	23905	0.341
3	1.308	0.050	1.238	3655501	6968253	99.282
4	2.055	0.042	16.225	1662	2619	0.037
5	2.168	0.069	2.029	1232	3115	0.044
Total				3672664	7018664	100.000

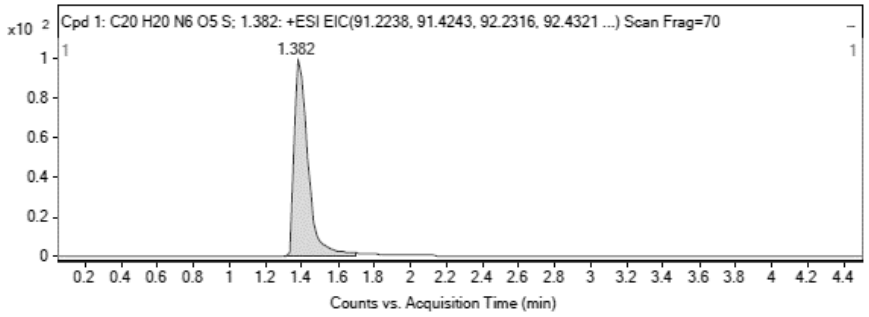
HRMC *N*-[[(2*R*,3*S*,4*R*,5*R*)-5-(6-Aminopurin-9-yl)-3,4-dihydroxy-tetrahyd rofuran-2-yl]methyl]naphthalene-2-sulfonamide **(32)**

Compound Table

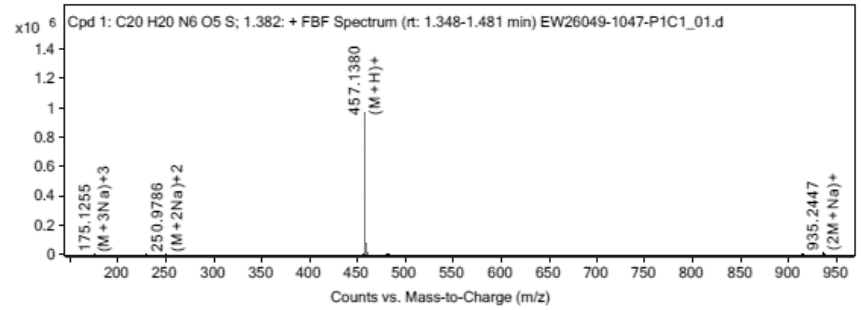
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C20 H20 N6 O5 S; 1.382	55.63	19.37	C20 H20 N6 O5 S	1.382	456.1216	456.1304

Obs. m/z	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
479.1183	1.382	456.1304	C20 H20 N6 O5 S	456.1216	19.37	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

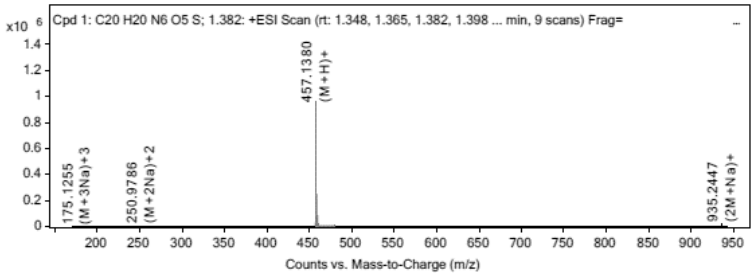


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
457.138	1	963884.31	(M+H)+

458.1397	1	246694.72	(M+H)+
459.1368	1	78569.22	(M+H)+
460.138	1	14403.13	(M+H)+
479.1183	1	8718.25	(M+Na)+
480.1208	1	2249.66	(M+Na)+
935.2447	1	14602.82	(2M+Na)+
936.248	1	7317.42	(2M+Na)+
937.2406	1	4128.79	(2M+Na)+
938.2402	1	1599.48	(2M+Na)+

MS Zoomed Spectrum

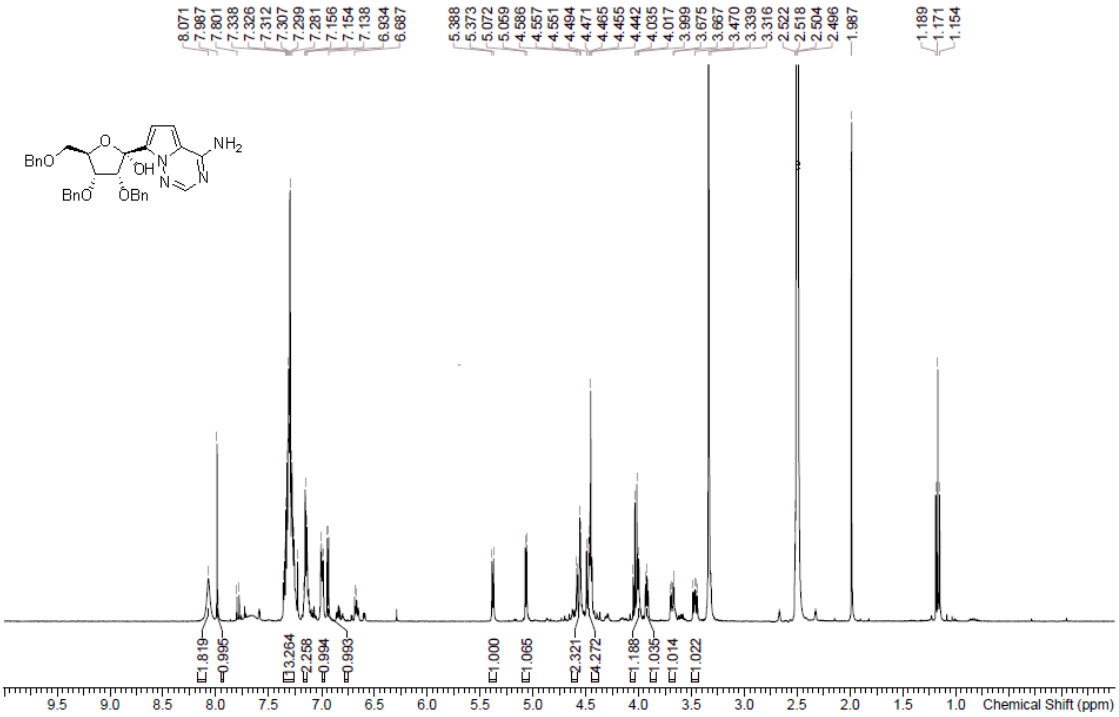


MS Spectrum Peak List

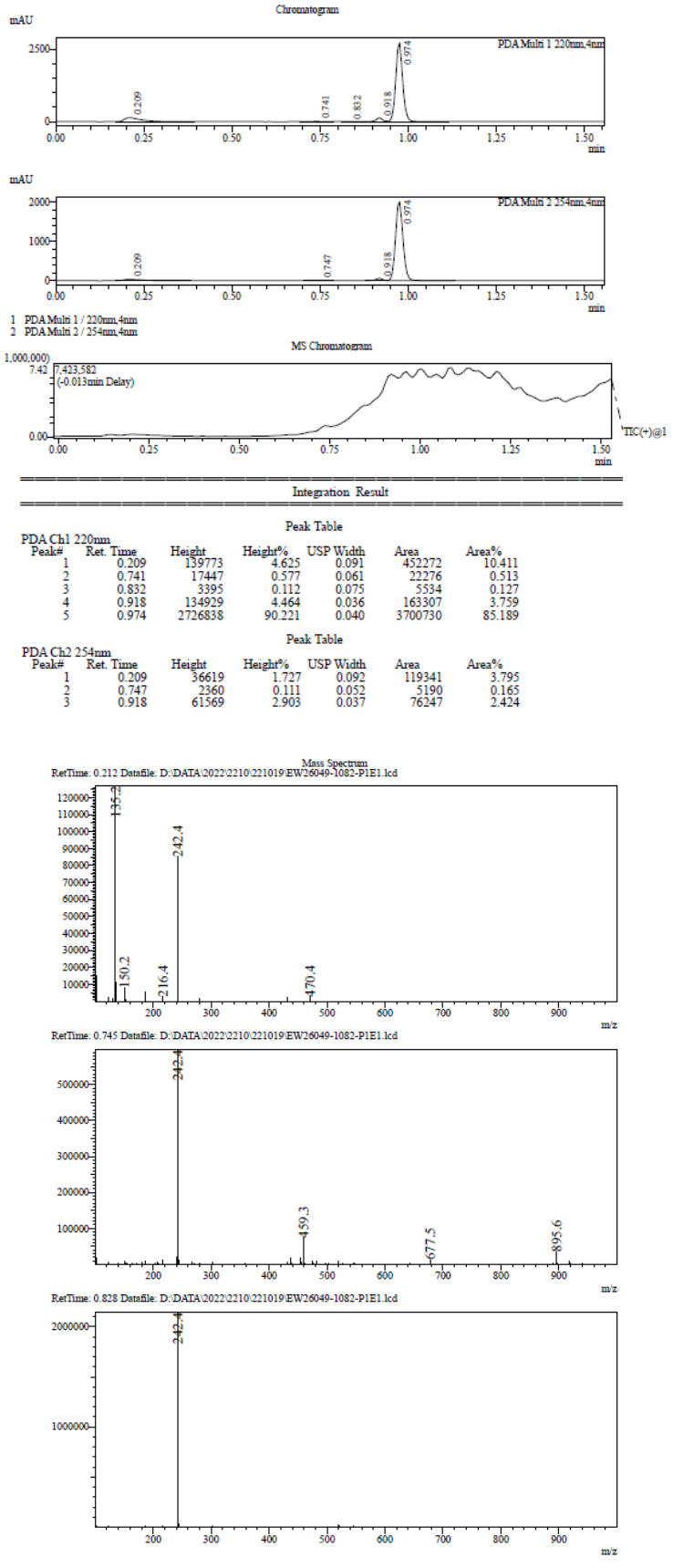
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
457.138	1	963884.31	(M+H)+	-20.01
458.1397	1	246694.72	(M+H)+	-17.84
459.1368	1	78569.22	(M+H)+	-16.9
460.138	1	14403.13	(M+H)+	-16.93
479.1183	1	8718.25	(M+Na)+	-15.66
480.1208	1	2249.66	(M+Na)+	-15.12
935.2447	1	14602.82	(2M+Na)+	-13.16
936.248	1	7317.42	(2M+Na)+	-13.75
937.2406	1	4128.79	(2M+Na)+	-7.09
938.2402	1	1599.48	(2M+Na)+	-5.91

— End Of Report —

^{1}H NMR (2*S*,3*R*,4*R*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4- dibenzyloxy-5-(benzyloxymethyl)tetrahydrofuran-2-ol **(111)**



LCMS (2*S*,3*R*,4*R*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4- dibenzyloxy-5-(benzyloxymethyl)tetrahydrofuran-2-ol **(111)**



Integration Result

Peak Table

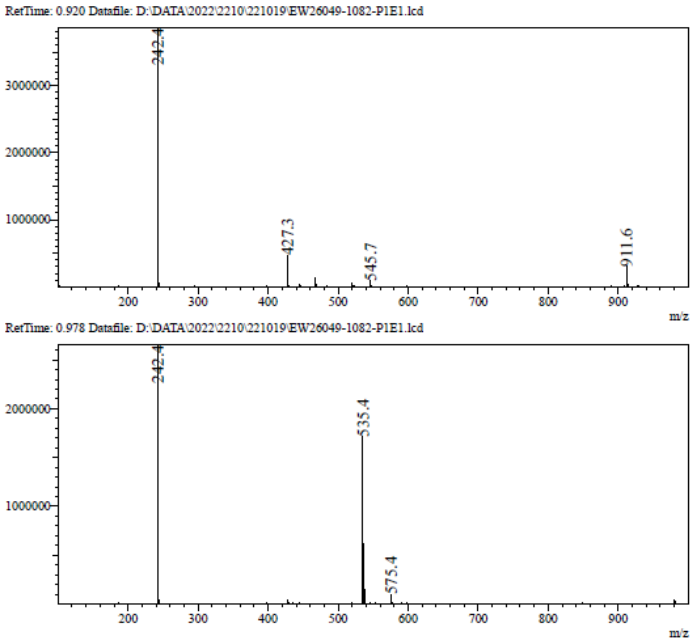
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.209	139773	4.625	0.091	452272	10.411
2	0.741	17447	0.577	0.061	22276	0.513
3	0.832	3395	0.112	0.075	5534	0.127
4	0.918	134929	4.464	0.036	163307	3.759
5	0.974	2726838	90.221	0.040	3700730	85.189

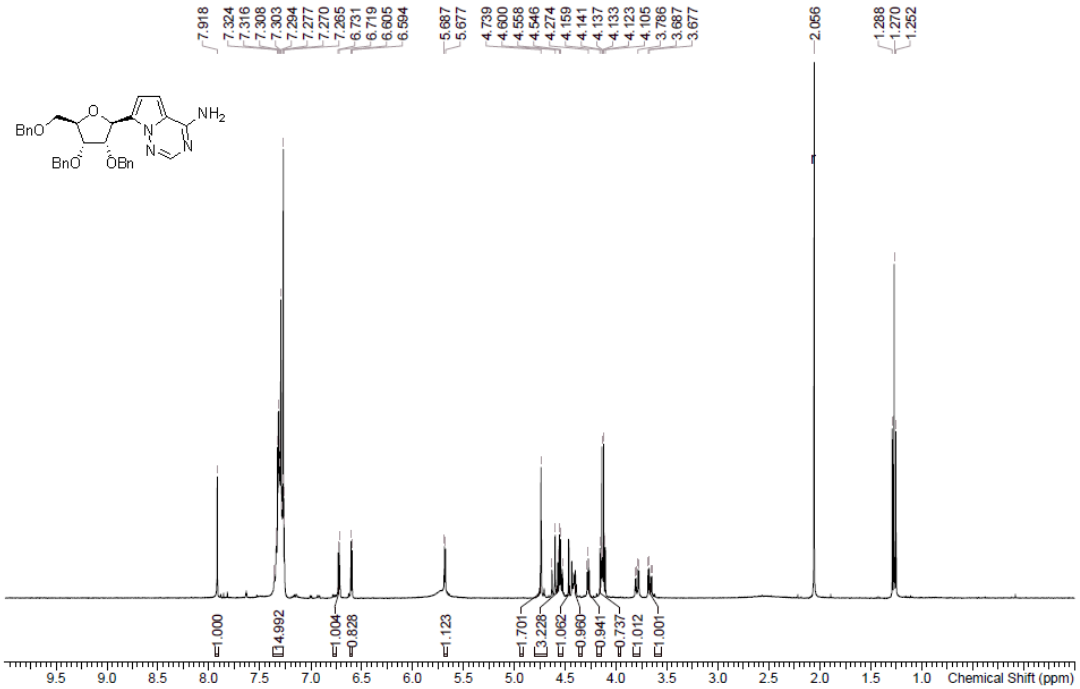
Peak Table

PDA Ch2 254nm

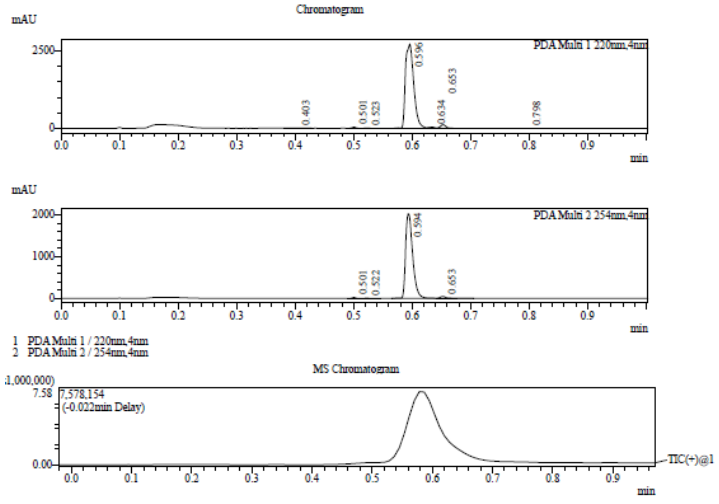
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.209	36619	1.727	0.092	119341	3.795
2	0.747	2360	0.111	0.052	5190	0.165
3	0.918	61569	2.903	0.037	76247	2.424



^{1}H NMR 7-[(2*S*,3*S*,4*R*,5*R*)-3,4-Dibenzyloxy-5-(benzyloxymethyl) tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(112)**



LCMS 7-[(2*S*,3*S*,4*R*,5*R*)-3,4-Dibenzyloxy-5-(benzyloxymethyl) tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(112)**



Integration Result

Peak Table

PDA Ch1 220nm

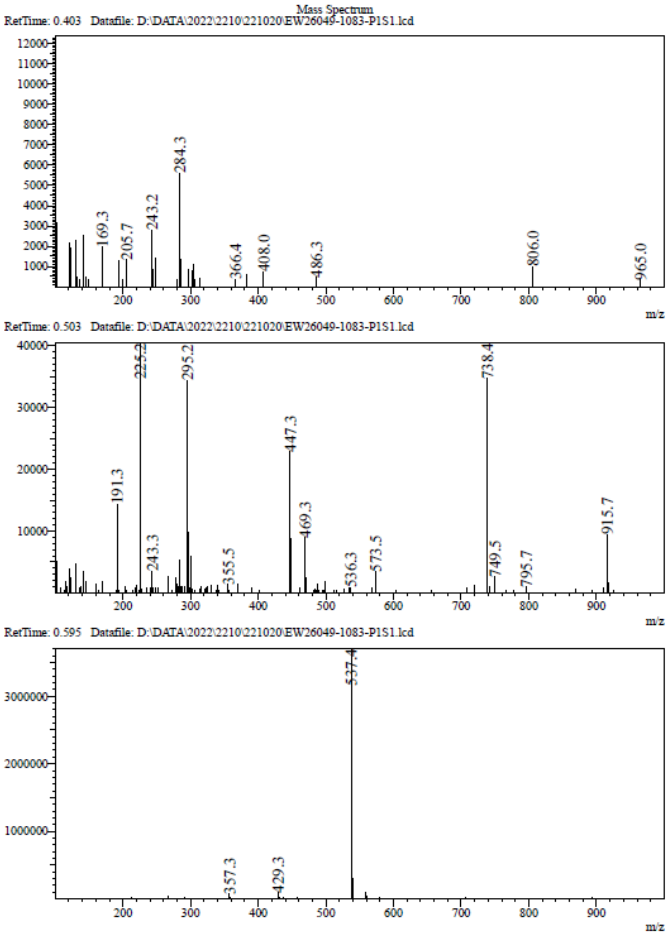
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.403	8122	0.276	0.050	13581	0.476
2	0.501	39688	1.350	0.015	19264	0.676
3	0.523	10082	0.343	0.019	6804	0.239
4	0.596	2736880	93.090	0.026	2715869	95.258
5	0.634	29710	1.011	0.014	13844	0.486
6	0.653	113312	3.854	0.019	72626	2.547
7	0.798	2255	0.077	0.075	9091	0.319

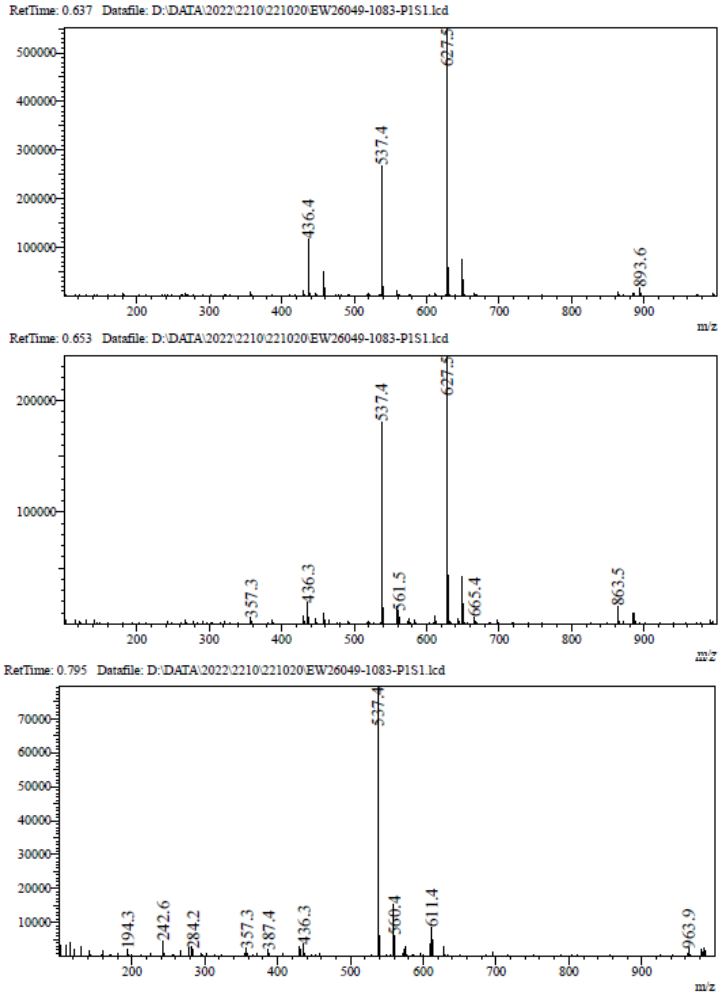
Peak Table

PDA Ch2 254nm

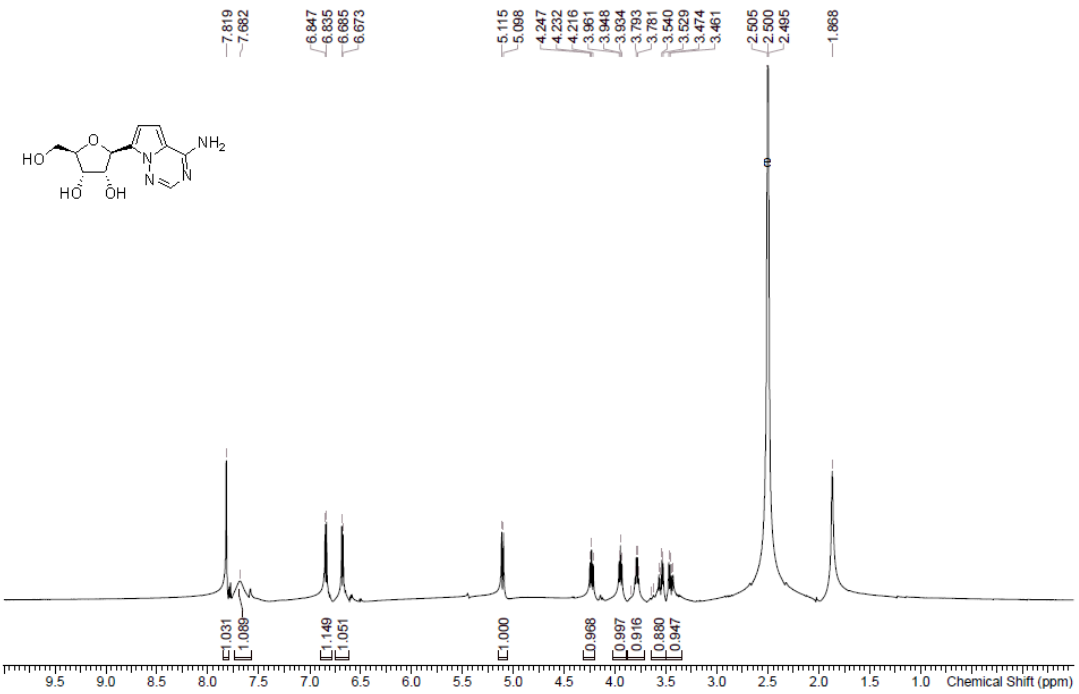
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.501	22975	1.092	0.015	11201	0.633
2	0.522	7731	0.367	0.020	5097	0.288
3	0.594	2028739	96.382	0.024	1721343	97.335

Mass Spectrum

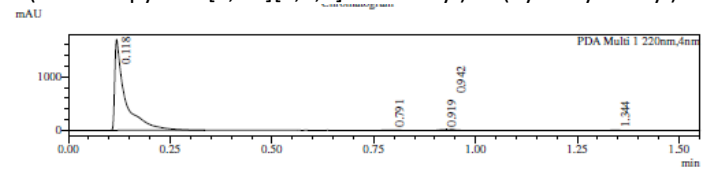


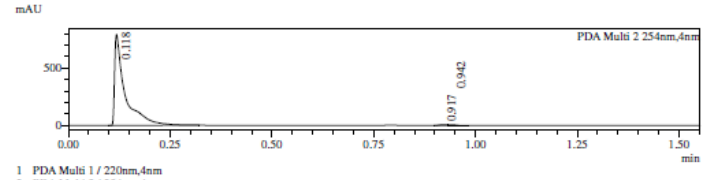


^{1}H NMR (2*S*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl) -5-(hydroxymethyl)tetrahydrofuran-3,4-diol **(113)**

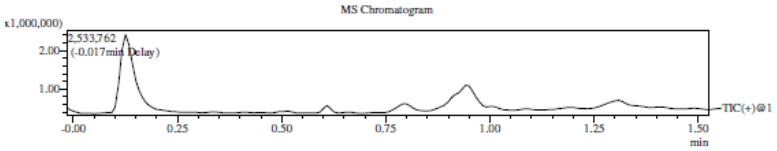


LCMS (2*S*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl) -5-(hydroxymethyl)tetrahydrofuran-3,4-diol **(113)**





1 PDA Multi 1 / 220nm,4nm
2 PDA Multi 2 / 254nm,4nm



Integration Result

Peak Table

PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.118	1700627	97.863	0.036	3080256	98.324
2	0.791	6785	0.390	0.047	11769	0.376
3	0.919	11797	0.679	0.060	14638	0.467
4	0.942	15165	0.873	0.046	20187	0.644
5	1.344	3386	0.195	0.051	5921	0.189

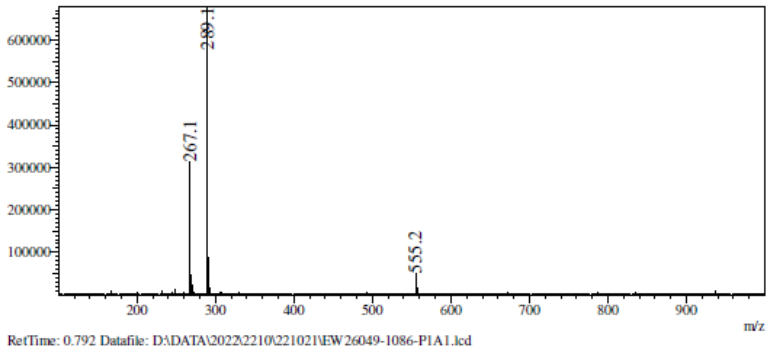
Peak Table

PDA Ch2 254nm

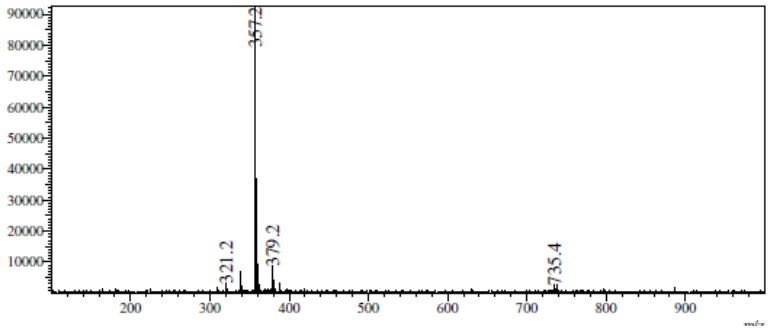
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.118	792180	98.230	0.036	1414925	98.783
2	0.917	6361	0.789	0.060	7453	0.520
3	0.942	7917	0.982	0.042	9979	0.697

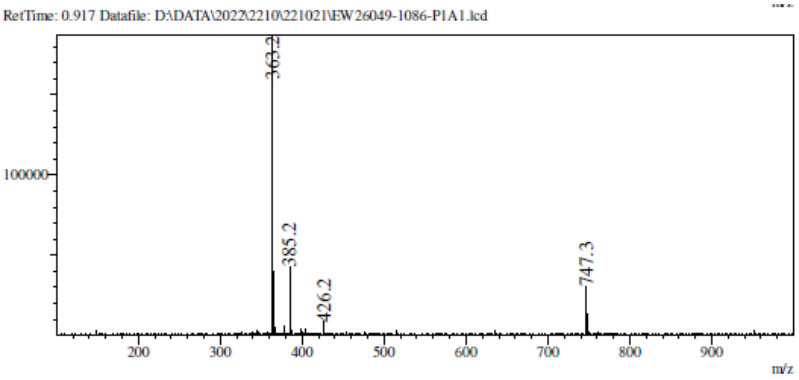
Mass Spectrum

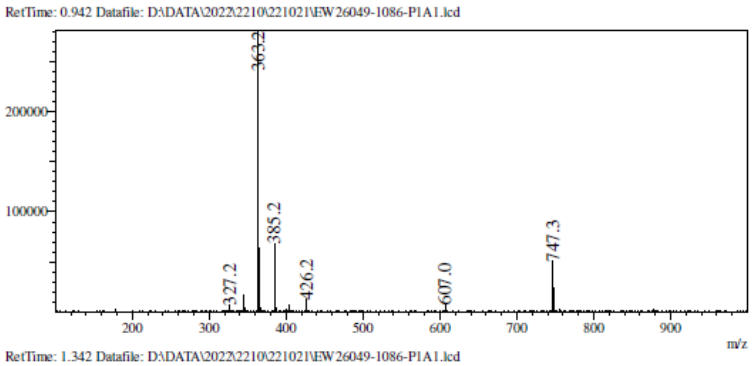
RetTime: 0.117 Datafile: D:\DATA\2022\2210\221021\EW26049-1086-P1A1.lcd

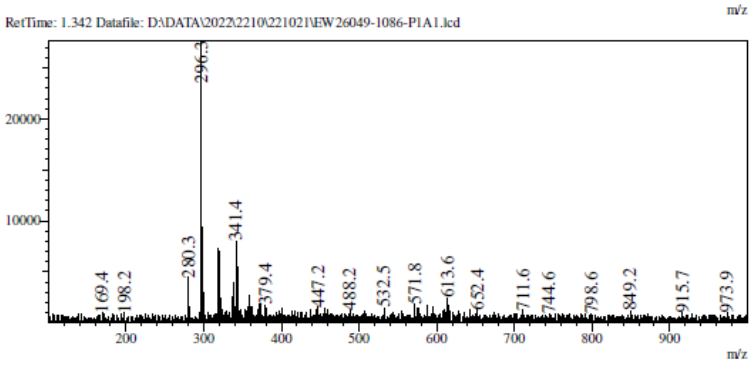


RetTime: 0.792 Datafile: D:\DATA\2022\2210\221021\EW26049-1086-P1A1.lcd

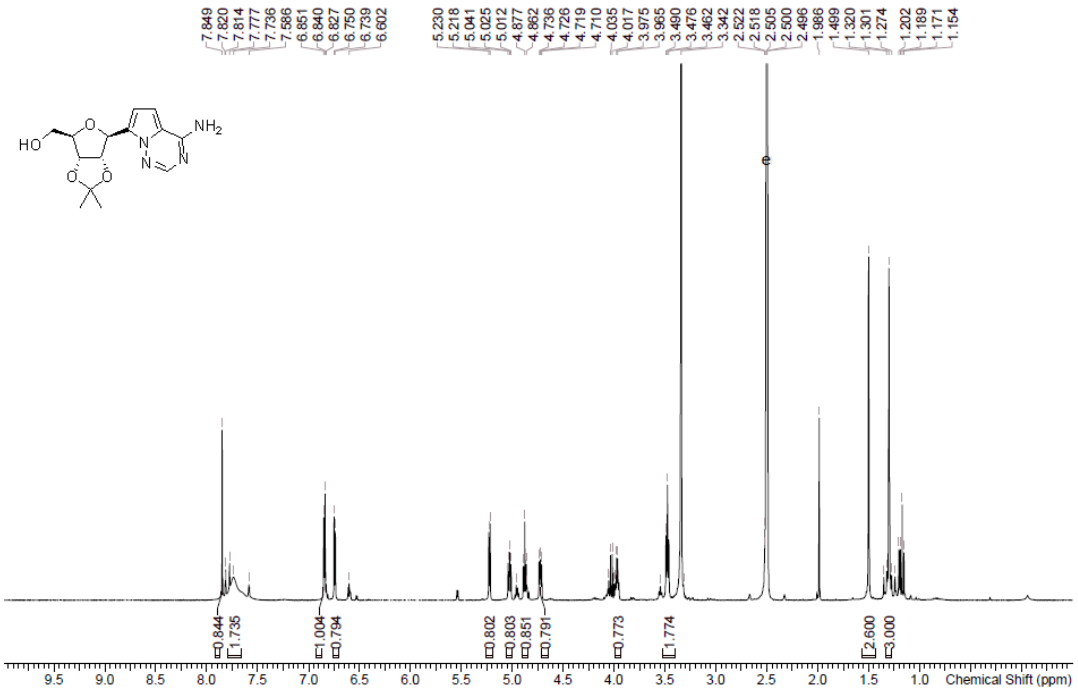



RetTime: 0.917 Datafile: D:\DATA\2022\2210\221021\EW26049-1086-P1A1.lcd
363.2
385.2
426.2
747.3
100000
200
300
400
500
600
700
800
900
m/z

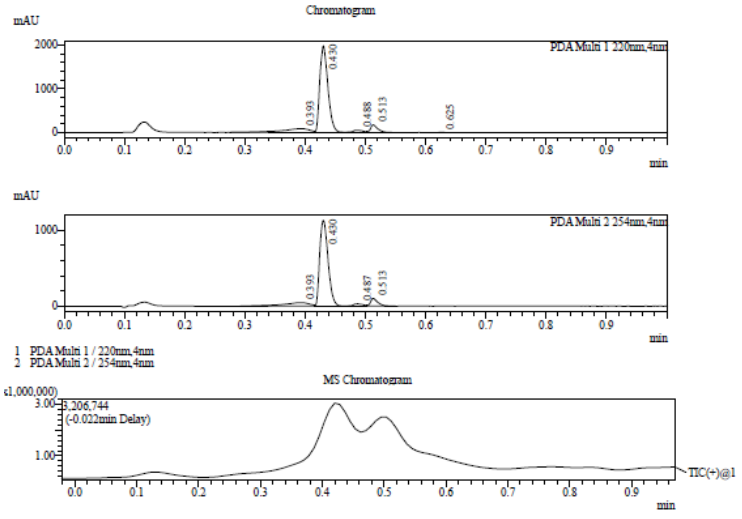

RetTime: 0.942 Datafile: D:\DATA\2022\2210\221021\EW26049-1086-P1A1.lcd
363.2
385.2
327.2
426.2
607.0
747.3
200000
100000
200
300
400
500
600
700
800
900
m/z


RetTime: 1.342 Datafile: D:\DATA\2022\2210\221021\EW26049-1086-P1A1.lcd
296.3
341.4
280.3
169.4
198.2
379.4
447.2
488.2
532.5
571.8
613.6
652.4
711.6
744.6
798.6
849.2
915.7
973.9
20000
10000
200
300
400
500
600
700
800
900
m/z

^{1}H NMR [(3a*S*,4*S*,6*R*,6a*R*)-4-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-2,2 -dimethyl-3a,4,6,6a-tetrahydrofuro[3,4-d][1,3]dioxol-6-yl]methanol **(114)**



LCMS [(3a*S*,4*S*,6*R*,6a*R*)-4-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-2,2 -dimethyl-3a,4,6,6a-tetrahydrofuro[3,4-d][1,3]dioxol-6-yl]methanol **(114)**



Integration Result

Peak Table

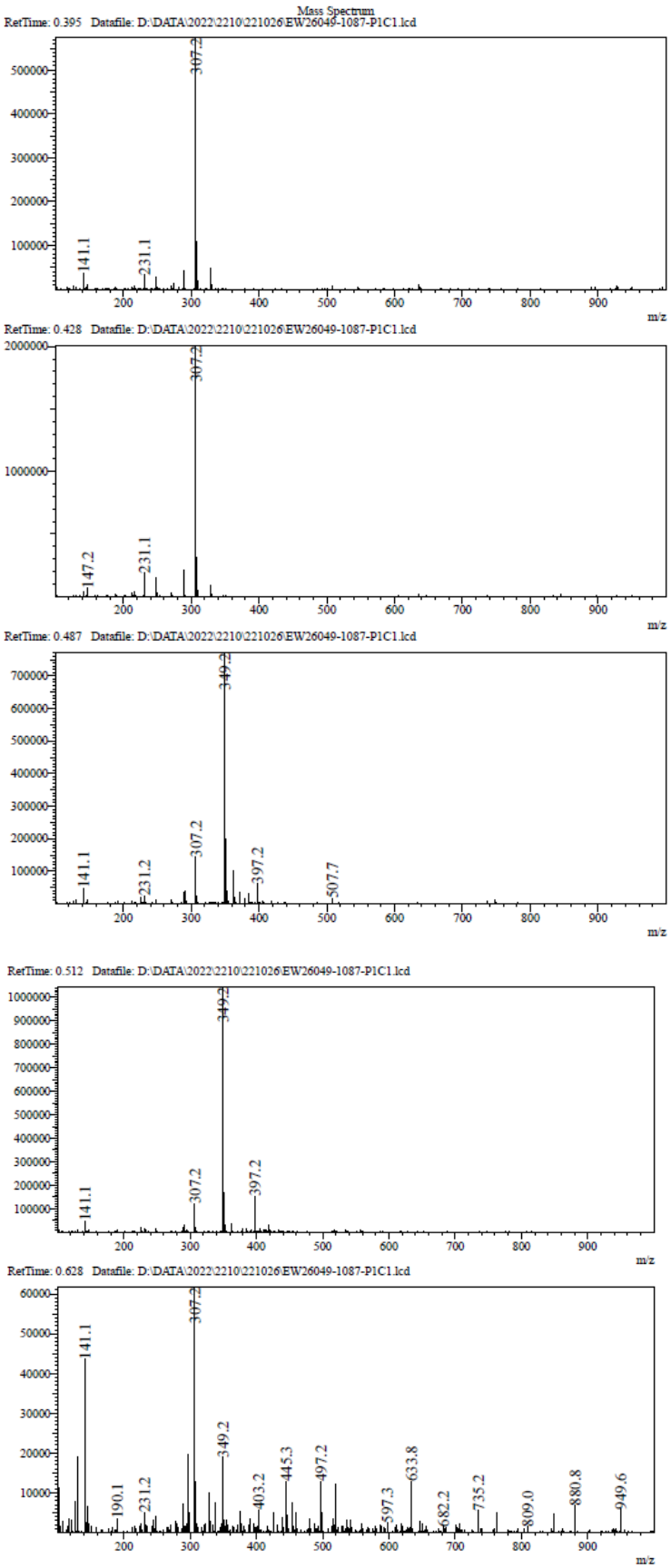
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.393	89246	3.873	0.093	297792	12.565
2	0.430	1981009	85.966	0.027	1851247	78.110
3	0.488	53281	2.312	0.035	65594	2.768
4	0.513	173677	7.537	0.024	149220	6.296
5	0.625	7198	0.312	0.025	6201	0.262

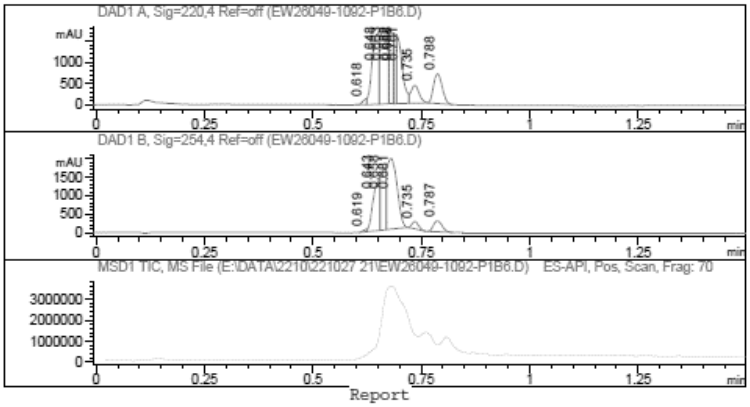
Peak Table

PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.393	46381	3.567	0.078	150081	11.103
2	0.430	1123938	86.433	0.027	1080783	79.958
3	0.487	29100	2.238	0.034	33048	2.445
4	0.513	100946	7.763	0.025	87773	6.494


Mass Spectrum
RetTime: 0.395 Datafile: D:\DATA\2022\2210\221026\EW26049-1087-P1C1.lcd
307.2
141.1
231.1
m/z
RetTime: 0.428 Datafile: D:\DATA\2022\2210\221026\EW26049-1087-P1C1.lcd
307.2
147.2
231.1
m/z
RetTime: 0.487 Datafile: D:\DATA\2022\2210\221026\EW26049-1087-P1C1.lcd
349.2
141.1
231.2
307.2
397.2
507.7
m/z
RetTime: 0.512 Datafile: D:\DATA\2022\2210\221026\EW26049-1087-P1C1.lcd
349.2
141.1
307.2
397.2
m/z
RetTime: 0.628 Datafile: D:\DATA\2022\2210\221026\EW26049-1087-P1C1.lcd
307.2
141.1
349.2
190.1
231.2
403.2
445.3
497.2
597.3
633.8
682.2
735.2
809.0
880.8
949.6
m/z

LCMS 7-[(3a*S*,4*S*,6*R*,6a*R*)-6-(Azidomethyl)-2,2-dimethyl-3a,4,6,6a-tetrah ydrofuro[3,4-d][1,3]dioxol-4-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(115)**



Report

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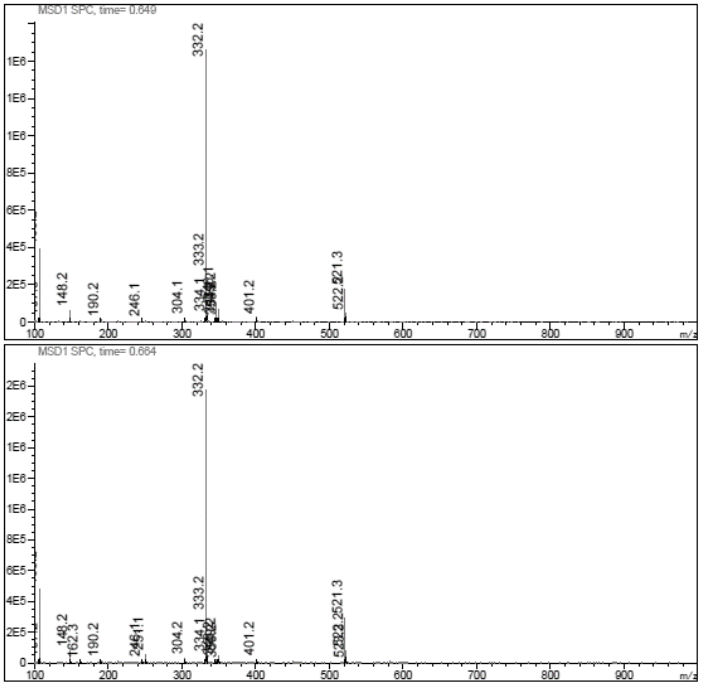
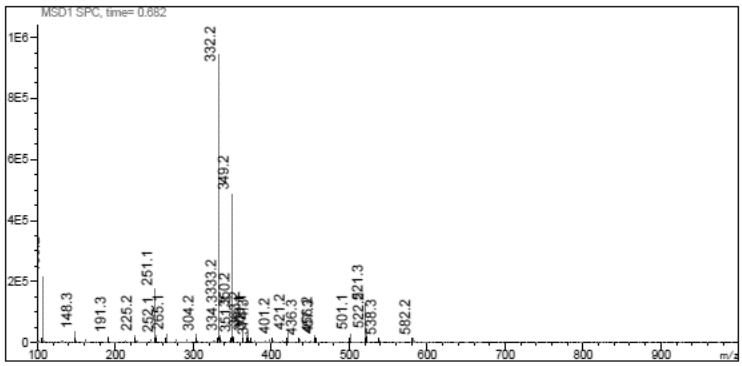
Signal 1 : DAD1 A, Sig=220,4 Ref=off

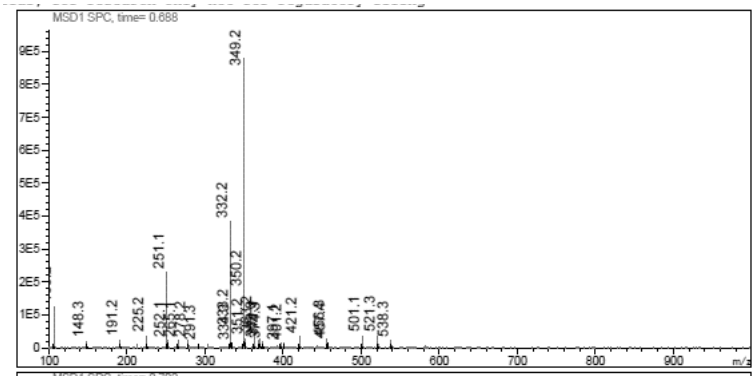
#	Meas. Ret.	Height	Width	Area	Area %
1	0.618	106.373	0.011	85.019	0.964
2	0.648	1637.115	0.017	1792.176	20.330
3	0.663	1720.668	0.016	2162.343	24.529
4	0.682	1674.983	0.009	1145.922	12.999
5	0.688	1647.396	0.007	653.476	7.413
6	0.701	1309.991	0.019	1464.338	16.611
7	0.735	421.110	0.020	546.329	6.198
8	0.788	694.686	0.023	965.701	10.955

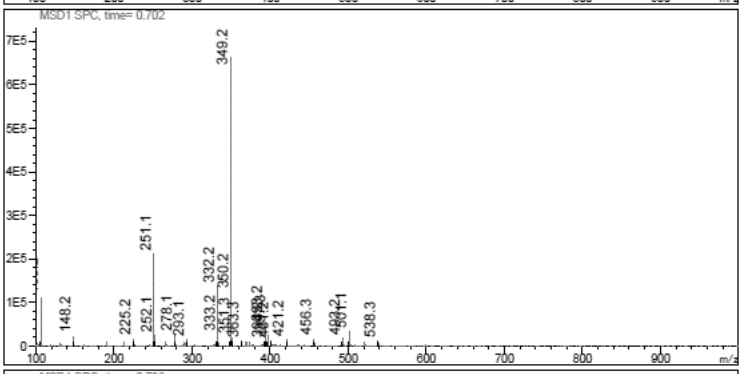
Signal 2 : DAD1 B, Sig=254,4 Ref=off

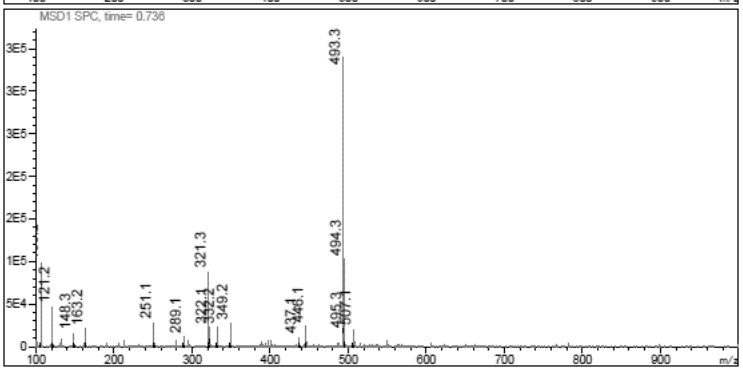
#	Meas. Ret.	Height	Width	Area	Area %
1	0.619	53.908	0.010	35.445	0.541
2	0.643	1081.293	0.019	1395.774	21.306
3	0.658	1547.609	0.016	1446.321	22.078
4	0.681	1913.257	0.025	3061.511	46.733
5	0.735	194.248	0.017	202.960	3.098
6	0.787	293.950	0.022	409.085	6.245

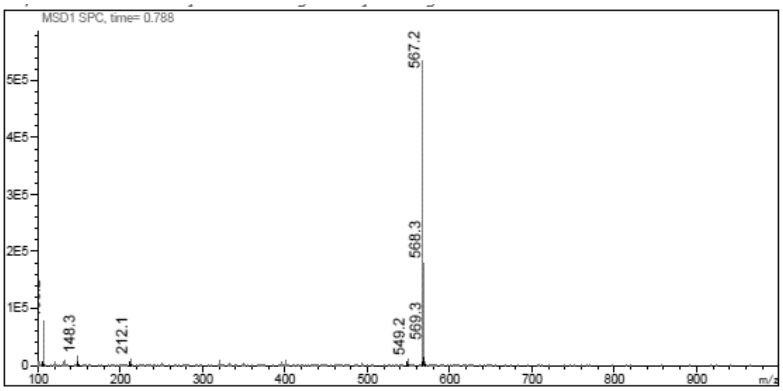



MSD1 SPC, time= 0.682
332.2
349.2
148.3
191.3
225.2
251.1
304.2
401.2
421.2
501.1
521.3
538.3
582.2

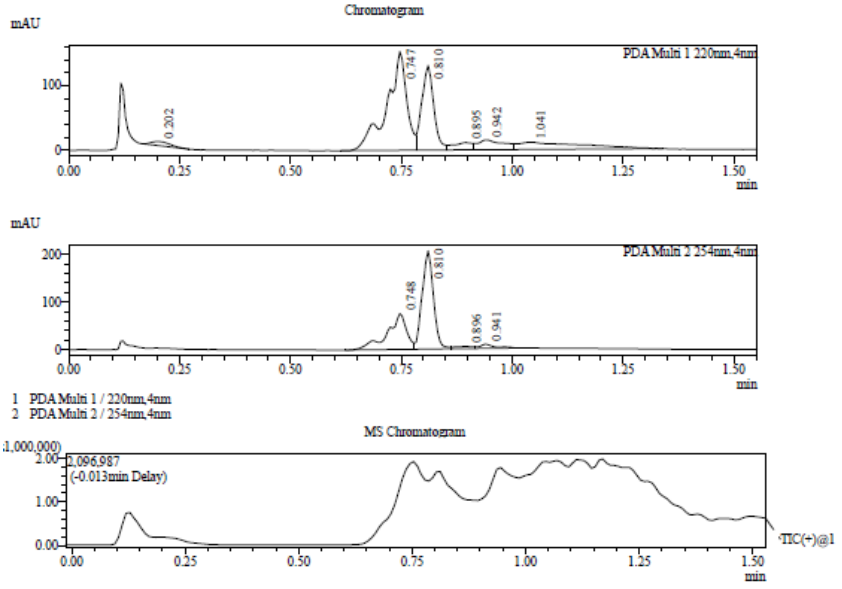

MSD1 SPC, time= 0.688
349.2
332.2
251.1
350.2
148.3
191.2
225.2
421.2
501.1
521.3
538.3


MSD1 SPC, time= 0.702
349.2
251.1
332.2
350.2
148.2
225.2
252.1
278.1
293.1
421.2
456.3
538.3


MSD1 SPC, time= 0.736
493.3
494.3
321.3
121.2
148.3
163.2
251.1
289.1
349.2



LCMS 7-[(3a*S*,4*S*,6*R*,6a*R*)-6-(Aminomethyl)-2,2-dimethyl-3a,4,6,6a-tetrahydrofuro[3,4-d][1,3]dioxol-4-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(116)**



Integration Result

Peak Table

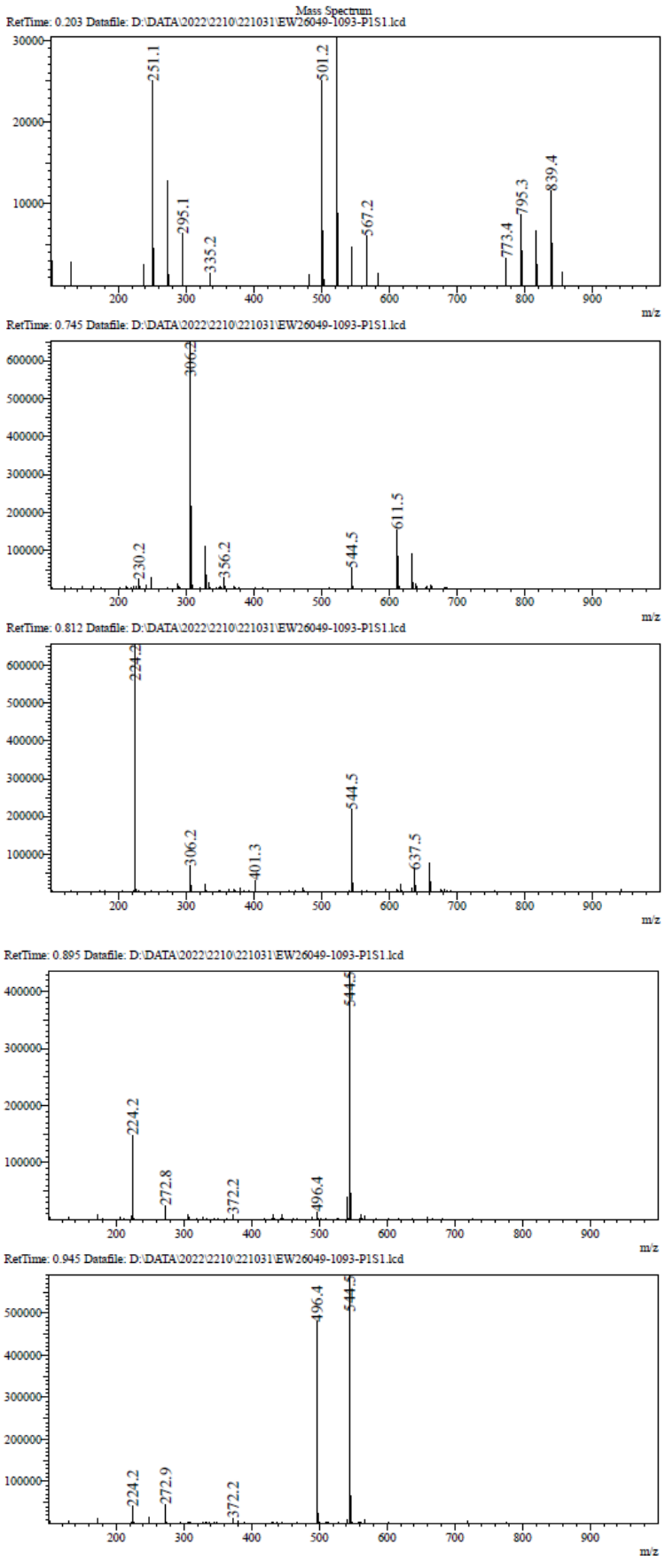
PDA Ch1 220nm

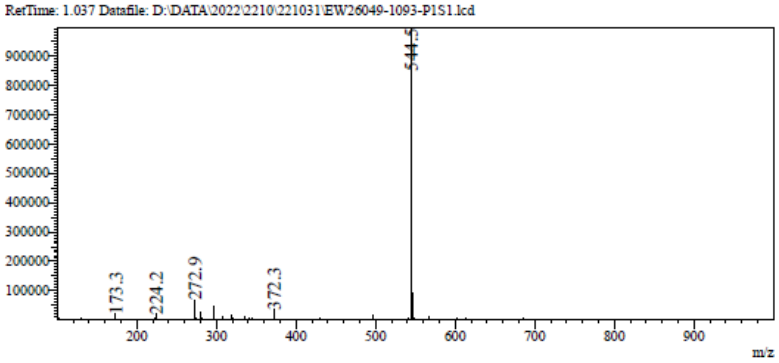
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.202	6335	1.933	0.082	17758	1.876
2	0.747	152720	46.593	0.063	477623	50.468
3	0.810	130811	39.909	0.059	241949	25.565
4	0.895	11397	3.477	0.189	33166	3.504
5	0.942	15254	4.654	0.137	61302	6.477
6	1.041	11256	3.434	0.507	114598	12.109

Peak Table

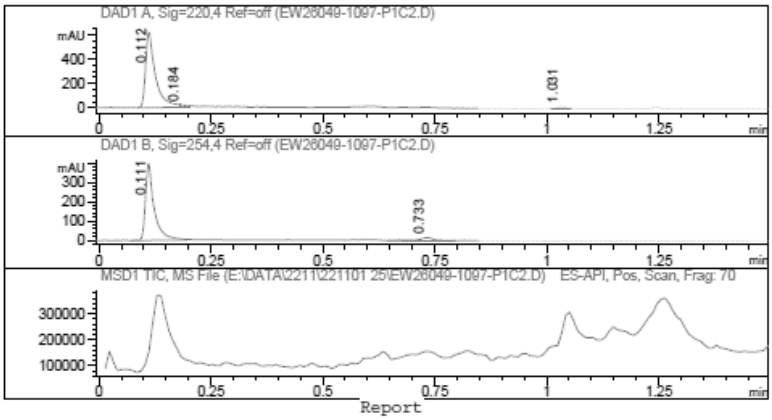
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.748	75044	25.486	0.063	227406	36.494
2	0.810	206166	70.016	0.057	363034	58.260


Mass Spectrum
RetTime: 0.203 Datafile: D:\DATA\2022\2210\221031\EW26049-1093-P1S1.lcd
251.1
501.2
295.1
335.2
567.2
773.4
795.3
839.4
m/z
RetTime: 0.745 Datafile: D:\DATA\2022\2210\221031\EW26049-1093-P1S1.lcd
306.2
230.2
356.2
544.5
611.5
m/z
RetTime: 0.812 Datafile: D:\DATA\2022\2210\221031\EW26049-1093-P1S1.lcd
224.2
306.2
401.3
544.5
637.5
m/z
RetTime: 0.895 Datafile: D:\DATA\2022\2210\221031\EW26049-1093-P1S1.lcd
544.5
224.2
272.8
372.2
496.4
m/z
RetTime: 0.945 Datafile: D:\DATA\2022\2210\221031\EW26049-1093-P1S1.lcd
496.4
544.5
224.2
272.9
372.2
m/z



LCMS (2*R*,3*S*,4*R*,5*S*)-2-(Aminomethyl)-5-(4-aminopyrrolo[2,1-f][1,2,4] triazin-7-yl)tetrahydrofuran-3,4-diol **(117)**



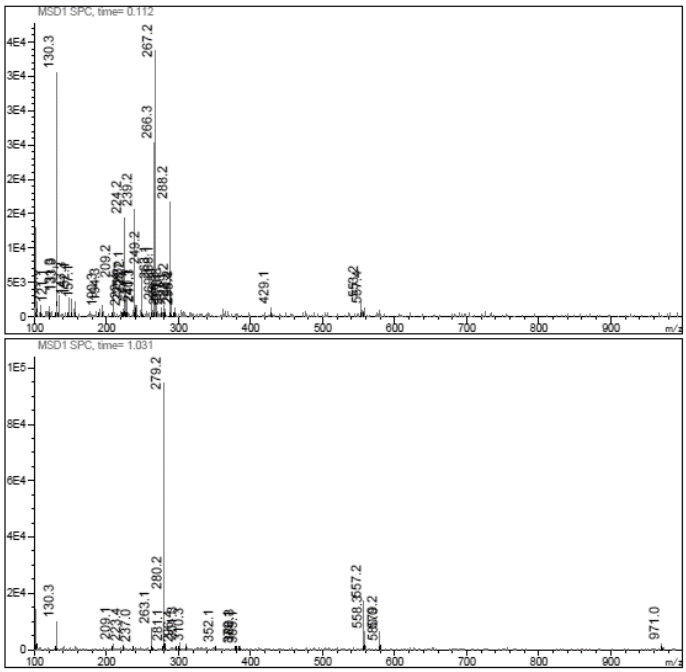
Report

Signal 1 : DAD1 A, Sig=220,4 Ref=off

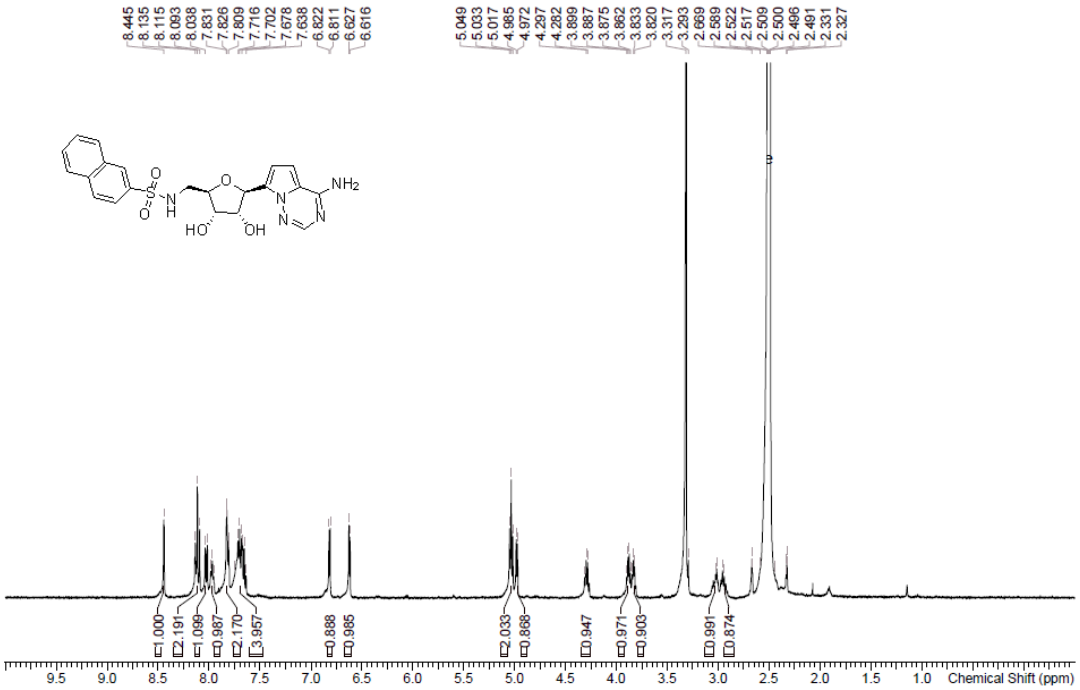
#	Meas. Ret.	Height	Width	Area	Area %
1	0.112	619.410	0.022	946.249	95.803
2	0.184	19.870	0.012	17.703	1.792
3	1.031	19.416	0.020	23.747	2.404

Signal 2 : DAD1 B, Sig=254,4 Ref=off

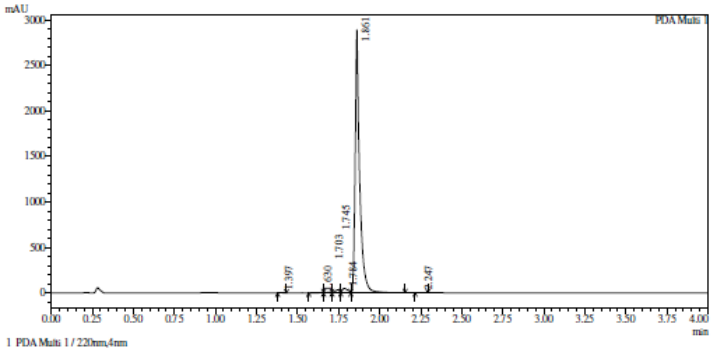
#	Meas. Ret.	Height	Width	Area	Area %
1	0.111	396.627	0.019	541.895	92.847
2	0.733	16.556	0.035	41.748	7.153



^{1}H NMR *N*-[[(2*R*,3*S*,4*R*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4- dihydroxy-tetrahydrofuran-2-yl]methyl]naphthalene-2-sulfonamide **(34)**



HPLC *N*-[[(2*R*,3*S*,4*R*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4- dihydroxy-tetrahydrofuran-2-yl]methyl]naphthalene-2-sulfonamide **(34)**

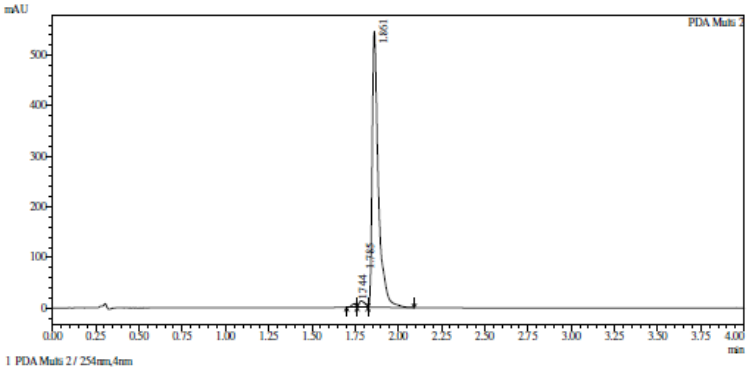


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.397	0.043	0.000	702	1066	0.019
2	1.630	0.125	2.792	3571	10988	0.193
3	1.703	0.535	0.220	7029	14769	0.260
4	1.745	0.079	0.137	33177	68410	1.203
5	1.784	0.079	0.498	49412	125124	2.199
6	1.861	0.045	1.236	2893192	5466691	96.094
7	2.247	0.066	6.991	796	1847	0.032
Total				2987881	5688896	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.744	0.079	0.000	6956	13230	0.935
2	1.785	0.079	0.506	12972	33163	2.345
3	1.861	0.060	1.090	545778	1367928	96.720
Total				565707	1414320	100.000

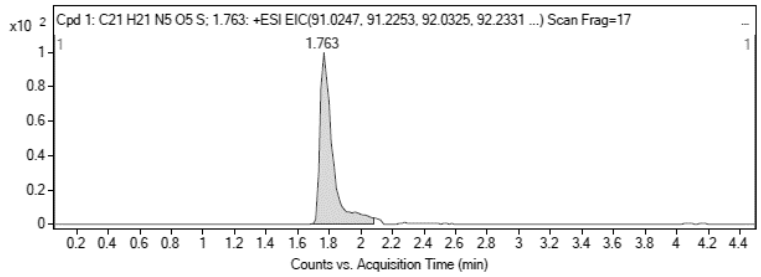
HRMS *N*-[[(2*R*,3*S*,4*R*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4- dihydroxy-tetrahydrofuran-2-yl]methyl]naphthalene-2-sulfonamide **(34)**

Compound Table

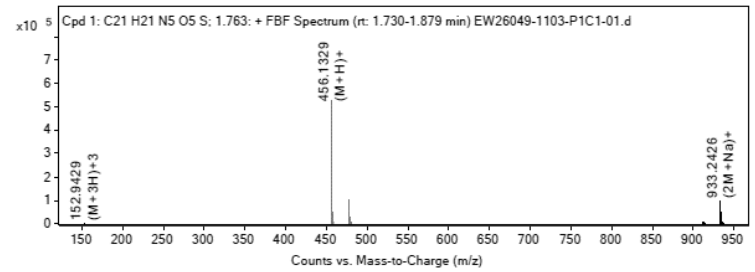
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C21 H21 N5 O5 S; 1.763	99.38	-2.2	C21 H21 N5 O5 S	1.763	455.1263	455.1253

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
933.2426	1.763	455.1253	C21 H21 N5 O5 S	455.1263	-2.2	Find by Formula

Compound Chromatograms



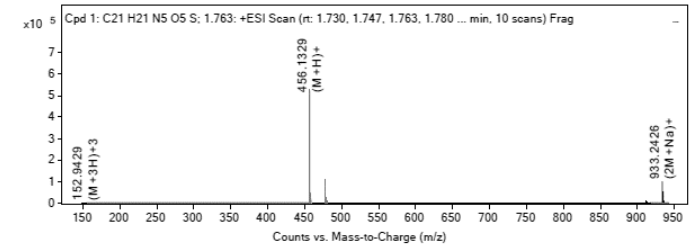
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
456.1329	1	525477.63	(M+H)+
457.1349	1	141160.08	(M+H)+
458.1321	1	43342.77	(M+H)+
478.1134	1	104224.06	(M+Na)+
479.1154	1	27611.89	(M+Na)+
480.1133	1	8924.78	(M+Na)+
933.2426	1	101196.81	(2M+Na)+
934.2447	1	51909.96	(2M+Na)+
935.2432	1	23879.92	(2M+Na)+
936.2436	1	8033.02	(2M+Na)+

MS Zoomed Spectrum

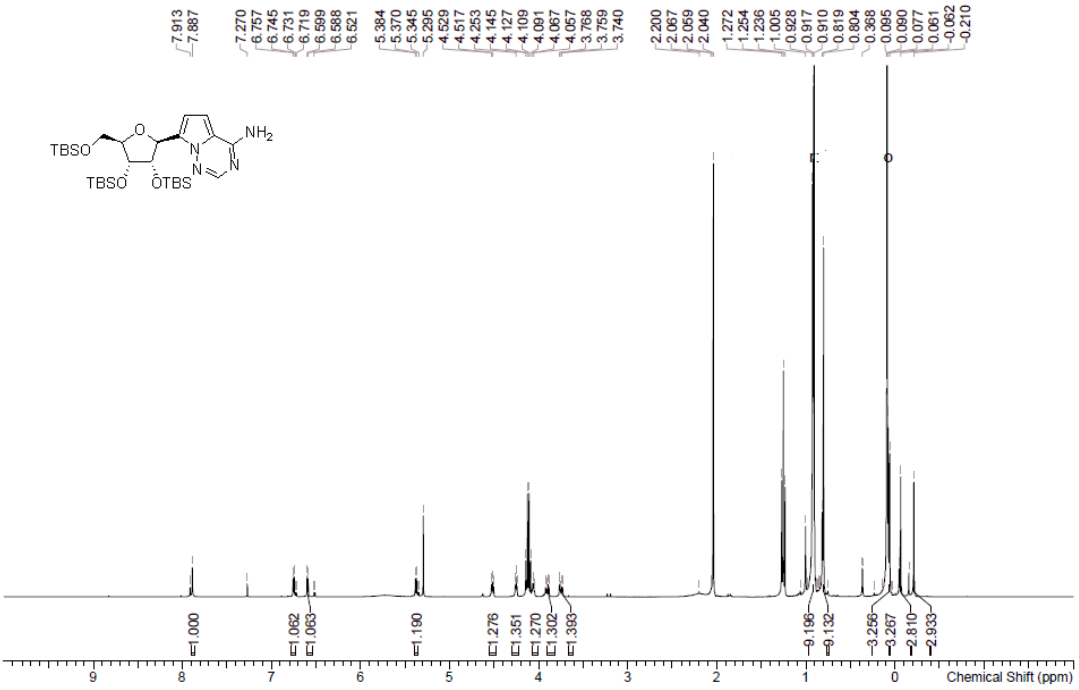


MS Spectrum Peak List

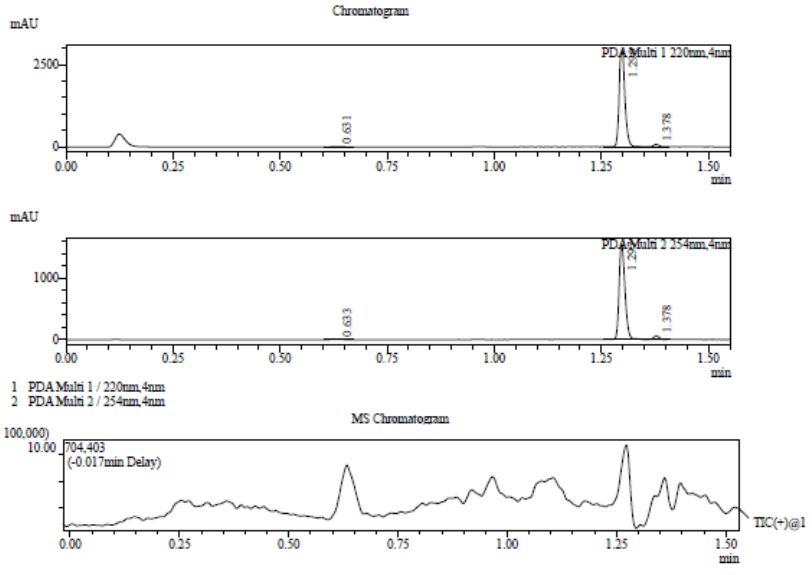
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
456.1329	1	525477.63	(M+H)+	1.59
457.1349	1	141160.08	(M+H)+	3.46
458.1321	1	43342.77	(M+H)+	4.23
478.1134	1	104224.06	(M+Na)+	4.52
479.1154	1	27611.89	(M+Na)+	6.23
480.1133	1	8924.78	(M+Na)+	5.57
933.2426	1	101196.81	(2M+Na)+	-0.79
934.2447	1	51909.96	(2M+Na)+	0.01
935.2432	1	23879.92	(2M+Na)+	0.62
936.2436	1	8033.02	(2M+Na)+	0.84

--- End Of Report ---

^{1}H NMR 7-[(2*S*,3*S*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert-butyl(dimethyl)silyl]oxymethyl]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(118)**



LCMS 7-[(2*S*,3*S*,4*R*,5*R*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[[tert-butyl(dimethyl)silyl]oxymethyl]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(118)**



Integration Result

Peak Table

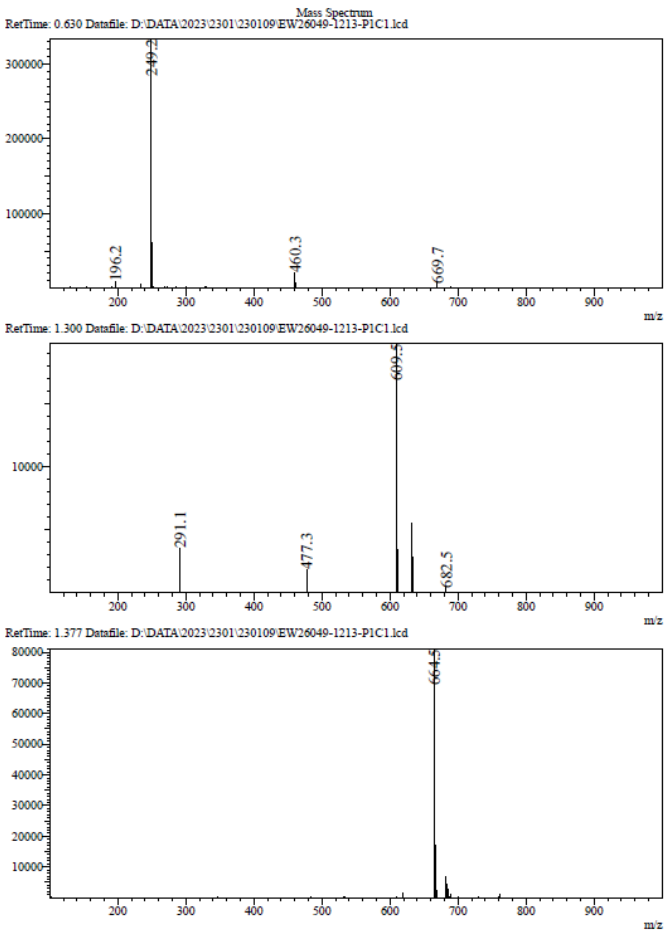
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.631	5178	0.173	0.052	9101	0.324
2	1.299	2916589	97.511	0.025	2735515	97.409
3	1.378	69272	2.316	0.026	63658	2.267

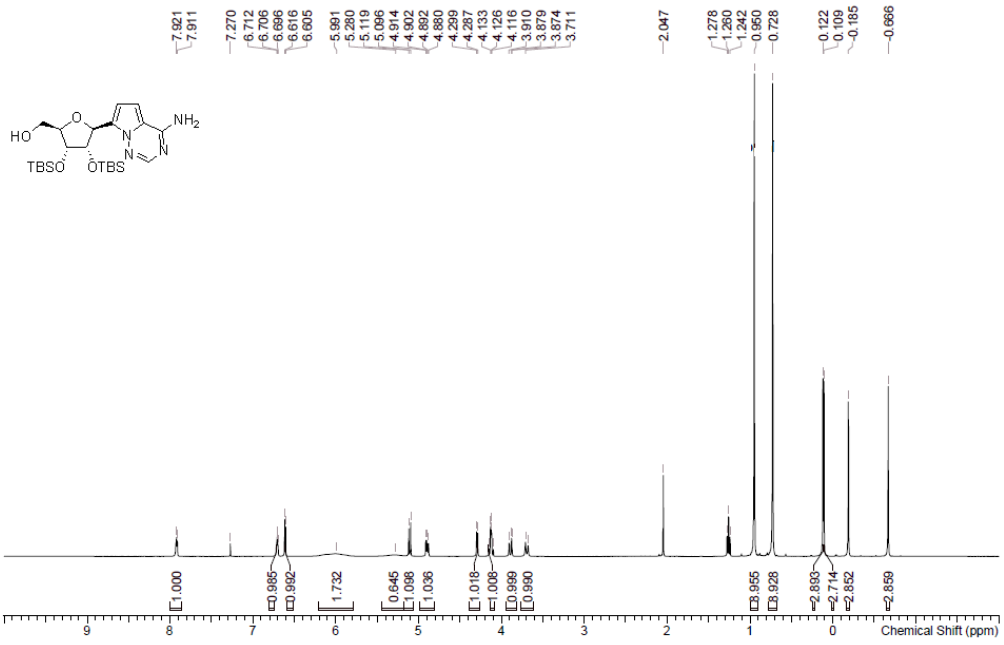
Peak Table

PDA Ch2 254nm

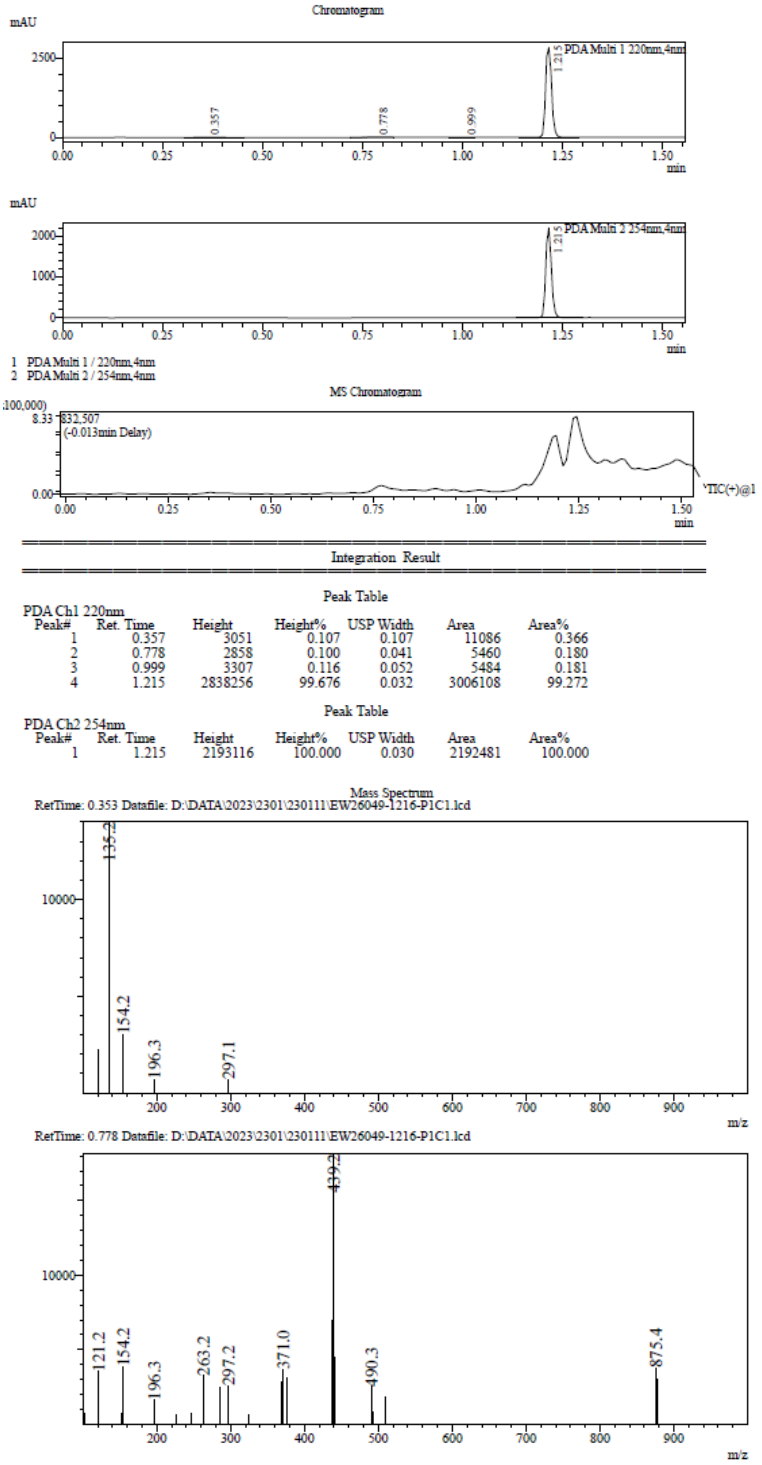
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.633	3275	0.202	0.047	5580	0.366
2	1.297	1556053	96.100	0.027	1464576	96.159
3	1.378	59874	3.698	0.025	52920	3.475

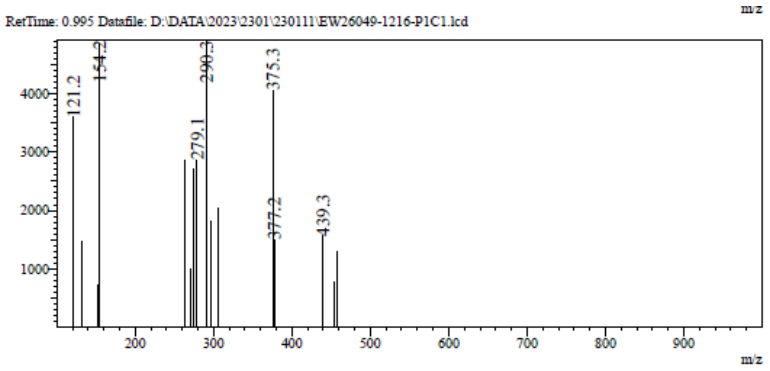


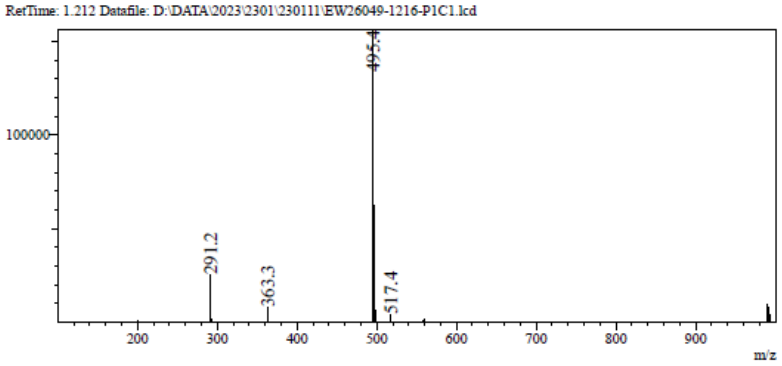
^{1}H NMR [(2*R*,3*R*,4*S*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl) -3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methanol **(119)**



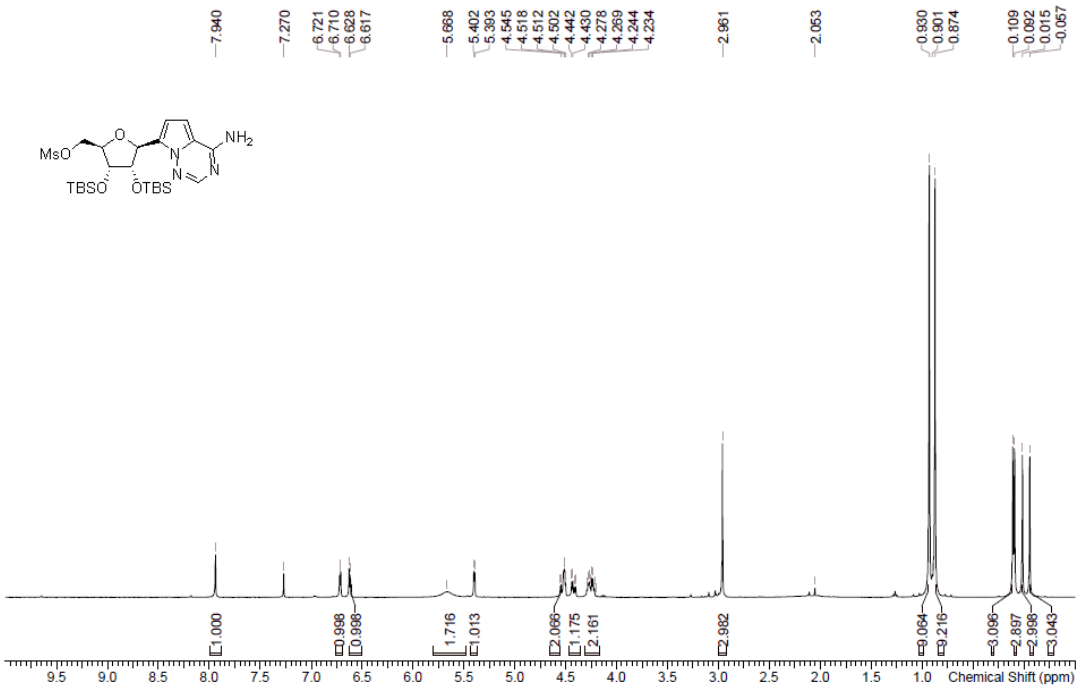
LCMS [(2*R*,3*R*,4*S*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl) -3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methanol **(119)**



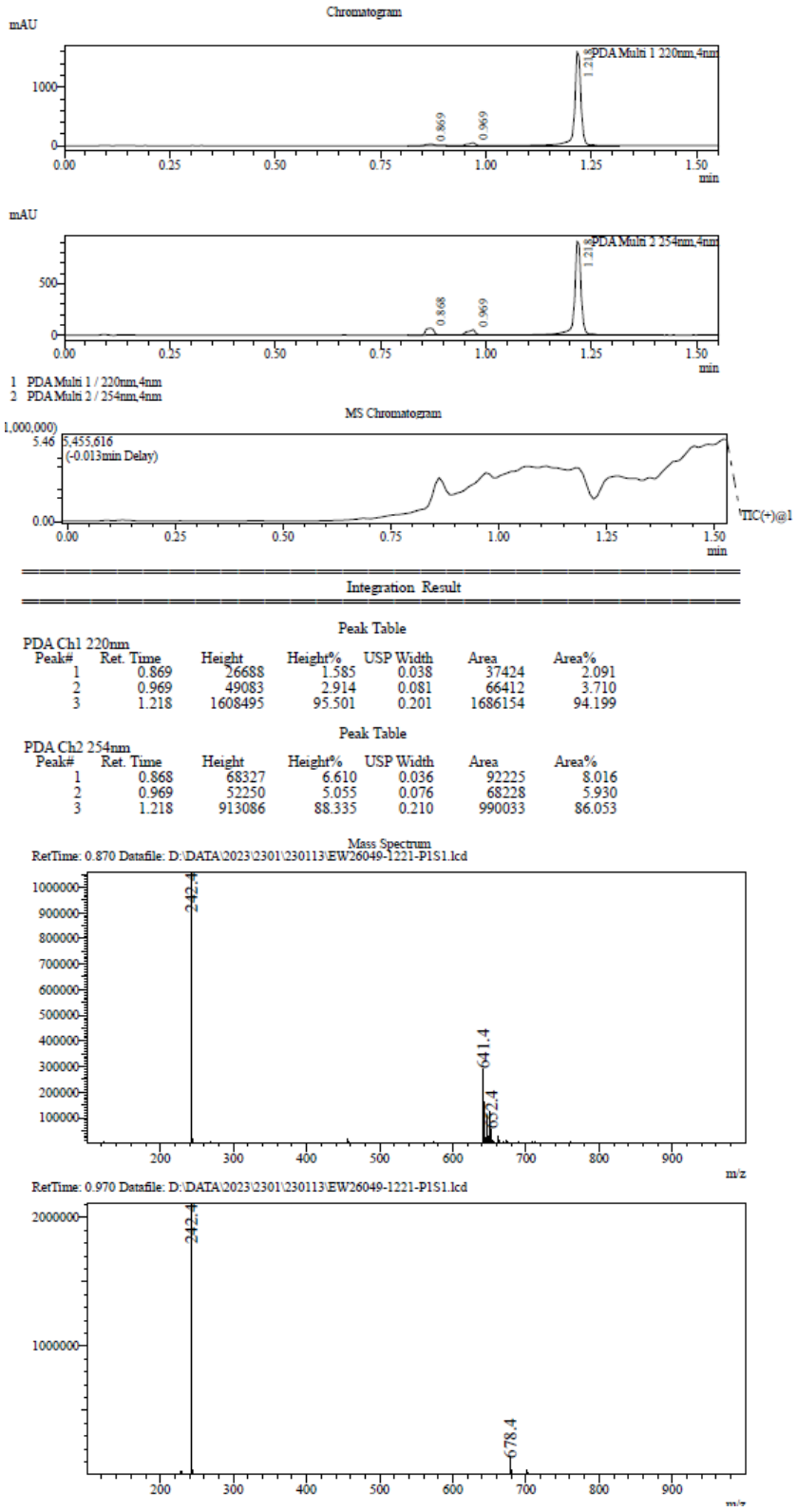


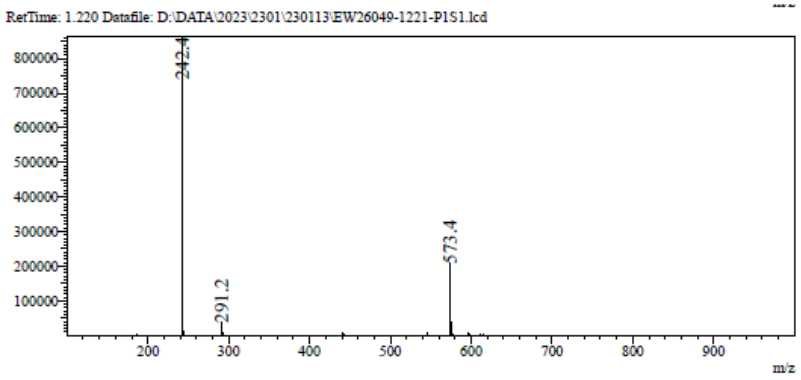


^{1}H NMR [(2*R*,3*R*,4*S*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methyl methanesulfonate **(120)**

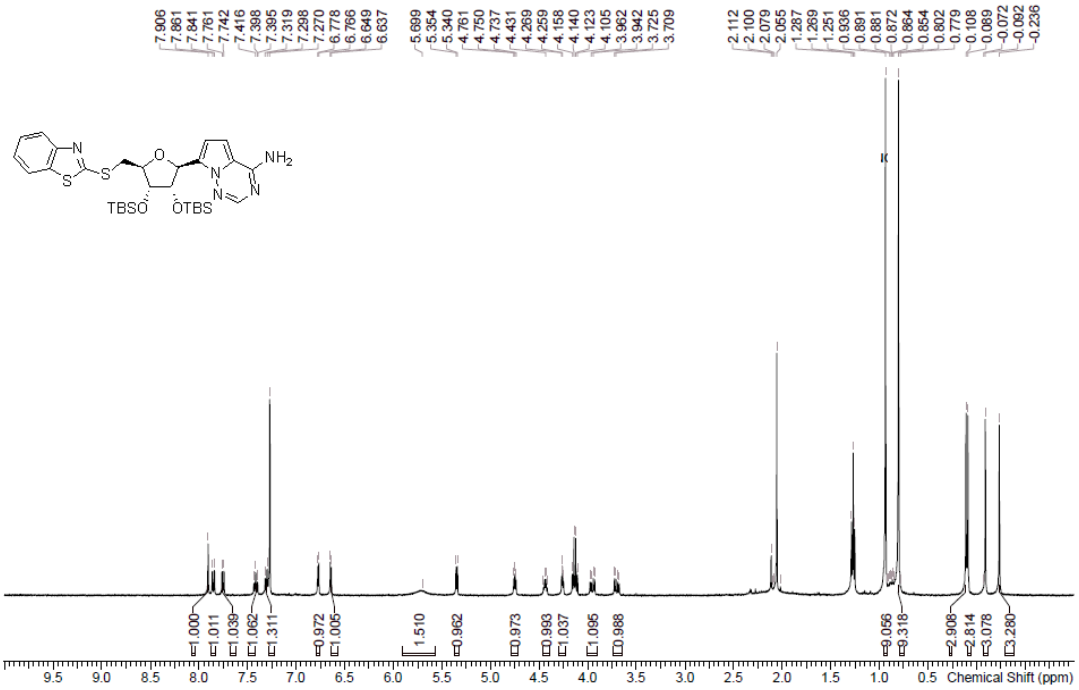


LCMS [(2*R*,3*R*,4*S*,5*S*)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]methyl methanesulfonate **(120)**

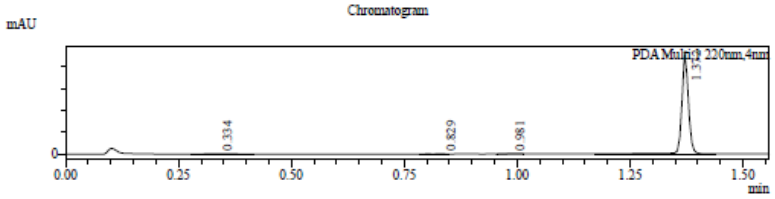


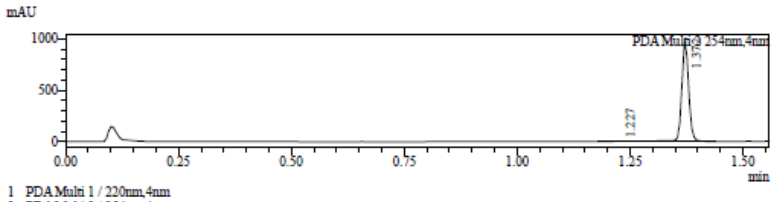


^{1}H NMR 7-[(2*S*,3*S*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl) -3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(121a)**

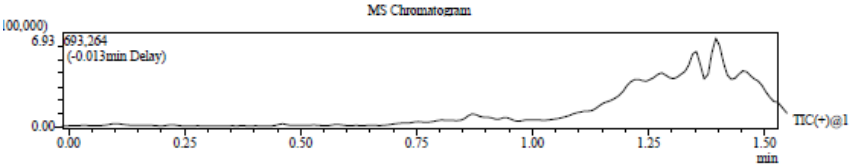


LCMS 7-[(2*S*,3*S*,4*R*,5*S*)-5-(1,3-Benzothiazol-2-ylsulfanylmethyl) -3,4-bis[[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(121a)**





1 PDA Multi 1 / 220nm,4nm
2 PDA Multi 2 / 254nm,4nm



Integration Result

Peak Table

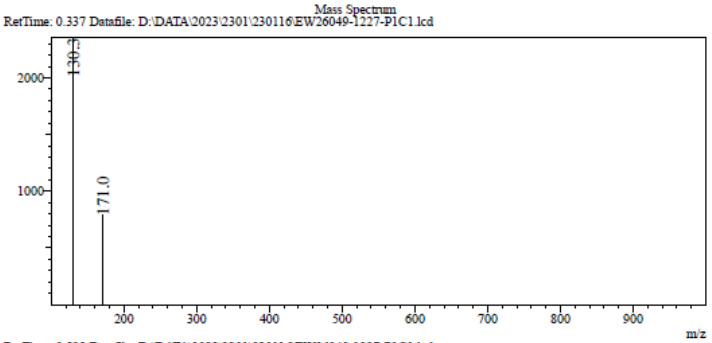
PDA Ch1 220nm

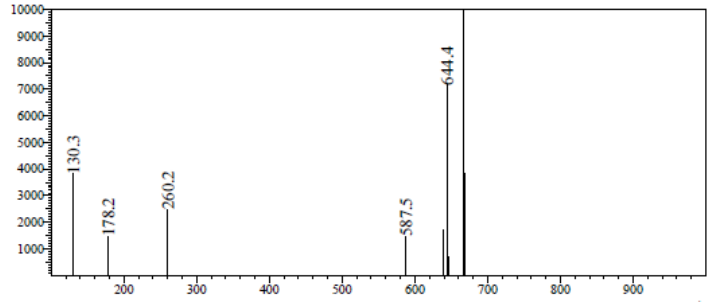
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.334	5086	0.217	0.102	18409	0.774
2	0.829	2309	0.099	0.277	5476	0.230
3	0.981	7994	0.341	0.034	9188	0.387
4	1.372	2325600	99.343	0.199	2343870	98.609

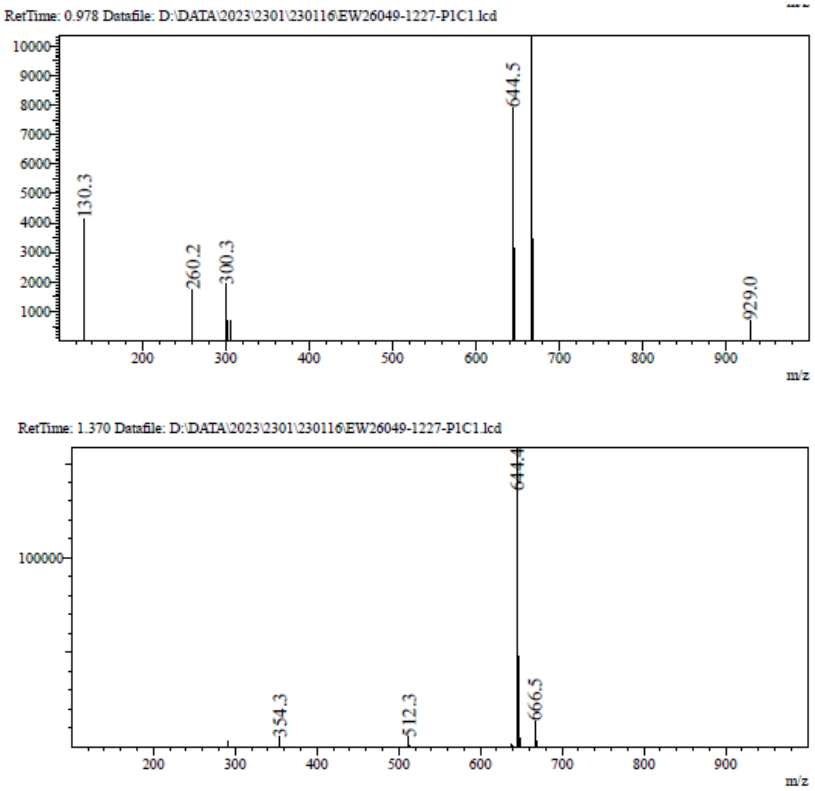
Peak Table

PDA Ch2 254nm

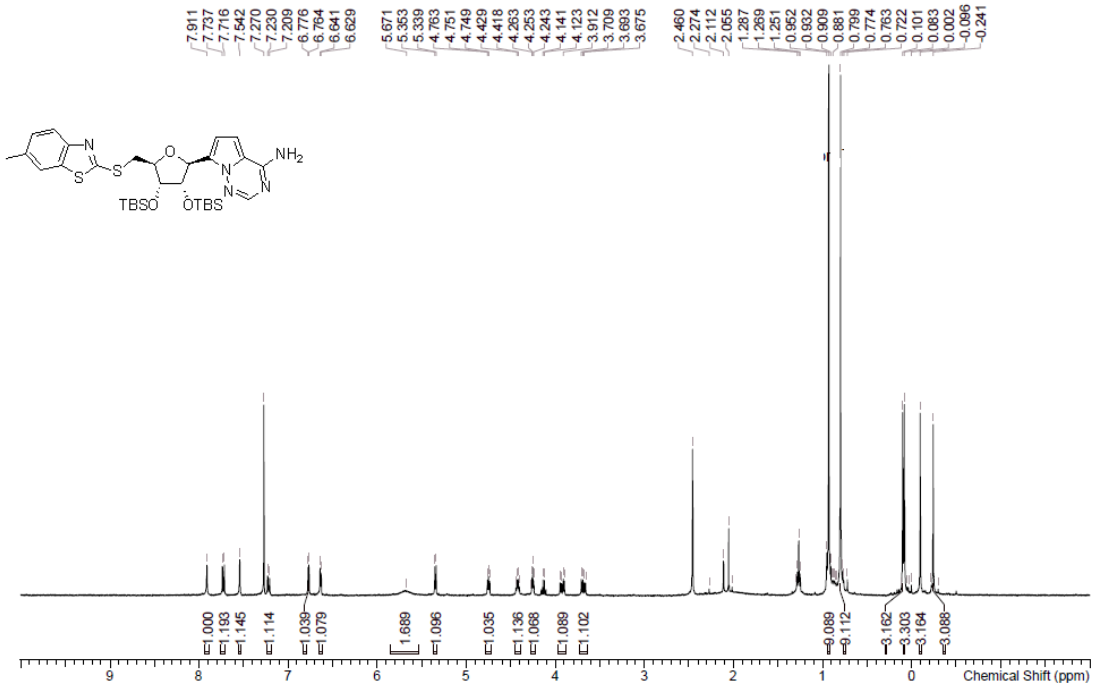
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.227	2675	0.271	0.000	5723	0.540
2	1.372	984651	99.729	0.147	1053628	99.460



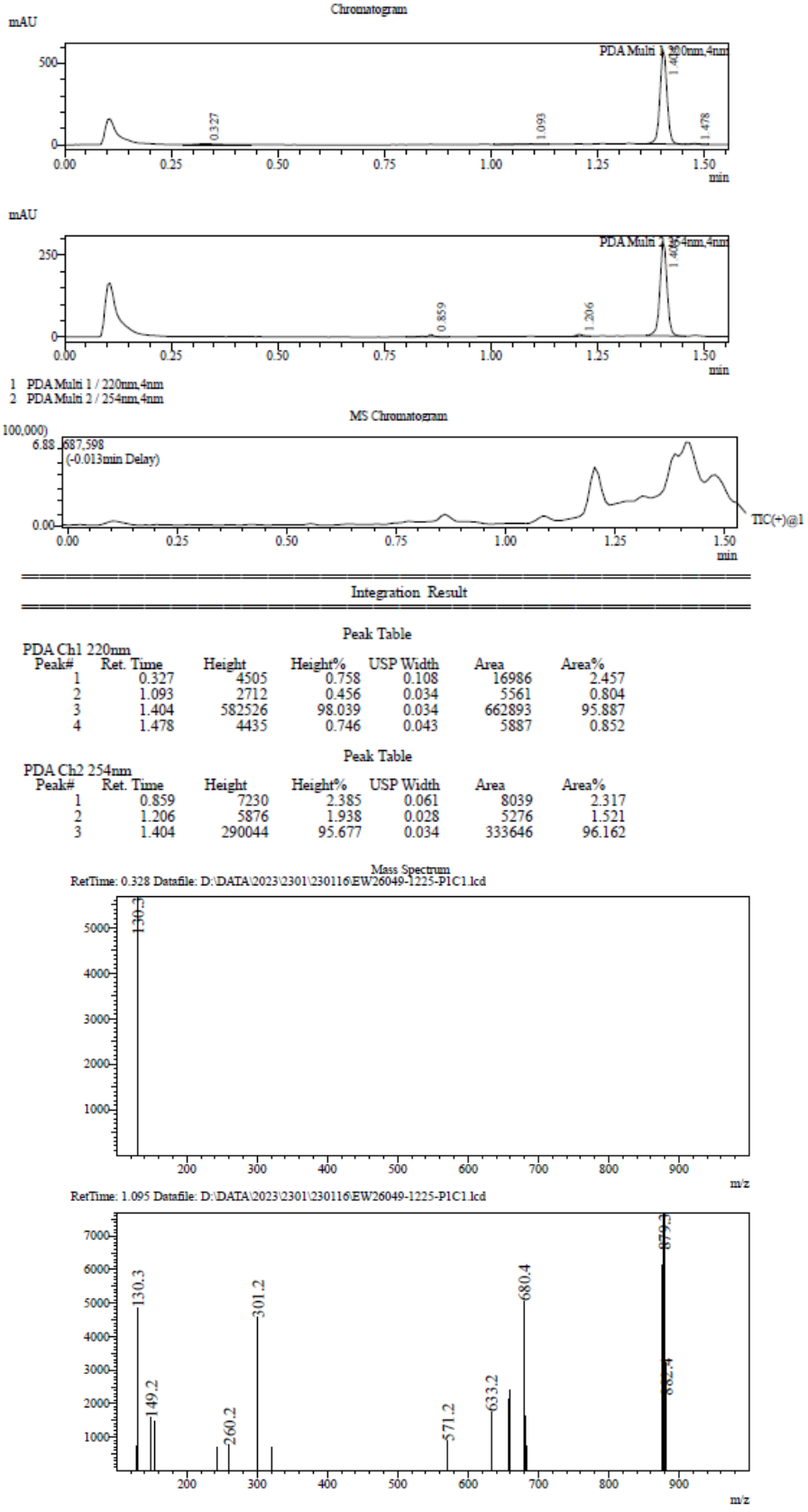




^{1}H NMR 7-[(2S,3S,4R,5S)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[(6-methyl -1,3-benzothiazol-2-yl)sulfanylmethyl]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(121b)**



LCMS 7-[(2S,3S,4R,5S)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5-[(6-methyl -1,3-benzothiazol-2-yl)sulfanylmethyl]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(121b)**



Integration Result

Peak Table

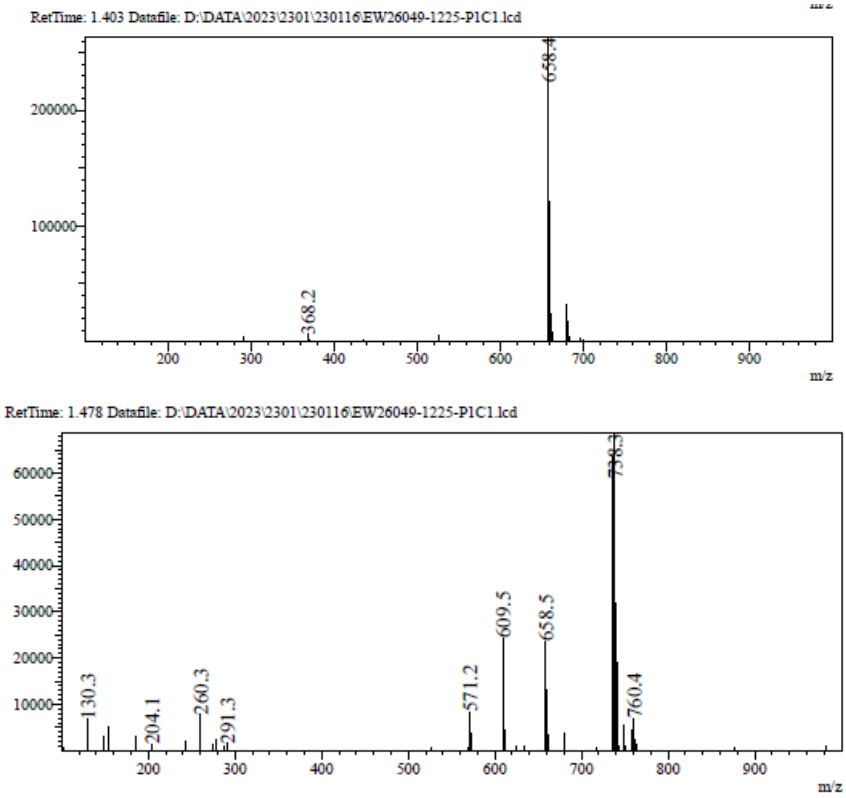
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.327	4505	0.758	0.108	16986	2.457
2	1.093	2712	0.456	0.034	5561	0.804
3	1.404	582526	98.039	0.034	662893	95.887
4	1.478	4435	0.746	0.043	5887	0.852

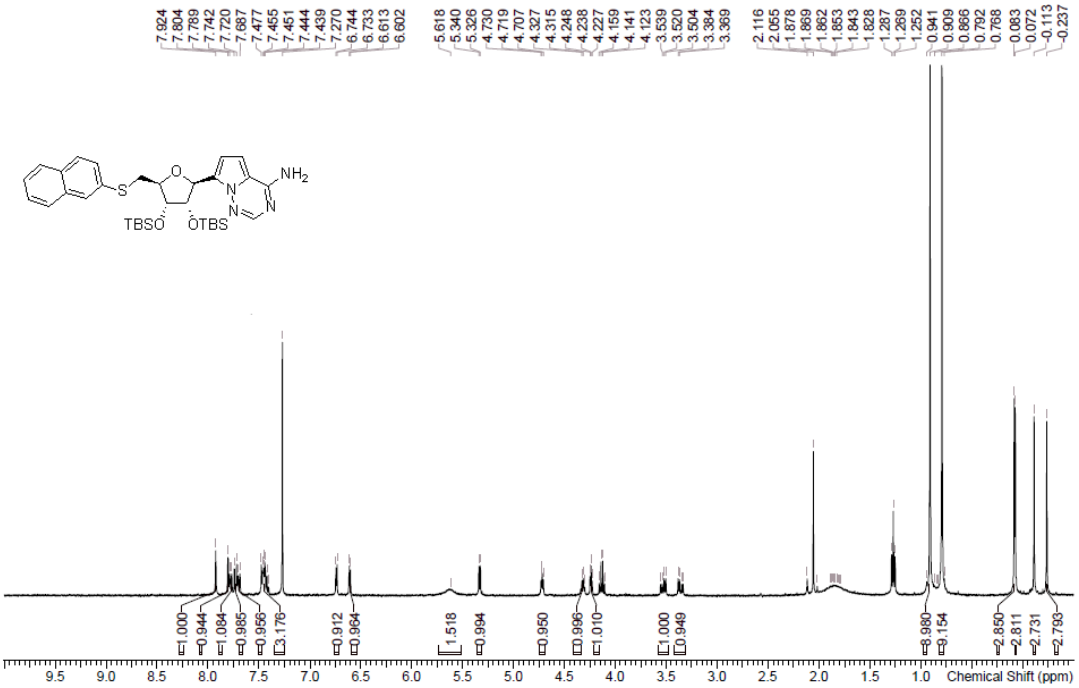
Peak Table

PDA Ch2 254nm

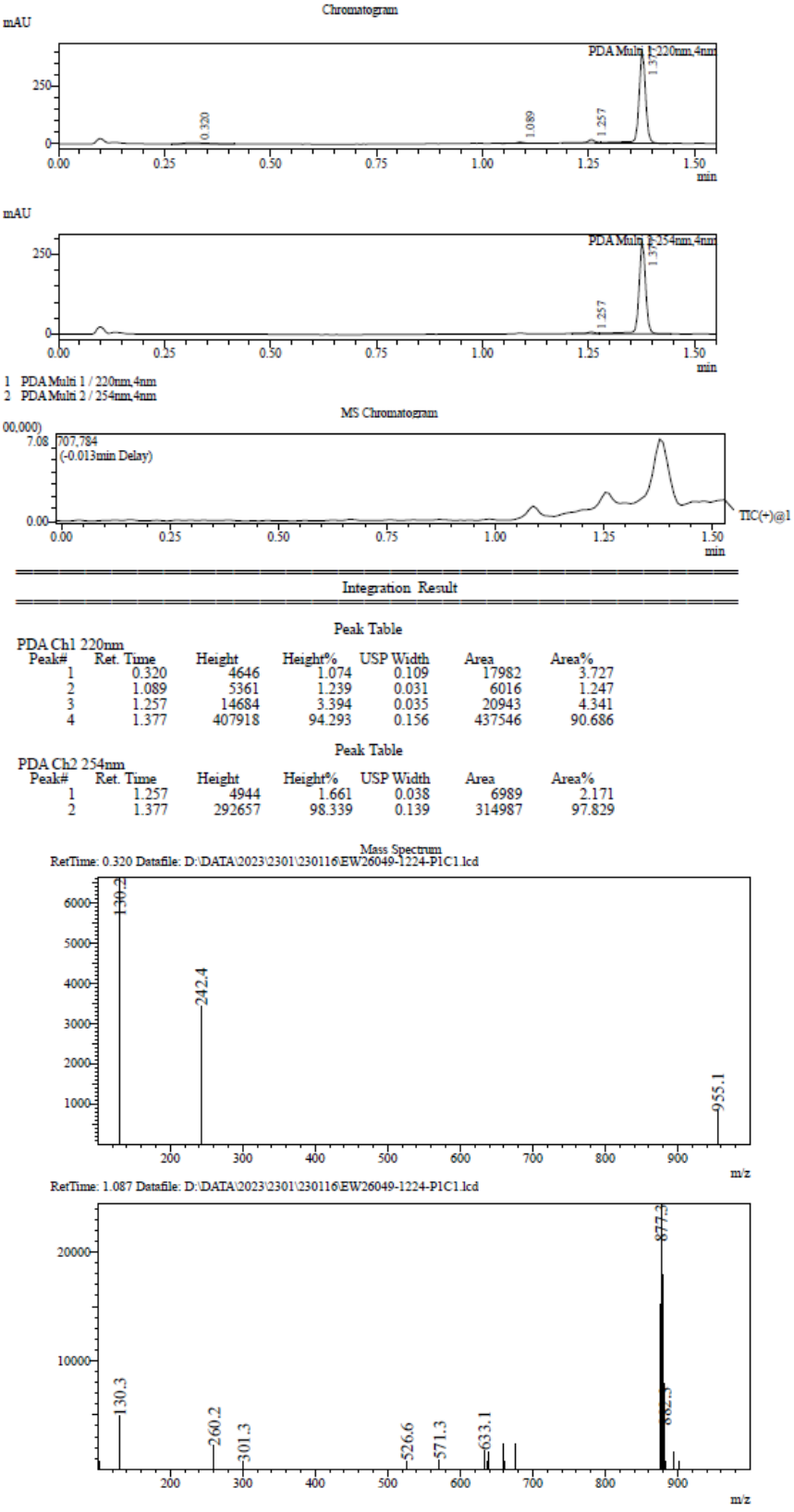
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.859	7230	2.385	0.061	8039	2.317
2	1.206	5876	1.938	0.028	5276	1.521
3	1.404	290044	95.677	0.034	333646	96.162



^{1}H NMR 7-[(2*S*,3*S*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (2-naphthylsulfanylmethyl)tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(121c)**



LCMS 7-[(2*S*,3*S*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]-5- (2-naphthylsulfanylmethyl)tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(121c)**



Integration Result

Peak Table

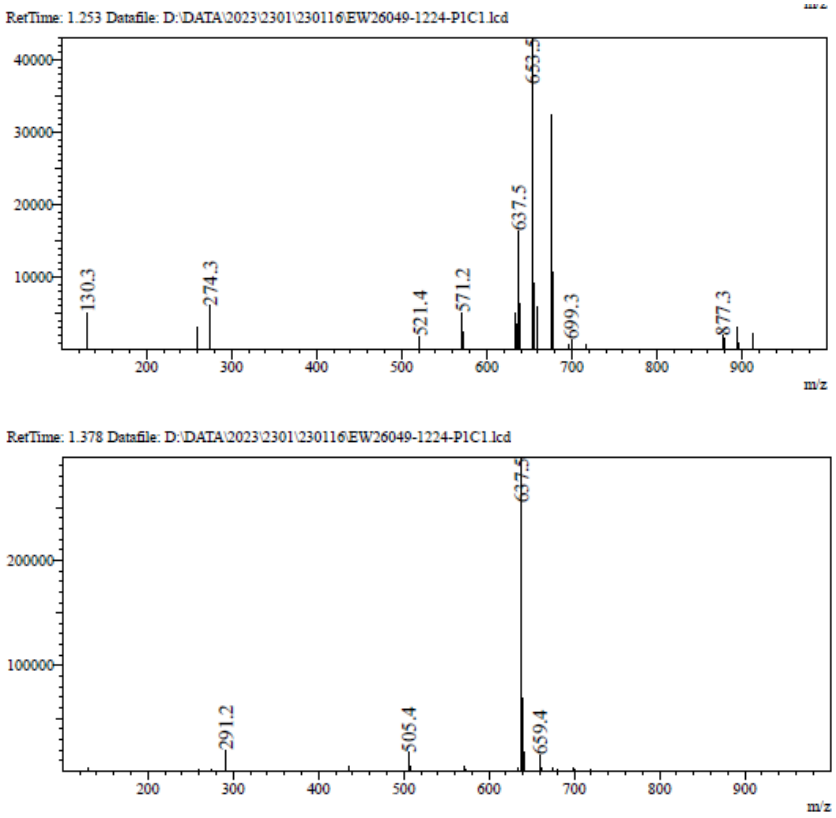
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.320	4646	1.074	0.109	17982	3.727
2	1.089	5361	1.239	0.031	6016	1.247
3	1.257	14684	3.394	0.035	20943	4.341
4	1.377	407918	94.293	0.156	437546	90.686

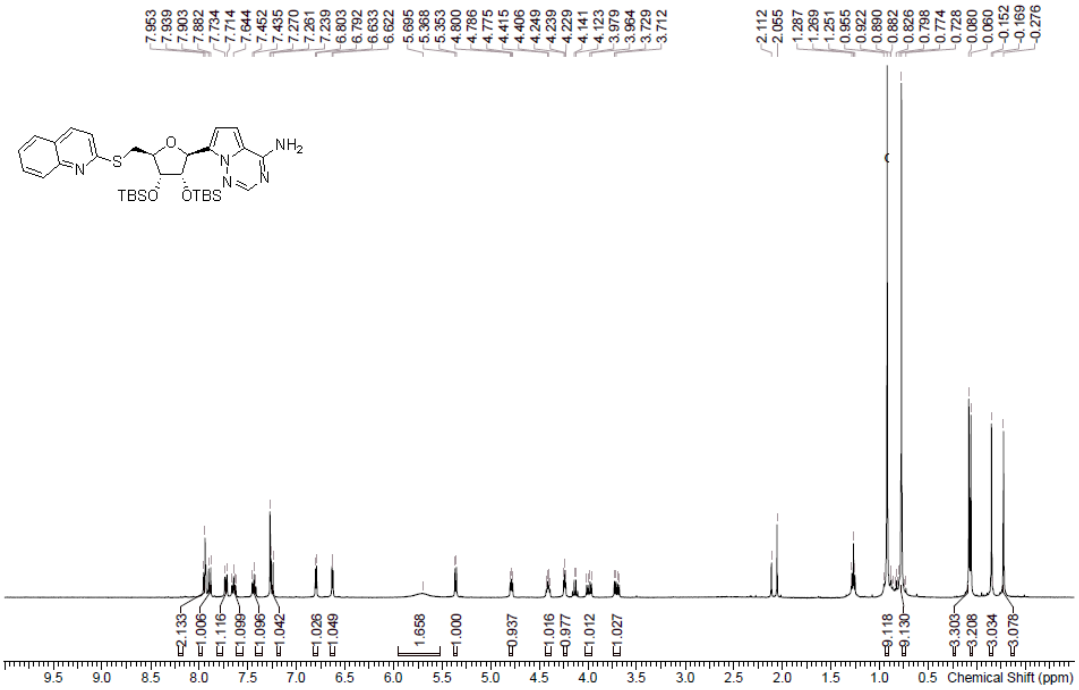
Peak Table

PDA Ch2 254nm

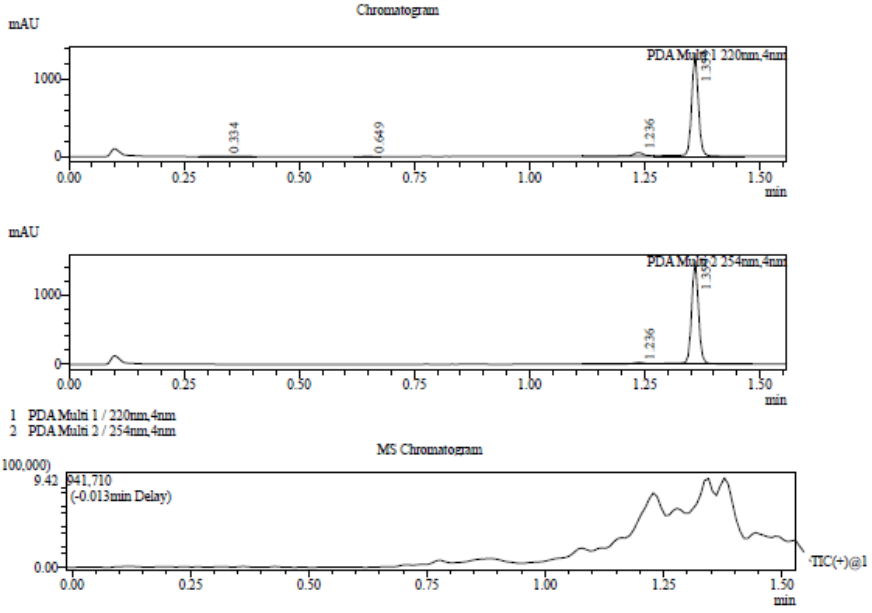
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.257	4944	1.661	0.038	6989	2.171
2	1.377	292657	98.339	0.139	314987	97.829



^{1}H NMR 7-[(2*S*,3*S*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]- 5-(2-quinolylsulfanylmethyl) tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4- amine **(121d)**



LCMS 7-[(2*S*,3*S*,4*R*,5*S*)-3,4-Bis[[tert-butyl(dimethyl)silyl]oxy]- 5-(2-quinolylsulfanylmethyl) tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4- amine **(121d)**



Integration Result

Peak Table

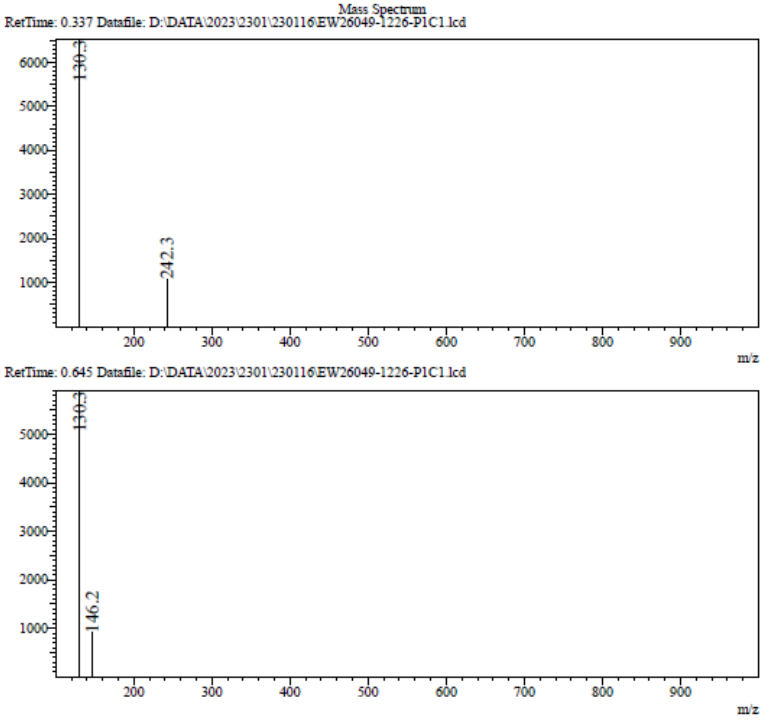
PDA Ch1 220nm

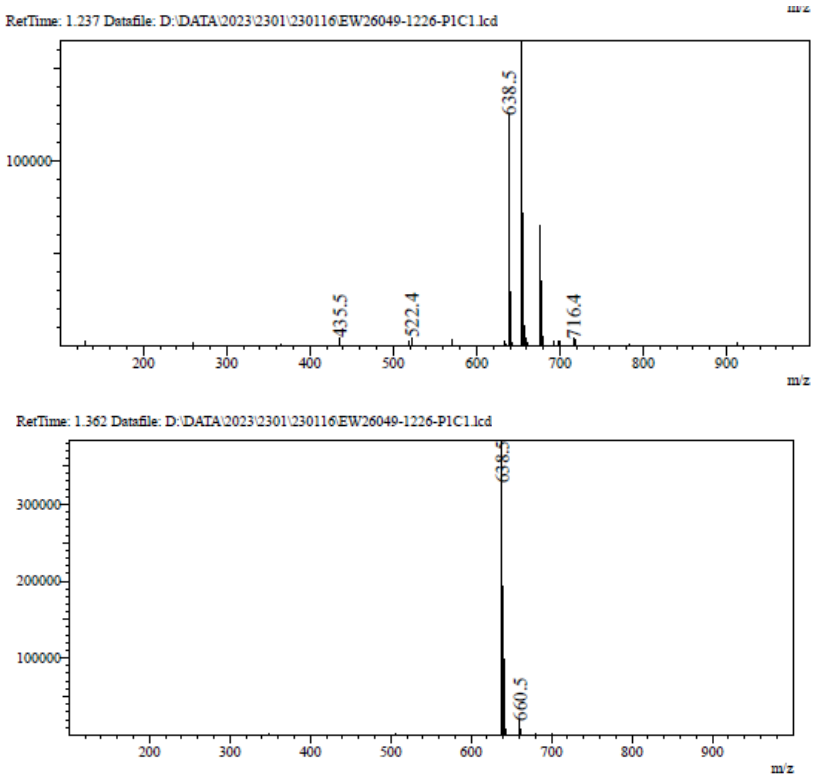
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.334	4335	0.312	0.104	16164	1.084
2	0.649	4334	0.312	0.038	5566	0.373
3	1.236	47013	3.387	0.045	84665	5.676
4	1.359	1332160	95.988	0.119	1385270	92.867

Peak Table

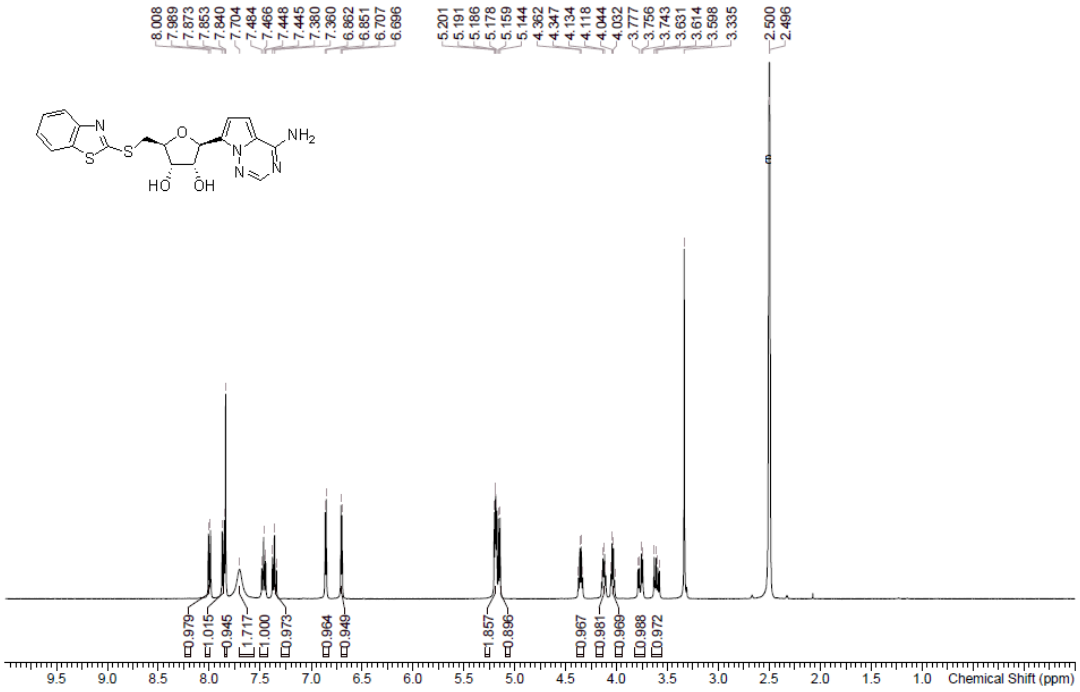
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.236	23167	1.535	0.056	50256	3.046
2	1.359	1486112	98.465	0.032	1599631	96.954

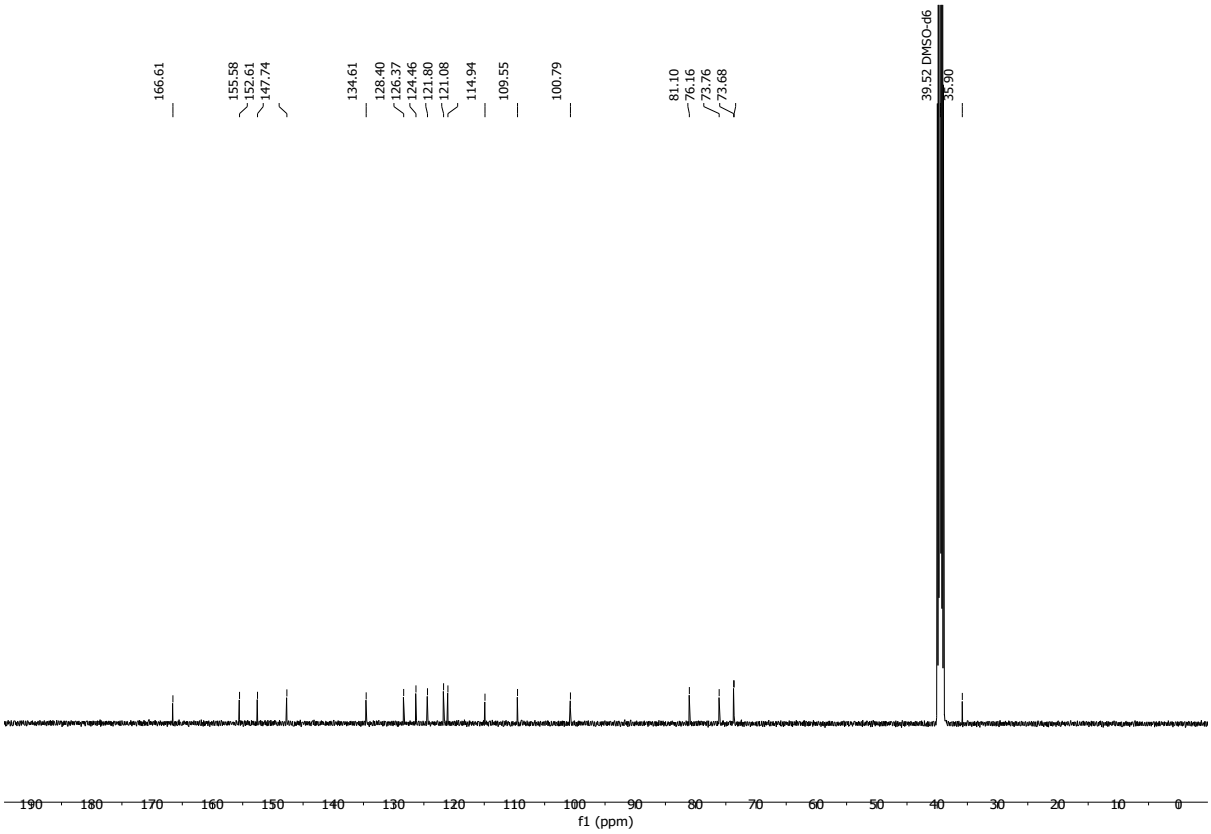




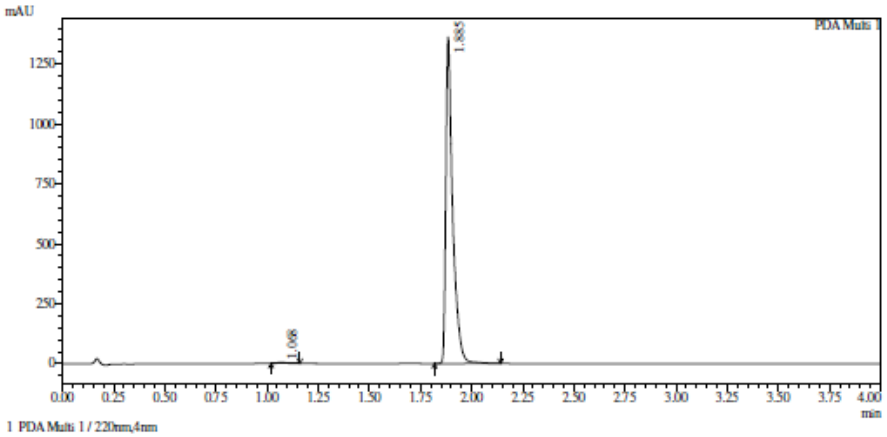
^{1}H NMR (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(35)**



^{13}C NMR (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(35)**



HPLC (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(35)**

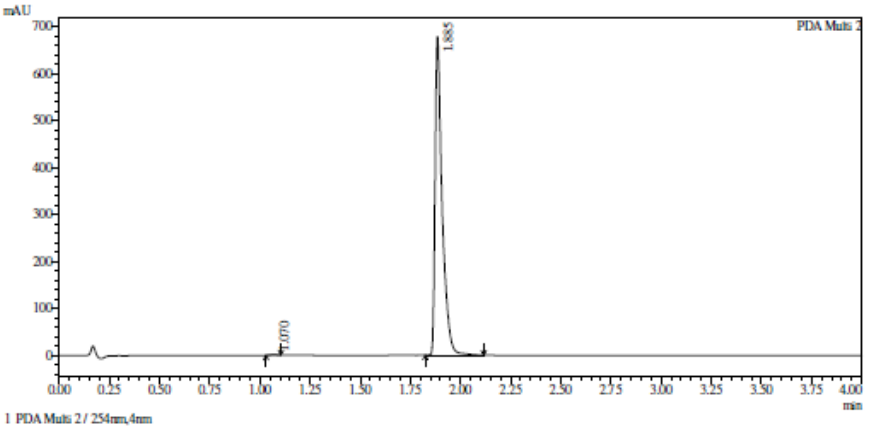


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.068	0.075	0.000	5252	15723	0.491
2	1.885	0.056	12.449	1362095	3188169	99.509
Total				1367347	3203892	100.000



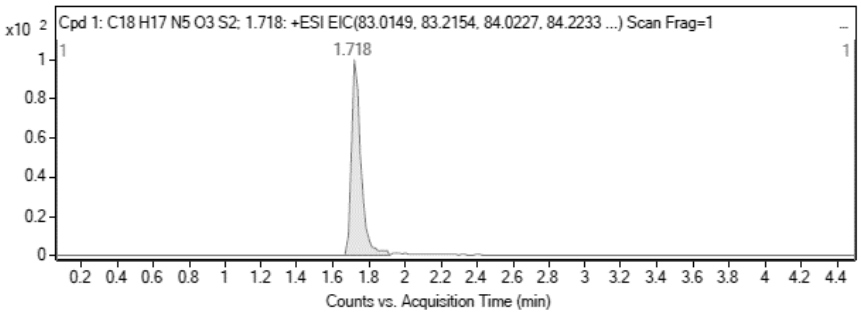
Integration result

PeakTable

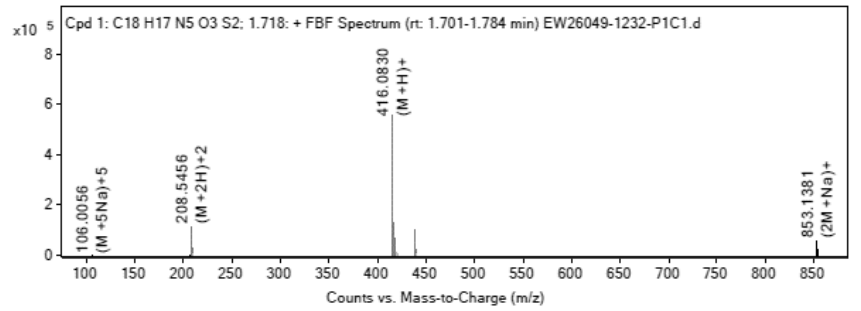
PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.070	0.059	0.000	996	2263	0.135
2	1.885	0.060	13.713	679112	1669071	99.865
Total				680109	1671335	100.000

HRMS (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (1,3-benzothiazol-2-ylsulfanylmethyl)tetrahydrofuran-3,4-diol **(35)**



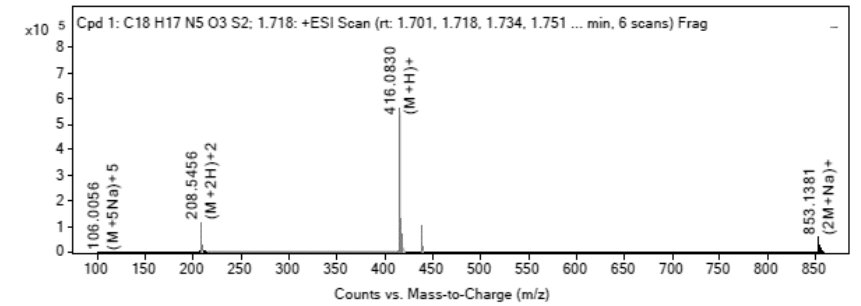
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
208.5456	2	116103.53	(M+2H)+2
209.0467	2	26254.92	(M+2H)+2
209.5448	2	14248.66	(M+2H)+2
416.083	1	559536.25	(M+H)+
417.0849	1	128231.88	(M+H)+
418.0803	1	63988.23	(M+H)+
438.0639	1	101660.52	(M+Na)+
439.0662	1	24114.88	(M+Na)+
853.1381	1	57645.03	(2M+Na)+
854.1398	1	25484.41	(2M+Na)+

MS Zoomed Spectrum

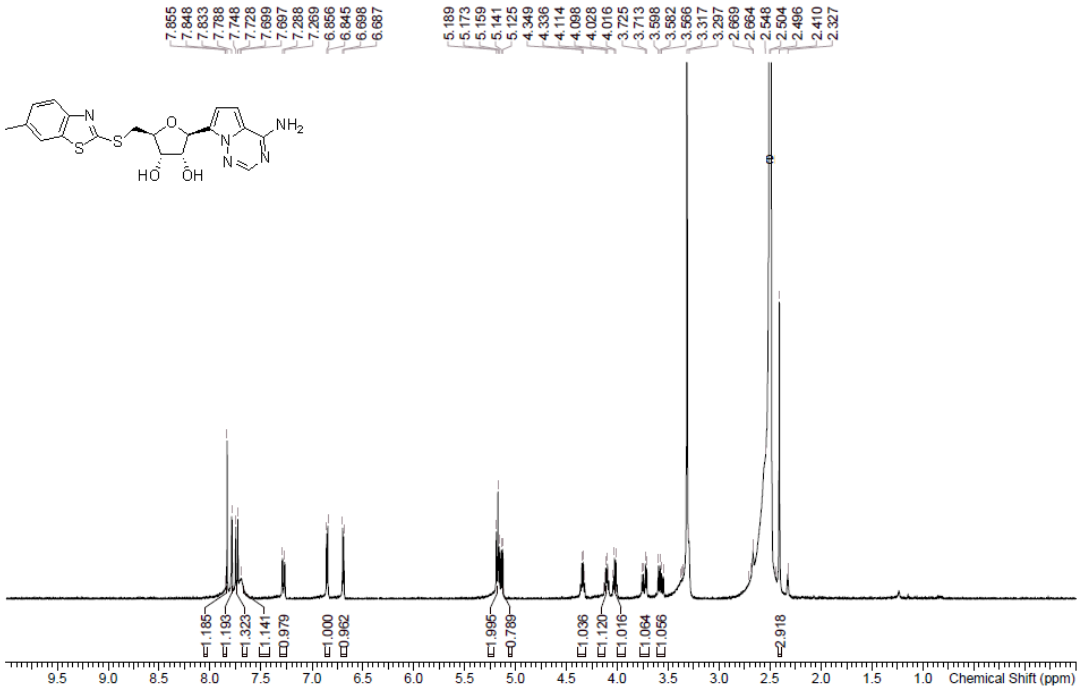


MS Spectrum Peak List

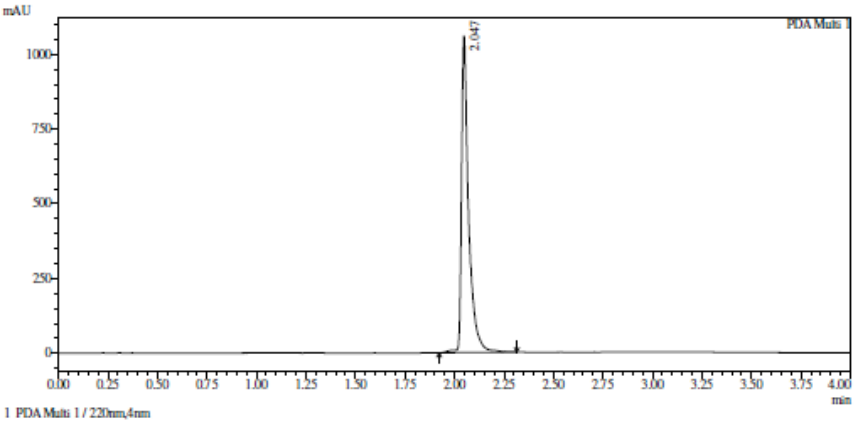
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
208.5456	2	116103.53	(M+2H)+2	1.32
209.0467	2	26254.92	(M+2H)+2	2.3
209.5448	2	14248.66	(M+2H)+2	1.32
416.083	1	559536.25	(M+H)+	3.81
417.0849	1	128231.88	(M+H)+	5.46
418.0803	1	63988.23	(M+H)+	5.87
438.0639	1	101660.52	(M+Na)+	5.85
439.0662	1	24114.88	(M+Na)+	6.67
853.1381	1	57645.03	(2M+Na)+	6.61
854.1398	1	25484.41	(2M+Na)+	7.73

— End Of Report —

^{1}H NMR (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [(6-methyl-1,3-benzothiazol-2-yl)sulfanylmethyl]tetrahydrofuran-3,4-diol **(36)**



HPLC (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [(6-methyl-1,3-benzothiazol-2-yl)sulfanylmethyl]tetrahydrofuran-3,4-diol **(36)**

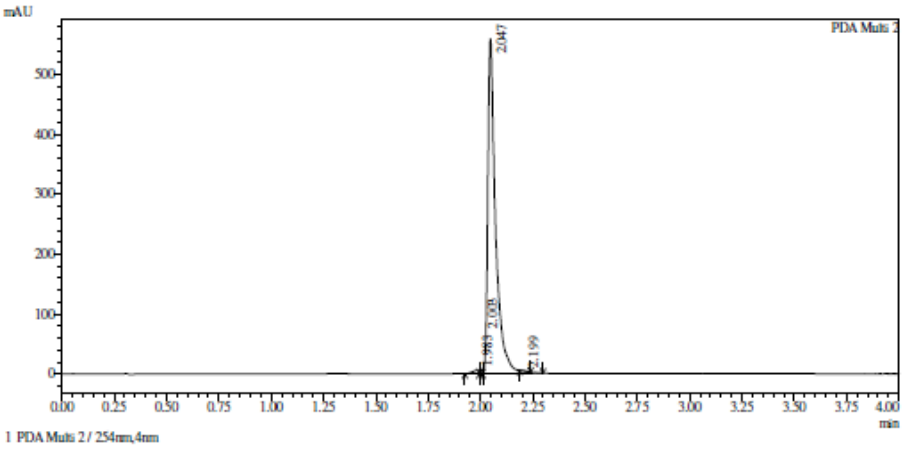


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	2.047	0.057	0.000	1060182	2646473	100.000
Total				1060182	2646473	100.000



Integration result

PeakTable

PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.983	0.449	0.000	5882	12794	0.874
2	2.003	0.000	0.000	6154	5875	0.401
3	2.047	0.060	0.000	559244	1444709	98.655
4	2.199	0.043	2.956	644	1021	0.070
Total				571924	1464399	100.000

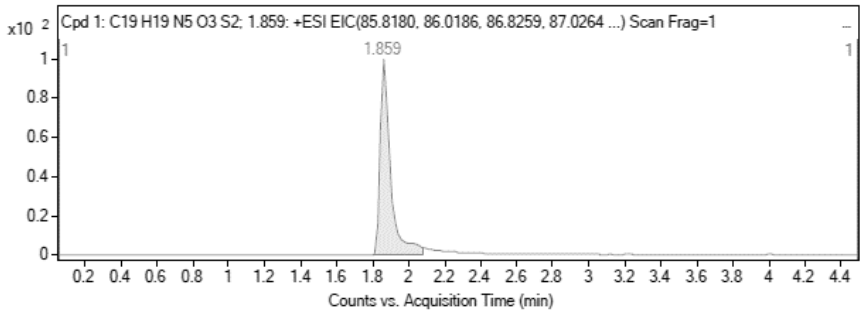
HRMS (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [(6-methyl-1,3-benzothiazol-2-yl)sulfanylmethyl]tetrahydrofuran-3,4-diol **(36)**

Compound Table

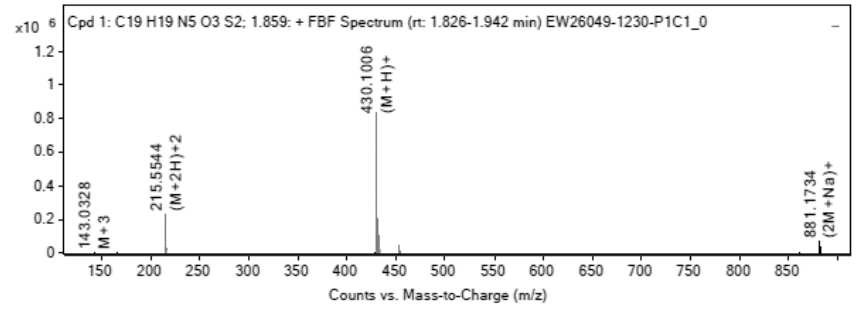
Label	Tgt Score	Mass Error (ppm)	Tgt Formula	Obs. RT	Ref. Mass	Obs. Mass
Cpd 1: C19 H19 N5 O3 S2; 1.859	97.39	0.46	C19 H19 N5 O3 S2	1.859	429.0929	429.0931

Obs. *m/z*	Obs. RT	Obs. Mass	Tgt Formula	Tgt Mass	Tgt Mass Error (ppm)	Find Cpds Algorithm
430.1006	1.859	429.0931	C19 H19 N5 O3 S2	429.0929	0.46	Find by Formula

Compound Chromatograms



MS Zoomed Spectrum

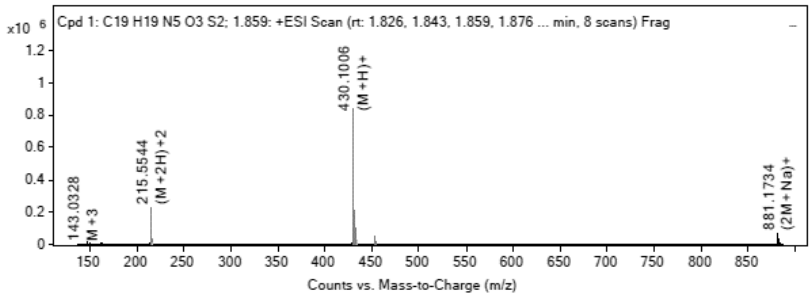


MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
215.5544	2	228431.22	(M+2H)+2

216.0555	2	55924.73 (M+2H)+2
216.5535	2	28726.35 (M+2H)+2
430.1006	1	834947.69 (M+H)+
431.1025	1	204448.72 (M+H)+
432.098	1	99319.41 (M+H)+
452.0811	1	48844.35 (M+Na)+
453.0836	1	12057.81 (M+Na)+
881.1734	1	69624.05 (2M+Na)+
882.1762	1	33133.84 (2M+Na)+

MS Zoomed Spectrum

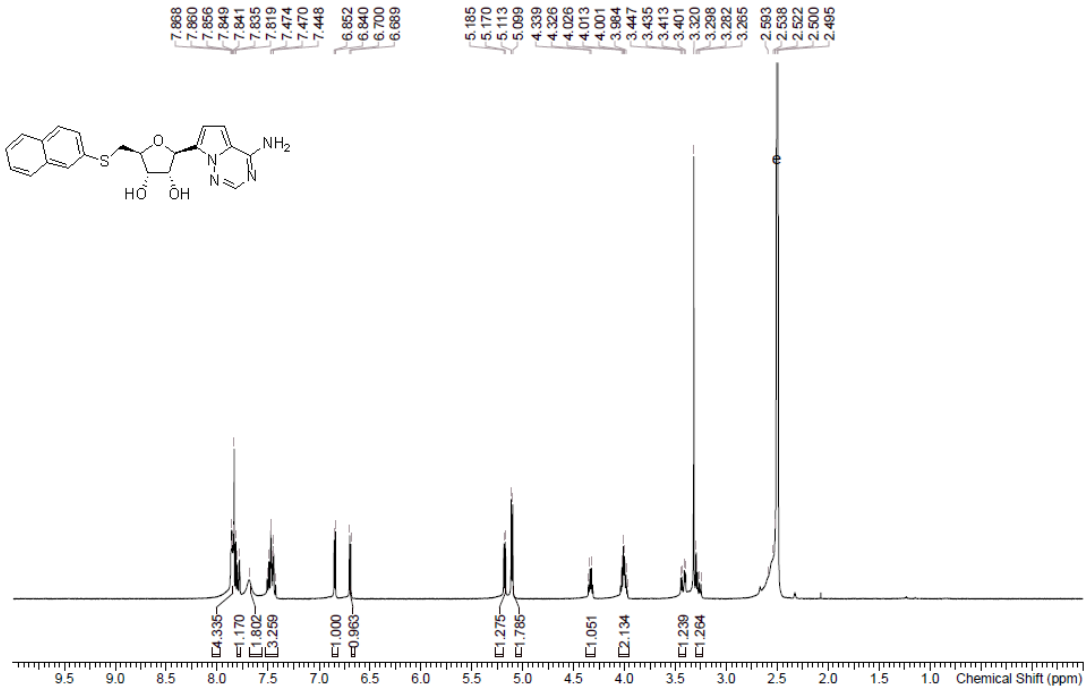


MS Spectrum Peak List

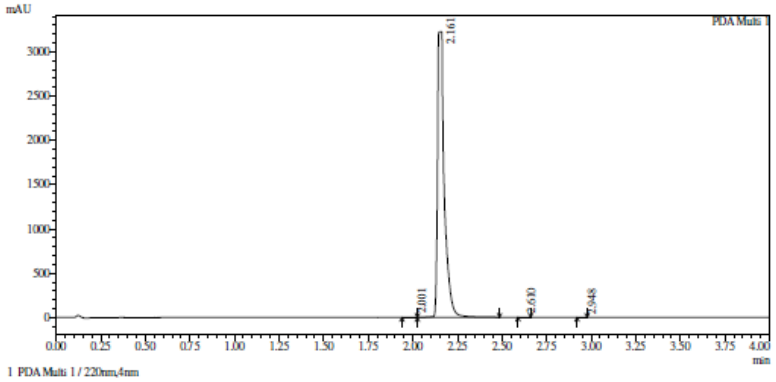
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
215.5544	2	228431.22	(M+2H)+2	-3.06
216.0555	2	55924.73	(M+2H)+2	-2.03
216.5535	2	28726.35	(M+2H)+2	-2.75
430.1006	1	834947.69	(M+H)+	-0.81
431.1025	1	204448.72	(M+H)+	0.87
432.098	1	99319.41	(M+H)+	1.33
452.0811	1	48844.35	(M+Na)+	2.35
453.0836	1	12057.81	(M+Na)+	2.73
881.1734	1	69624.05	(2M+Na)+	1.91
882.1762	1	33133.84	(2M+Na)+	1.69

— End Of Report —

^{1}H NMR (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)- 5-(2-naphthylsulfanylmethyl) tetrahydrofuran-3,4-diol **(37)**



HPLC (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)- 5-(2-naphthylsulfanylmethyl)tetrahydrofuran-3,4-diol **(37)**

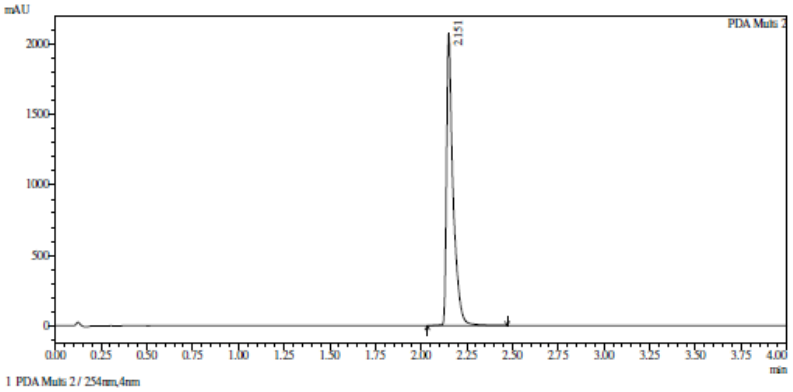


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	2.001	0.103	0.000	1210	3918	0.045
2	2.161	0.050	2.106	3225123	8687268	99.921
3	2.610	0.052	8.854	889	1692	0.019
4	2.948	0.050	6.654	702	1232	0.014
Total				3227925	8694109	100.000



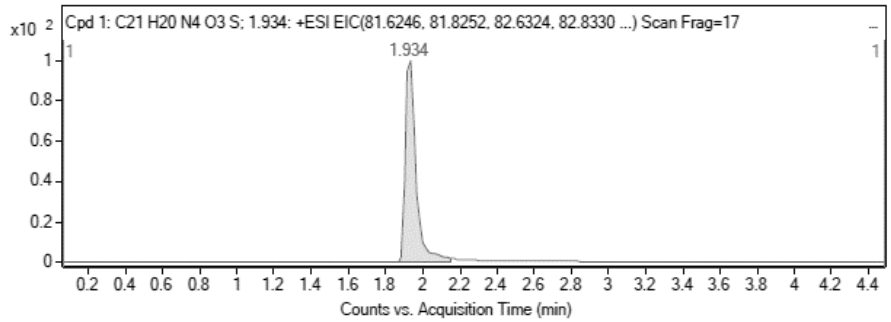
Integration result

PeakTable

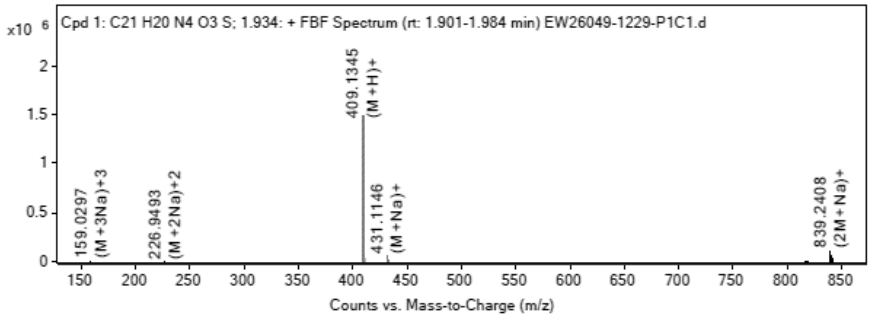
PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	2.151	0.060	0.000	2076332	5202085	100.000
Total				2076332	5202085	100.000

HRMS (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)- 5-(2-naphthylsulfanylmethyl)tetrahydrofuran-3,4-diol **(37)**



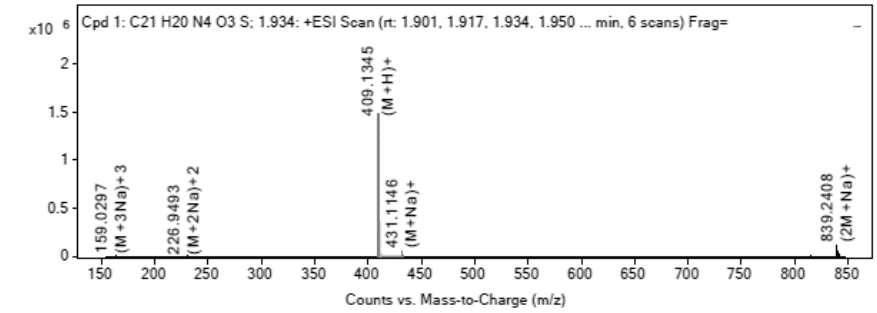
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
409.1345	1	1475529.13	(M+H)+
410.1366	1	389048.5	(M+H)+
411.1338	1	117840.38	(M+H)+
431.1146	1	57345.16	(M+Na)+
432.1174	1	14351.31	(M+Na)+
816.2443	1	3766.16	2M+
839.2408	1	110424.12	(2M+Na)+
840.2431	1	56908.58	(2M+Na)+
841.2425	1	24947.69	(2M+Na)+
842.2418	1	8018.12	(2M+Na)+

MS Zoomed Spectrum

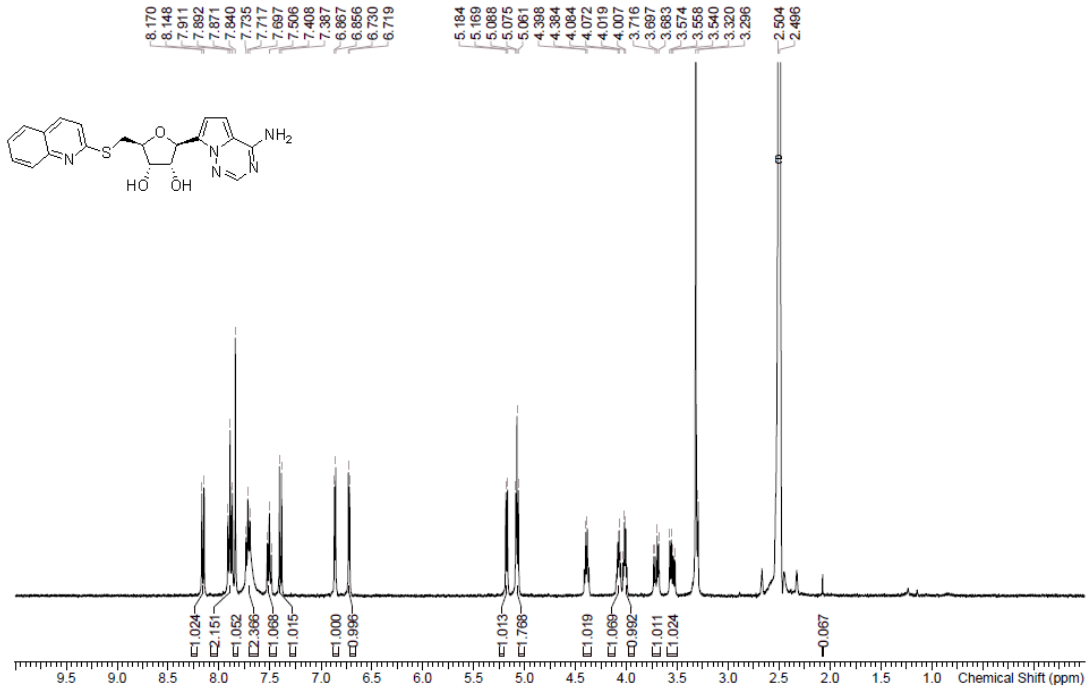


MS Spectrum Peak List

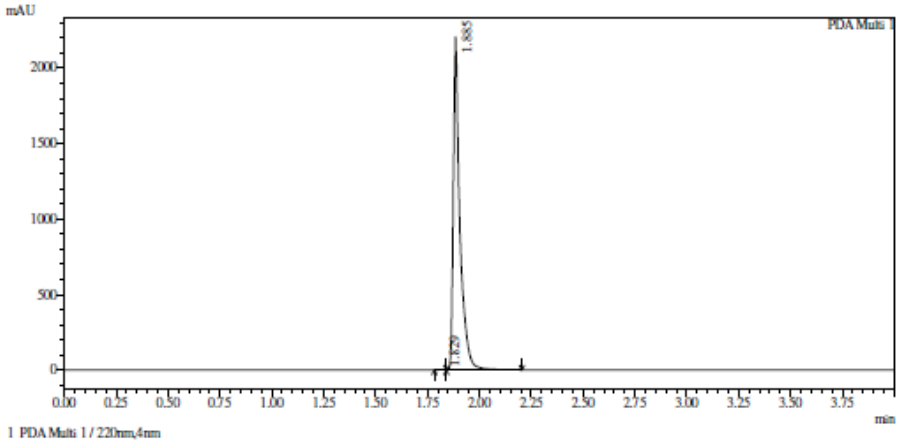
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
409.1345	1	1475529.13	(M+H)+	-3.88
410.1366	1	389048.5	(M+H)+	-1.96
411.1338	1	117840.38	(M+H)+	-1.76
431.1146	1	57345.16	(M+Na)+	0.52
432.1174	1	14351.31	(M+Na)+	0.76
816.2443	1	3766.16	2M+	7.8
839.2408	1	110424.12	(2M+Na)+	-0.38
840.2431	1	56908.58	(2M+Na)+	0.26
841.2425	1	24947.69	(2M+Na)+	-0.36
842.2418	1	8018.12	(2M+Na)+	1.17

--- End Of Report ---

^{1}H NMR (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (2-quinolylsulfanylmethyl)tetrahydrofuran-3,4-diol **(38)**



HPLC (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (2-quinolylsulfanylmethyl)tetrahydrofuran-3,4-diol **(38)**

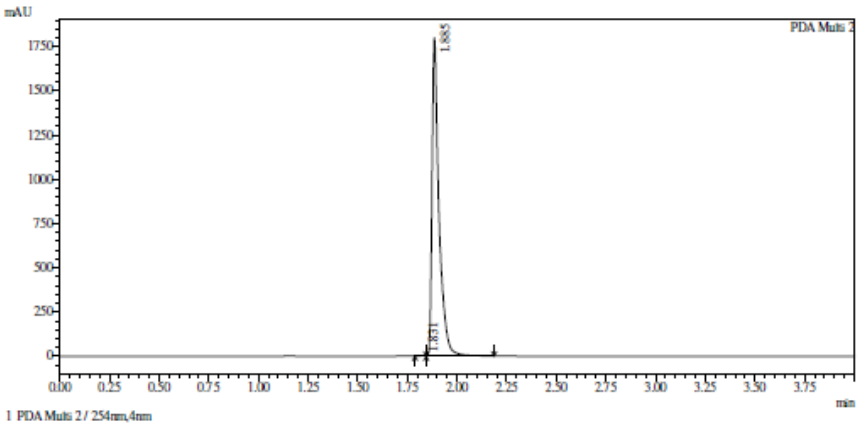


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.829	0.360	0.000	2722	5049	0.105
2	1.885	0.052	0.270	2207403	4826089	99.895
Total				2210125	4831138	100.000



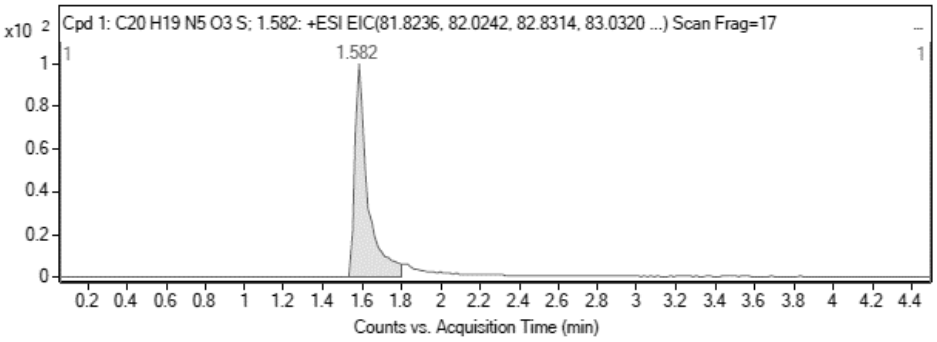
Integration result

PeakTable

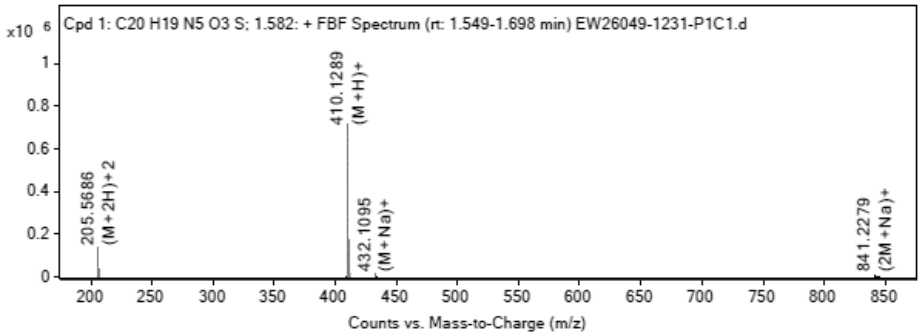
PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.831	0.189	0.000	3022	5723	0.131
2	1.885	0.058	0.443	1799424	4367031	99.869
Total				1802446	4372754	100.000

HRMS (2*S*,3*R*,4*S*,5*S*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- (2-quinolylsulfanylmethyl)tetrahydrofuran-3,4-diol **(38)**



MS Zoomed Spectrum

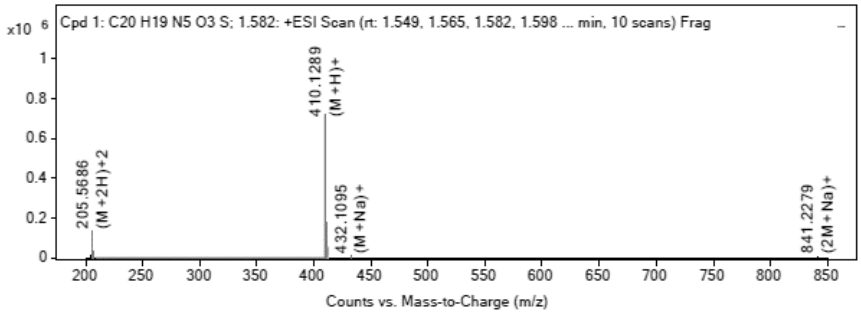


MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
205.5686	2	131317.02	(M+2H)+2
206.0698	2	34125.49	(M+2H)+2

206.5683	2	10675.34 (M+2H)+2
410.1289	1	716498 (M+H)+
411.1309	1	176433.63 (M+H)+
412.1281	1	54705.14 (M+H)+
432.1095	1	11102.03 (M+Na)+
433.1122	1	2709.34 (M+Na)+
841.2279	1	8108.4 (2M+Na)+
842.2323	1	4070.93 (2M+Na)+

MS Zoomed Spectrum

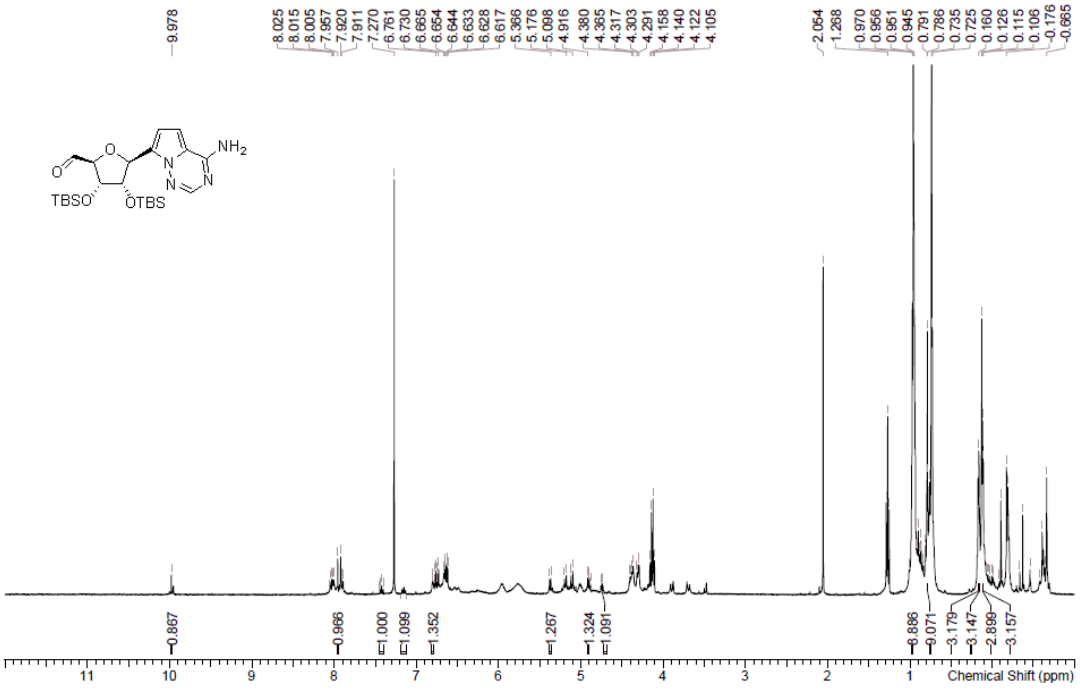


MS Spectrum Peak List

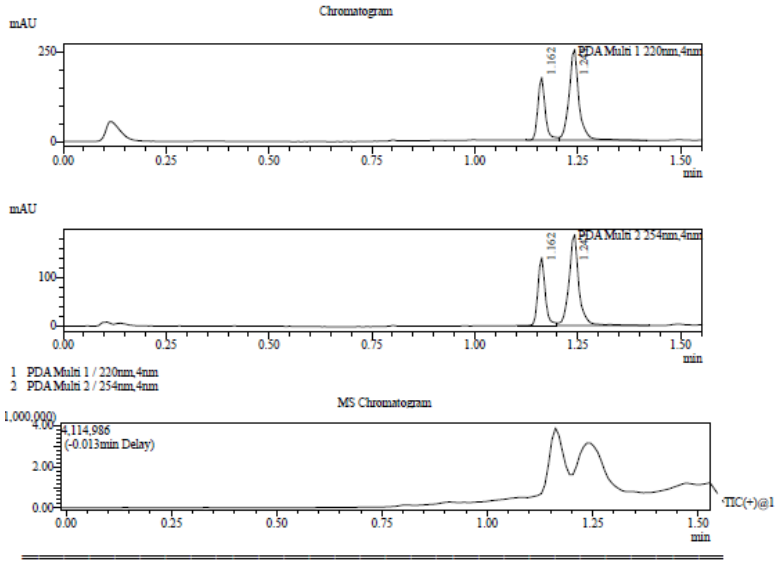
Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
205.5686	2	131317.02	(M+2H)+2	-4.52
206.0698	2	34125.49	(M+2H)+2	-3.51
206.5683	2	10675.34	(M+2H)+2	-2.84
410.1289	1	716498	(M+H)+	-1.86
411.1309	1	176433.63	(M+H)+	0.03
412.1281	1	54705.14	(M+H)+	-0.05
432.1095	1	11102.03	(M+Na)+	1.4
433.1122	1	2709.34	(M+Na)+	1.65
841.2279	1	8108.4	(2M+Na)+	3.56
842.2323	1	4070.93	(2M+Na)+	1.65

— End Of Report —

^{1}H NMR (2S,3R,4S,5S)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-carbaldehyde **(122)**



LCMS (2S,3R,4S,5S)-5-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-carbaldehyde **(122)**



Integration Result

Peak Table

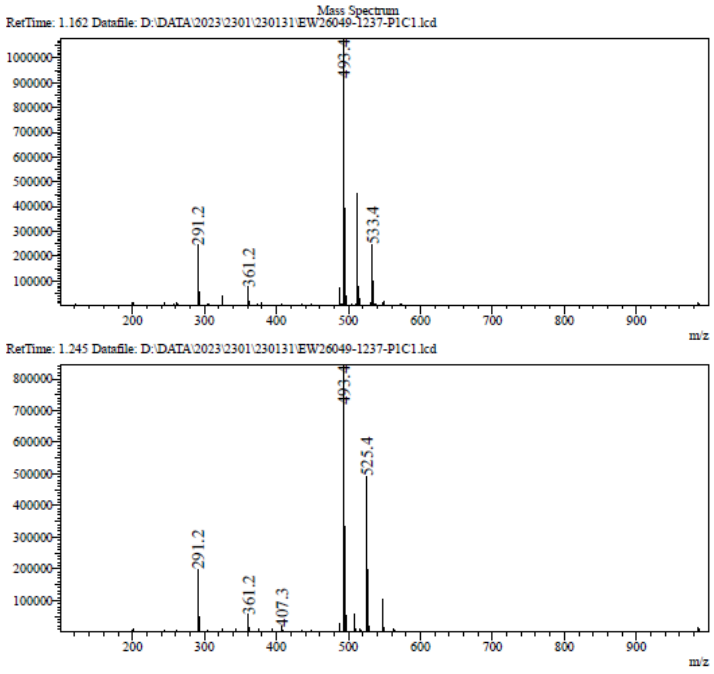
PDA Ch1 220nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.162	175202	40.862	0.036	216793	33.969
2	1.241	253567	59.138	0.046	421417	66.031

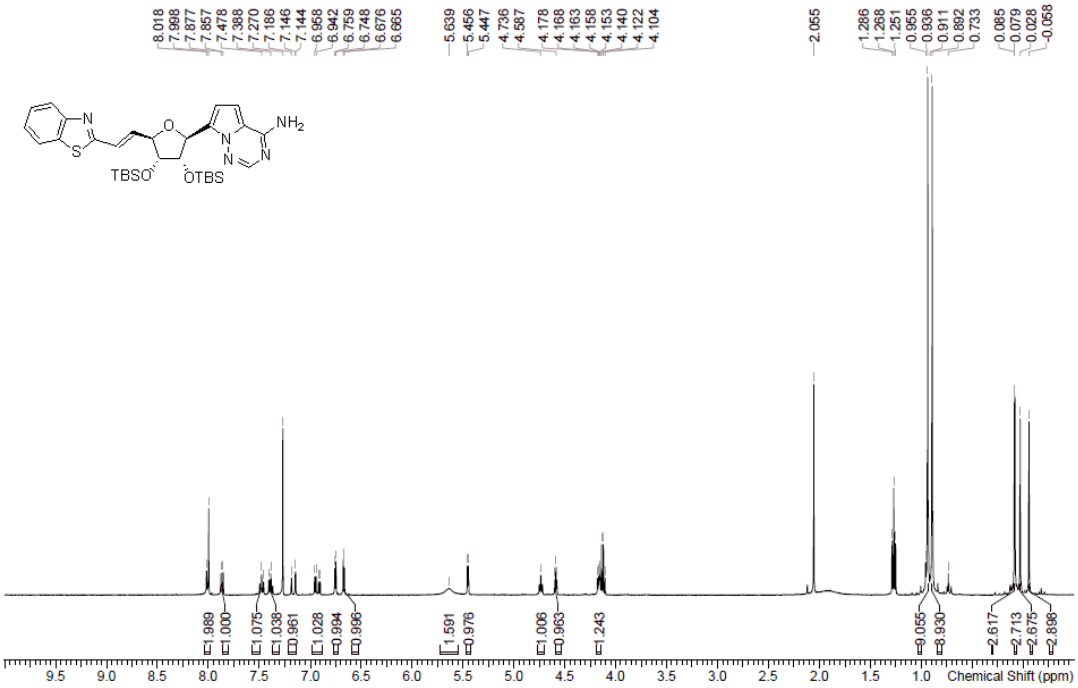
Peak Table

PDA Ch2 254nm

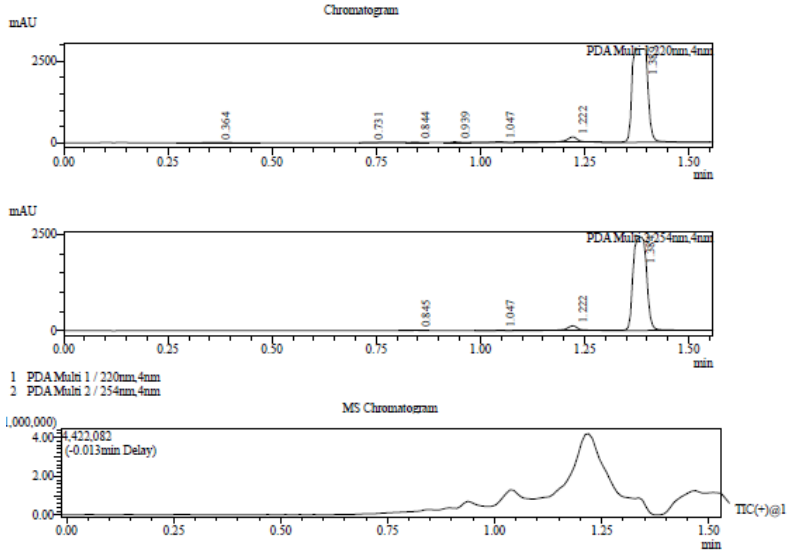
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.162	140119	42.848	0.036	172054	35.564
2	1.241	186894	57.152	0.046	311728	64.436



^{1}H NMR 7-[(2*S*,3*S*,4*R*,5*R*)-5-[(*E*)-2-(1,3-Benzothiazol-2-yl)vinyl]-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(123)**



LCMS 7-[(2*S*,3*S*,4*R*,5*R*)-5-[(*E*)-2-(1,3-Benzothiazol-2-yl)vinyl]-3,4-bis [[tert-butyl(dimethyl)silyl]oxy]tetrahydrofuran-2-yl]pyrrolo[2,1-f][1,2,4]triazin-4-amine **(123)**



Integration Result

Peak Table

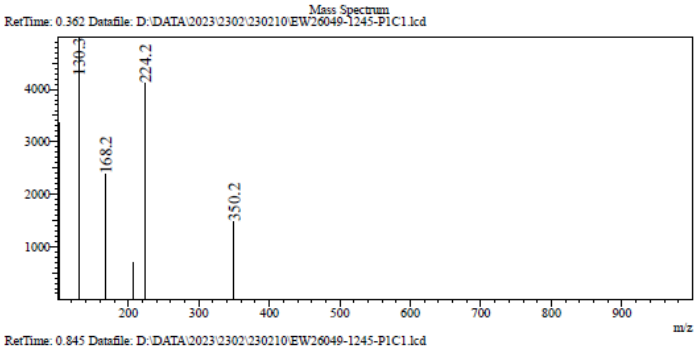
PDA Ch1 220nm

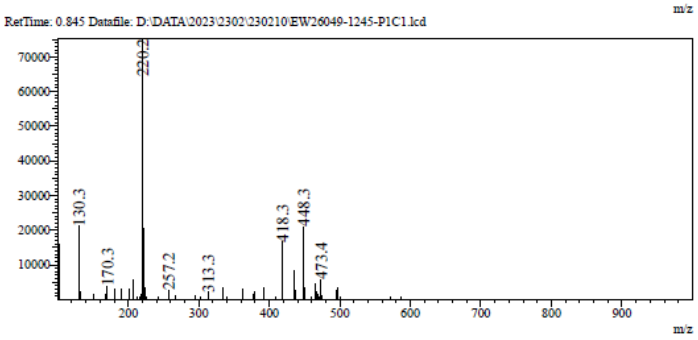
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.364	5345	0.173	0.123	22903	0.289
2	0.731	3391	0.110	0.311	8368	0.106
3	0.844	18885	0.610	0.037	22529	0.284
4	0.939	19380	0.626	0.035	22579	0.285
5	1.047	23326	0.754	0.052	50926	0.643
6	1.222	168259	5.436	0.054	370884	4.683
7	1.389	2856913	92.292	0.062	7421135	93.709

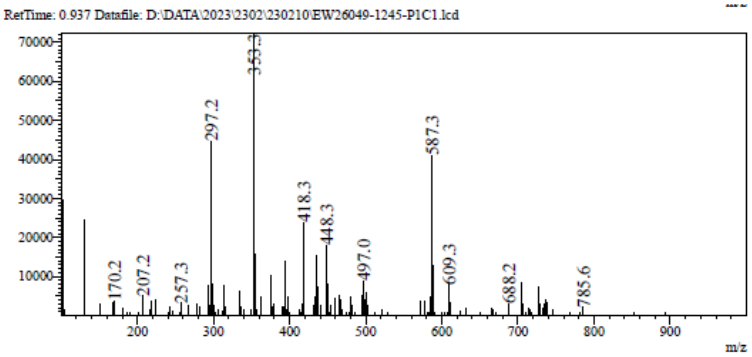
Peak Table

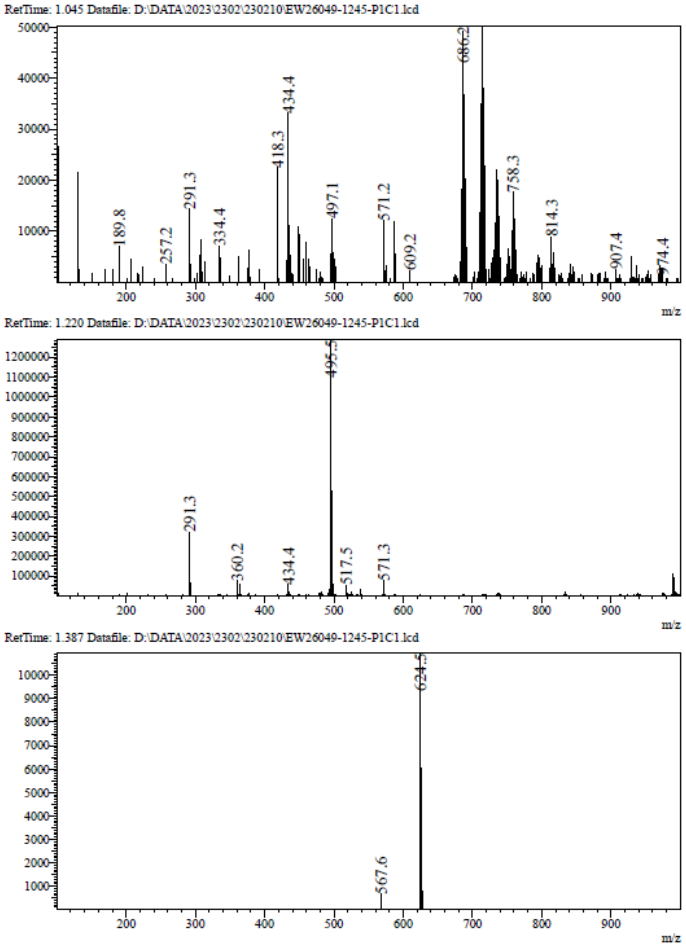
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	0.845	7004	0.273	0.035	8121	0.142

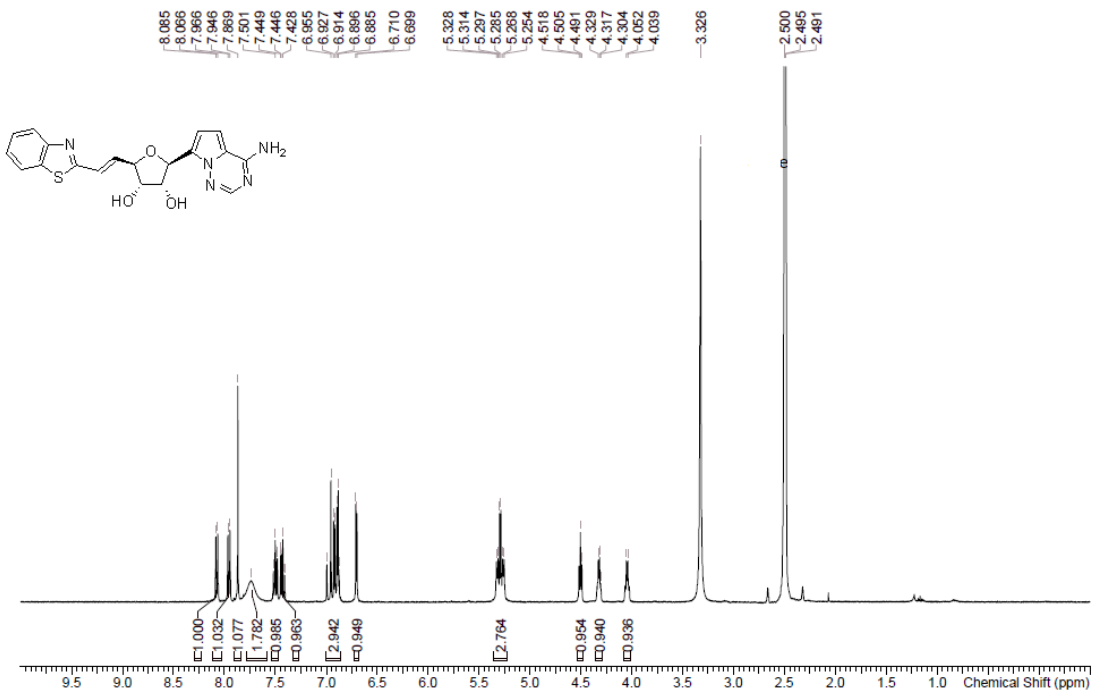

Mass Spectrum
RetTime: 0.362 Datafile: D:\DATA\2023\2302\230210\EW26049-1245-P1C1.lcd
130.3
224.2
168.2
350.2
m/z


RetTime: 0.845 Datafile: D:\DATA\2023\2302\230210\EW26049-1245-P1C1.lcd
224.2
130.3
170.3
257.2
313.3
418.3
448.3
473.4
m/z

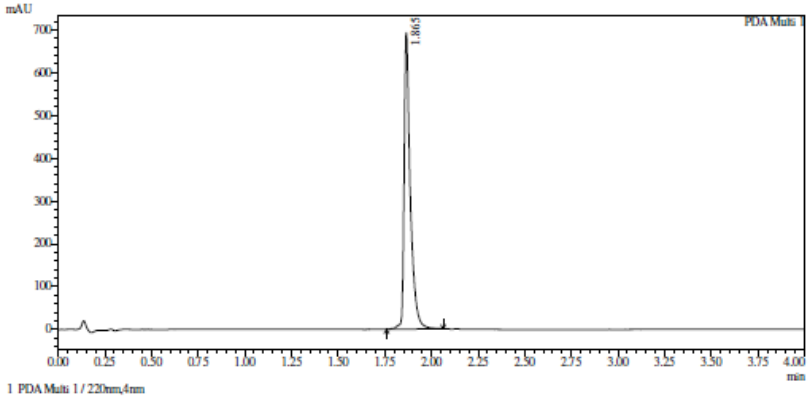

RetTime: 0.937 Datafile: D:\DATA\2023\2302\230210\EW26049-1245-P1C1.lcd
353.3
297.2
587.3
418.3
448.3
497.0
170.2
207.2
257.3
609.3
688.2
785.6
m/z



^{1}H NMR (2*S*,3*R*,4*S*,5*R*)-2-(4-aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5-[(*E*)-2-(1,3-benzothiazol-2-yl)vinyl]tetrahydrofuran-3,4-diol **(40)**



HPLC (2*S*,3*R*,4*S*,5*R*)-2-(4-aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5-[(*E*)-2- (1,3-benzothiazol-2-yl)vinyl]tetrahydrofuran-3,4-diol **(40)**

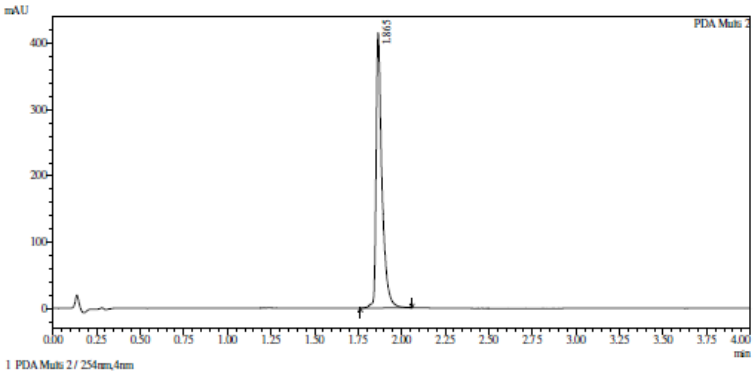


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.865	0.055	0.000	692840	1597361	100.000
Total				692840	1597361	100.000



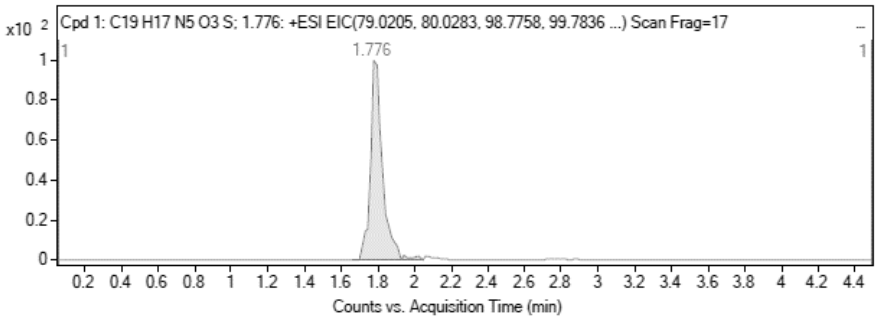
Integration result

PeakTable

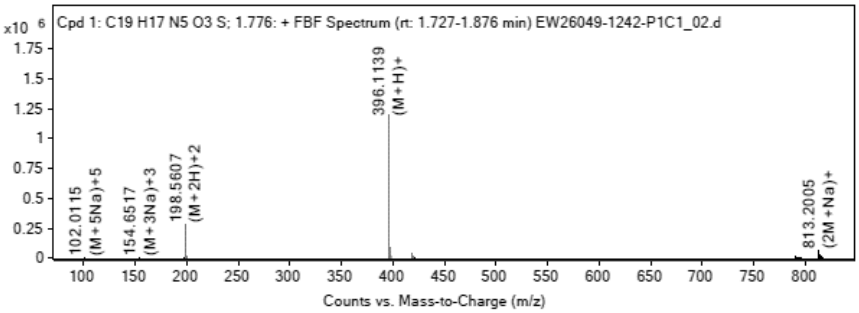
PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.865	0.056	0.000	415790	978971	100.000
Total				415790	978971	100.000

HRMC (2*S*,3*R*,4*S*,5*R*)-2-(4-aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5-[(*E*)-2- (1,3-benzothiazol-2-yl)vinyl]tetrahydrofuran-3,4-diol **(40)**



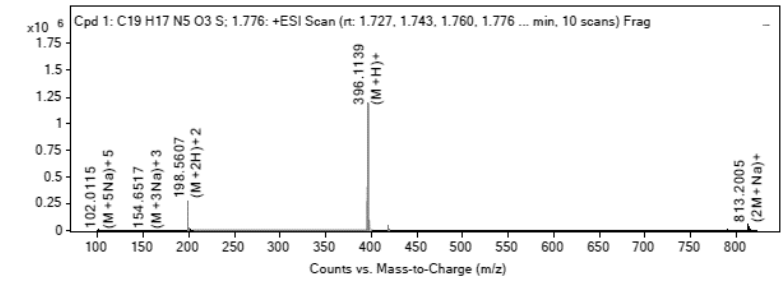
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. *m/z*	Charge	Abund	Ion/Isotope
198.5607	2	273549.53	(M+2H)+2
199.0618	2	66969.58	(M+2H)+2
199.5605	2	21584.39	(M+2H)+2
396.1139	1	1196108.75	(M+H)+
397.116	1	286005.56	(M+H)+
398.113	1	87600.13	(M+H)+
418.0943	1	42684.21	(M+Na)+
813.2005	1	55999.89	(2M+Na)+
814.2029	1	26855.9	(2M+Na)+
815.2003	1	12059.15	(2M+Na)+

MS Zoomed Spectrum

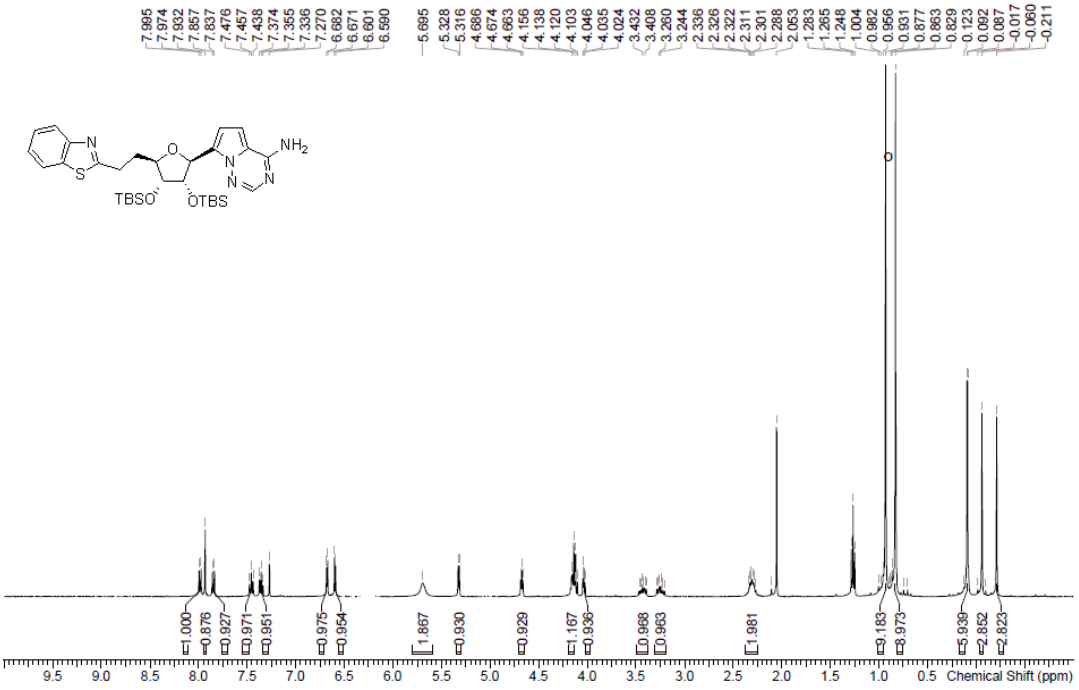


MS Spectrum Peak List

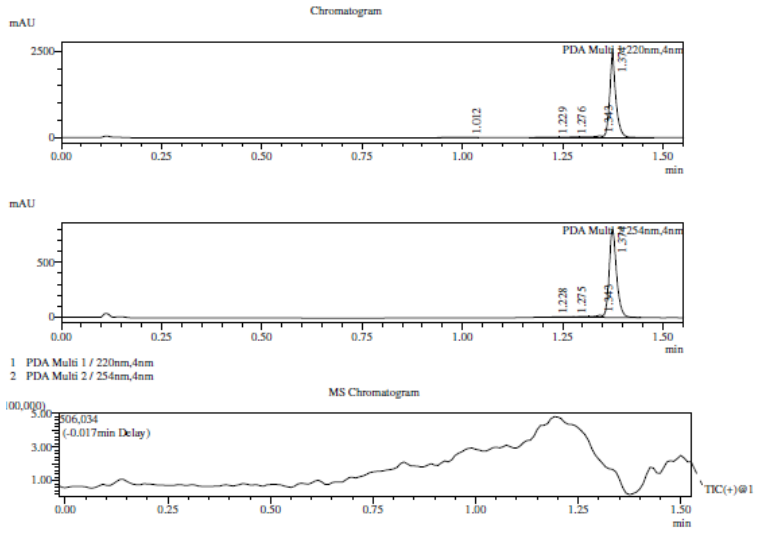
Obs. *m/z*	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
198.5607	2	273549.53	(M+2H)+2	-4.18
199.0618	2	66969.58	(M+2H)+2	-2.62
199.5605	2	21584.39	(M+2H)+2	-3.51
396.1139	1	1196108.75	(M+H)+	-3.56
397.116	1	286005.56	(M+H)+	-2.02
398.113	1	87600.13	(M+H)+	-1.76
418.0943	1	42684.21	(M+Na)+	0.24
813.2005	1	55999.89	(2M+Na)+	-1.04
814.2029	1	26855.9	(2M+Na)+	-0.55
815.2003	1	12059.15	(2M+Na)+	0.78

--- End Of Report ---

^{1}H NMR 7-((2*S*,3*S*,4*R*,5*R*)-5-(2-(benzo[d]thiazol-2-yl)ethyl)-3,4-bis((tert-butyl dimethylsilyl)oxy)tetrahydrofuran-2-yl)pyrrolo[2,1-f][1,2,4]triazin-4-amine **(124)**



LCMS 7-((2*S*,3*S*,4*R*,5*R*)-5-(2-(benzo[d]thiazol-2-yl)ethyl)-3,4-bis((tert-butyl dimethylsilyl)oxy)tetrahydrofuran-2-yl)pyrrolo[2,1-f][1,2,4]triazin-4-amine **(124)**



Integration Result

Peak Table

PDA Ch1 220nm

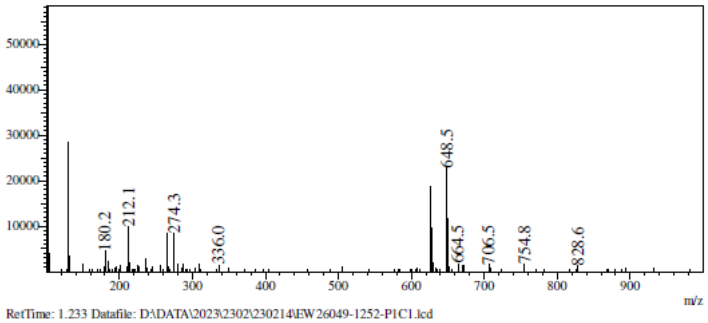
Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.012	2280	0.085	0.092	8860	0.314
2	1.229	8294	0.309	0.789	20726	0.735
3	1.276	14669	0.546	0.000	37473	1.329
4	1.343	48085	1.789	0.045	88300	3.132
5	1.374	2614459	97.272	0.137	2663576	94.489

Peak Table

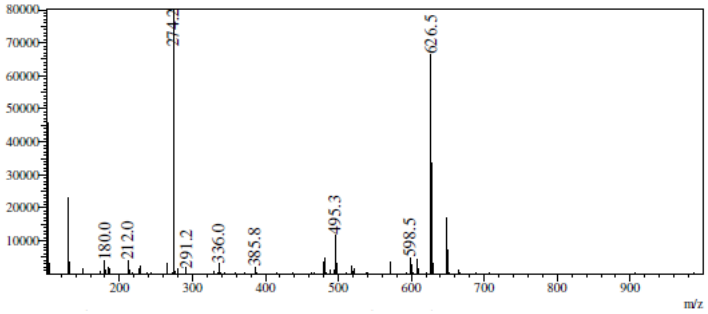
PDA Ch2 254nm

Peak#	Ret. Time	Height	Height%	USP Width	Area	Area%
1	1.228	2554	0.304	0.149	7953	0.730
2	1.275	5432	0.646	0.654	18625	1.711
3	1.343	20173	2.399	0.049	26077	2.395
4	1.374	812831	96.652	0.035	1036189	95.164

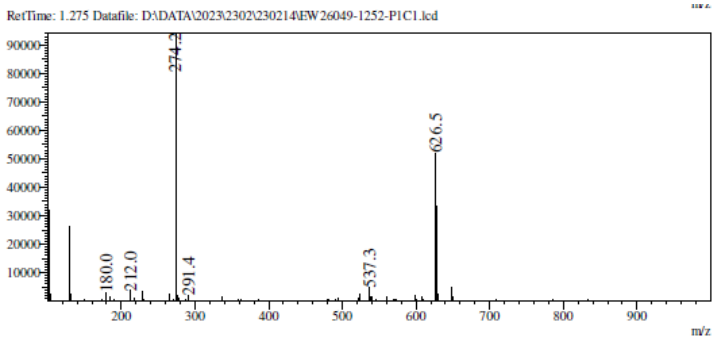
Mass Spectrum
RetTime: 1.008 Datafile: D:\DATA\2023\2302\230214\EW26049-1252-P1C1.lcd



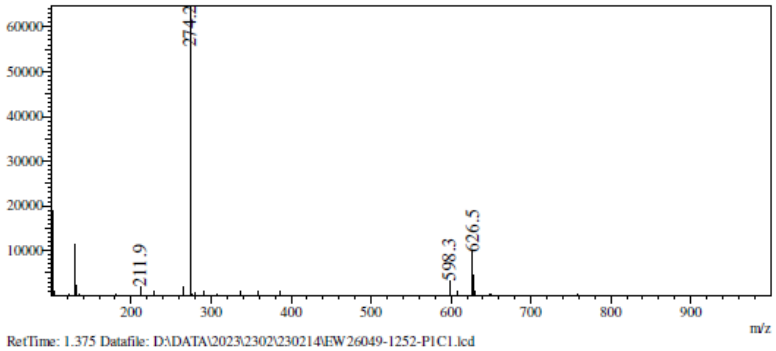
RetTime: 1.233 Datafile: D:\DATA\2023\2302\230214\EW26049-1252-P1C1.lcd



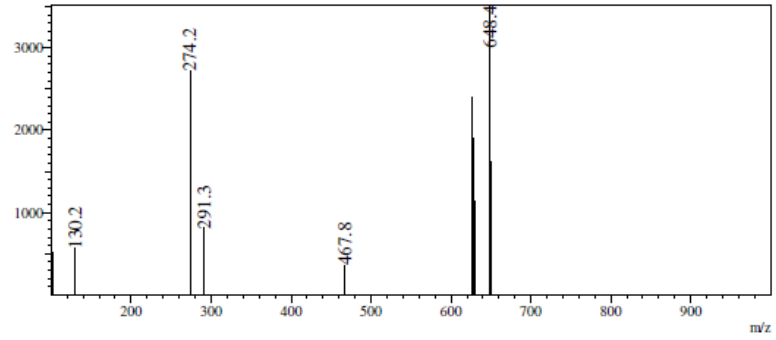
RetTime: 1.275 Datafile: D:\DATA\2023\2302\230214\EW26049-1252-P1C1.lcd



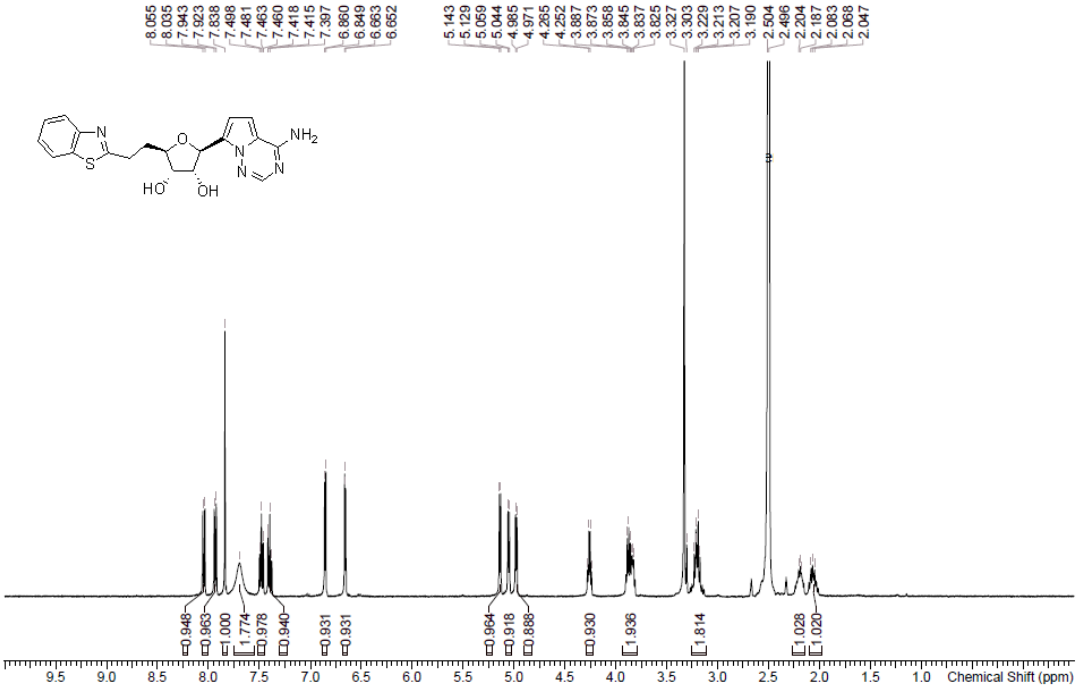
RetTime: 1.342 Datafile: D:\DATA\2023\2302\230214\EW26049-1252-P1C1.lcd



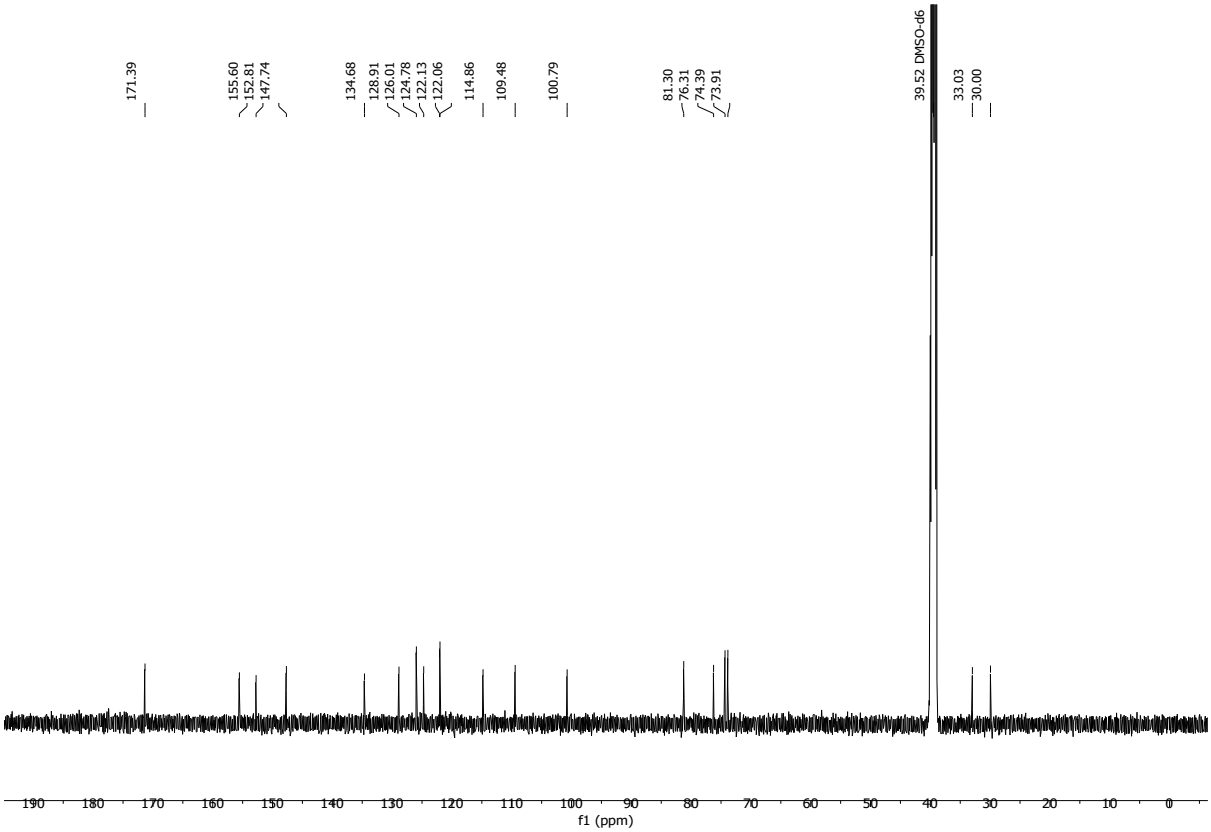
RetTime: 1.375 Datafile: D:\DATA\2023\2302\230214\EW26049-1252-P1C1.lcd



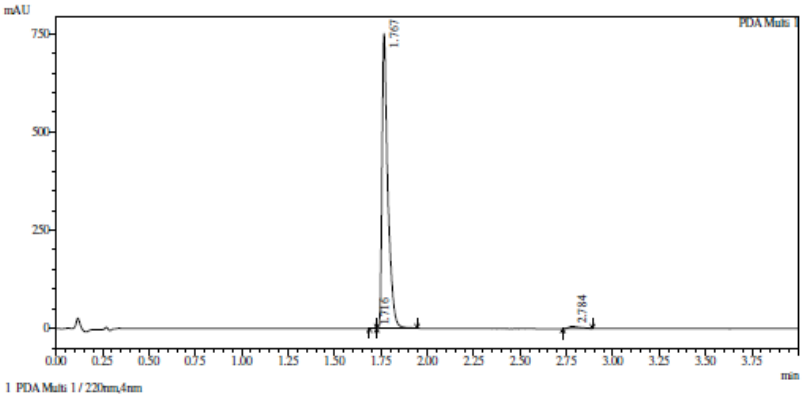
^{1}H NMR (2*S*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [2-(1,3-benzothiazol-2-yl)ethyl]tetrahydrofuran-3,4-diol **(39)**



^{13}C NMR (2*S*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [2-(1,3-benzothiazol-2-yl)ethyl]tetrahydrofuran-3,4-diol **(39)**



HPLC (2*S*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [2-(1,3-benzothiazol-2-yl)ethyl]tetrahydrofuran-3,4-diol **(39)**

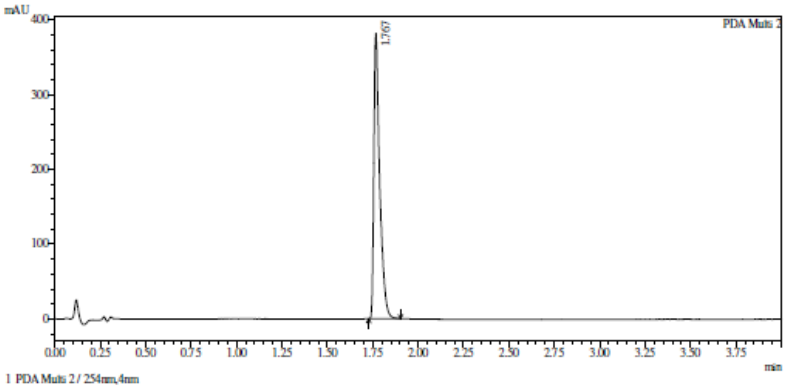


Integration result

PeakTable

PDA Ch1 220nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.716	0.000	0.000	999	1596	0.096
2	1.767	0.054	0.000	749570	1640868	98.651
3	2.784	0.110	12.387	5120	20847	1.253
Total				755689	1663311	100.000



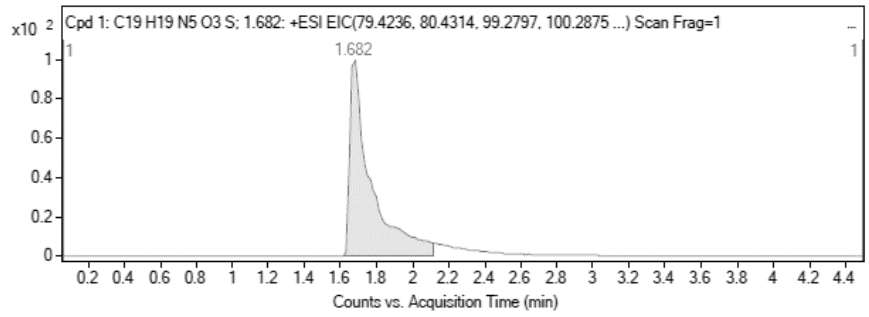
Integration result

PeakTable

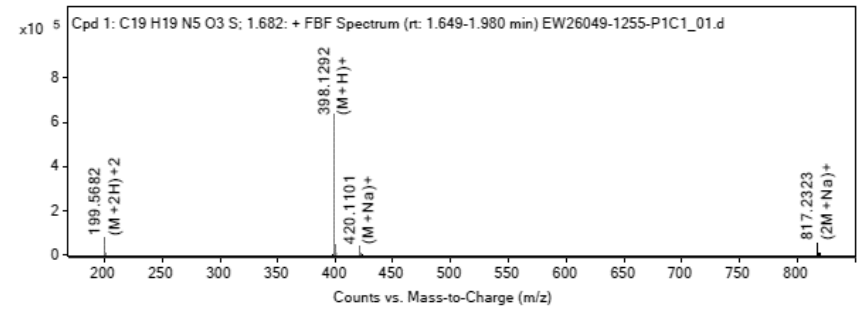
PDA Ch2 254nm

Peak#	Ret. Time	USP Width	Resolution	Height	Area	Area %
1	1.767	0.056	0.000	381870	856790	100.000
Total				381870	856790	100.000

HRMS (2*S*,3*R*,4*S*,5*R*)-2-(4-Aminopyrrolo[2,1-f][1,2,4]triazin-7-yl)-5- [2-(1,3-benzothiazol-2-yl)ethyl]tetrahydrofuran-3,4-diol **(39)**



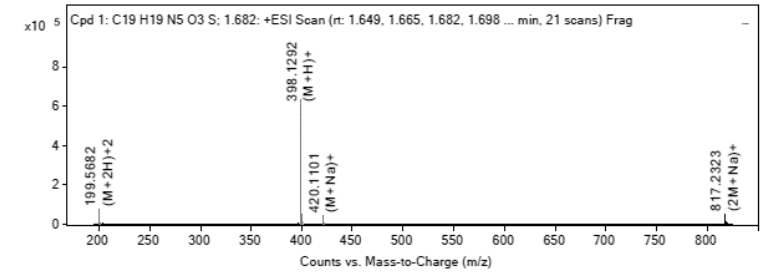
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope
199.5682	2	75111.74	(M+2H)+2
200.0695	2	18732.5	(M+2H)+2
398.1292	1	633819.06	(M+H)+
399.1313	1	152739.59	(M+H)+
400.1286	1	46530.06	(M+H)+
420.1101	1	41638.2	(M+Na)+
421.1129	1	10103.08	(M+Na)+
817.2323	1	54105.62	(2M+Na)+
818.2347	1	26256.98	(2M+Na)+
819.2327	1	11576.3	(2M+Na)+

MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Charge	Abund	Ion/Isotope	Tgt Mass Error (ppm)
199.5682	2	75111.74	(M+2H)+2	-2.55
200.0695	2	18732.5	(M+2H)+2	-1.85
398.1292	1	633819.06	(M+H)+	-2.6
399.1313	1	152739.59	(M+H)+	-1.07
400.1286	1	46530.06	(M+H)+	-1.74
420.1101	1	41638.2	(M+Na)+	-0.06
421.1129	1	10103.08	(M+Na)+	-0.1
817.2323	1	54105.62	(2M+Na)+	-1.61
818.2347	1	26256.98	(2M+Na)+	-1.2
819.2327	1	11576.3	(2M+Na)+	-0.56

--- End Of Report ---