Supplementary Information for

Chiral Binaphthol-Catalyzed Enantioselective Conjugate Addition of Alkenyl Trifluoroborates to Alkenyl-Substituted Benzothiazoles

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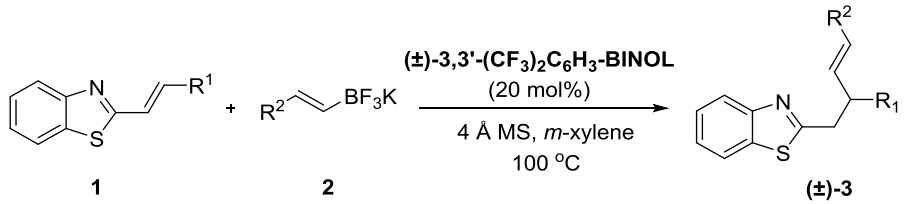
1. General information

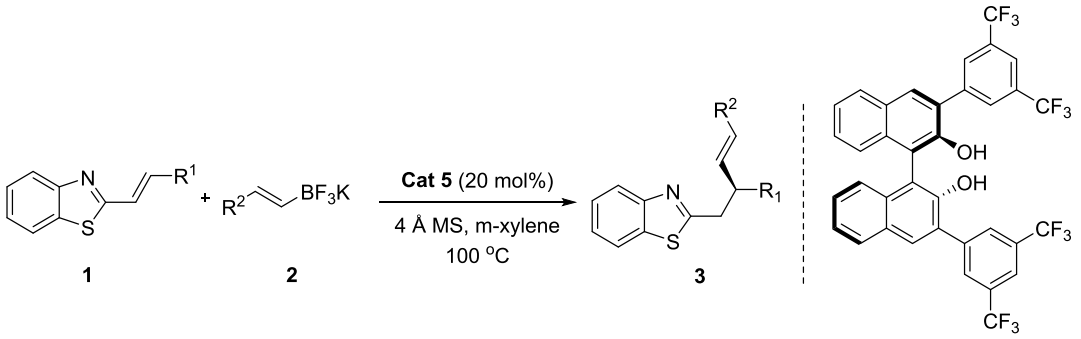
The ^{1}H NMR spectra were recorded on a 400 MHz NMR spectrometer. The ^{13}C NMR spectra were recorded at 100 MHz. The ^{19}F NMR spectra were recorded at 376 MHz. The residual solvent signals were used as references and the chemical shifts were converted to the TMS scale. The coupling constants were given in Hz. High-resolution mass spectra (HRMS) were recorded with a ThermoScientific Orbitrap Explories MX mass spectrometer. The conversion of starting materials was monitored by thin layer chromatography (TLC) using silica gel plates (silica gel 60 F254 0.25 mm), and components were visualized under UV light (254 and 365 nm). Column chromatography was performed on silica gel 300-400 mesh. HPLC analysis was performed on a Dionex UltiMate 3000, ThermoScientific. Chiral HPLC data for the products could be obtained using a Chiralpak IA, Chiralpak IB, Chiralpak IC, Chiralpak IE, and Chiralpak IG, Chiralcel OJ-H column. All reactions were carried out under an atmosphere of nitrogen using standard Schlenk techniques. All the reactions that require heating were heated by oil bath. Unless otherwise noted, all solvents and reagents were obtained from commercial sources and purified according to established procedures before use. Chiral catalysts (*R*)-3,3′-Br_2-BINOL **Cat 1**, (*R*)-BINOL **Cat 2**, (*R*)-3,3′-I_2-BINOL **Cat 3**, (*R*)-3,3′-Ph_2-BINOL **Cat 4**, **Cat 5** bearing two 3,5-*bis*(trifluoromethyl)phenyl groups, and **Cat 6** (*R*)-3,3′-Me_2-BINOL were purchased from Daicel Chemical Industries Ltd. **Cat 7** and **Cat 8** were prepared according to the procedure previously reported.[1] Alkenyl-substituted benzothiazoles **1a-1r** and alkenylthiazoline **1s** were synthesized according to the literature procedures.[2] Potassium trifluoroborates **2m-2p**, **2s,** and **2t** were purchased from commercial suppliers and used without further purification. Potassium alkenyl trifluoroborates **2a-2l, 2q,** and **2r** were prepared according to those reported in the literature.[3]

2. General procedures for the preparation of racemic products



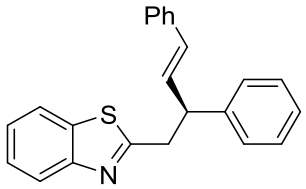
To a 10 mL Schlenk tube equipped with a stirring bar was added 4 Å MS (100 mg), and the tube was flame-dried under high vacuum. After cooling to r.t., the tube was then back-filled with nitrogen. Then trifluoroborate salts **2a**–**2m** (0.2 mmol, 2.0 equiv), (±)-3,3'-$(CF_3)_2C_6H_3$-BINOL (0.02 mmol, 20 mol %), alkenyl-substituted benzothiazoles **1a**–**1s** (0.1 mmol, 1.0 equiv), and dry *m*-xylene (1.0 mL) were successively added to the test tube under N_2. The tube was sealed up with a screw cap, and allowed to stir at 100 ℃ in an oil bath for 48 h. After the removal of solvents via rotary evaporation, the residue was purified through flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 100:1–50:1) to give pure racemic adducts **3**.

3. General procedures for the enantioselective conjugate addition of alkenyl trifluoroborates to alkenyl-substituted benzothiazoles



To a 10 mL Schlenk tube equipped with a stirring bar was added 4 Å MS (100 mg), and the tube was flame-dried under high vacuum. After cooling to r.t., the tube was then back-filled with nitrogen. Then trifluoroborate salts **2a–2m** (0.2 mmol, 2.0 equiv), (*R*)-3,3'-$(CF_3)_2C_6H_3$-BINOL (0.02 mmol, 20 mol %), alkenyl-substituted benzothiazoles **1a–1s** (0.1 mmol, 1.0 equiv), and dry *m*-xylene (1.0 mL) were successively added to the test tube under N_2. The tube was sealed up with a screw cap, and allowed to stir at 100 ℃ in an oil bath for 48 h. After the removal of solvents via rotary evaporation, the residue was purified through flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 100:1–50:1) to give pure adducts **3**.

(S,E)-2-(2,4-diphenylbut-3-en-1-yl)benzo[d]thiazole **(3aa)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (31.3 mg, 92% yield); mp 73-74 °C;

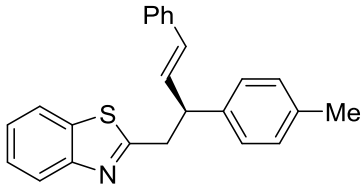
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.0 min, t_R (minor) = 5.5 min, 99.8:0.2 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +16.1 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.43 (t, *J* = 8.0 Hz, 1H), 7.33-7.18 (m, 11H), 6.48-6.40 (m, 2H), 4.18-4.13 (m, 1H), 3.69-3.58 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.7, 153.2, 142.6, 137.2, 135.4, 132.0, 131.1, 128.9, 128.6, 127.9, 127.5, 127.0, 126.4, 126.0, 124.9, 122.7, 121.6, 49.2, 40.7;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{20}NS$, 342.1311; found, 342.1311.

(S,E)-2-(4-phenyl-2-(p-tolyl)but-3-en-1-yl)benzo[d]thiazole **(3ba)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

White soild (27.4 mg, 77% yield); mp 62-63 °C;

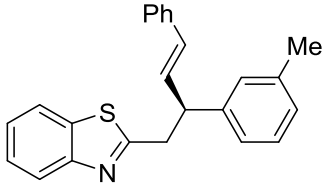
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.1 min, t_R (minor) = 5.4 min, 99.7:0.3 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +19.3 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.44-7.40 (m, 11H), 7.33-7.12 (m, 10H), 6.46-6.38 (m, 2H), 4.14-4.09 (m, 1H), 3.67-3.56 (m, 2H), 2.31 (s, 3H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.8, 153.2, 139.5, 137.2, 136.6, 135.4, 132.3, 130.8, 129.6, 128.6, 127.7, 127.4, 126.4, 126.0, 124.8, 122.7, 121.6, 48.7, 40.8, 21.2;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{22}NS$, 356.1467; found, 356.1468.

(S,E)-2-(4-phenyl-2-(m-tolyl)but-3-en-1-yl)benzo[d]thiazole **(3ca)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

White soild (24.3 mg, 68% yield); mp 77-79 °C;

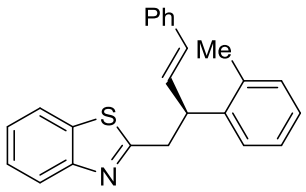
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.7 min, t_R (minor) = 5.2 min, 99.5:0.5 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +15.7 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.45-7.40 (m, 1H), 7.33-7.12 (m, 9H),7.04 (d, *J* = 7.6 Hz, 1H), 6.43-6.42 (m, 2H), 4.13-4.08 (m, 1H), 3.68-3.57 (m, 2H), 2.33 (s, 3H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.8, 153.2, 142.6, 138.5, 137.2, 135.4, 132.1, 131.0, 128.8, 128.62, 128.58, 127.8, 127.5, 126.4, 126.0, 124.8, 122.7, 121.6, 49.1, 40.8, 21.6;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{22}NS$, 356.1467; found, 356.1468.

(S,E)-2-(4-phenyl-2-(o-tolyl)but-3-en-1-yl)benzo[d]thiazole **(3da)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Colorless oil (19.9 mg, 56% yield);

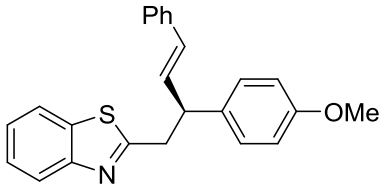
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.6 min, t_R (minor) = 4.9 min, 99.4:0.6 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +19.5 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 7,6 Hz, 1H), 7.45-7.37 (m, 2H), 7.33-7.14 (m, 9H), 6.43-6.34 (m, 2H), 4.43-4.38 (m, 1H), 3.70-3.57 (m, 2H), 2.37 (s, 3H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.9, 153.2, 140.5, 137.2, 135.4, 131.8, 130.87, 130.85, 128.6, 127.5, 126.8, 126.7, 126.6, 126.4, 126.0, 124.9, 122.8, 121.6, 44.5, 40.2, 19.9;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{22}NS$, 356.1467; found, 356.1468.

(S,E)-2-(2-(4-methoxyphenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ea)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (18.9 mg, 51% yield); mp 63-65 °C

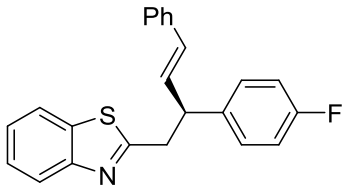
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 0.5 mL/min, λ = 254 nm) t_R (major) = 16.3 min, t_R (minor) = 14.7 min, 99.7:0.3 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +5.4 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.77 (d, *J* = 7.6 Hz, 1H), 7.45-7.41 (m, 1H), 7.34-7.18 (m, 8H), 6.87-6.84 (m, 2H), 6.46-6.38 (m, 2H), 4.13-4.08 (m, 1H), 3.78 (s, 3H), 3.67-3.54 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.8, 158.6, 153.1, 137.2, 135.4, 134.6, 132.4, 130.7, 128.9, 128.6, 127.5, 126.4, 126.0, 124.8, 122.7, 121.6, 114.3, 55.4, 48.3, 40.9;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{22}NOS$, 372.1417; found, 372.1417.

(S,E)-2-(2-(4-fluorophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3fa)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow soild (26.7 mg, 74% yield); mp 85-87 °C

HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.9 min, t_R (minor) = 5.5 min, 99.4:0.6 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +12.3 (*c* 1.0, $CHCl_3$);

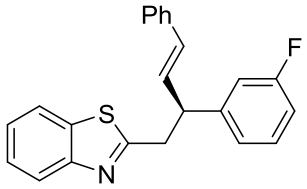
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.46-7.42 (m, 1H), 7.35-7.18 (m, 8H), 7.02-6.97 (m, 2H), 6.46-6,37 (m, 2H), 4.17-4.13 (m, 1H), 3.67-3.53 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.3, 161.9 (d, *J* = 244.0 Hz), 153.2, 138.2 (d, *J* = 3.0 Hz), 137.0, 135.3, 131.8, 131.1, 129.4 (d, *J* = 8.0 Hz), 128.7, 127.6, 126.5, 126.1, 125.0, 122.8, 121.6, 115.7(d, *J* = 22.0 Hz), 48.3, 40.8;

^{19}F {^{1}H} NMR (376 MHz, $CDCl_3$) δ –115.9;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}FNS$, 360.1217; found, 360.1217.

(S,E)-2-(2-(3-fluorophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ga)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

White solid (33.6 mg, 93% yield); mp 81-83 °C

HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.0 min, t_R (minor) = 5.5 min, 99.8:0.2 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +14.9 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.45-7.41 (m, 1H), 7.34-7.17 (m, 7H), 7.10-7.02 (m, 2H), 6.94-6.89 (m, 1H), 6.47-6,36 (m, 2H), 4.20-4.14 (m, 1H), 3.67-3.55 (m, 2H);

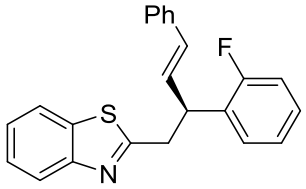
^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.1, 163.1 (d, *J* = 245.0 Hz), 153.2, 145.2

(d, *J* = 7.0 Hz), 136.9, 135.3, 131.5, 131.2, 130.4 (d, *J* = 9.0 Hz), 128.7, 127.7, 126.5, 126.1, 125.0, 123.5 (d, *J* = 3,0 Hz), 122.8, 121.6, 114.8 (d, *J* = 22.0 Hz), 114.0 (d, *J* = 21.0 Hz), 48.8, 40.5;

^{19}F {^{1}H} NMR (376 MHz, $CDCl_3$) δ –112.6;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}FNS$, 360.1217; found, 360.1217.

(S,E)-2-(2-(2-fluorophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ha)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow soild (27.6 mg, 77% yield); mp 98-99 °C

HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 0.5 mL/min, λ = 254 nm) t_R (major) = 10.8 min, t_R (minor) = 9.6 min, 99.7:0.3 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +20.3 (*c* 1.0, $CHCl_3$);

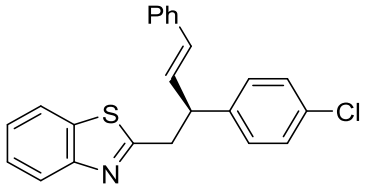
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.77 (d, *J* = 7.6 Hz, 1H), 7.44-7.40 (m, 1H), 7.33-7.16 (m, 8H), 7.11-7.02 (m, 2H), 6.51-6.43 (m, 2H), 4.45-4.40 (m, 1H), 3.72-3.62 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.3, 160.9 (d, *J* = 245.0 Hz), 153.2, 137.1, 135.4, 131.7, 130.3, 129.5 (d, *J* = 14.0 Hz), 129.3 (d, *J* = 5.0 Hz), 128.7, 128.6, 127.6, 126.5, 126.0, 124.9, 124.5 (d, *J* = 4,0 Hz), 122.8, 121.6, 116.0 (d, *J* = 22.0 Hz), 43.4, 39.5;

^{19}F {^{1}H} NMR (376 MHz, $CDCl_3$) δ –117.0;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}FNS$, 360.1217; found, 360.1217.

(S,E)-2-(2-(4-chlorophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ia)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow soild (29.1 mg, 77% yield); mp 80-82 °C

HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.8 min, t_R (minor) = 5.4 min, 99.6:0.4 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ =

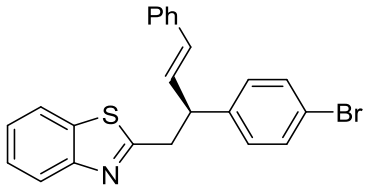
+3.0 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.0 Hz, 1H), 7.78 (d, *J* = 7.6 Hz, 1H), 7.46-7.42 (m, 1H), 7.35-7.18 (m, 10H), 6.45-6.36 (m, 2H), 4.18-4.13 (m, 1H), 3.67-3.53 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.1, 153.2, 141.0, 137.0, 135.3, 132.8, 131.5, 131.3, 129.3, 129.0, 128.7, 127.7, 126.5, 126.1, 125.0, 122.8, 121.7, 48.4, 40.6;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}ClNS$, 360.0921; found, 360.0921.

(S,E)-2-(2-(4-bromophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ja)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (33.6 mg, 80% yield); mp 81-83 °C;

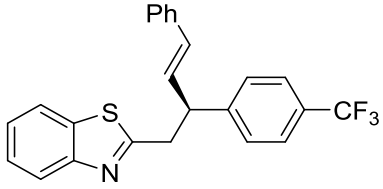
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.9 min, t_R (minor) = 5.6 min, 99.5:0.5 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = -5.6 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.79 (d, *J* = 7.6 Hz, 1H), 7.46-7.42 (m, 3H), 7.36-7.26 (m, 5H), 7.22-7.18 (m, 3H), 6.45-6.36 (m, 2H), 4.17-4.11 (m, 1H), 3.67-3.54 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.1, 153.1, 141.5, 136.9, 135.3, 132.0, 131.4, 129.7, 128.7, 127.7, 126.5, 126.1, 125.0, 122.8, 121.7, 120.9, 48.5, 40.5;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}{}^{79}BrNS$, 420.0416; found, 420.0416.

(*S,E*)-2-(4-phenyl-2-(4-(trifluoromethyl)phenyl)but-3-en-1-yl)benzo[d]thiazole (3ka)



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (34.8 mg, 85% yield); mp 81-83 °C;

HPLC (Daicel Chiralpak IA, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.0 min, t_R (minor) = 6.7 min, 99.9:0.1 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ =

+9.7 (*c* 1.0, $CHCl_3$);

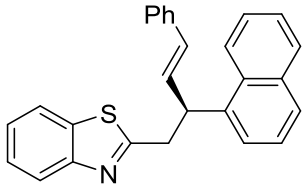
^1H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, J = 8.4 Hz, 1H), 7.79 (d, J = 8.0 Hz, 1H), 7.57 (d, J = 8.0 Hz, 2H), 7.46-7.43 (m, 3H), 7.36-7.19 (m, 6H), 6.48-6.38 (m, 2H), 4.28-4.23 (m, 1H), 3.70-3.58 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 168.8, 153.2, 146.7, 136.8, 135.3, 131.8, 131.0, 129.3 (q, J = 32.0 Hz), 128.7, 128.3, 127.8, 126.5, 126.2, 125.9 (q, J = 3,0 Hz), 125.1, 124.3 (q, J = 270.0 Hz), 122.8, 121.7, 53.6, 48.8, 40.4;

^{19}F {^1H} NMR (376 MHz, $CDCl_3$) δ –62.4;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{19}F_3NS$, 410.1185; found, 410.1184.

(S,E)-2-(2-(naphthalen-1-yl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3la)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (24.1 mg, 62% yield); mp 74-75 °C

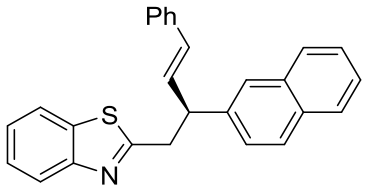
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.3 min, t_R (minor) = 5.6 min, 99.2:0.8 *e.r.*, 98% *ee*; $[\alpha]_D^{29}$ = -5.5 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 8.26 (d, J = 8.4 Hz, 1H), 7.98 (d, J = 8.4 Hz, 1H), 7.87 (d, J = 8.0 Hz, 1H), 7.78-7.74 (m, 2H), 7.58-7.43 (m, 5H), 7.33-7.16 (m, 6H), 6.61-6.45 (m, 2H), 5.06-5.01 (m, 1H), 3.85-3.76 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.9, 153.2, 138.7, 137.2, 135.4, 134.2, 131.7, 131.6, 131.5, 129.2, 128.6, 127.7, 127.5, 126.5, 126.4, 126.0, 125.8, 125.7, 124.9, 124.6, 123.4, 122.8, 121.6, 43.8, 40.3;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{27}H_{22}NS$, 392.1467; found, 392.1468.

(S,E)-2-(2-(naphthalen-2-yl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ma)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (23.8 mg, 61% yield); mp 84-86 °C;

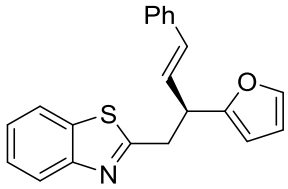
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.8 min, t_R (minor) = 6.2 min, 99.7:0.3 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = -4.6 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.82-7.73 (m, 5H), 7.48-7.40 (m, 4H), 7.32-7.16 (m, 6H), 6.55-6.44 (m, 2H), 4.33 (q, *J* = 6.8 Hz, 1H), 3.79-3.69 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.6, 153.2, 140.0, 137.2, 135.4, 133.7, 132.7, 131.9, 131.3, 128.6, 127.9, 127.8, 127.6, 126.5, 126.27, 126.26, 126.0, 125.8, 124.9, 122.8, 121.6, 49.2, 40.6;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{27}H_{22}NS$, 392.1467; found, 392.1468.

(*S,E*)-2-(2-(furan-2-yl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole (3na)



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow soild (20.7 mg, 63% yield); mp 67-69 °C;

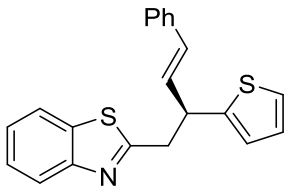
HPLC (Daicel Chiralpak IB, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 7.6 min, t_R (minor) = 5.4 min, 99.6:0.4 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +50.4 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.98 (d, *J* = 8.0 Hz, 1H), 7.79 (d, *J* = 8.0 Hz, 1H), 7.46-7.18 (m, 8H), 6.48 (d, *J* = 16.0 Hz, 1H), 6.37-6.29 (m, 2H), 6.13 (d, *J* = 3.2 Hz, 1H), 4.24 (q, *J* = 7.6 Hz, 1H), 3.74-3.53 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.0, 155.1, 153.2, 141.9, 136.9, 135.5, 132.3, 128.8, 128.6, 127.7, 126.6, 126.0, 124.9, 122.8, 121.6, 110.4, 106.4, 42.9, 38.7;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{21}H_{18}NOS$, 332.1104; found, 332.1104.

***(S,E)-2-(4-phenyl-2-(thiophen-2-yl)but-3-en-1-yl)benzo[d]thiazole* (3oa)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

At 120 °C for 48 h. Yellow solid (18.8 mg, 54% yield); mp 78-80 °C;

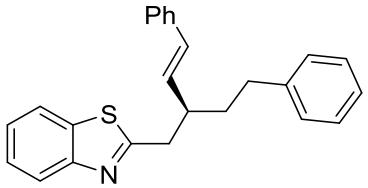
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.1 min, t_R (minor) = 5.6 min, 99.7:0.3 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +8.2 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (d, *J* = 8.0 Hz, 1H), 7.79 (d, *J* = 8.0 Hz, 1H), 7.46-7.43 (m, 1H), 7.35-7.19 (m, 7H), 6.96-6.94 (m, 2H), 6.52-6.37 (m, 2H), 4.45 (q, *J* = 7,6 Hz, 1H), 3.72-3.61 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.9, 153.2, 146.3, 136.9, 135.4, 131.7, 131.2, 128.7, 127.7, 127.1, 126.6, 126.1, 125.0, 124.5, 124.2, 122.8, 121.7, 44.4, 41.7;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{21}H_{18}NS_2$, 348.0875; found, 348.0875.

(S,E)-2-(2-phenethyl-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3pa)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Colorless oil (36.9 mg, 99% yield);

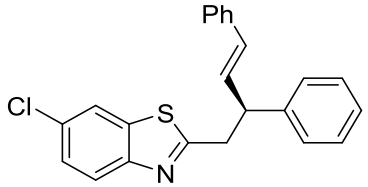
HPLC (Daicel Chiralpak OJ-H, hexane/*i*-PrOH = 60:40, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 8.9 min, t_R (minor) = 10.4 min, 99.6:0.4 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +35.2 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.0 Hz, 1H), 7.79 (d, *J* = 8.0 Hz, 1H), 7.45-7.41 (m, 1H), 7.35-7.14 (m, 11H), 6.43 (d, *J* = 15.6 Hz, 1H), 6.13 (dd, *J* = 8.8, 15.6 Hz, 1H), 3.33-3.20 (m, 2H), 2.86-2.73 (m, 1H), 2.66-2.62 (m, 2H), 2.01-1.76 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 170.0, 153.2, 142.1, 137.3, 135.4, 132.4, 132.0, 128.64, 128.55, 128.5, 127.4, 126.4, 125.99, 125.95, 124.8, 122.7, 121.6, 43.5, 40.5, 36.7, 33.7;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{25}H_{24}NS$, 370.1624; found, 370.1624.

(S,E)-6-chloro-2-(2,4-diphenylbut-3-en-1-yl)benzo[d]thiazole **(3qa)**



Eluent: petroleum ether/EtOAc = 100:1–50:1;

Yellow solid (25.6 mg, 68% yield); mp 91-93 °C;

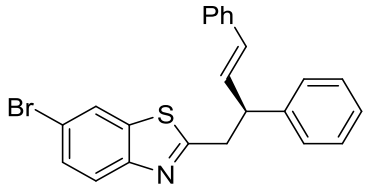
HPLC (Daicel Chiralpak IE, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 7.1 min, t_R (minor) = 6.8 min, 99.7:0.3 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +14.6 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.94 (d, *J* = 1.6 Hz, 1H), 7.67 (d, *J* = 8.8 Hz, 1H), 7.34-7.17 (m, 11H), 6.47-6.38 (m, 2H), 4.16-4.11 (m, 1H), 3.68-3.56 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 171.7, 154.0, 142.4, 137.1, 133.6, 132.1, 131.8, 131.2, 128.9, 128.6, 127.9, 127.6, 127.1, 126.4, 125.4, 122.7, 122.3, 49.1, 40.8;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}ClNS$, 376.0921; found, 376.0921.

(S,E)-6-bromo-2-(2,4-diphenylbut-3-en-1-yl)benzo[d]thiazole **(3ra)**



Eluent: petroleum ether/EtOAc = 100:1–50:1;

Yellow solid (32.4 mg, 77% yield); mp 112-113 °C;

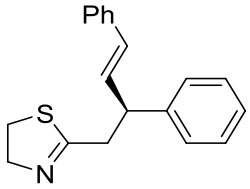
HPLC (Daicel Chiralpak IE, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 7.6 min, t_R (minor) = 7.2 min, 99.1:0.9 *e.r.*, 98% *ee*; $[\alpha]_D^{29}$ = +21.5 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 8.10 (d, *J* = 1.6 Hz, 1H), 7.60 (d, *J* = 8.4 Hz, 1H), 7.41 (dd, *J* = 2.0, 8.8 Hz, 1H), 7.34-7.16 (m, 10H), 6.46-6.38 (m, 2H), 4.16-4.10 (m, 1H)， 3.67-3.56 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 171.5, 154.3, 142.4, 137.1, 134.2, 131.8, 131.1, 128.9, 128.6, 128.0, 127.8, 127.6, 127.1, 126.4, 125.7, 122.6, 119.6, 49.1, 40.7;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}N^{79}BrS$, 420.0416; found, 420.0416.

(S,E)-2-(2,4-diphenylbut-3-en-1-yl)-4,5-dihydrothiazole **(3sa)**



Eluent: petroleum ether/EtOAc = 50:1–10:1;

At 80 °C for 48 h. Colorless oil (13.5 mg, 46% yield);

HPLC (Daicel Chiralpak IG, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ =

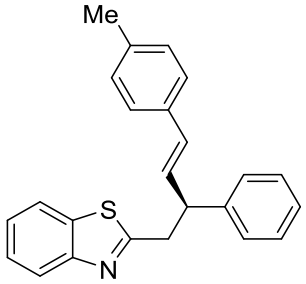
254 nm) t_R (major) = 9.8 min, t_R (minor) = 8.9 min, 94.9:5.1 *e.r.*,90% *ee*; $[\alpha]_D^{29}$ = +5.5 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.34-7.16 (m, 10H), 6.45-6.31 (m, 2H), 4.12 (t, *J* = 8.0 Hz, 2H), 3.96 (q, *J* = 7.2 Hz, 1H), 3.21-3.17 (m, 2H), 3.08-2.95 (m,2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.7, 142.8, 137.3, 132.2, 130.4, 128.7, 128.5, 127.7, 127.3, 126.8, 126.4, 64.4, 47.2, 40.4, 34.1;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{19}H_{20}NS$, 294.1311; found, 294.1311.

(S,E)-2-(2-phenyl-4-(p-tolyl)but-3-en-1-yl)benzo[d]thiazole **(3ab)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (21.3 mg, 60% yield); mp 69-70 °C;

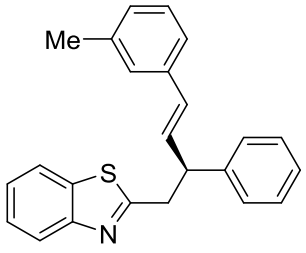
HPLC (Daicel Chiralpak OJ-H, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 14.3 min, t_R (minor) = 15.9 min, 99.4:0.6 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +9.8 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.42 (t, *J* = 7.6 Hz, 1H), 7.32-7.19 (m, 8H), 7.06 (d, *J* = 8.0 Hz, 2H), 6.43-6.34 (m, 2H), 4.16-4.11 (m, 1H), 3.68-3.57 (m, 2H), 2.29 (s, 3H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.8, 153.2, 142.8, 137.3, 135.4, 134.4, 131.0, 130.9, 129.3, 128.9, 127.9, 127.0, 126.3, 126.0, 124.8, 122.7, 121.6, 49.2, 40.8, 21.3;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{22}NS$, 356.1467; found, 356.1468.

(S,E)-2-(2-phenyl-4-(m-tolyl)but-3-en-1-yl)benzo[d]thiazole **(3ac)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow soild (22.3 mg, 63% yield); mp 82-84 °C;

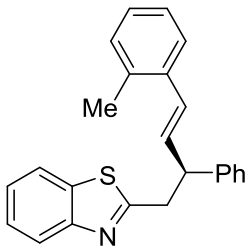
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.6 min, t_R (minor) = 5.3 min, 99.7:0.3 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +15.4 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.77 (d, *J* = 7.6 Hz, 1H), 7.45-7.41 (m, 1H), 7.32-7.29 (m, 5H), 7.24-7.21 (m, 1H), 7.17-7.09 (m, 3H), 7.00 (d, *J* = 7.2 Hz, 1H), 6.46-6.37 (m, 2H), 4.17-4.12 (m, 1H), 3.69-3.75 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.7, 153.2, 142.7, 138.2, 137.1, 135.4, 131.8, 131.1, 128.9, 128.5, 128.3, 127.9, 127.1, 127.0, 126.0, 124.8, 123.6, 122.7, 121.6, 49.2, 40.8, 21.5;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{22}NS$, 356.1467; found, 356.1468.

(S,E)-2-(2-phenyl-4-(o-tolyl)but-3-en-1-yl)benzo[d]thiazole **(3ad)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Colorless oil (23.3 mg, 65% yield);

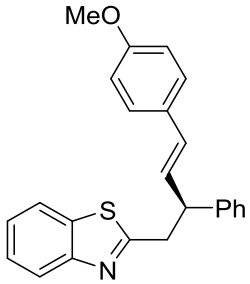
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.6 min, t_R (minor) = 6.2 min, 99.4:0.6 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +16.6 (*c* 1.0, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.78 (d, *J* = 7.6 Hz, 1H), 7.45-7.41 (m, 1H), 7.37-7.30 (m, 6H), 7.26-7.22 (m, 1H), 7.11-7.04 (m, 3H), 6.64 (d, *J* = 15.6 Hz, 1H), 6.27 (dd, *J* = 8.0, 15.6 Hz, 1H), 4.21-4.16 (m, 1H), 3.69-3.58 (m, 2H), 2.15 (s, 3H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.7, 153.2, 142.8, 136.4, 135.5, 135.3, 133.2, 130.2, 129.2, 128.9, 127.8, 127.4, 127.0, 126.1, 126.0, 125.9, 124.9, 122.7, 121.6, 49.5, 40.9, 19.8;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{22}NS$, 356.1467; found, 356.1468.

(S,E)-2-(4-(4-methoxyphenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ae)**



Eluent: petroleum ether/EtOAc = 100:1–50:1;

At 145 °C for 48 h. Yellow solid (14.9 mg, 40% yield); mp 95-96 °C

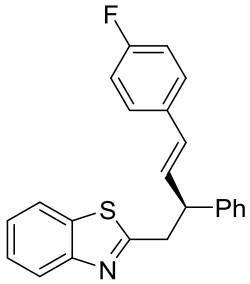
HPLC (Daicel Chiralpak IG, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 16.0 min, t_R (minor) = 15.2 min, 98.0:2.0 *e.r.*, 96% *ee*; $[\alpha]_D^{29}$ = +13.7 (*c* 0.5, $CHCl_3$);

^1H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.4 Hz, 1H), 7.77 (d, *J* = 7.6 Hz, 1H), 7.45-7.41 (m, 1H), 7.34-7.29 (m, 5H), 7.25-7.20 (m, 3H), 6.82-6.78 (m, 2H), 6.40-6.26 (m, 2H), 4.12 (q, *J* = 7.2 Hz, 1H), 3.77 (s, 3H), 3.68-3.57 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.8, 159.2, 153.2, 142.9, 135.4, 130.5, 130.0, 129.9, 128.9, 127.9, 127.6, 127.0, 126.0, 124.8, 122.7, 121.6, 144.0, 55.4, 49.2, 40.9;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{24}H_{22}ONS$, 372.1417; found, 372.1417.

(S,E)-2-(4-(4-fluorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole **(3af)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

White solid (14.0 mg, 39% yield); mp 83-84 °C

HPLC (Daicel Chiralpak IG, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 9.5 min, t_R (minor) = 8.7 min, 99.6:0.4 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +6.5 (*c* 1.0, $CHCl_3$);

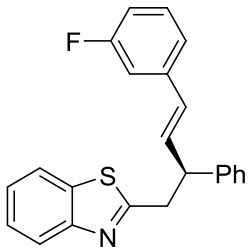
^1H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.43-7.41 (m, 1H), 7.34-7.31 (m, 5H), 7.27-7.22 (m, 3H), 6.96-6.92 (m, 2H), 6.41-6.31 (m, 2H), 4.16-4.11 (m, 1H), 3.68-3.57 (m, 2H);

^{13}C {^1H} NMR (100 MHz, $CDCl_3$) δ 169.6, 162.3 (d, *J* = 245.0 Hz), 153.2, 142.5, 135.4, 133.3 (d, *J* = 3.0 Hz), 131.8, 129.9, 129.0, 127.92 (d, *J* = 8.0 Hz), 127.86, 127.1, 126.0, 124.9, 122.8, 121.6, 115.5 (d, *J* = 21.0 Hz), 49.1, 40.7;

^{19}F {^1H} NMR (376 MHz, $CDCl_3$) δ –114.8;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}FNS$, 360.1217; found, 360.1217.

(S,E)-2-(4-(3-fluorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ag)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (31.8 mg, 88% yield); mp 74-76 °C;

HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.9 min, t_R (minor) = 5.5 min, 99.4:0.6 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +8.4 (*c* 1.0, $CHCl_3$);

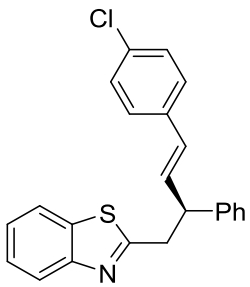
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.44 (t, *J* = 8.0 Hz, 1H), 7.33-7.17 (m, 7H), 7.05-6.99 (m, 2H), 6.89-6.85 (m, 1H), 6.49-6.36 (m, 2H), 4.16 (q, *J* = 7.6 Hz, 1H), 3.68-3.37 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.4, 163.2 (d, *J* = 244.0 Hz), 153.2, 142.3, 139.5 (d, *J* = 8.0 Hz), 135.4, 133.4, 130.04, 129.99 (d, *J* = 4.0 Hz), 129.0, 127.9, 127.2, 126.1, 124.9, 122.8, 122.4 (d, *J* = 3.0 Hz), 121.6, 114.3 (d, *J* = 22.0 Hz), 112.9 (d, *J* = 21.0 Hz), 49.1, 40.6;

^{19}F {^{1}H} NMR (376 MHz, $CDCl_3$) δ –113.6;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}FNS$, 360.1217; found, 360.1217.

(S,E)-2-(4-(4-chlorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ah)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (27.9 mg, 74% yield); mp 63-65 °C;

HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.2 min, t_R (minor) = 5.7 min, 99.5:0.5 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +21.1 (*c* 1.0, $CHCl_3$);

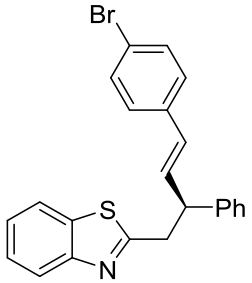
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 8.0 Hz, 1H),

7.45-7.41 (m, 1H), 7.35-7.30 (m, 5H), 7.26-7.21 (m, 5H), 6.45-6.34 (m, 2H), 4.14 (q, *J* = 7.2 Hz, 1H), 3.68-3.57 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.5, 153.2, 142.4, 135.7, 135.4, 133.1, 132.7, 129.9, 129.0, 128.7, 127.9, 127.7, 127.2, 126.1, 124.9, 122.8, 121.6, 49.1, 40.7;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}ClNS$, 376.0921; found, 376.0921.

(S,E)-2-(4-(4-bromophenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ai)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (21.0 mg, 50% yield); mp 107-109 °C;

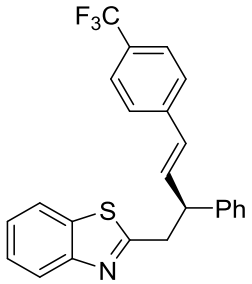
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.2 min, t_R (minor) = 5.7 min, 99.0:1.0 *e.r.*, 98% *ee*; $[\alpha]_D^{29}$ = +25.7 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.78 (d, *J* = 7.6 Hz, 1H), 7.46-7.42 (m, 1H), 7.38-7.32 (m, 7H), 7.25-7.22 (m, 1H), 7.16-7.14 (m, 2H), 6.46-6.32 (m, 2H), 4.14 (q, *J* = 7.6 Hz, 1H), 3.68-3.57 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.5, 153.2, 142.3, 136.1, 135.4, 132.8, 131.7, 129.9, 129.0, 128.0, 127.9, 127.2, 126.1, 124.9, 122.8, 121.6, 121.2, 49.2, 40.6;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}{}^{79}BrNS$, 420.0416; found, 420.0416.

(S,E)-2-(2-phenyl-4-(4-(trifluoromethyl)phenyl)but-3-en-1-yl)benzo[d]thiazole **(3aj)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

White soild (20.8 mg, 51% yield); mp 106-107 °C

HPLC (Daicel Chiralpak IG, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 8.2 min, t_R (minor) = 7.5 min, 99.5:0.5 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +18.6 (*c* 1.0, $CHCl_3$);

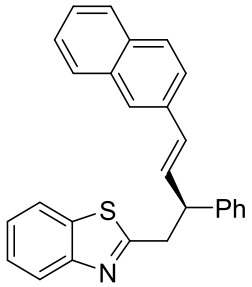
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, J = 8.0 Hz, 1H), 7.78 (d, J = 7.6 Hz, 1H), 7.51-7.42 (m, 3H), 7.39-7.31 (m, 7H), 7.27-7.23 (m, 1H), 6.58-6.42 (m, 2H), 4.18 (q, J = 7.2 Hz, 1H), 3.70-3.59 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.3, 153.2, 142.1, 140.6, 135.3, 134.7, 129.8, 129.3 (q, J = 32.0 Hz), 129.0, 127.9, 127.3, 126.6, 126.1, 125.6 (q, J = 4.0 Hz), 125.0 (q, J = 270.0 Hz), 122.8, 121.6, 49.2, 40.6;

^{19}F {^{1}H} NMR (376 MHz, $CDCl_3$) δ –62.5;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{19}F_3NS$, 410.1185; found, 410.1185.

(S,E)-2-(4-(naphthalen-2-yl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ak)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (18.4 mg, 47% yield); mp 112-114 °C;

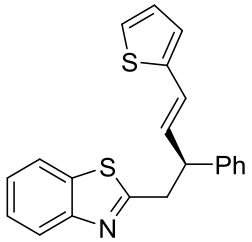
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 8.3 min, t_R (minor) = 7.3 min, 99.7:0.3 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +37.0 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (d, J = 8.0 Hz, 1H), 7.78-7.71 (m, 4H),7.54-7.52 (m, 1H), 7.43-7.23 (m, 9H), 6.62-6.53 (m, 2H), 4.23-4.18 (m, 1H), 3.73-3.62 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.7, 153.2, 142.6, 135.4, 134.6, 133.7, 133.0, 132.4, 131.2, 129.0, 128.2, 128.0, 127.9, 127.7, 127.1, 126.32, 126.26, 126.0, 125.9, 123.7, 122.8, 121.6, 49.3, 40.8;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{27}H_{22}NS$, 392.1467; found, 392.1468.

(S,E)-2-(2-phenyl-4-(thiophen-2-yl)but-3-en-1-yl)benzo[d]thiazole **(3al)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

Yellow solid (29.7 mg, 85% yield); mp 99-101 °C;

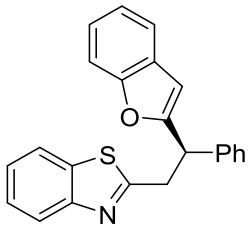
HPLC (Daicel Chiralpak IB, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 6.9 min, t_R (minor) = 5.7 min, 96.6:3.4 *e.r.*, 93% *ee*; $[\alpha]_D^{29}$ = +19.4 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.0 Hz, 1H), 7.76 (d, *J* = 8.0 Hz, 1H), 7.44-7.40 (m, 1H), 7.33-7.29 (m, 5H), 7.25-7.21 (m, 1H), 7.08 (d, *J* = 4.8 Hz, 1H), 6.90-6.88 (m, 1H), 6.84 (d, *J* = 3.2 Hz, 1H), 6.53 (d, *J* = 15.6 Hz, 1H), 6.29 (dd, *J* = 7.2, 15.6 Hz, 1H), 4.14-4.08 (m, 1H), 3.66-3.55 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 169.5, 153.2, 142.29, 142.27, 135.4, 131.7, 128.9, 127.9, 127.4, 127.1, 126.0, 125.5, 124.9, 124.3, 124.1, 122.8, 121.6, 49.0, 40.6;

HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{21}H_{18}NS_2$, 348.0875; found, 348.0875.

(R)-2-(2-(benzofuran-2-yl)-2-phenylethyl)benzo[d]thiazole **(3am)**



Eluent: petroleum ether/EtOAc = 50:1–30:1;

White soild (30.8 mg, 87% yield); mp 150-151 ^{o}C

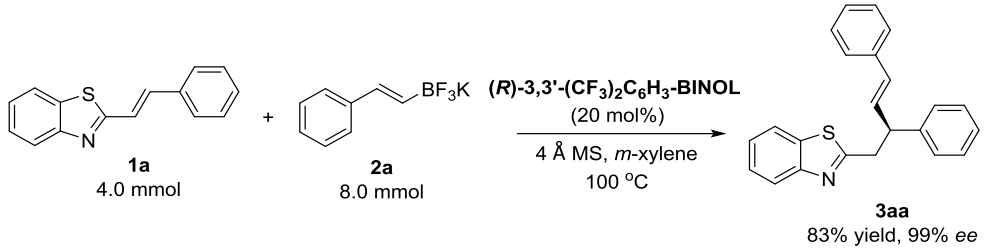
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.7 min, t_R (minor) = 5.3 min, 99.6:0.4 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = -6.8 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.0 Hz, 1H), 7.73 (d, *J* = 8.0 Hz, 1H), 7.47-7.14 (m, 11H), 6.51 (s, 1H), 4.83 (t, *J* = 7.6 Hz, 1H), 4.05 (dd, J = 8.0, 14.8 Hz, 1H), 3.78 (dd, *J* =8.0, 15.2 Hz, 1H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 168.8, 158.8, 155.0, 153.1, 140.4, 135.4, 128.9, 128.5, 128.2, 127.5, 126.0, 125.0, 123.9, 122.80, 122.78, 121.6, 120.9, 111.2, 103.8, 45.8, 39.3;

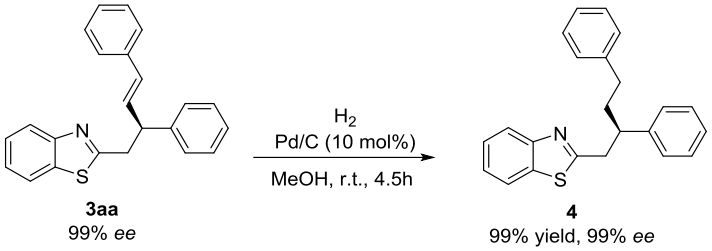
HRMS (ESI) *m/z*: $[M + H]^+$ calcd for $C_{23}H_{18}NOS$, 356.1104; found, 356.1104.

4. Large-scale reaction and synthetic transformations of products



To a 100 mL Schlenk tube equipped with a stirring bar was added 4 Å MS (4.0 g), and the tube was flame-dried under high vacuum. The tube was then back-filled with nitrogen. To the tube was added (*E*)-2-styrylbenzo[d]thiazole **1a** (4.0 mmol, 1.0 equiv, 949.0 mg), potassium styryltrifluoroborate **2a** (8.0 mmol, 2.0 equiv, 1.68 g), **Cat 5** (0.8 mmol, 20 mol%, 568.0 mg) and dry *m*-xylene (40.0 mL) under n itrogen. The reaction mixture was kept stirring at 100 ℃ for 48 h and monitored by TLC until (*E*)-2-styrylbenzo[d]thiazole **1a** was consumed. After the removal of solvents via rotary evaporation, the residue was purified through flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 100:1–50:1) to give pure adducts **3aa** (1.13 g, 83% yield, 99% *ee*).

Synthesis of ***(R)-2-(2,4-diphenylbutyl)benzo[d]thiazole*** **(4)**



To a stirred solution of **3aa** (99% *ee*, 34.1 mg, 0.1 mmol, 1.0 equiv) in MeOH (1 mL) was added Pd-C (0.01 mmol, 10 mol %). The reaction mixture was stirred under H_2 balloon for 5 h at room temperature. The resulting mixture was filtered through a Celite pad and solvents were concentrated via rotary evaporation. The residue was purified through flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 50:1) to give product **4** (34.0 mg, 99% yield, 99% *ee*);

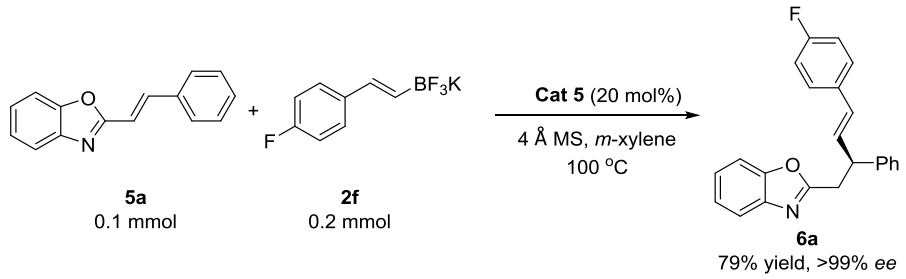
HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.9 min, t_R (minor) = 5.0 min, 99.3:0.7 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = -35.7 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, J = 8.0 Hz, 1H), 7.66 (d, J = 8.0 Hz, 1H), 7.35-7.31 (m, 1H), 7.25-7.20 (m, 3H), 7.17-7.12 (m, 5H), 7.08-7.04 (m, 1H), 6,98 (d, J = 7.2 Hz, 2H), 3,41-3,27 (m, 2H), 3.19-3.12 (m, 1H), 2.47-2.34 (m, 2H), 2.09-1.91 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 170.2, 153.1, 143.3, 142.0, 135.4, 128.8, 128.5, 128.4, 127.9, 126.9, 125.93, 125.90, 124.8, 122.7, 121.6, 46.1, 41.8, 37.9, 33.6;

HRMS (ESI) *m*/*z*: $[M + H]^+$ calcd for $C_{23}H_{22}NS$, 344.1467; found, 344.1468.

Synthesis of ***(S,E)-2-(4-(4-fluorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]oxazole*** **(6a)**



To a 10 mL Schlenk tube equipped with a stirring bar was added 4 Å MS (100 mg), and the tube was flame-dried under high vacuum. After cooling to r.t., the tube was then back-filled with nitrogen. Then trifluoroborate salts **2f** (0.2 mmol, 2.0 equiv), (*R*)- 3,3'-$(CF_3)_2C_6H_3$-BINOL (0.02 mmol, 20 mol %), alkenyl-substituted benzothiazoles **5a** (0.1 mmol, 1.0 equiv), and dry *m*-xylene (1.0 mL) were successively added to the test tube under N_2. The tube was sealed up with a screw cap, and allowed to stir at 100 ℃ in an oil bath for 48 h. After the removal of solvents via rotary evaporation, the residue was purified through flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 100:1–50:1) to give pure product **6a** as yellow oil (27.1 mg, 79% yield, >99% *ee*);

HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.7 min, t_R (minor) = 5.4 min, 99.8:0.2 *e.r.*, >99% *ee*; $[\alpha]_D^{29}$ = +19.1 (*c* 1.0, $CHCl_3$);

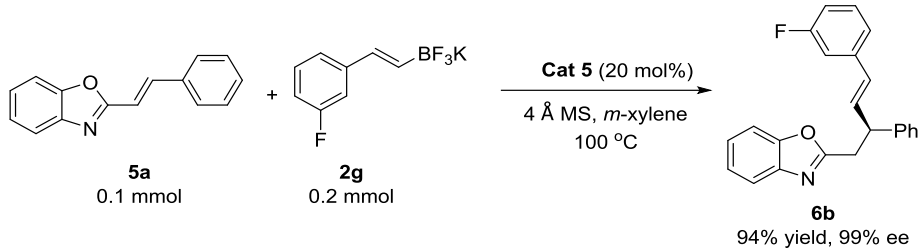
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67-7.63 (m, 1H), 7.46-7.42 (m, 1H), 7.32 (d, *J* = 4.4 Hz, 4H), 7.30-7.20 (m, 5H), 6.95-6.89 (m, 2H), 6.41-6.31 (m, 2H), 4.26 (dd, *J* = 6.8, 14.8 Hz, 1H), 3.50-3.38 (m, 2H);

^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 165.1, 162.3 (d, *J* = 245.0 Hz), 150.9, 142.4, 141.4, 133.2 (d, *J* = 4.0 Hz), 131.5 (d, *J* = 2.0 Hz), 129.7, 128.9, 127.9 (d, *J* = 8.0 Hz), 127.6, 127.1, 124.7, 124.3, 119.8, 115.4 (d, *J* = 22.0 Hz), 46.8, 35.3;

^{19}F {^{1}H} NMR (376 MHz, $CDCl_3$) δ –114.7;

HRMS (ESI) *m*/*z*: $[M + H]^+$ calcd for $C_{23}H_{19}ONF$ 344.1445; found 344.1445.

Synthesis of ***(S,E)-2-(4-(3-fluorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]oxazole*** **(6b)**



To a 10 mL Schlenk tube equipped with a stirring bar was added 4 Å MS (100 mg), and the tube was flame-dried under high vacuum. After cooling to r.t., the tube was then back-filled with nitrogen. Then trifluoroborate salts **2 g** (0.2 mmol, 2.0 equiv), (*R*)-3,3'-$(CF_3)_2C_6H_3$-BINOL (0.02 mmol, 20 mol %), alkenyl-substituted benzothiazoles **5a** (0.1 mmol, 1.0 equiv), and dry *m*-xylene (1.0 mL) were successively added to the test tube under N_2. The tube was sealed up with a screw cap, and allowed to stir at 100 ℃ in an oil bath for 48 h. After the removal of solvents via rotary evaporation, the residue was purified through flash column chromatography on silica gel (eluent: petroleum ether/ethyl acetate = 100:1–50:1) to give pure product **6b** as yellow solid (32.2 mg, 94% yield, 99% *ee*), mp 73-75 °C;

HPLC (Daicel Chiralpak IC, hexane/*i*-PrOH = 90:10, flow rate 1.0 mL/min, λ = 254 nm) t_R (major) = 5.8 min, t_R (minor) = 5.4 min, 99.5:0.5 *e.r.*, 99% *ee*; $[\alpha]_D^{29}$ = +19.9 (*c* 1.0, $CHCl_3$);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67-7.62 (m, 1H), 7.46-7.42 (m, 1H), 7.31 (d, *J* = 4.4 Hz, 4H), 7.29-7.15 (m, 4H), 7.03-6.96 (m, 2H), 6.88-6.83 (m, 1H), 6.47-6.36 (m, 2H), 4.27 (dd, *J* = 7.2, 15.2 Hz, 1H), 3.50-3.39 (m, 2H);

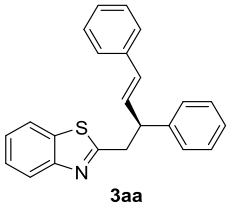
^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$) δ 165.0, 163,1 (d, *J* = 243.0 Hz), 150.9, 142.2, 141.4, 139.4 (d, *J* = 7.0 Hz), 133.2, 130.0 (d, *J* = 9.0 Hz), 129.8 (d, *J* = 3.0 Hz), 129.0, 127.6, 127.2, 124.7, 124.3, 122.3 (d, *J* = 3.0 Hz), 119.8, 114.3 (d, *J* = 21.0 Hz), 112.9 (d, *J* = 22.0 Hz), 110.4, 46.7, 35.2;

^{19}F {^{1}H} NMR (376 MHz, $CDCl_3$) δ –113.6;

HRMS (ESI) *m*/*z*: $[M + H]^+$ calcd for $C_{23}H_{19}ONF$ 344.1445; found 344.1445.

5. Absolute configuration determination and DFT calculation

In order to establish the absolute configuration of the products, we detected CD (circular dichroism) of optical pure **3aa** (99% *ee*) at the concentration of 0.01 mg/mL in MeOH (Fig. S1). Through comparison of CD and ECD (electrostatic circular dichroism) of **3aa** (Fig. S2), the absolute configuration of **3aa** was determined to be (*S*,*E*).



3aa

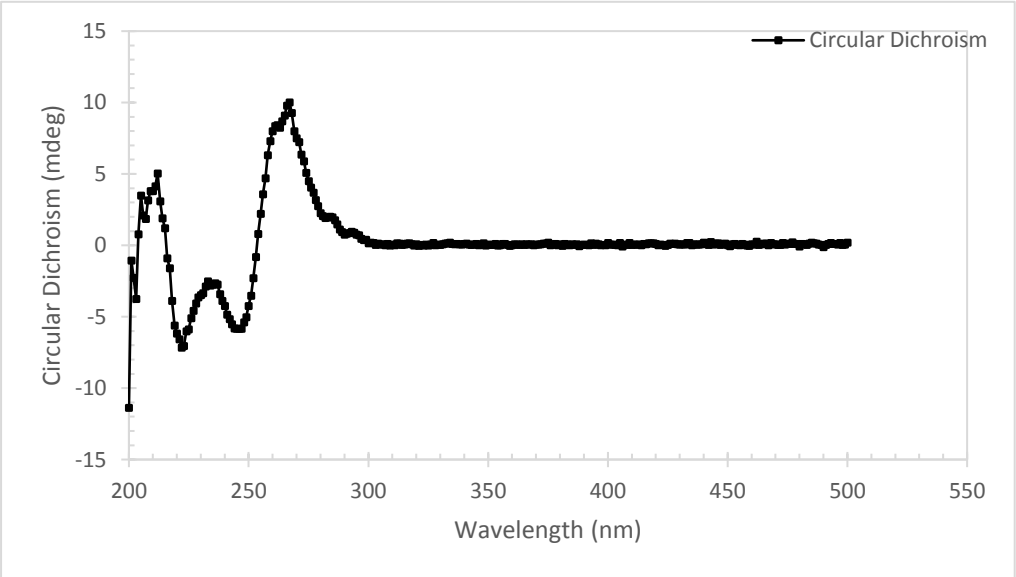
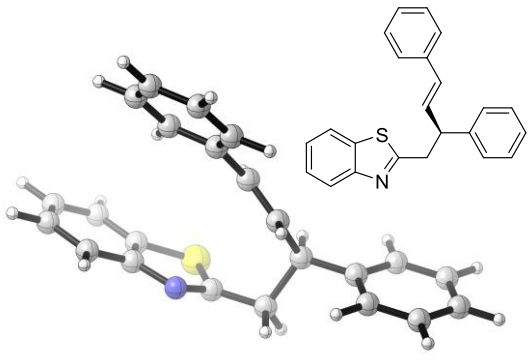
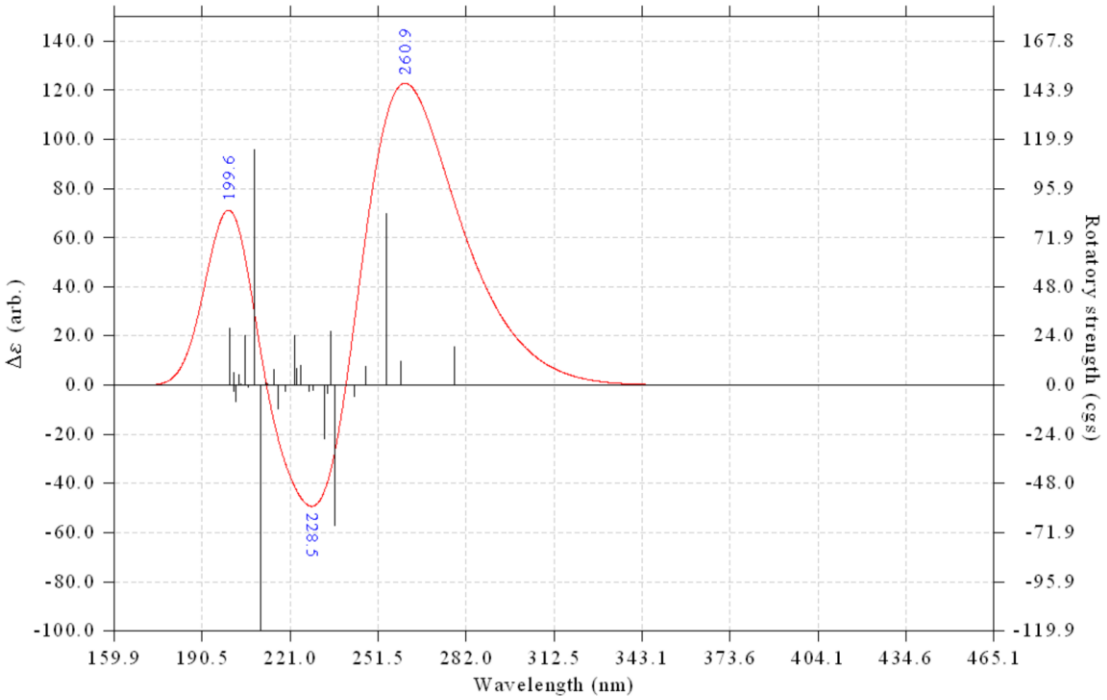


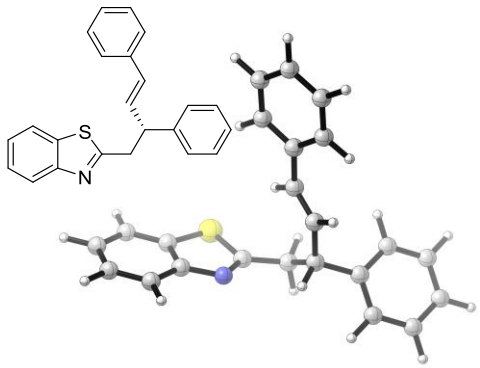
Fig. S1 CD spectrum of **3aa**



[a] **3aa**


140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
Δε (arb.)
167.8
143.9
119.9
95.9
71.9
48.0
24.0
0.0
-24.0
-48.0
-71.9
-95.9
-119.9
Rotatory strength (cgs)
199.6
228.5
260.9
159.9
190.5
221.0
251.5
282.0
312.5
343.1
373.6
404.1
434.6
465.1
Wavelength (nm)

[b]


S
N

3aa'

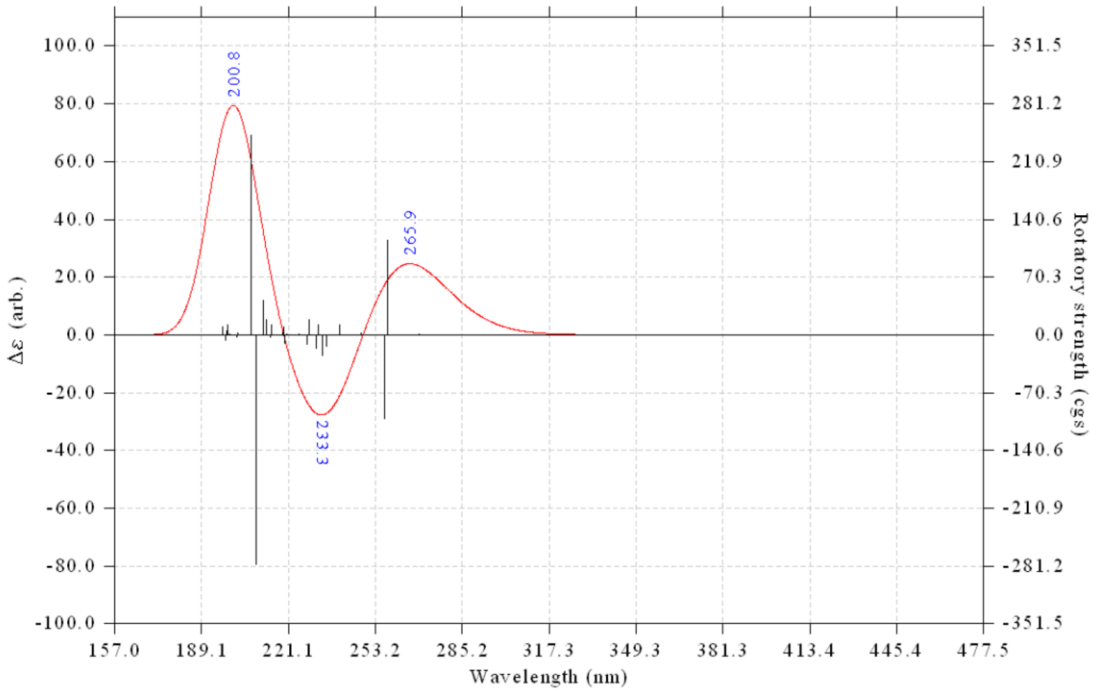


Fig. S2 ECD spectrum of **3aa/3aa'**

All the density functional theory (DFT) calculations were performed with the Gaussian 16 B.01 series of programs.[4] The B3LYP-D3BJ[5, 6] functional with the standard 6-311G(d,p) basis set was used for the geometry optimizations. The ECD spectra was calculated via the TDDFT method.[7] The 3D images of the calculated structures were prepared using CYLview.[8]

[a]

C	-6.20995200	0.33074700	-0.17843600
C	-5.33628800	0.56903100	-1.23769200
C	-3.97624200	0.31531500	-1.09325200
C	-3.46434300	-0.17877300	0.11110800
C	-4.34900900	-0.41286400	1.16499300
C	-5.71193000	-0.16131200	1.02429400
C	1.61718800	4.22167700	-0.29201400
C	0.62628200	3.28723000	-0.01508100
C	0.94616500	2.06544700	0.59266000
C	2.28409900	1.81604300	0.92982800
C	3.27577900	2.74837500	0.64648700
C	2.94649200	3.95543800	0.03415000

C	-0.05287400	1.02029200	0.84496500
C	-1.12376600	0.76329300	0.09150100
C	-1.98401000	-0.45863700	0.27746700
C	-1.52335600	-1.59206900	-0.70766600
H	-5.71520000	0.95303300	-2.17790900
H	-3.30849000	0.50578700	-1.92629900
H	-3.96506400	-0.79185800	2.10619700
H	-6.38280200	-0.34851900	1.85489400
H	1.35207300	5.16448600	-0.75700300
H	-0.40762200	3.50841600	-0.25354400
H	2.54748200	0.86885100	1.38765100
H	4.30650400	2.52967200	0.90066000
H	3.71728800	4.68591600	-0.18247800
H	0.17592100	0.34418900	1.66551000
H	-1.33147500	1.37677400	-0.78053200
H	-1.82233700	-0.83549900	1.29084400
H	-1.74321300	-1.30213700	-1.73566800
H	-2.08279700	-2.50266500	-0.47976100
H	-7.26956400	0.52818900	-0.29072200
C	-0.04947000	-1.80121800	-0.60712100
C	2.10636000	-1.40960000	-0.94047100
C	2.23293800	-2.11164800	0.28035100
C	3.24722600	-0.88820100	-1.55709200
C	3.47465800	-2.30584200	0.88260100
C	4.48200300	-1.07203200	-0.95382500
H	3.13959600	-0.33691300	-2.48226800
C	4.59537200	-1.77558800	0.25444300
H	3.56607700	-2.84653100	1.81631500
H	5.37153100	-0.66355800	-1.41792800
H	5.57052200	-1.90710400	0.70816700
N	0.80892200	-1.26205200	-1.40266800
S	0.64369900	-2.60292500	0.82871000

[b]

C	5.61949400	-2.08260100	-0.14376900
C	5.08190200	-1.00576100	-0.84550600
C	3.75530100	-0.63365800	-0.64733400
C	2.94588200	-1.33341600	0.25176600
C	3.49459800	-2.41023000	0.95138700
C	4.82184700	-2.78419200	0.75678600
C	1.09633500	4.94106000	0.85097200
C	1.29838200	3.57307800	0.72358000
C	0.41535200	2.78334800	-0.02872700
C	-0.66227500	3.41797100	-0.66269400
C	-0.86574700	4.78799800	-0.53516400
C	0.01203300	5.55600800	0.22479500
C	0.57178400	1.33114000	-0.18207800
C	1.31377900	0.52744100	0.58418100
C	1.48126400	-0.96186900	0.43536900
C	0.64156500	-1.59052900	-0.69562900
H	5.69783800	-0.45199700	-1.54495600
H	3.34269900	0.21316300	-1.18418000
H	2.87564600	-2.95754200	1.65486200
H	5.23356000	-3.62009300	1.31080600
H	1.79182400	5.53400600	1.43410600
H	2.15803100	3.11478200	1.19770900
H	-1.35093400	2.82136700	-1.25152700
H	-1.70939700	5.25565500	-1.02976100
H	-0.14100300	6.62426300	0.32381200
H	-0.01783700	0.90256400	-0.98592000
H	1.87139900	0.94961500	1.41602500
H	1.13651900	-1.42016400	1.36844900
H	0.88542500	-1.12458700	-1.65380300
H	0.92081900	-2.64504700	-0.78563600
H	6.65344400	-2.37024500	-0.29481400
C	-0.83332200	-1.51294900	-0.43640100
C	-2.75691100	-1.51835600	0.66360900
C	-3.28454800	-1.30091200	-0.63003600
C	-3.62497700	-1.59665500	1.75669500

C	-4.65442800	-1.16429000	-0.84420500
C	-4.98873300	-1.45945000	1.54468000
H	-3.21434200	-1.76133600	2.74479500
C	-5.49916200	-1.24528800	0.25604400
H	-5.05220500	-0.99893900	-1.83761800
H	-5.67047300	-1.51753100	2.38464800
H	-6.56816800	-1.14035600	0.11414300
N	-1.37719600	-1.63204200	0.72445500
S	-1.96743500	-1.24316300	-1.78389100

6. References

[1] (a) Le, P. Q.; Nguyen, T. S.; May, J. A. *Org. Lett.* **2012**, *14*, 6104–6107; (b) Shih, J. L.; Nguyen, T. S.; May, J. A. Angew. *Chem., Int. Ed.* **2015**, *54*, 9931–9935.

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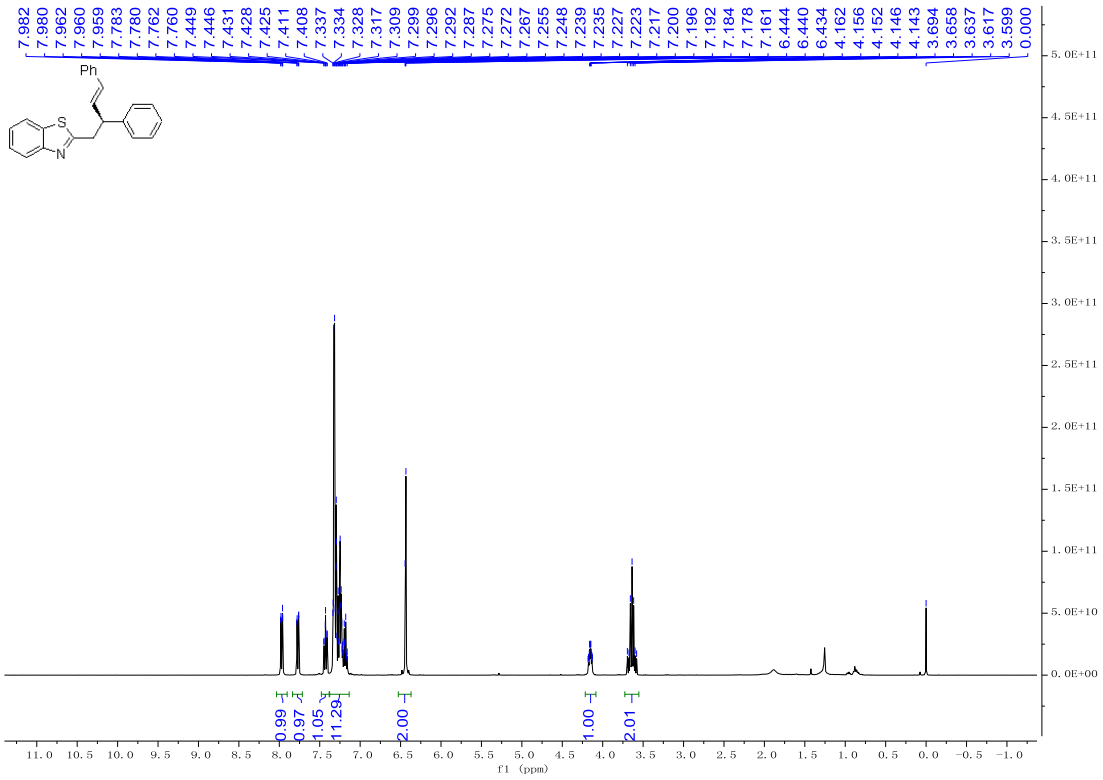
[8] Legault, C. Y. CYLview, 1.0b; Universitéde Sherbrooke: 2009(http://www.cylview.org).

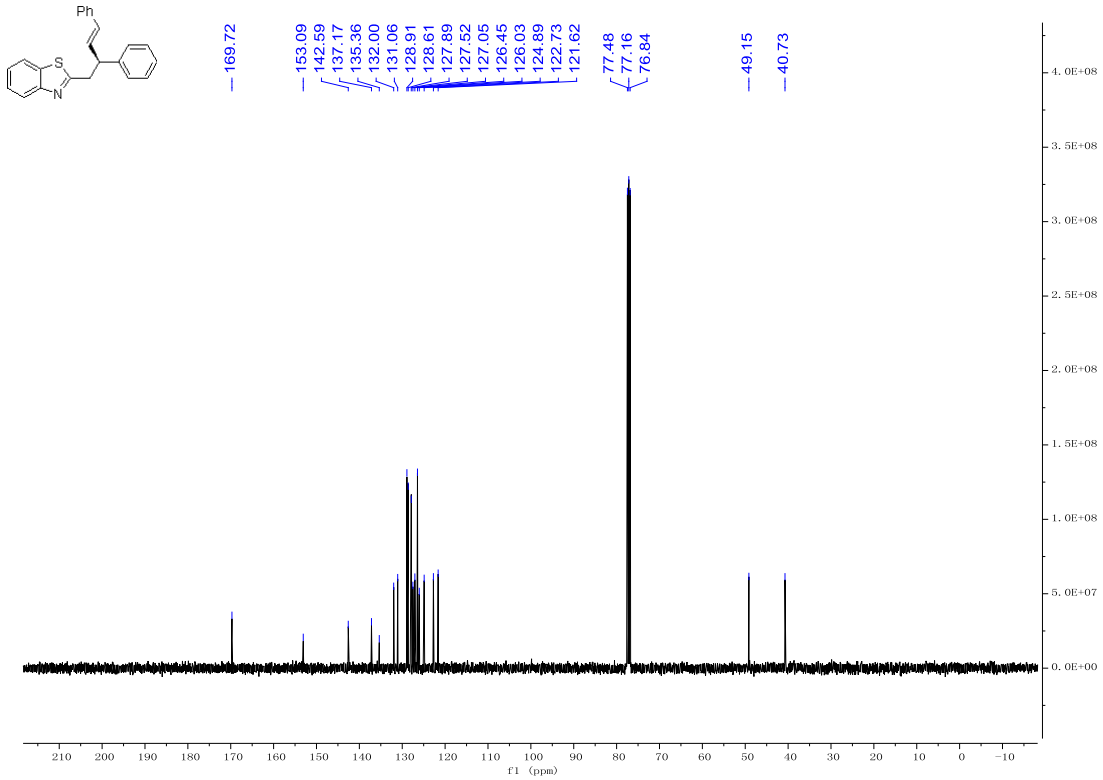
7. Copies of ^{1}H, ^{13}C, and ^{19}F NMR spectra

(S,E)-2-(2,4-diphenylbut-3-en-1-yl)benzo[d]thiazole (3aa)

^{1}H NMR (400 MHz, $CDCl_3$)

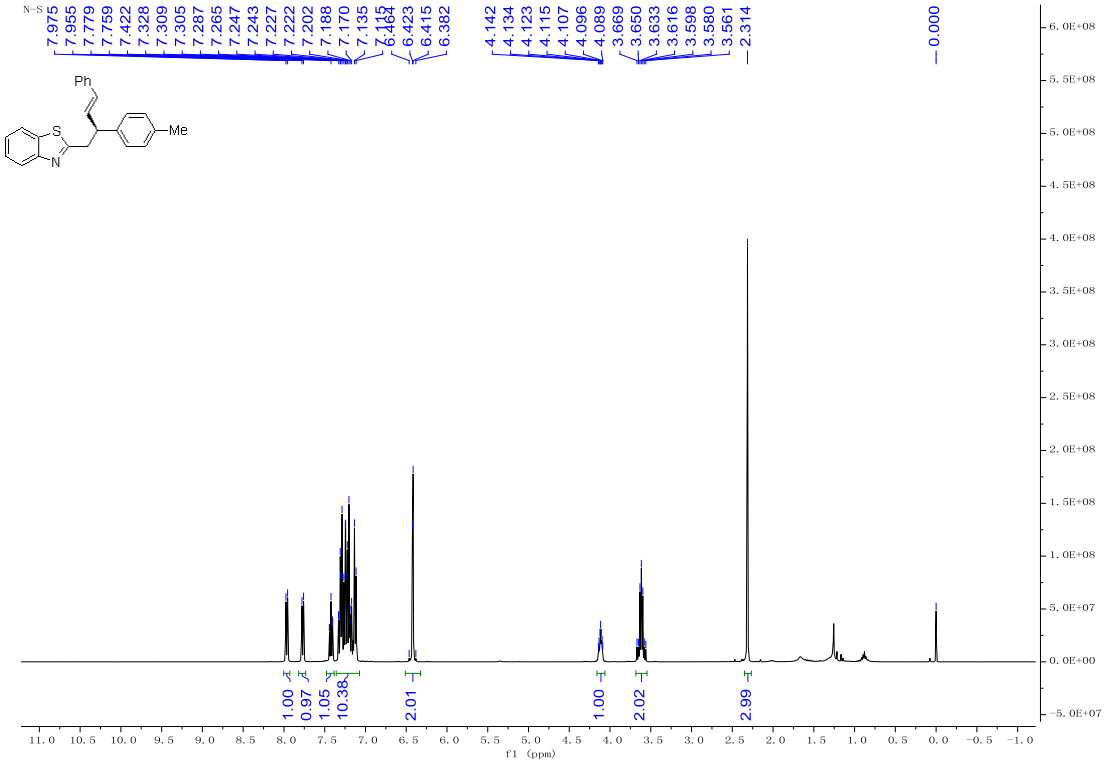


^{13}C {^{1}H} NMR (100 MHz, $CDCl_3$)

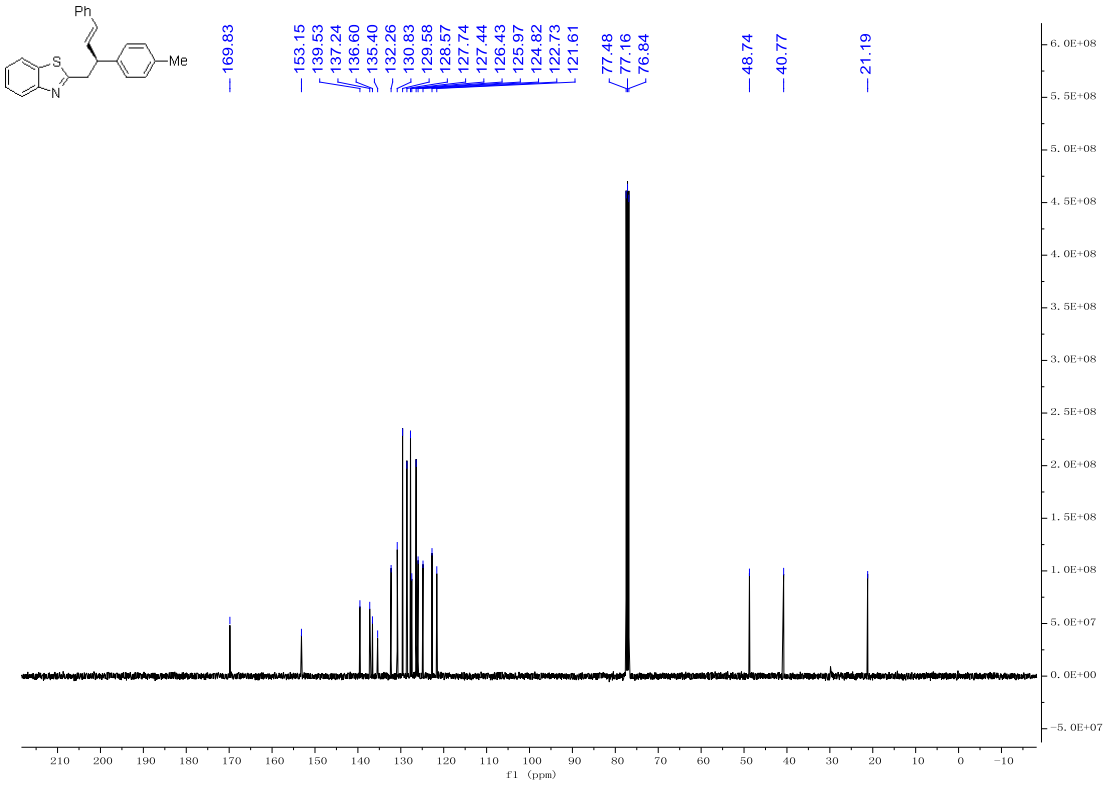


(S,E)-2-(4-phenyl-2-(p-tolyl)but-3-en-1-yl)benzo[d]thiazole (3ba)

^{1}H NMR (400 MHz, $CDCl_3$)

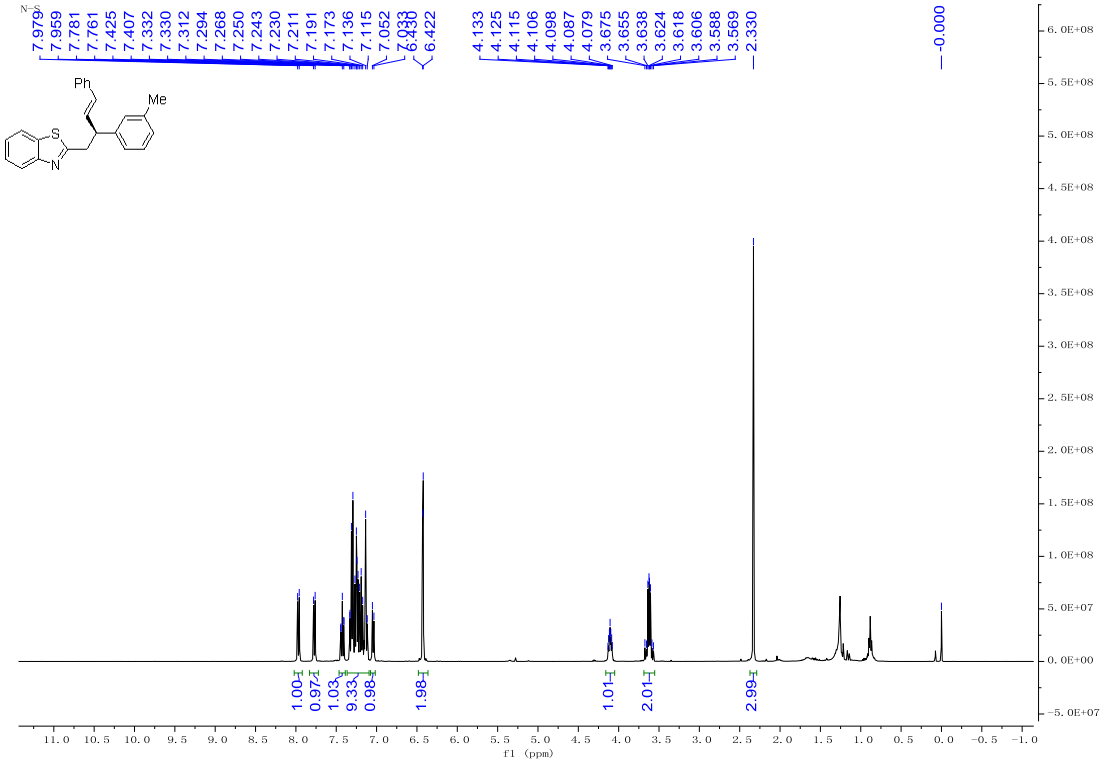


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

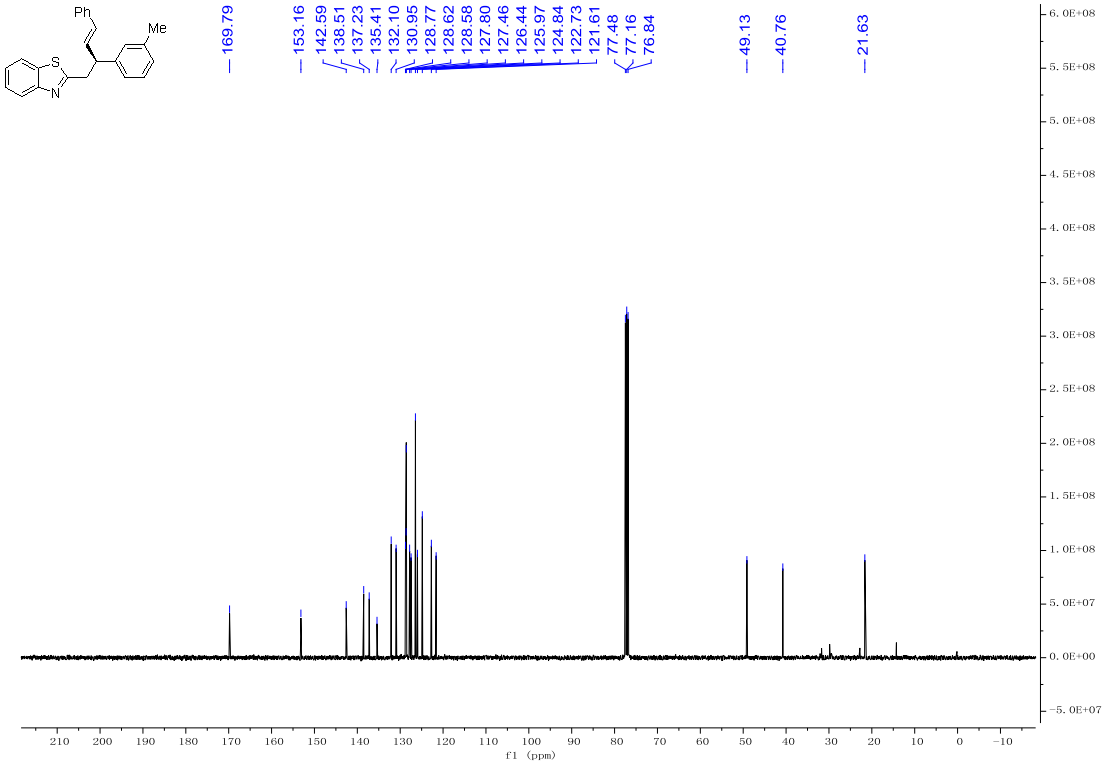


(S,E)-2-(4-phenyl-2-(m-tolyl)but-3-en-1-yl)benzo[d]thiazole (3ca)

^{1}H NMR (400 MHz, $CDCl_3$)

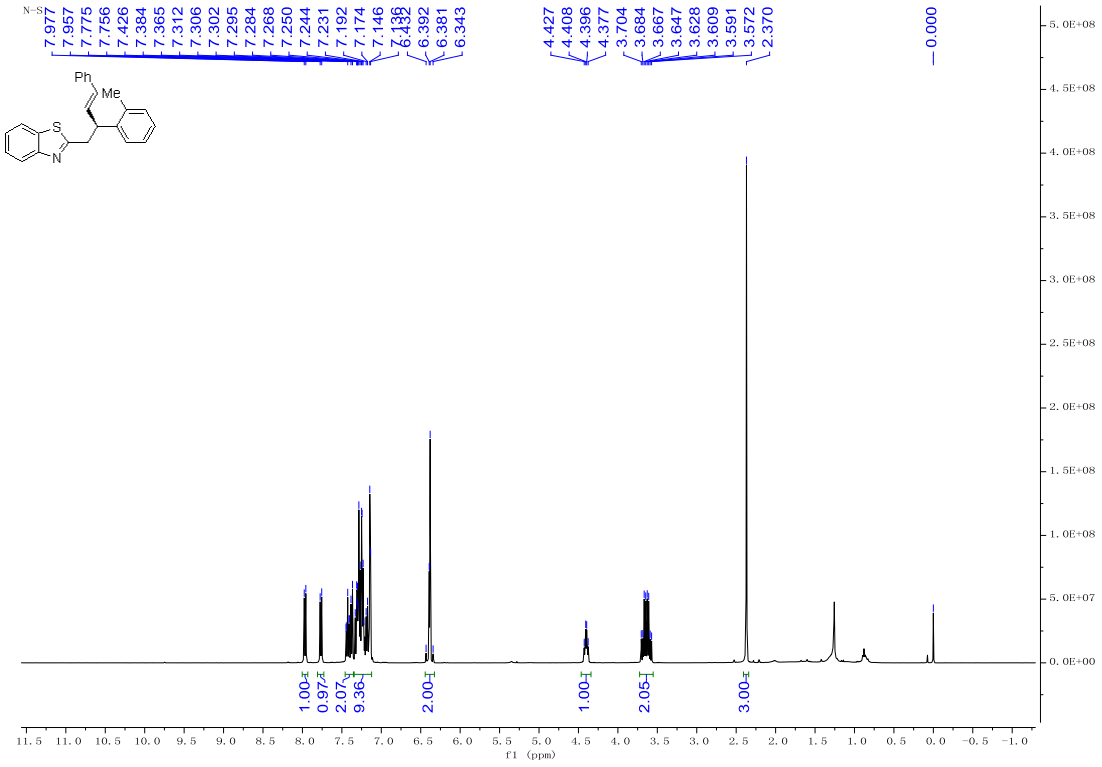


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

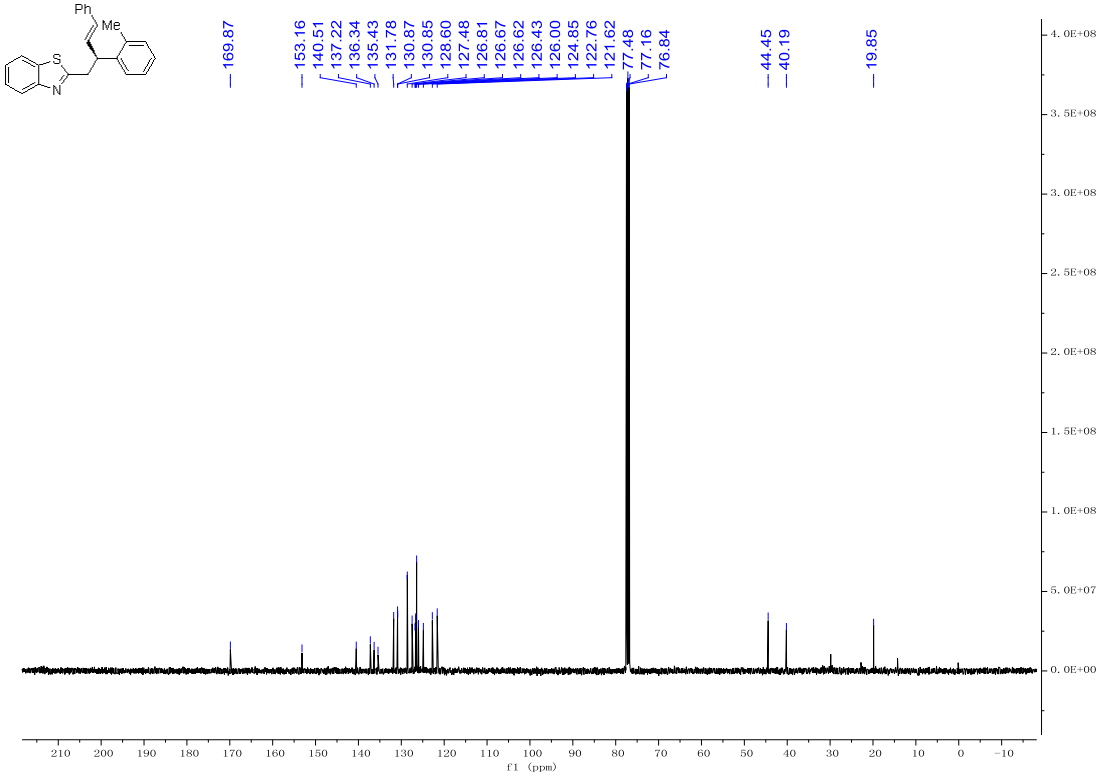


(S,E)-2-(4-phenyl-2-(o-tolyl)but-3-en-1-yl)benzo[d]thiazole (3da)

^{1}H NMR (400 MHz, $CDCl_3$)

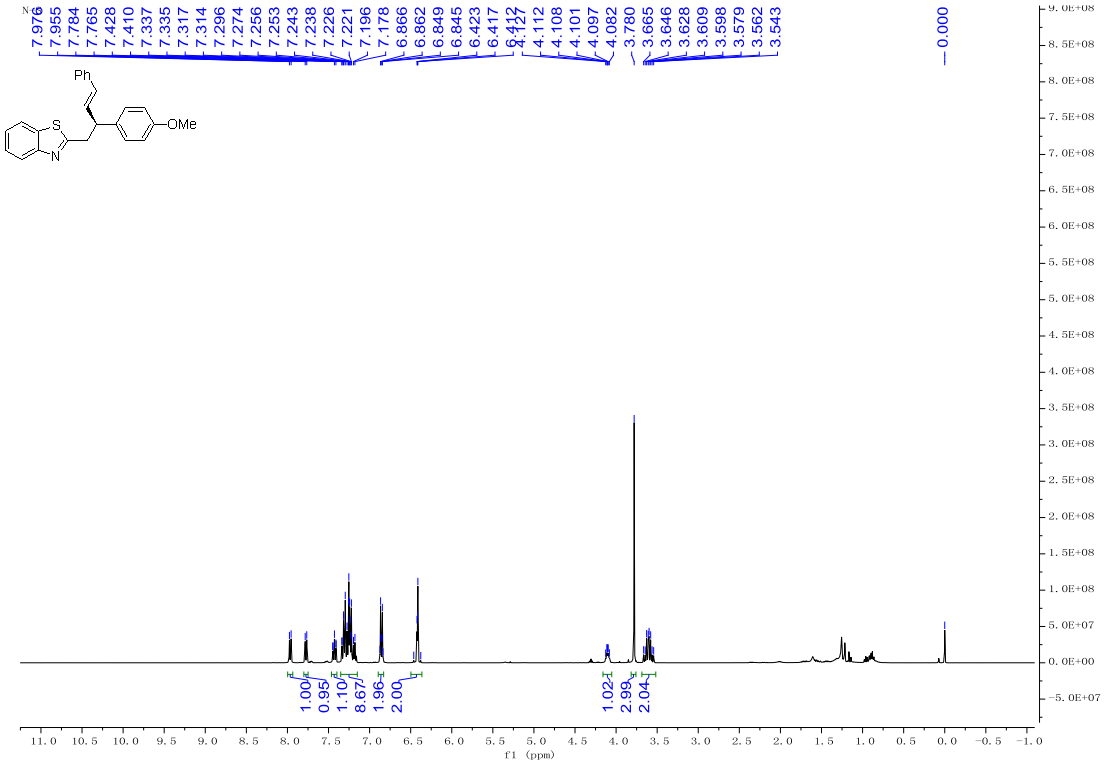


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

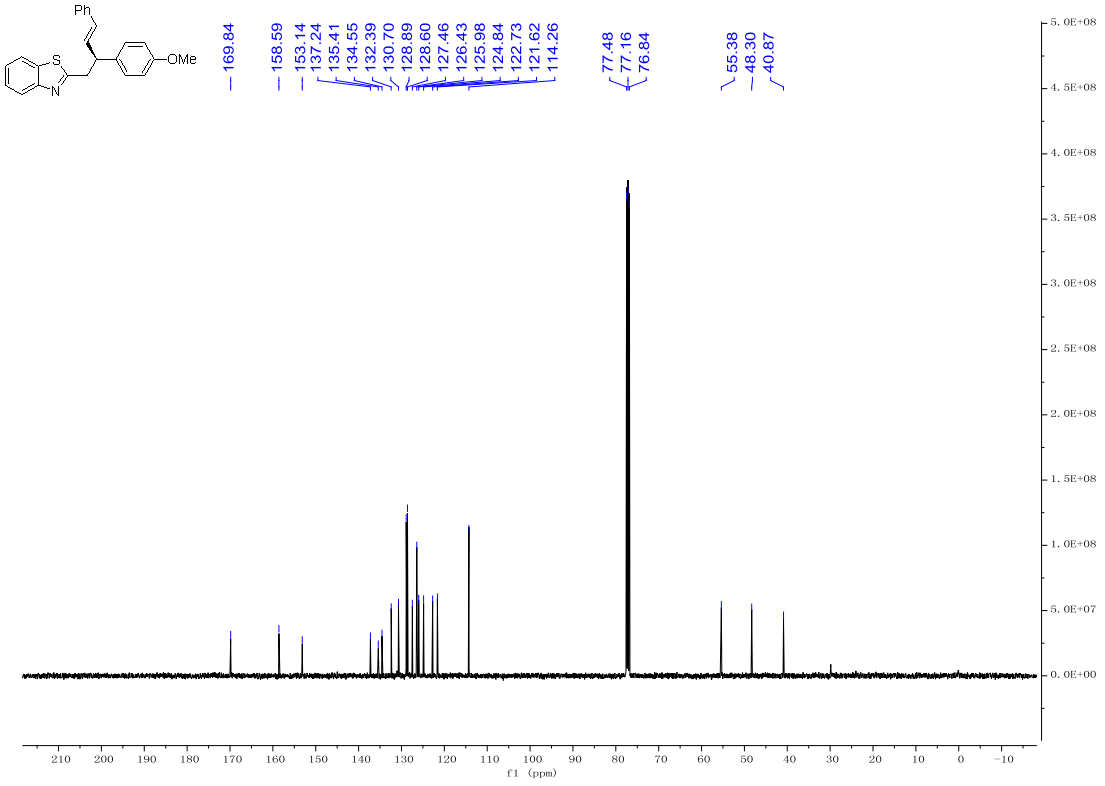


***(S,E)-2-(2-(4-methoxyphenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole* (3ea)**

^{1}H NMR (400 MHz, $CDCl_3$)

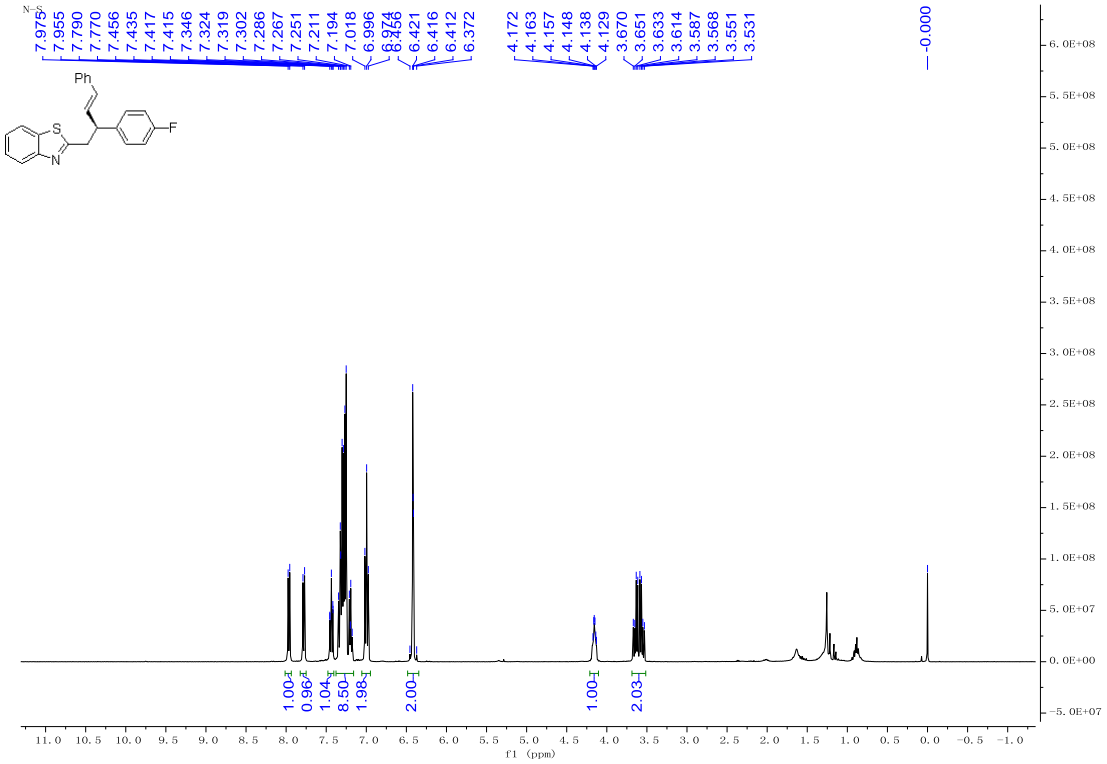


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

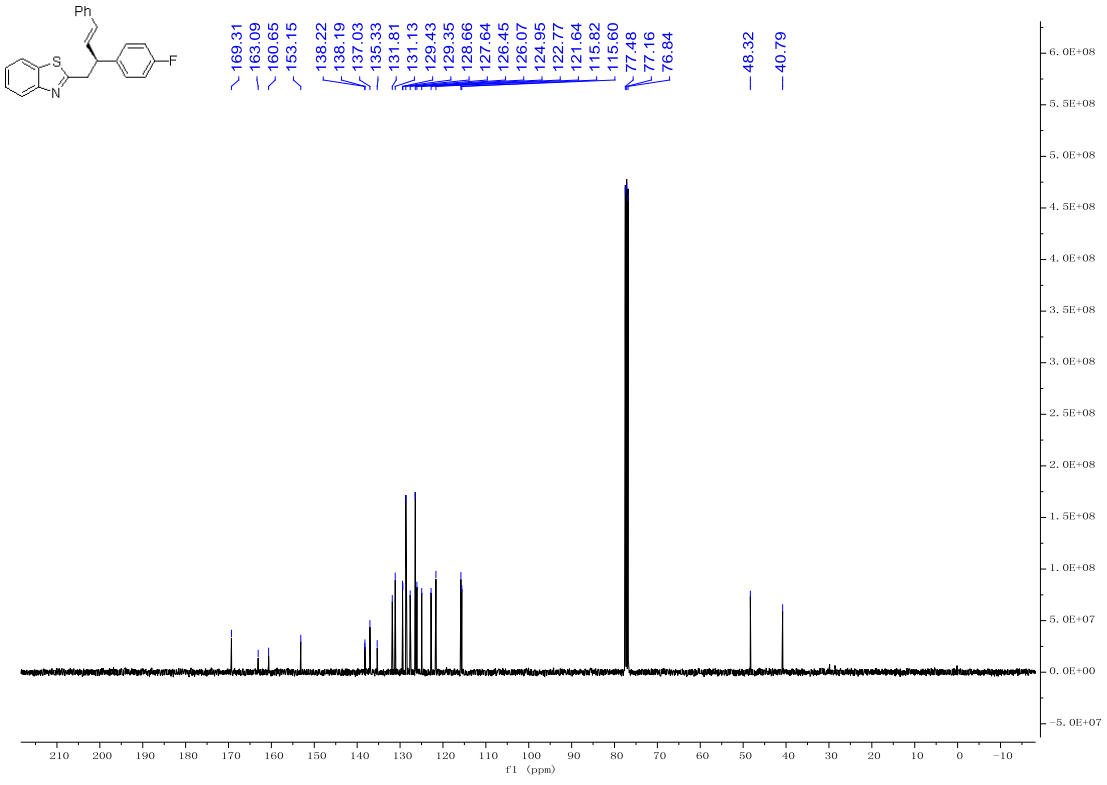


***(S,E)-2-(2-(4-fluorophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole* (3fa)**

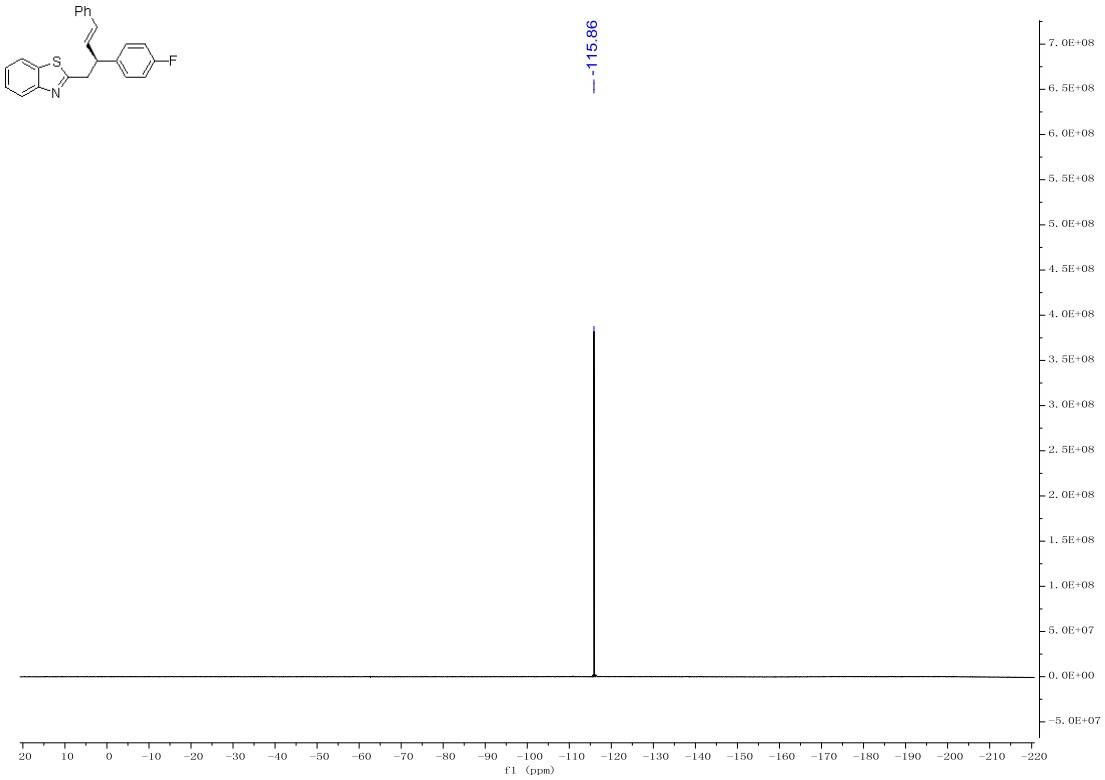
^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

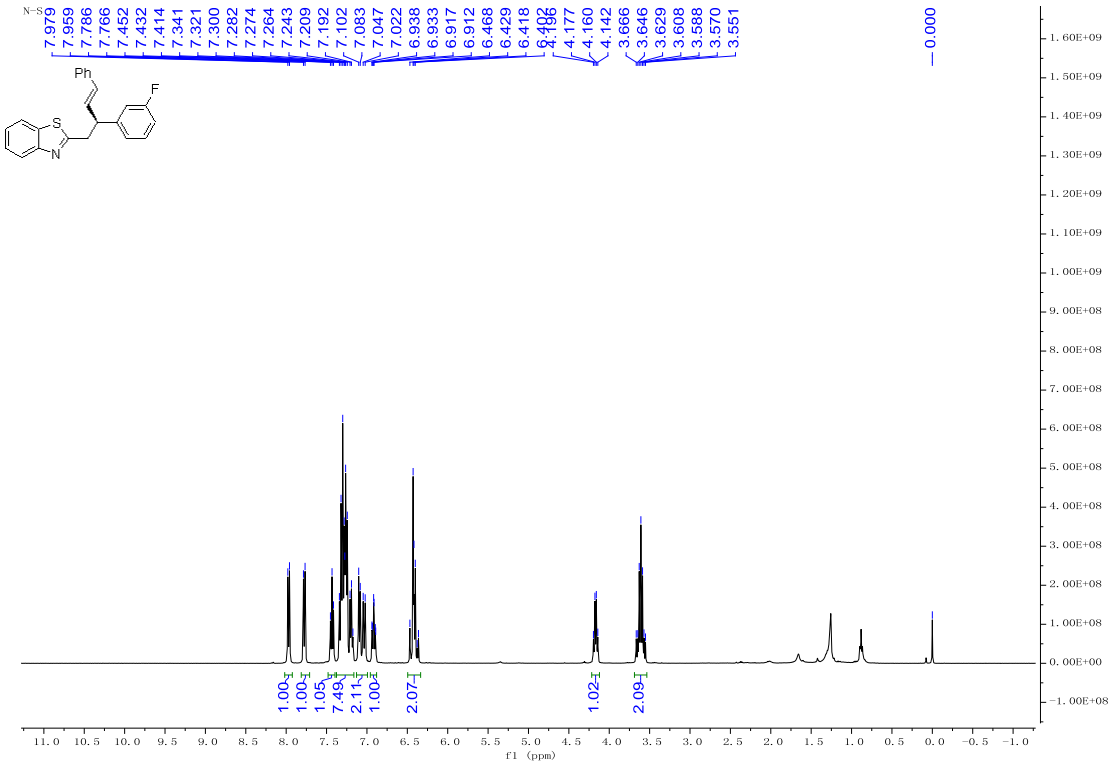


$^{19}F\{^{1}H\}$NMR (376 MHz, $CDCl_3$)

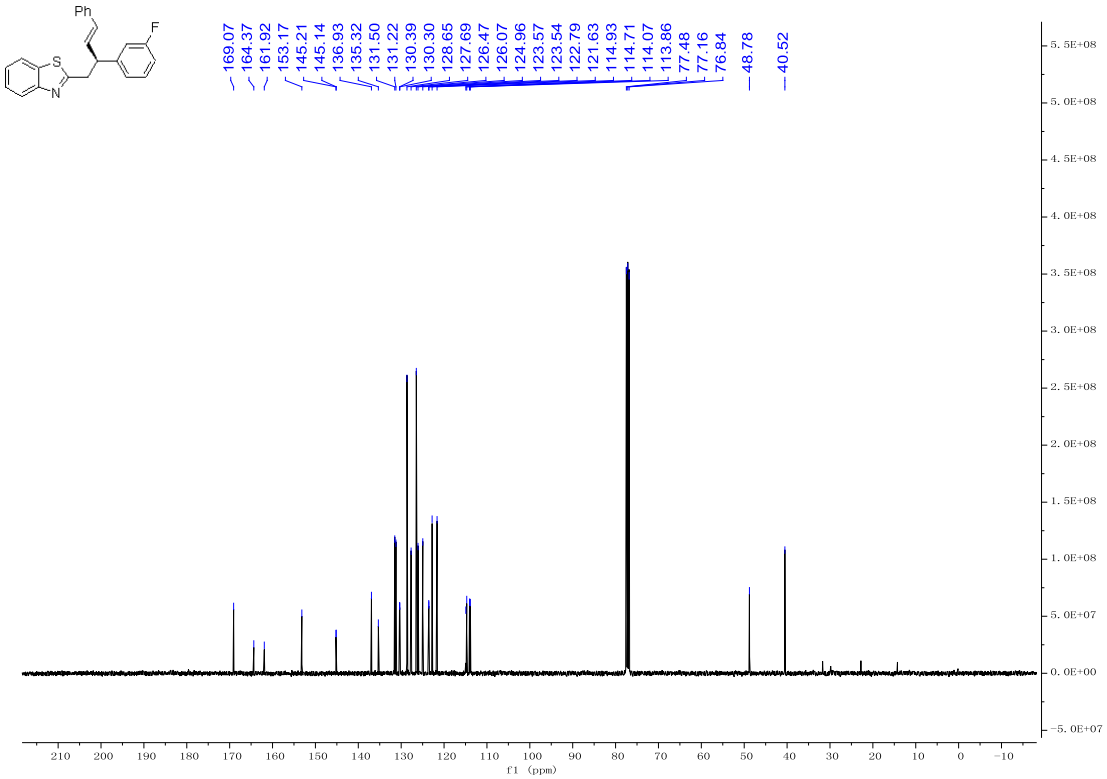


(S,E)-2-(2-(3-fluorophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ga)**

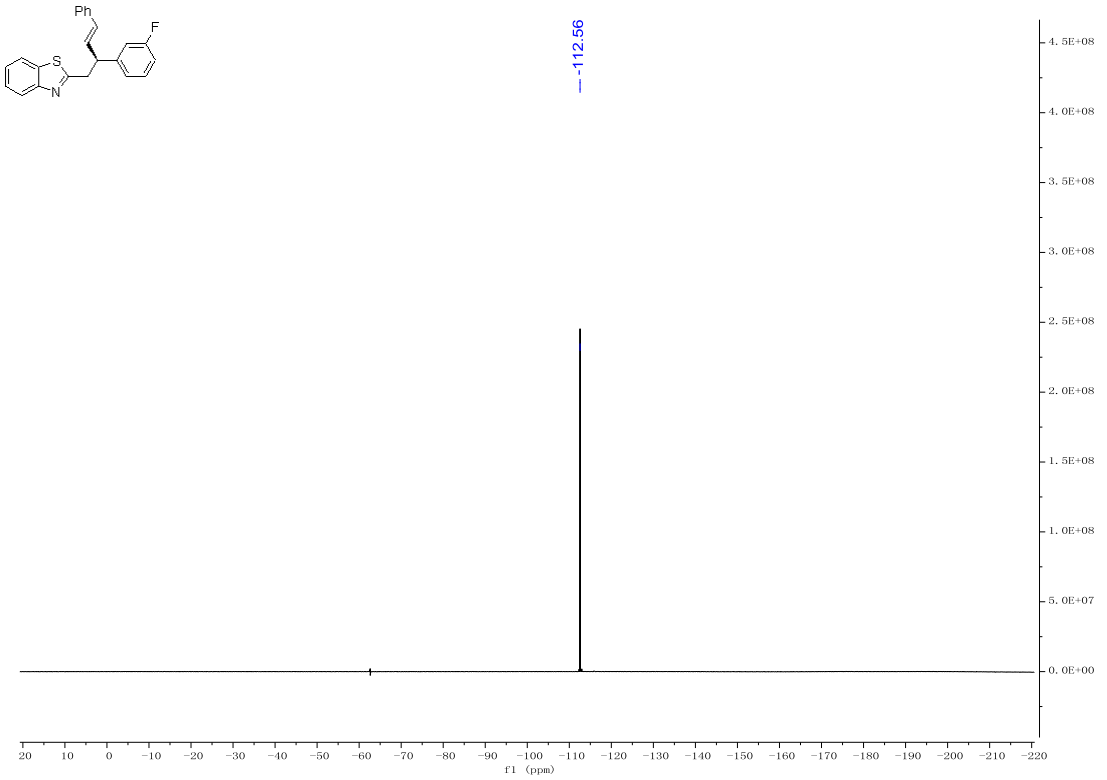
^{1}H NMR (400 MHz, $CDCl_3$)



$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

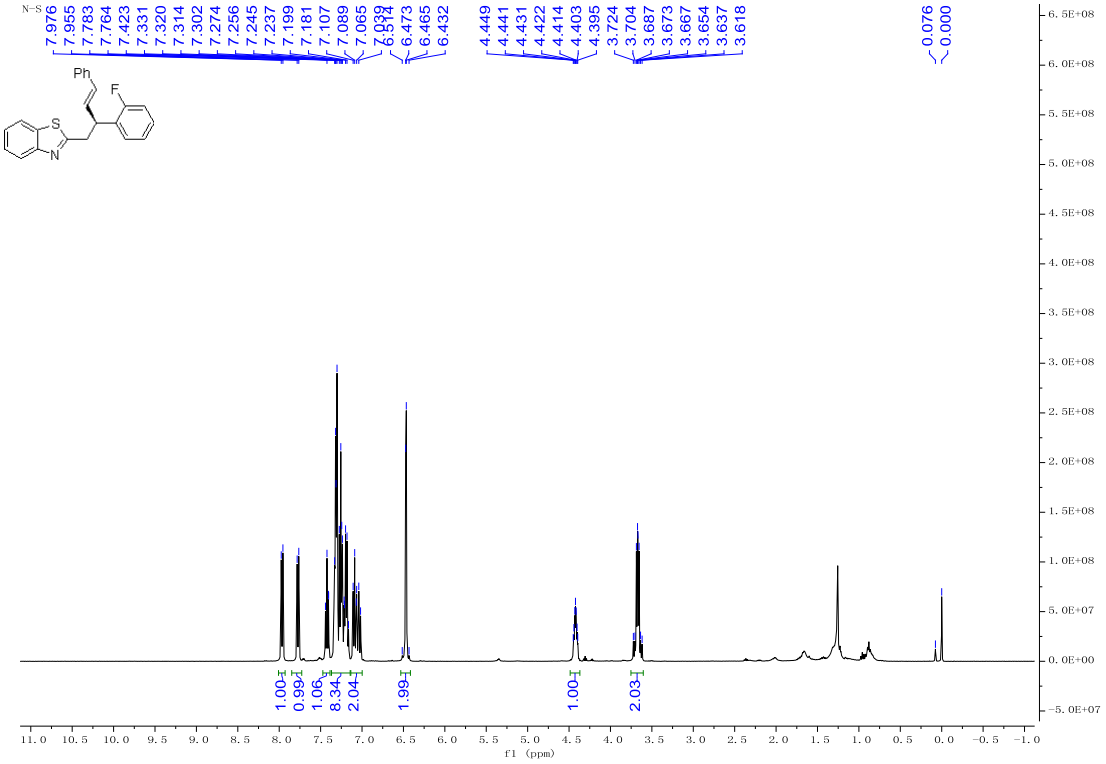


$^{19}F\{^{1}H\}$NMR (376 MHz, $CDCl_3$)

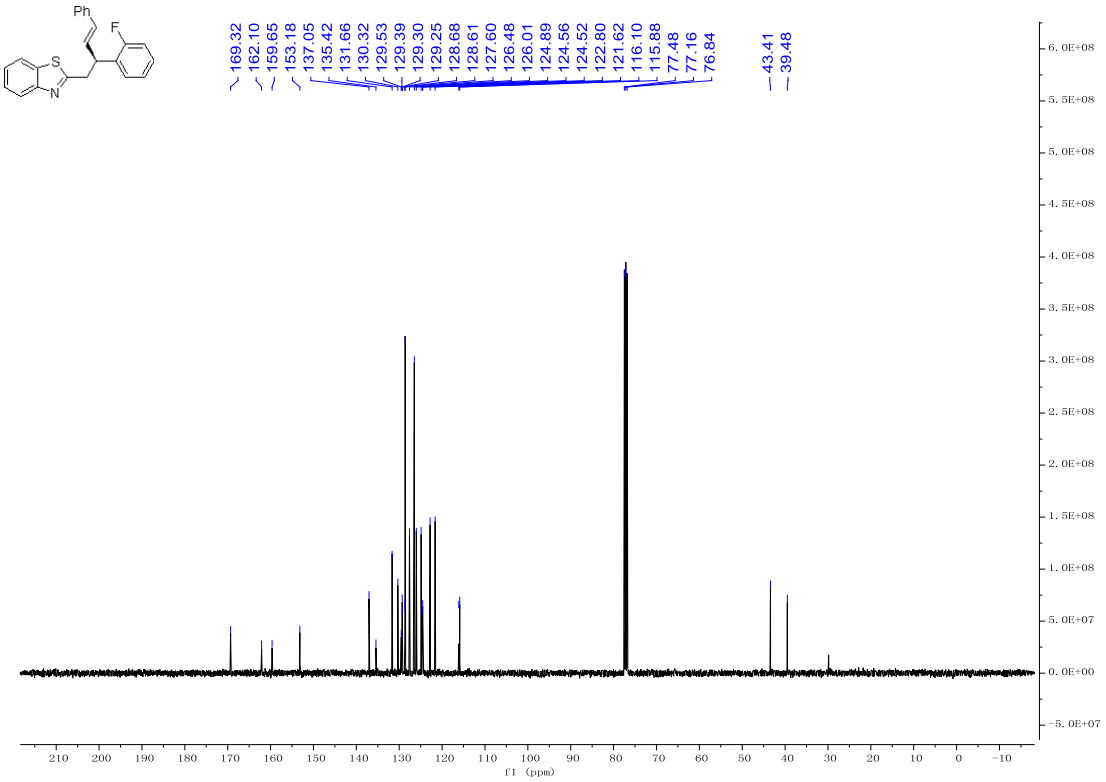


(S,E)-2-(2-(2-fluorophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole (**3ha**)

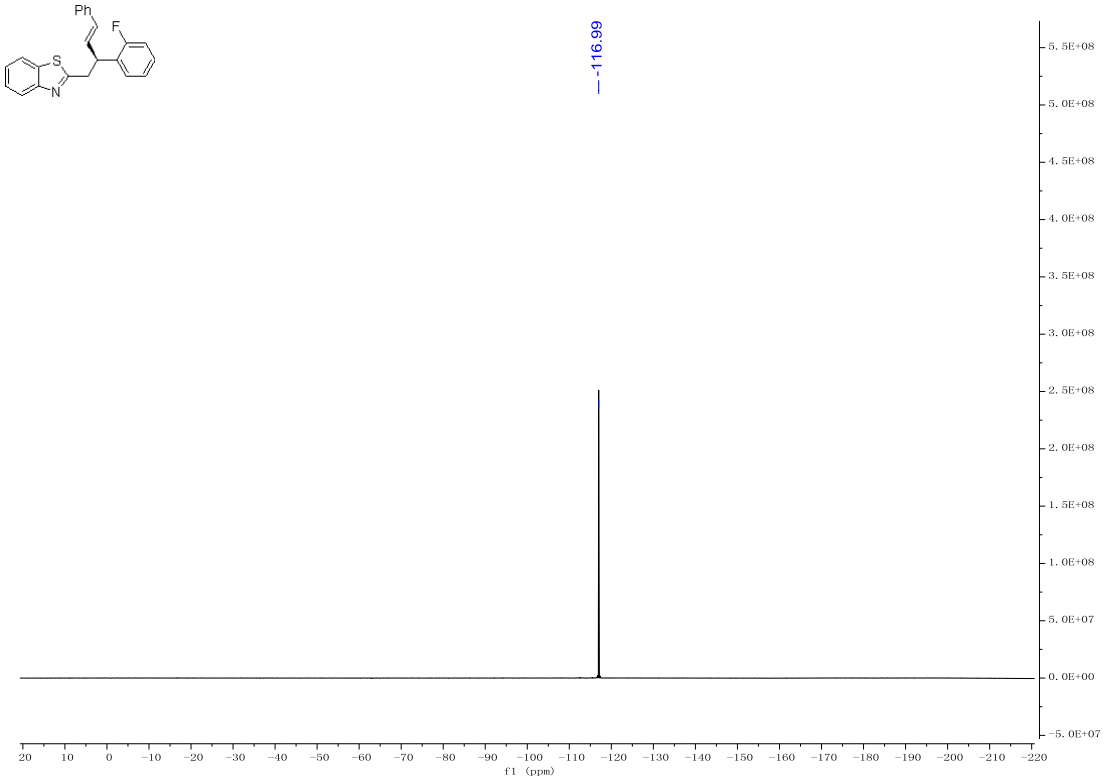
^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

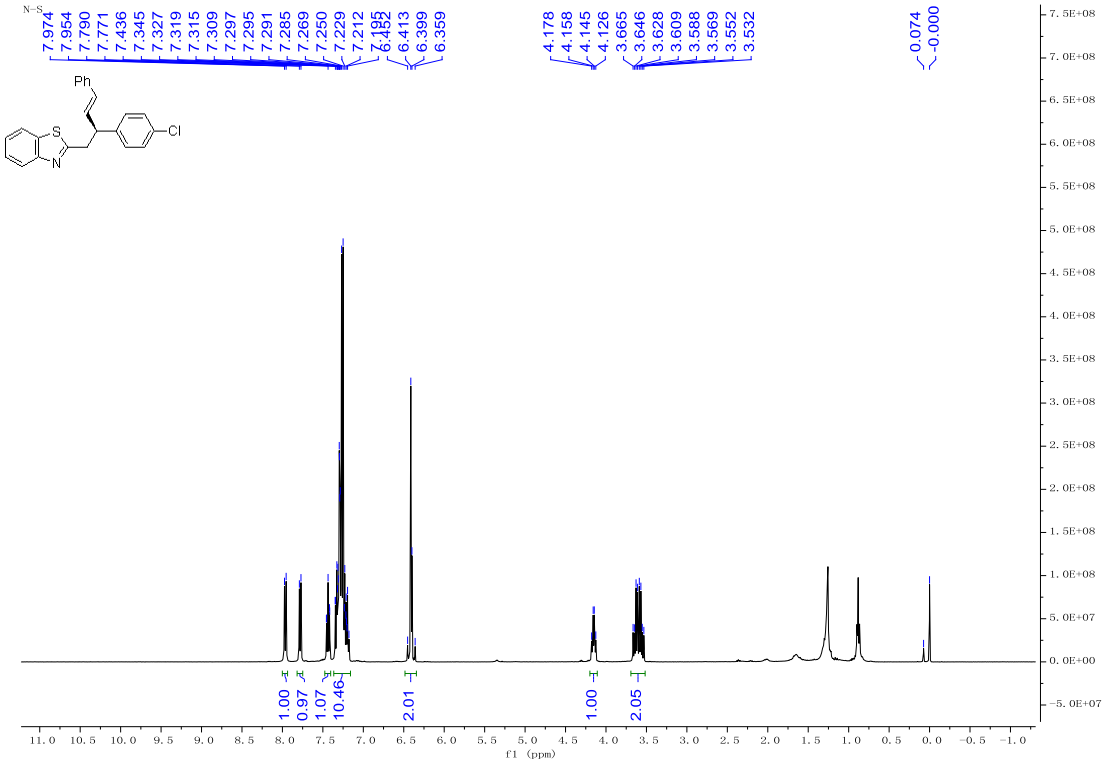


$^{19}F\{^{1}H\}$NMR (376 MHz, $CDCl_3$)

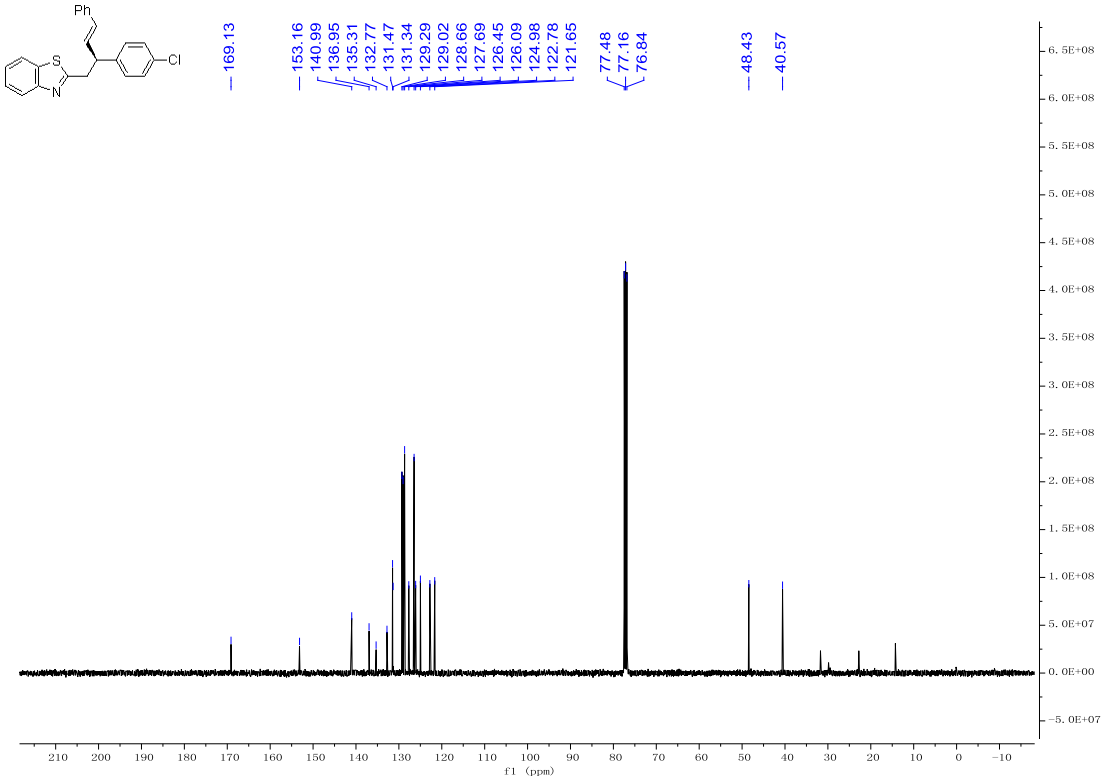


(S,E)-2-(2-(4-chlorophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ia)**

^{1}H NMR (400 MHz, $CDCl_3$)

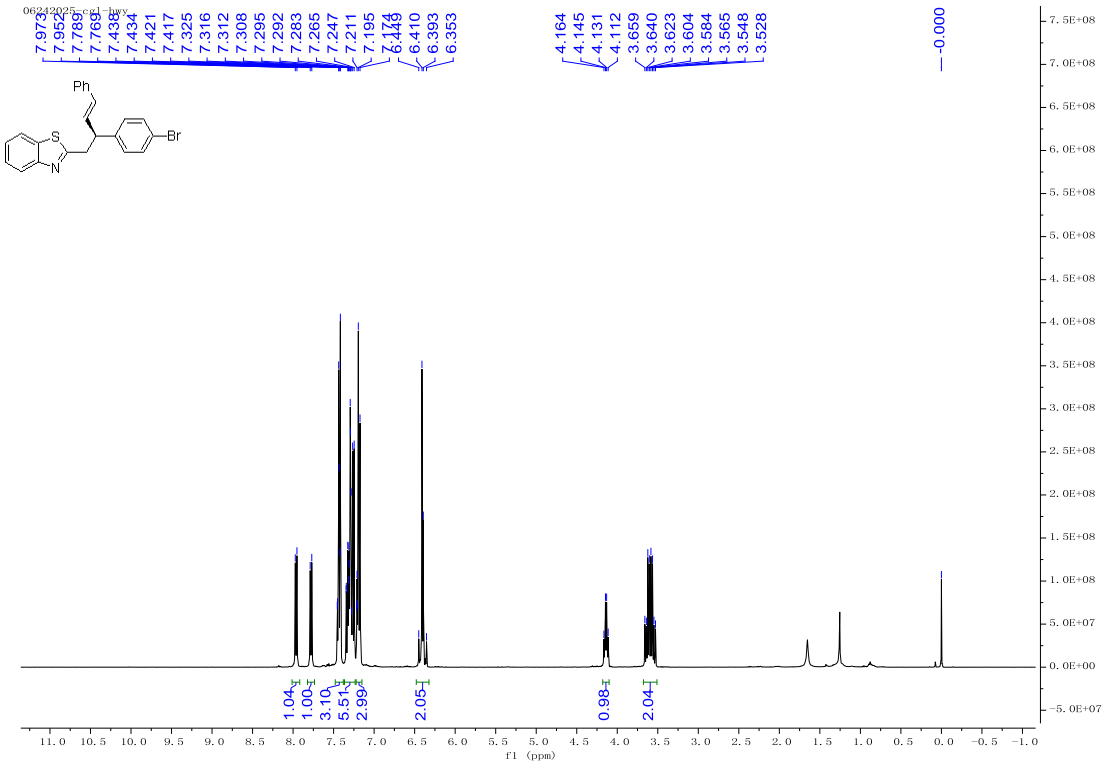


$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

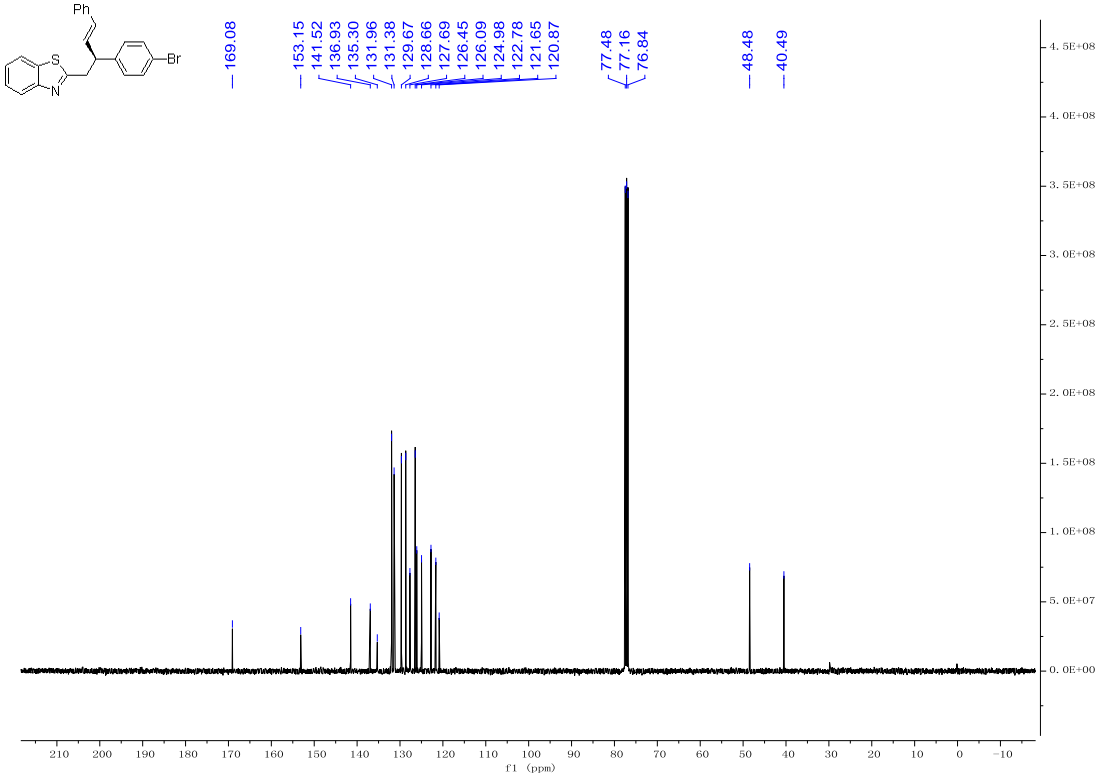


(S,E)-2-(2-(4-bromophenyl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ja)**

^{1}H NMR (400 MHz, $CDCl_3$)

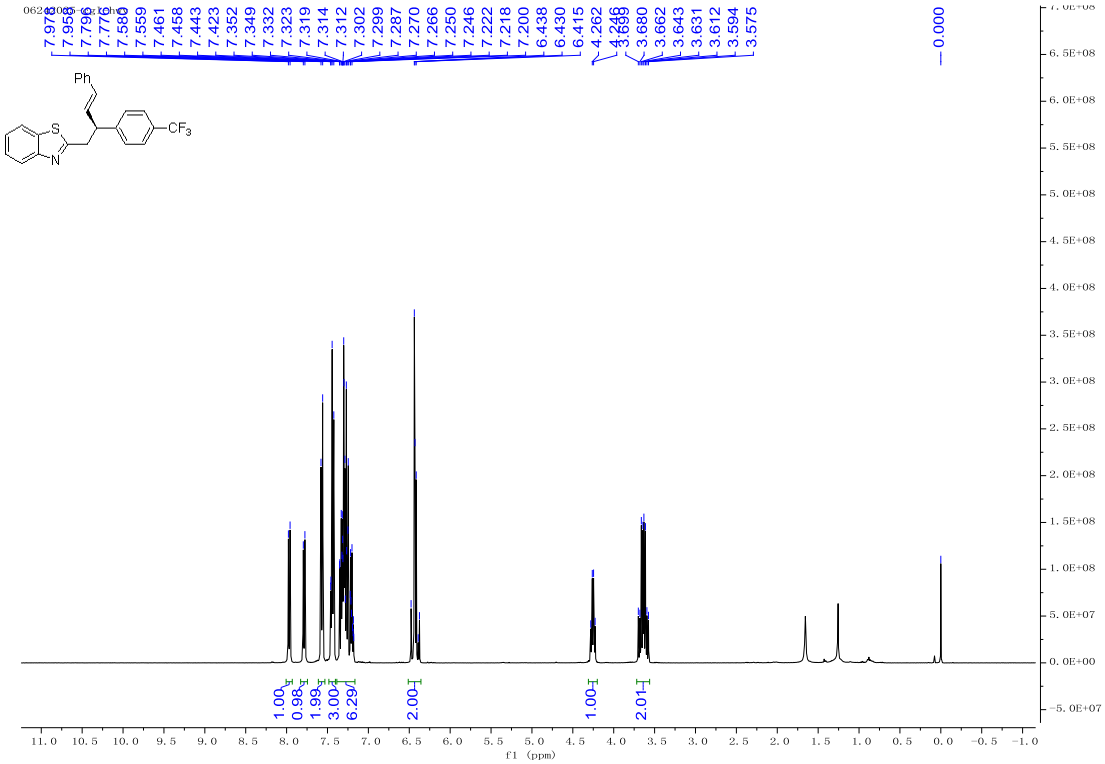


$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

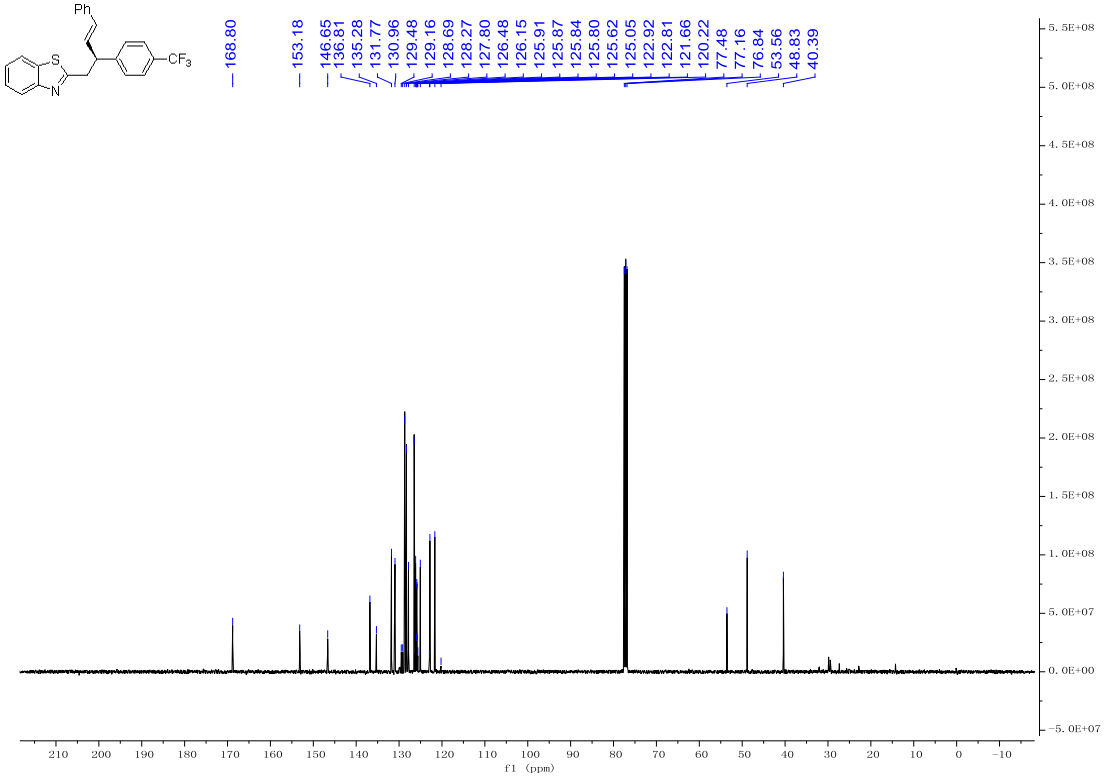


(*S*,*E*)-2-(4-phenyl-2-(4-(trifluoromethyl)phenyl)but-3-en-1-yl)benzo[d]thiazole (3ka)

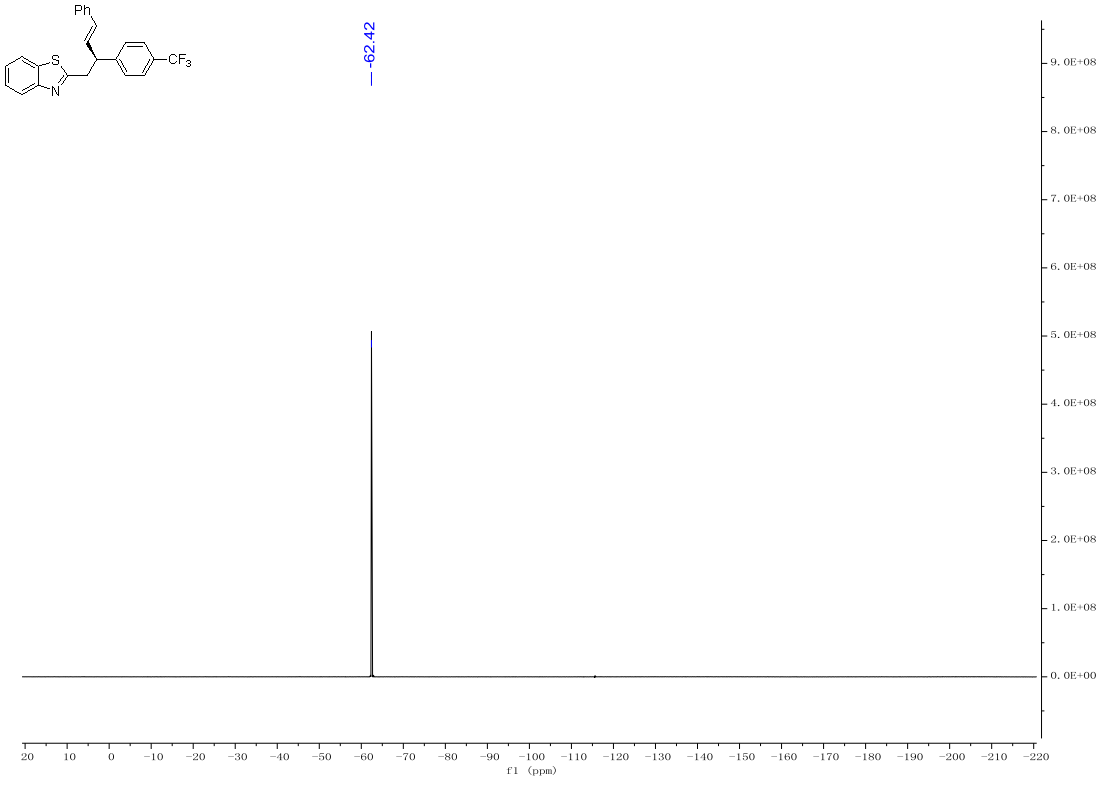
^{1}H NMR (400 MHz, $CDCl_3$)



$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

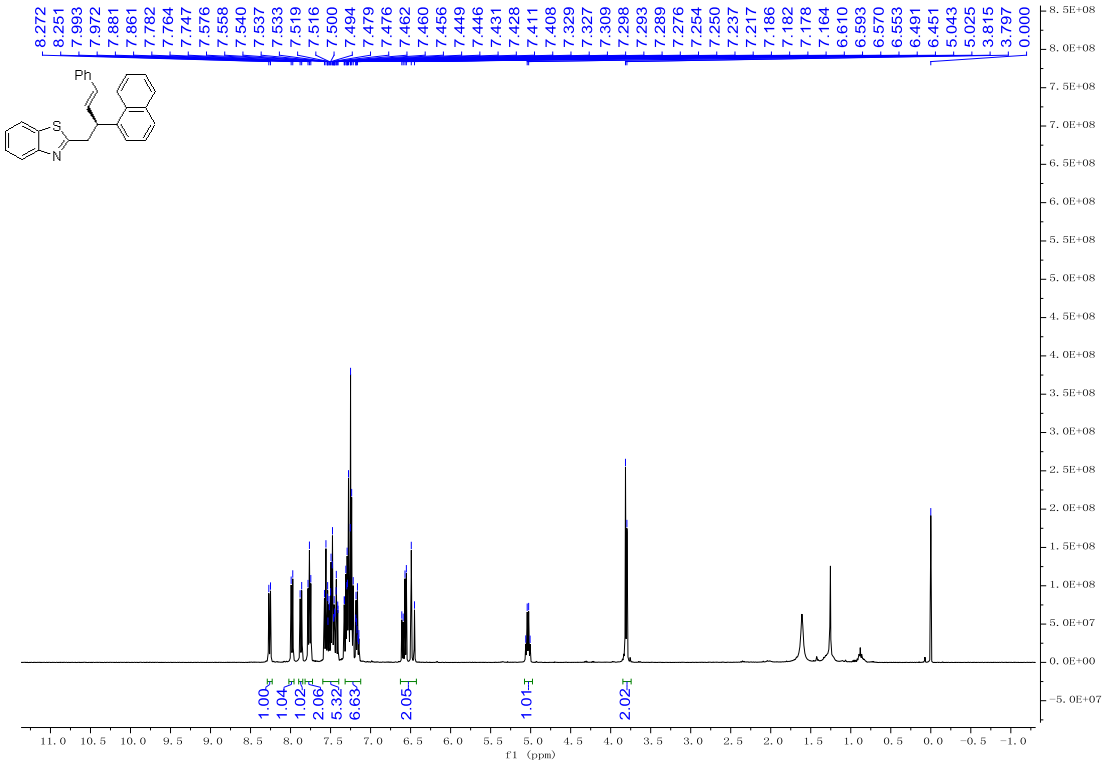


$^{19}F\{^{1}H\}$NMR (376 MHz, $CDCl_3$)

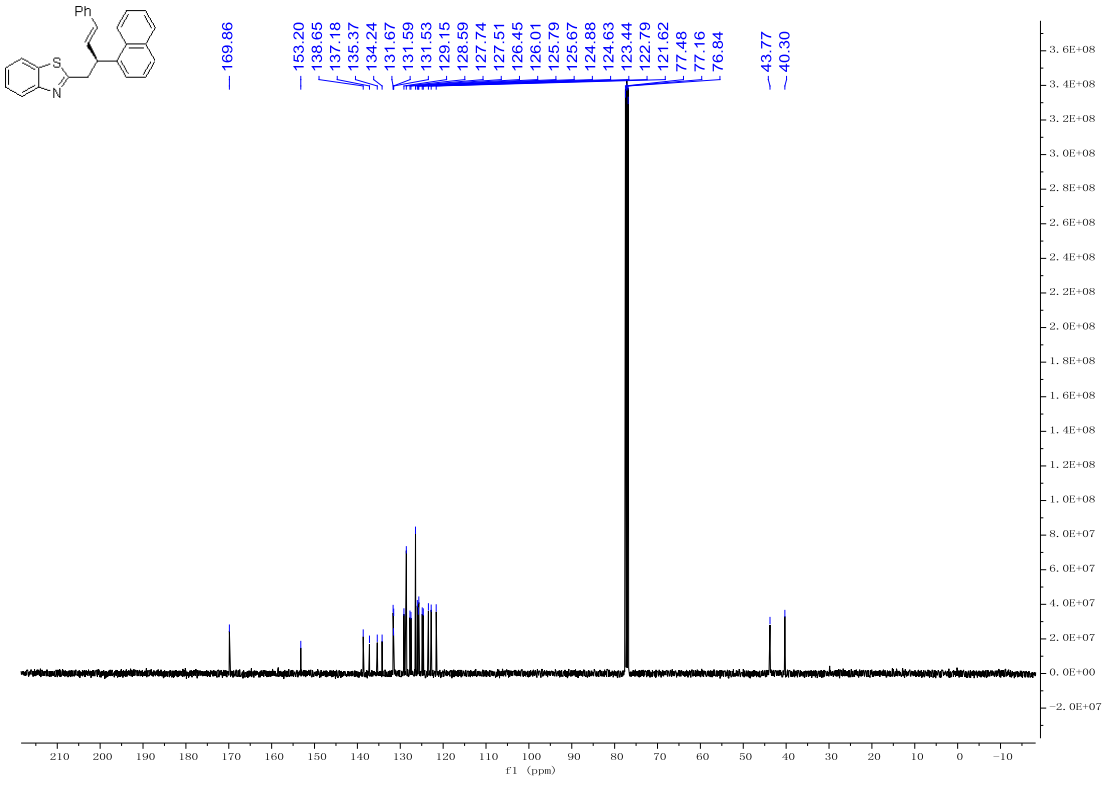


(S,E)-2-(2-(naphthalen-1-yl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole **(3la)**

^{1}H NMR (400 MHz, $CDCl_3$)

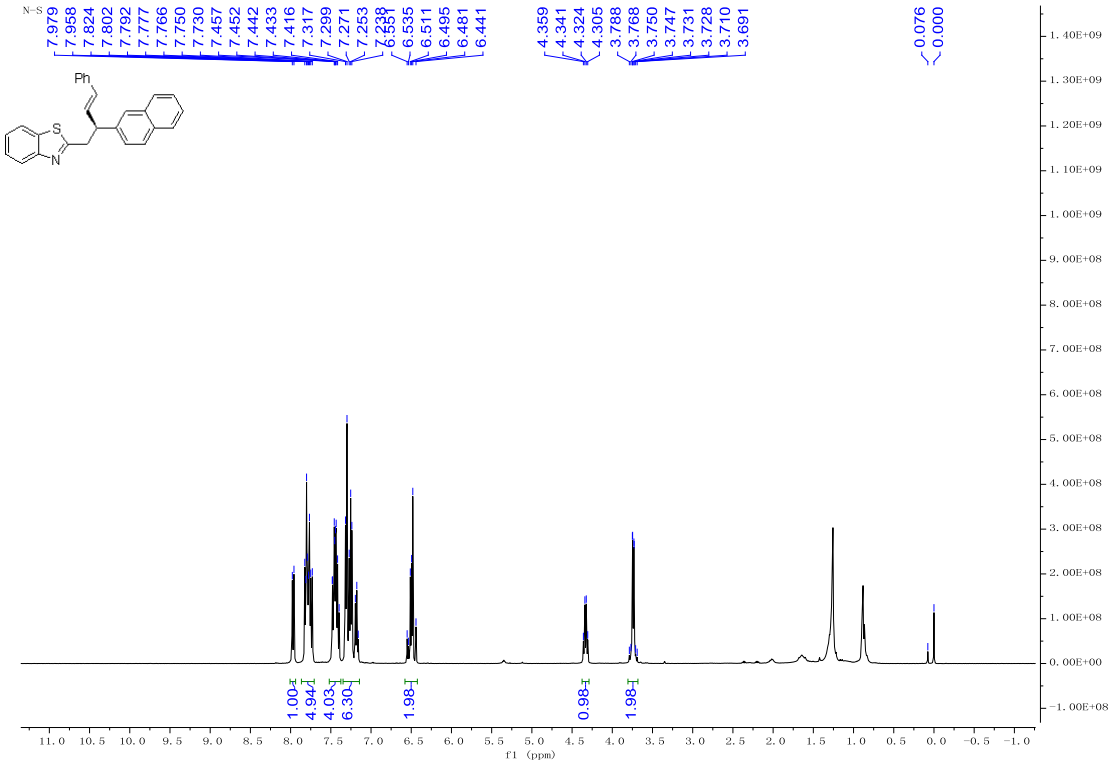


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

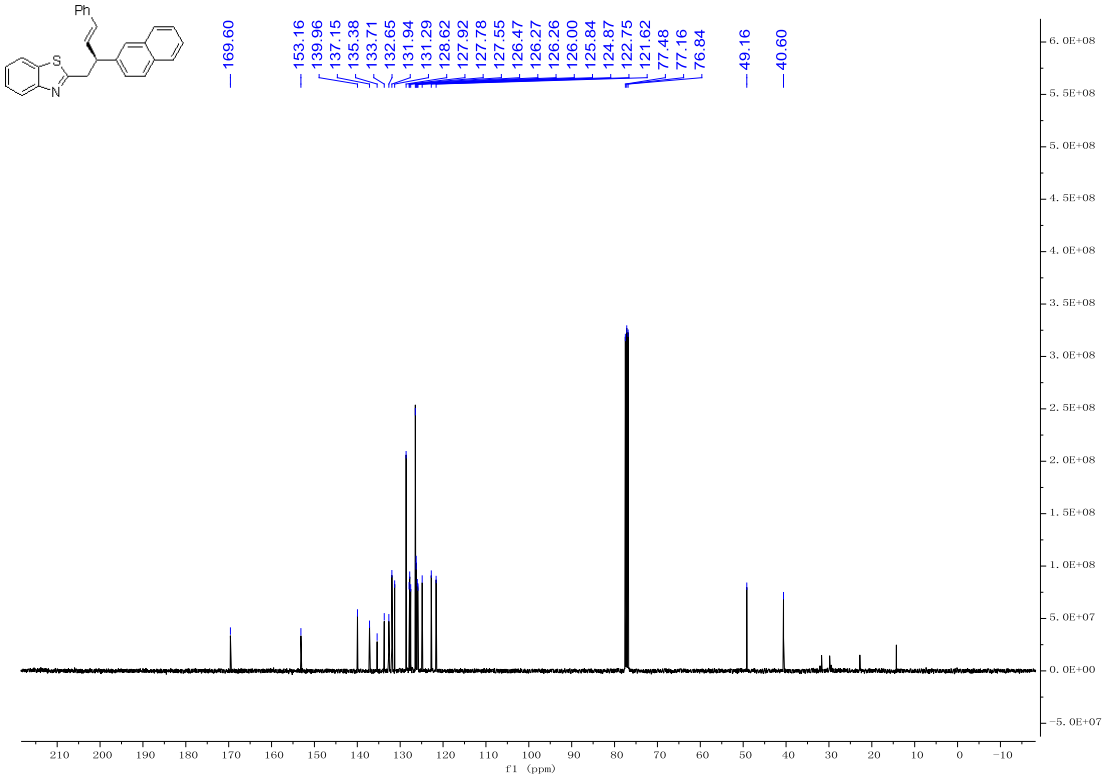


(S,E)-2-(2-(naphthalen-2-yl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole (3ma)

^{1}H NMR (400 MHz, $CDCl_3$)

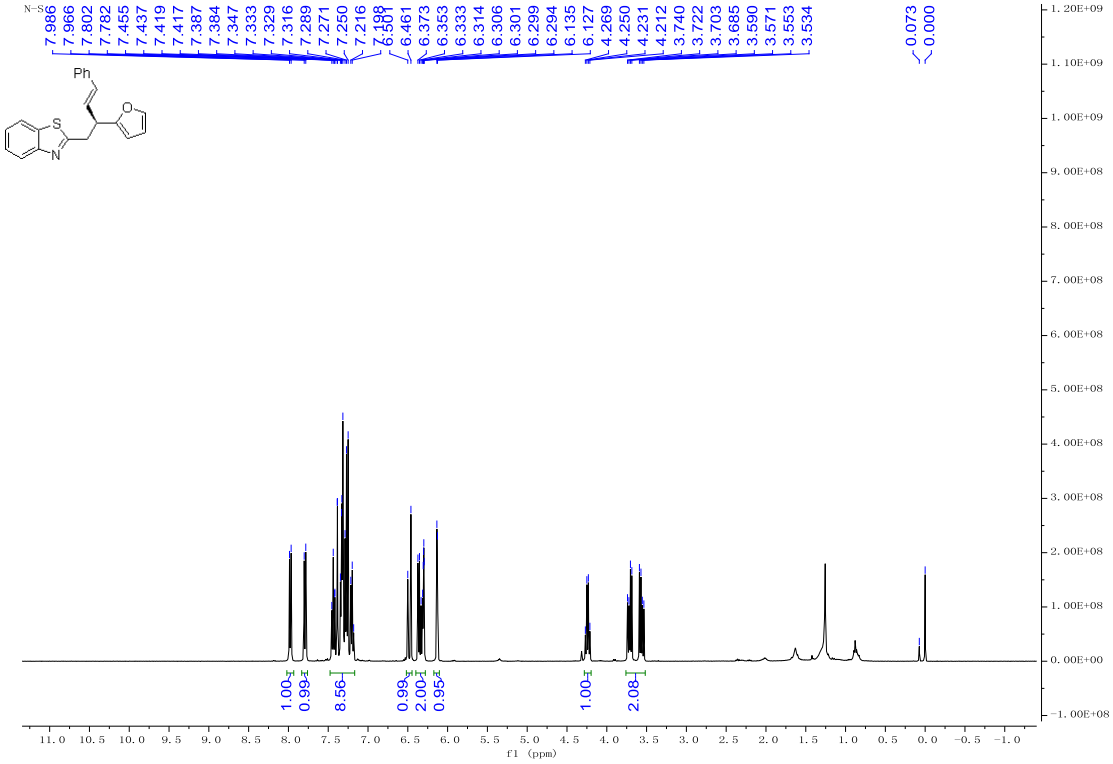


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

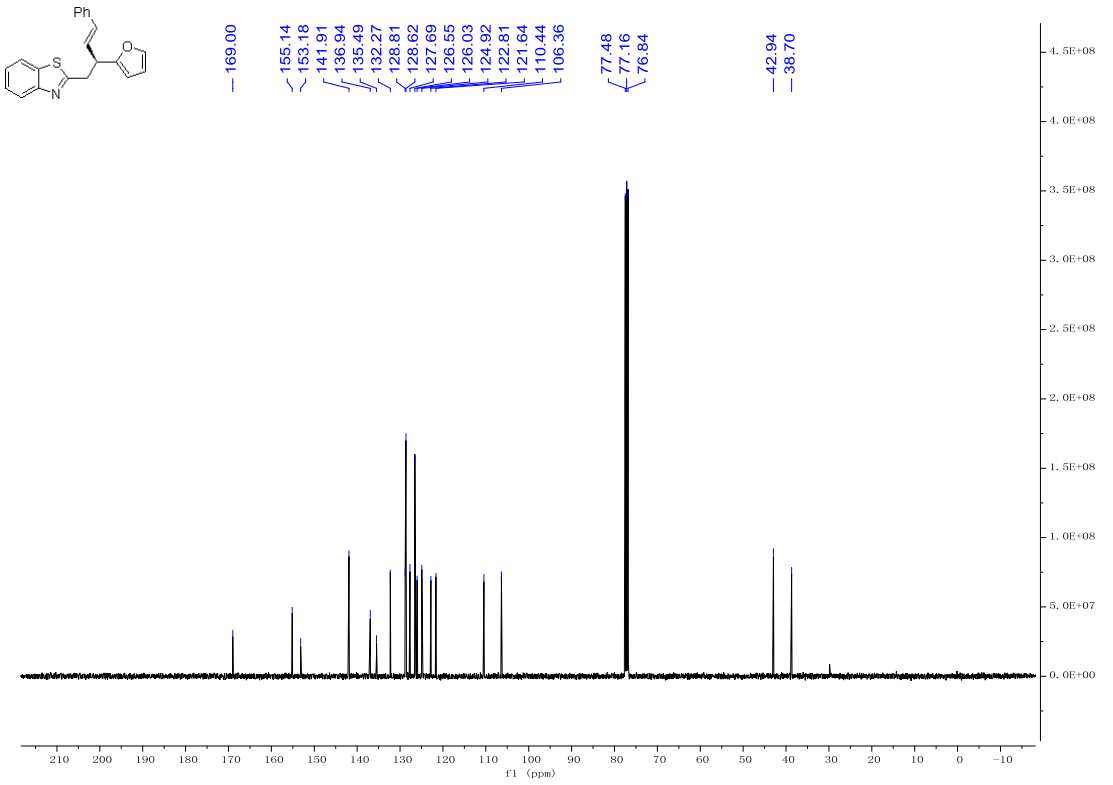


(*S*,*E*)-2-(2-(furan-2-yl)-4-phenylbut-3-en-1-yl)benzo[d]thiazole (3na)

^{1}H NMR (400 MHz, $CDCl_3$)

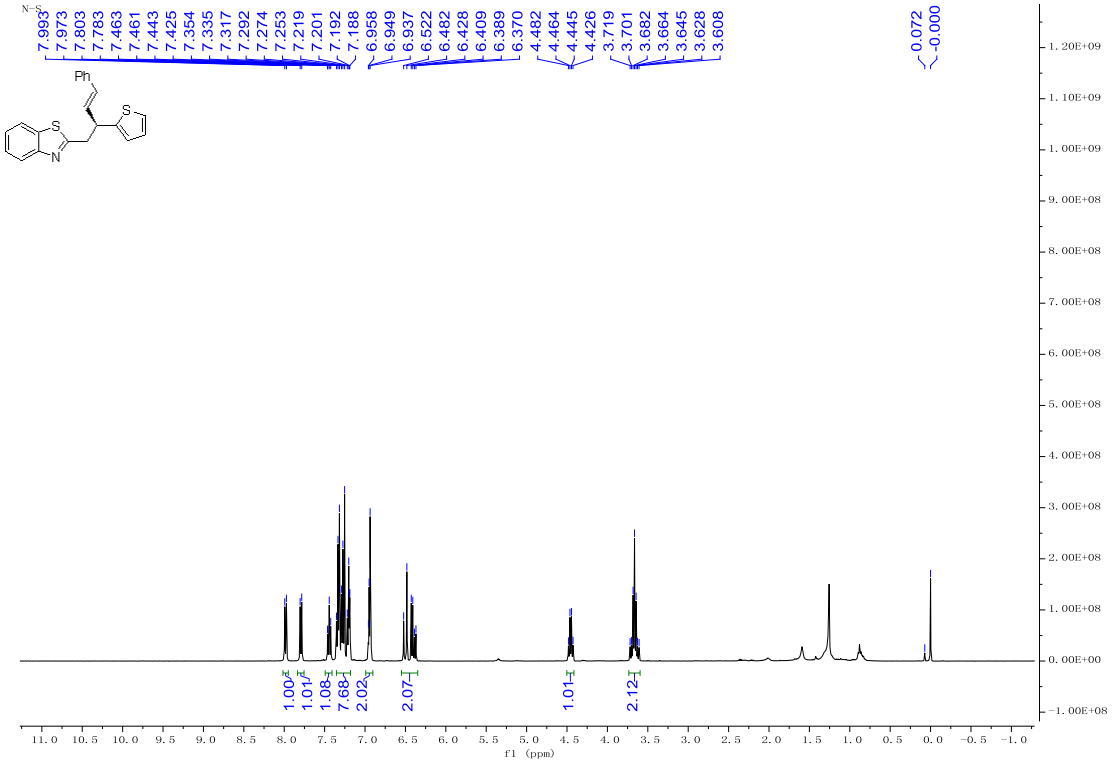


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

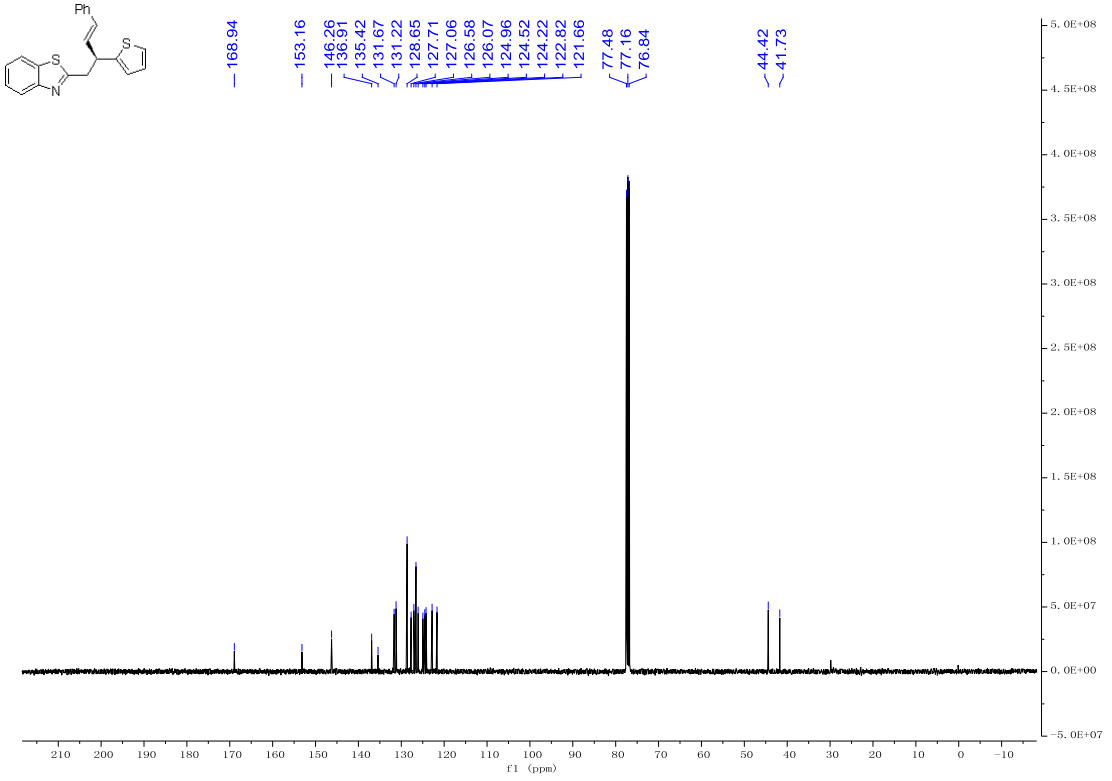


(S,E)-2-(4-phenyl-2-(thiophen-2-yl)but-3-en-1-yl)benzo[d]thiazole (3oa)

^{1}H NMR (400 MHz, $CDCl_3$)

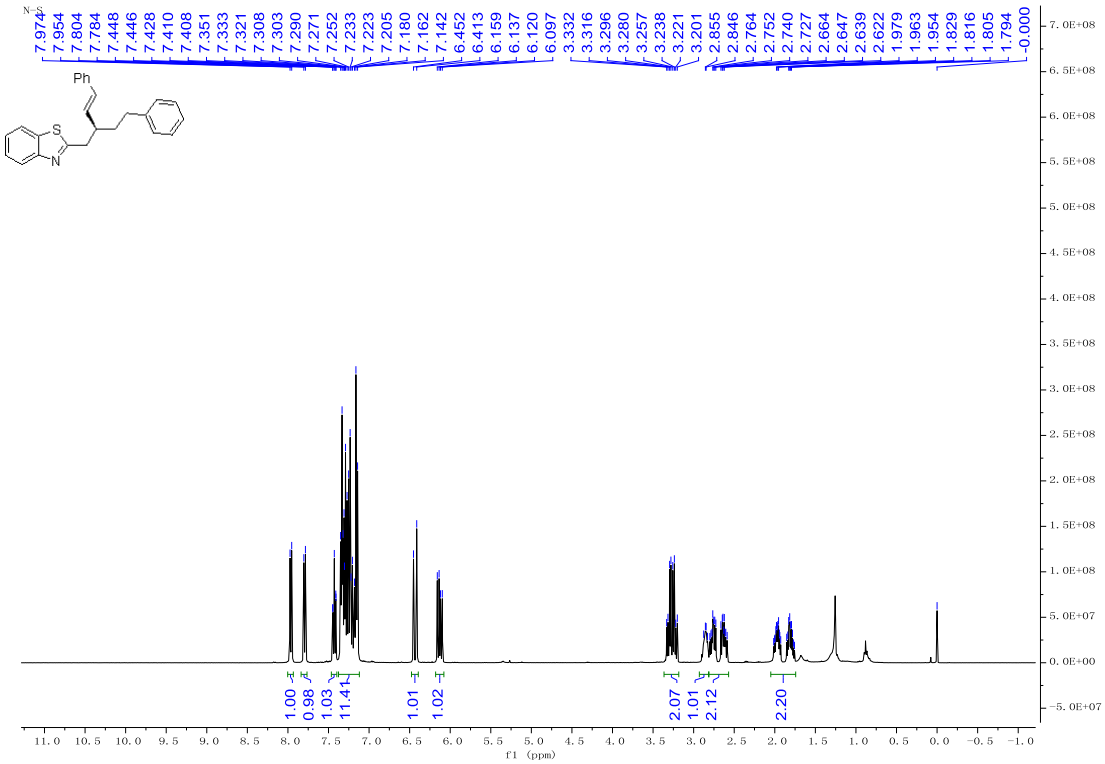


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

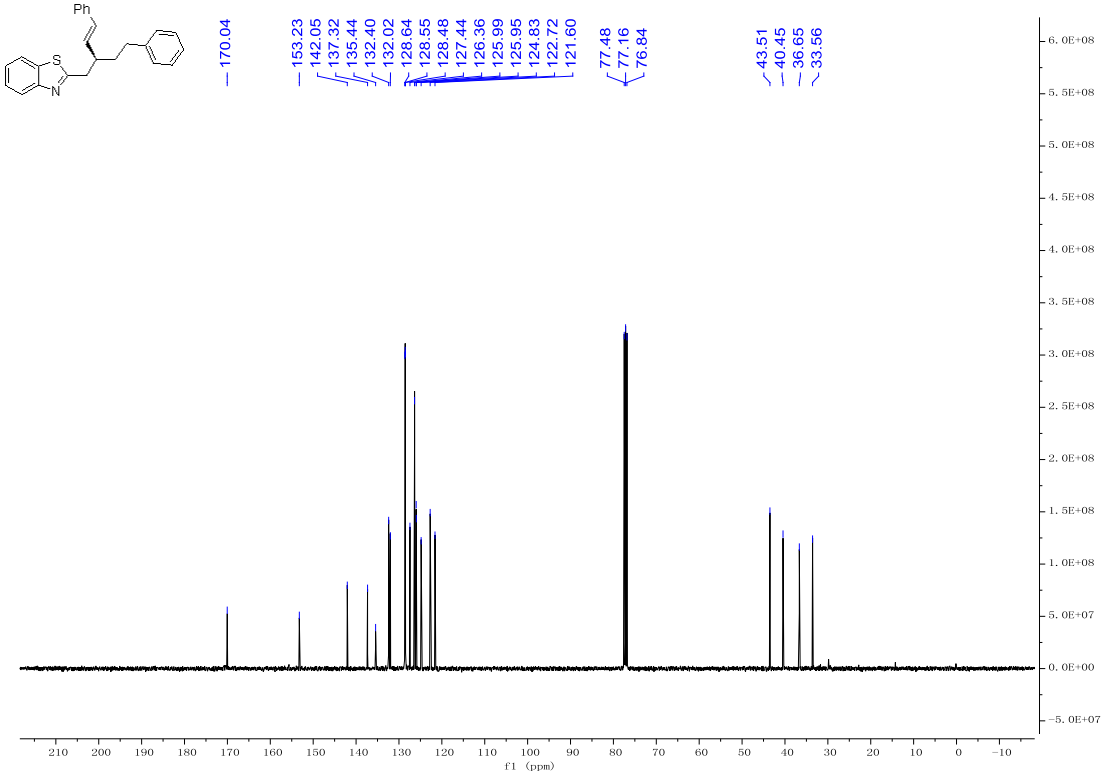


***(S,E)-2-(2-phenethyl-4-phenylbut-3-en-1-yl)benzo[d]thiazole* (3pa)**

^{1}H NMR (400 MHz, $CDCl_3$)

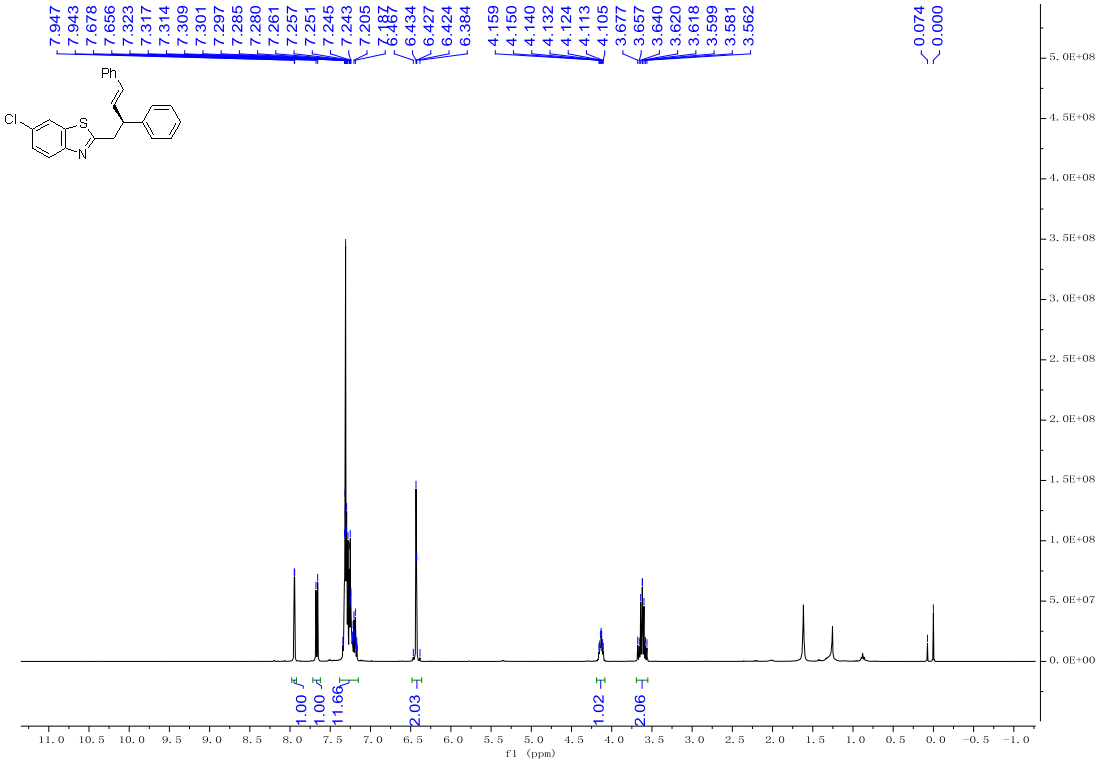


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

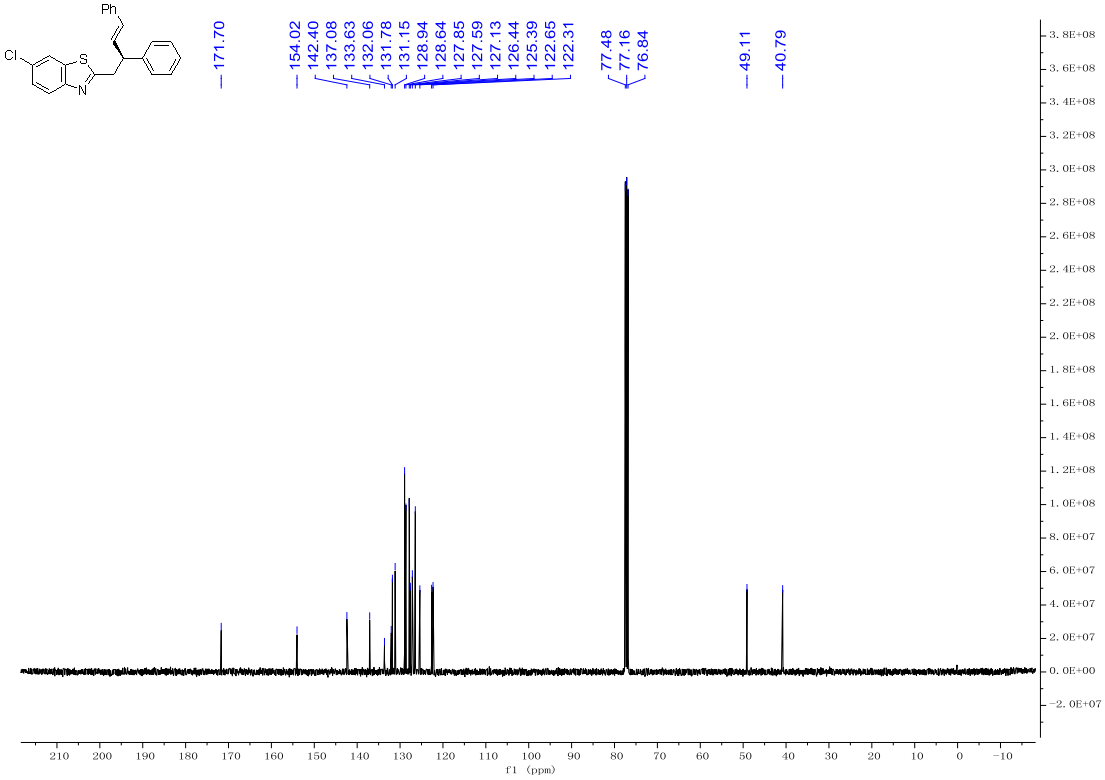


(S,E)-6-chloro-2-(2,4-diphenylbut-3-en-1-yl)benzo[d]thiazole (3qa)

^{1}H NMR (400 MHz, $CDCl_3$)

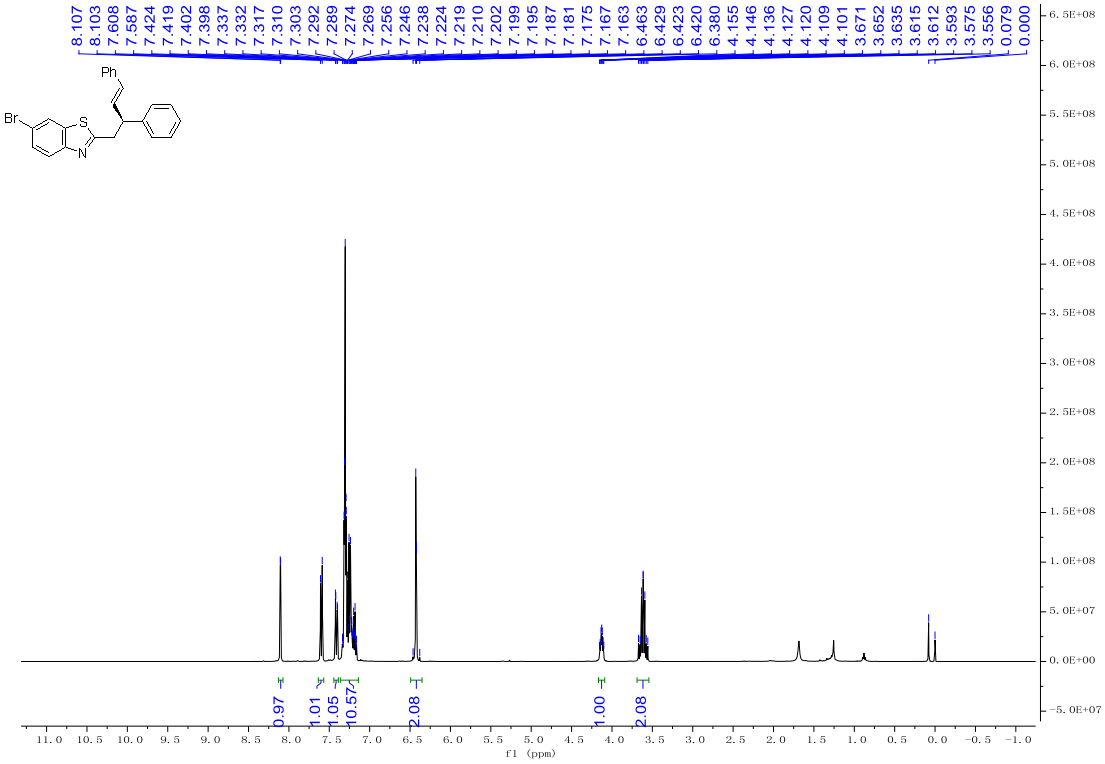


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

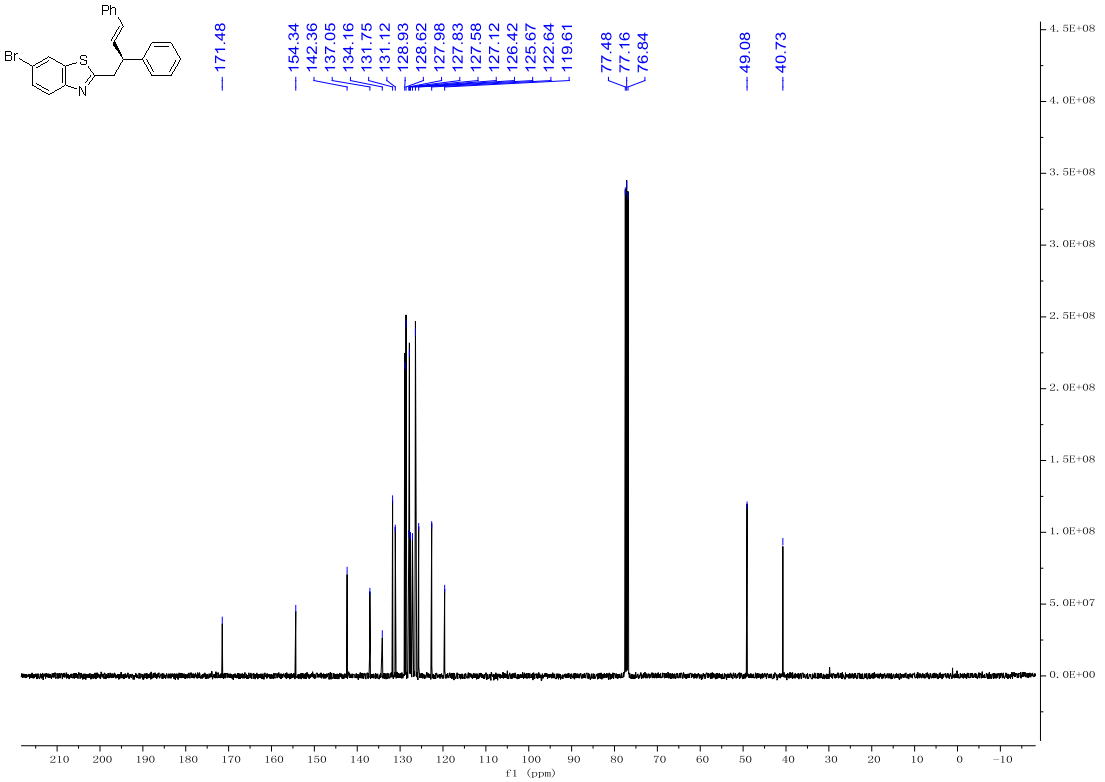


(S,E)-6-bromo-2-(2,4-diphenylbut-3-en-1-yl)benzo[d]thiazole (3ra)

^{1}H NMR (400 MHz, $CDCl_3$)

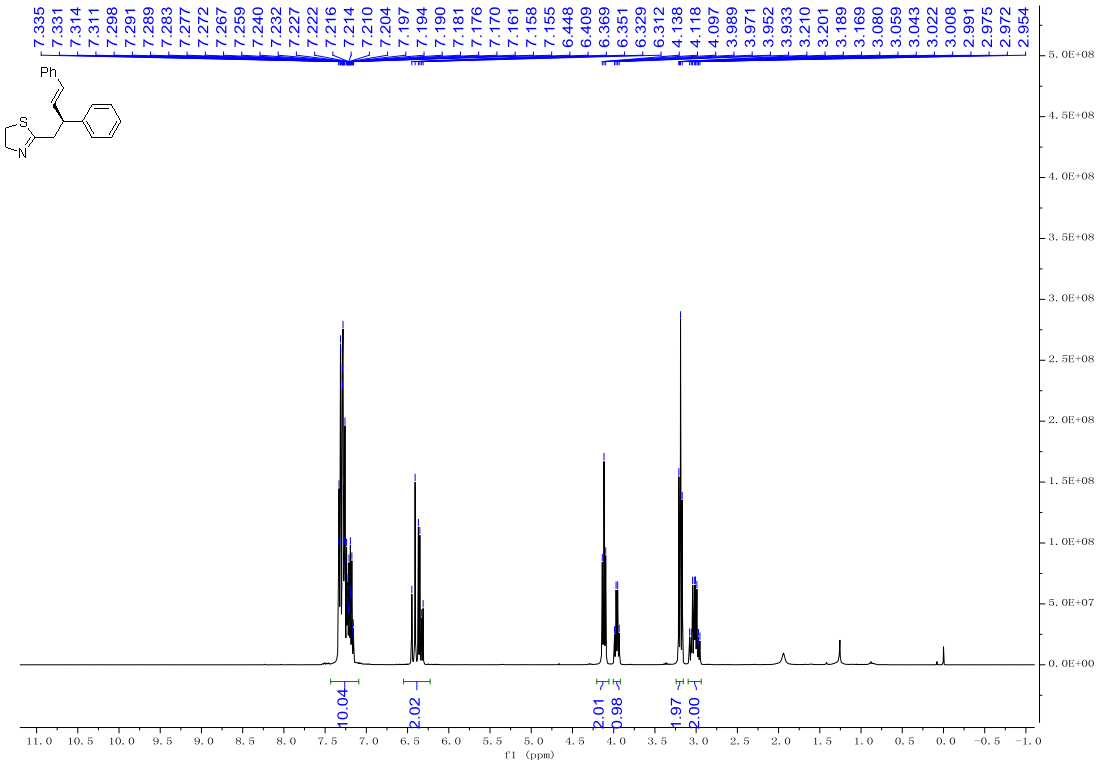


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

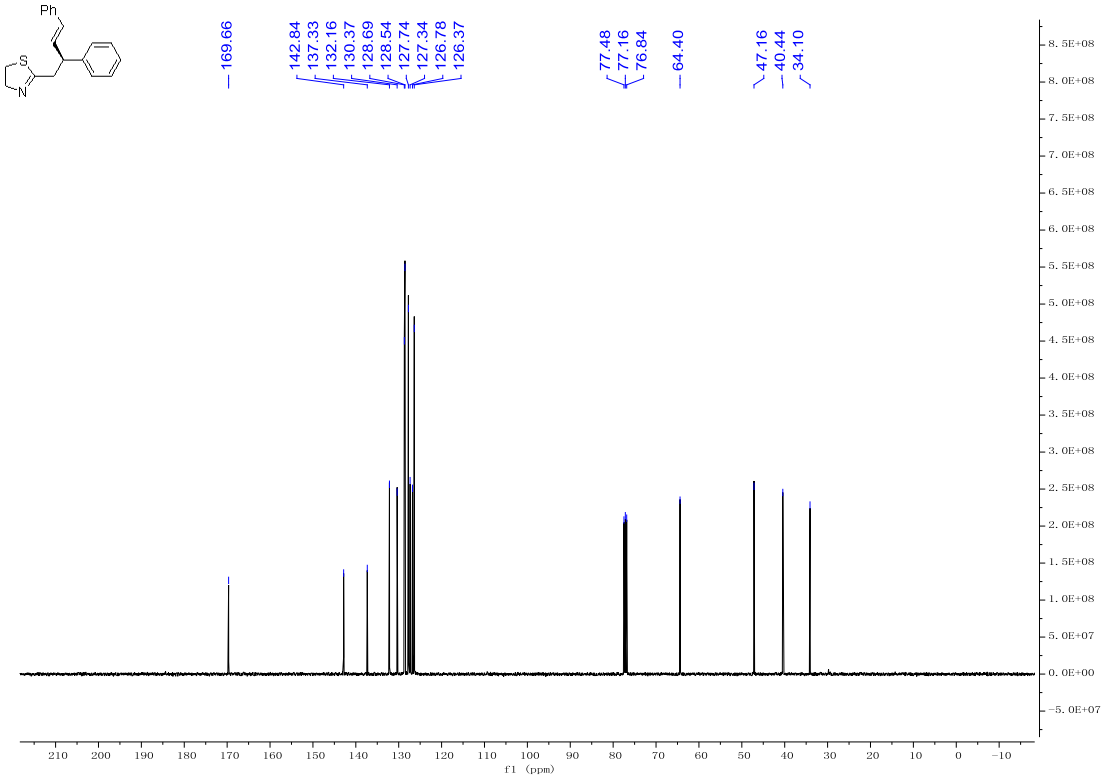


***(S,E)-2-(2,4-diphenylbut-3-en-1-yl)-4,5-dihydrothiazole* (3sa)**

^{1}H NMR (400 MHz, $CDCl_3$)

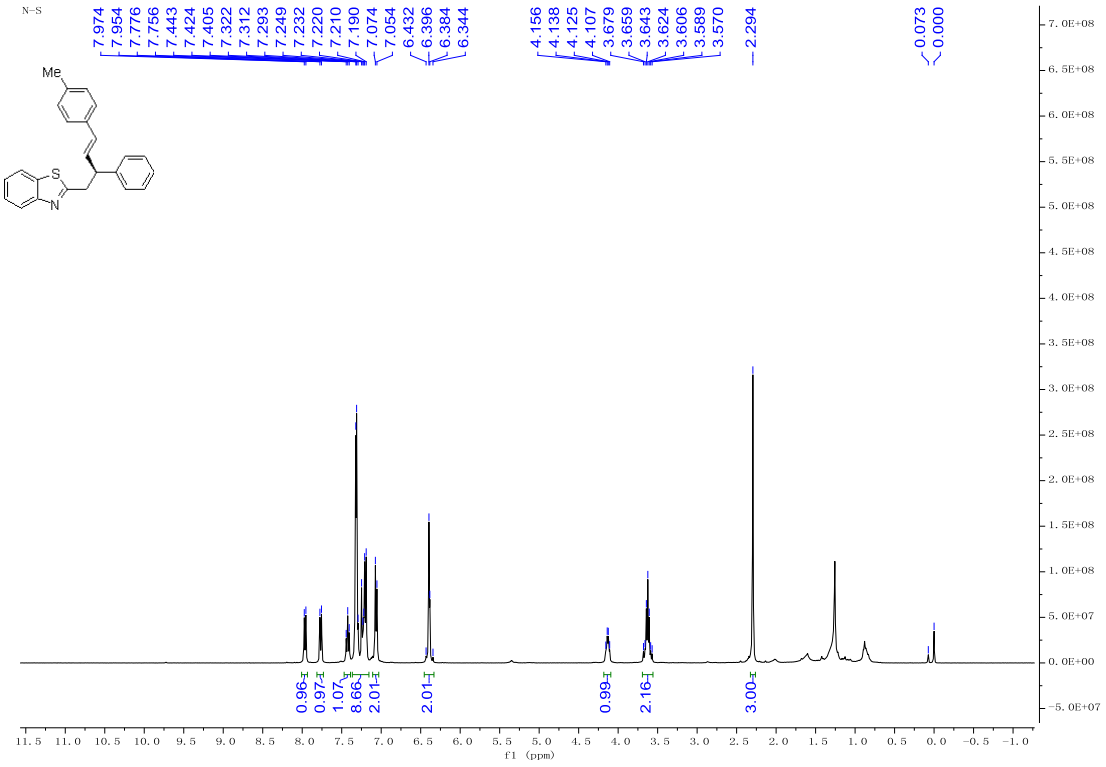


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

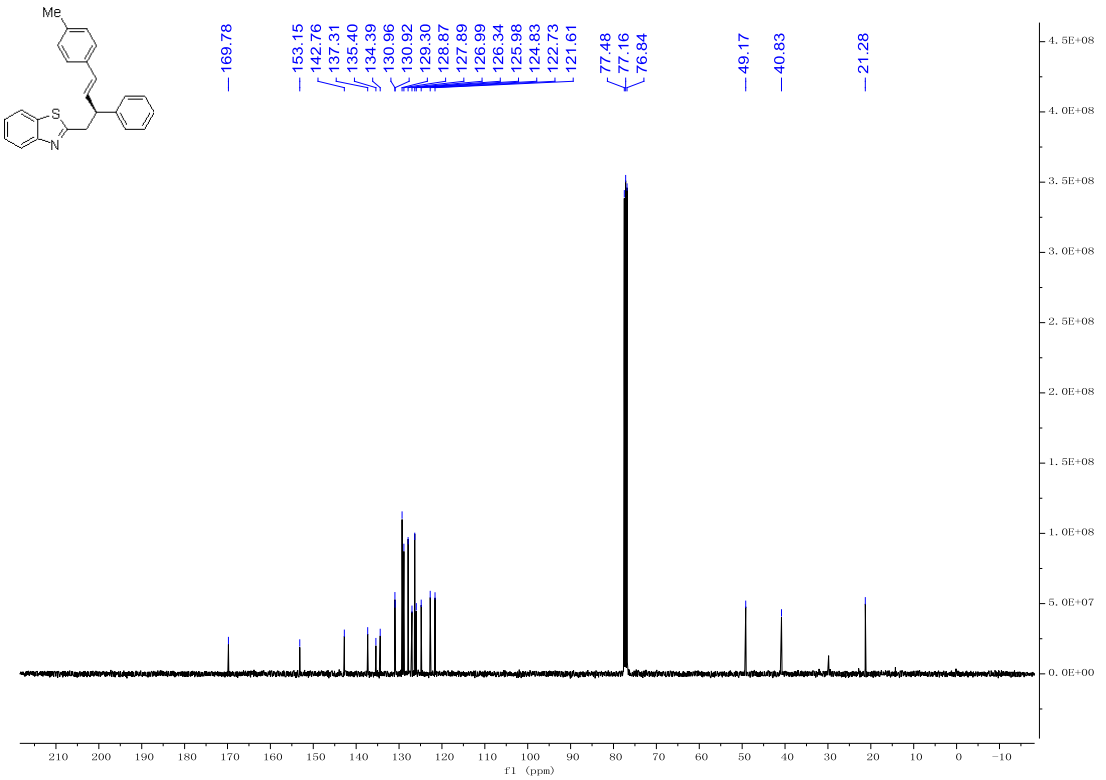


(S,E)-2-(2-phenyl-4-(p-tolyl)but-3-en-1-yl)benzo[d]thiazole (3ab)

^{1}H NMR (400 MHz, $CDCl_3$)

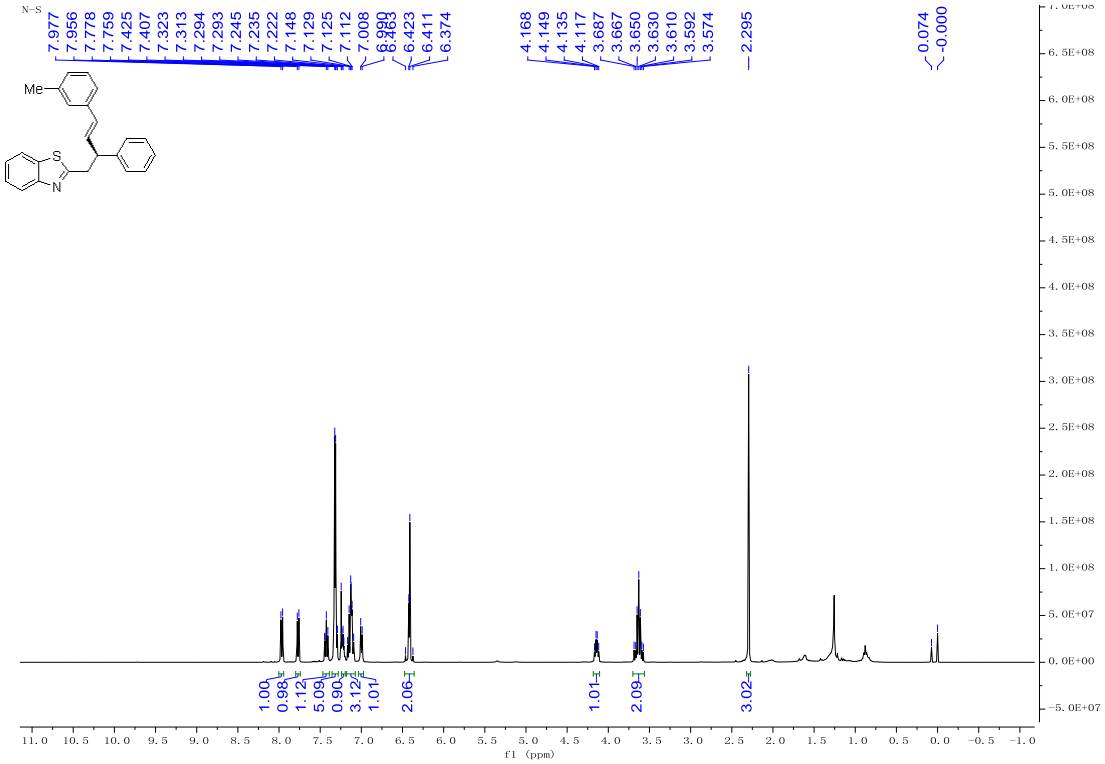


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

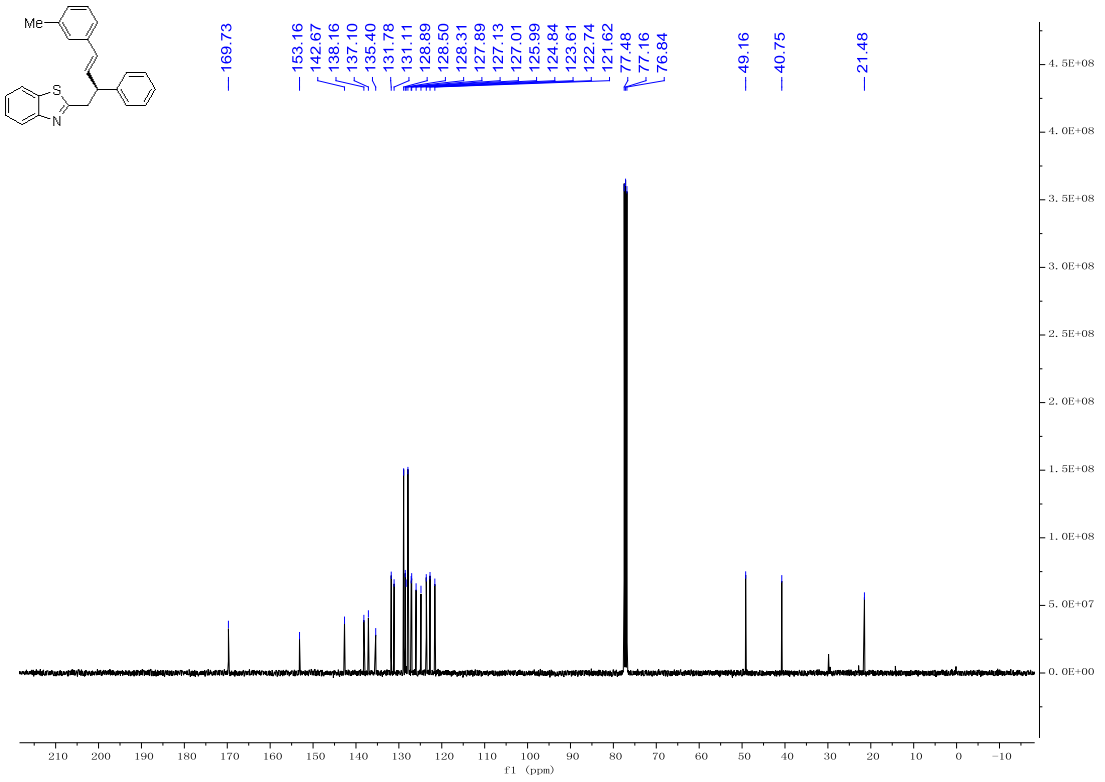


(S,E)-2-(2-phenyl-4-(m-tolyl)but-3-en-1-yl)benzo[d]thiazole (3ac)

^{1}H NMR (400 MHz, $CDCl_3$)

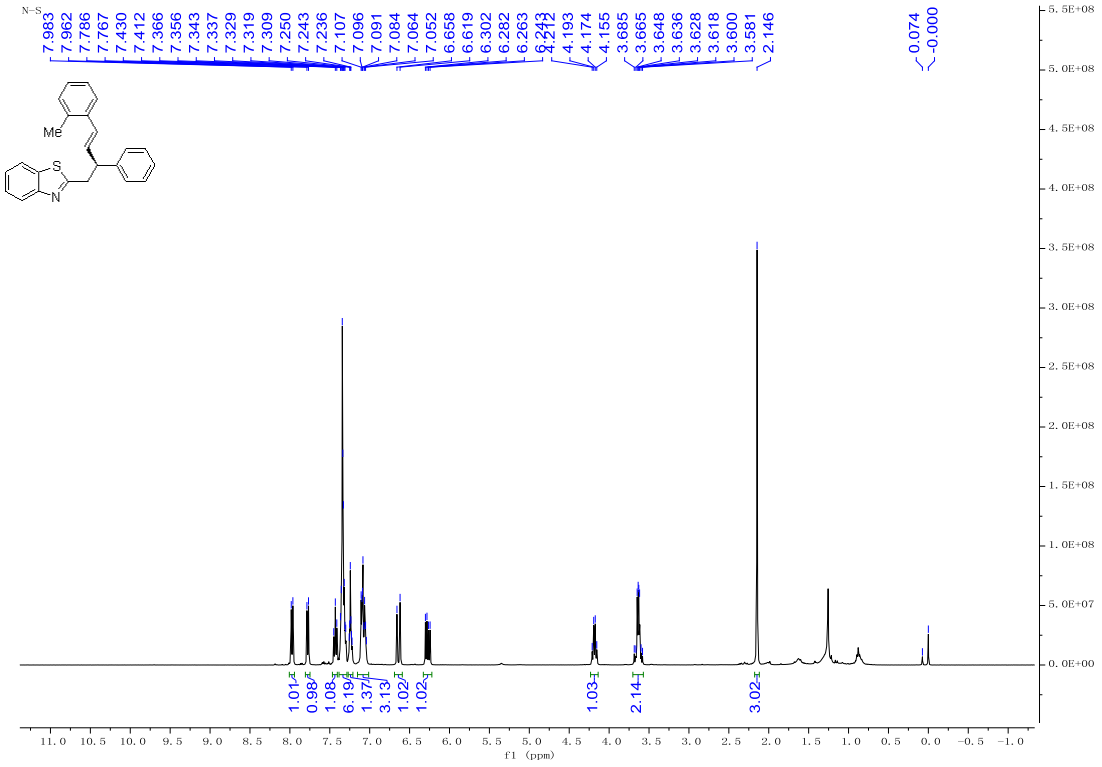


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

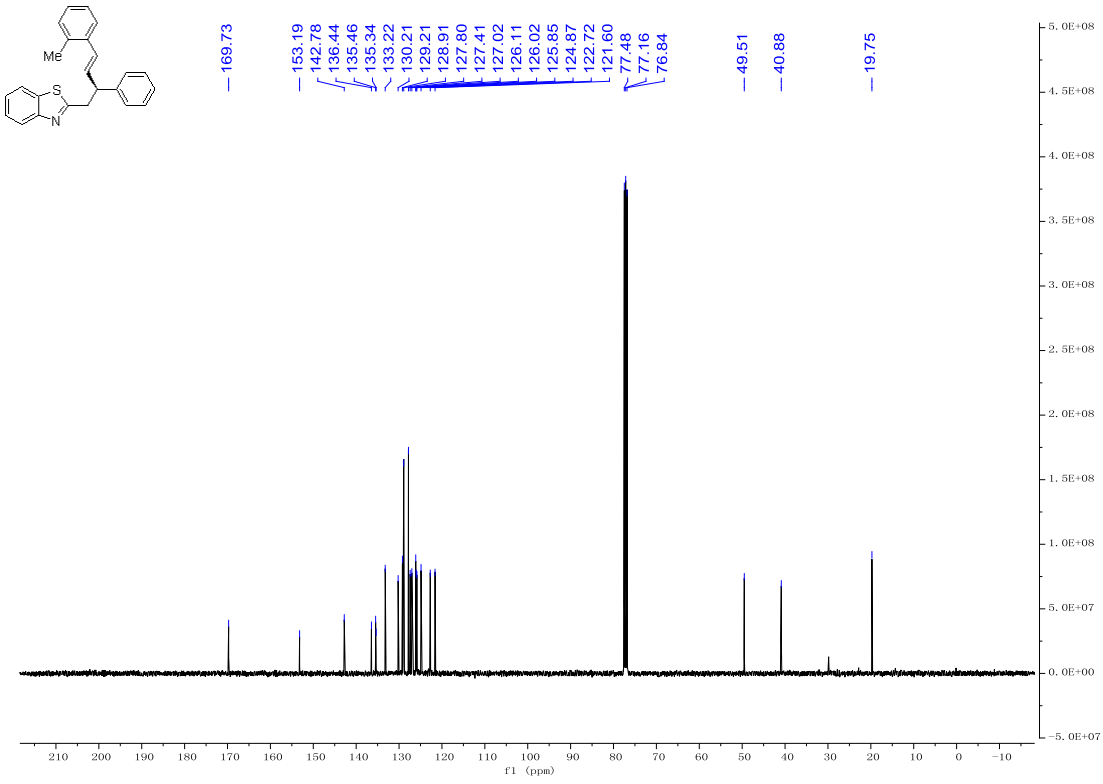


(S,E)-2-(2-phenyl-4-(o-tolyl)but-3-en-1-yl)benzo[d]thiazole (3ad)

^{1}H NMR (400 MHz, $CDCl_3$)

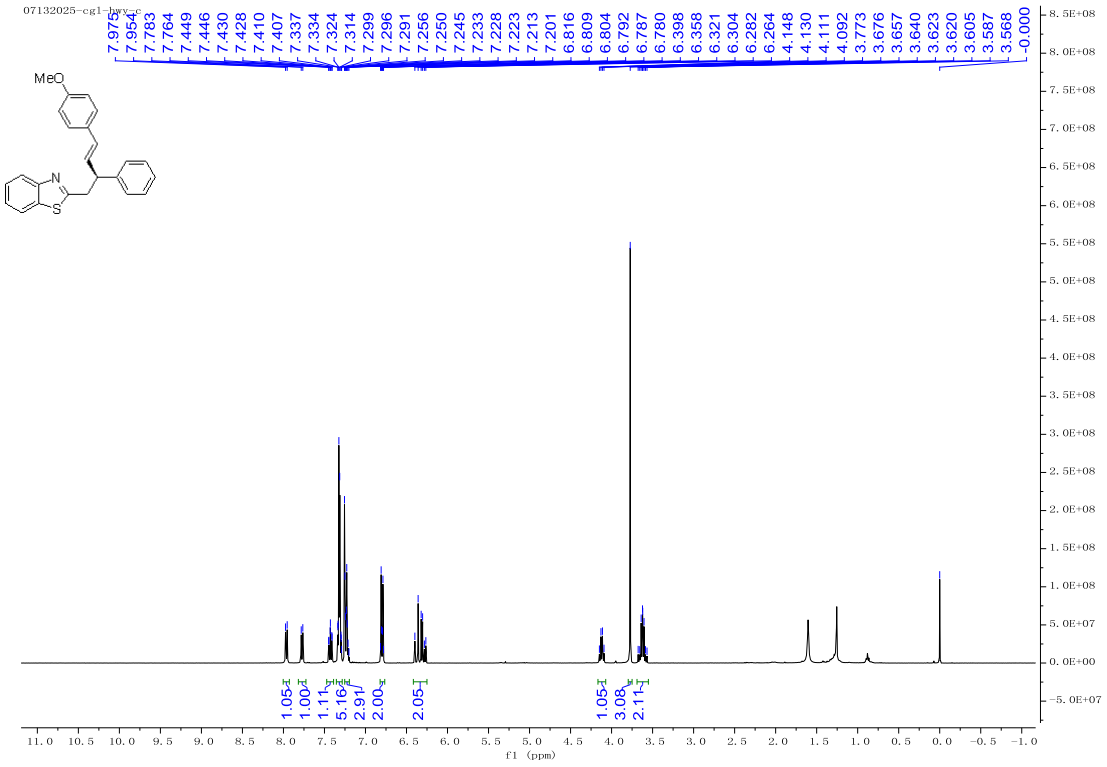


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

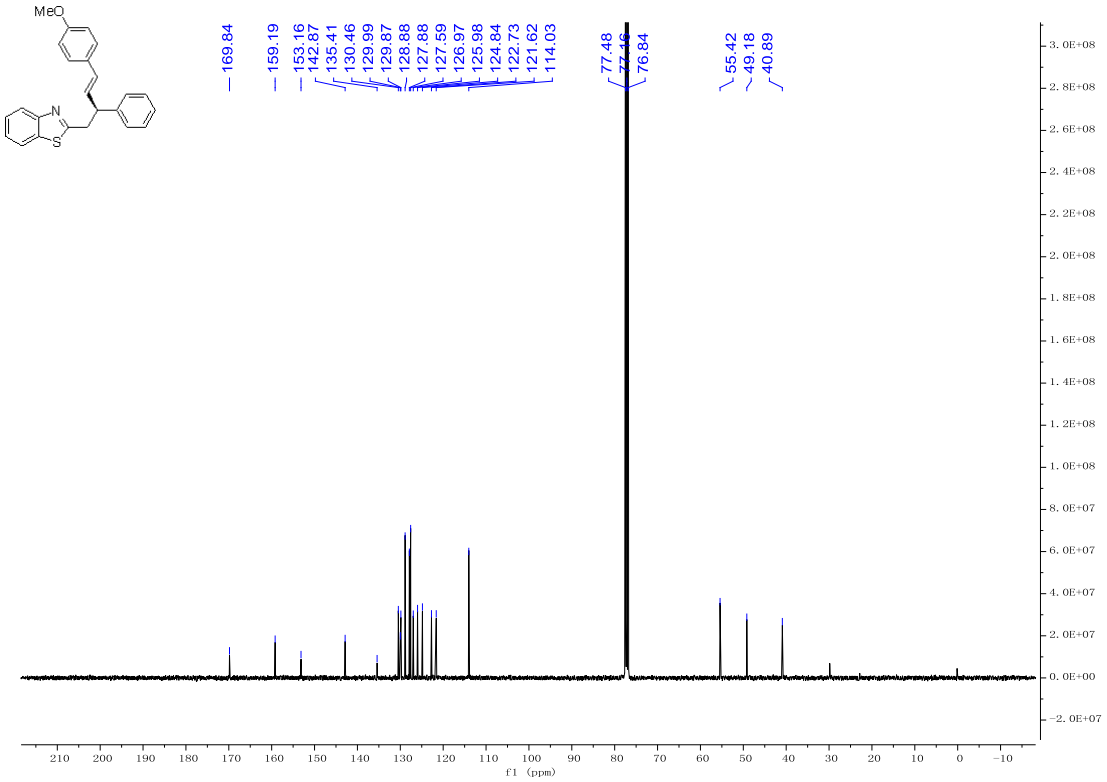


(S,E)-2-(4-(4-methoxyphenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole (3ae)

^{1}H NMR (400 MHz, $CDCl_3$)

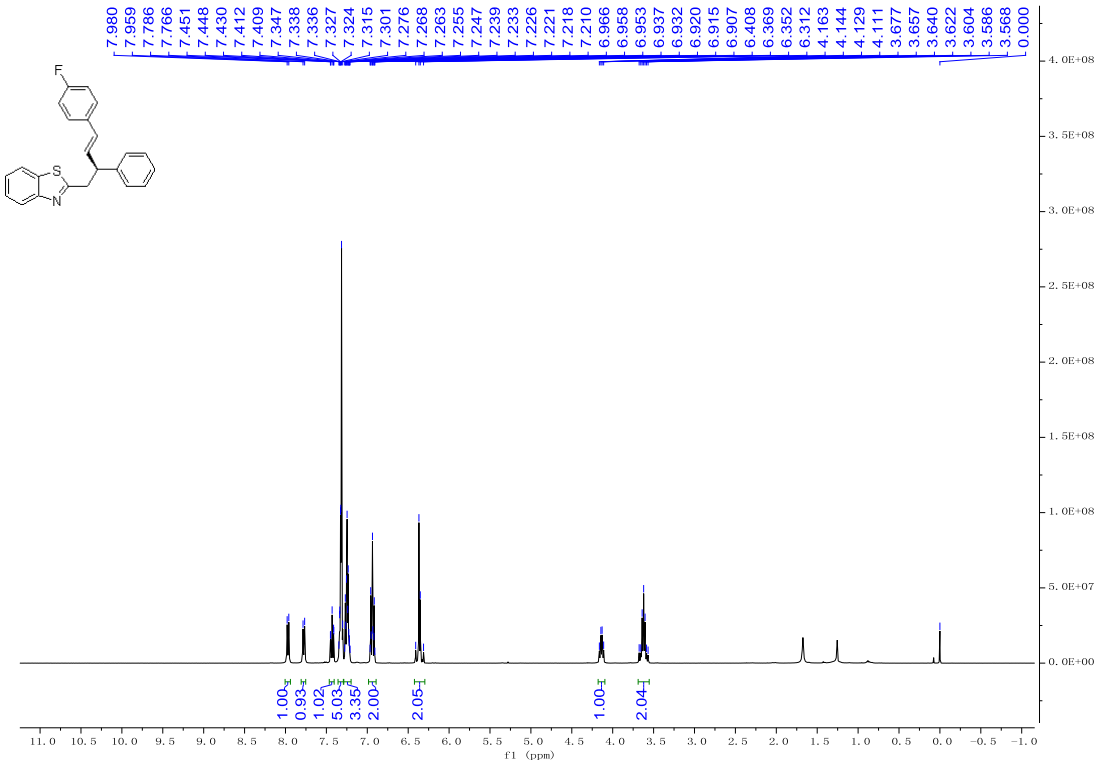


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

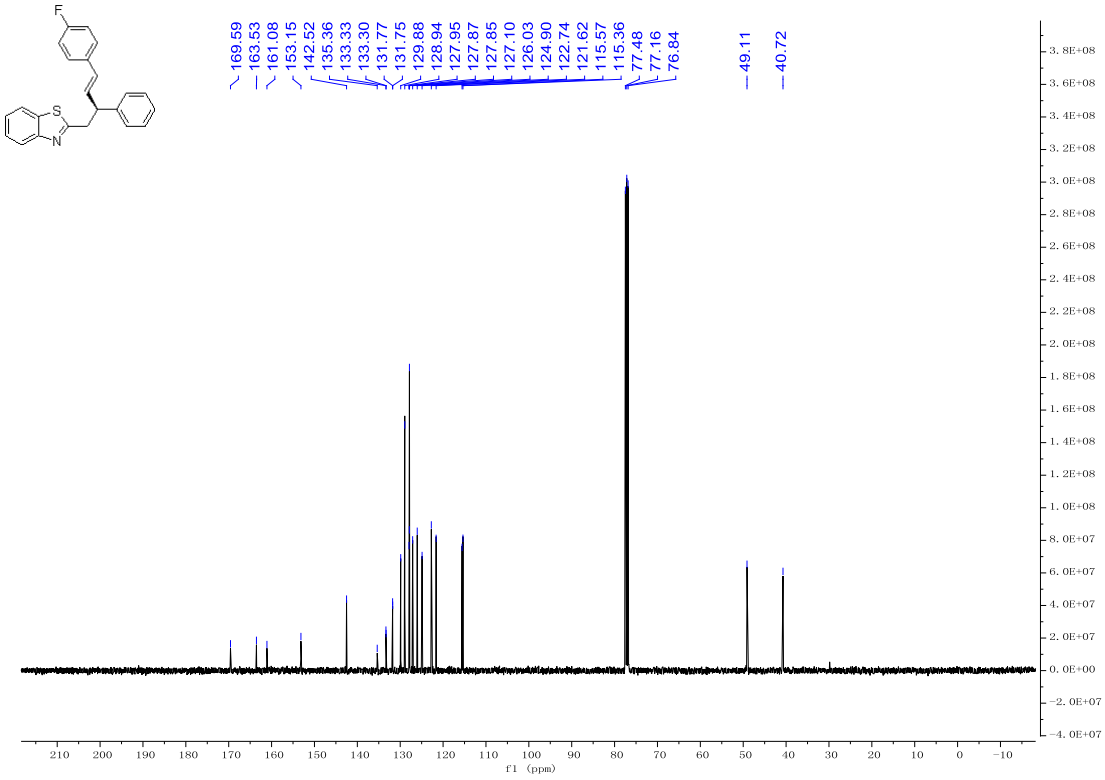


(S,E)-2-(4-(4-fluorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole (3af)

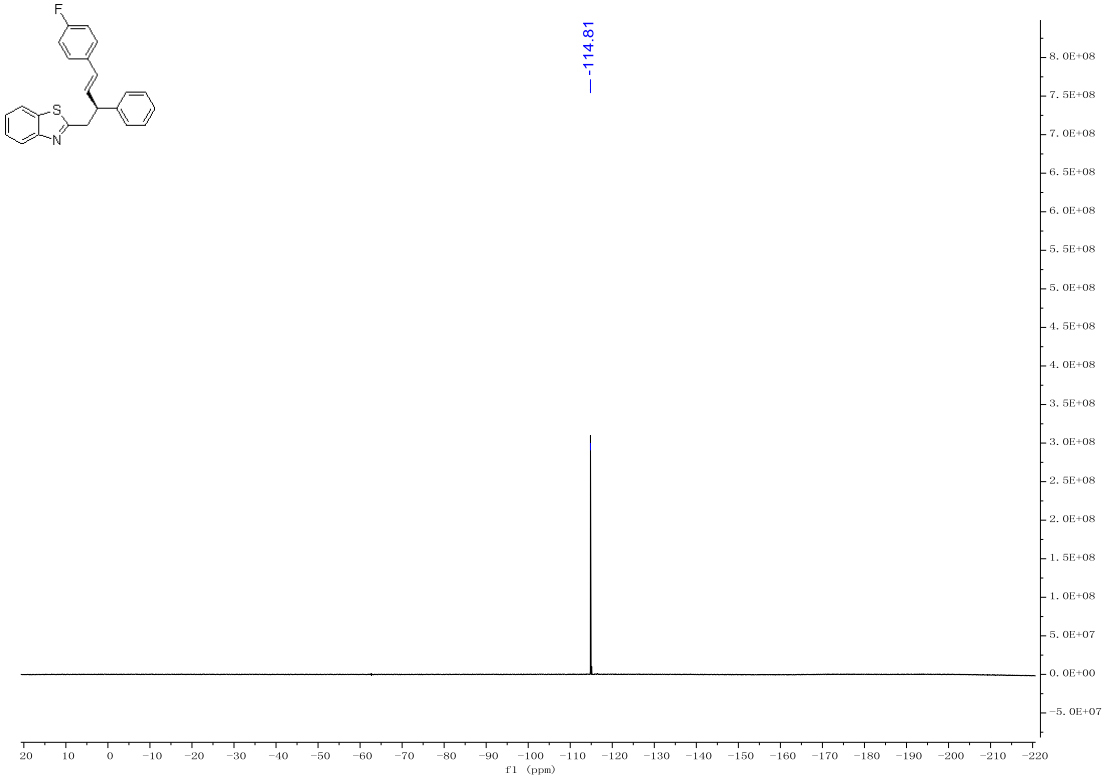
^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

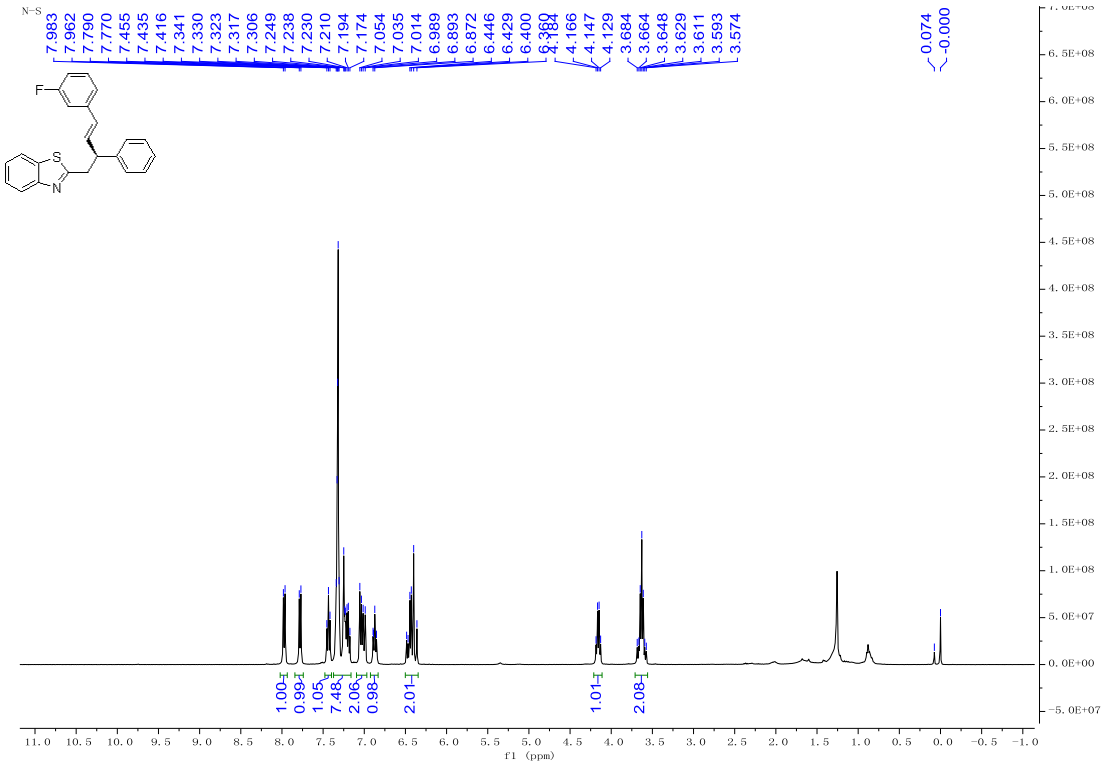


$^{19}F\{^{1}H\}$ NMR (376 MHz, $CDCl_3$)

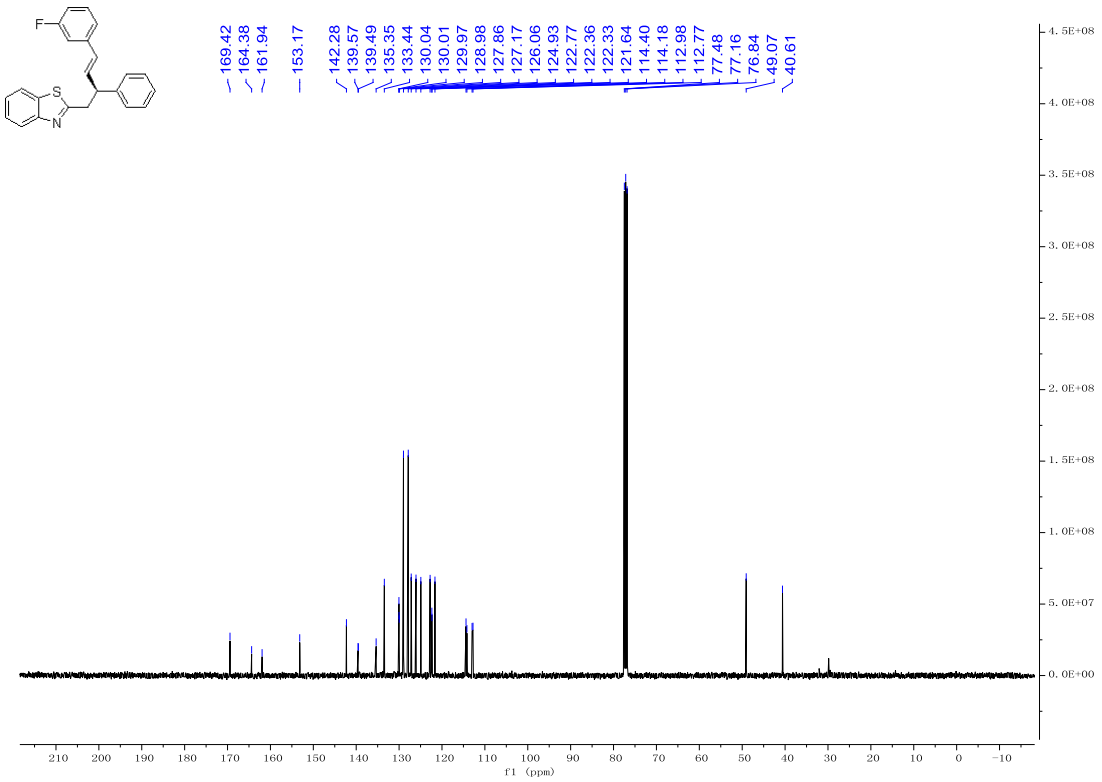


(S,E)-2-(4-(3-fluorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ag)**

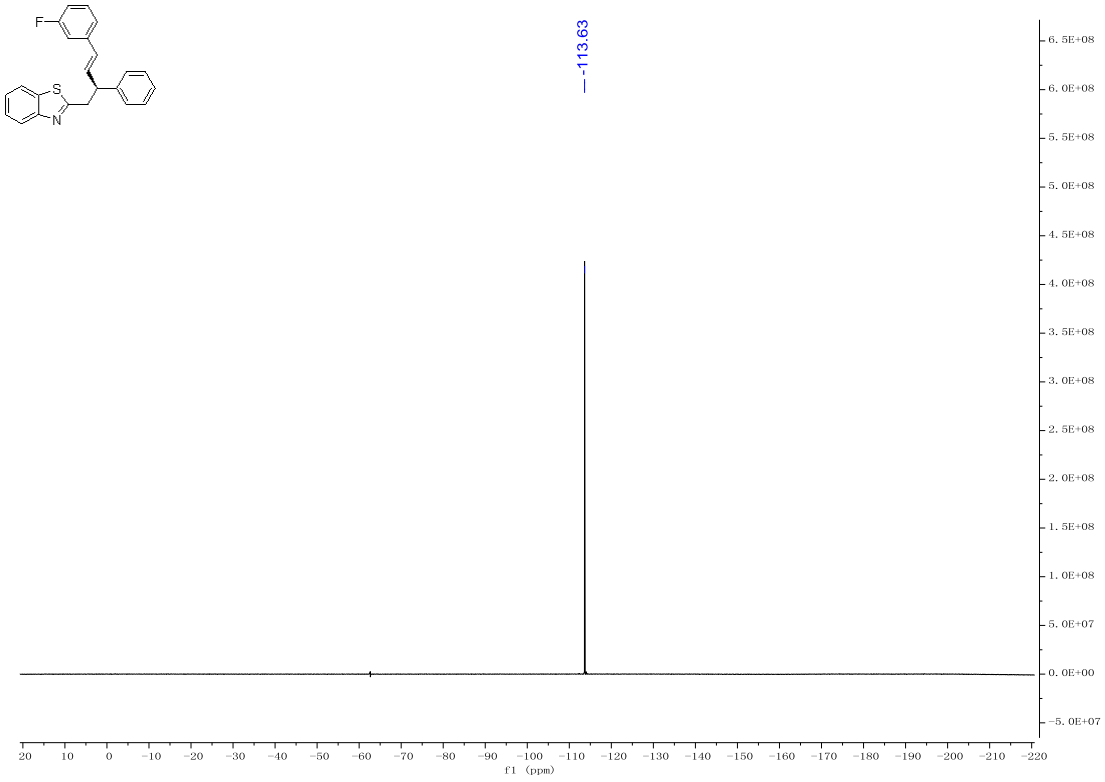
^{1}H NMR (400 MHz, $CDCl_3$)



$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

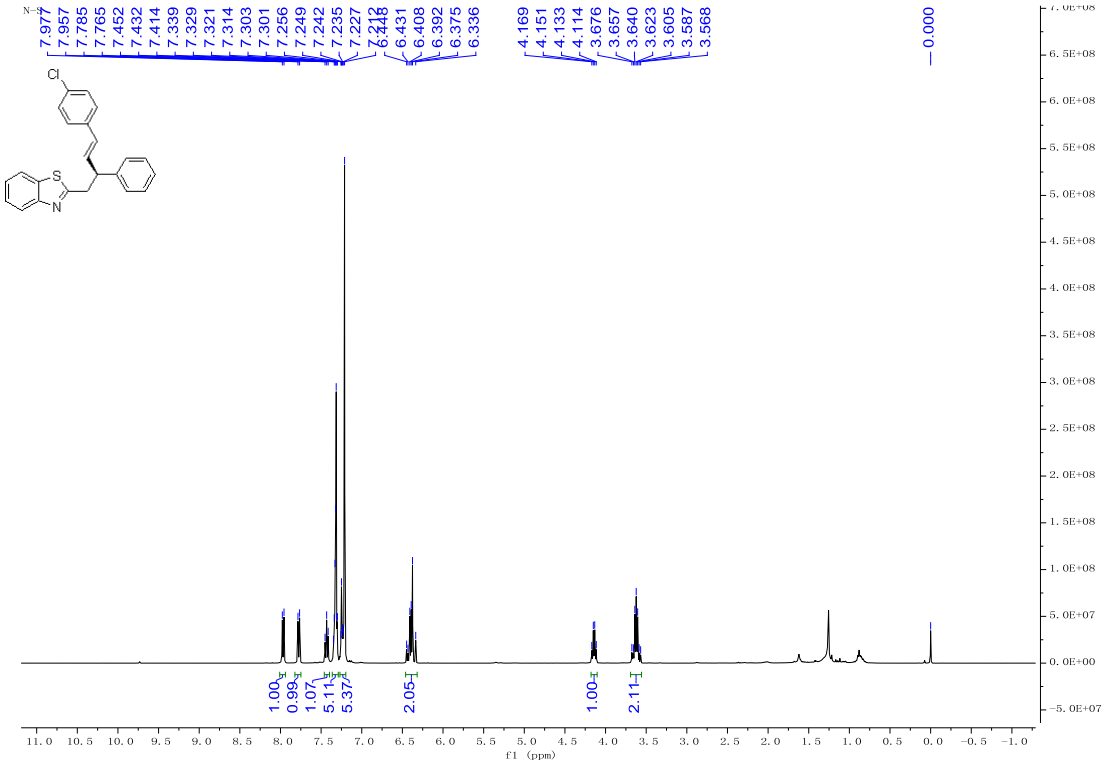


$^{19}F\{^{1}H\}$ NMR (376 MHz, $CDCl_3$)

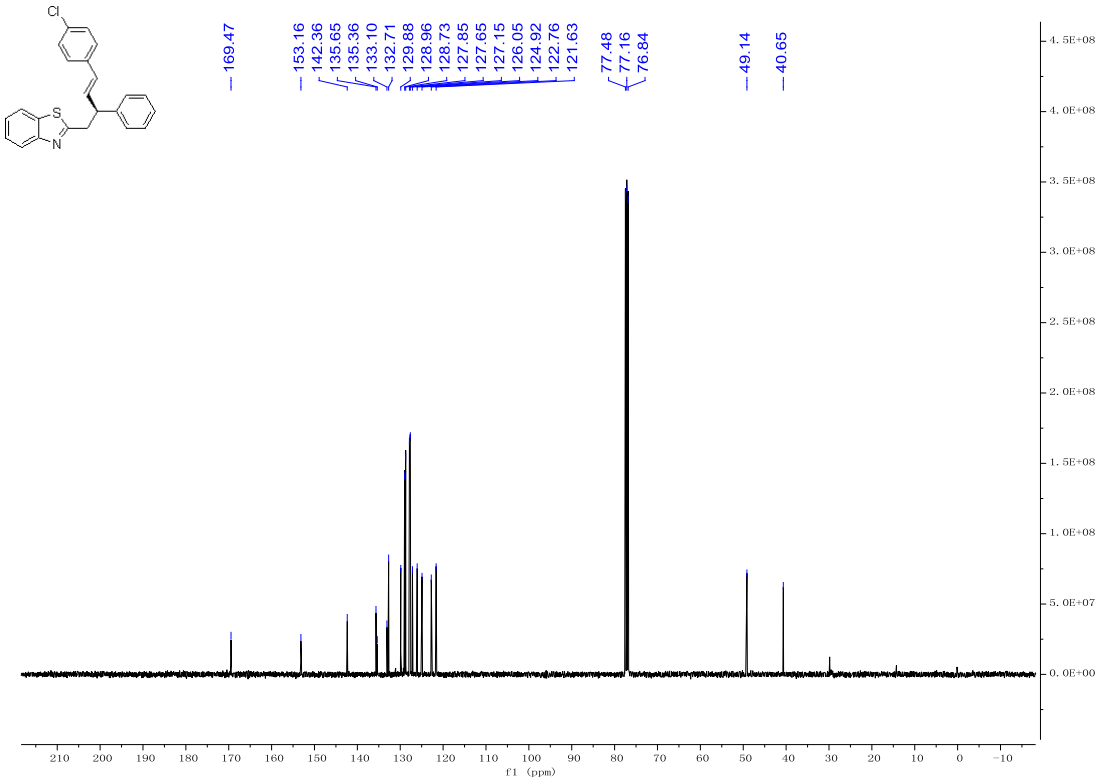


(S,E)-2-(4-(4-chlorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole (3ah)

^{1}H NMR (400 MHz, $CDCl_3$)

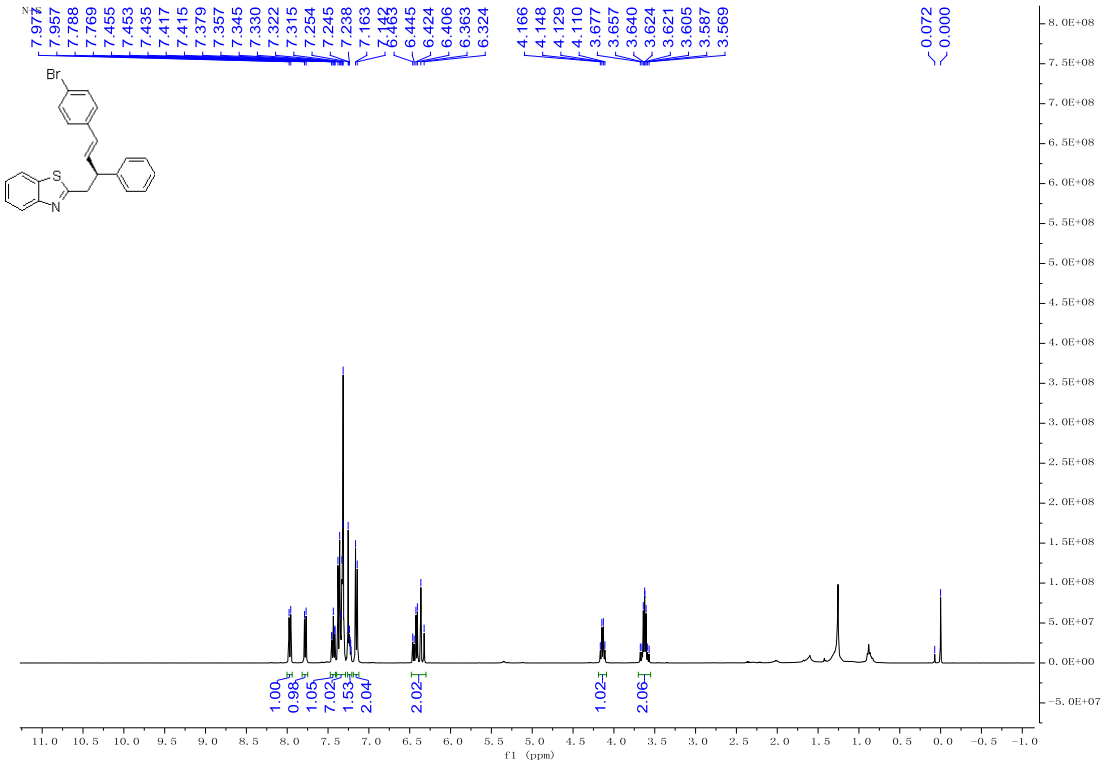


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

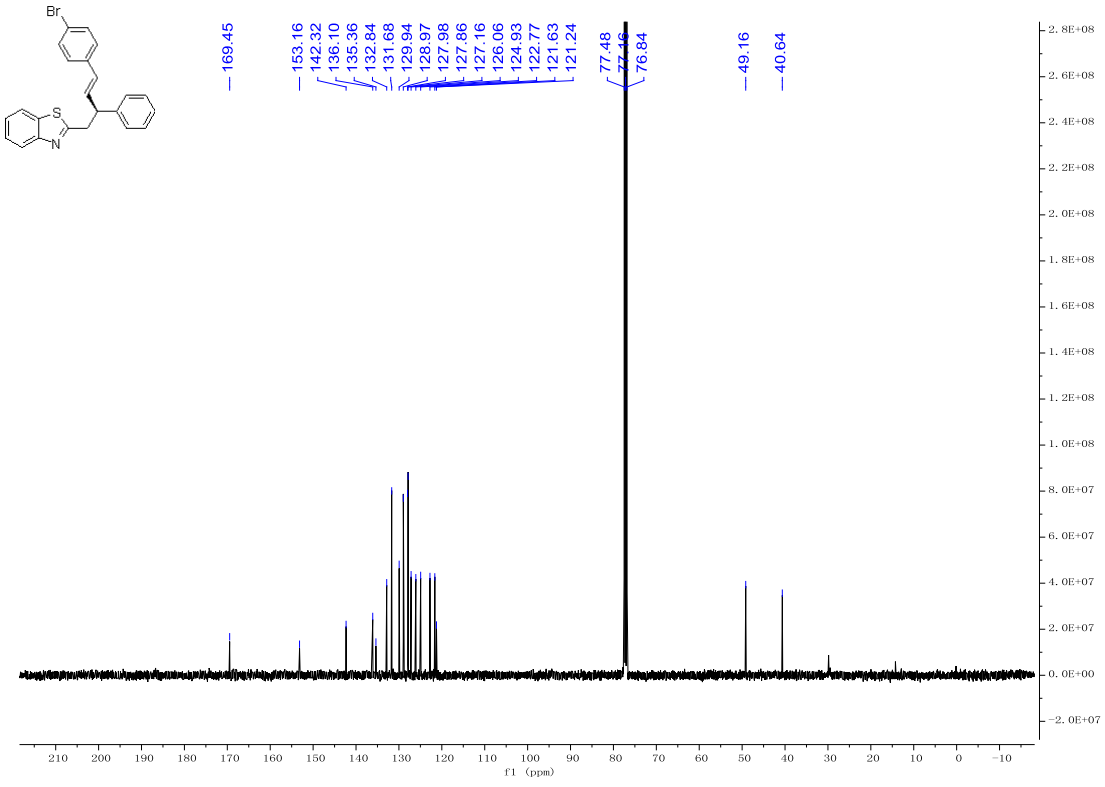


(S,E)-2-(4-(4-bromophenyl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole (3ai)

^{1}H NMR (400 MHz, $CDCl_3$)

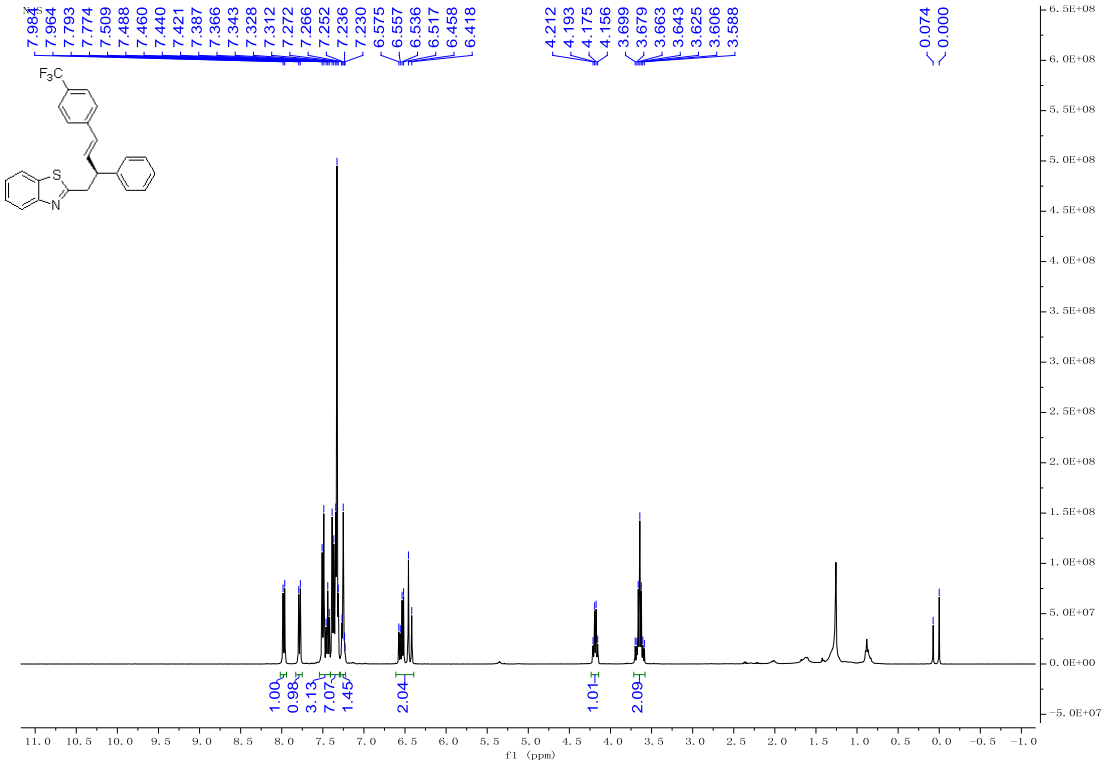


^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

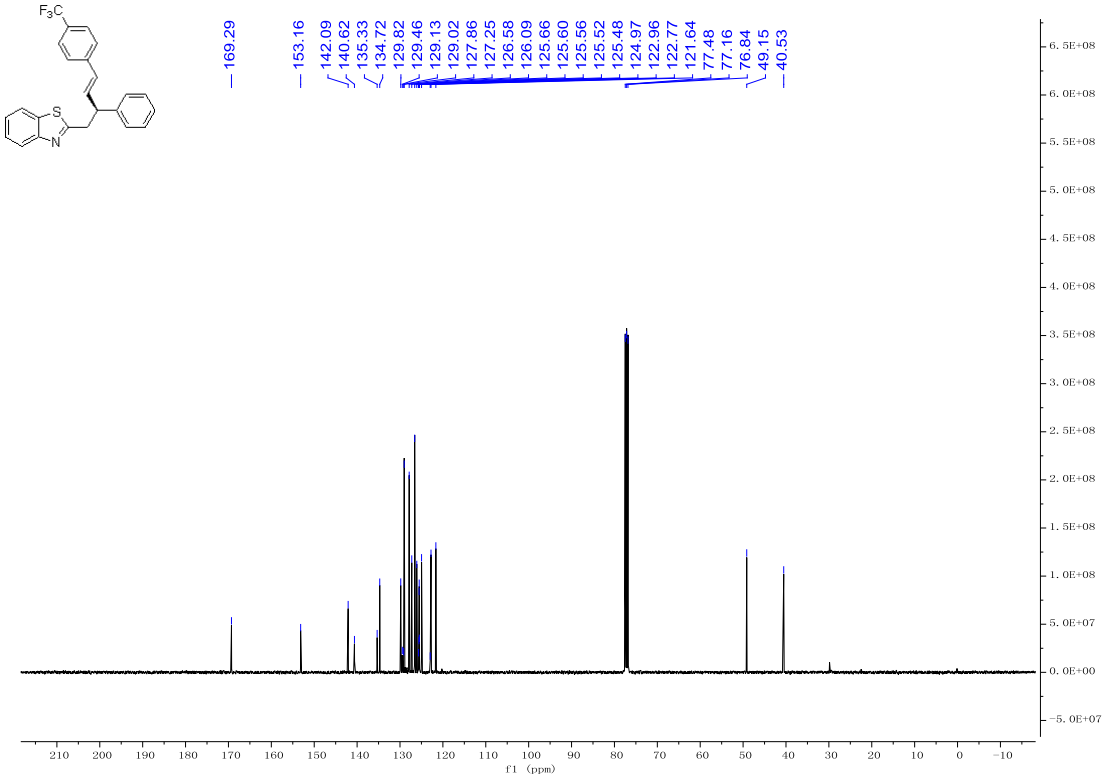


(S,E)-2-(2-phenyl-4-(4-(trifluoromethyl)phenyl)but-3-en-1-yl)benzo[d]thiazole (3aj)

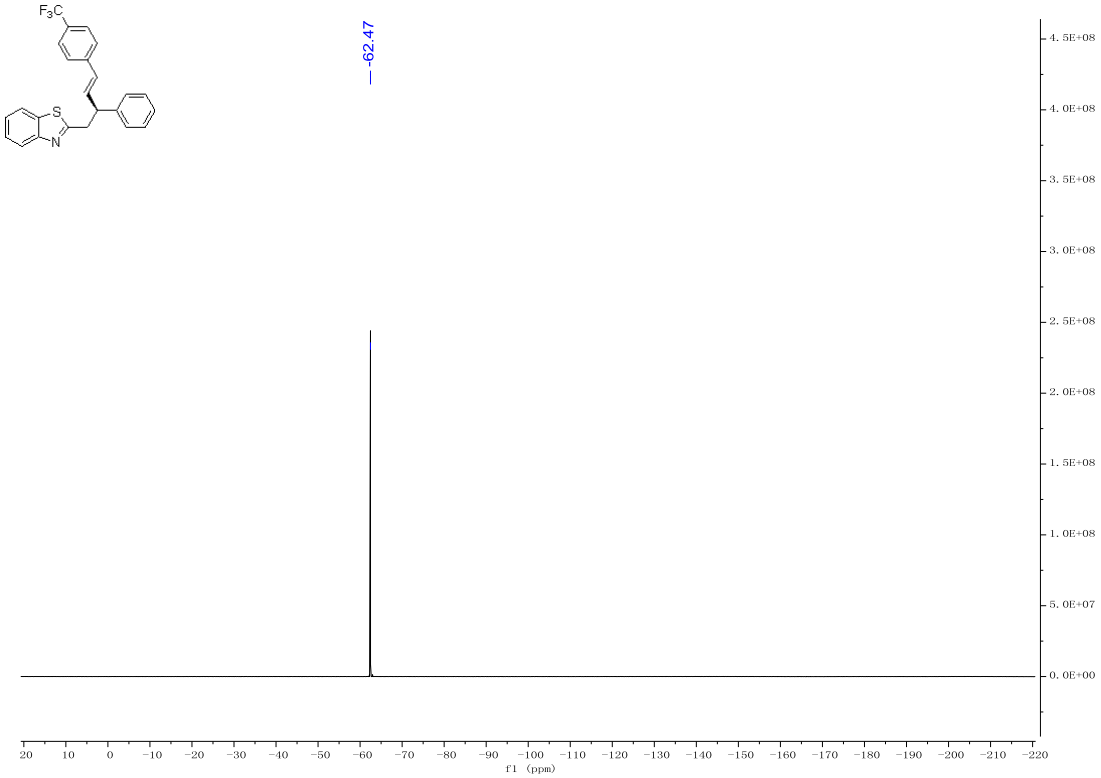
^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

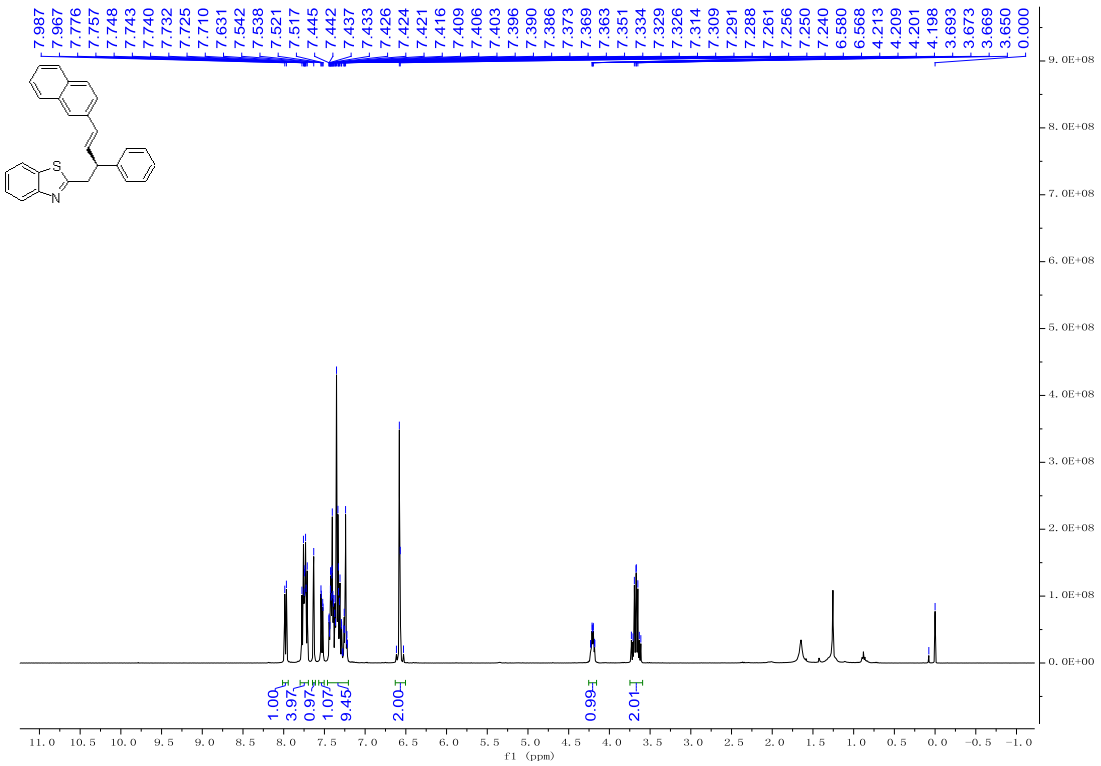


$^{19}F\{^{1}H\}$ NMR (376 MHz, $CDCl_3$)

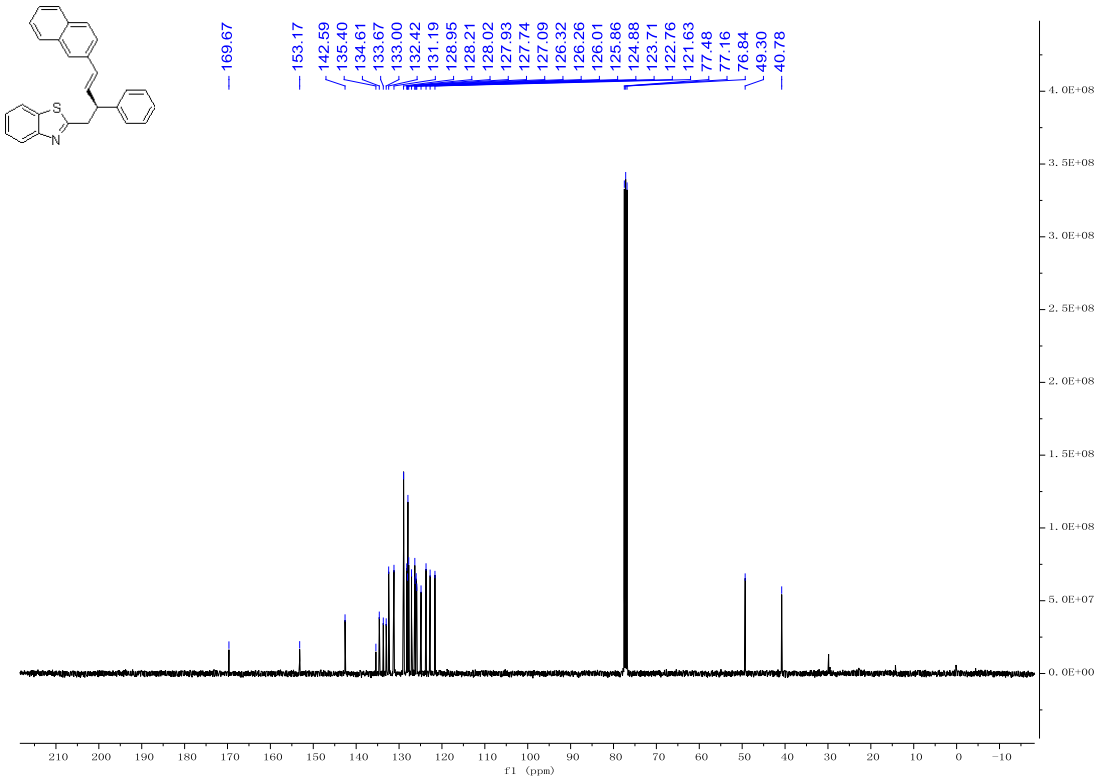


(S,E)-2-(4-(naphthalen-2-yl)-2-phenylbut-3-en-1-yl)benzo[d]thiazole **(3ak)**

^{1}H NMR (400 MHz, $CDCl_3$)

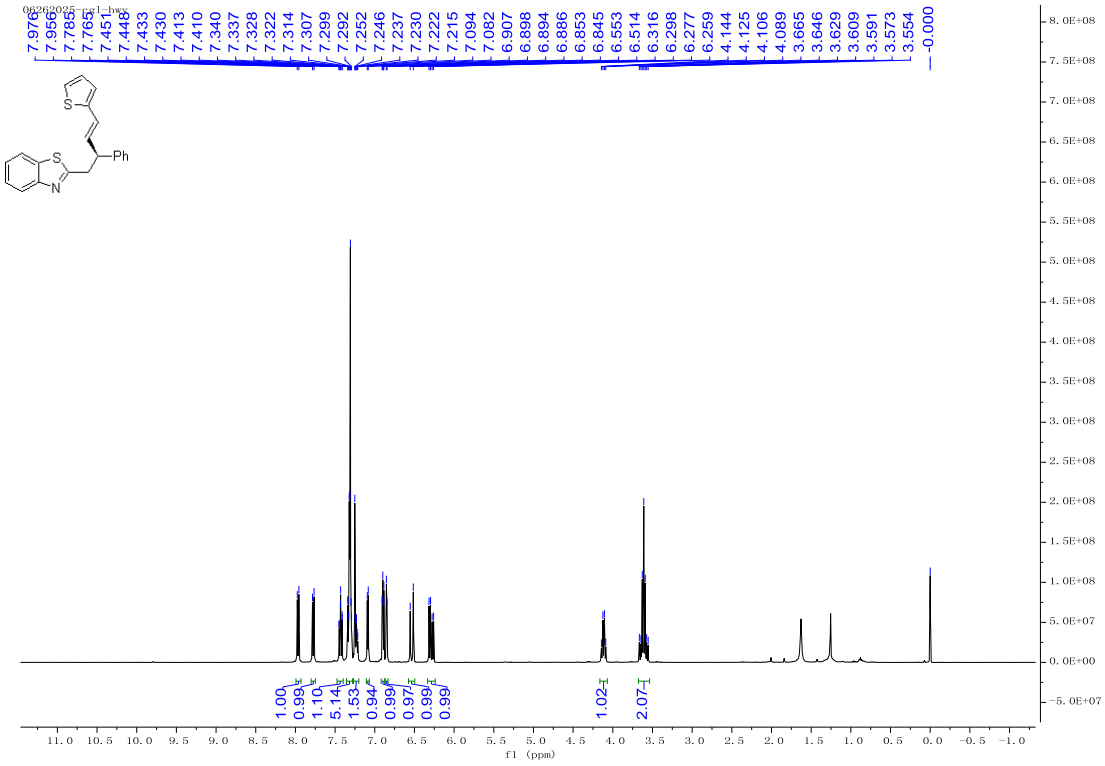


$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

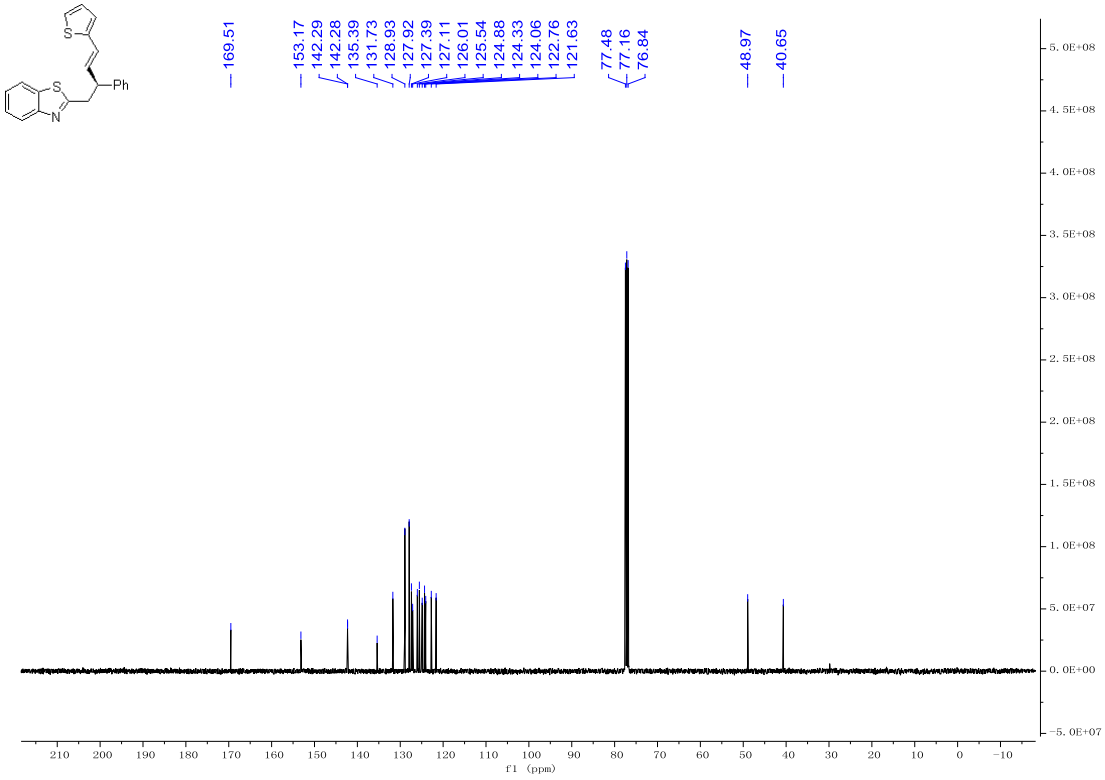


***(S,E)-2-(2-phenyl-4-(thiophen-2-yl)but-3-en-1-yl)benzo[d]thiazole* (3al)**

^{1}H NMR (400 MHz, $CDCl_3$)

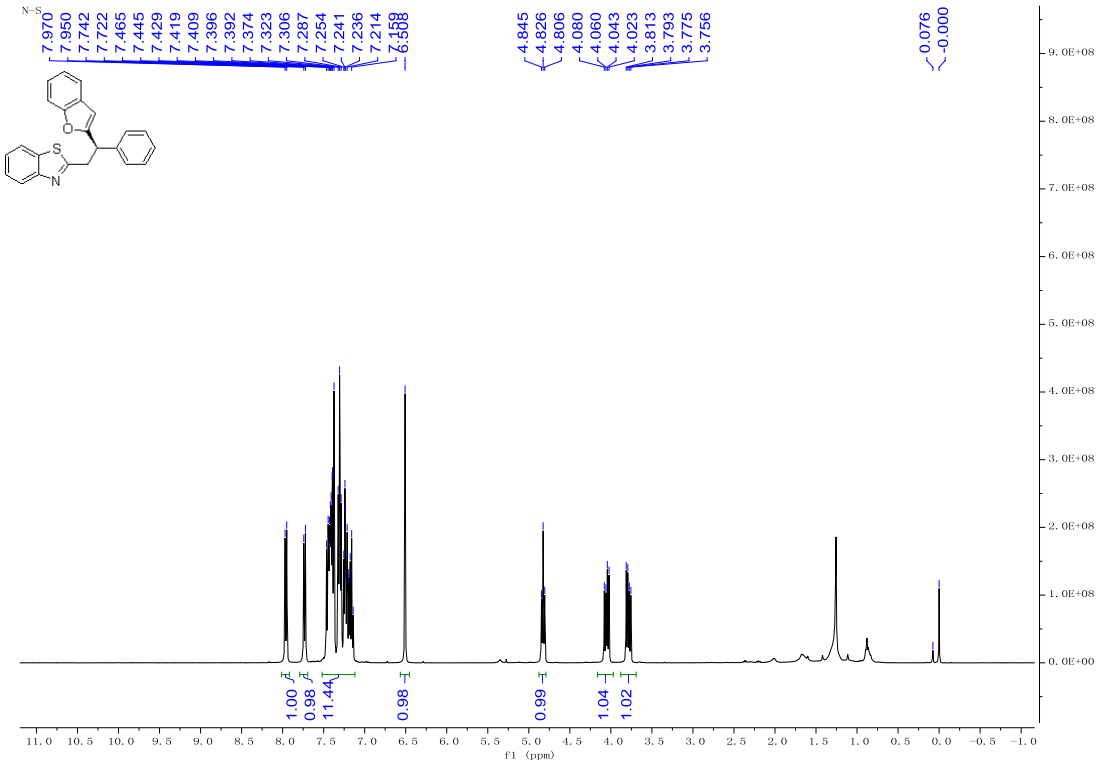


$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

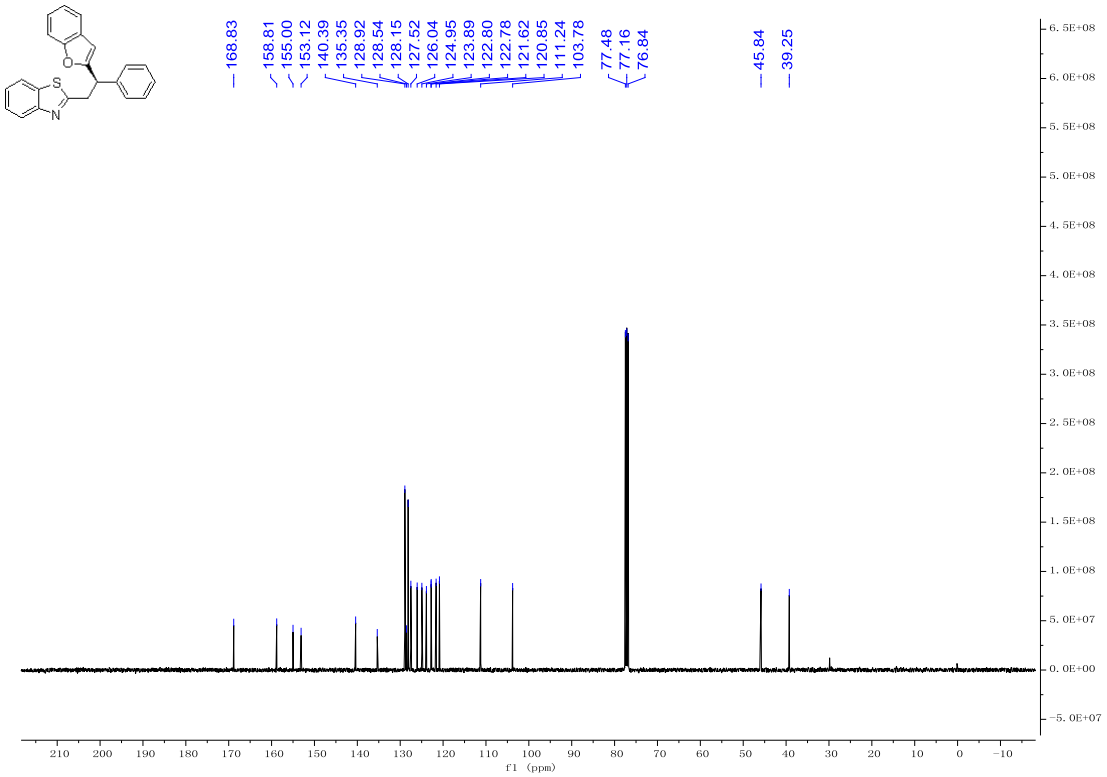


(R)-2-(2-(benzofuran-2-yl)-2-phenylethyl)benzo[d]thiazole **(3am)**

^{1}H NMR (400 MHz, $CDCl_3$)

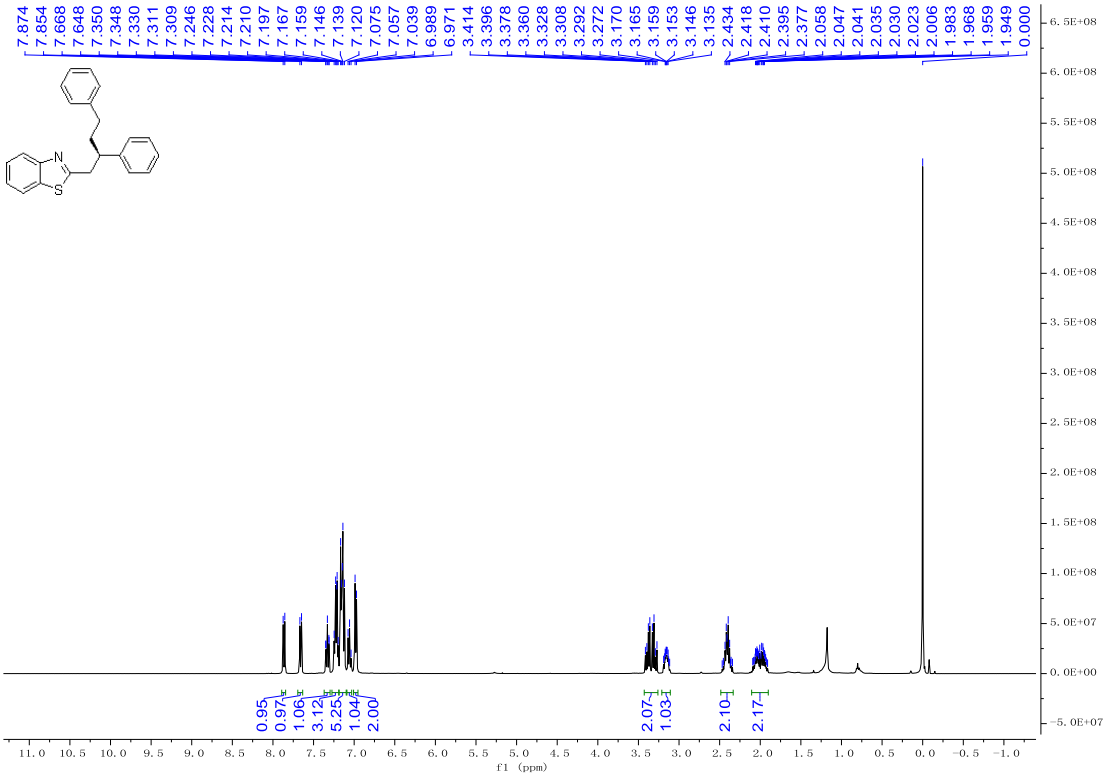


$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

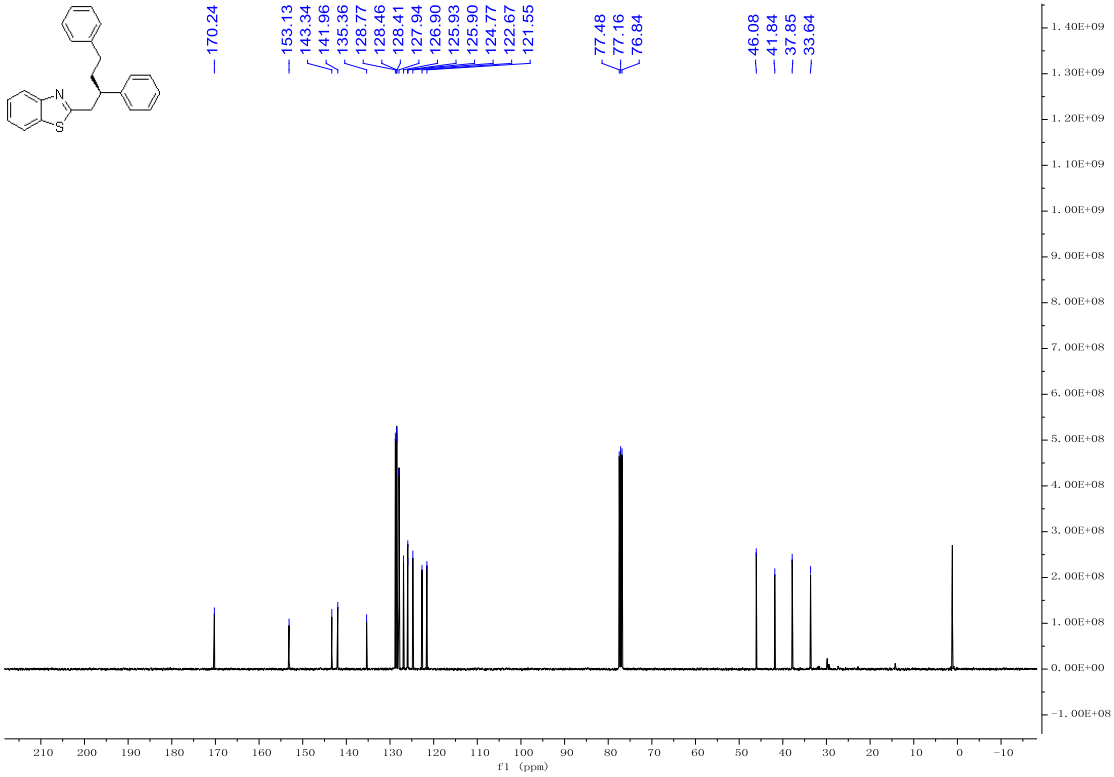


***(R)-2-(2,4-diphenylbutyl)benzo[d]thiazole* (4)**

^{1}H NMR (400 MHz, $CDCl_3$)

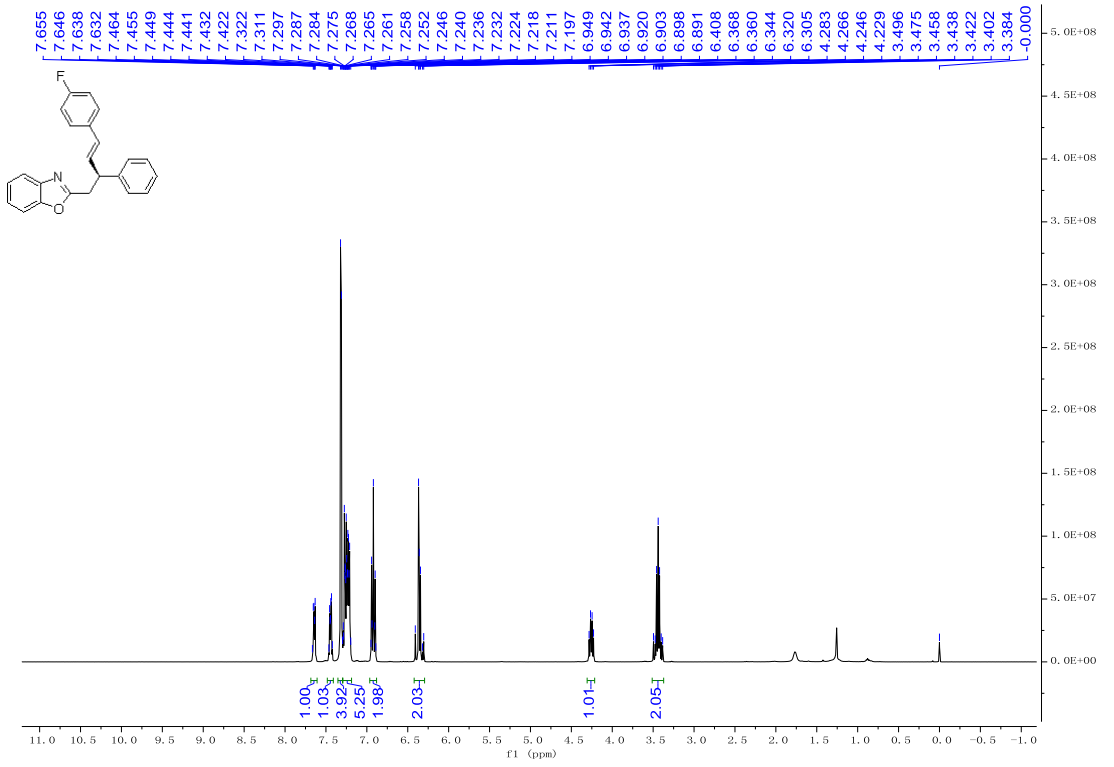


$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

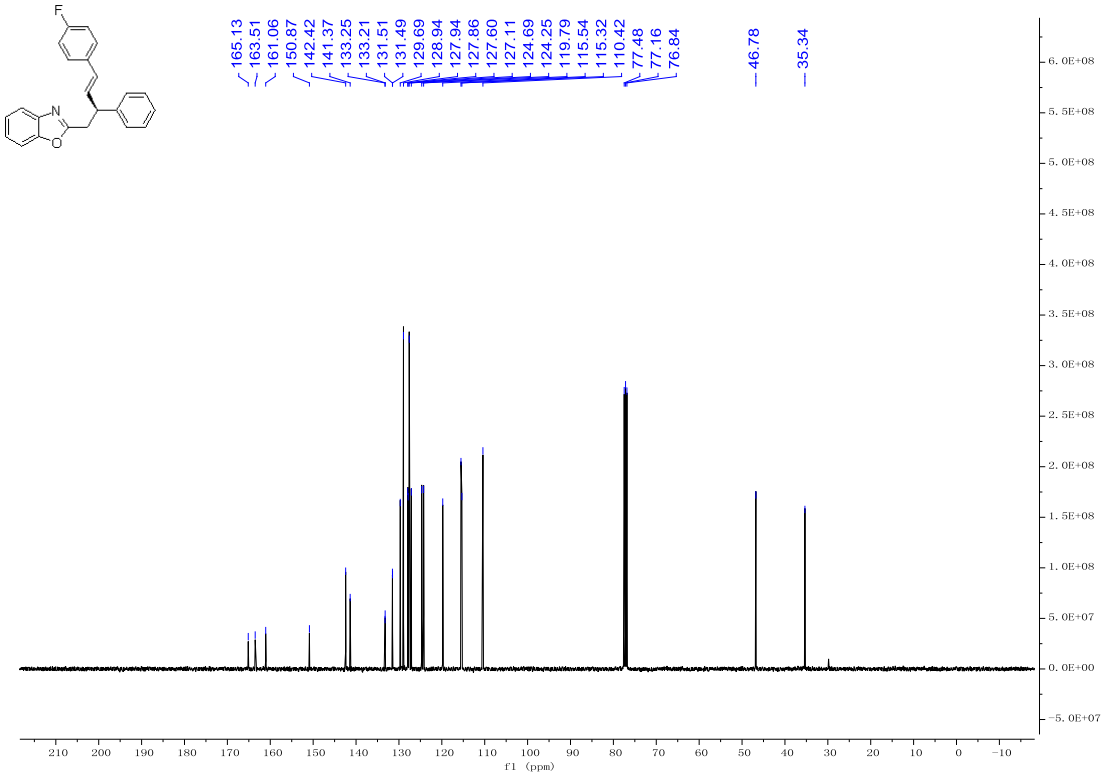


***(S,E)-2-(4-(4-fluorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]oxazole* (6a)**

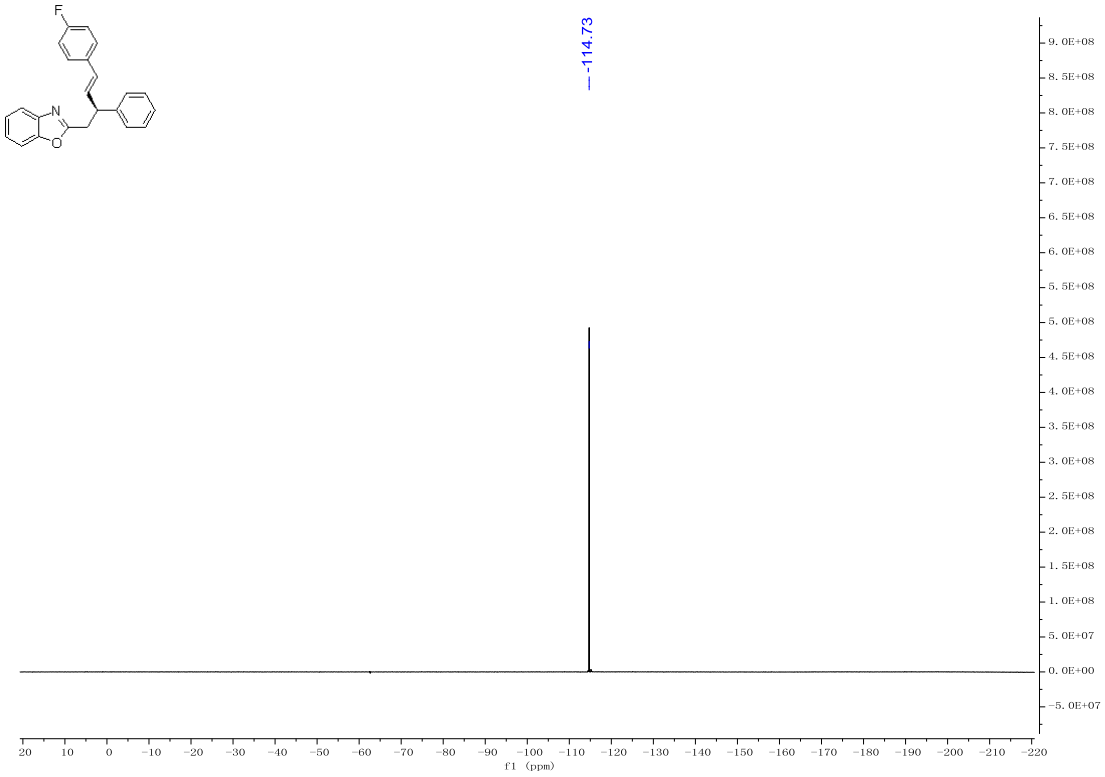
^{1}H NMR (400 MHz, $CDCl_3$)



$^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$)

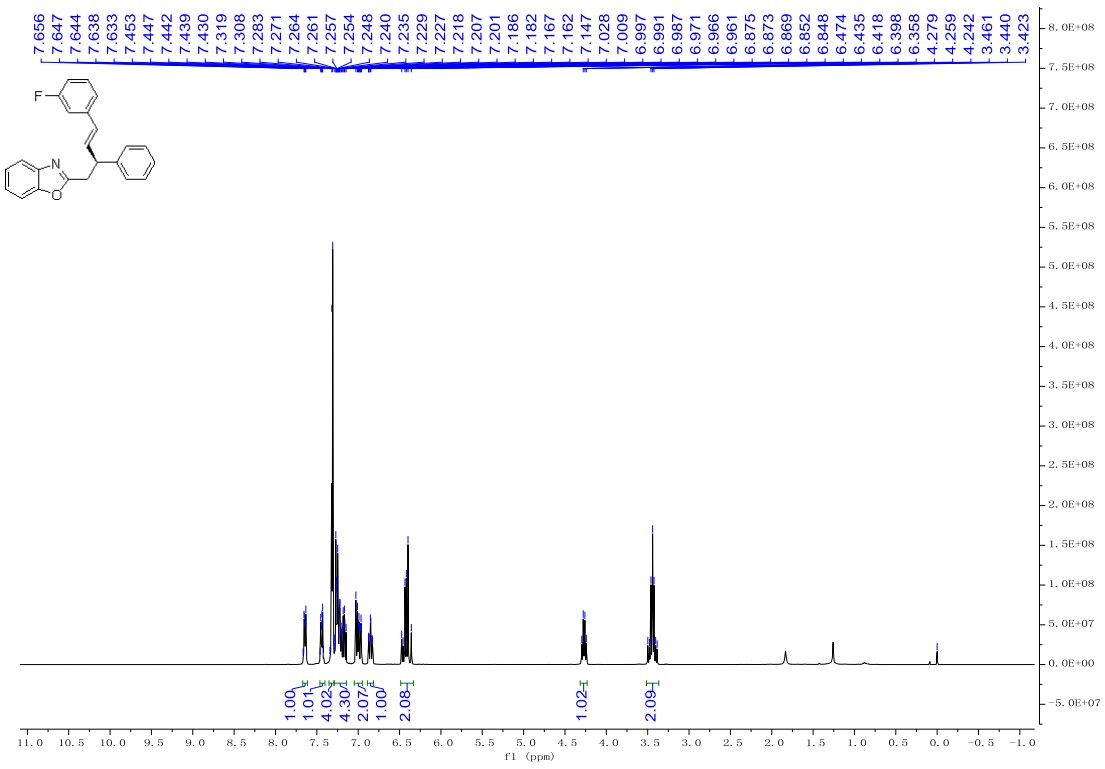


$^{19}F\{^{1}H\}$ NMR (376 MHz, $CDCl_3$)

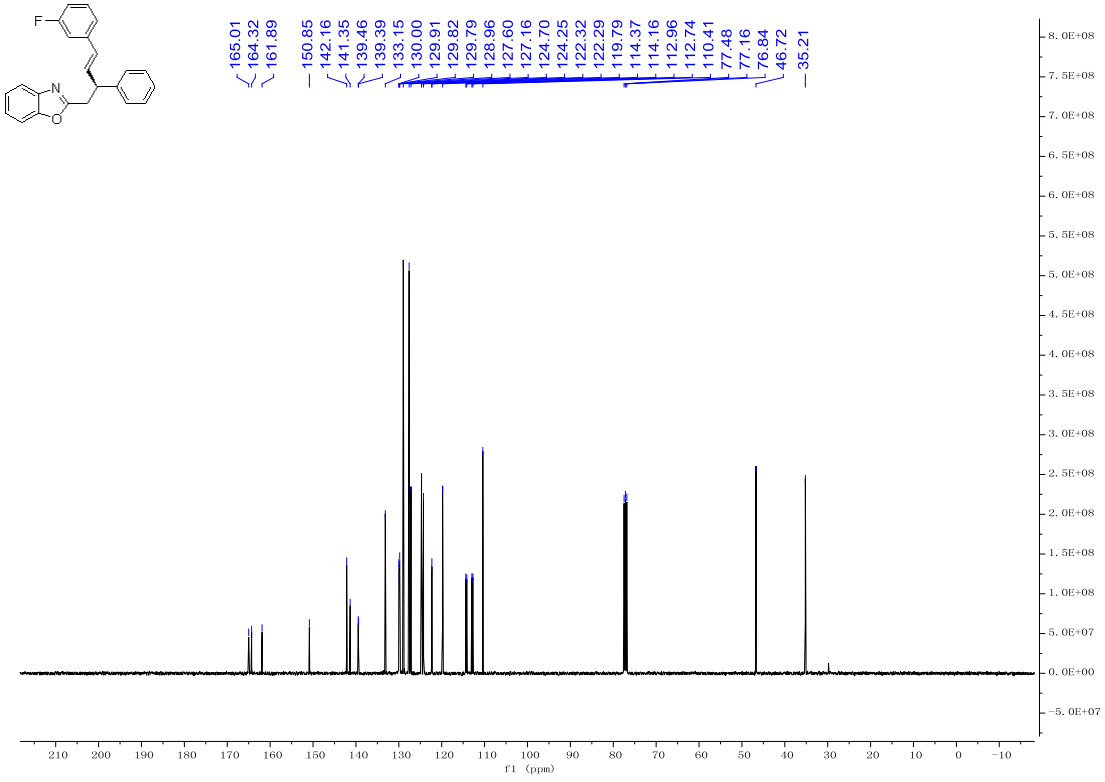


***(S,E)-2-(4-(3-fluorophenyl)-2-phenylbut-3-en-1-yl)benzo[d]oxazole* (6b)**

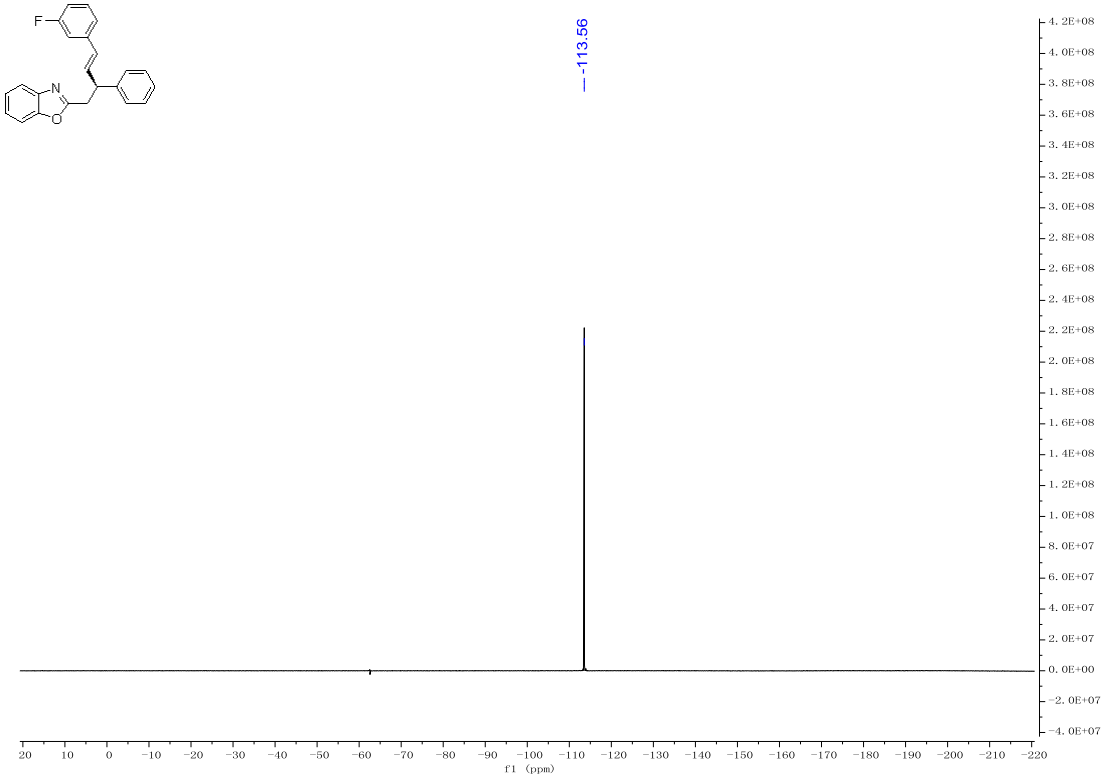
^{1}H NMR (400 MHz, $CDCl_3$)



^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$)

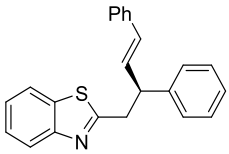


$^{19}F\{^{1}H\}$ NMR (376 MHz, $CDCl_3$)

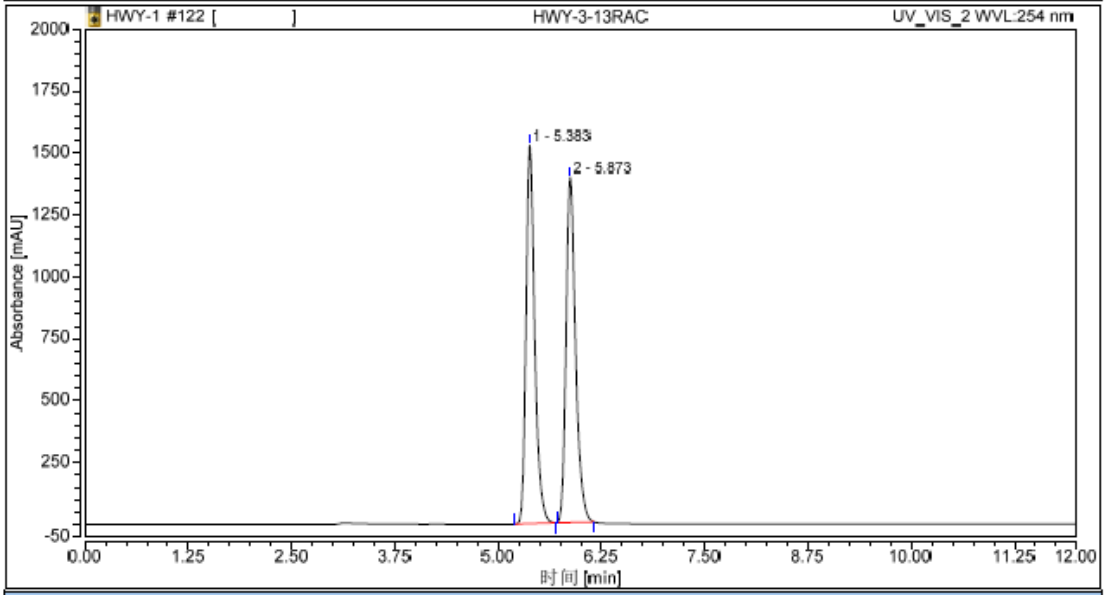


8. HPLC traces of optically active compounds

Compound 3aa



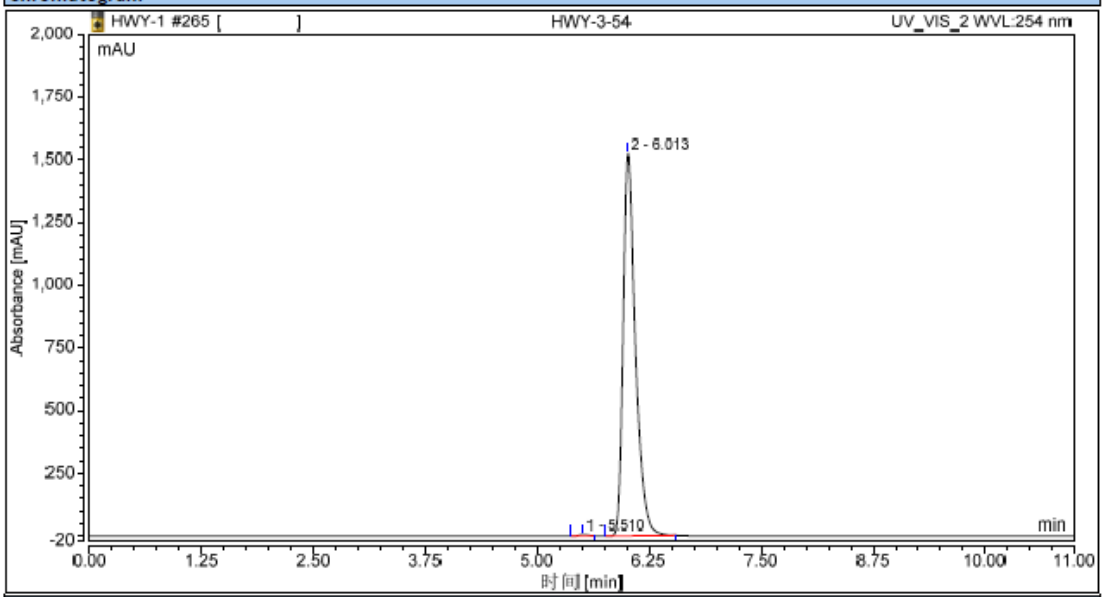
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.383	186.344	1528.010	50.03	52.29	n.a.
2		5.873	186.108	1394.096	49.97	47.71	n.a.
Total:			**372.452**	**2922.106**	**100.00**	**100.00**	

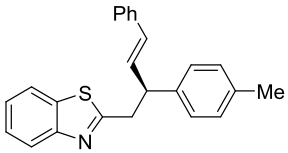
Chromatogram



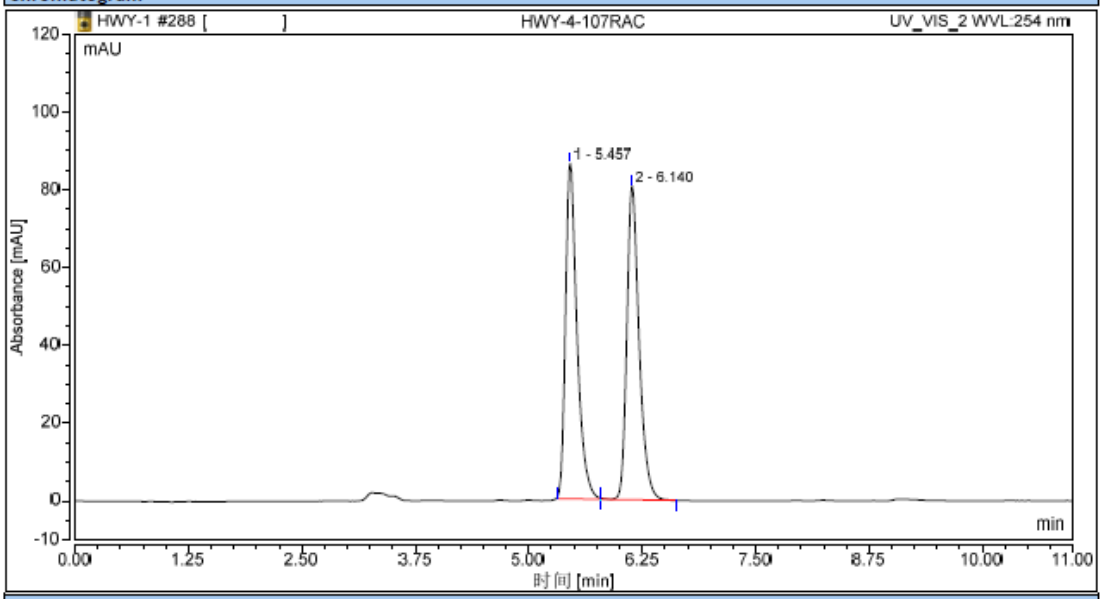
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.510	0.578	5.104	0.24	0.33	n.a.
2		6.013	241.750	1525.471	99.76	99.67	n.a.
Total:			**242.329**	**1530.575**	**100.00**	**100.00**	

Compound 3ba



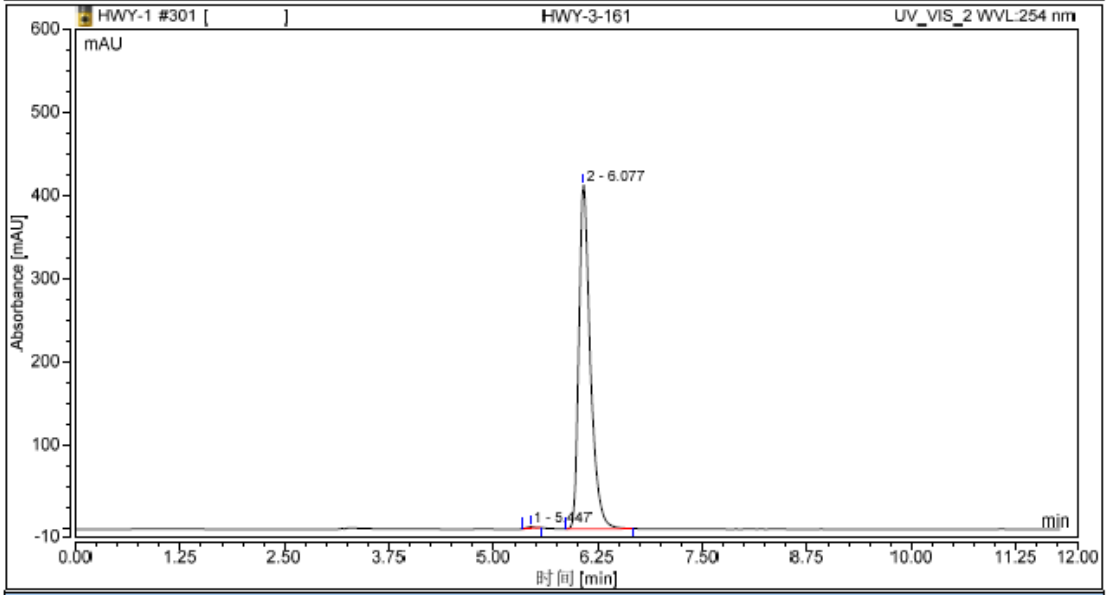
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.457	12.671	86.145	50.09	51.69	n.a.
2		6.140	12.625	80.522	49.91	48.31	n.a.
Total:			**25.296**	**166.667**	**100.00**	**100.00**	

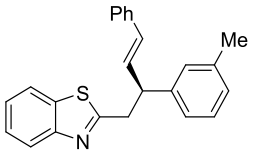
Chromatogram



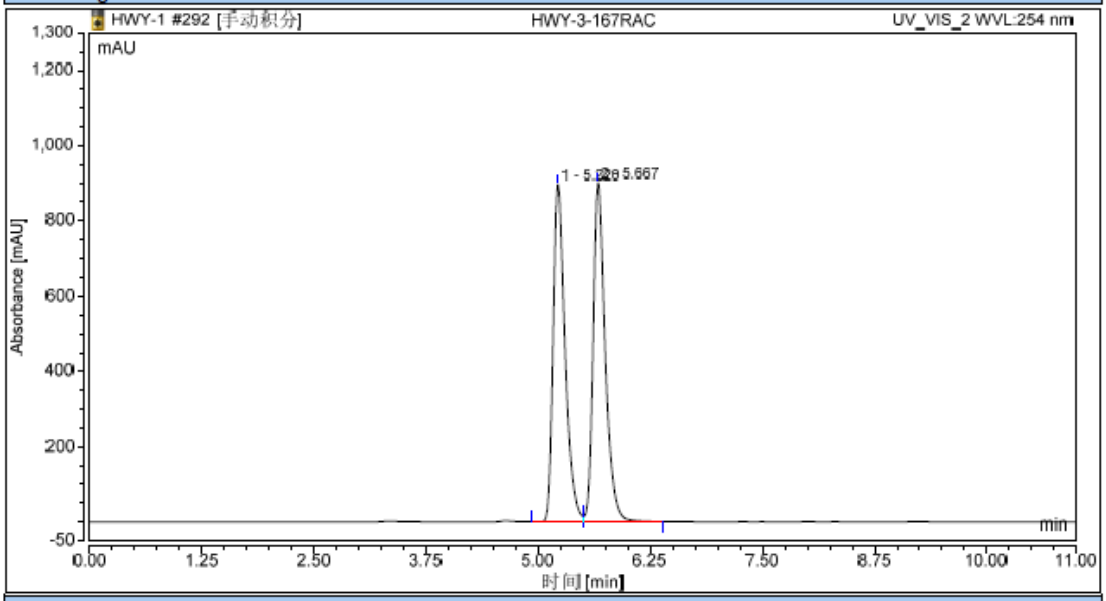
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.447	0.200	1.916	0.30	0.46	n.a.
2		6.077	65.556	412.226	99.70	99.54	n.a.
Total:			**65.756**	**414.142**	**100.00**	**100.00**	

Compound 3ca



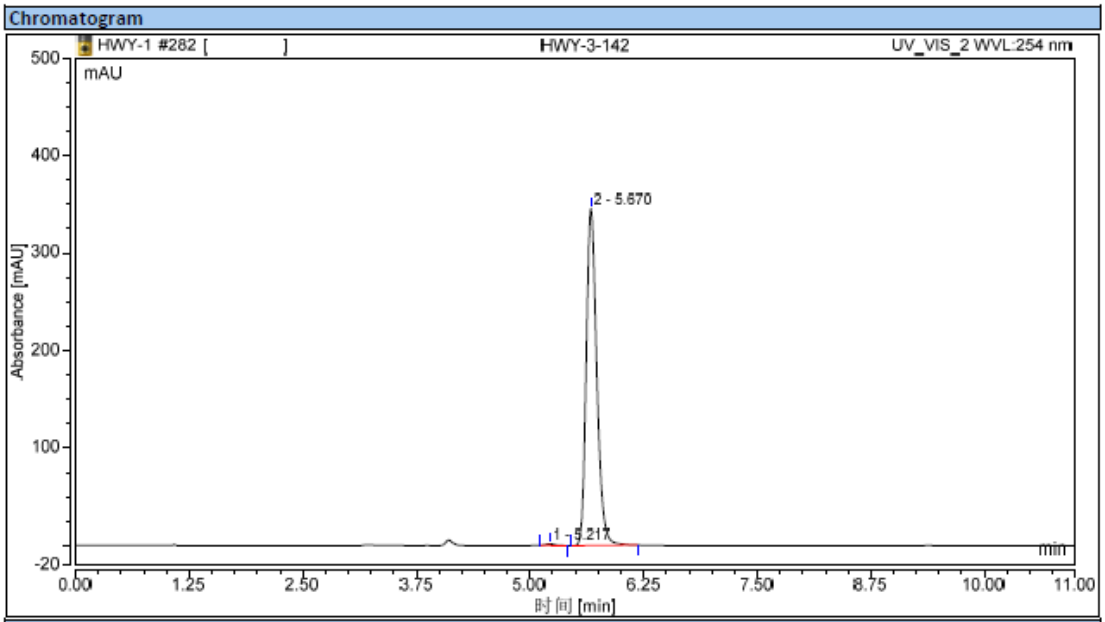
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.220	138.351	895.046	49.59	49.85	n.a.
2		5.667	140.639	900.594	50.41	50.15	n.a.
Total:			**278.990**	**1795.640**	**100.00**	**100.00**	

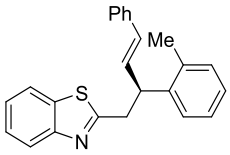
Chromatogram



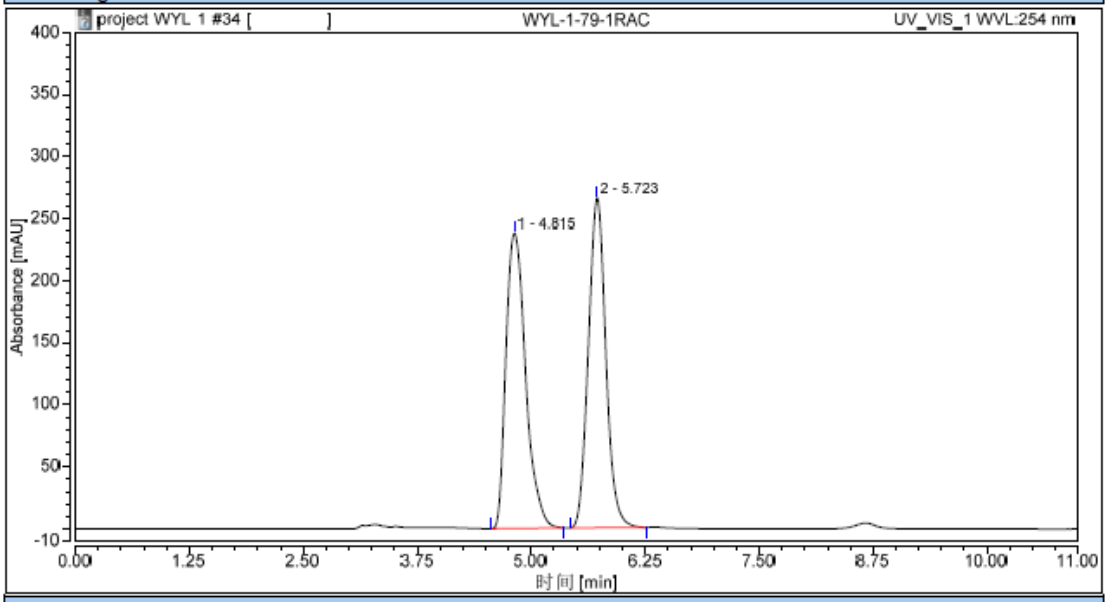
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.217	0.204	1.755	0.45	0.51	n.a.
2		5.670	45.625	345.542	99.55	99.49	n.a.
Total:			**45.829**	**347.297**	**100.00**	**100.00**	

Compound 3da



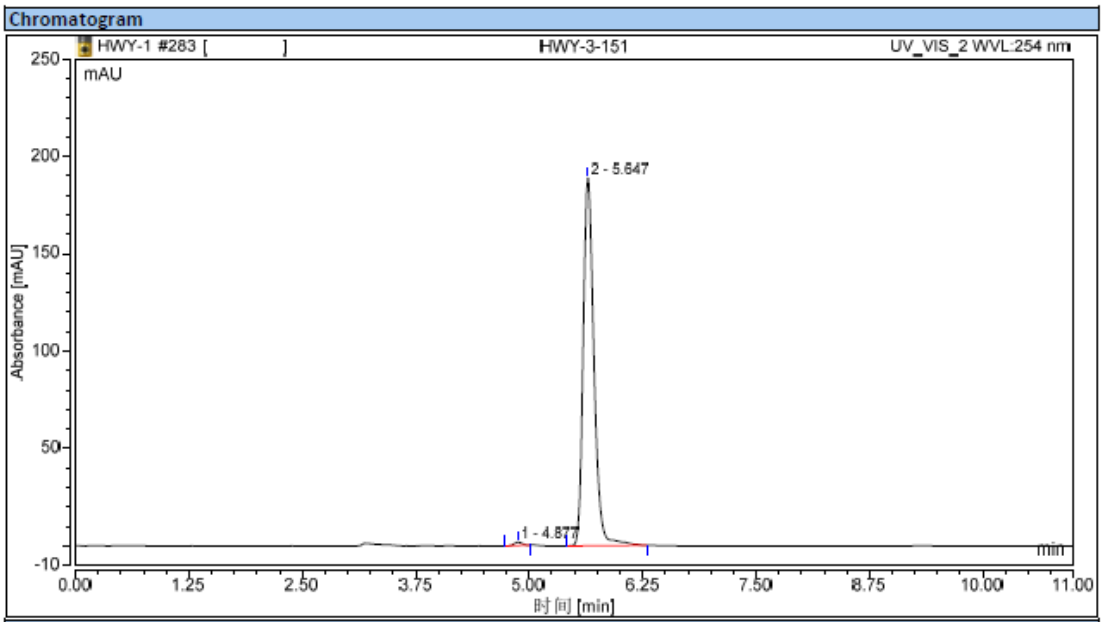
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		4.815	59.564	238.146	50.20	47.23	n.a.
2		5.723	59.084	266.037	49.80	52.77	n.a.
Total:			**118.649**	**504.183**	**100.00**	**100.00**	

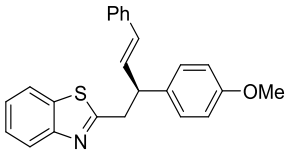
Chromatogram



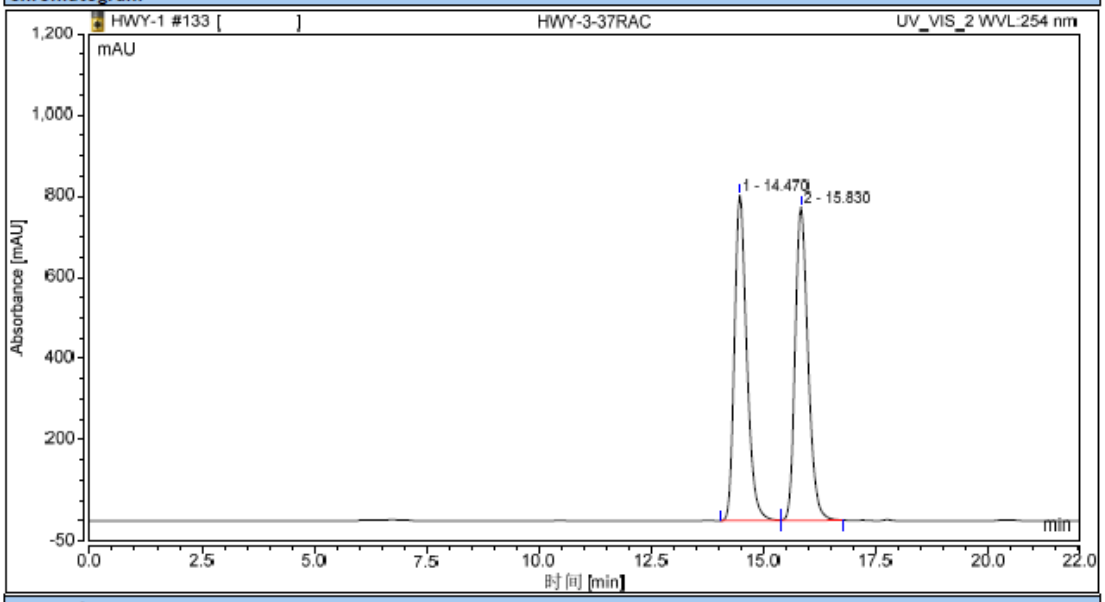
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		4.877	0.154	1.667	0.60	0.87	n.a.
2		5.647	25.567	188.881	99.40	99.13	n.a.
Total:			**25.721**	**190.548**	**100.00**	**100.00**	

Compound 3ea



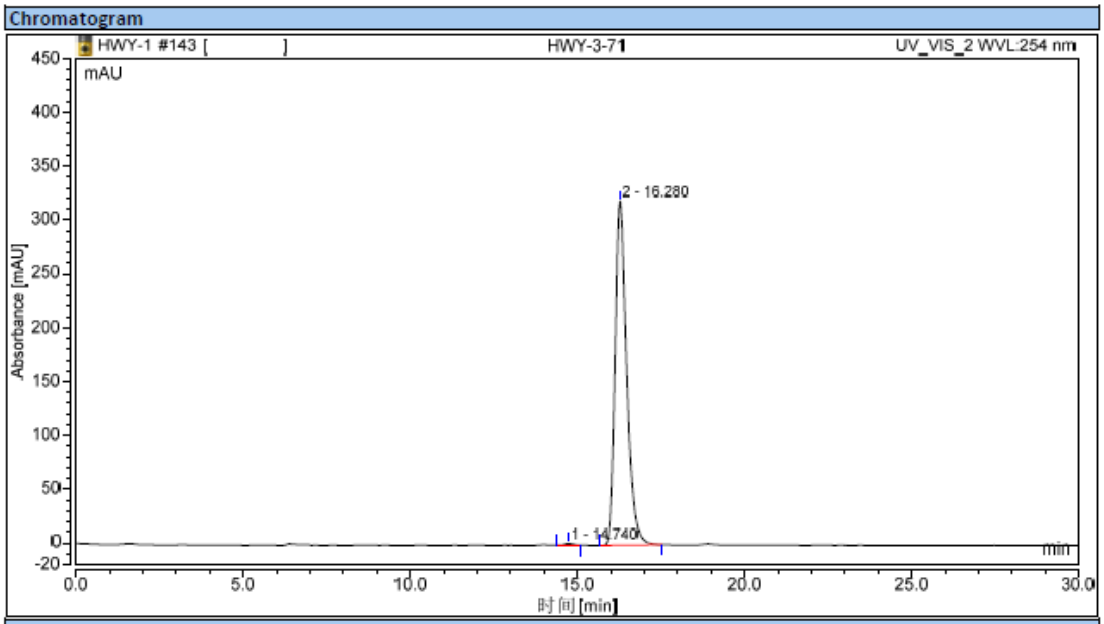
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.470	256.194	802.765	50.06	50.94	n.a.
2		15.830	255.612	773.086	49.94	49.06	n.a.
Total:			**511.806**	**1575.851**	**100.00**	**100.00**	

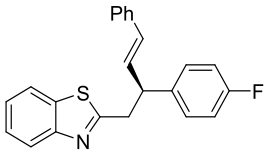
Chromatogram



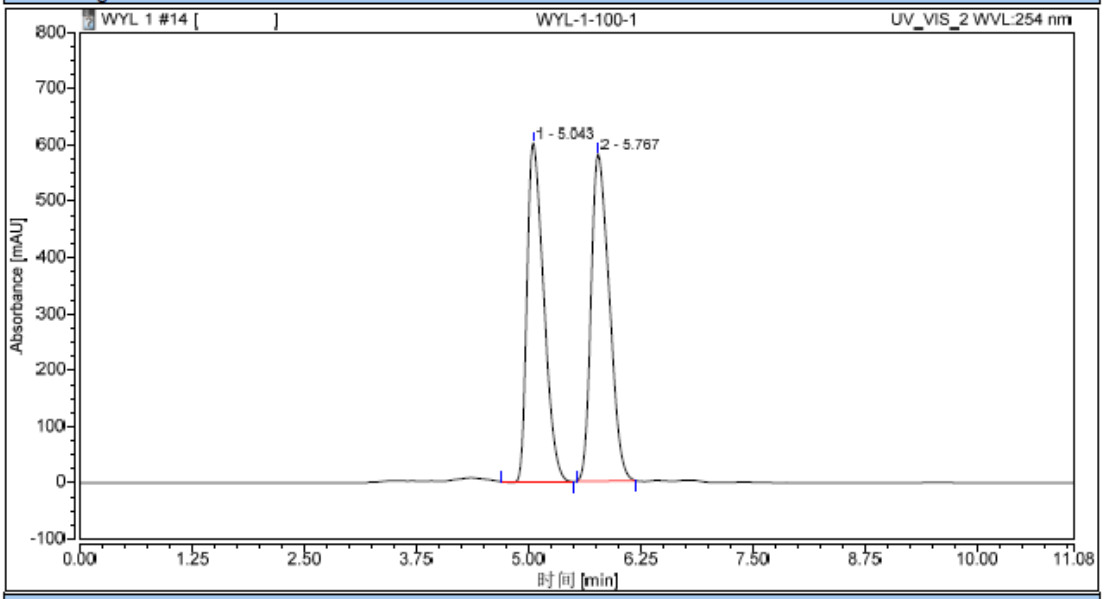
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.740	0.425	1.437	0.33	0.45	n.a.
2		16.280	126.987	319.358	99.67	99.55	n.a.
Total:			**127.411**	**320.794**	**100.00**	**100.00**	

Compound 3fa



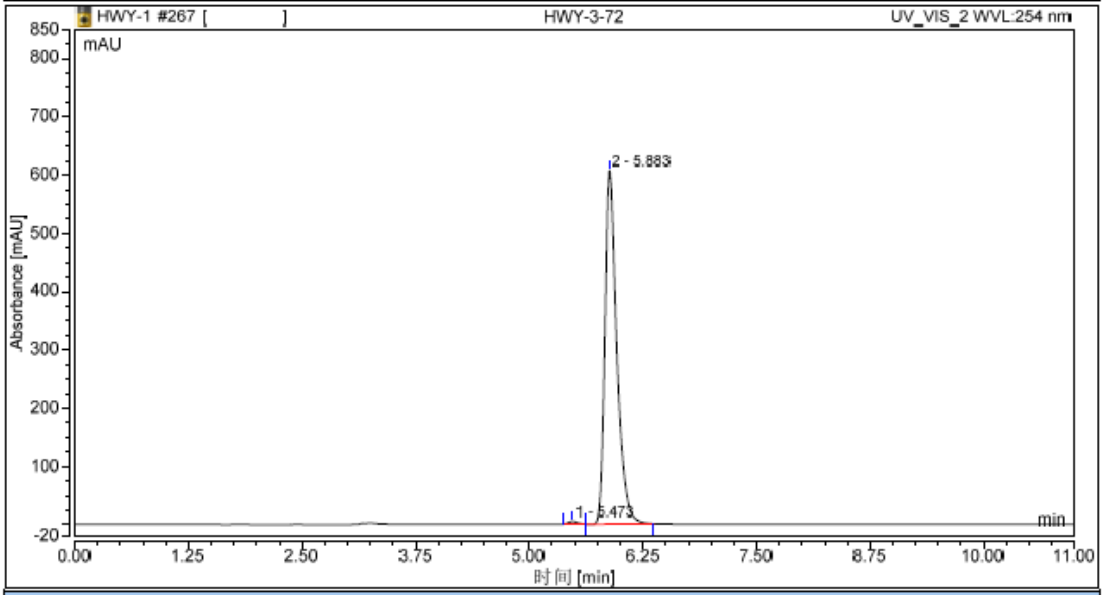
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.043	128.943	601.399	48.61	50.85	n.a.
2		5.767	136.343	581.196	51.39	49.15	n.a.
Total:			**265.285**	**1182.595**	**100.00**	**100.00**	

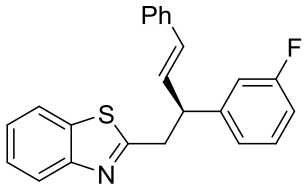
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.473	0.572	4.687	0.62	0.77	n.a.
2		5.883	91.439	606.524	99.38	99.23	n.a.
Total:			**92.010**	**611.211**	**100.00**	**100.00**	

Compound 3ga



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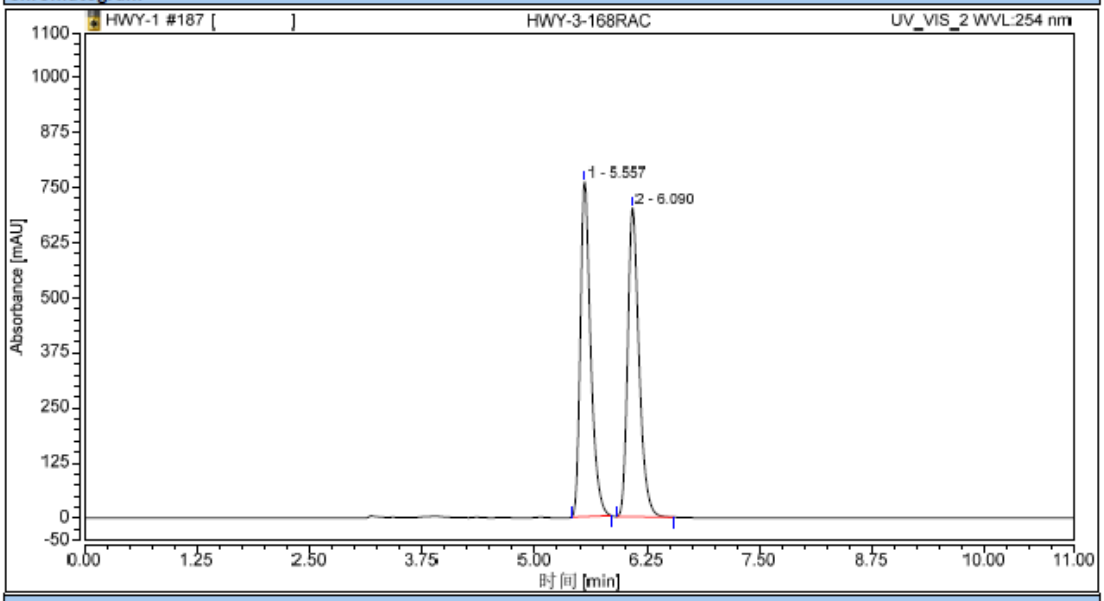
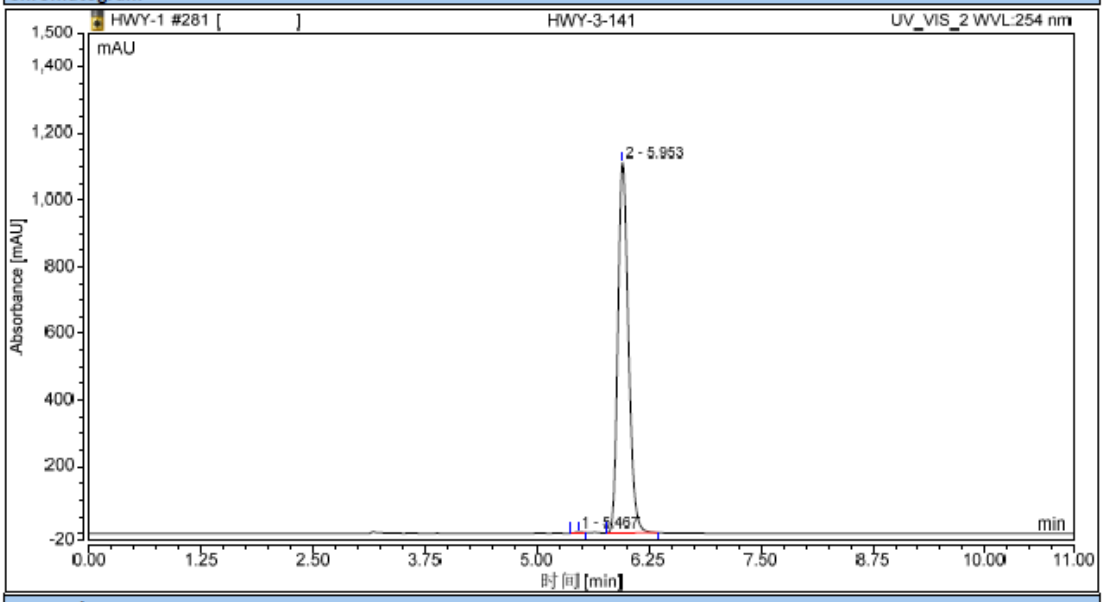


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.557	101.778	759.614	49.95	52.03	n.a.
2		6.090	101.983	700.372	50.05	47.97	n.a.
Total:			**203.760**	**1459.987**	**100.00**	**100.00**	

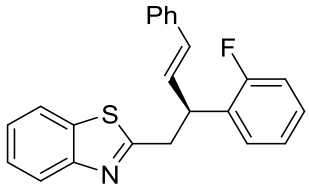
Chromatogram



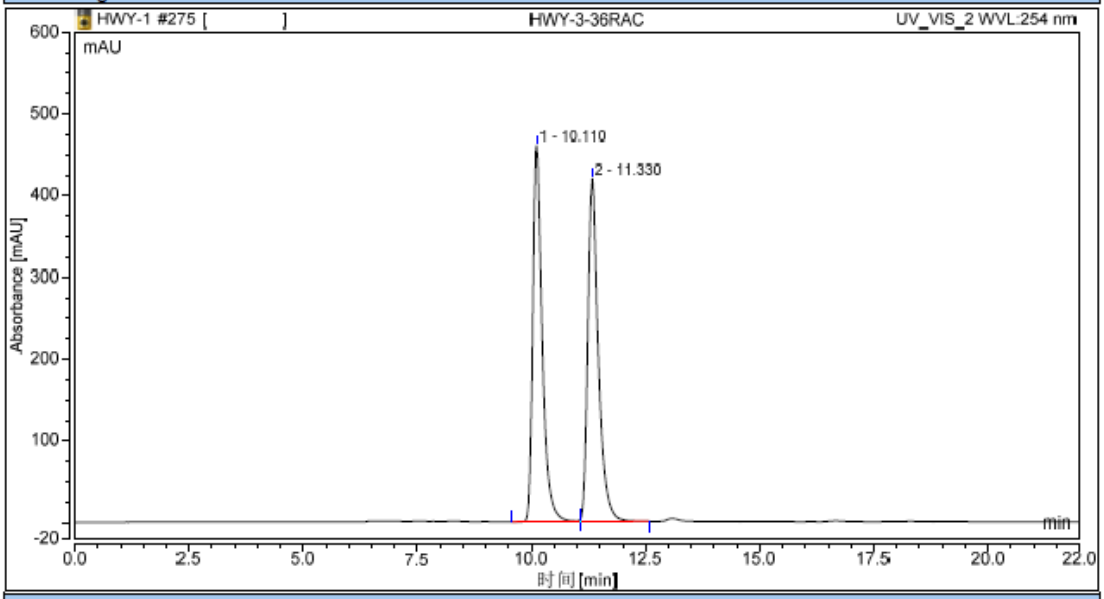
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.467	0.278	3.026	0.18	0.27	n.a.
2		5.953	150.097	1111.283	99.82	99.73	n.a.
Total:			**150.375**	**1114.309**	**100.00**	**100.00**	

Compound 3ha



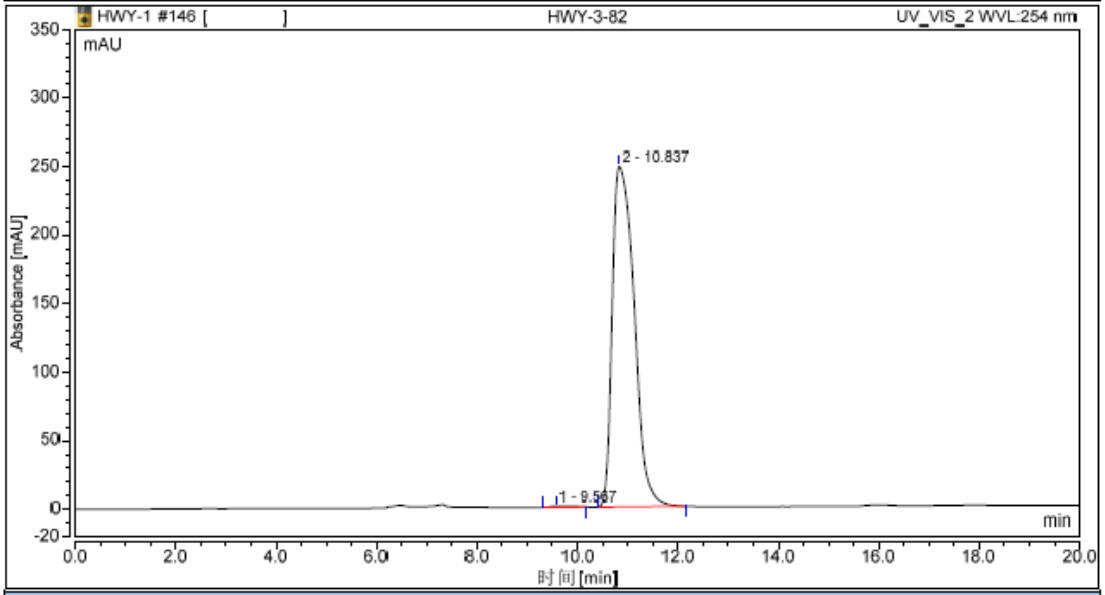
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.110	110.488	459.919	49.75	52.32	n.a.
2		11.330	111.591	419.065	50.25	47.68	n.a.
Total:			**222.079**	**878.984**	**100.00**	**100.00**	

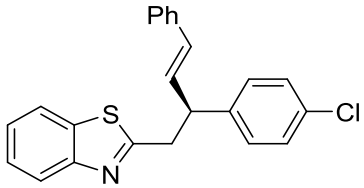
Chromatogram



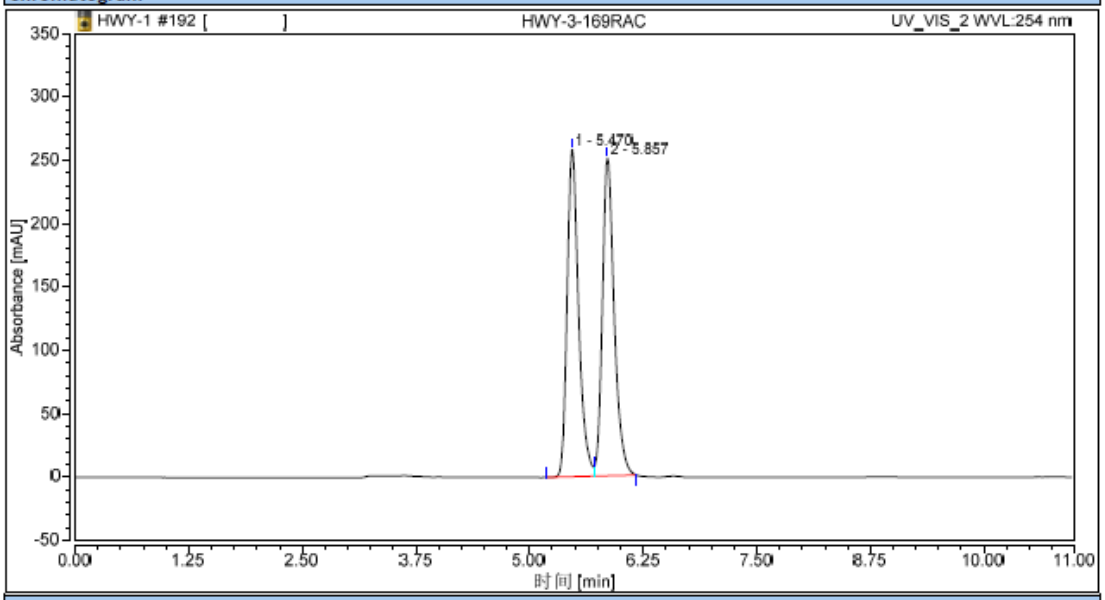
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.567	0.429	0.889	0.34	0.36	n.a.
2		10.837	124.740	248.279	99.66	99.64	n.a.
Total:			**125.169**	**249.168**	**100.00**	**100.00**	

Compound 3ia



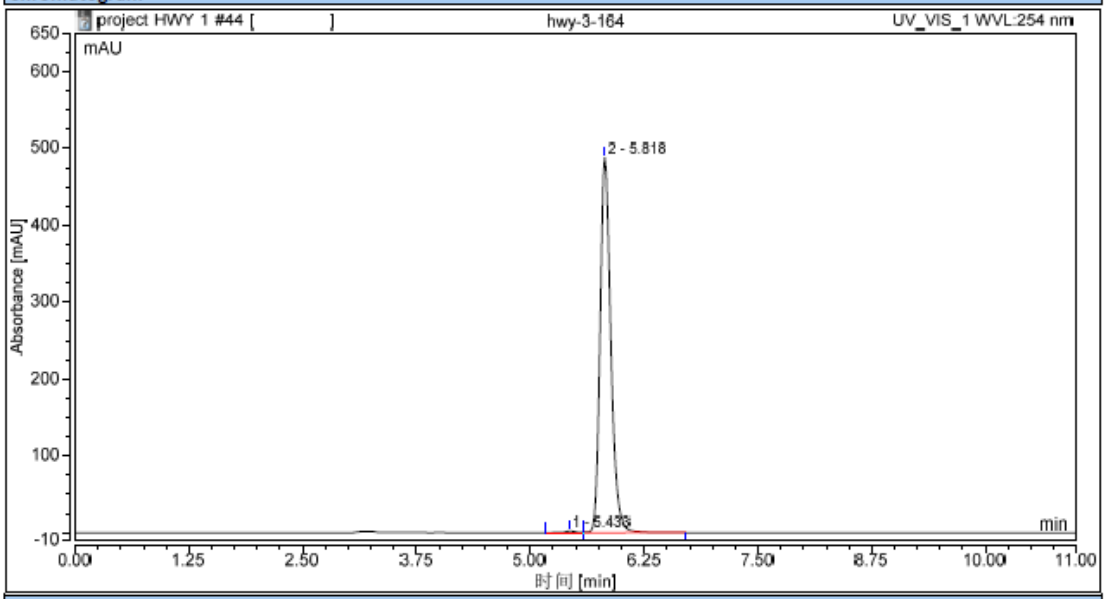
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.470	37.661	258.053	49.93	50.73	n.a.
2		5.857	37.774	250.630	50.07	49.27	n.a.
Total:			**75.435**	**508.683**	**100.00**	**100.00**	

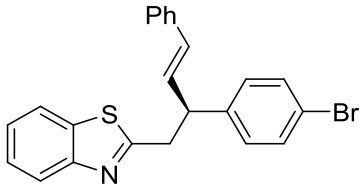
Chromatogram



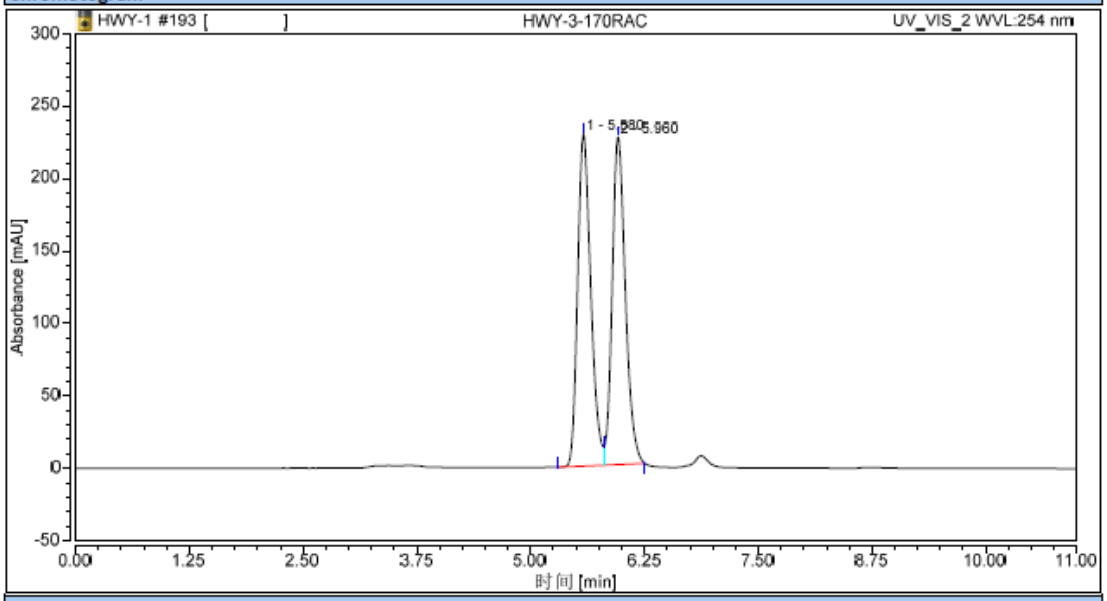
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.433	0.288	1.904	0.43	0.39	n.a.
2		5.818	66.692	487.946	99.57	99.61	n.a.
Total:			**66.980**	**489.850**	**100.00**	**100.00**	

Compound 3ja



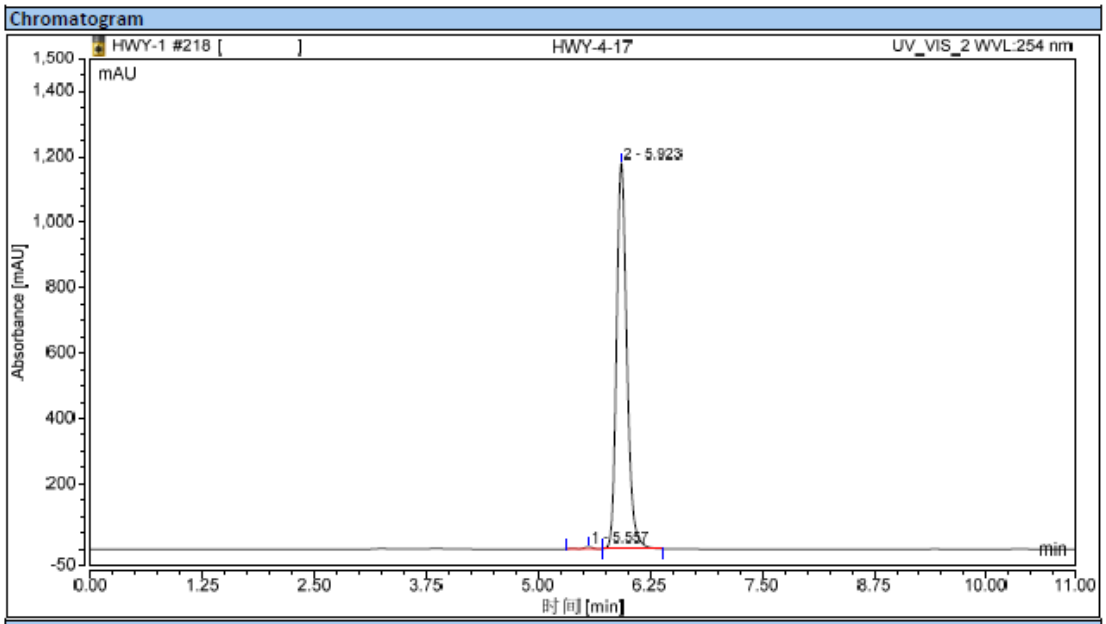
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.580	37.781	228.823	49.95	50.32	n.a.
2		5.960	37.850	225.893	50.05	49.68	n.a.
Total:			**75.631**	**454.716**	**100.00**	**100.00**	

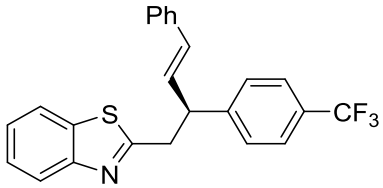
Chromatogram



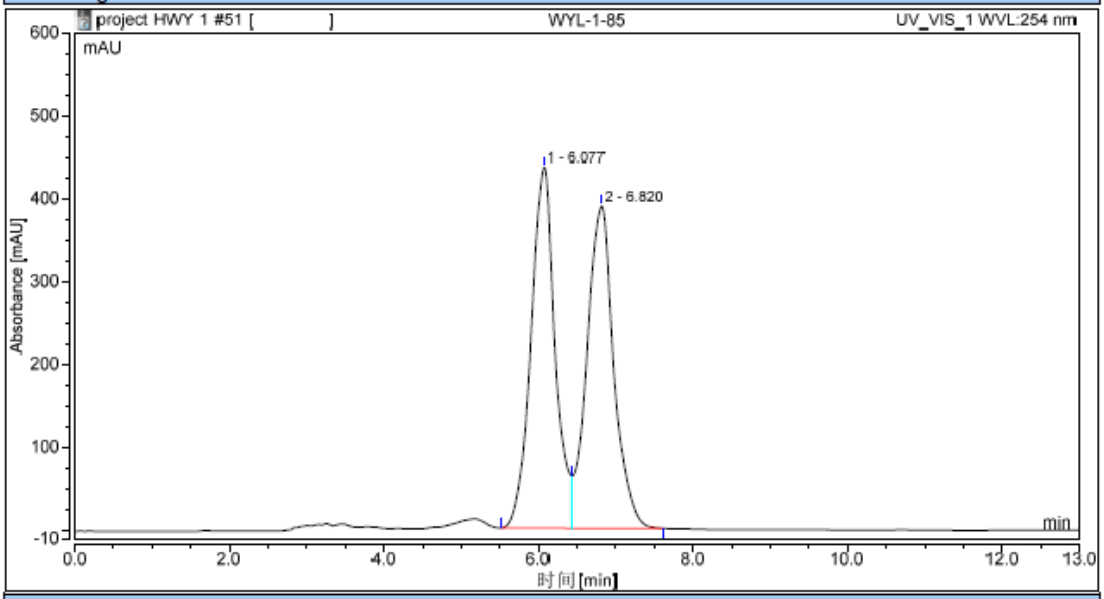
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.557	0.720	5.690	0.46	0.48	n.a.
2		5.923	156.843	1179.007	99.54	99.52	n.a.
Total:			**157.564**	**1184.697**	**100.00**	**100.00**	

Compound 3ka



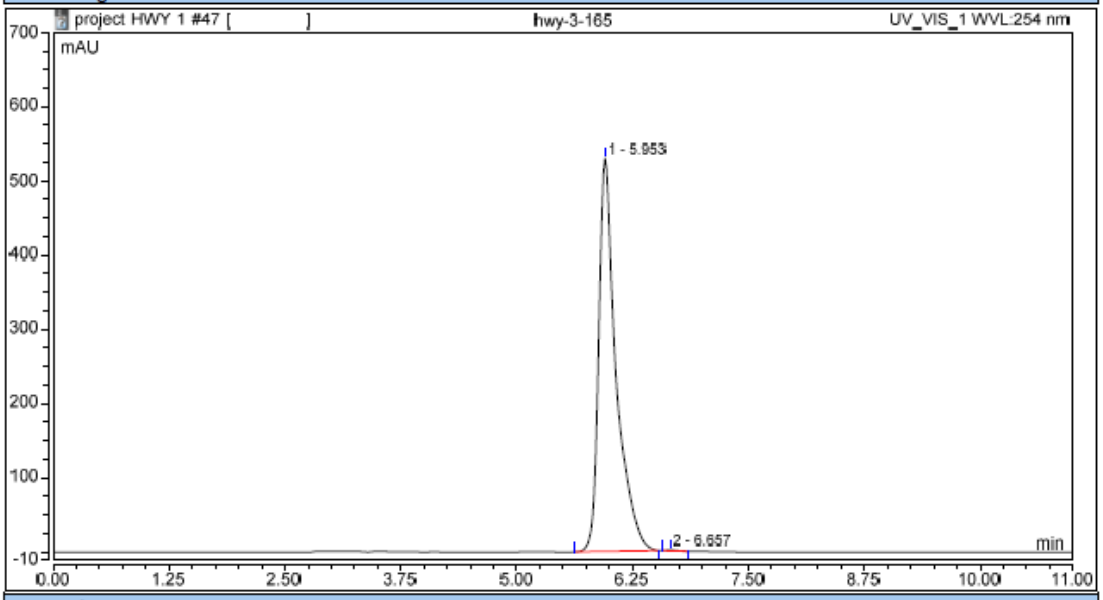
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		6.077	156.820	434.561	50.15	52.82	n.a.
2		6.820	155.903	388.110	49.85	47.18	n.a.
Total:			**312.723**	**822.671**	**100.00**	**100.00**	

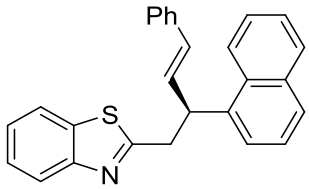
Chromatogram



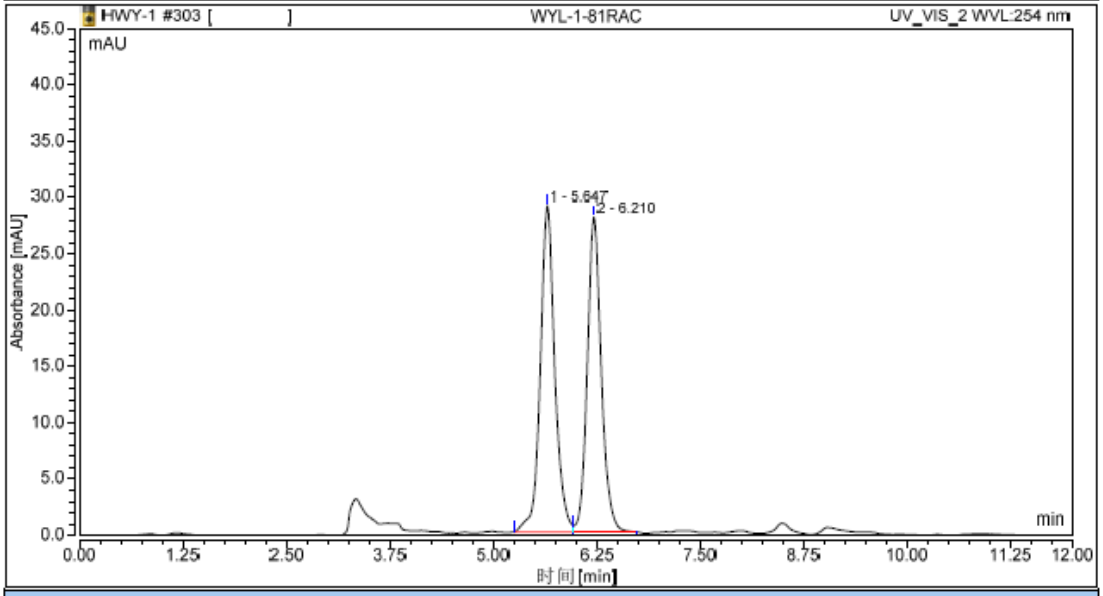
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.953	114.836	529.875	99.86	99.78	n.a.
2		6.657	0.159	1.154	0.14	0.22	n.a.
Total:			**114.995**	**531.030**	**100.00**	**100.00**	

Compound 3la



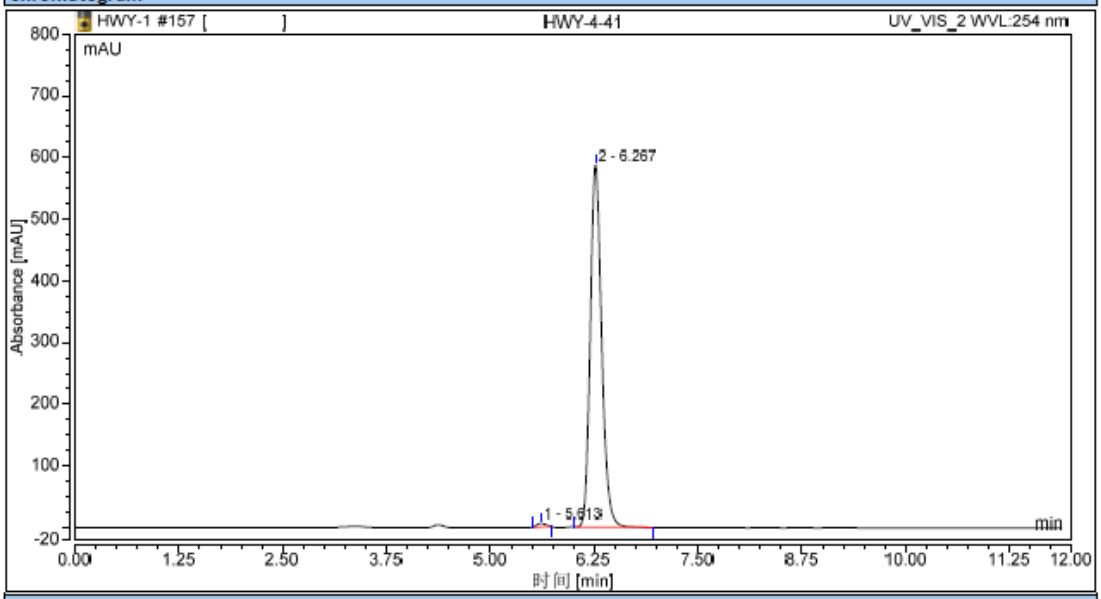
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.647	5.890	28.988	51.84	50.91	n.a.
2		6.210	5.471	27.952	48.16	49.09	n.a.
Total:			**11.362**	**56.939**	**100.00**	**100.00**	

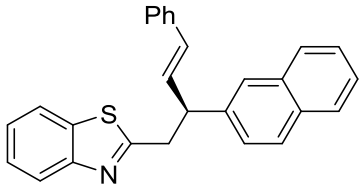
Chromatogram



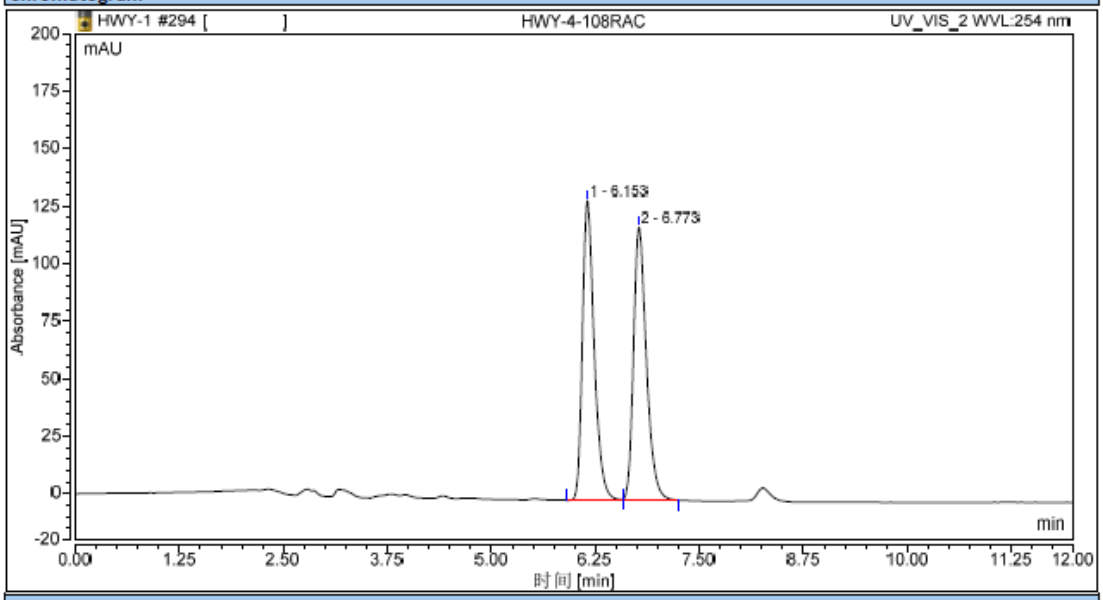
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.613	0.765	5.932	0.81	1.00	n.a.
2		6.267	93.240	586.759	99.19	99.00	n.a.
Total:			**94.006**	**592.692**	**100.00**	**100.00**	

Compound 3ma



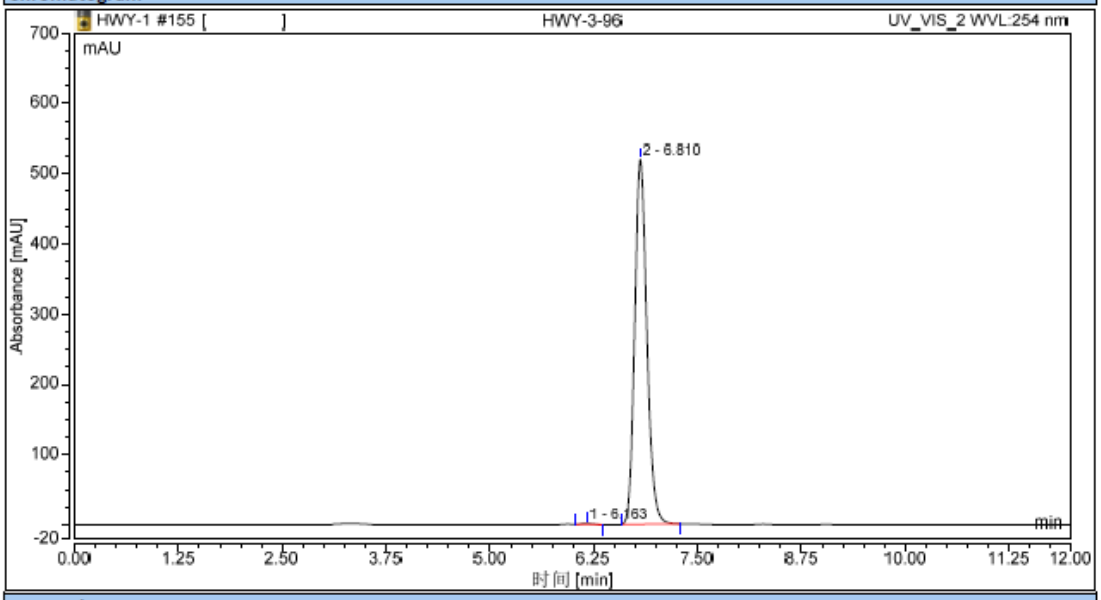
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		6.153	21.237	130.197	49.96	52.33	n.a.
2		6.773	21.273	118.624	50.04	47.67	n.a.
Total:			**42.510**	**248.822**	**100.00**	**100.00**	

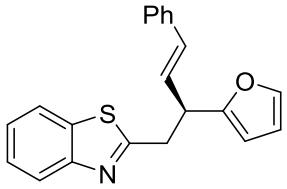
Chromatogram



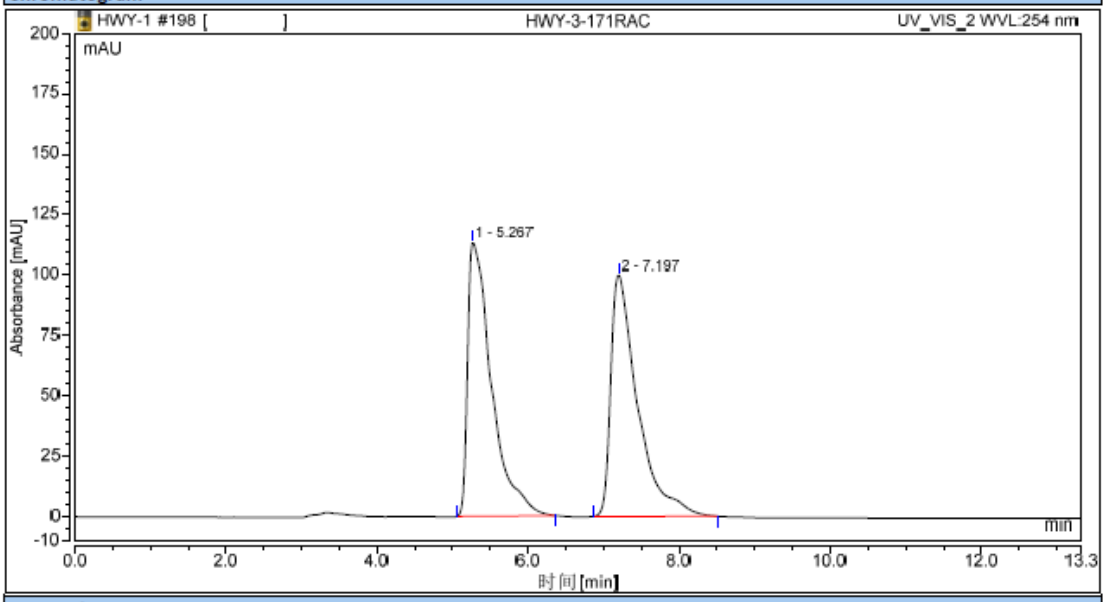
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		6.163	0.240	1.660	0.27	0.32	n.a.
2		6.810	88.041	519.620	99.73	99.68	n.a.
Total:			**88.281**	**521.279**	**100.00**	**100.00**	

Compound 3na



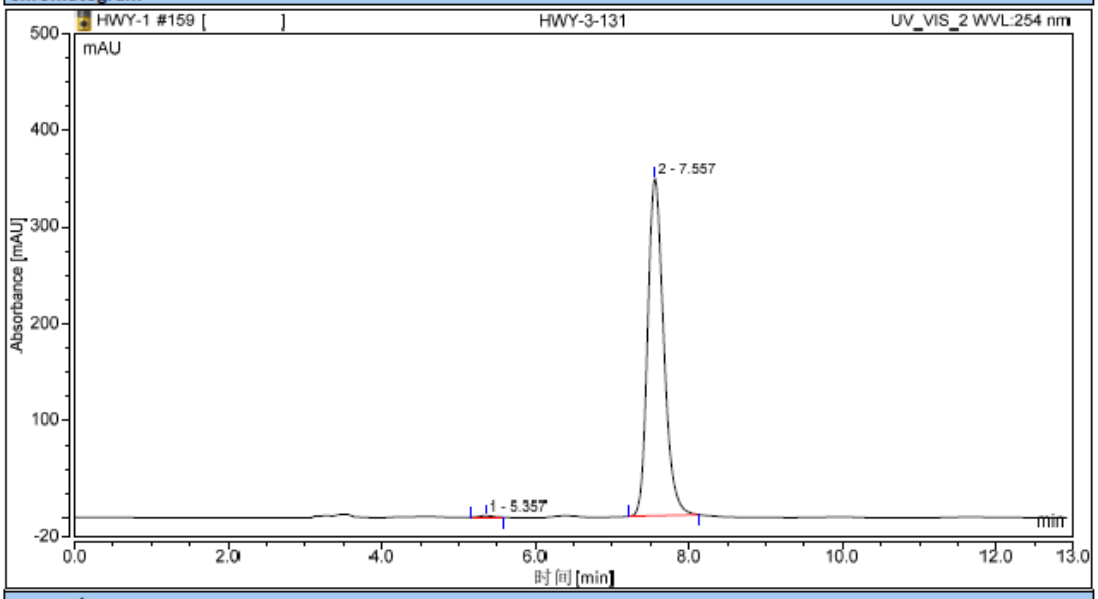
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.267	41.256	113.460	50.03	53.16	n.a.
2		7.197	41.211	99.981	49.97	46.84	n.a.
Total:			**82.467**	**213.441**	**100.00**	**100.00**	

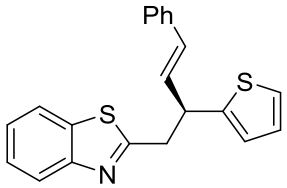
Chromatogram



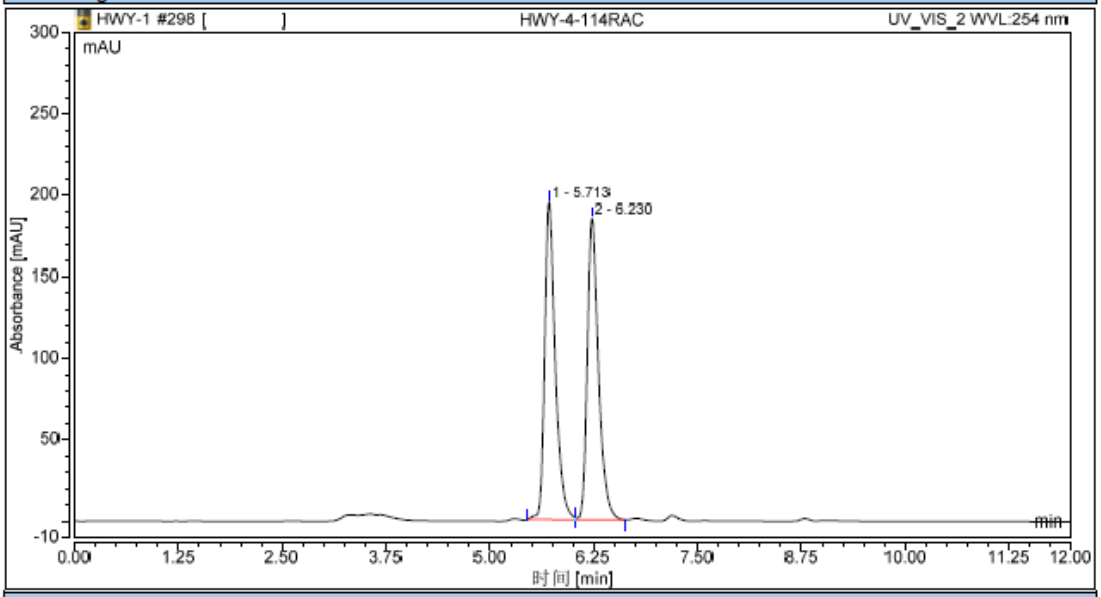
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.357	0.369	1.674	0.44	0.48	n.a.
2		7.557	84.004	348.801	99.56	99.52	n.a.
Total:			**84.373**	**350.475**	**100.00**	**100.00**	

Compound 3oa



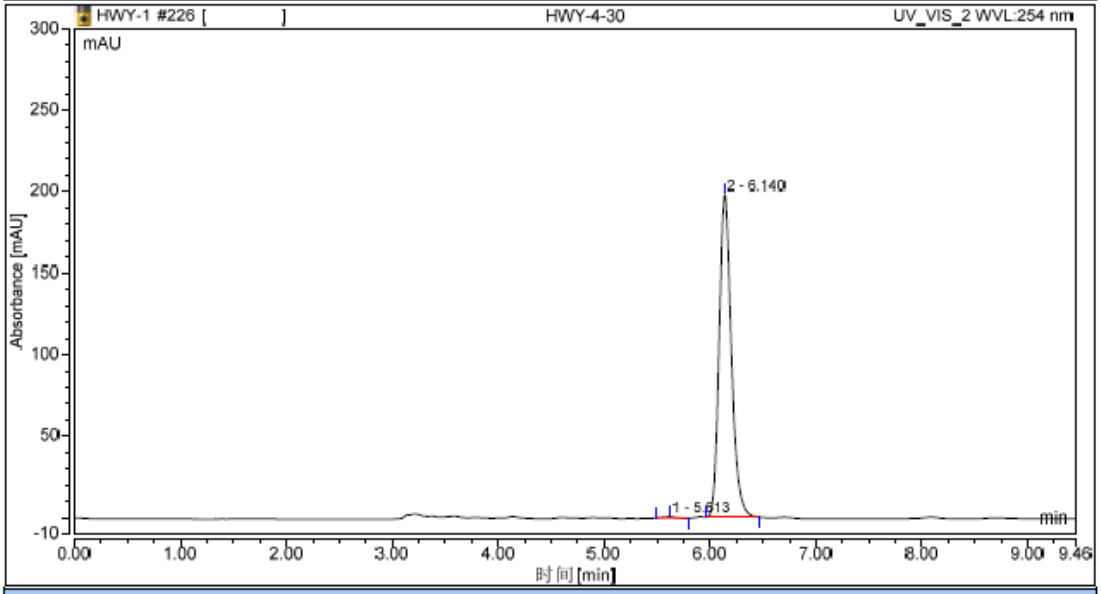
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.713	28.788	195.050	50.10	51.32	n.a.
2		6.230	28.674	185.034	49.90	48.68	n.a.
Total:			**57.462**	**380.085**	**100.00**	**100.00**	

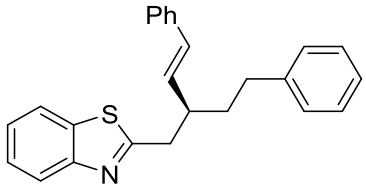
Chromatogram



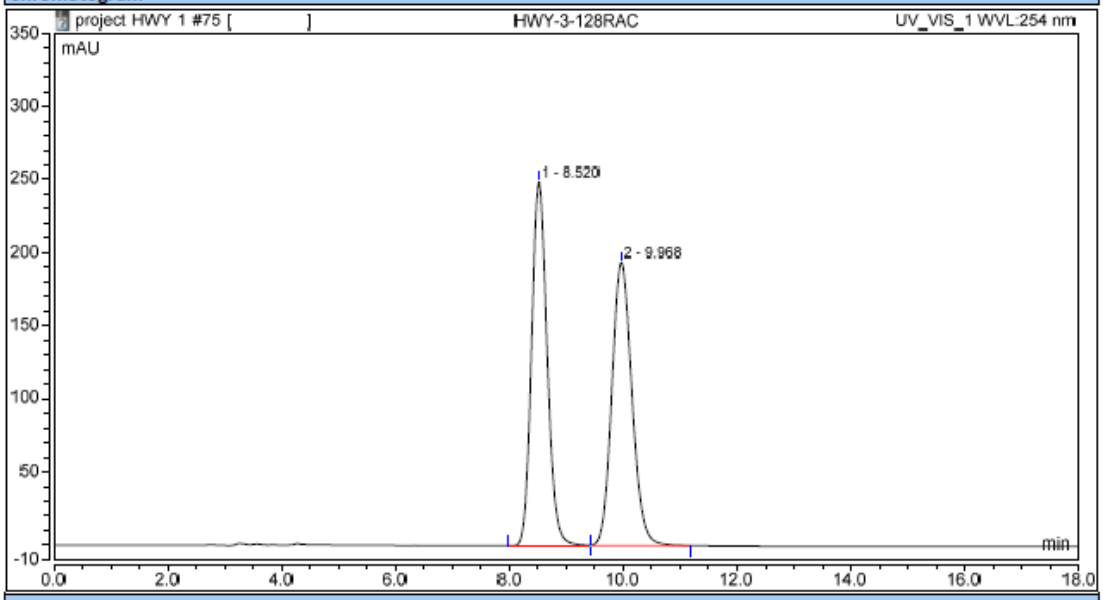
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.613	0.086	0.805	0.33	0.41	n.a.
2		6.140	26.288	197.654	99.67	99.59	n.a.
Total:			**26.374**	**198.459**	**100.00**	**100.00**	

Compound 3pa



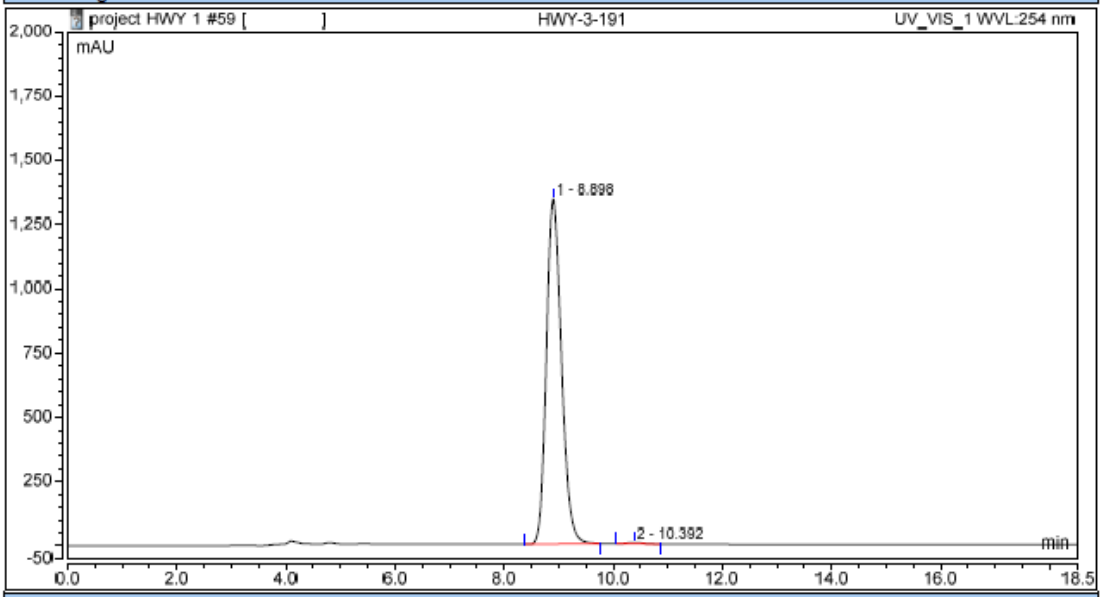
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.520	79.170	249.082	50.04	56.22	n.a.
2		9.968	79.032	193.933	49.96	43.78	n.a.
Total:			**158.202**	**443.016**	**100.00**	**100.00**	

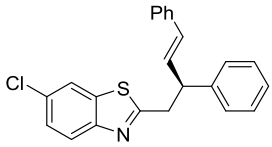
Chromatogram



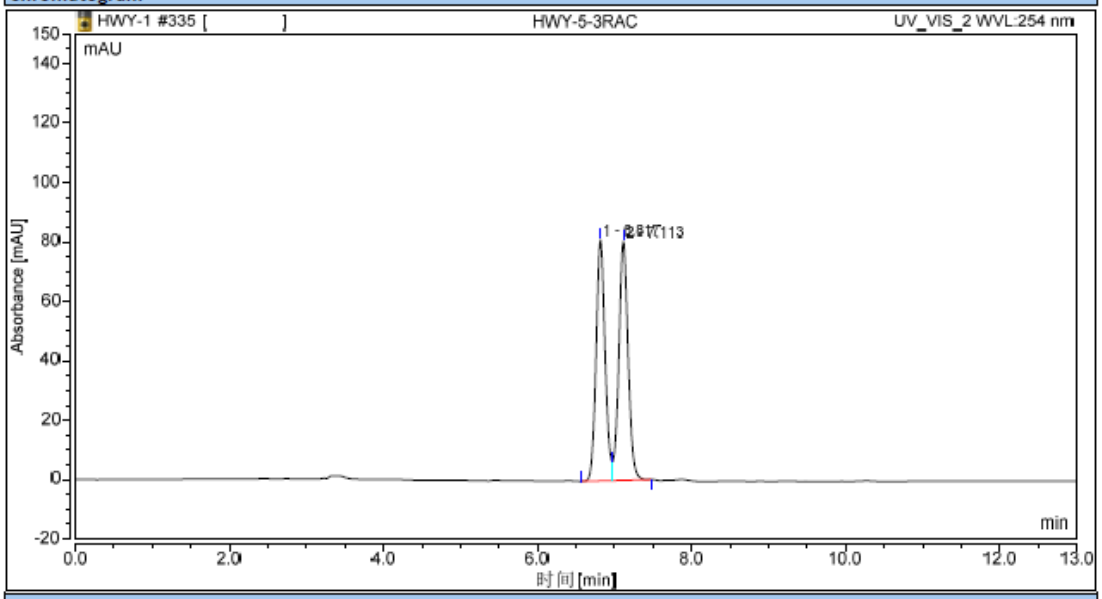
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.898	428.490	1343.528	99.63	99.69	n.a.
2		10.392	1.594	4.211	0.37	0.31	n.a.
Total:			**430.084**	**1347.739**	**100.00**	**100.00**	

Compound 3qa



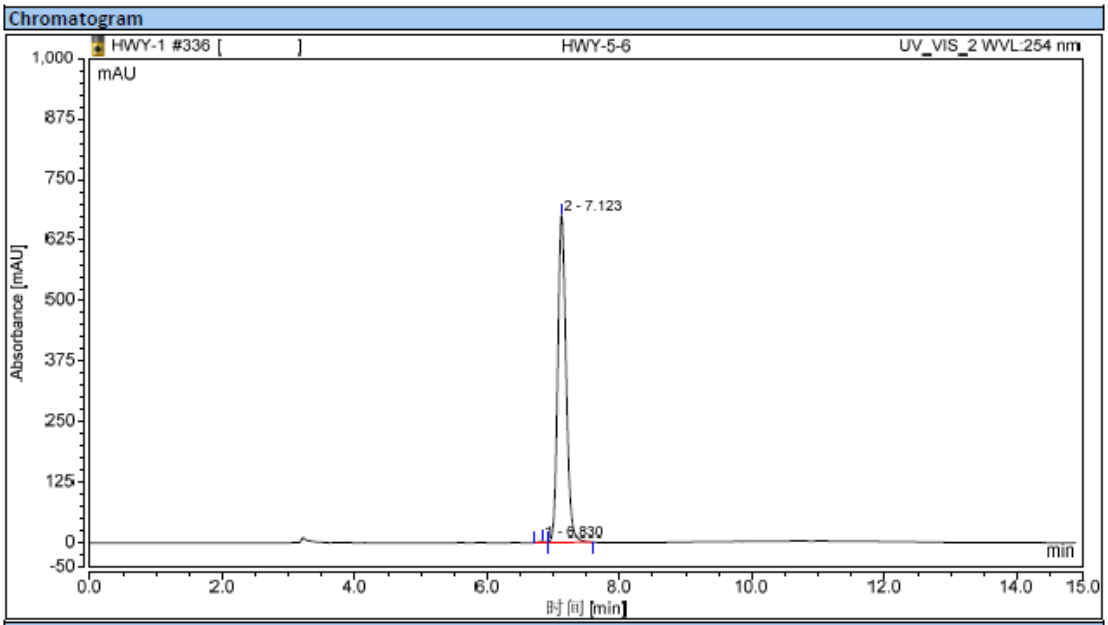
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		6.817	10.972	81.169	49.53	50.25	n.a.
2		7.113	11.179	80.361	50.47	49.75	n.a.
Total:			**22.150**	**161.530**	**100.00**	**100.00**	

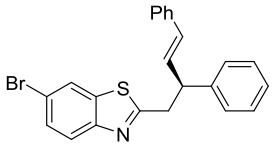
Chromatogram



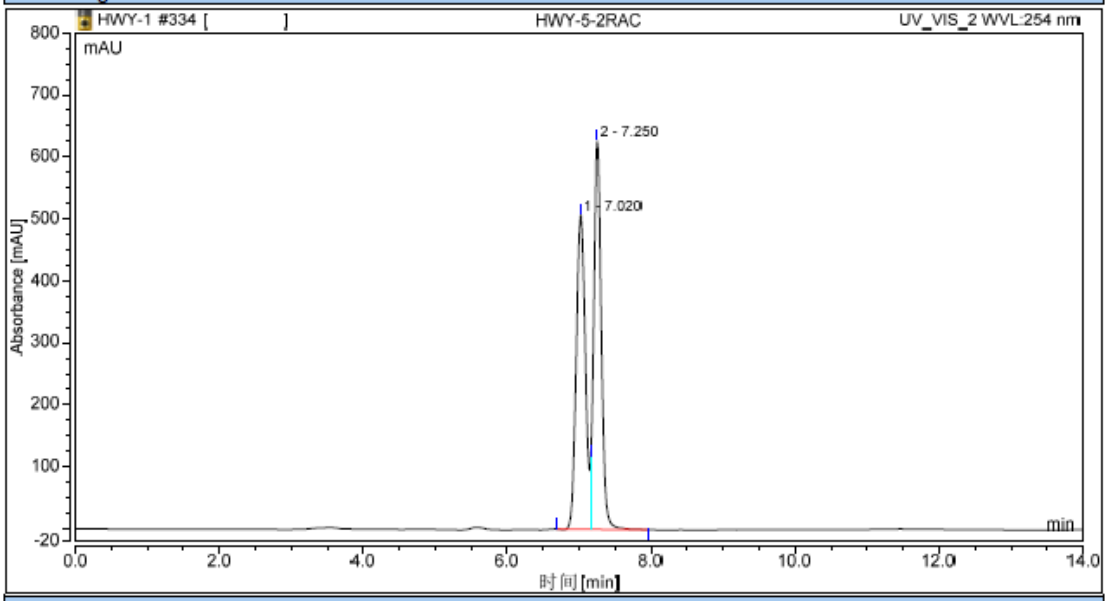
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		6.830	0.293	2.482	0.30	0.37	n.a.
2		7.123	98.096	676.251	99.70	99.63	n.a.
Total:			**98.389**	**678.733**	**100.00**	**100.00**	

Compound 3ra



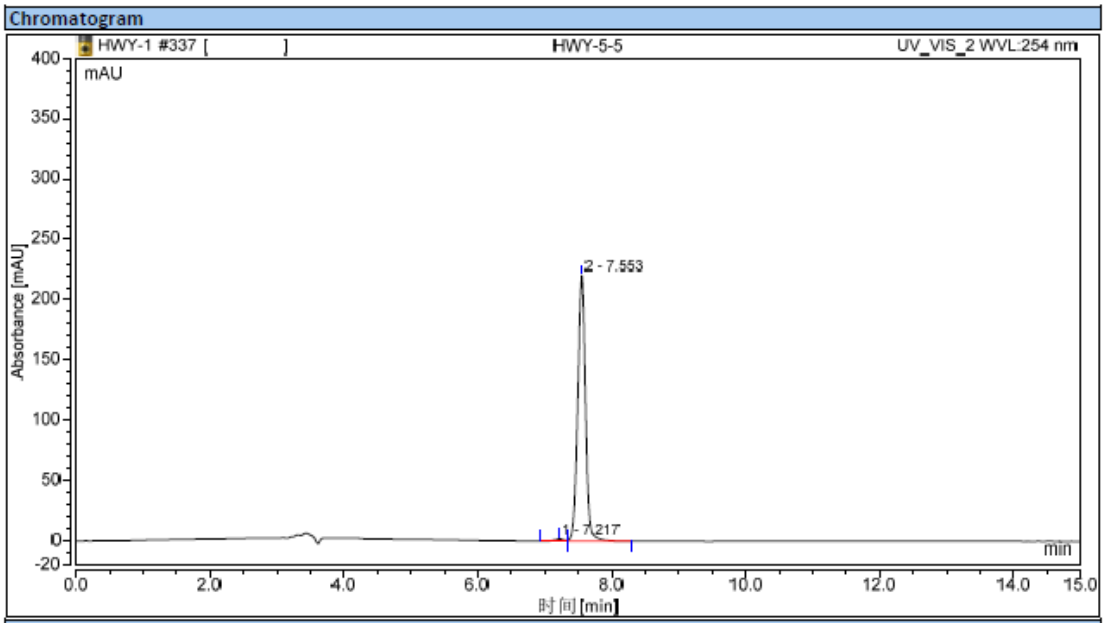
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.020	74.879	506.563	49.85	44.71	n.a.
2		7.250	75.342	626.319	50.15	55.29	n.a.
Total:			**150.220**	**1132.882**	**100.00**	**100.00**	

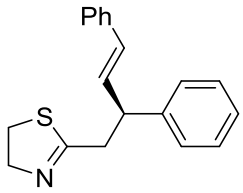
Chromatogram



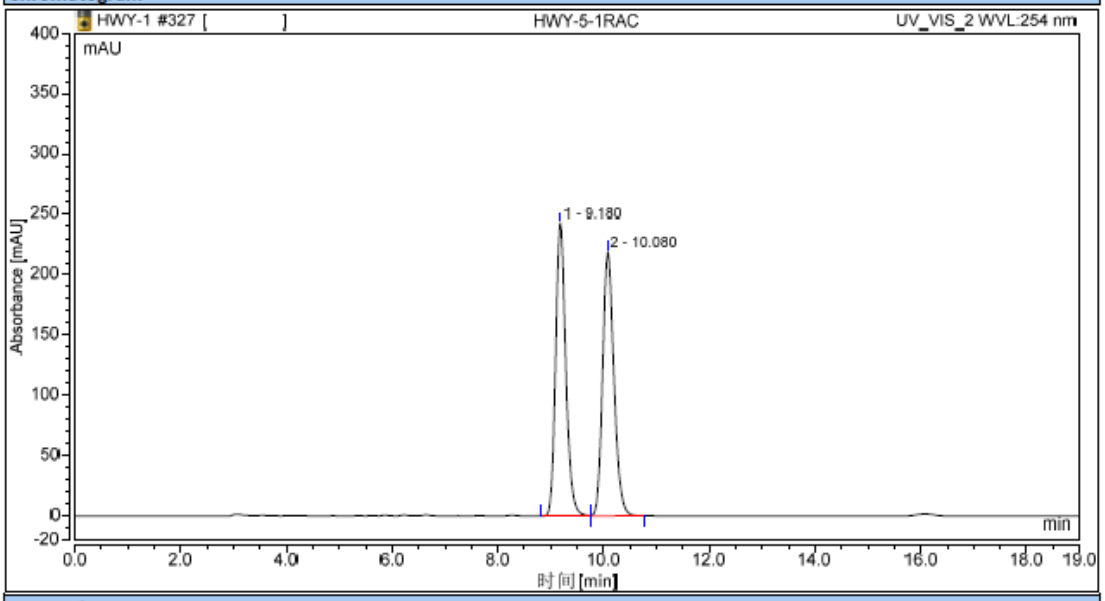
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.217	0.283	1.721	0.95	0.78	n.a.
2		7.553	29.537	220.132	99.05	99.22	n.a.
Total:			**29.820**	**221.853**	**100.00**	**100.00**	

Compound 3sa



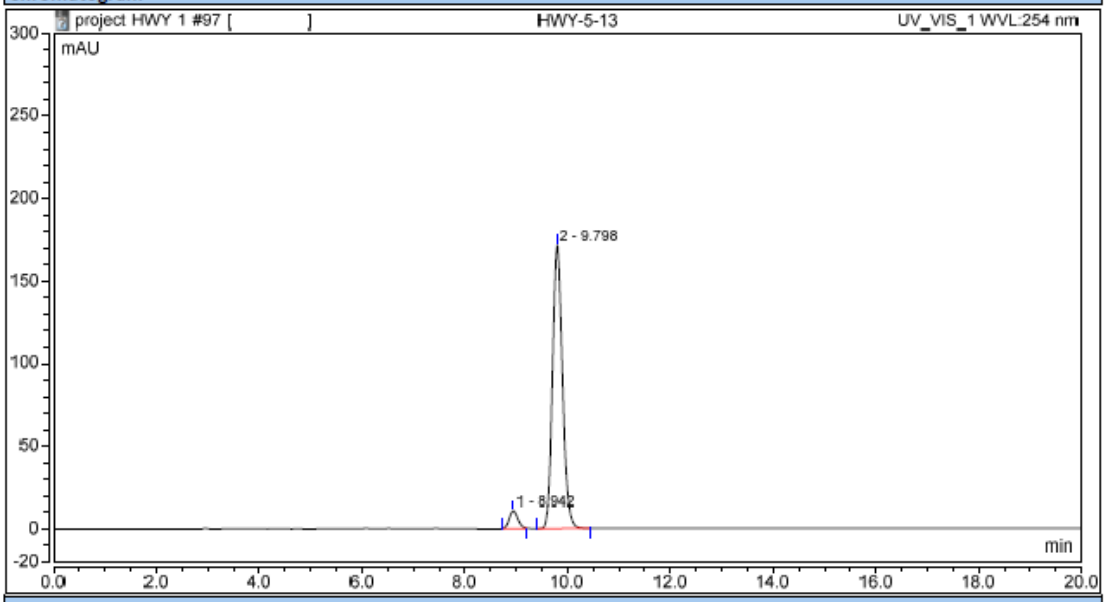
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.180	54.041	242.955	49.98	52.60	n.a.
2		10.080	54.091	218.953	50.02	47.40	n.a.
Total:			**108.131**	**461.907**	**100.00**	**100.00**	

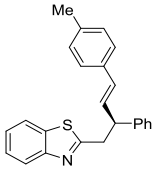
Chromatogram



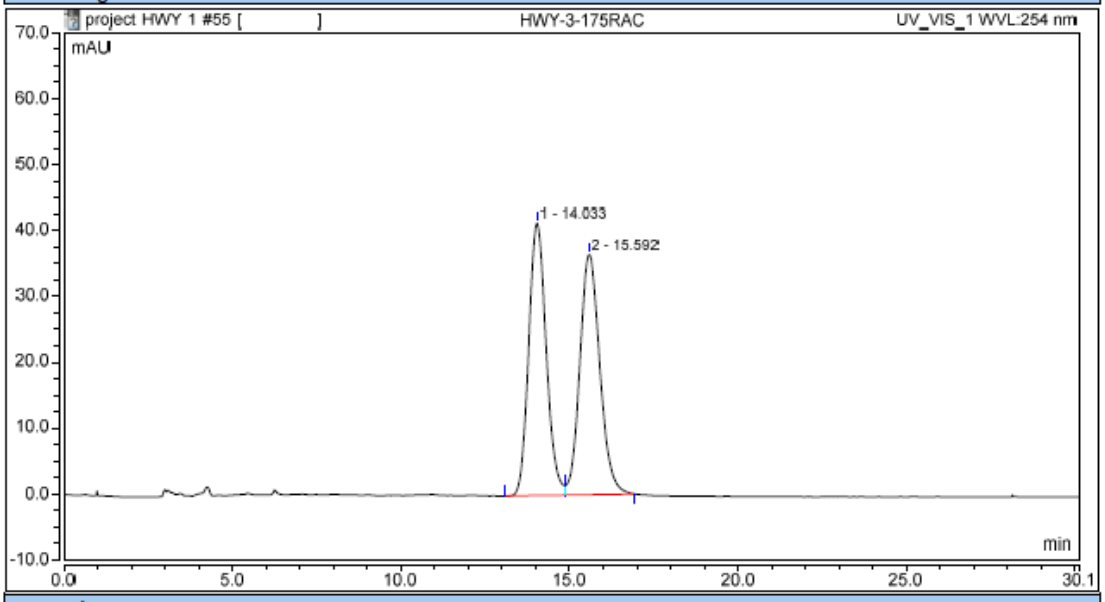
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.942	2.081	10.794	5.14	5.92	n.a.
2		9.798	38.423	171.454	94.86	94.08	n.a.
Total:			**40.504**	**182.248**	**100.00**	**100.00**	

Compound 3ab



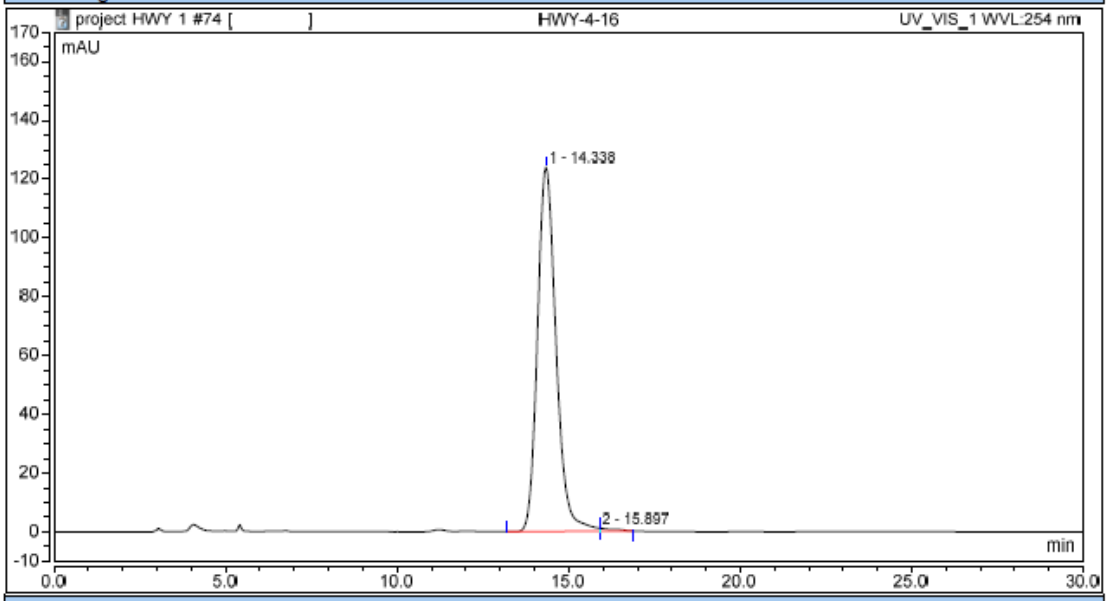
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.033	24.799	41.363	49.78	53.13	n.a.
2		15.592	25.019	36.493	50.22	46.87	n.a.
Total:			**49.817**	**77.856**	**100.00**	**100.00**	

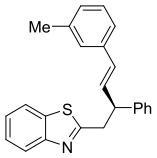
Chromatogram



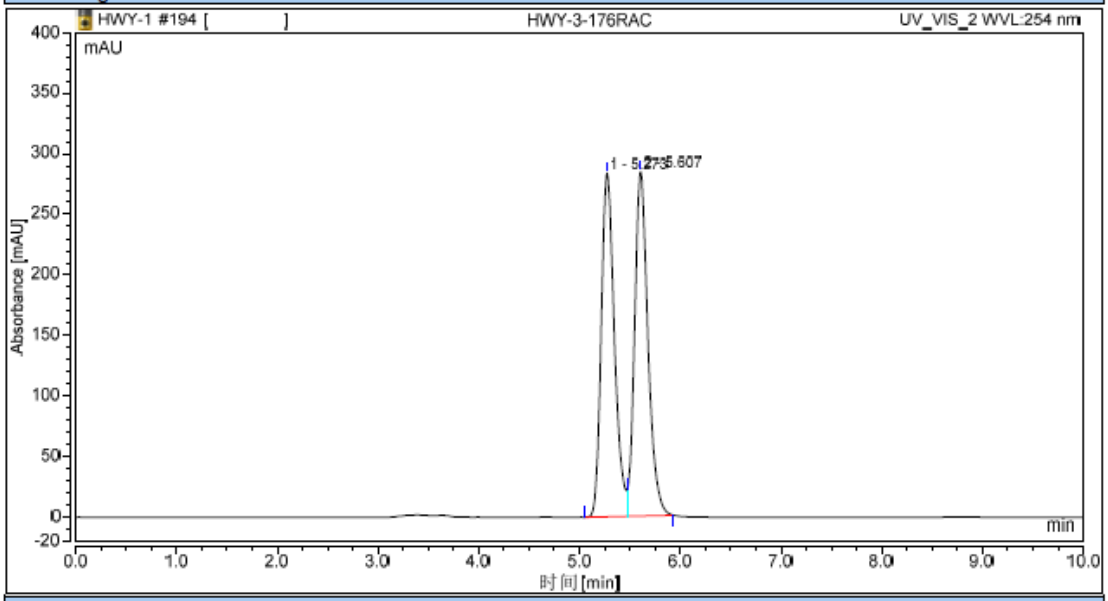
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.338	77.700	123.944	99.35	99.17	n.a.
2		15.897	0.508	1.036	0.65	0.83	n.a.
Total:			**78.208**	**124.980**	**100.00**	**100.00**	

Compound 3ac



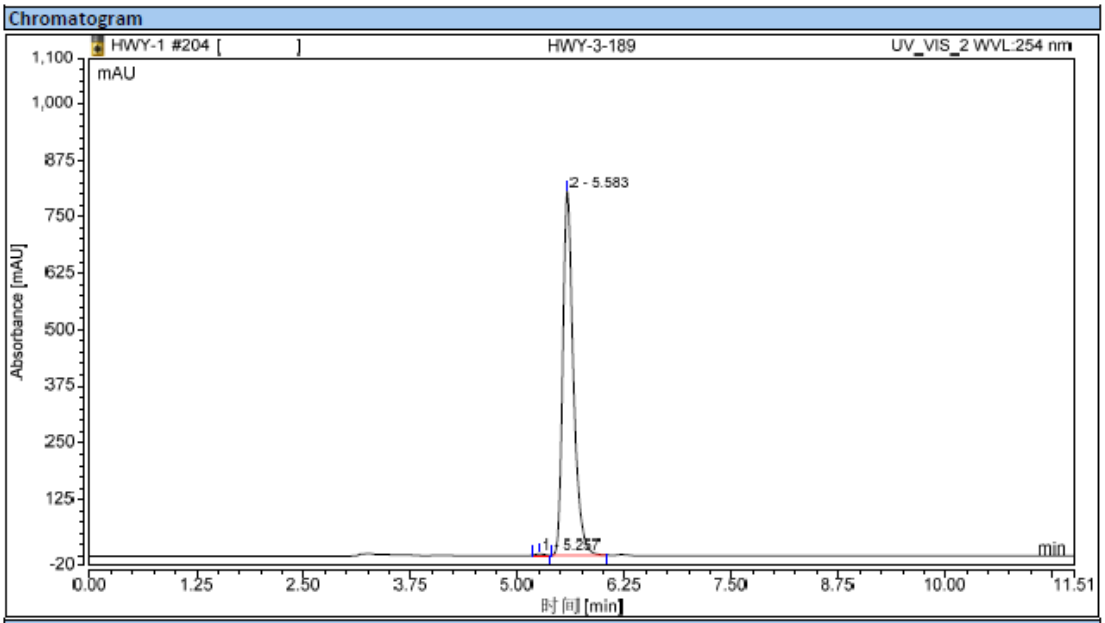
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.273	42.812	283.384	49.65	49.93	n.a.
2		5.607	43.415	284.183	50.35	50.07	n.a.
Total:			**86.227**	**567.567**	**100.00**	**100.00**	

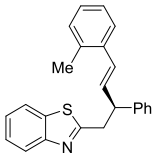
Chromatogram



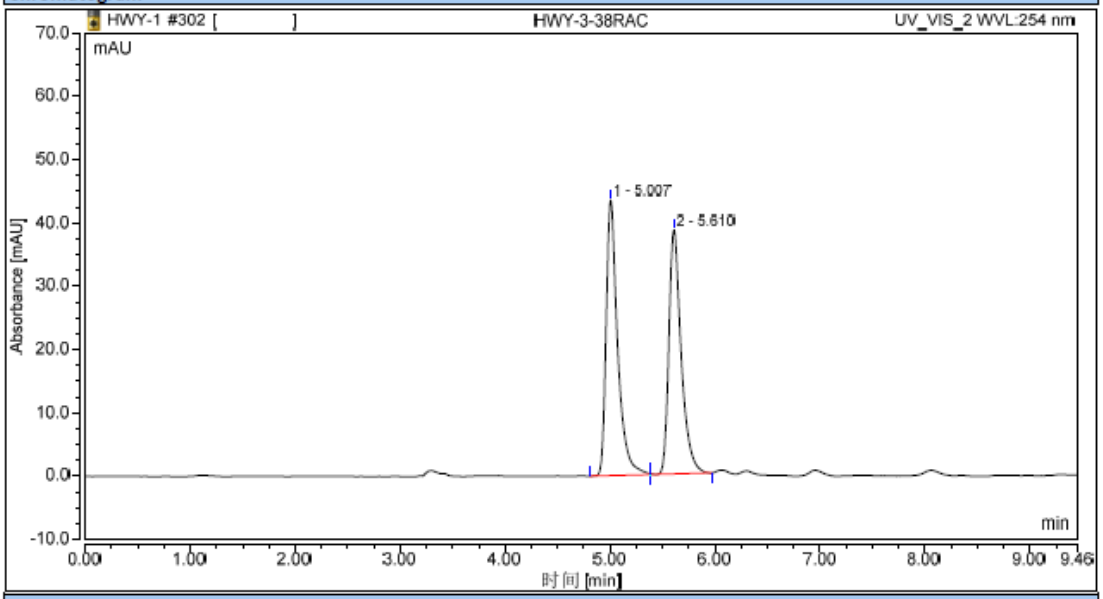
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.257	0.353	3.356	0.30	0.42	n.a.
2		5.583	115.502	803.435	99.70	99.58	n.a.
Total:			**115.855**	**806.790**	**100.00**	**100.00**	

Compound 3ad



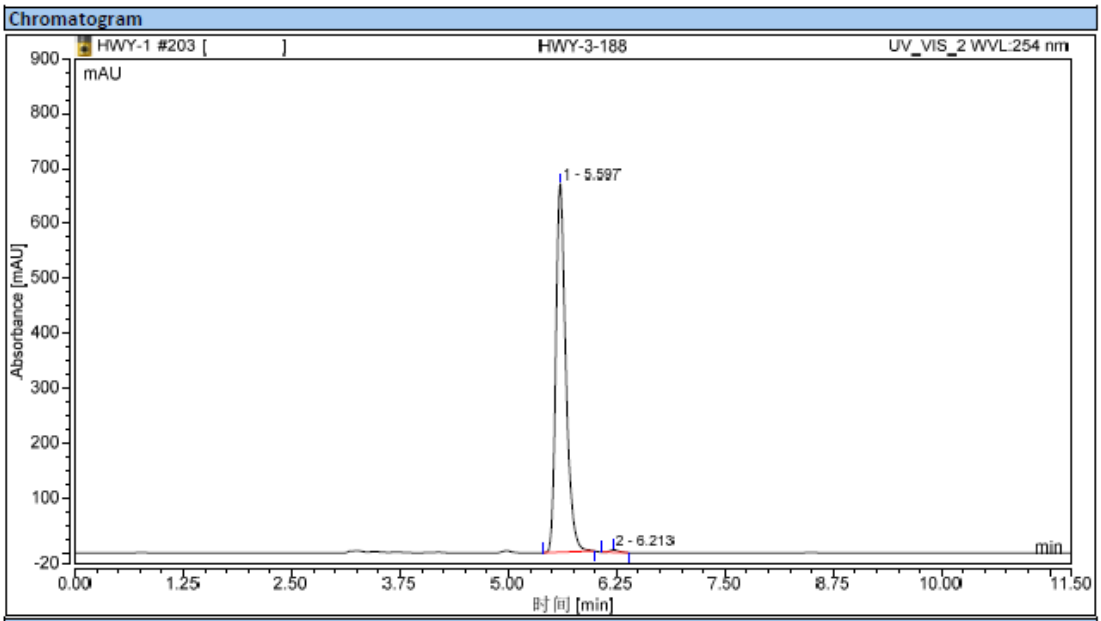
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.007	5.480	43.517	51.21	53.02	n.a.
2		5.610	5.221	38.556	48.79	46.98	n.a.
Total:			**10.701**	**82.072**	**100.00**	**100.00**	

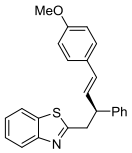
Chromatogram



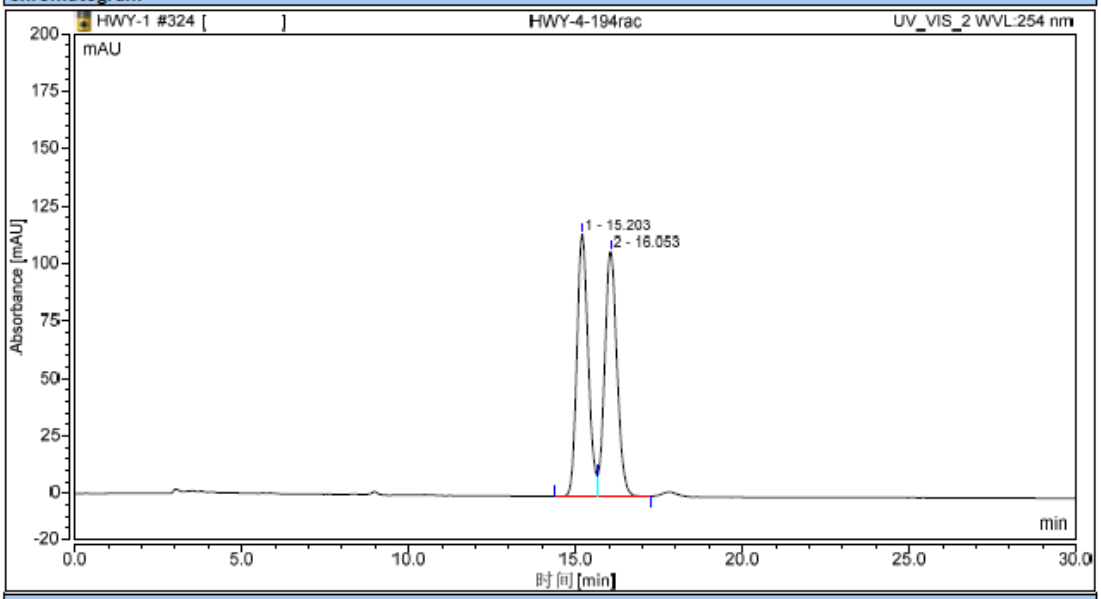
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.597	89.458	670.947	99.44	99.34	n.a.
2		6.213	0.508	4.429	0.56	0.66	n.a.
Total:			**89.966**	**675.375**	**100.00**	**100.00**	

Compound 3ae



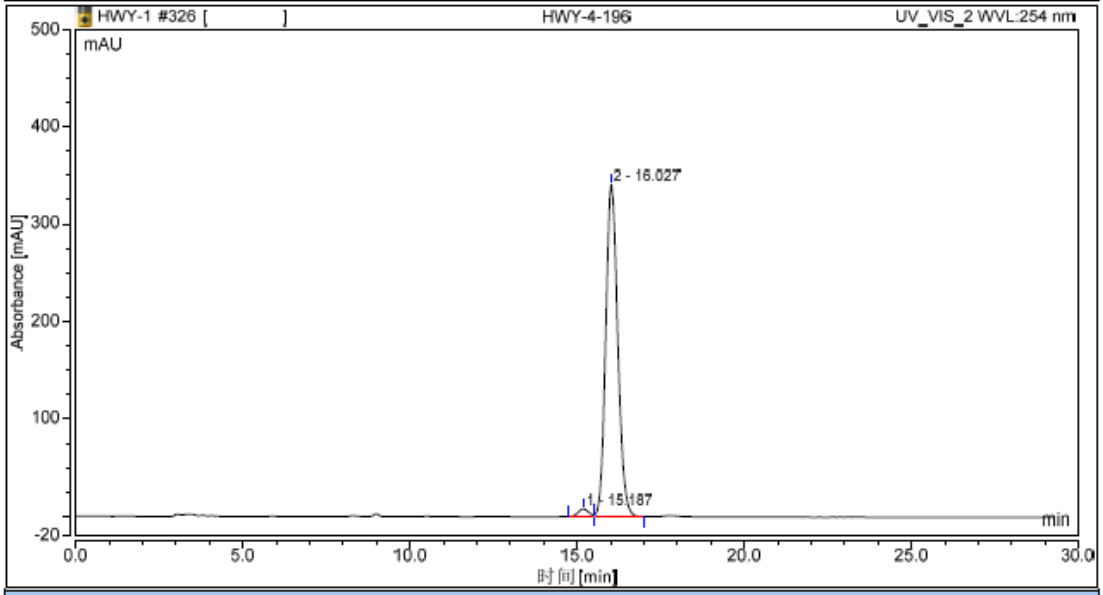
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		15.203	44.581	114.070	49.75	51.70	n.a.
2		16.053	45.032	106.578	50.25	48.30	n.a.
Total:			**89.613**	**220.648**	**100.00**	**100.00**	

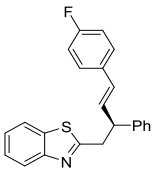
Chromatogram



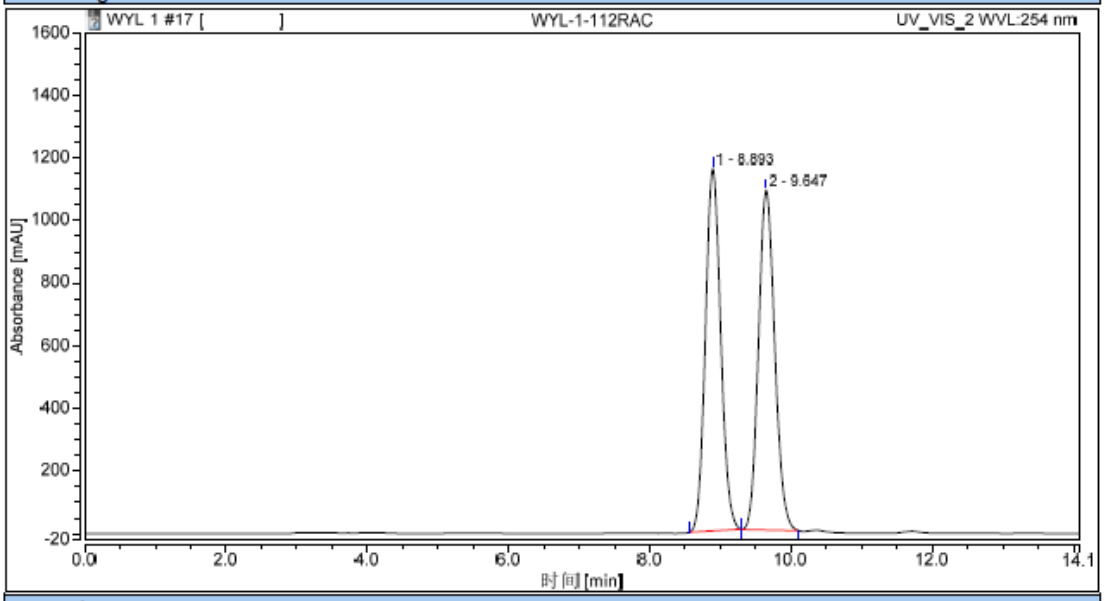
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		15.187	2.961	8.068	2.05	2.31	n.a.
2		16.027	141.503	341.161	97.95	97.69	n.a.
Total:			**144.465**	**349.229**	**100.00**	**100.00**	

Compound 3af



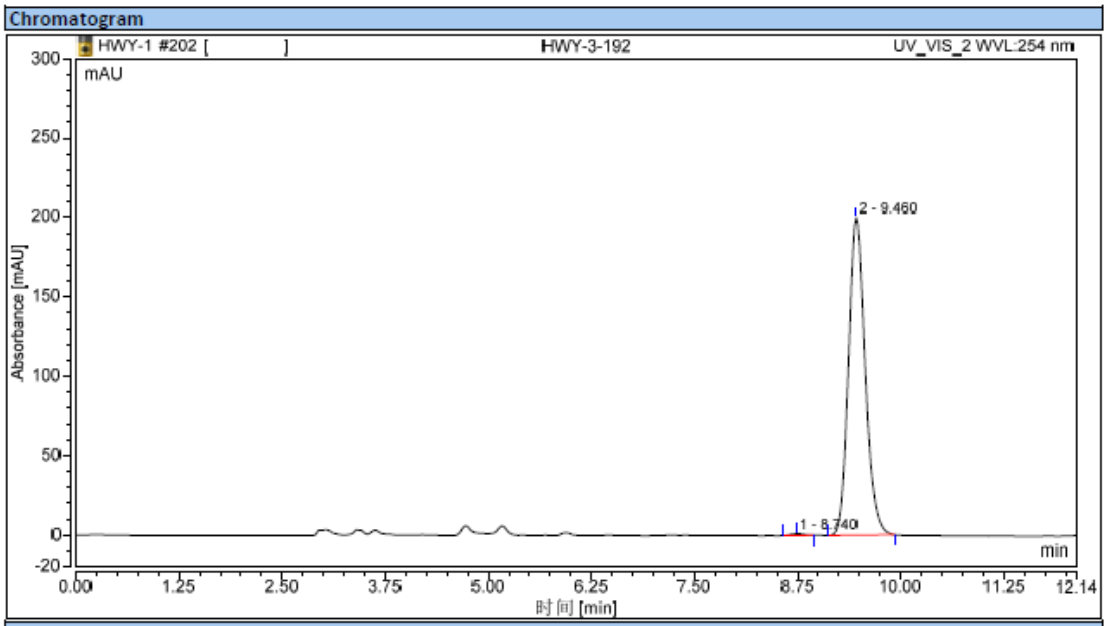
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.893	289.575	1156.675	50.03	51.59	n.a.
2		9.647	289.255	1085.498	49.97	48.41	n.a.
Total:			**578.830**	**2242.174**	**100.00**	**100.00**	

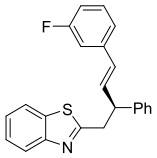
Chromatogram



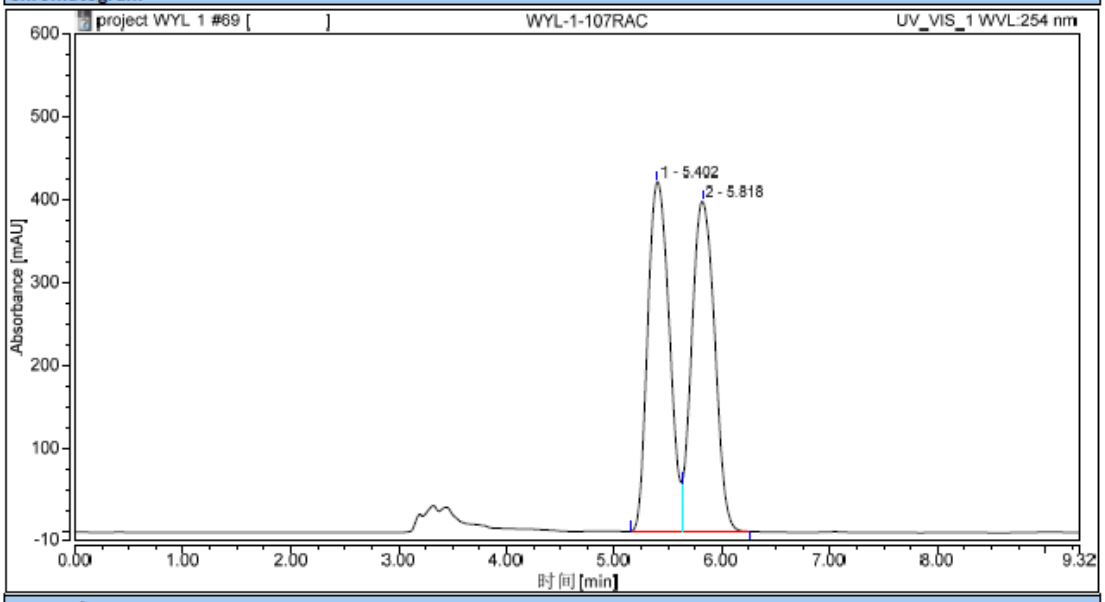
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.740	0.177	1.017	0.38	0.51	n.a.
2		9.460	46.828	200.002	99.62	99.49	n.a.
Total:			**47.004**	**201.019**	**100.00**	**100.00**	

Compound 3ag



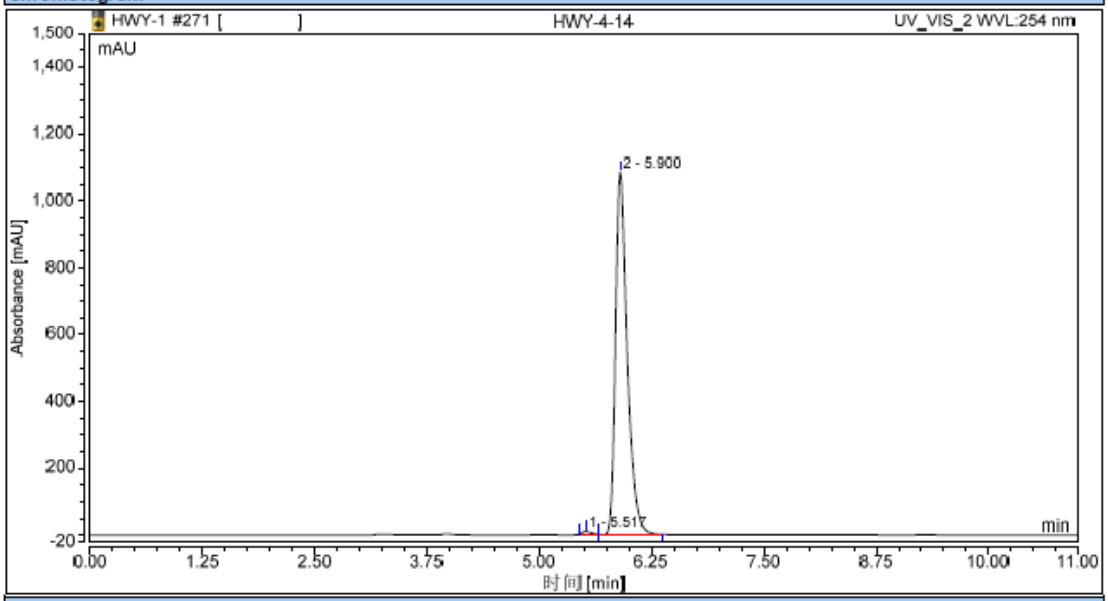
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.402	97.096	421.338	49.75	51.46	n.a.
2		5.818	98.076	397.386	50.25	48.54	n.a.
Total:			**195.172**	**818.725**	**100.00**	**100.00**	

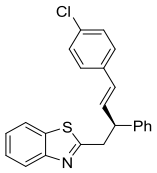
Chromatogram



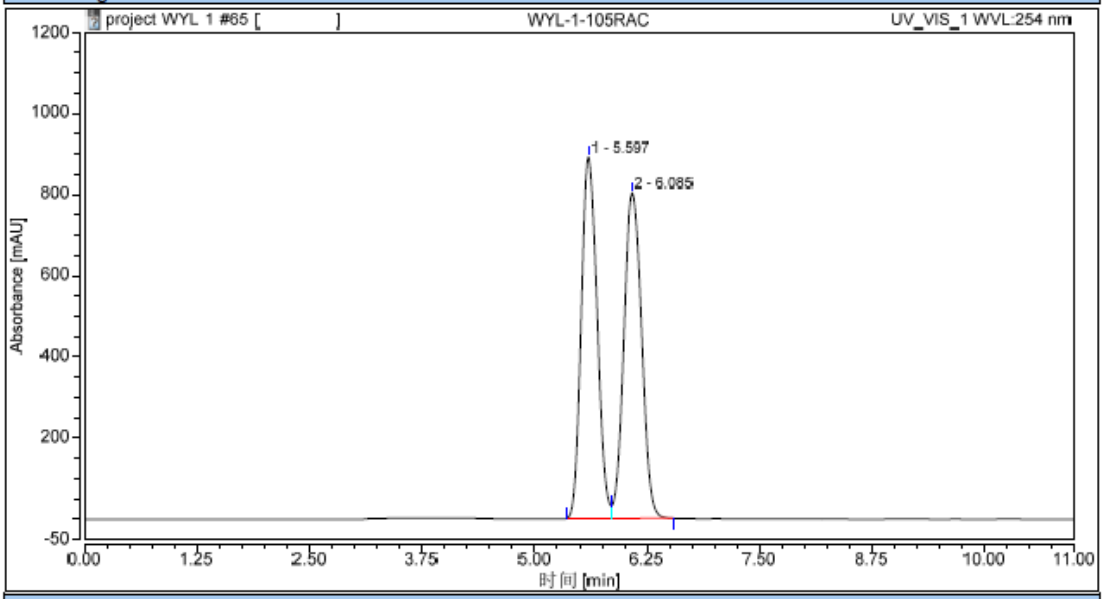
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.517	1.005	8.725	0.61	0.80	n.a.
2		5.900	162.851	1082.997	99.39	99.20	n.a.
Total:			**163.855**	**1091.721**	**100.00**	**100.00**	

Compound 3ah



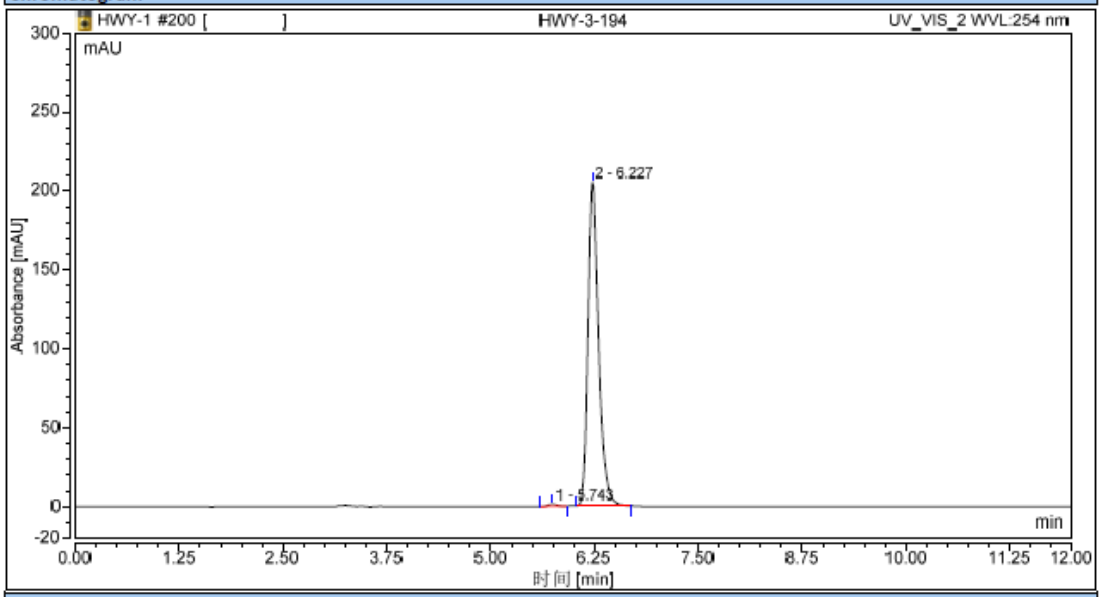
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.597	181.089	891.279	49.68	52.62	n.a.
2		6.085	183.422	802.652	50.32	47.38	n.a.
Total:			**364.511**	**1693.931**	**100.00**	**100.00**	

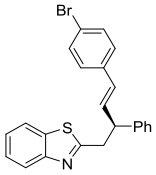
Chromatogram



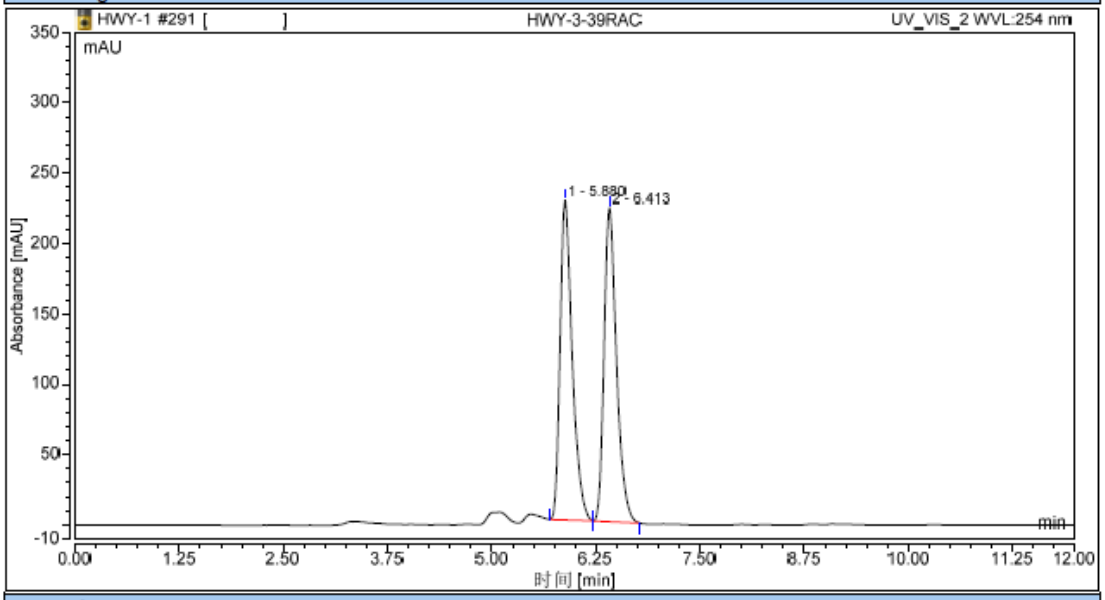
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.743	0.143	1.247	0.47	0.60	n.a.
2		6.227	30.367	205.081	99.53	99.40	n.a.
Total:			**30.511**	**206.327**	**100.00**	**100.00**	

Compound 3ai



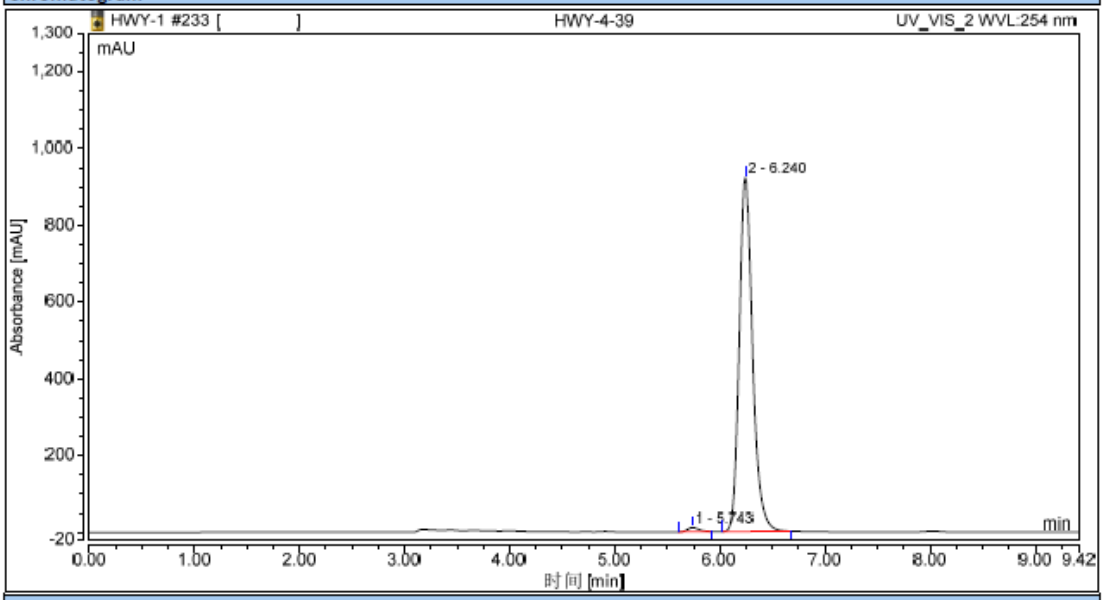
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.880	38.388	227.222	49.96	50.47	n.a.
2		6.413	38.457	223.032	50.04	49.53	n.a.
Total:			**76.845**	**450.254**	**100.00**	**100.00**	

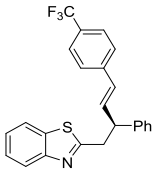
Chromatogram



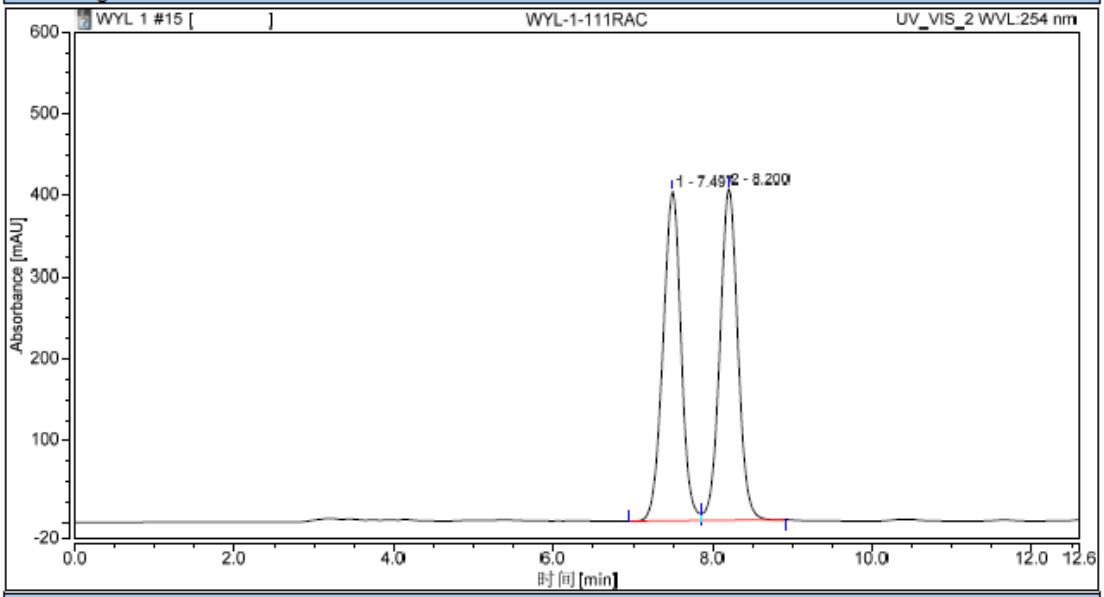
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.743	1.366	10.872	1.00	1.16	n.a.
2		6.240	135.535	922.649	99.00	98.84	n.a.
Total:			**136.901**	**933.521**	**100.00**	**100.00**	

Compound 3aj



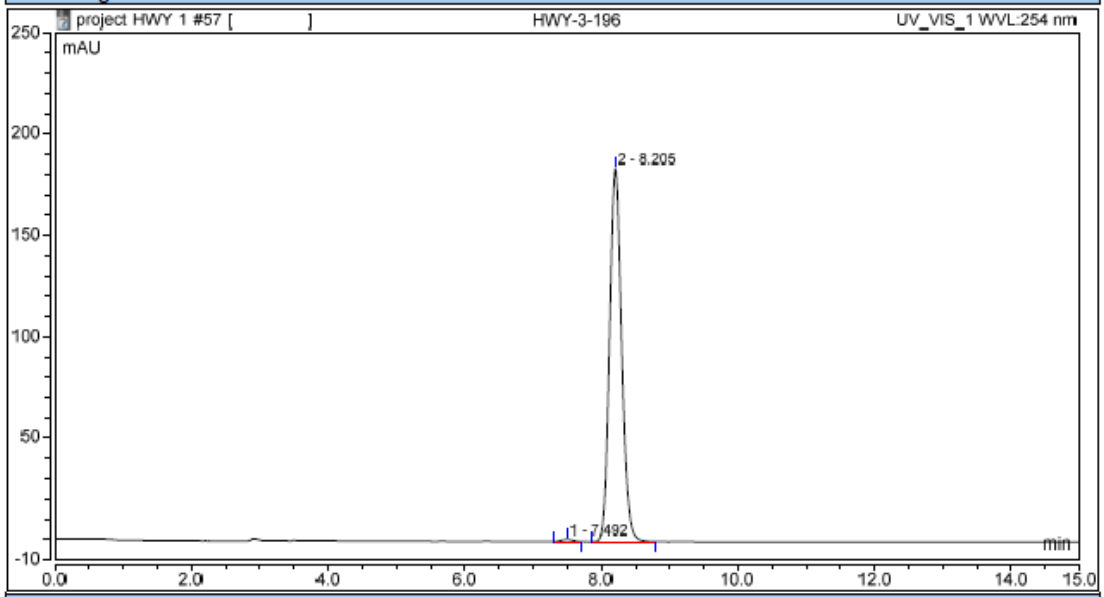
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.497	105.573	403.487	49.90	49.84	n.a.
2		8.200	105.994	406.097	50.10	50.16	n.a.
Total:			**211.567**	**809.583**	**100.00**	**100.00**	

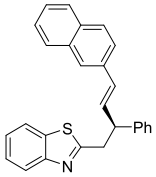
Chromatogram



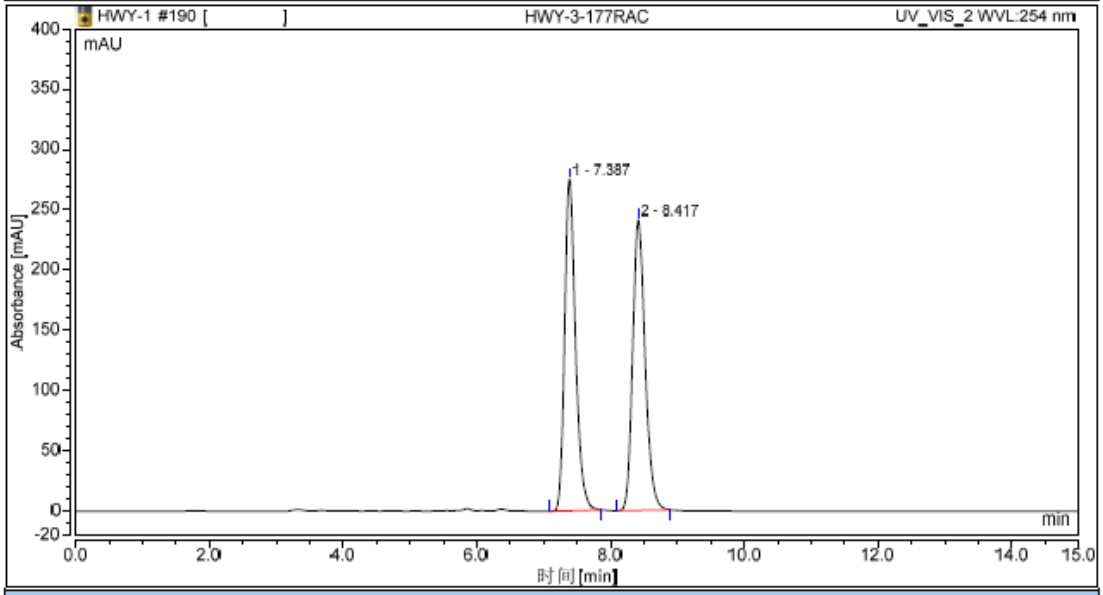
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.492	0.190	1.085	0.50	0.59	n.a.
2		8.205	37.666	184.180	99.50	99.41	n.a.
Total:			**37.856**	**185.265**	**100.00**	**100.00**	

Compound 3ak



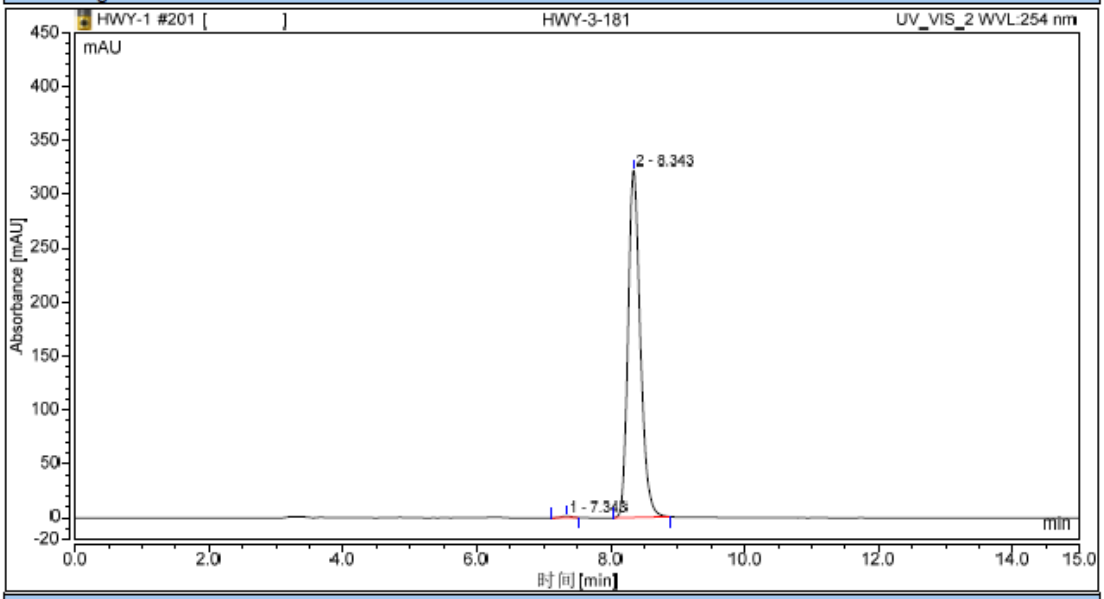
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.387	51.738	275.077	50.02	53.31	n.a.
2		8.417	51.691	240.926	49.98	46.69	n.a.
Total:			**103.429**	**516.004**	**100.00**	**100.00**	

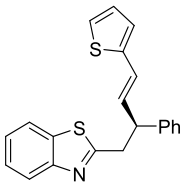
Chromatogram



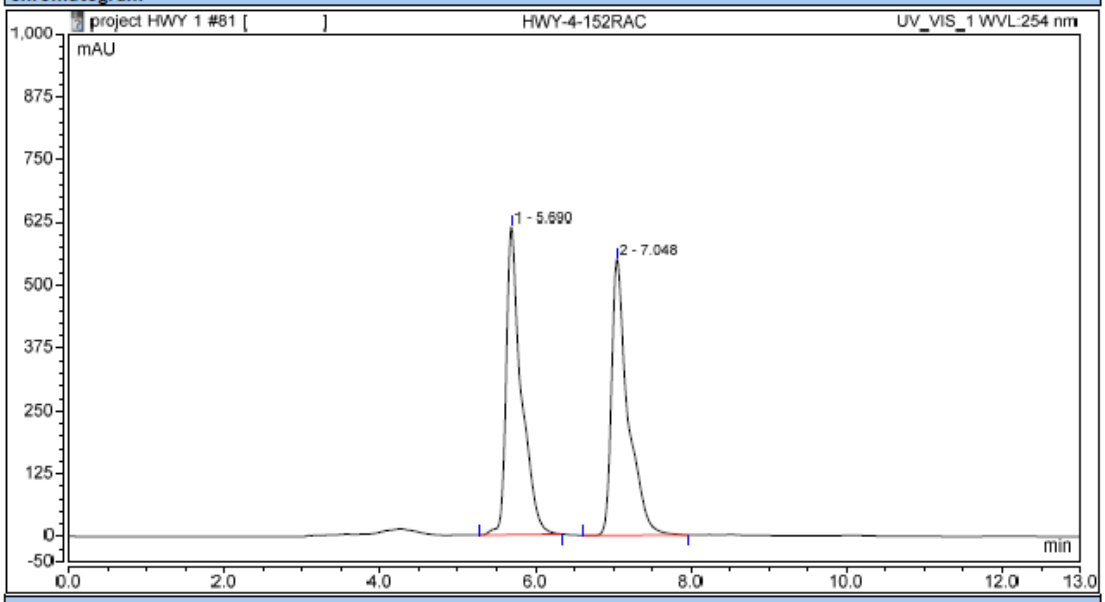
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.343	0.226	1.393	0.33	0.43	n.a.
2		8.343	68.072	321.755	99.67	99.57	n.a.
Total:			**68.298**	**323.148**	**100.00**	**100.00**	

Compound 3al



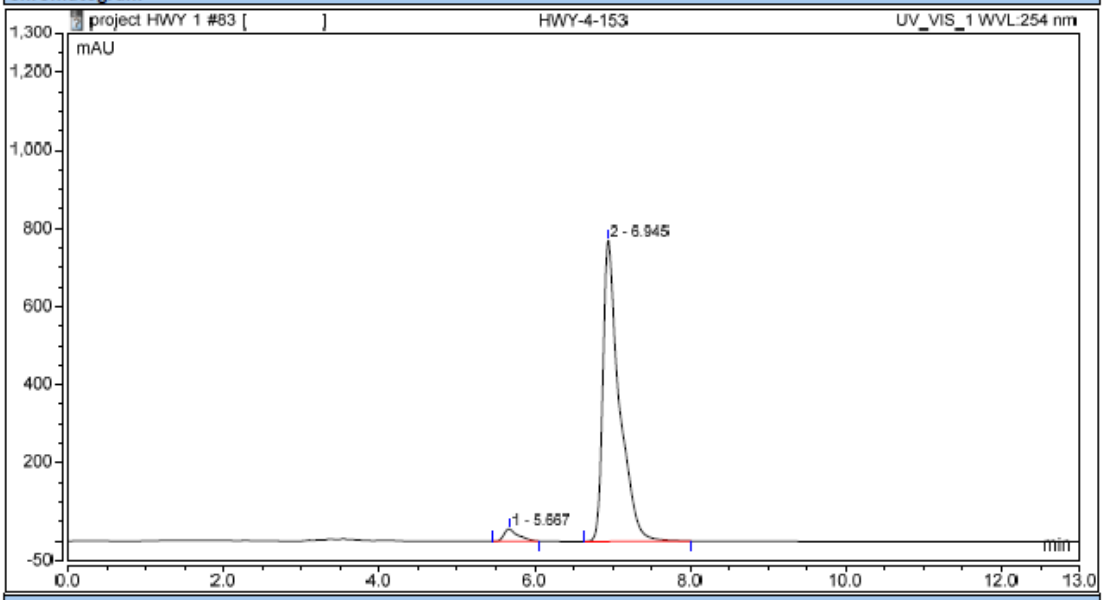
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.690	137.691	612.848	50.67	52.73	n.a.
2		7.048	134.058	549.306	49.33	47.27	n.a.
Total:			**271.749**	**1162.154**	**100.00**	**100.00**	

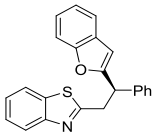
Chromatogram



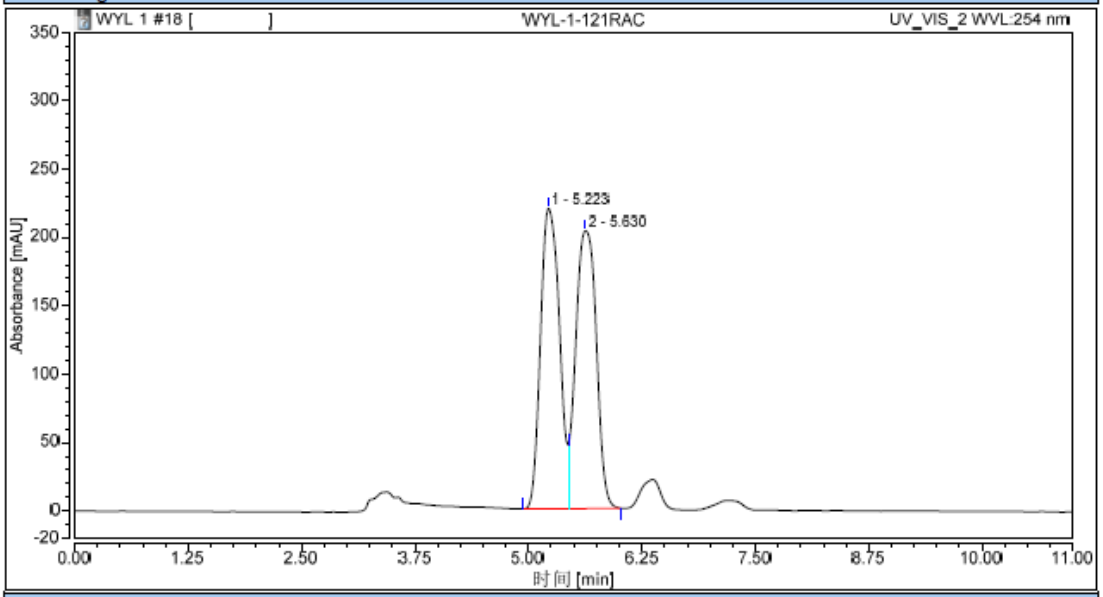
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.667	6.538	31.482	3.37	3.93	n.a.
2		6.945	187.739	770.261	96.63	96.07	n.a.
Total:			**194.278**	**801.744**	**100.00**	**100.00**	

Compound 3am



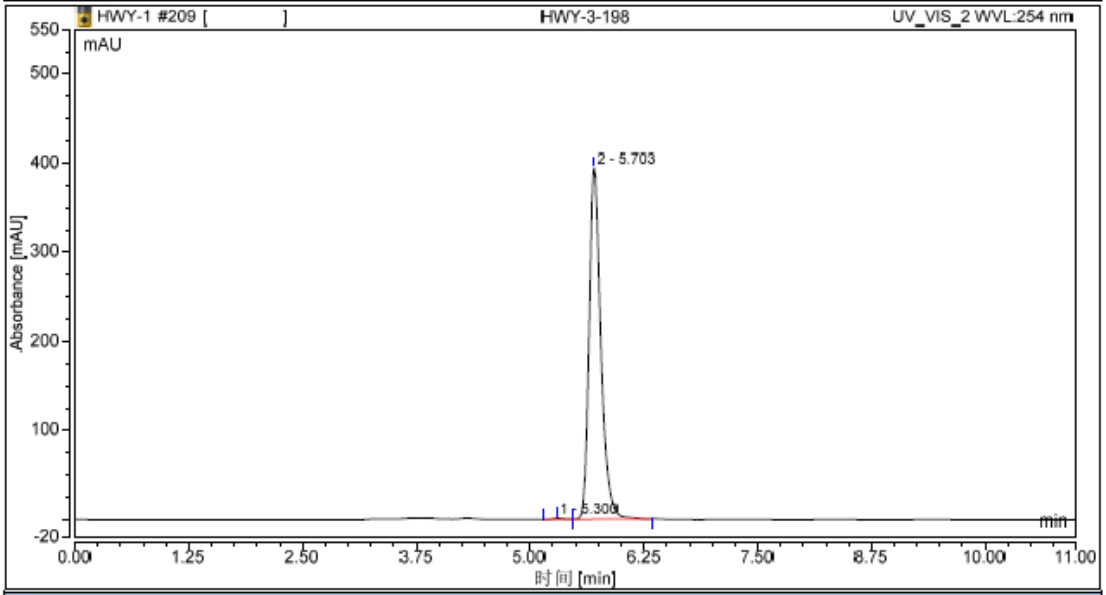
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.223	53.014	220.000	49.89	51.98	n.a.
2		5.630	53.238	203.261	50.11	48.02	n.a.
Total:			**106.251**	**423.262**	**100.00**	**100.00**	

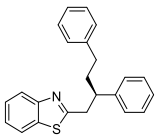
Chromatogram



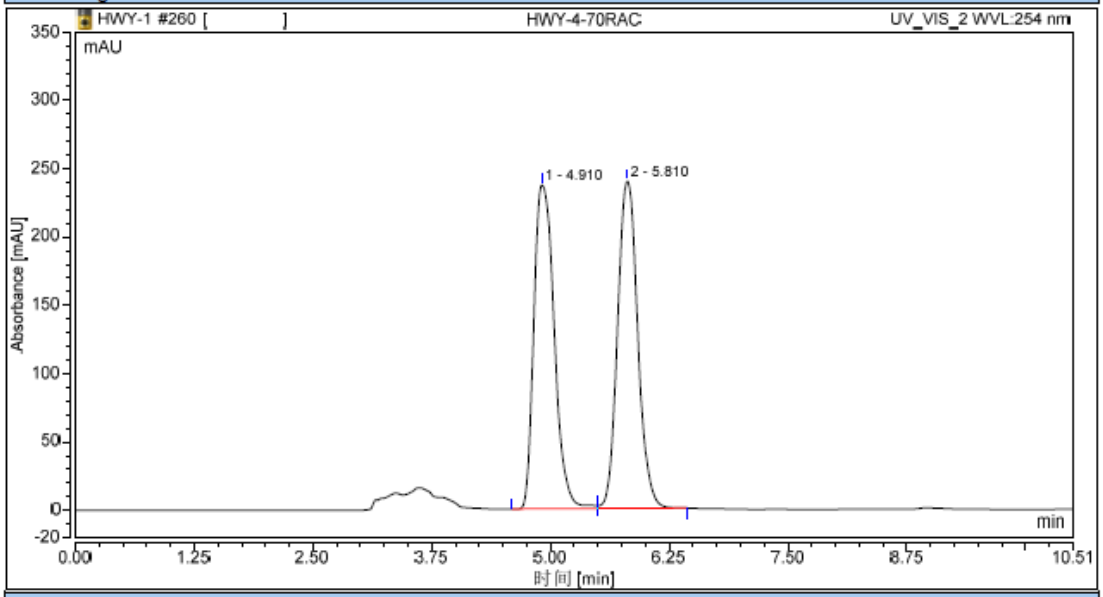
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.300	0.211	1.428	0.36	0.36	n.a.
2		5.703	58.461	394.214	99.64	99.64	n.a.
Total:			**58.672**	**395.642**	**100.00**	**100.00**	

Compound 4



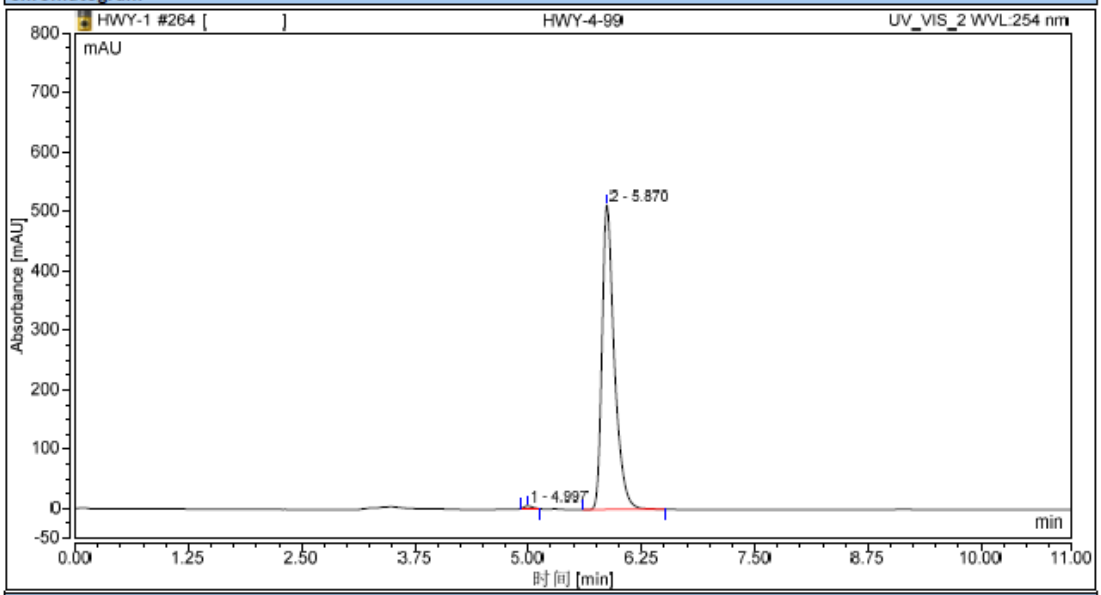
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		4.910	58.823	237.216	49.98	49.74	n.a.
2		5.810	58.868	239.716	50.02	50.26	n.a.
Total:			**117.691**	**476.932**	**100.00**	**100.00**	

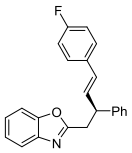
Chromatogram



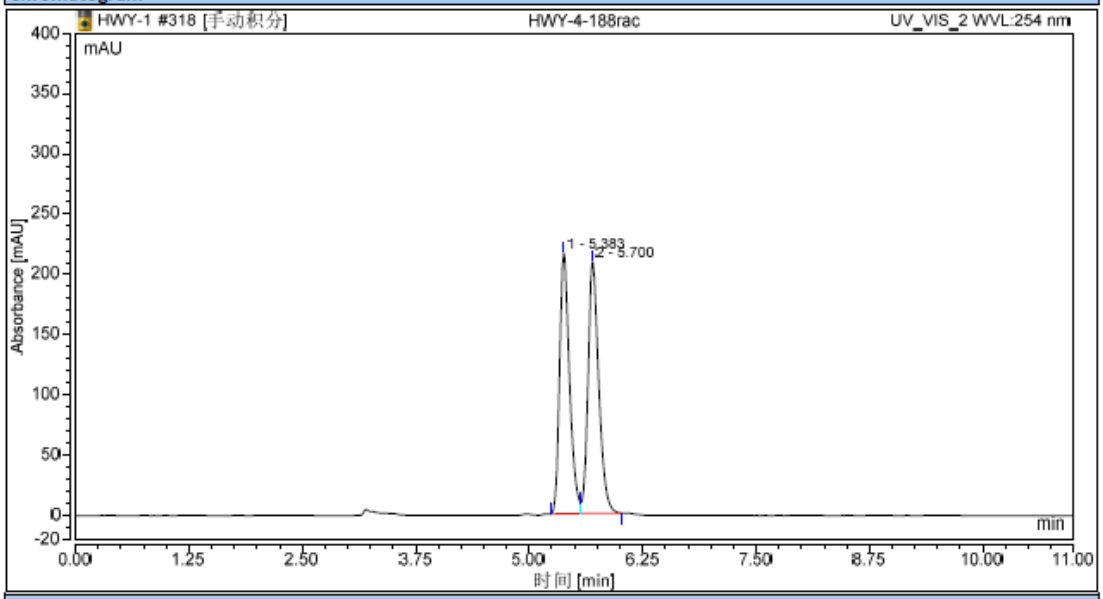
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		4.997	0.550	4.934	0.68	0.96	n.a.
2		5.870	80.757	511.735	99.32	99.04	n.a.
Total:			**81.307**	**516.670**	**100.00**	**100.00**	

Compound 6a



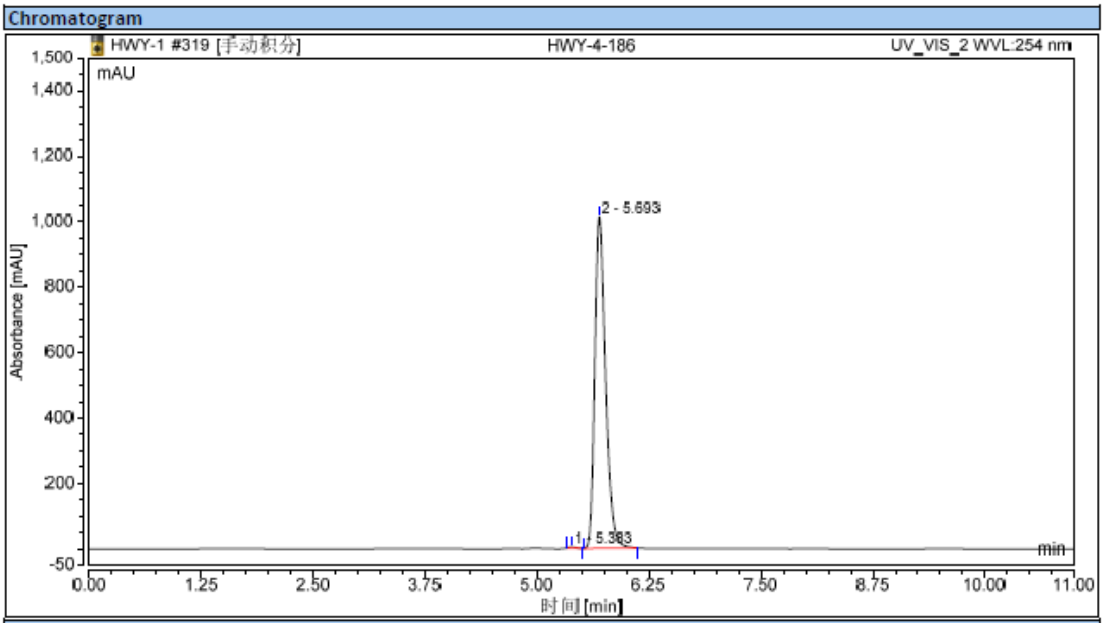
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.383	27.442	215.983	49.34	50.89	n.a.
2		5.700	28.178	208.456	50.66	49.11	n.a.
Total:			**55.620**	**424.440**	**100.00**	**100.00**	

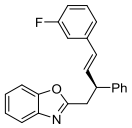
Chromatogram



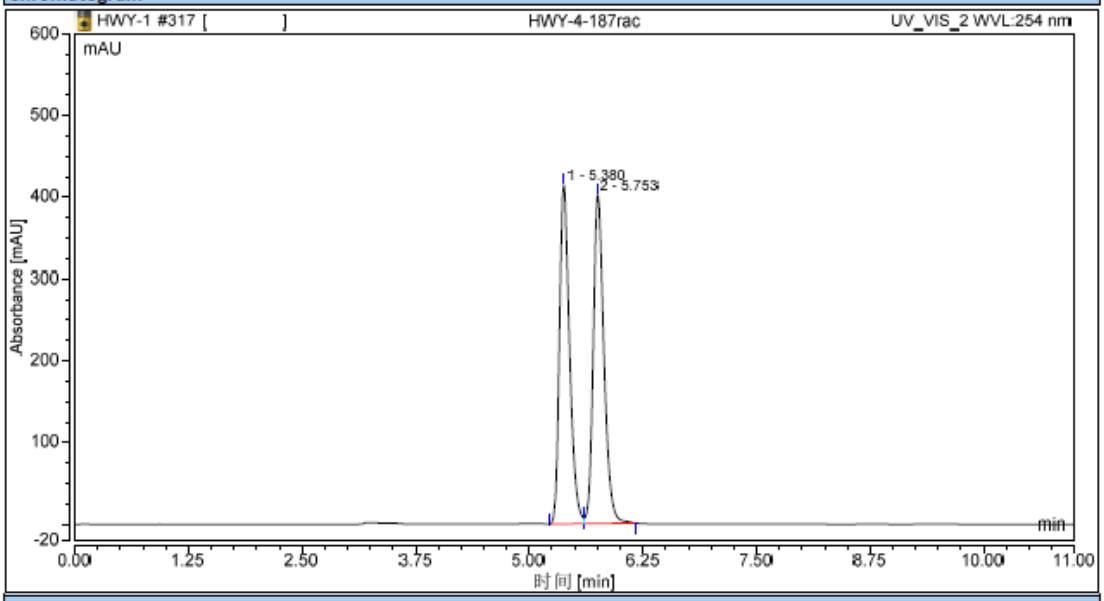
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.383	0.288	3.141	0.21	0.31	n.a.
2		5.693	139.925	1012.845	99.79	99.69	n.a.
Total:			**140.214**	**1015.986**	**100.00**	**100.00**	

Compound 6b



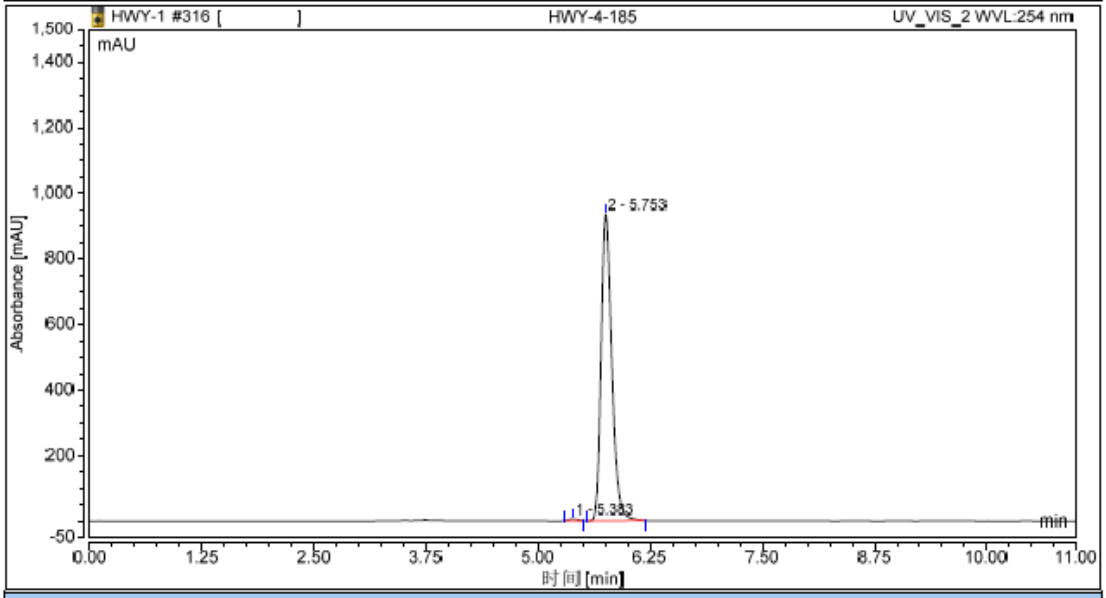
Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.380	53.531	414.604	49.45	50.78	n.a.
2		5.753	54.711	401.902	50.55	49.22	n.a.
Total:			**108.242**	**816.507**	**100.00**	**100.00**	

Chromatogram



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		5.383	0.592	5.428	0.46	0.58	n.a.
2		5.753	128.690	935.790	99.54	99.42	n.a.
Total:			**129.283**	**941.217**	**100.00**	**100.00**	