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Supporting Information

Enantioselective N-Heterocyclic Carbene-catalyzed Synthesis of Indenopyrones

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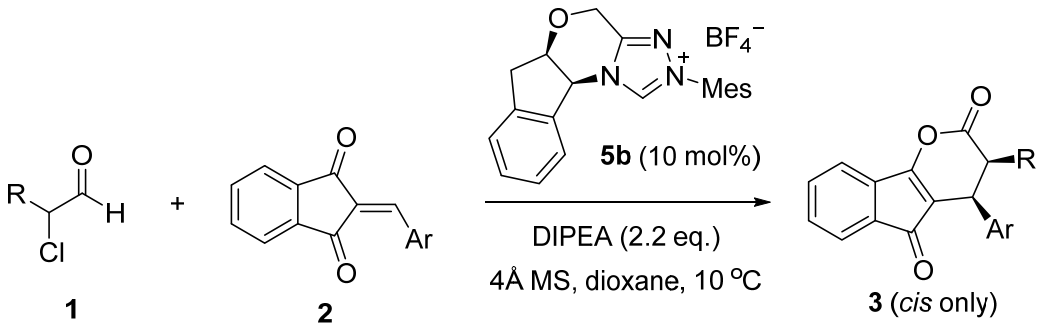
Part I Experimental part

1.1 General information

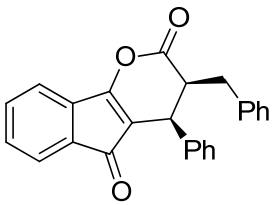
Unless otherwise indicated, all reactions were carried out under nitrogen atmosphere in oven-dried glassware with magnetic stirring. All solvents were dried and distilled by standard procedures. NHC precursors,[1] chloroaldehydes[2] and 1,3-indanediones[3] were prepared according to literatures. Column chromatograph was performed on silica gel 200~300 mesh. All ^{1}H NMR (400 MHz), ^{13}C NMR (100 MHz) spectra were recorded on a Bruker-DMX 400 spectrometer in $CDCl_3$, with tetramethylsilane as an internal standard and reported in parts per million (ppm, δ). ^{1}H NMR Spectroscopy splitting patterns were designated as singlet (s), doublet (d), triplet (t). Splitting patterns that could not be interpreted or easily visualized were designated as multiplet (m) or broad (br). Infrared spectra were recorded on a JASCO FT/IR-480 spectrophotometer and reported as wave number (cm^{-1}). Optical rotations were measured on Perkin Elmer/Model-343 digital polarimeter operating at the sodium D line with a 100 mm path cell, and are reported as follows: $[\alpha]_D^T$ (concentration (g/100 mL), solvent).

1.2 NHC-catalyzed synthesis of indenopyrones (Table 2)



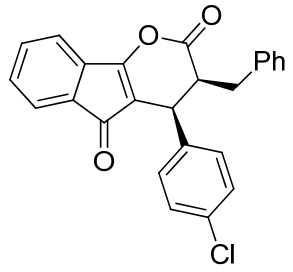
General Procedure. To the solution of NHC precursor **5b** (0.02 mmol), **DIPEA** (0.044

mmol), α-chloroaldehyde **2**(0.24 mmol) in 1,4-dioxane (3 mL), was added 1,3-indanediones **1** (0.2 mmol). The reaction mixture was stirred at 10°C for 12 h. The reaction mixture was passed through a pad of silica gel and washed with ethyl acetate. The solvent was removed under reduced pressure, and the residue was purified by flash chromatography on silica gel (ethyl acetate/petroleum ether, typically 1/80 - 1/50) to give the cycloadduct **3**. Racemic samples for the standard of chiral HPLC spectra were prepared using 10 mol% of racemic NHC precursor *rac*-**C4** as the precatalyst.



3a

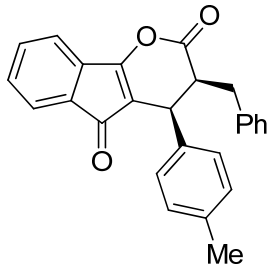
(3S,4S)-3-benzyl-4-phenyl-3,4-dihydroindeno[1,2-b]pyran-2,5-dione (CKQ-113A).[4] Total yield: 92 mg (84 %), yellow solid, mp 110-111°C, R_f = 0.30 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ +26.0 (*c* 1.0, $CHCl_3$), HPLC analysis: 96 % ee [Daicel CHIRALPAK AD-H column, 20 °C, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 8.8 min (minor) , 22.1 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ7.38 (t, *J* = 7.0 Hz, 2H), 7.34 – 7.24 (m, 8H),, 7.09 – 7.05 (m, 4H), 3.93 (d, *J* = 6.8 Hz, 1H), 3.41 (t, *J* = 10.2 Hz, 1H), 3.29 (dd, *J* = 14.5, 4.5 Hz, 1H), 2.53 (dd, *J* = 14.4, 9.4 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.6, 169.2, 168.9, 137.6, 136.9, 136.2, 132.9, 131.7, 130.6, 129.1, 129.0, 128.7, 128.0, 128.0, 126.9, 122.4, 118.7, 114.1, 46.1, 37.1, 32.6. IR (KBr) *v* 2919,1795,1507,1054 cm^{-1}. HRMS (ESI) *m/z*: [M+H] Calc. for $C_{25}H_{19}O_3$, 366.12579, Found 366.12770.



3b

(*4R,5S*)-5-(4-fluorophenyl)-4-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

(CKQ-114A). Total yield: 52.8 mg (66 %), yellow solid, mp 138-142°C , R_f = 0.35 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -0.126 (*c* 1.0, $CHCl_3$), HPLC analysis: 98 % ee [Daicel CHIRALPAK A、AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 9.9 min (minor), 22.3 min (major)]. ^1H NMR (400 MHz, $CDCl_3$) δ 7.46 -7.38 (m, J = 7.0 HZ 4H), 7.33 - 7.25 (m, 5H), 7.04 (d, *J* = 6.9 Hz, 2H), 6.95 - 6.93 (dd, *J* = 17.6 2H), 3.89 (d, *J* = 7.1 Hz, 1H), 3.43 (ddd, *J* = 9.6, 7.0, 4.9 Hz, 1H), 3.31 (dd, *J* = 14.6, 4.9 Hz, 1H), 2.50 (dd, *J* = 14.6, 9.6 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.6, 169.5, 168.7, 137.4, 136.1, 133.1, 132.4, 131.7, 130.9, 129.9, 129.1, 128.9, 127.2, 122.7, 122.1, 119.0, 113.6, 45.8, 36.7, 32.7. IR (KBr) *v* 2923,1796,1433,1054cm^{-1}.HRMS (ESI) *m/z*: [M+H]Calc. for $C_{25}H_{10}O_3Cl$, 401.09321, Found 401.09390.

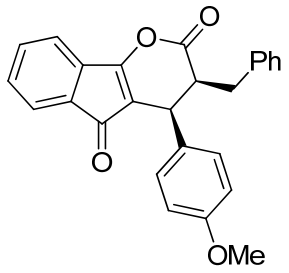


3c

(*4R,5S*)-5-(3,5-dichlorophenyl)-4-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

(CKQ-119D). Total yield: 70 mg (92 %), yellow solid, mp 158-159°C , R_f= 0.34 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -0.849 (*c* 1.0, $CHCl_3$), HPLC analysis: 99% ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 9.2

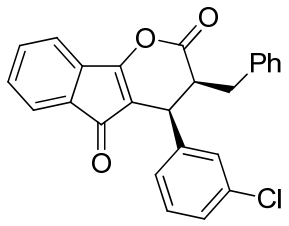
min (minor), 20.4 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (t, *J* = 6.9 Hz, 2H), 7.31 – 7.20 (m, 7H), 7.06 (d, *J* = 7.0 Hz, 2H), 6.87 (d, *J* = 8.1 Hz, 2H), 3.89 (d, *J* = 7.0 Hz, 1H), 3.39 (ddd, *J* = 9.3, 7.0, 4.9 Hz, 1H), 3.28 (dd, *J* = 14.5, 4.9 Hz, 1H), 2.53 (dd, *J* = 14.5, 9.3 Hz, 1H), 2.31 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.8, 169.2, 169.1, 137.9, 137.8, 136.4, 133.9, 133.0, 131.9, 130.7, 129.9, 129.2, 128.8, 128.0, 127.0, 122.5, 118.8, 114.5, 46.4, 36.9, 32.8, 21.2.IR (KBr) *v* 2922,1796,1496,1054 cm^{-1}.HRMS (ESI) *m/z*: [M+H]Calc. for $C_{24}H_{15}Cl_2O_3$, 381.14852 , Found 381.14787.



3d

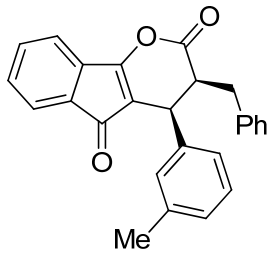
(*4R,5S*)-4-phenyl-5-(p-tolyl)-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

(CKQ-116A). Total yield: 68.9 mg (87 %), yellow solid, mp 93-97°C , R_f= 0.3 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -5.68 (*c* 1.0, $CHCl_3$), HPLC analysis: 97 % ee [Daicel CHIRALPAK AD-H column, 20 ^{o}C, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 14.2 min (minor), 34.0 min (major)].^{1}H NMR (400 MHz, $CDCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (t, *J* = 7.1 Hz, 2H), 7.32 – 7.24 (m, 5H), 7.06 (d, *J* = 7.1 Hz, 2H), 6.99 (d, *J* = 8.6 Hz, 2H), 6.84 (d, *J* = 8.6 Hz, 2H), 3.88 (d, *J* = 7.0 Hz, 1H), 3.79 (s, 3H), 3.39 (ddd, *J* = 9.3, 7.0, 5.0 Hz, 1H), 3.28 (dd, *J* = 14.6, 4.8 Hz, 1H), 2.53 (dd, *J* = 14.5, 9.4 Hz, 1H).^{13}C NMR (101 MHz, $CDCl_3$) δ 190.9, 169.2, 169.1, 159.4, 137.9, 136.4, 133.0, 131.9, 130.8, 129.3, 129.1, 128.9, 128.8, 126.9, 122.6, 118.8, 114.6, 114.5, 55.4, 46.4, 36.5, 32.8. IR (KBr) *v* 2926,1795,1496,1055 cm^{-1}.HRMS (ESI) *m/z*: [M-H] Calc. for $C_{26}H_{19}O_4$, 395.12717, Found 395.12779.



3e

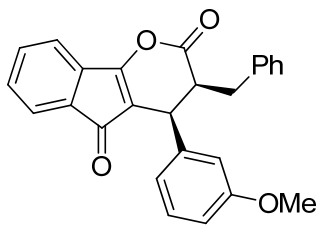
(*4R,5S*)-5-(3,5-dimethoxyphenyl)-4-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one (CKQ-114C). Total yield: 56.8 mg (71 %), yellow solid, mp 98-99°C , R_f= 0.30 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -0.048 (*c* 1.0, $CHCl_3$), HPLC analysis: 98 % ee [Daicel CHIRALPAK AD-H column, 20 °C, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 9.8 min (major), 19.8 min (minor)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (t, *J* = 6.8 Hz, 2H), 7.33 – 7.26 (m, 7H), 7.05 (d, *J* = 6.9 Hz, 2H), 7.02 – 6.97 (m, 2H), 3.90 (d, *J* = 7.1 Hz, 1H), 3.43 (ddd, *J* = 9.6, 7.0, 4.9 Hz, 1H), 3.31 (dd, *J* = 14.7, 4.9 Hz, 1H), 2.50 (dd, *J* = 14.6, 9.6 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ , 190.7, 169.5, 168.7, 137.4, 136.1, 135.6, 134.1, 133.1, 131.7, 130.9, 129.6, 129.4, 129.1, 128.9, 128.6, 128.5, 127.2, 122.7, 119.0, 115.7, 113.7, 45.9, 36.6, 32.7. IR (KBr) *v* 2924,1796,1432,1054 cm^{-1} HRMS (ESI) *m/z*: $[M+H]^+$Calc. for $C_{26}H_{23}O_5^+$, 401.09320, Found 401.09390.



3f

(*4R,5S*)-4-(4-methoxyphenyl)-5-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

(CKQ-123A). Total yield: 62 mg (82 %), yellow solid, mp 81-82°C, R_f= 0.27 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -0.37 (*c* 1.0, $CHCl_3$), HPLC analysis: 98 % ee [Daicel CHIRALPAK AD-H column, 20 °C, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 11.8 min (minor), 28.8 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (t, *J* = 7.1 Hz, 2H), 7.35 – 7.16 (m, 6H), 7.09 – 7.05 (m, 3H), 6.95 – 6.78 (m, 2H), 3.89 (d, *J* = 7.1 Hz, 1H), 3.40 (ddd, *J* = 9.3, 7.0, 5.0 Hz, 1H), 3.28 (dd, *J* = 14.6, 4.9 Hz, 1H), 2.52 (dd, *J* = 14.6, 9.3 Hz, 1H), 2.31 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.8, 169.4, 169.0, 138.9, 137.9, 136.9, 136.3, 133.0, 131.9, 130.7, 129.2, 129.1, 129.0, 128.9, 128.8, 127.0, 125.2, 122.6, 118.9, 114.3, 46.3, 37.3, 32.8, 21.6. IR (KBr) *v* 2919,1796,1387,1054 cm^{-1}. HRMS (ESI) *m/z*: $[M+H]^+$Calc. for $C_{25}H_{21}O_4^+$, 381.147852, Found 381.147887.

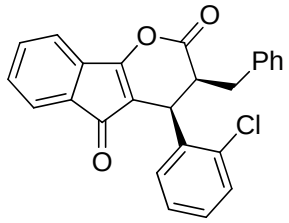


3g

(*4R,5S*)-4-(furan-2-yl)-5-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

(CKQ-120A). Total yield: 68 mg (86 %), yellow solid, mp 88-90°C , R_f= 0.31 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ +0.5 (*c* 1.0, $CHCl_3$), HPLC analysis: 99 % ee [Daicel CHIRALPAK AD-H column, 20 °C, 250 nm hexane/*i*-PrOH = 85:15, 1.0 mL/min, 250 nm, 14.1 min (minor) , 22.0 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (m, 2H), 7.32 – 7.21 (m, 6H), 7.08 (d, *J* = 6.9 Hz, 2H), 6.82 – 6.80 (m, 1H), 6.67 (d, *J* = 7.6 Hz, 1H), 6.61 – 6.60 (m, 1H), 3.89 (d, *J* = 7.0 Hz, 1H), 3.76 (d, *J* = 3.9 Hz, 3H), 3.43 (ddd, *J* = 9.4, 7.0, 4.9 Hz, 1H), 3.31 (dd, *J* = 14.6, 4.8 Hz, 1H), 2.55 (dd, *J* = 14.6, 9.4 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ

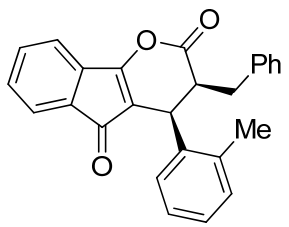
190.8, 169.4, 168.9, 160.1, 138.5, 137.8, 136.3, 133.0, 131.8, 130.8, 130.3, 129.2, 128.8, 127.0, 122.6, 120.1, 118.9, 114.1, 114.1, 113.6, 55.3, 46.2, 37.3, 32.8.. IR (KBr) *v* 2920,1795,1507,1053cm^{-1}. HRMS (ESI) *m/z*: [M-H] Calc. for $C_{26}H_{19}O_4$, 395.12779, Found 395.12719.



3h

(*4R,5S*)-4-phenyl-5-(m-tolyl)-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

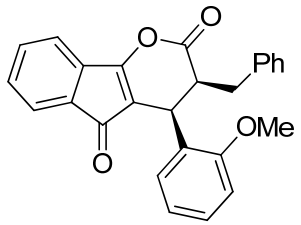
(CKQ-117B).[4] Total yield: 42.4 mg (53 %), yellow solid, mp 94-95°C , R_f= 0.30 (petroleum ether/ethyl acetate, 20:1). $[\alpha]_D^{20}$ -0.176 (*c* 1.0, $CHCl_3$), HPLC analysis: 97 % ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 10.1min (minor), 16.5min (major),].^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (t, *J* = 7.0 Hz, 2H), 7.33 – 7.25 (m, 7H), 7.05 – 6.99 (m, 4H), 3.90 (d, *J* = 7.1 Hz, 1H), 3.42 (ddd, *J* = 9.5, 7.0, 5.1 Hz, 1H), 3.30 (dd, *J* = 14.7, 5.0 Hz, 1H), 2.50 (dd, *J* = 14.7, 9.5 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.6, 169.5, 168.7, 137.4, 136.1, 135.6, 134.1, 133.1, 131.7, 130.9, 129.6, 129.4, 129.0, 128.9, 127.2, 122.7, 119.0, 113.7, 45.9, 36.6, 32.7. IR (KBr) *v* 2924,1796,1432,1054cm^{-1}. HRMS (ESI) *m/z*: $[M+H]^+$Calc. for $C_{25}H_{18}O_4Cl$, 401.09390, Found 401.09320.



3i

(3R,4R)-3-benzyl-4-(o-tolyl)-3,4-dihydroindeno[1,2-b]pyran-2,5-dione (CKQ-120B).

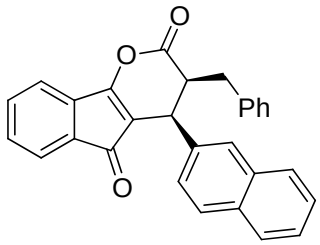
Total yield: 62 mg (82 %), yellow solid, mp 86-92°C , R_f= 0.5 (petroleum ether/ethyl acetate, 20:1).$[\alpha]_D^{20}$ -4.1 (*c* 1.0, $CHCl_3$), HPLC analysis: 96 % ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 7.0 min (minor) , 8.4 min (major)]. ^1H NMR (400 MHz, $CDCl_3$) δ 7.35 (dd, *J* = 11.1, 4.2 Hz, 2H), 7.34 – 7.22 (m, 5H), 7.16 – 7.11 (m, 3H), 6.96 (dd, *J* = 4.9, 4.0 Hz, 1H), 6.94 – 6.89 (m, 2H), 4.11 (d, *J* = 7.7 Hz, 1H), 3.50 (ddd, *J* = 10.1, 7.6, 4.9 Hz, 1H), 3.38 (dd, *J* = 14.6, 4.9 Hz, 1H), 2.53 (dd, *J* = 14.6, 10.2 Hz, 1H), 2.06 (s, 3H). 13C NMR (101 MHz, CDCl3) δ 191.1, 169.4, 168.7, 137.6, 137.4, 136.6 136.2, 133.0, 131.7, 131.3, 130.6, 129.0, 128.8, 127.7, 127.0, 126.9, 126.4, 122.4, 118.8, 115.0, 45.1, 32.9, 32.3, 19.6.IR (KBr) *v* 2924,1796,1432,1054cm^{-1}. HRMS (ESI) *m/z*: $[M+H]^+$Calc. for $C_{26}H_{21}O_3^+$, 381.14752, Found 381.14788.



3j

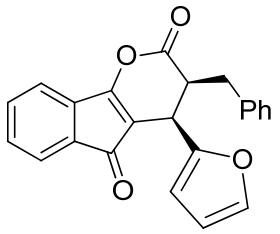
(*4R,5S*)-4-(2-chlorophenyl)-5-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one (CKQ-118B). Total yield: 77 mg (97 %), yellow solid, mp 81-83°C , R_f= 0.35 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -0.34 (*c* 1.0, $CHCl_3$), HPLC analysis: 96 % ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 7.1

min (minor) , 12.3 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 – 7.32 (m, 2H), 7.28 – 7.20 (m, 6H), 6.98 (dd, *J* = 7.5, 1.5 Hz, 1H), 6.90 (t, *J* = 7.6 Hz, 3H), 6.83 (d, *J* = 8.2 Hz, 1H), 3.89 (d, *J* = 8.1 Hz, 1H), 3.73 (s, 3H), 3.46 (dd, *J* = 14.4, 4.0 Hz, 1H), 3.25 (ddd, *J* = 10.2, 8.3, 4.1 Hz, 1H), 2.35 (dd, *J* = 14.3, 10.3 Hz, 1H).. ^{13}C NMR (101 MHz, $CDCl_3$) δ 191.6, 168.9, 168.3, 157.6, 138.2, 136.9, 132.8, 132.7 132.0, 130.4, 129.3, 129.1, 128.5, 126.8, 124.3, 122.1, 121.0, 118.6, 110.7, 110.4, 53.9, 44.4, 36.2, 33.0. IR (KBr) *v* 2924,1790,1388,1080 cm^{-1}HRMS (ESI) *m/z*: [M-H] Calc. for $C_{26}H_{19}O_4$, 395.12779, Found 395.12721.



3k

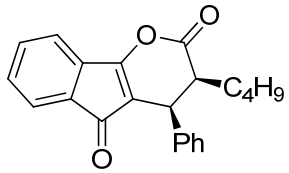
(*4R,5S*)-4-hexyl-5-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one (CKQ-123B). Total yield: 61 mg (73 %),yellow solid,R_f= 0.22 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ 0.1 (*c* 1.0, $CHCl_3$), HPLC analysis: 98 % ee [Daicel CHIRALPAK AD-H column, 20 ^{o}C, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 11.7 min (minor) , 28.9 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.0 Hz, 1H), 7.86 – 7.79 (m, 2H), 7.50 – 7.47 (m, 3H), 7.45 – 7.41 (m, 2H), 7.37 – 7.14 (m, 3H), 7.13 – 7.10 (m, 3H), 6.79 (d, *J* = 6.8 Hz, 2H), 4.87 (d, *J* = 7.3 Hz, 1H), 3.58 (ddd, *J* = 8.7, 7.3, 5.5 Hz, 1H), 3.22 (dd, *J* = 14.6, 5.5 Hz, 1H), 2.56 (dd, *J* = 14.6, 8.8 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.8, 169.4, 169.2, 137.8, 136.4, 134.2,134.1, 133.0, 131.8, 131.8, 130.7, 129.1, 128.8, 128.8, 128.7, 126.8, 126.4, 126.2, 125.6, 124.2， 123.8, 122.5, 118.8, 114.9, 46.8, 33.0, 31.4.IR (KBr) *v* 2924,1831,1496,1059 cm^{-1}.HRMS (ESI) *m/z*: [M+H] Calc. for $C_{29}H_{21}O_3$, 417.14852, Found 417.14774.



3l

(*4R,5S*)-5-(4-bromophenyl)-4-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

(CKQ-119C). Total yield: 53 mg (74 %), yellow solid, mp 179-181°C , R_f= 0.32 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -0.467 (*c* 1.0, $CHCl_3$), HPLC analysis: 92 % ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 10.3 min (minor), 17.4 min major)]. ^1H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.25 (m, 8H), 7.14 (d, *J* = 4.0 Hz, 2H) 6.32 (dd, *J* = 3.2, 1.9 Hz, 1H), 6.20 (d, *J* = 3.0 Hz, 1H), 3.99 (d, *J* = 6.6 Hz, 1H), 3.41 (dd, *J* = 14.4, 4.2 Hz, 1H), 3.24 (ddd, *J* = 10.7, 6.6, 4.3 Hz, 1H), 2.47 (dd, *J* = 14.4, 10.2 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.5, 170.4, 168.2, 149.9, 142.9, 137.7, 136.2, 133.0, 131.9, 130.9, 129.2, 128.9, 127.1, 122.6, 119.0, 111.1, 110.6, 109.0, 45.6, 33.0, 30.5. IR (KBr) *v* 2925,1747,1388,1053 cm^{-1}. HRMS (ESI) *m/z*: [M+H] Calc. for $C_{23}H_{17}O_4^+$, 357.11214, Found 357.11144.

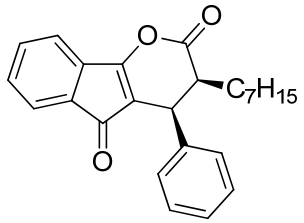


3m

(*4R,5S*)-4-(3-chlorophenyl)-5-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

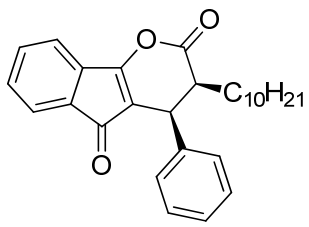
(CKQ-128C). Total yield 52 mg (78 %), yellow solid, mp 78-81°C , R_f= 0.42 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -0.94 (*c* 1.0, $CHCl_3$), HPLC analysis: 96 % ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 8.8 min (minor) , 21.9 min (major)]. ^1H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.38 (m, 2H), 7.33 –

7.24 (m, 5H), 7.24 – 7.13 (m, 2H), 4.08 (d, *J* = 7.1 Hz, 1H), 2.99 (dd, *J* = 13.4, 7.4 Hz, 1H), 1.78 (dt, *J* = 8.8, 6.3 Hz, 1H), 1.44 – 1.12 (br, 5H), 0.87 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.9, 169.7, 169.3, 137.2, 136.4, 133.0, 131.9, 130.7, 129.2, 128.0, 127.8, 122.5, 118.8, 114.1, 44.7, 37.8, 29.3, 26.6, 22.5, 14.0. IR (KBr) *v* 2952,1796,1432,1068 cm^{-1}.HRMS (ESI) *m/z*: $[M+H]^+$Calc. for $C_{22}H_{21}O_3$, 333.14852, Found 333.14798.



3n

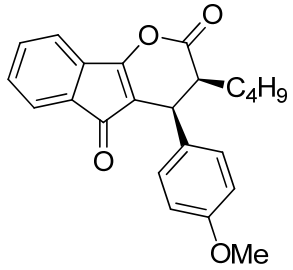
(*4R,5S*)-4-(4-bromophenyl)-5-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one (CKQ-128B). Total yield: 60 mg (80 %), yellow solid, mp 95-96°C , R_f= 0.40 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -0.60 (*c* 1.0, $CHCl_3$), HPLC analysis: 91 % ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 7.7 min (minor), 14.7 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.37 (m, 2H), 7.37-7.24 (m, 5H), 7.15 – 7.13 (m, 2H), 4.08 (d, *J* = 7.2 Hz, 1H), 2.99 (dd, *J* = 13.3, 7.5 Hz, 1H), 1.83 – 1.74 (m, 1H), 1.42 (dd, *J* = 13.3, 7.2 Hz, 2H), 1.27-1.23 (m, 9H), 0.86 (t, *J* = 6.9 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.9, 169.7, 169.3, 137.2, 136.4, 133.0, 132.0, 130.7, 129.2, 128.0, 127.8, 122.5, 118.9, 114.1, 44.7, 37.8, 31.8, 29.4, 29.1, 27.0, 26.9, 22.7, 14.2. IR (KBr) *v* 2925,1796,1455,1035 cm^{-1}. HRMS (ESI) *m/z*: [M+H] Calc. for $C_{25}H_{27}O_3$, 375.19547, Found 375.19492



3o

(4R,5R)-4-phenyl-5-((E)-styryl)-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

(CKQ-128A). Total yield: 64 mg (78 %), yellow solid, mp 98-100°C , R_f= 0.35 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$-0.553 (*c* 1.0, $CHCl_3$), HPLC analysis: 98% ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH = 85:15, 1.0 mL/min, 250 nm, 5.2 min (minor), 8.3 min (major)]. ^1H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.37 (m, 2H), 7.33 – 7.24 (m, 5H), 7.14 (d, *J* = 7.0 Hz, 2H), 4.08 (d, *J* = 7.1 Hz, 1H), 2.99 (dd, *J* = 13.4, 7.3 Hz, 1H), 1.79 (td, *J* = 14.0, 7.1 Hz, 1H), 1.40 (d, *J* = 6.1 Hz, 2H), 1.23 (m, 15H), 0.88 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.8, 169.5, 169.1, 137.1, 136.3, 132.8, 131.8, 130.6, 129.1, 127.8, 127.7, 122.4, 118.7, 114.0, 44.6, 37.7, 32.1, 29.5, 29.5, 29.4, 29.3, 26.9, 26.8, 22.7, 14.1. IR (KBr) *v* 2918,1782,1388 cm^{-1}. HRMS (ESI) *m/z*: [M+H] Calc. for $C_{28}H_{33}O_3$,417.24182, Found 417.24242.

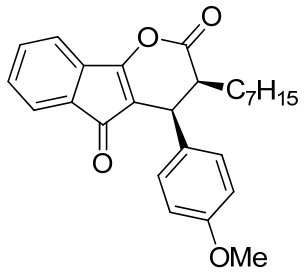


3p

(*4R,5S*)-4-(4-chlorophenyl)-5-phenyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one

(CKQ-132B). Total yield: 72 mg (99 %), yellow solid, mp 94-95°C , R_f= 0.40 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -1.59 (*c* 1.0, $CHCl_3$), HPLC analysis: 98 % ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH =90:10, 1.0 mL/min, 250 nm, 6.6

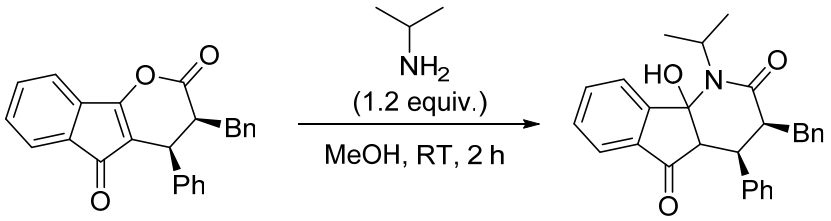
min (minor) , 16.8 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (dd, *J* = 15.5, 7.2 Hz, 2H), 7.32 – 7.24 (m, 2H), 7.05 (d, *J* = 8.6 Hz, 2H), 6.82 (d, *J* = 8.6 Hz, 2H), 4.04 (d, *J* = 7.1 Hz, 1H), 3.75 (s, 3H), 2.96 (dd, *J* = 13.4, 7.3 Hz, 1H), 1.79 (td, *J* = 13.8, 6.9 Hz, 1H), 1.43 – 1.331 (m, 2H), 1.29 – 1.23 (m, 3H), 0.87 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 191.0, 169.5, 169.4, 159.3, 136.4, 132.9, 131.9, 130.6, 129.1, 128.9, 122.5, 118.8, 114.5, 114.3, 55.3, 44.8, 37.0, 31.8, 29.3, 26.9, 22.5, 14.0. .IR (KBr) *v* 2955,1796,1388，1040 cm^{-1}. HRMS (ESI) *m/z*: [M+H] Calc. for $C_{23}H_{23}O_4$, 363.15963, Found 363.15871.



3q

(*4R,5S*)-5-phenyl-4-propyl-4,5-dihydrooxepino[3,2-b]benzofuran-2(3H)-one (CKQ-132A). Total yield: 80 mg (99 %), yellow solid, mp 79-80°C ,R_f= 0.51 (petroleum ether/ethyl acetate, 10:1). $[\alpha]_D^{20}$ -1.1 (*c* 1.0, $CHCl_3$), HPLC analysis: 98 % ee [Daicel CHIRALPAK AD-H column, 20 ^{o}C, 250 nm hexane/*i*-PrOH = 90:10, 1.0 mL/min, 250 nm, 9.0 min (minor) 21.7 min (major)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (dd, *J* = 15.7, 7.2 Hz, 2H), 7.34 – 7.24 (m, 2H), 7.06 – 6.04 (m, 2H), 6.83 – 6.80 (m, 2H), 4.04 (d, *J* = 7.1 Hz, 1H), 3.75 (s, 3H), 2.96 (dd, *J* = 13.3, 7.4 Hz, 1H), 1.82 – 1.74 (m, 1H), 1.58 – 1.33 (m, 2H), 1.26 – 1.24 (m, 9H), 0.87 (t, *J* = 6.9 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 191.0, 169.5, 169.3, 159.2, 136.4, 132.9, 131.9, 130.6, 129.1, 128.9, 122.5, 118.8, 114.5, 114.3, 55.3, 44.8, 37.0, 31.8, 29.3, 29.1, 27.0, 26.9, 22.7, 14.2. IR (KBr) *v* 2926,1796,1388,1075 cm^{-1}. HRMS (ESI) *m/z*: $[M+H]^+$Calc. for $C_{26}H_{29}O_4$,405.20658, Found 405.20324.

1.3 Synthesis of indenopyridine 6



To the solution of **3a** (73.2 mg, 0.2 mmol) in 3 mL methanol was added slowly the solution of isopropyl amine (14.2 mg, 0.24 mmol) in 1 mL methanol. The reaction mixture was stirred at room temperature for 2 h. The solvent was removed under reduced pressure, and the residue was purified by flash chromatography on silica gel (ethyl acetate/petroleum ether 3:1) to get the indenopyridine **6**.

(3S,4S)-3-benzyl-9b-hydroxy-1-isopropyl-4-phenyl-4,4a-dihydro-1H-indeno[1,2-b]pyridine-2,5(3H,9bH)-dione (GZH-396C).

Yield: 75.6 mg (89 %), white solid, mp 145-148°C , R_f= 0.20 (petroleum ether/ethyl acetate, 2:1). $[\alpha]_D^{20}$ -24.9 (*c* 1.0, $CHCl_3$), HPLC analysis: 94 % ee [Daicel CHIRALPAK AD-H column, 20 ^oC, 250 nm hexane/*i*-PrOH =60:40, 1.0 mL/min, 250 nm, 4.6 min (minor) , 6.3 min (major)]. ^1H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 7.4 Hz, 1H), 7.71 – 7.61 (m, 3H), 7.26 (d, *J* = 7.1 Hz, 2H), 7.21 – 7.17 (m, 3H), 7.10 (t, *J* = 7.3 Hz, 1H), 7.06 – 7.04 (m, 2H), 6.98 – 6.89 (m, 3H), 4.38 (d, *J* = 8.2 Hz, 1H), 3.92 (dd, *J* = 11.4, 4.4 Hz, 1H), 3.58 (d, *J* = 4.4 Hz, 1H), 3.50 – 3.37 (m, 1H), 3.25 (td, *J* = 11.4, 3.4 Hz, 1H), 3.10 (dd, *J* = 12.4, 3.3 Hz, 1H), 2.91 (t, *J* = 11.9 Hz, 1H), 0.46 (d, *J* = 6.6 Hz, 3H), 0.30 (d, *J* = 6.6 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.3, 171.0, 142.6, 142.5, 139.6, 139.1, 135.6, 135.65, 129.2, 128.9, 128.3, 128.1, 127.0, 126.3, 123.1, 122.9, 54.7, 53.6, 47.4, 40.2, 37.0, 22.1, 22.0. IR (KBr) *v* 3120, ,1766,1488，1040 cm^{-1}. HRMS (ESI) *m/z*: [M+H] Calc. for $C_{28}H_{28}O_3N$, 426.20637, Found 426.20563.

1.4 X-ray crystal structures of 3e

The single crystal of **3e** was prepared by slow evaporation of its solution in ethyl ether/*n*-hexane = 10/1. The ***4R,5S*** absolute configuration of **3e** was established by X-ray analysis of its crystal with 0.013(6) of the absolute structure parameter (Figure 1).

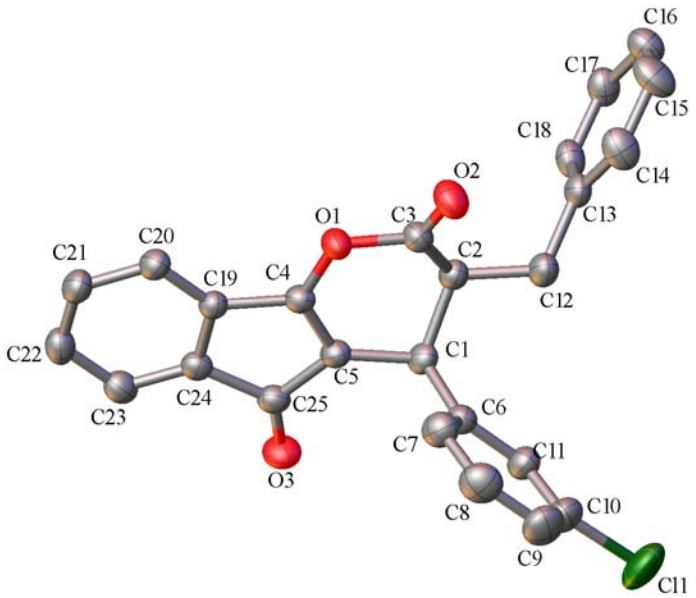


Figure 1 X-ray structure of **3e**.

1.5 References

1. (a) M. He, J. R. Struble and J. W. Bode, *J. Am. Chem. Soc.*, 2006, **128**, 8418;

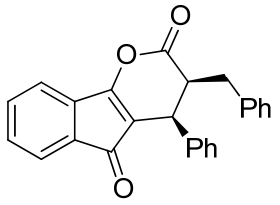
   (b) Y.-R. Zhang,L.He,X.Wu,P.-L.Shao and S. Ye, *Org. Lett.*, 2008, **10**, 277.

2. M. He, G. J. Uc and J. W. Bode, *J. Am. Chem. Soc.*, 2006, **128**, 15088.

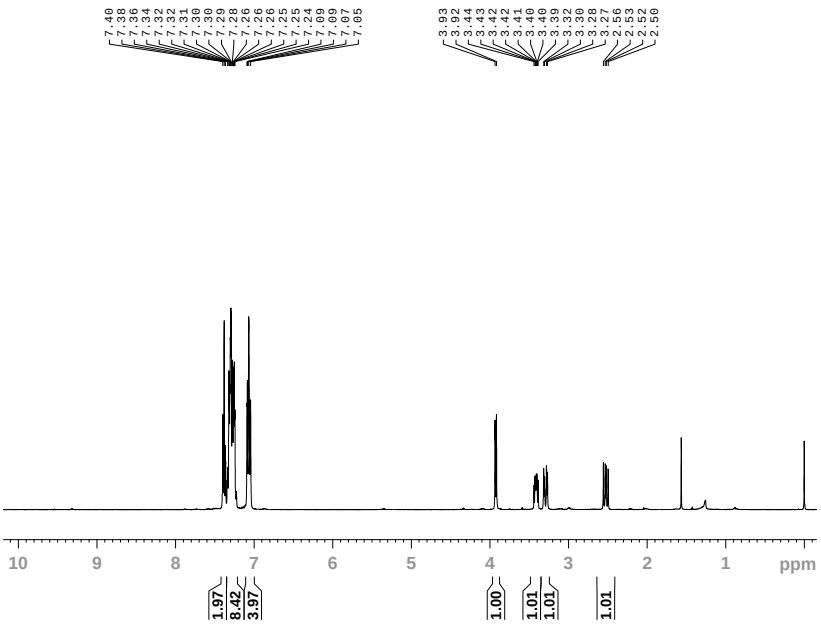
3. C.-J. Lee, C.-N. Sheu, C.-C. Tsai, Z.-Z. Wu and W. Lin, *Chem. Commun.*, 2014, **50**, 5304.

4. The experiment number for the synthesis of the compound is showed in parenthesis.

Part II NMR Spectra



3a

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FIDRES          0.244532 Hz
AQ             2.0447731 sec
RG                140.59
DW                62.400 usec
DE                  6.50 usec
TE                 298.2 K
D1           2.00000000 sec
TD0                    1

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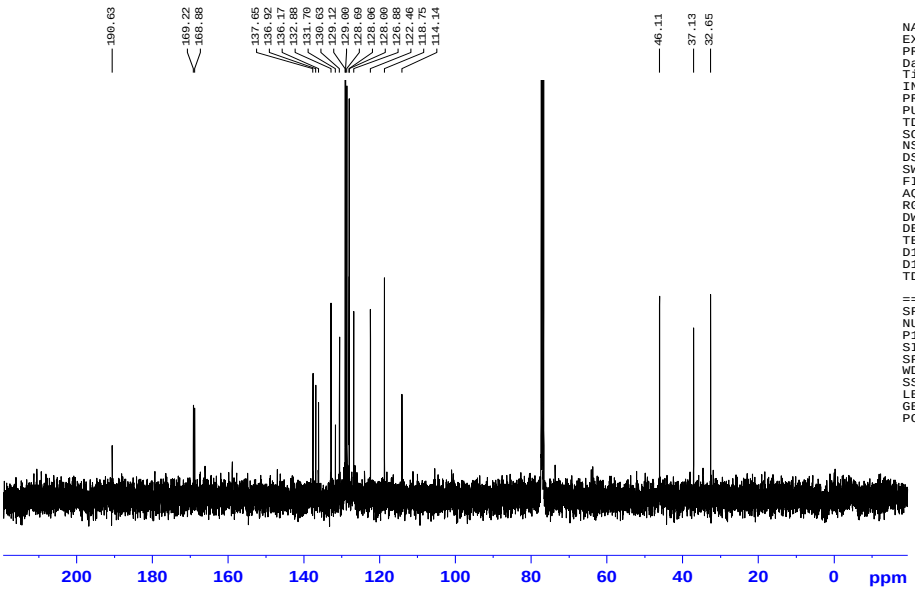


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TD                 65536
SOLVENT            CDCl3
NS                   151
DS                     4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ             1.3631988 sec
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DE                  6.50 usec
TE                 296.6 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

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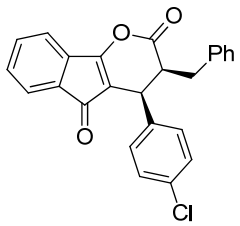
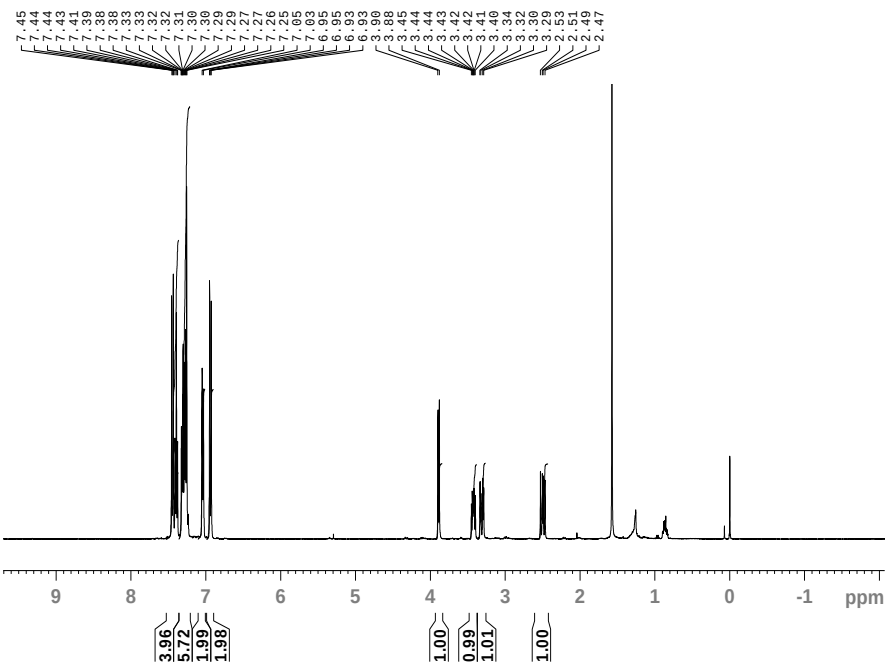


3b

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TD                32768
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DS                    0
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FIDRES         0.244532 Hz
AQ           2.0447731 sec
RG              206.33
DW              62.400 usec
DE                6.50 usec
TE               299.8 K
D1          2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
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SSB                    0
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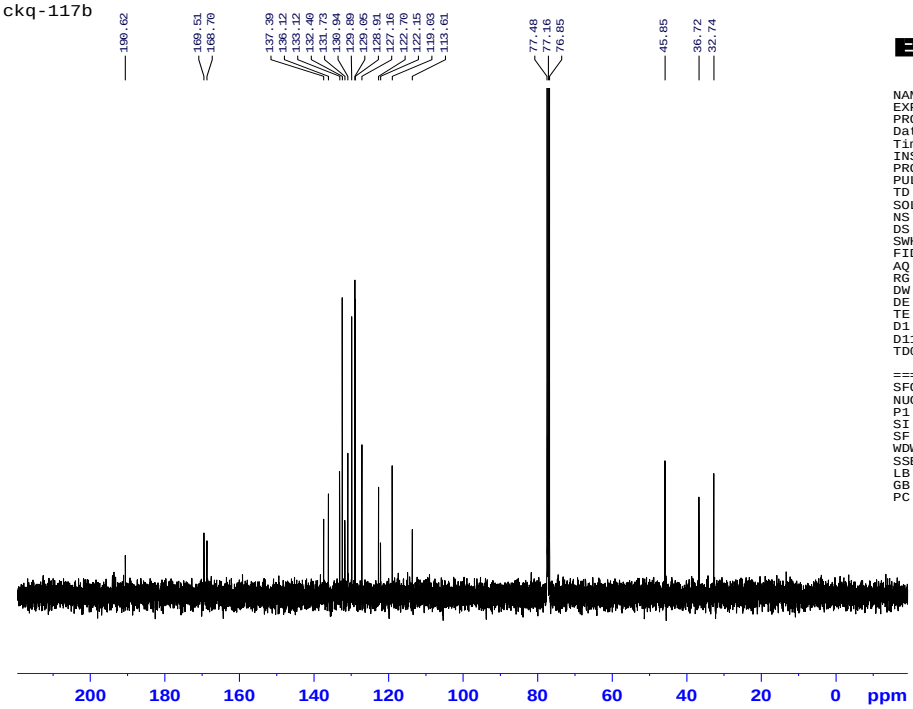
ckq-117b

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DS                    4
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FIDRES         0.366798 Hz
AQ           1.3631988 sec
RG              206.33
DW              20.800 usec
DE                6.50 usec
TE               300.4 K
D1          2.00000000 sec
D11         0.03000000 sec
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======== CHANNEL f1 ========
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WDW                   EM
SSB                    0
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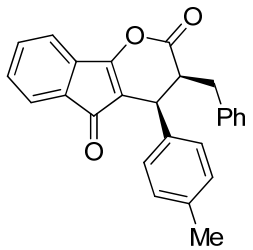
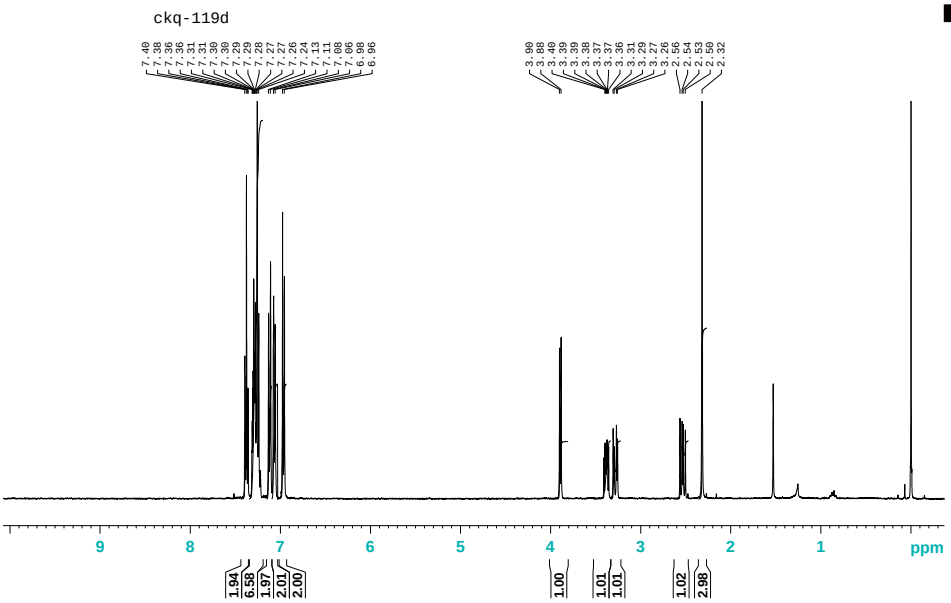
PC                  1.40
```

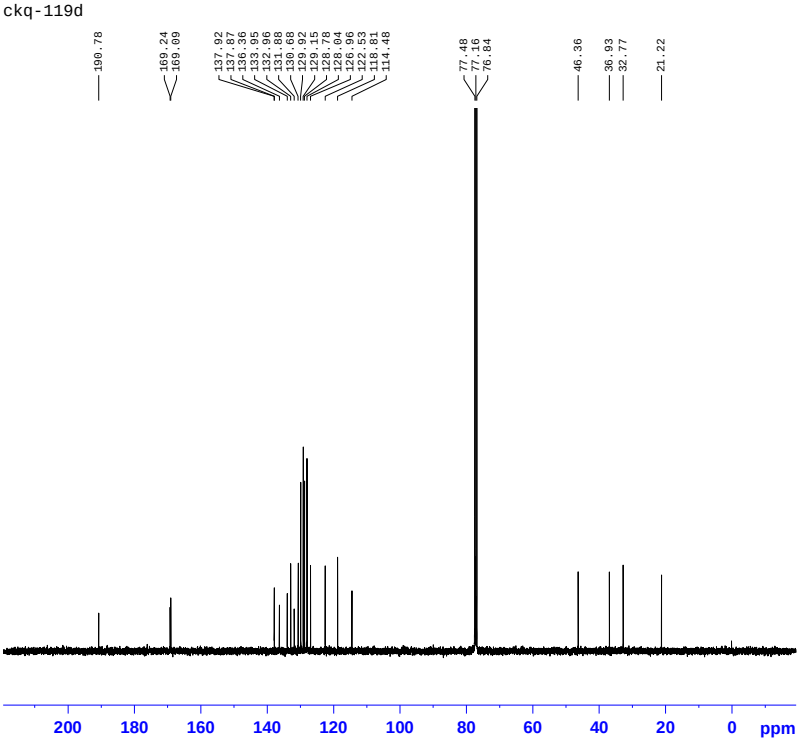


3c



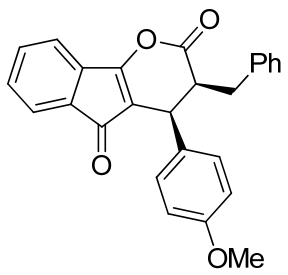

```
NAME          chenkunquan
EXPNO                  94
PROCNO                  1
Date_            20140915
Time                18.41
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG             zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH             8012.820 Hz
FIDRES          0.244532 Hz
AQ               2.0447731 sec
RG                 206.33
DW                 62.400 usec
DE                   6.50 usec
TE                  301.2 K
D1             2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          400.2424716 MHz
NUC1                    1H
P1                  14.80 usec
SI                  65536
SF            400.2400109 MHz
WDW                     EM
SSB                      0
LB                    0.30 Hz
GB                       0
PC                    1.00
```

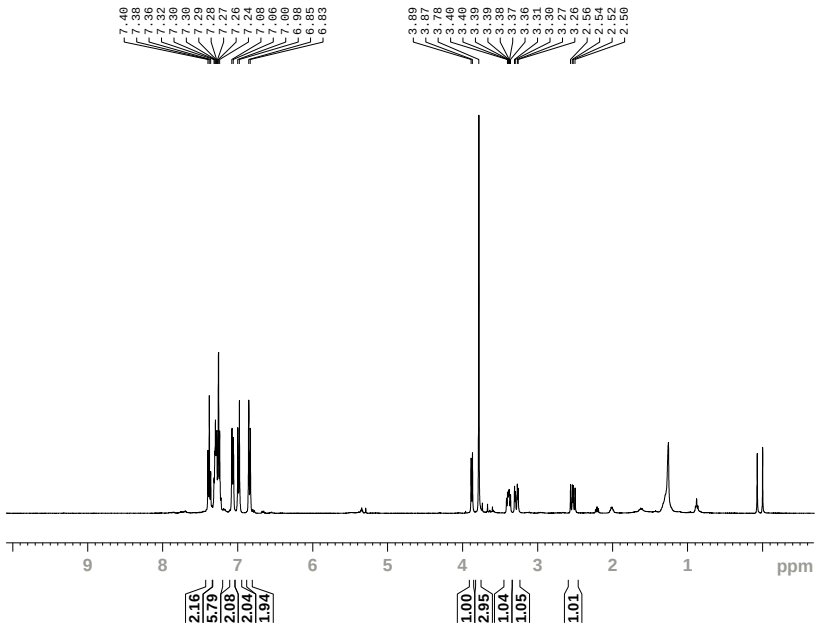



```
NAME          chenkunquan
EXPNO                 101
PROCNO                  1
Date_            20140917
Time                18.22
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG           zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    597
DS                      4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ              1.3631988 sec
RG                 206.33
DW                 20.800 usec
DE                   6.50 usec
TE                  300.7 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          100.6504916 MHz
NUC1                    13C
P1                  10.00 usec
SI                  32768
SF            100.6404152 MHz
WDW                     EM
SSB                      0
LB                    1.00 Hz
GB                       0
PC                    1.40
```



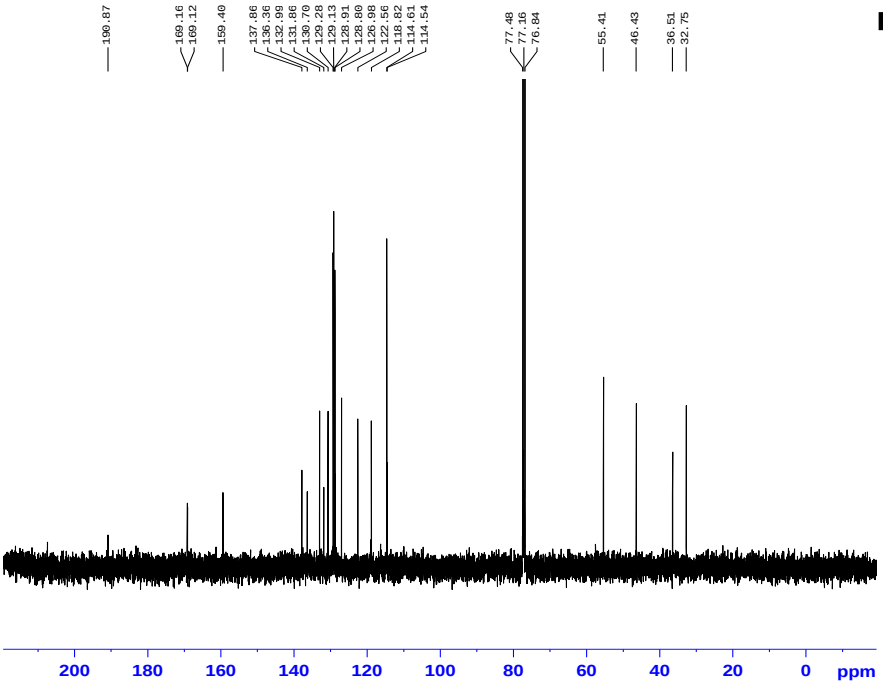
3d




```
NAME        chenkunquan
EXPNO                83
PROCNO                1
Date_          20140914
Time              16.53
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ           2.0447731 sec
RG              140.59
DW              62.400 usec
DE               6.50 usec
TE              299.8 K
D1          2.00000000 sec
TD0                   1

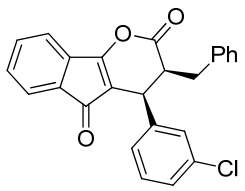
======== CHANNEL f1 ========
SFO1       400.2424716 MHz
NUC1                 1H
P1               14.80 usec
SI               65536
SF         400.2400111 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

ckq-116a

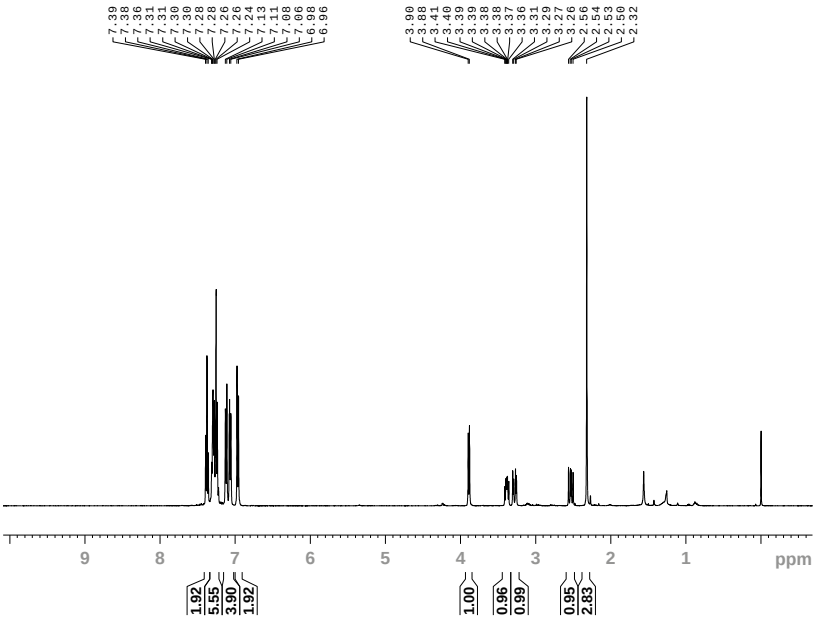



```
NAME        chenkunquan
EXPNO                 57
PROCNO                 1
Date_           20140901
Time               16.16
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  101
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ           1.3631988 sec
RG              206.33
DW              20.800 usec
DE               6.50 usec
TE              300.2 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1       100.6504916 MHz
NUC1                13C
P1               10.00 usec
SI               32768
SF         100.6404145 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

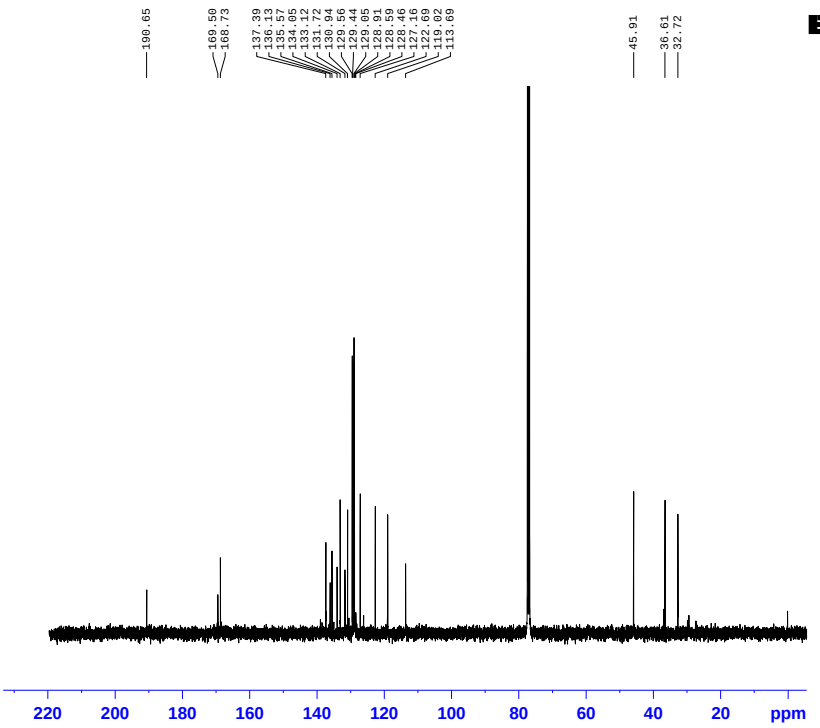


3e



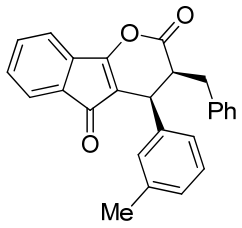

```
NAME        ckq4+2buchong
EXPNO                  43
PROCNO                  1
Date_            20150404
Time                20.34
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG               zg30
TD                   32768
SOLVENT              CDCl3
NS                      16
DS                       0
SWH              8012.820 Hz
FIDRES           0.244532 Hz
AQ             2.0447731 sec
RG                  206.33
DW                  62.400 usec
DE                    6.50 usec
TE                   298.1 K
D1             2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          400.2424716 MHz
NUC1                    1H
P1                   14.80 usec
SI                   65536
SF            400.2400116 MHz
WDW                     EM
SSB                      0
LB                    0.30 Hz
GB                       0
PC                    1.00
```

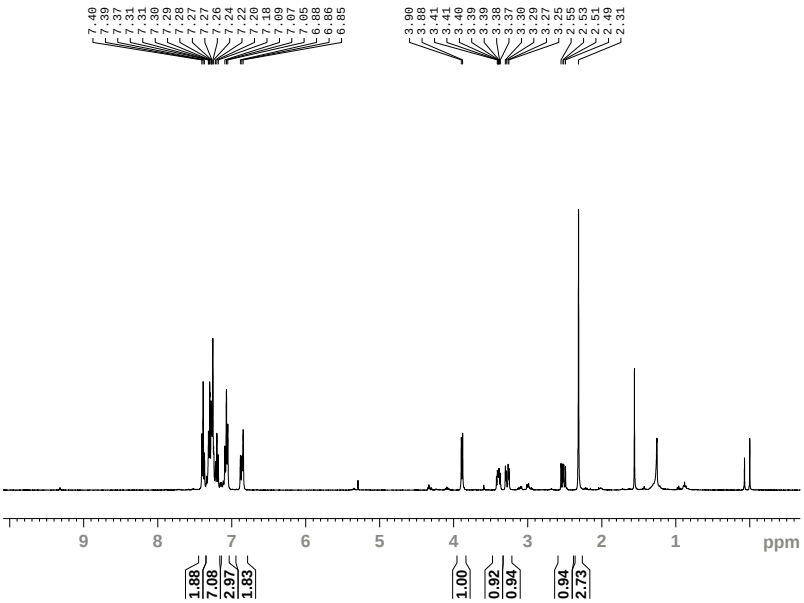



```
NAME        ckq4+2buchong
EXPNO                  44
PROCNO                  1
Date_            20150404
Time                21.34
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     988
DS                       4
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ             1.3631988 sec
RG                  206.33
DW                  20.800 usec
DE                    6.50 usec
TE                   298.1 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          100.6504916 MHz
NUC1                   13C
P1                   10.00 usec
SI                   32768
SF            100.6404145 MHz
WDW                     EM
SSB                      0
LB                    1.00 Hz
GB                       0
PC                    1.40
```

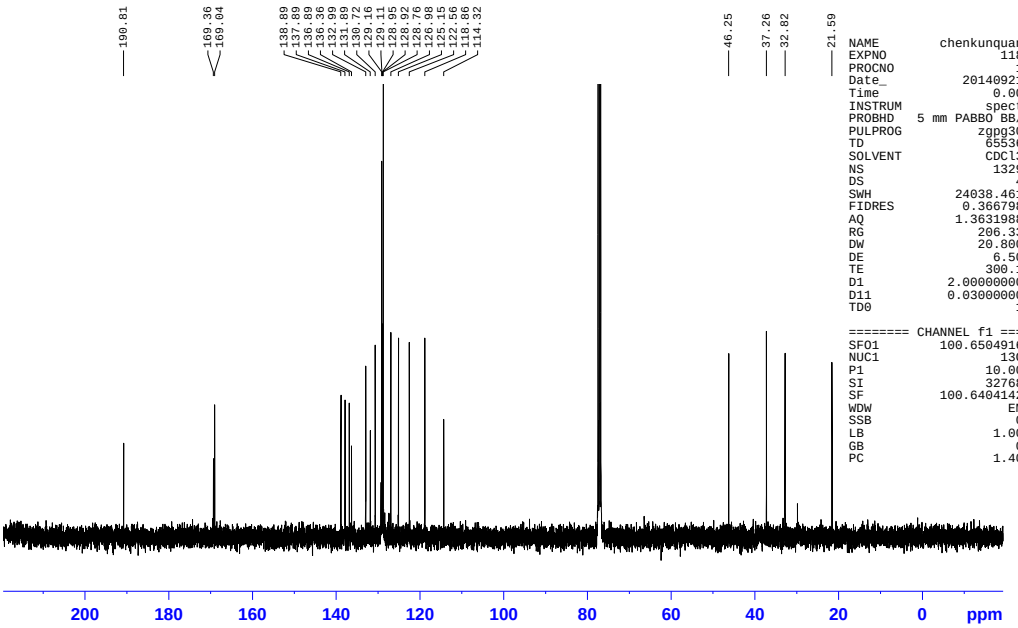


3f



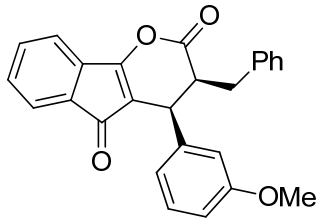

```
NAME          chenkunquan
EXPNO               116
PROCNO                1
Date_          20140920
Time              20.55
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ           2.0447731 sec
RG              162.77
DW              62.400 usec
DE               6.50 usec
TE              298.7 K
D1          2.00000000 sec
TD0                   1

======== CHANNEL f1 =======
SFO1        400.2424716 MHz
NUC1                 1H
P1               14.80 usec
SI               65536
SF          400.2400111 MHz
WDW                 EM
SSB                  0
LB                0.30 Hz
GB                   0
PC                1.00
```

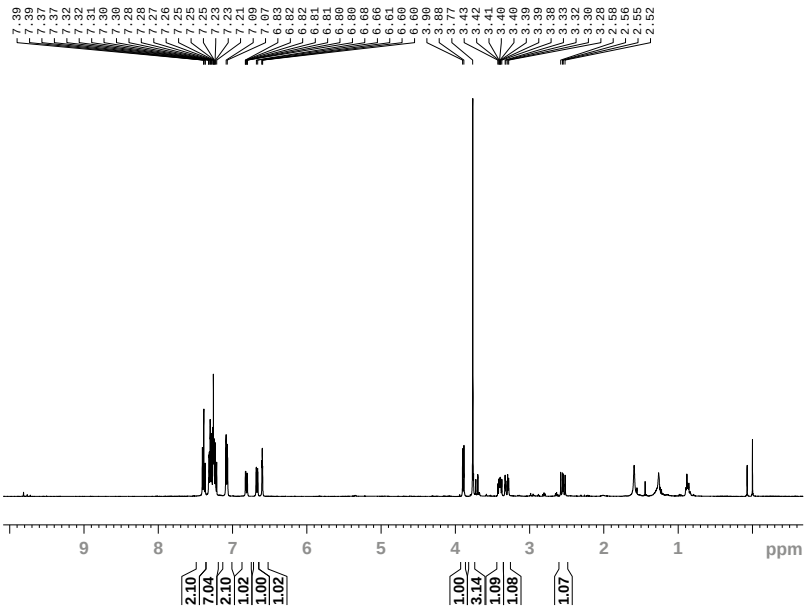



```
NAME          chenkunquan
EXPNO               118
PROCNO                1
Date_          20140921
Time              0.00
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                 1329
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ           1.3631988 sec
RG              206.33
DW              20.800 usec
DE               6.50 usec
TE              300.1 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                   1

======== CHANNEL f1 =======
SFO1        100.6504916 MHz
NUC1                 13C
P1               10.00 usec
SI               32768
SF          100.6404142 MHz
WDW                 EM
SSB                  0
LB                1.00 Hz
GB                   0
PC                1.40
```

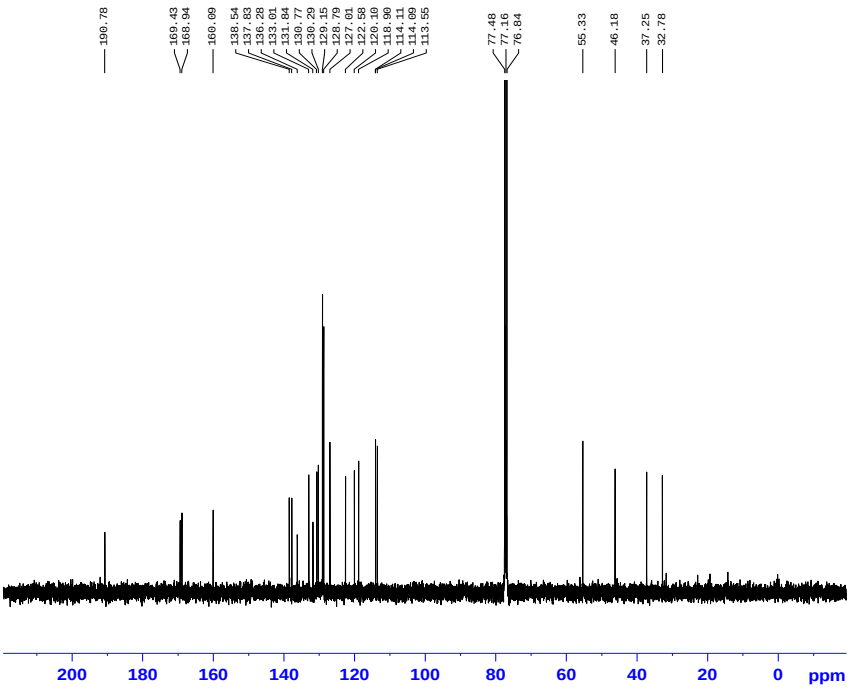


3g



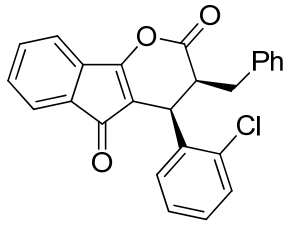

```
NAME          chenkunquan
EXPNO                 136
PROCNO                  1
Date_            20140927
Time                 7.58
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ            2.0447731 sec
RG               206.33
DW               62.400 usec
DE                 6.50 usec
TE                296.9 K
D1            2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         400.2424716 MHz
NUC1                   1H
P1                  14.80 usec
SI                  65536
SF           400.2400102 MHz
WDW                    EM
SSB                     0
LB                   0.30 Hz
GB                      0
PC                   1.00
```

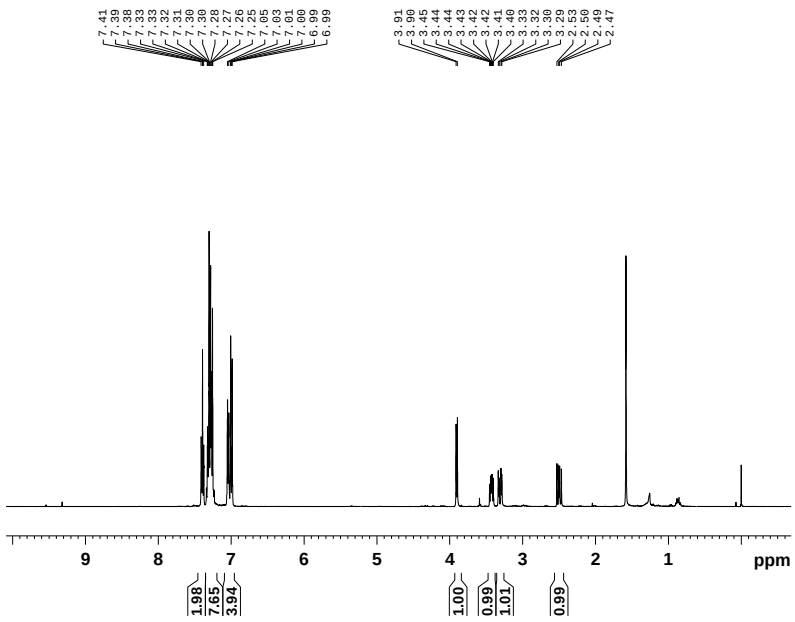



```
NAME          chenkunquan
EXPNO                 137
PROCNO                  1
Date_            20140927
Time                 8.01
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG           zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    623
DS                      4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG               206.33
DW               20.800 usec
DE                 6.50 usec
TE                297.8 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         100.6504916 MHz
NUC1                  13C
P1                  10.00 usec
SI                  32768
SF           100.6404152 MHz
WDW                    EM
SSB                     0
LB                   1.00 Hz
GB                      0
PC                   1.40
```

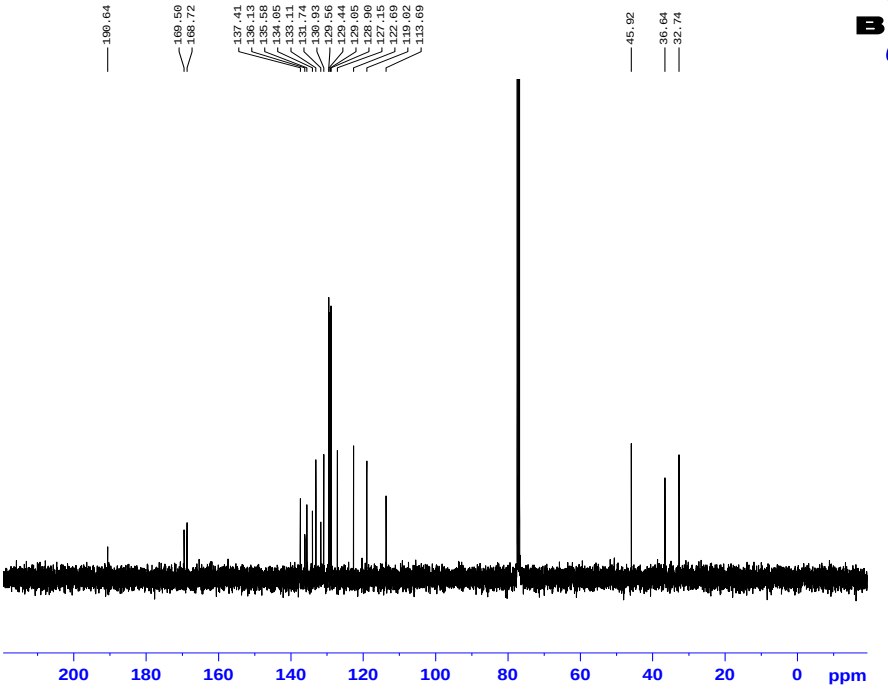


3h



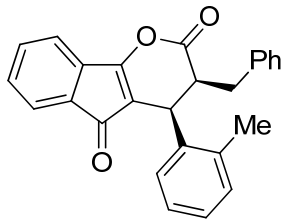

```
NAME          chenkunquan
EXPNO                  60
PROCNO                  1
Date_            20140901
Time                16.44
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH             8012.820 Hz
FIDRES          0.244532 Hz
AQ             2.0447731 sec
RG                 206.33
DW                 62.400 usec
DE                   6.50 usec
TE                  299.8 K
D1            2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         400.2424716 MHz
NUC1                   1H
P1                  14.80 usec
SI                  65536
SF           400.2400107 MHz
WDW                    EM
SSB                     0
LB                   0.30 Hz
GB                      0
PC                   1.00
```

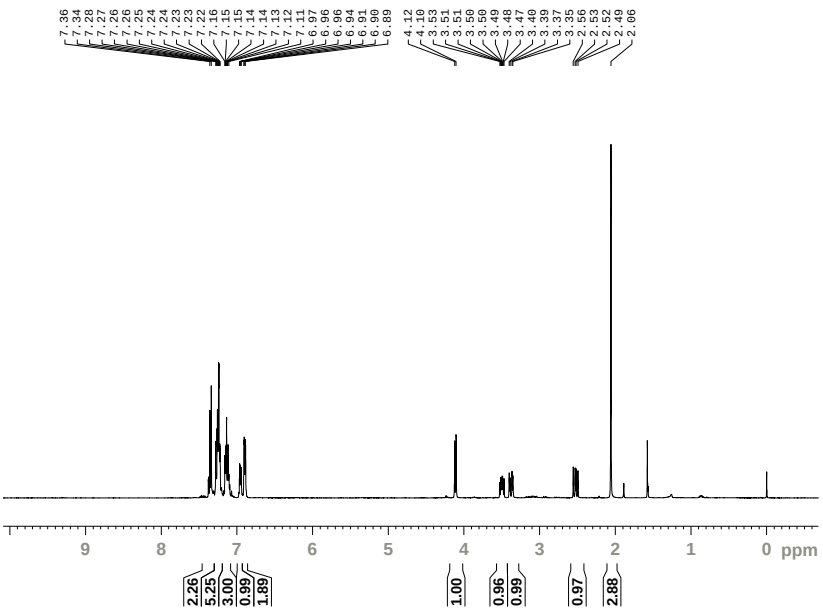



```
NAME          chenkunquan
EXPNO                  61
PROCNO                  1
Date_            20140901
Time                16.48
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG           zgpg30
TD                  65536
SOLVENT             CDCl3
NS                     67
DS                      4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ             1.3631988 sec
RG                 206.33
DW                 20.800 usec
DE                   6.50 usec
TE                  300.8 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         100.6504916 MHz
NUC1                  13C
P1                  10.00 usec
SI                  32768
SF           100.6404143 MHz
WDW                    EM
SSB                     0
LB                   1.00 Hz
GB                      0
PC                   1.40
```

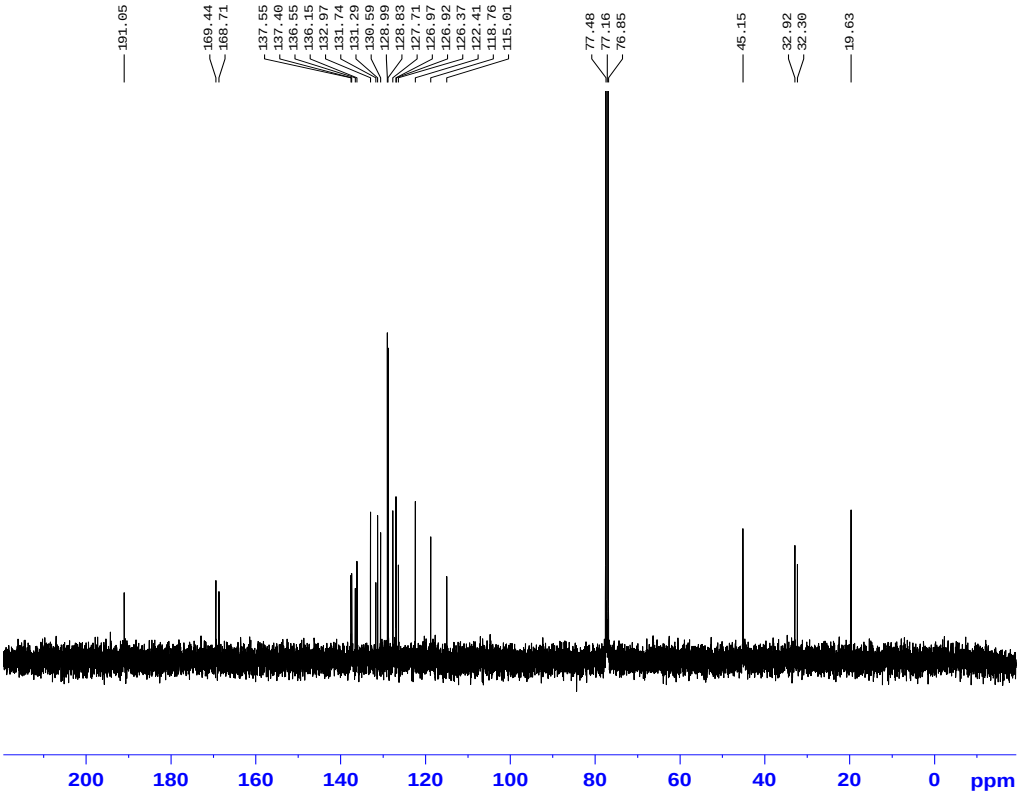


3i



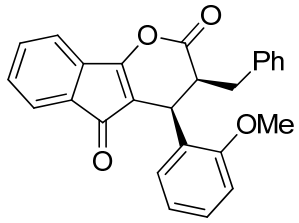

```
NAME        chenkunquan
EXPNO               128
PROCNO                1
Date_          20140924
Time               8.43
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ           2.0447731 sec
RG               102.73
DW               62.400 usec
DE                6.50 usec
TE               299.5 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 =======
SFO1        400.2424716 MHz
NUC1                 1H
P1                14.80 usec
SI                65536
SF          400.2400142 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

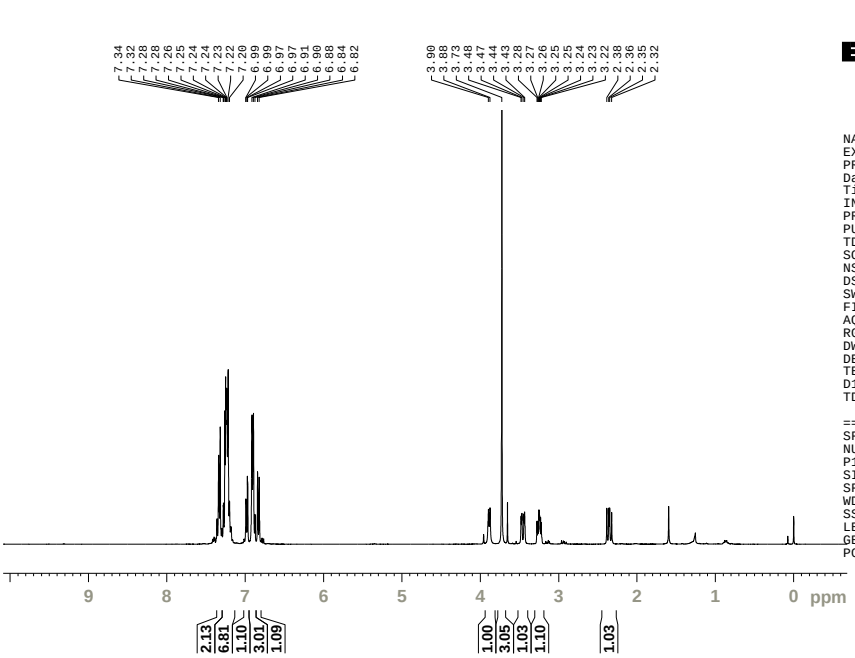



```
NAME        chenkunquan
EXPNO               129
PROCNO                1
Date_          20140924
Time               8.45
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                   39
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ           1.3631988 sec
RG               206.33
DW               20.800 usec
DE                6.50 usec
TE               300.3 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 =======
SFO1        100.6504916 MHz
NUC1                13C
P1                10.00 usec
SI                32768
SF          100.6404165 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

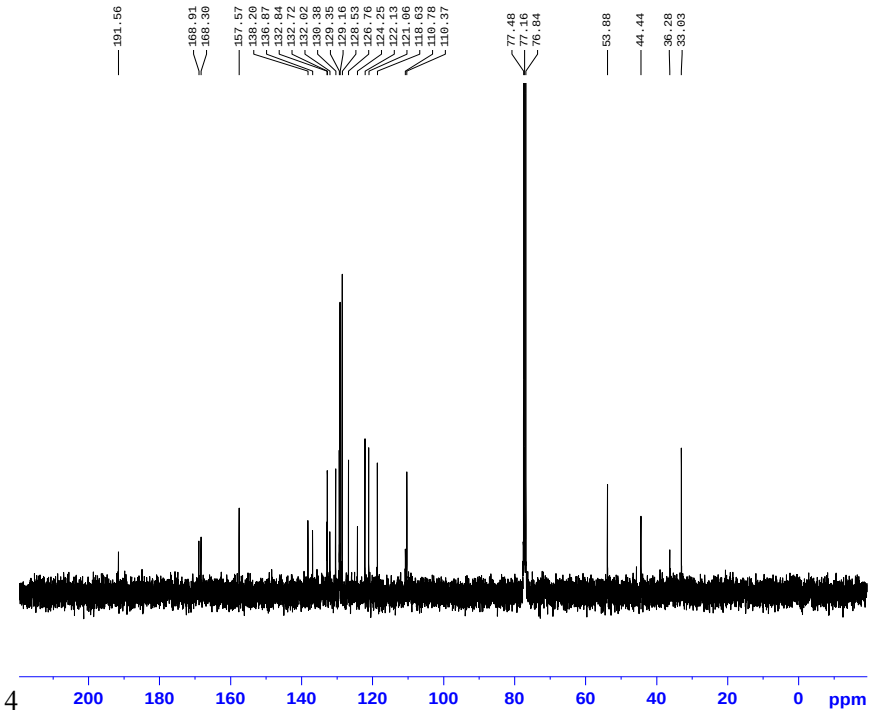


3j



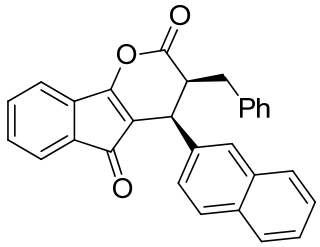

```
NAME        chenkunquan
EXPNO               126
PROCNO                1
Date_          20140924
Time               8.33
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ           2.0447731 sec
RG               65.71
DW               62.400 usec
DE                6.50 usec
TE               299.4 K
D1          2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        400.2424716 MHz
NUC1                 1H
P1                14.80 usec
SI                65536
SF          400.2400135 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

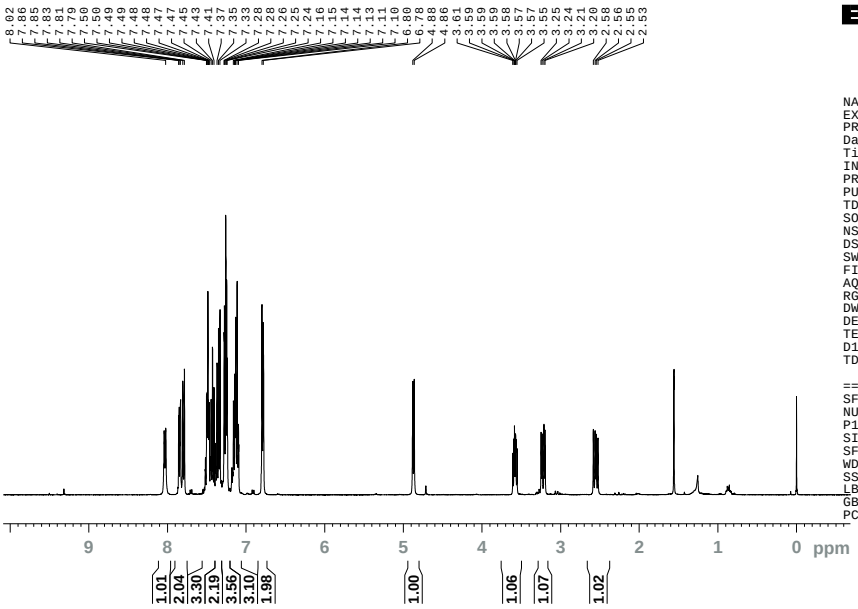



```
NAME        chenkunquan
EXPNO               127
PROCNO                1
Date_          20140927
Time               7.47
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  129
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ           1.3631988 sec
RG               206.33
DW               20.800 usec
DE                6.50 usec
TE               297.0 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6504916 MHz
NUC1                13C
P1                10.00 usec
SI                32768
SF          100.6404173 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

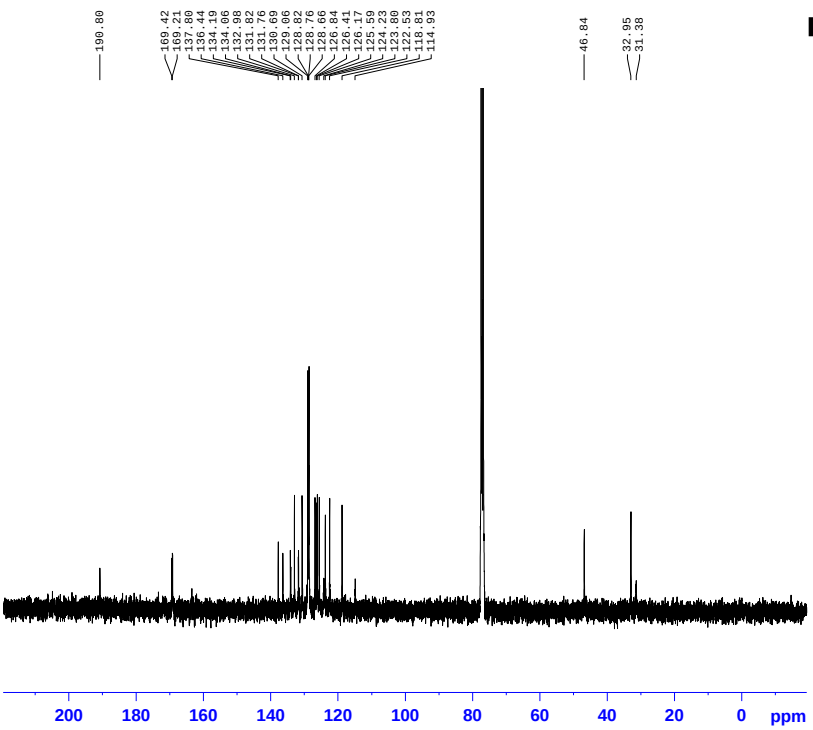


3k



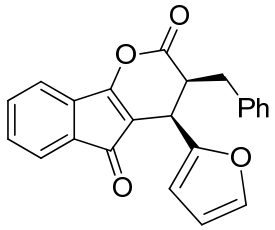

```
NAME        chenkunquan
EXPNO               132
PROCNO                1
Date_          20140925
Time             21.23
INSTRUM          spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ           2.0447731 sec
RG               125.02
DW               62.400 usec
DE                6.50 usec
TE               298.4 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        400.2424716 MHz
NUC1                 1H
P1                14.80 usec
SI                65536
SF          400.2400146 MHz
WDW                  EM
SSB                   0
LB                 0.30 Hz
GB                    0
PC                 1.00
```

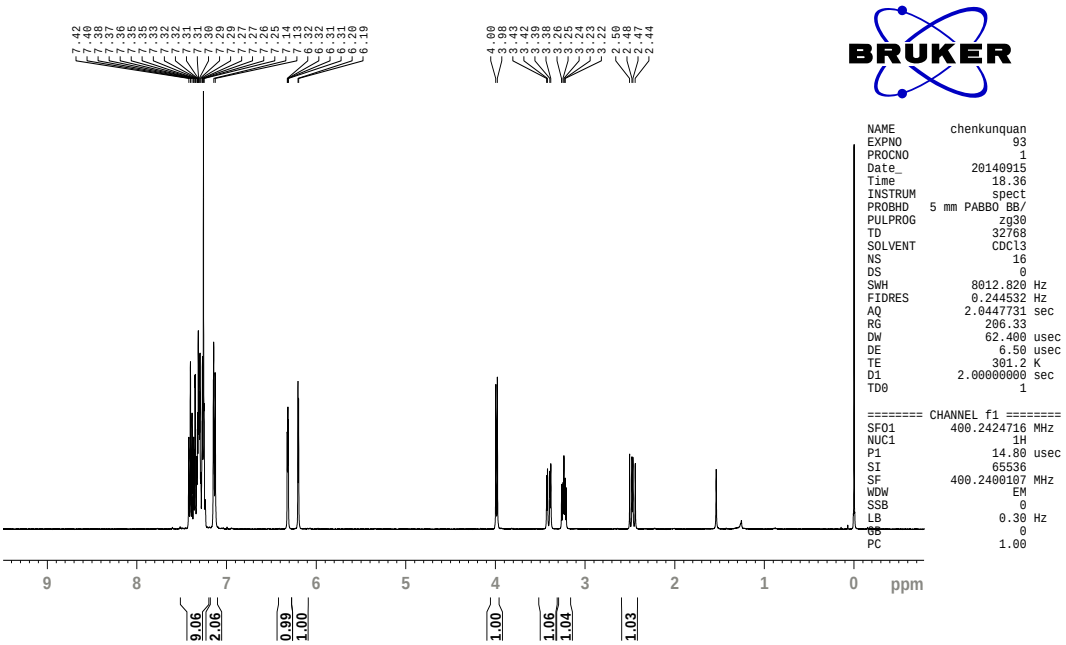



```
NAME        chenkunquan
EXPNO               133
PROCNO                1
Date_          20140926
Time              8.31
INSTRUM          spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  833
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ           1.3631988 sec
RG               206.33
DW               20.800 usec
DE                6.50 usec
TE               298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6504916 MHz
NUC1                 13C
P1                10.00 usec
SI                32768
SF          100.6404164 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```

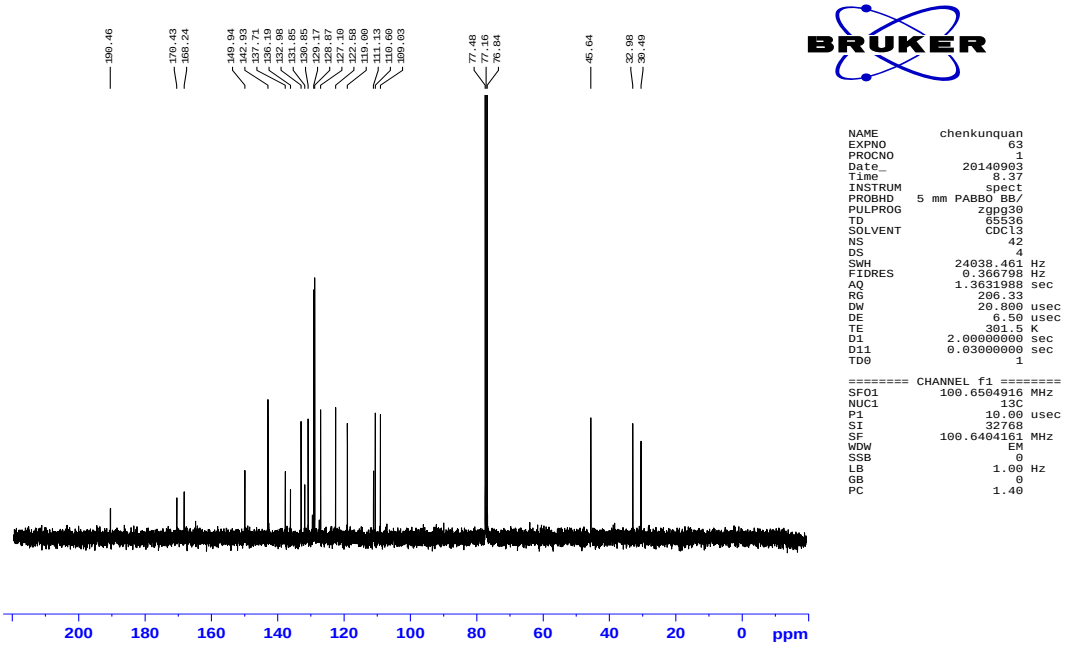


3l



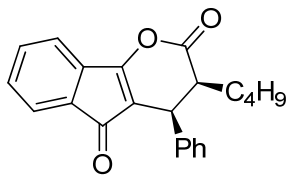

```
NAME          chenkunquan
EXPNO                  93
PROCNO                  1
Date_            20140915
Time                18.36
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH             8012.820 Hz
FIDRES          0.244532 Hz
AQ             2.0447731 sec
RG                206.33
DW                62.400 usec
DE                  6.50 usec
TE                 301.2 K
D1            2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         400.2424716 MHz
NUC1                   1H
P1                 14.80 usec
SI                 65536
SF           400.2400107 MHz
WDW                    EM
SSB                     0
LB                   0.30 Hz
GB                      0
PC                   1.00
```

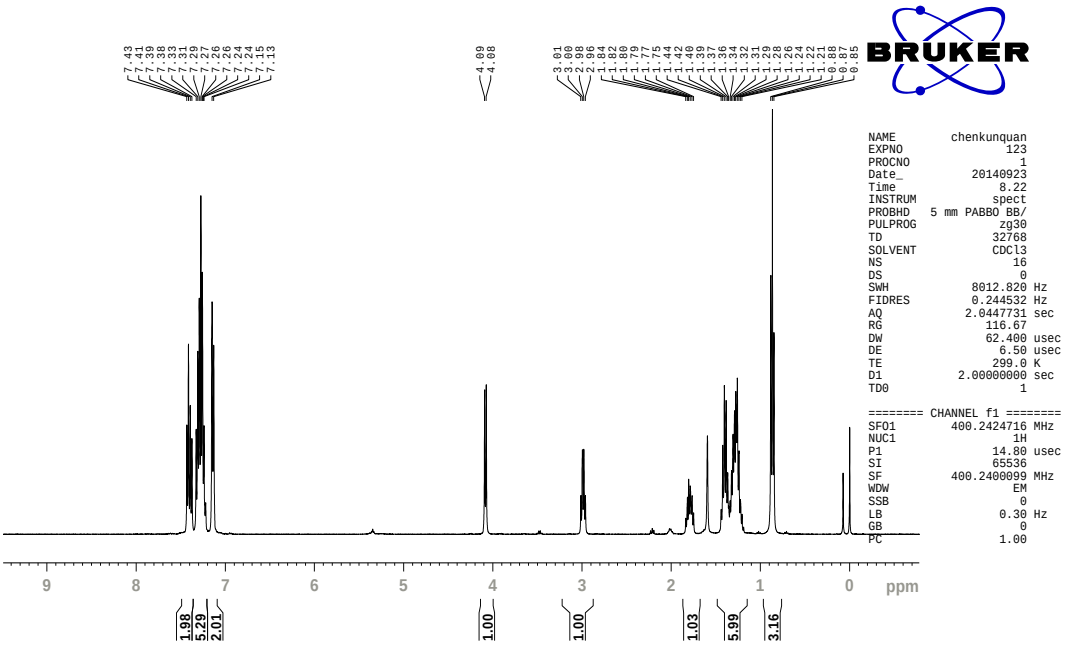



```
NAME          chenkunquan
EXPNO                  63
PROCNO                  1
Date_            20140903
Time                 8.37
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG           zgpg30
TD                  65536
SOLVENT             CDCl3
NS                     42
DS                      4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ             1.3631988 sec
RG                206.33
DW                20.800 usec
DE                  6.50 usec
TE                 301.5 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         100.6504916 MHz
NUC1                  13C
P1                 10.00 usec
SI                 32768
SF           100.6404161 MHz
WDW                    EM
SSB                     0
LB                   1.00 Hz
GB                      0
PC                   1.40
```

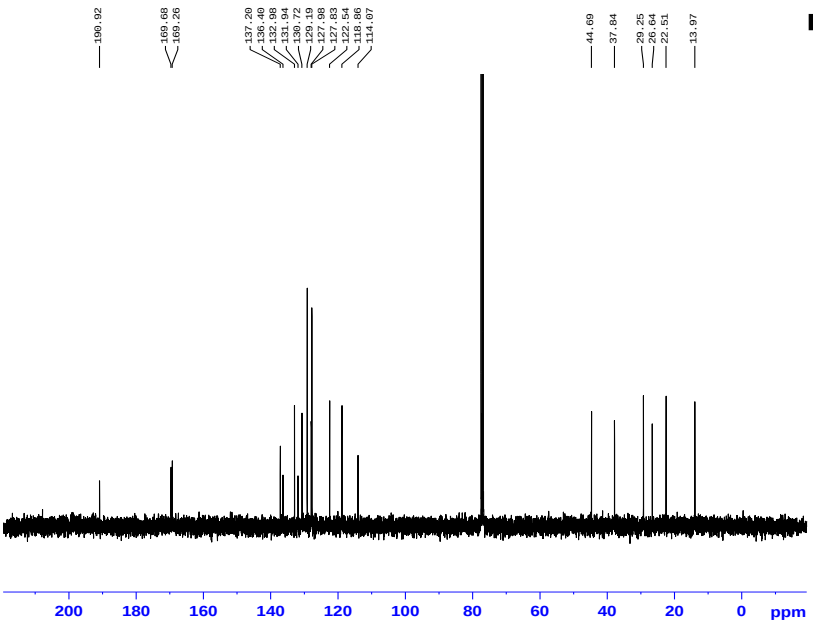


3m



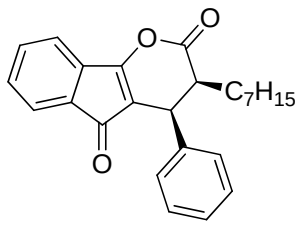

```
NAME        chenkunquan
EXPNO               123
PROCNO                1
Date_          20140923
Time               8.22
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ           2.0447731 sec
RG              116.67
DW              62.400 usec
DE               6.50 usec
TE              299.0 K
D1          2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        400.2424716 MHz
NUC1                  1H
P1               14.80 usec
SI               65536
SF          400.2400099 MHz
WDW                  EM
SSB                   0
LB               0.30 Hz
GB                    0
PC                 1.00
```

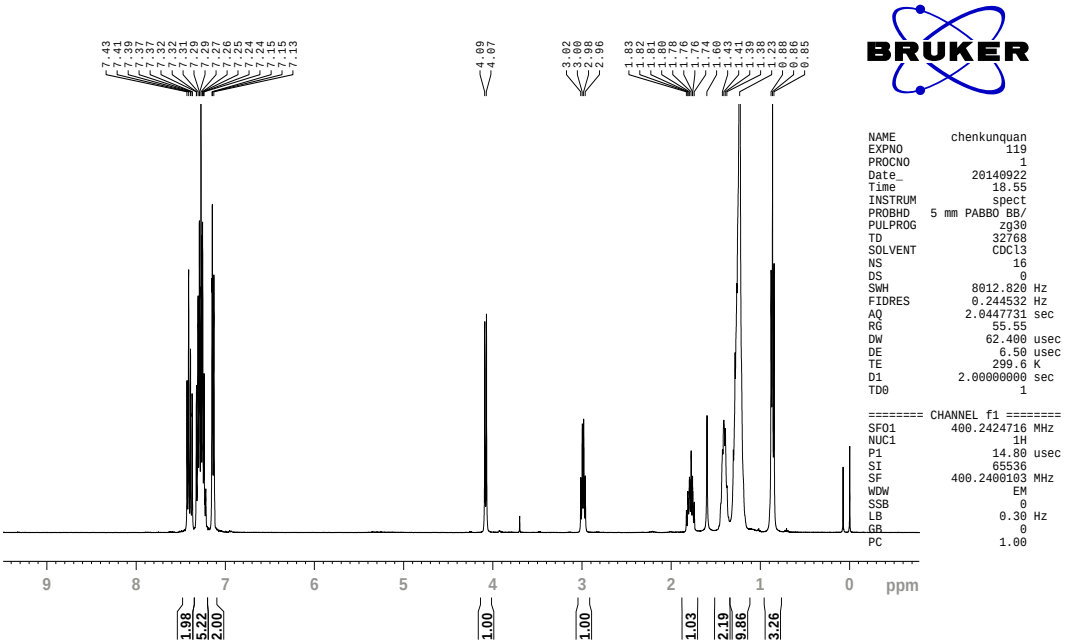



```
NAME        chenkunquan
EXPNO               124
PROCNO                1
Date_          20140923
Time               8.28
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD              65536
SOLVENT           CDCl3
NS                  148
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ           1.3631988 sec
RG              206.33
DW              20.800 usec
DE               6.50 usec
TE              300.2 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6504916 MHz
NUC1                 13C
P1               10.00 usec
SI               32768
SF          100.6404148 MHz
WDW                  EM
SSB                   0
LB               1.00 Hz
GB                    0
PC                 1.40
```

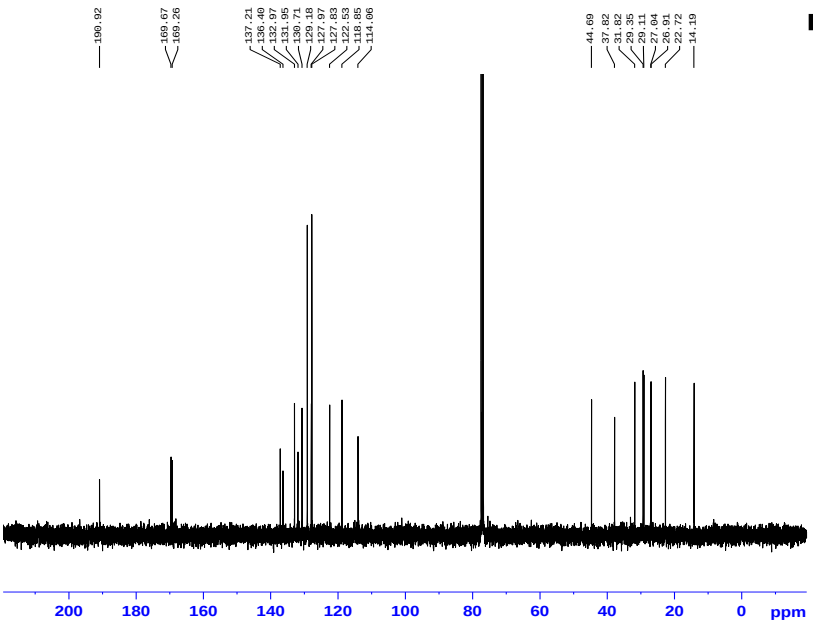


3n



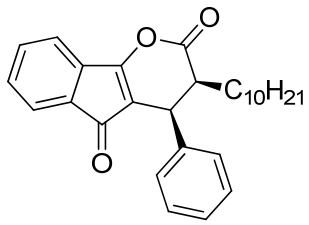

```
NAME          chenkunquan
EXPNO               119
PROCNO                1
Date_          20140922
Time              18.55
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ            2.0447731 sec
RG                55.55
DW                62.400 usec
DE                 6.50 usec
TE                299.6 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        400.2424716 MHz
NUC1                  1H
P1                14.80 usec
SI                65536
SF          400.2400103 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                  1.00
```

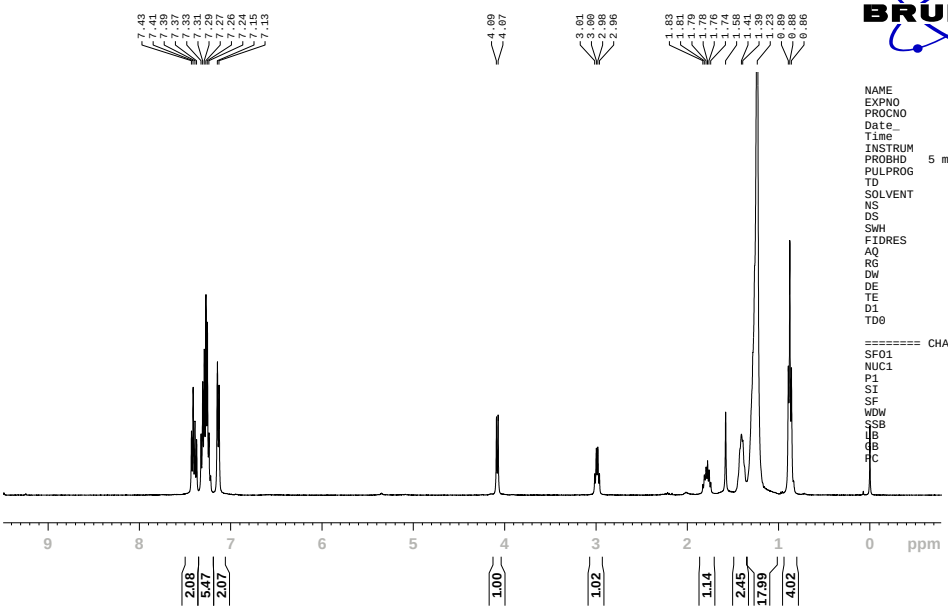



```
NAME          chenkunquan
EXPNO               120
PROCNO                1
Date_          20140922
Time              19.00
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  122
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG                206.33
DW                20.800 usec
DE                 6.50 usec
TE                300.6 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6504916 MHz
NUC1                 13C
P1                10.00 usec
SI                32768
SF          100.6404151 MHz
WDW                   EM
SSB                    0
LB                 1.00 Hz
GB                     0
PC                  1.40
```

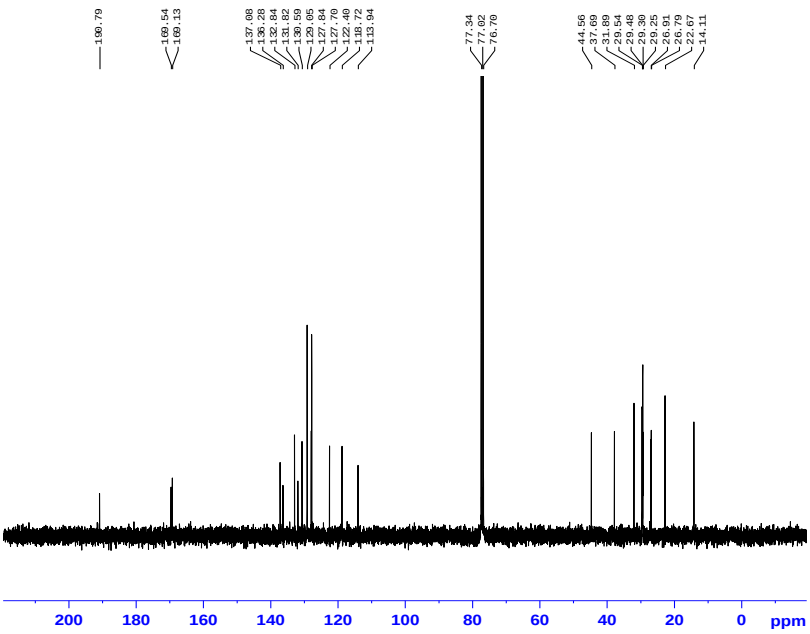


3o



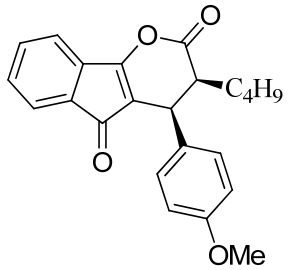

```
NAME          chenkunquan
EXPNO               102
PROCNO                1
Date_          20140917
Time              18.29
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG            zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ           2.0447731 sec
RG              102.73
DW              62.400 usec
DE               6.50 usec
TE              299.5 K
D1          2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        400.2424716 MHz
NUC1                1H
P1               14.80 usec
SI               65536
SF          400.2400102 MHz
WDW                 EM
SSB                  0
LB                0.30 Hz
GB                   0
PC                1.00
```



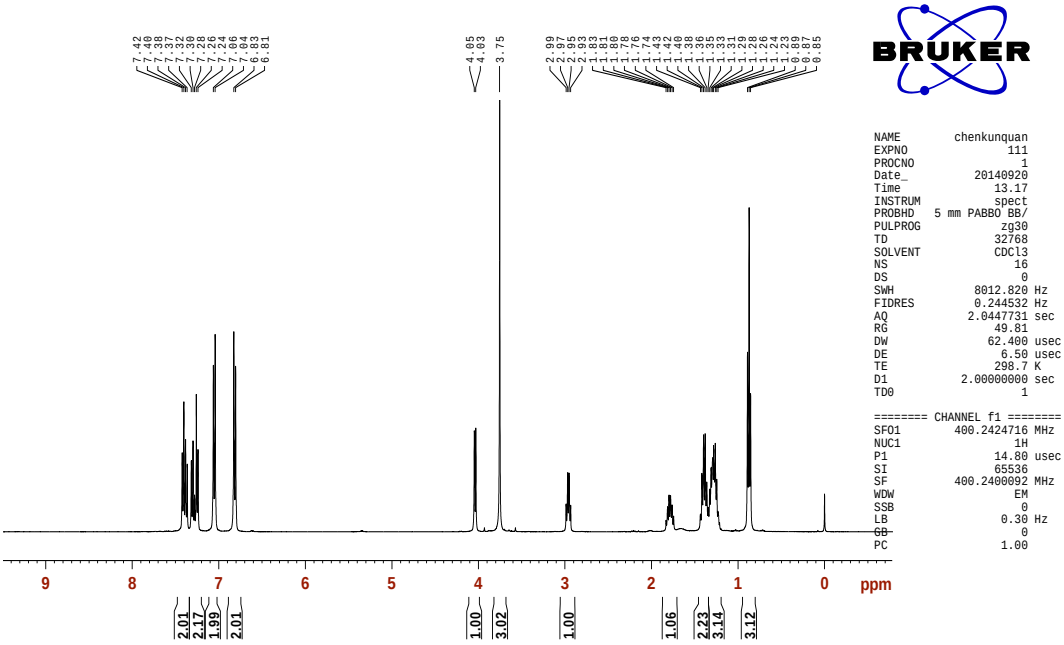

```
NAME          chenkunquan
EXPNO               103
PROCNO                1
Date_          20140917
Time              18.35
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                65536
SOLVENT           CDCl3
NS                  234
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ           1.3631988 sec
RG              206.33
DW              20.800 usec
DE               6.50 usec
TE              299.9 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6504916 MHz
NUC1                13C
P1               10.00 usec
SI               32768
SF          100.6404143 MHz
WDW                 EM
SSB                  0
LB                1.00 Hz
GB                   0
PC                1.40
```



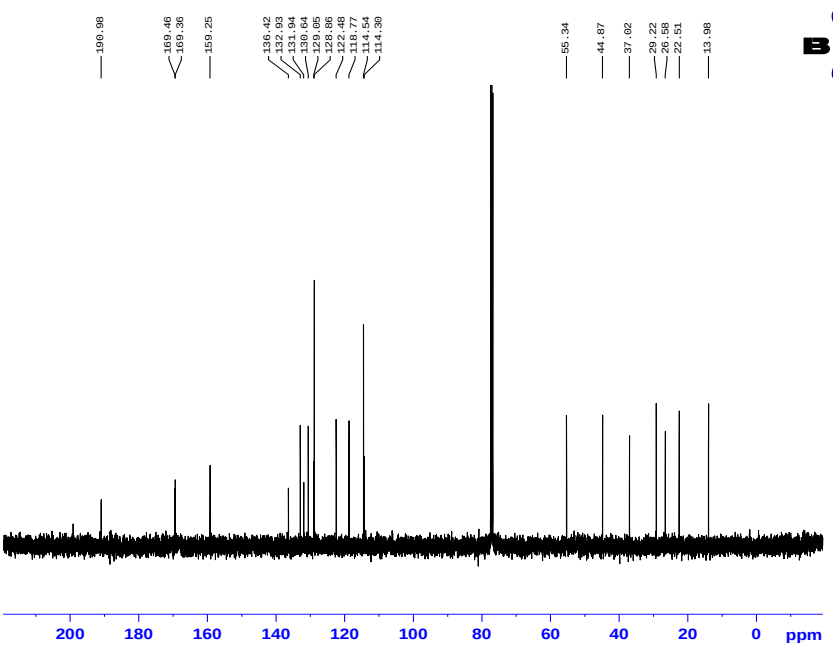
3p

b



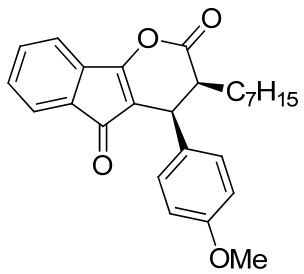

```
NAME        chenkunquan
EXPNO               111
PROCNO                1
Date_          20140920
Time             13.17
INSTRUM          spect
PROBHD   5 mm PABBO BB/
PULPROG           zg30
TD                32768
SOLVENT           CDCl3
NS                   16
DS                    0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ            2.0447731 sec
RG                49.81
DW               62.400 usec
DE                 6.50 usec
TE               298.7 K
D1           2.00000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        400.2424716 MHz
NUC1                  1H
P1                14.80 usec
SI                65536
SF          400.2400092 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
```

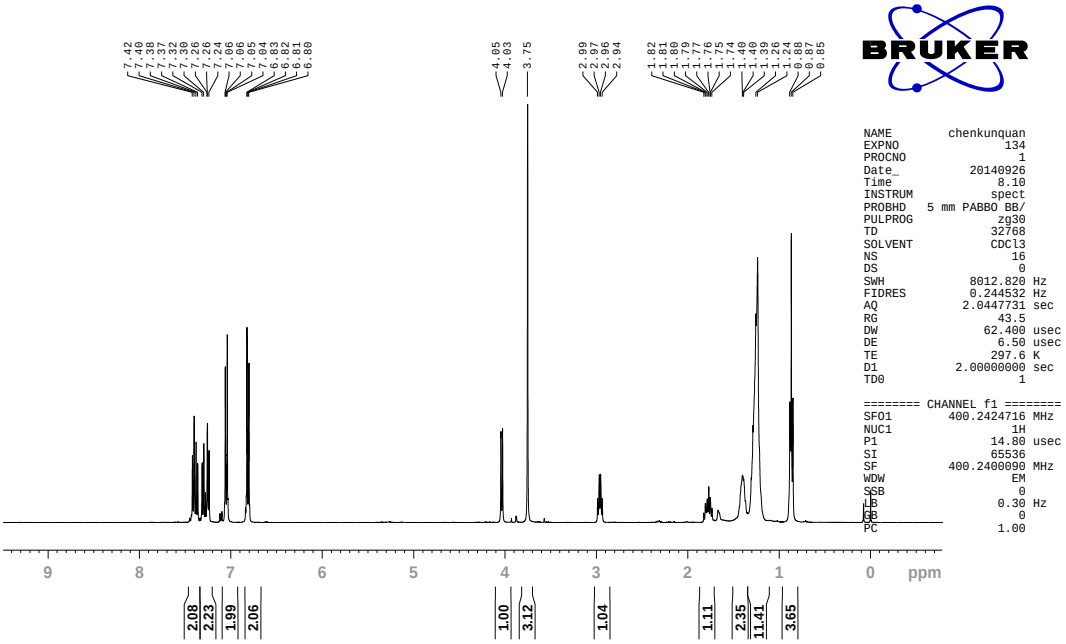



```
NAME        chenkunquan
EXPNO               112
PROCNO                1
Date_          20140920
Time             13.20
INSTRUM          spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD               65536
SOLVENT           CDCl3
NS                   44
DS                    4
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ            1.3631988 sec
RG               206.33
DW               20.800 usec
DE                 6.50 usec
TE               299.5 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6504916 MHz
NUC1                 13C
P1                10.00 usec
SI                32768
SF          100.6404173 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40
```

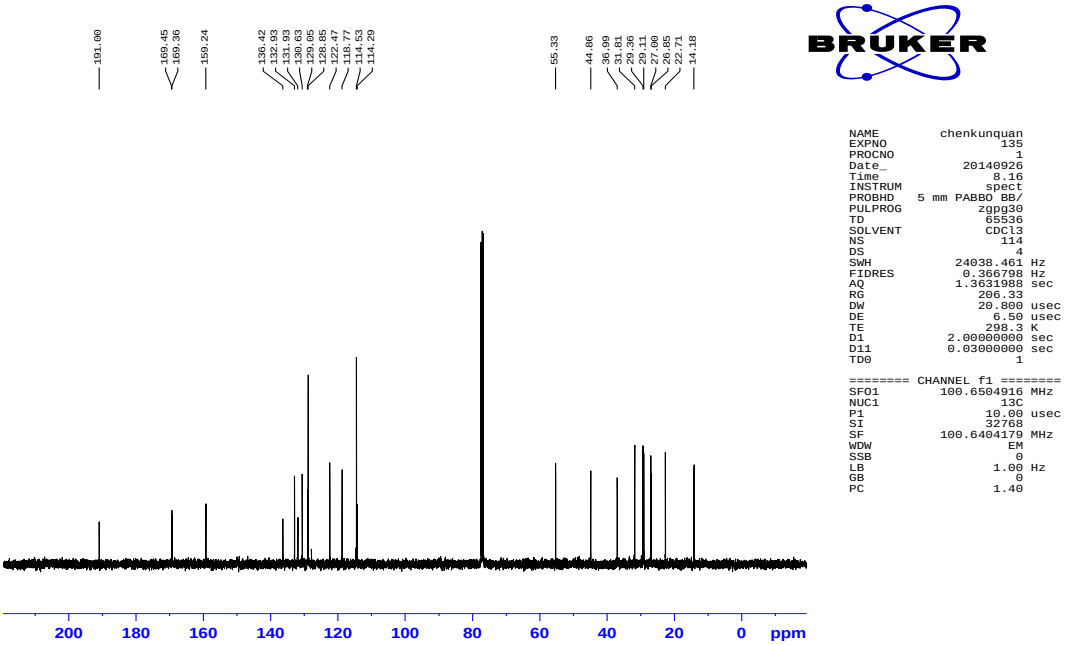


3q



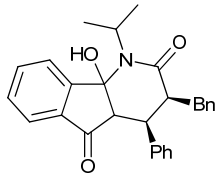

```
NAME          chenkunquan
EXPNO                 134
PROCNO                  1
Date_            20140926
Time                 8.10
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG              zg30
TD                  32768
SOLVENT             CDCl3
NS                     16
DS                      0
SWH             8012.820 Hz
FIDRES          0.244532 Hz
AQ            2.0447731 sec
RG                   43.5
DW                 62.400 usec
DE                  6.50 usec
TE                 297.6 K
D1            2.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         400.2424716 MHz
NUC1                   1H
P1                 14.80 usec
SI                 65536
SF           400.2400090 MHz
WDW                    EM
SSB                     0
LB                   0.30 Hz
GB                      0
PC                   1.00
```

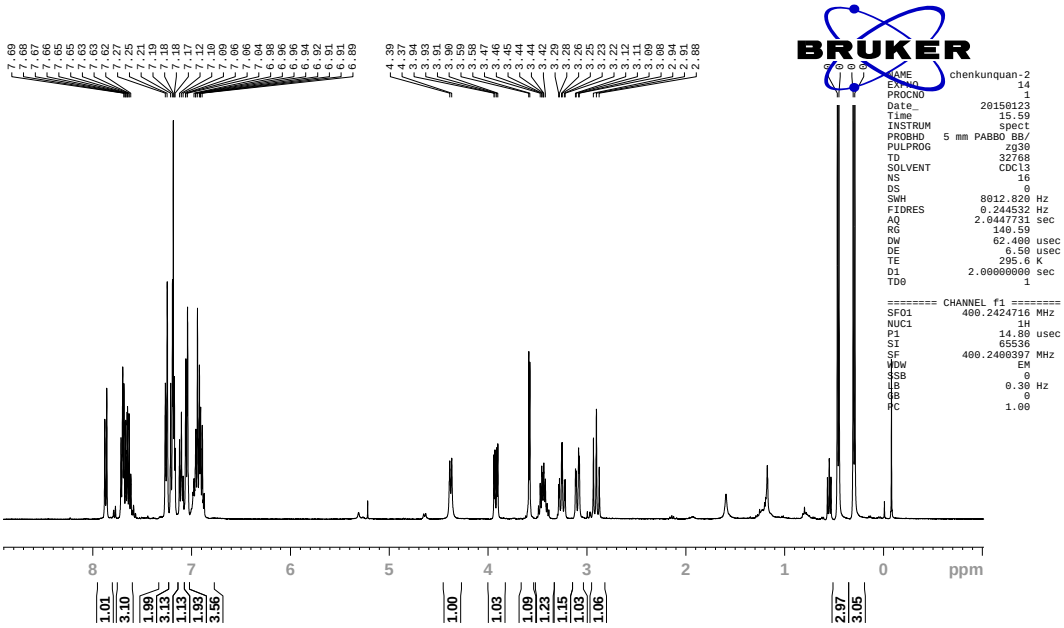


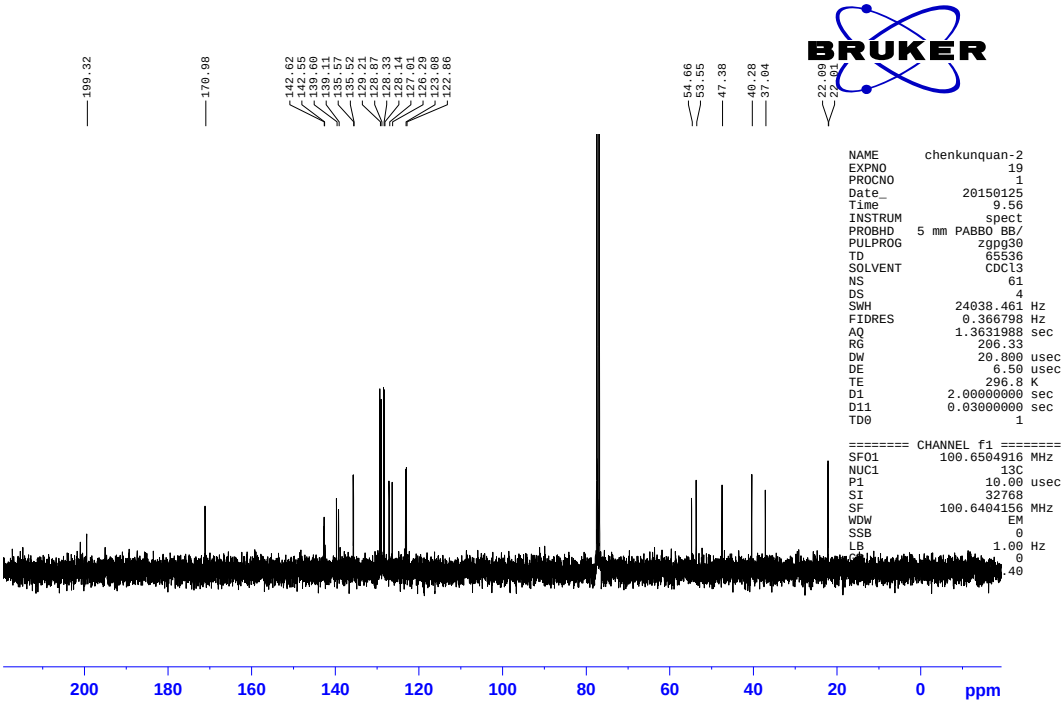

```
NAME          chenkunquan
EXPNO                 135
PROCNO                  1
Date_            20140926
Time                 8.16
INSTRUM             spect
PROBHD    5 mm PABBO BB/
PULPROG           zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    114
DS                      4
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ            1.3631988 sec
RG                  206.33
DW                 20.800 usec
DE                  6.50 usec
TE                 298.3 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         100.6504916 MHz
NUC1                  13C
P1                 10.00 usec
SI                 32768
SF           100.6404179 MHz
WDW                    EM
SSB                     0
LB                   1.00 Hz
GB                      0
PC                   1.40
```

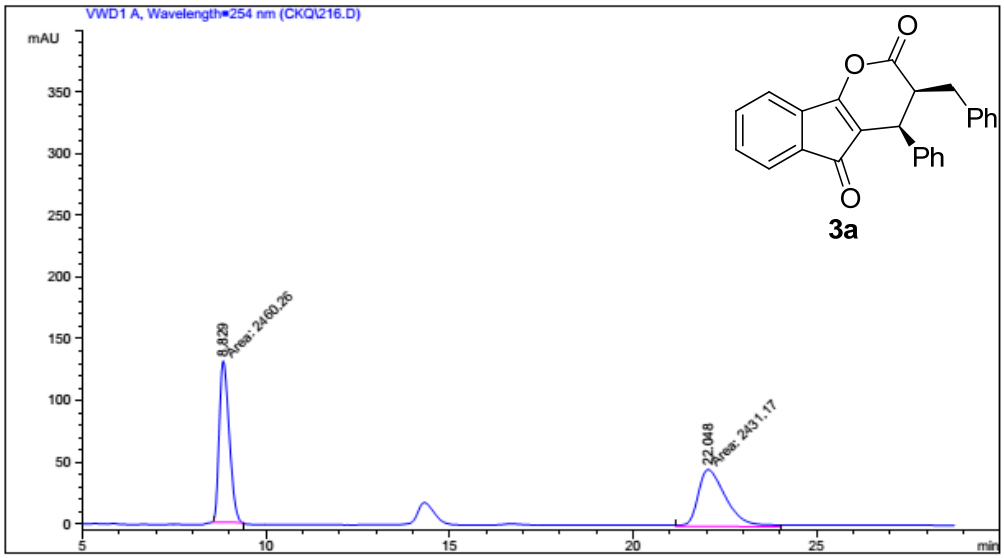

HO
N
O
Bn
Ph
O

6a


7.69 7.68 7.67 7.66 7.65 7.65 7.63 7.63 7.62 7.62 7.27 7.25 7.21 7.19 7.18 7.18 7.17 7.12 7.10 7.09 7.06 7.06 7.04 6.98 6.96 6.96 6.94 6.92 6.91 6.91 6.89
4.39 4.37 3.94 3.93 3.91 3.90 3.59 3.58 3.47 3.46 3.45 3.44 3.44 3.42 3.29 3.28 3.26 3.25 3.23 3.22 3.12 3.11 3.09 3.08 2.94 2.91 2.88
BRUKER
NAME chenkunquan-2
EXPNO 14
PROCNO 1
Date_ 20150123
Time 15.59
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 16
DS 0
SWH 8012.820 Hz
FIDRES 0.244532 Hz
AQ 2.0447731 sec
RG 140.59
DW 62.400 usec
DE 6.50 usec
TE 295.6 K
D1 2.00000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 400.2424716 MHz
NUC1 1H
P1 14.80 usec
SI 65536
SF 400.2400397 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
8 7 6 5 4 3 2 1 0 ppm
1.01 3.10 1.99 3.13 1.13 1.93 3.56 1.00 1.03 1.09 1.23 1.15 1.03 1.06 2.97 3.05


199.32 170.98 142.62 142.55 139.60 139.11 135.57 135.52 129.21 128.87 128.33 128.14 127.01 126.29 123.08 122.86 54.66 53.55 47.38 40.28 37.04 22.09 22.01
BRUKER
NAME chenkunquan-2
EXPNO 19
PROCNO 1
Date_ 20150125
Time 9.56
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 61
DS 4
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 206.33
DW 20.800 usec
DE 6.50 usec
TE 296.8 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6504916 MHz
NUC1 13C
P1 10.00 usec
SI 32768
SF 100.6404156 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
200 180 160 140 120 100 80 60 40 20 0 ppm

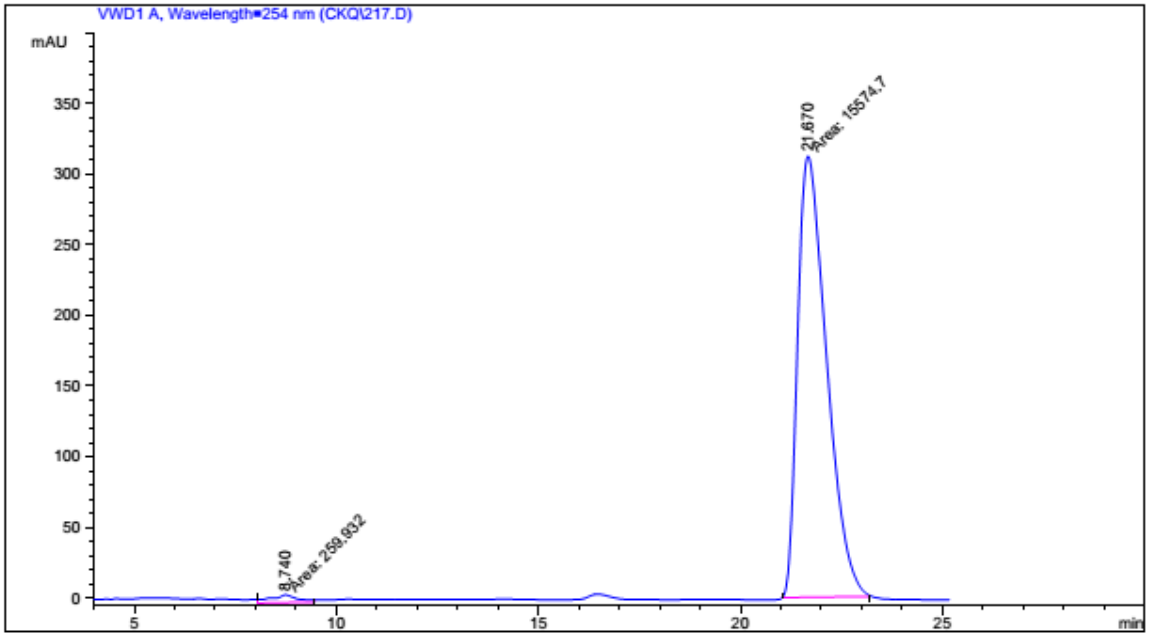
Part III HPLC Spectra



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.829	MM	0.3140	2460.26416	130.58856	50.2974
2	22.048	MM	0.8815	2431.16943	45.96867	49.7026

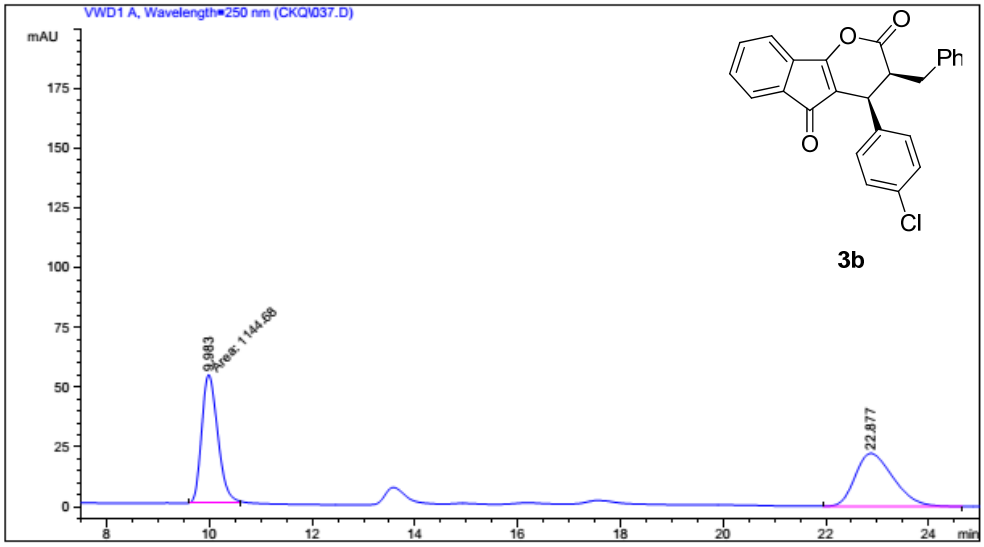
Totals : 4891.43359 176.55723



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.740	MM	0.7977	259.93222	5.43081	1.6415
2	21.670	MM	0.8323	1.55747e4	311.88501	98.3585

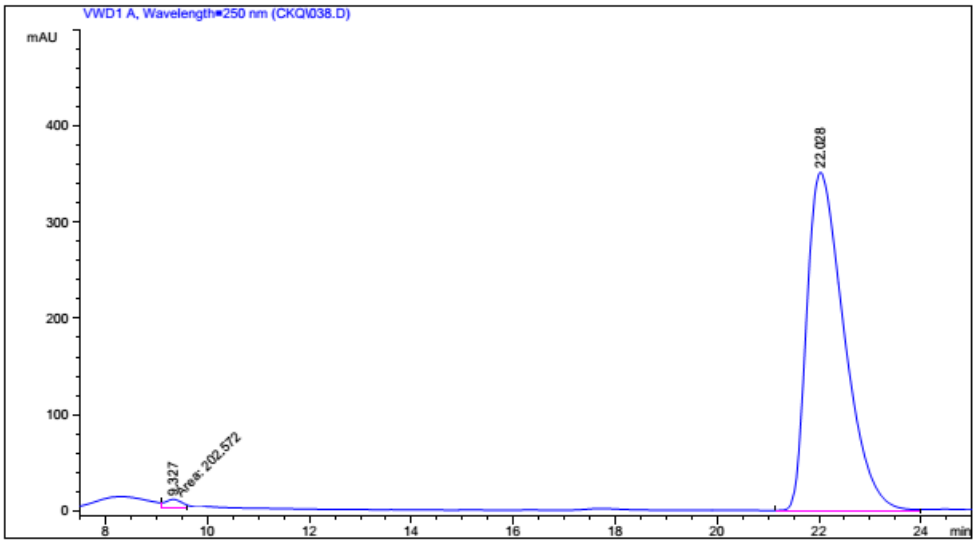
Totals : 1.58346e4 317.31582



Signal 1: VWD1 A, Wavelength=250 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.983	MM	0.3587	1144.67651	53.18369	50.1196
2	22.877	BB	0.8089	1139.21313	22.17828	49.8804

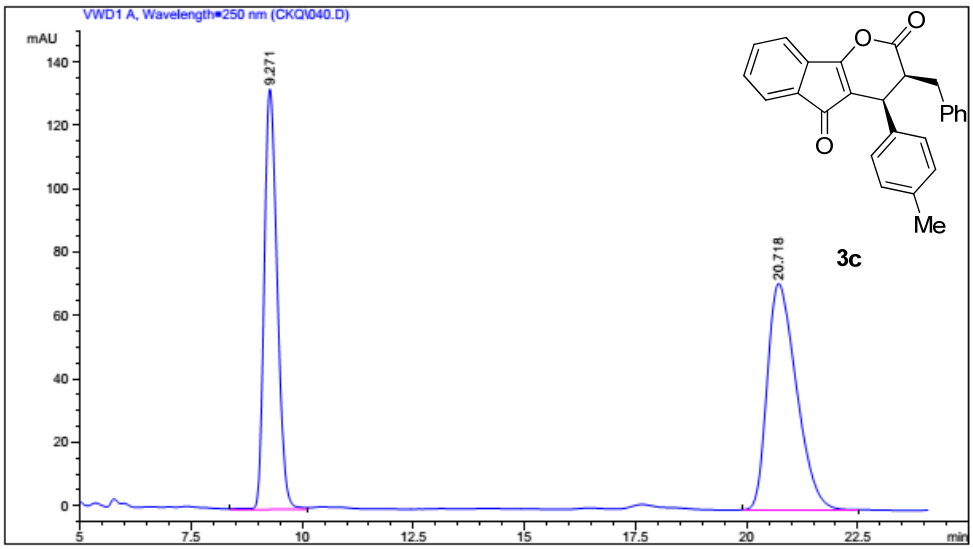
Totals : 2283.88965 75.36196



Signal 1: VWD1 A, Wavelength=250 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.327	MM	0.3780	202.57224	8.93257	1.1258
2	22.028	BV	0.7839	1.77904e4	350.78397	98.8742

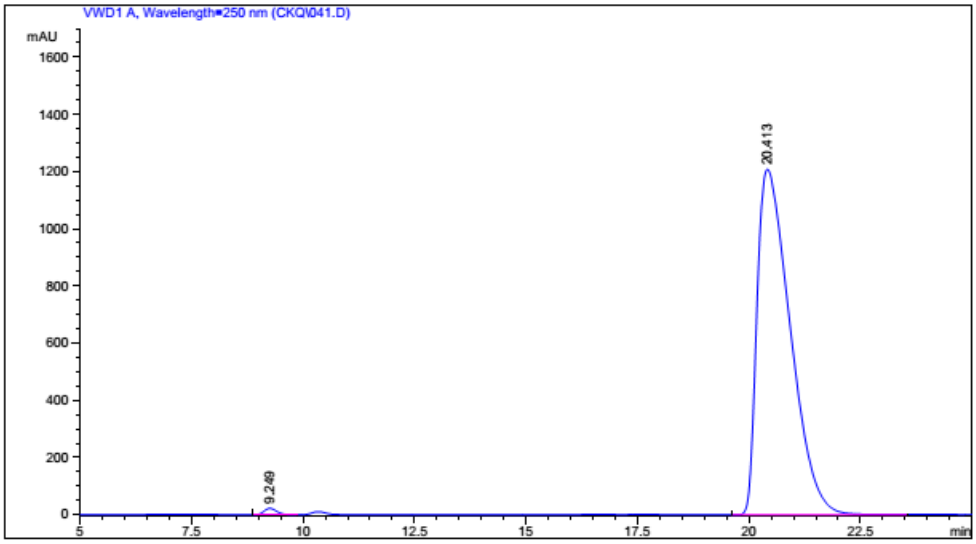
Totals : 1.79929e4 359.71654



Signal 1: VWD1 A, Wavelength=250 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.271	VV	0.3178	2687.53076	132.68779	45.1173
2	20.718	BB	0.7171	3269.22729	71.47204	54.8827

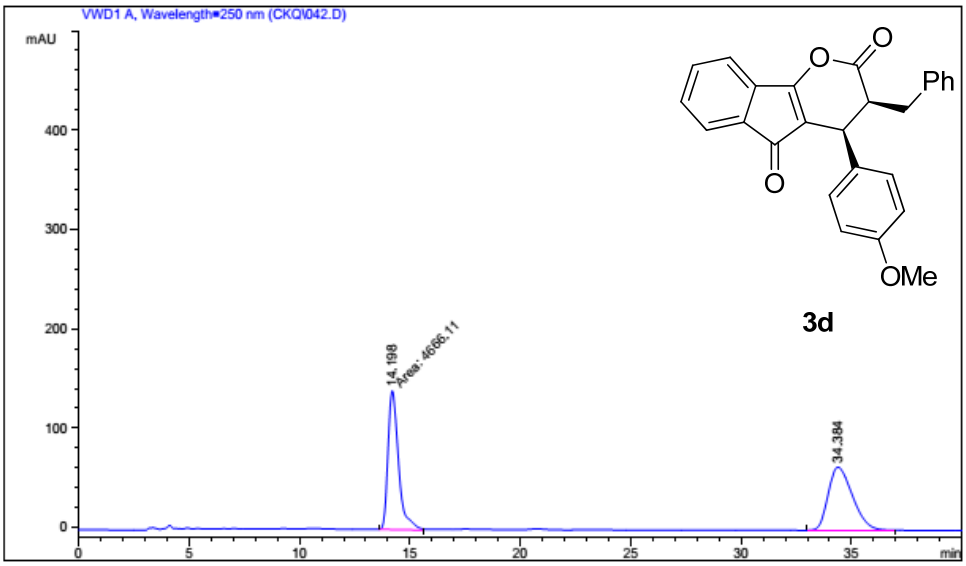
Totals : 5956.75806 204.15983



Signal 1: VWD1 A, Wavelength=250 nm

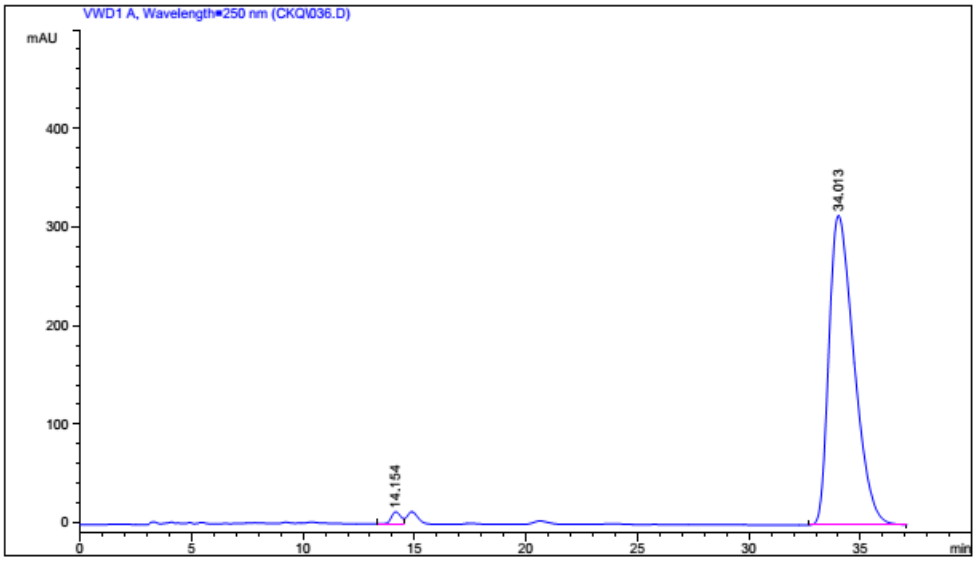
Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.249	VV	0.3188	483.77078	23.49799	0.7691
2	20.413	BV	0.8149	6.24205e4	1209.01868	99.2309

Totals : 6.29043e4 1232.51666



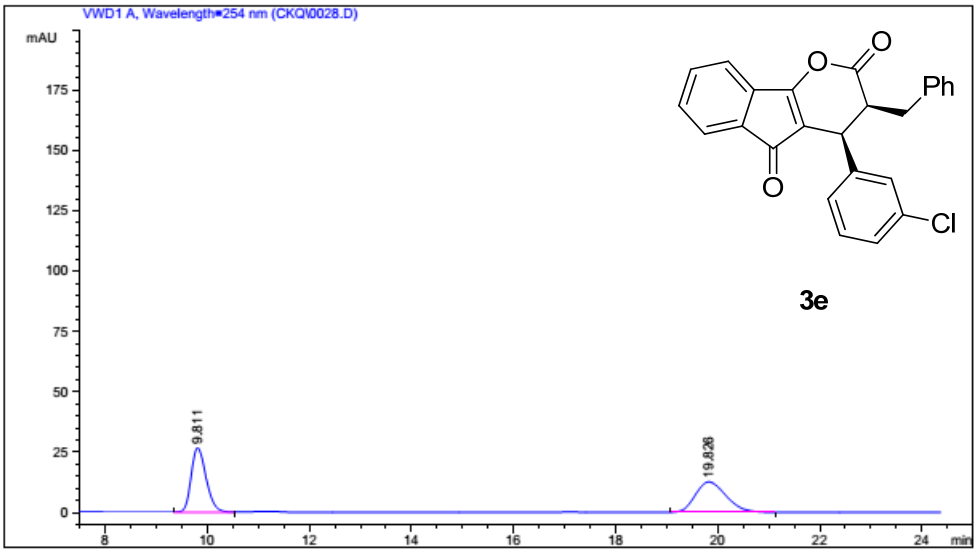
Signal 1: VWD1 A, Wavelength=250 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.198	MM	0.5570	4666.10889	139.61084	48.8717
2	34.384	BB	1.1684	4881.56055	63.65647	51.1283
Totals :				9547.66943	203.26731	



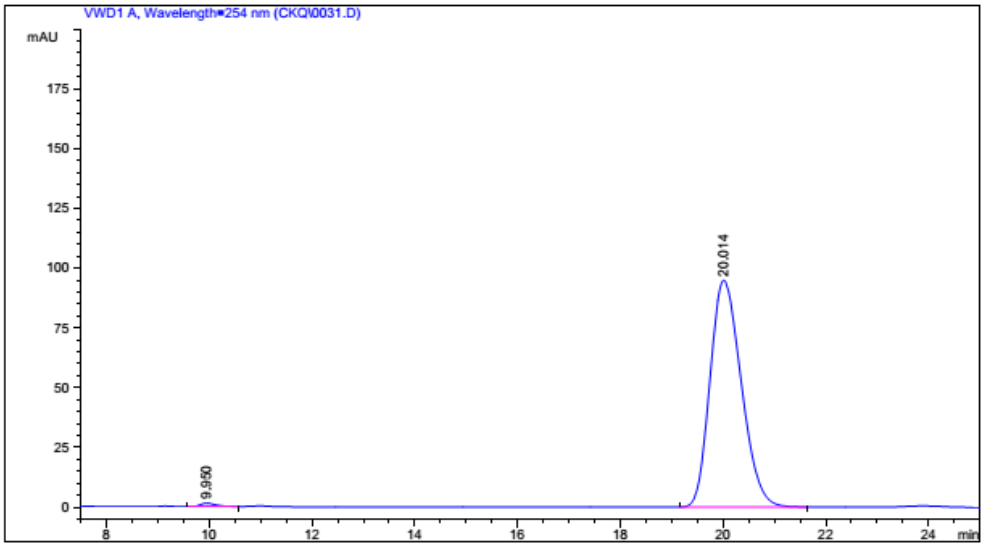
Signal 1: VWD1 A, Wavelength=250 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.154	BV	0.4675	370.51138	12.31554	1.4908
2	34.013	BBA	1.2127	2.44828e4	313.94543	98.5092
Totals :				2.48533e4	326.26098	



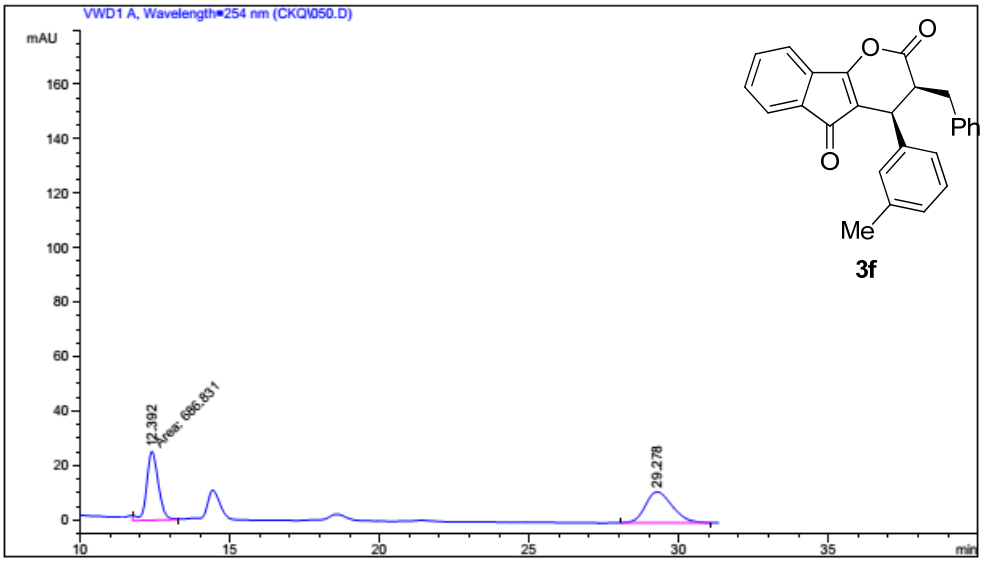
Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.811	BB	0.3168	546.39587	26.76026	50.8122
2	19.826	BB	0.6530	528.92828	12.67052	49.1878
Totals :				1075.32416	39.43078	



Signal 1: VWD1 A, Wavelength=254 nm

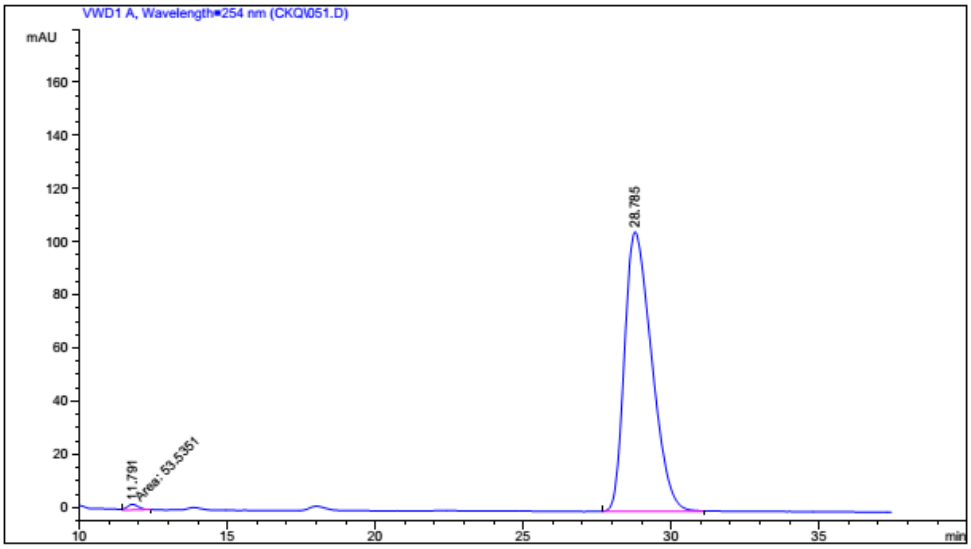
Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.950	VB	0.3458	34.26419	1.51294	0.8492
2	20.014	BB	0.6637	4000.41431	94.88999	99.1508
Totals :				4034.67850	96.40293	



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.392	MM	0.4540	686.83081	25.21660	49.1754
2	29.278	BB	0.9664	709.86456	11.33640	50.8246

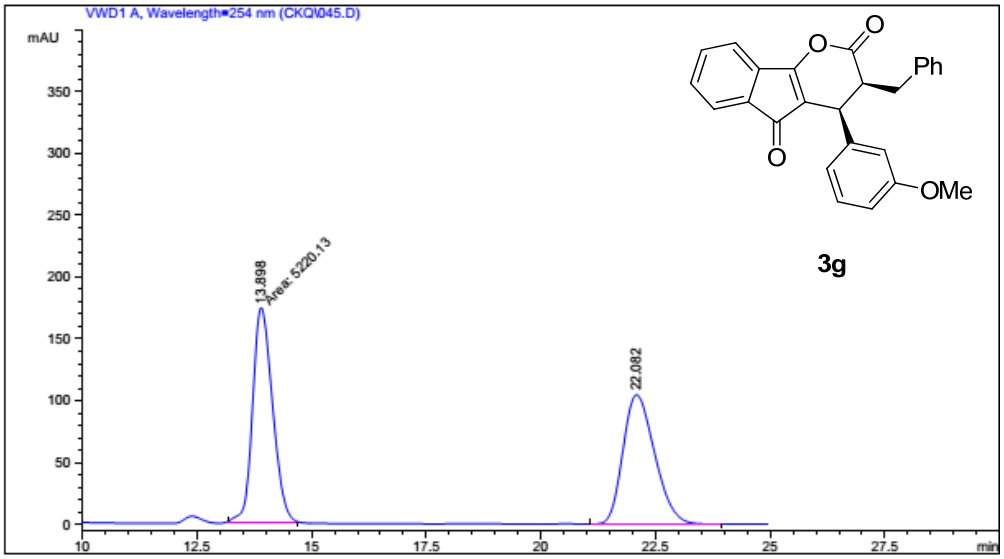
Totals : 1396.69537 36.55300



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.791	MM	0.4242	53.53511	2.10350	0.7938
2	28.785	BB	0.9872	6690.70947	105.11819	99.2062

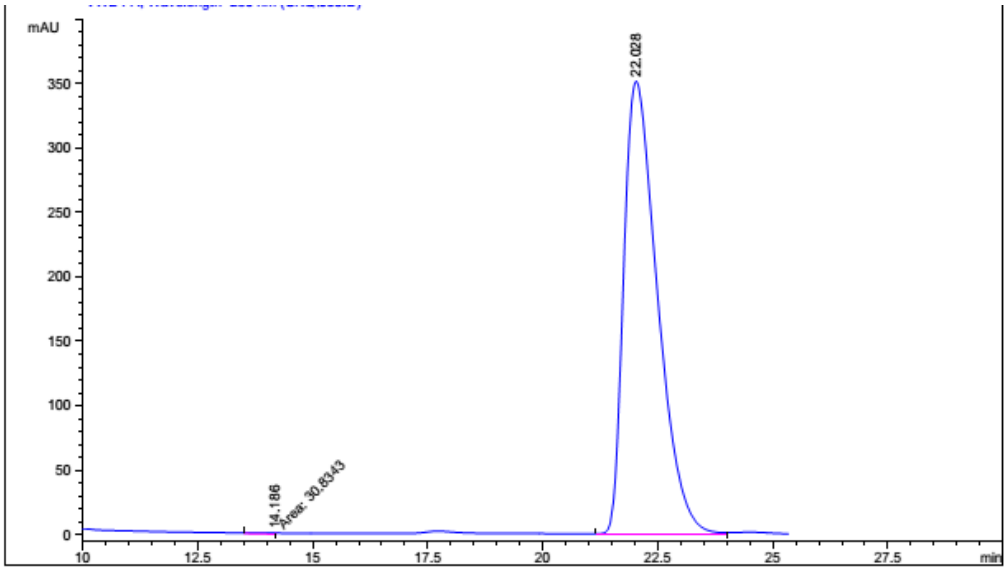
Totals : 6744.24459 107.22169



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	13.898	MM	0.4956	5111.50293	171.89182	50.4471
2	22.083	BB	0.7524	5020.89160	104.56728	49.5529

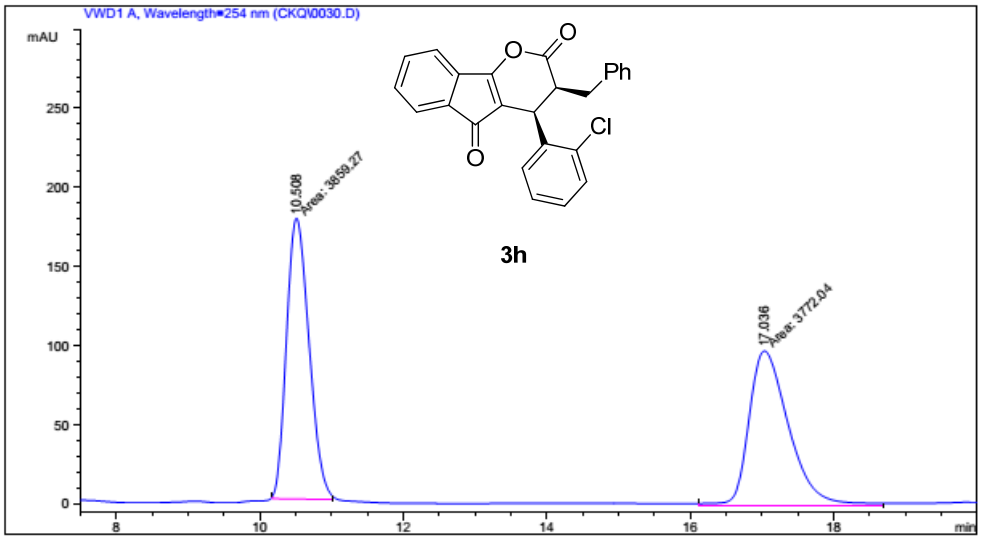
Totals : 1.01324e4 276.45909



Signal 1: VWD1 A, Wavelength=250 nm

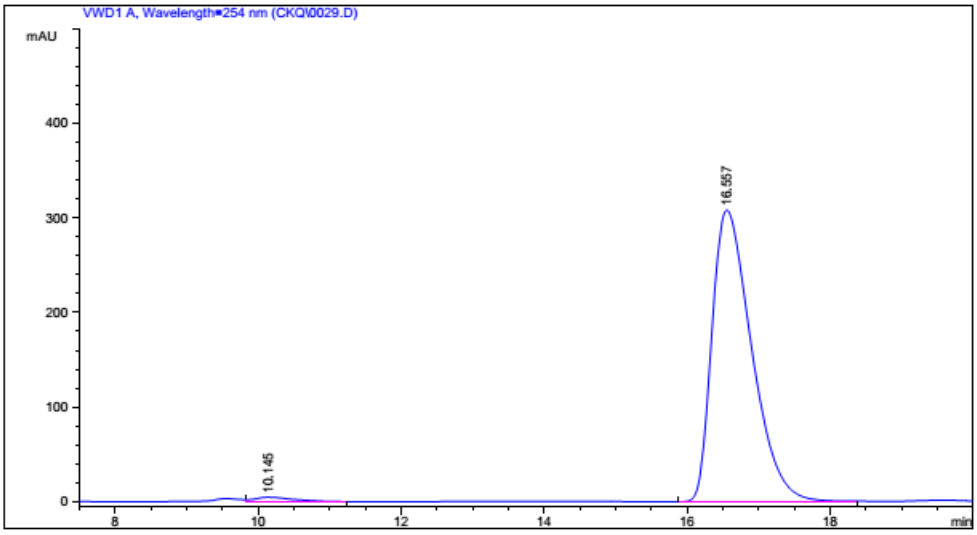
Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.186	MM	0.5712	30.83428	8.99637e-1	0.1730
2	22.028	BV	0.7839	1.77904e4	350.78397	99.8270

Totals : 1.78212e4 351.68360



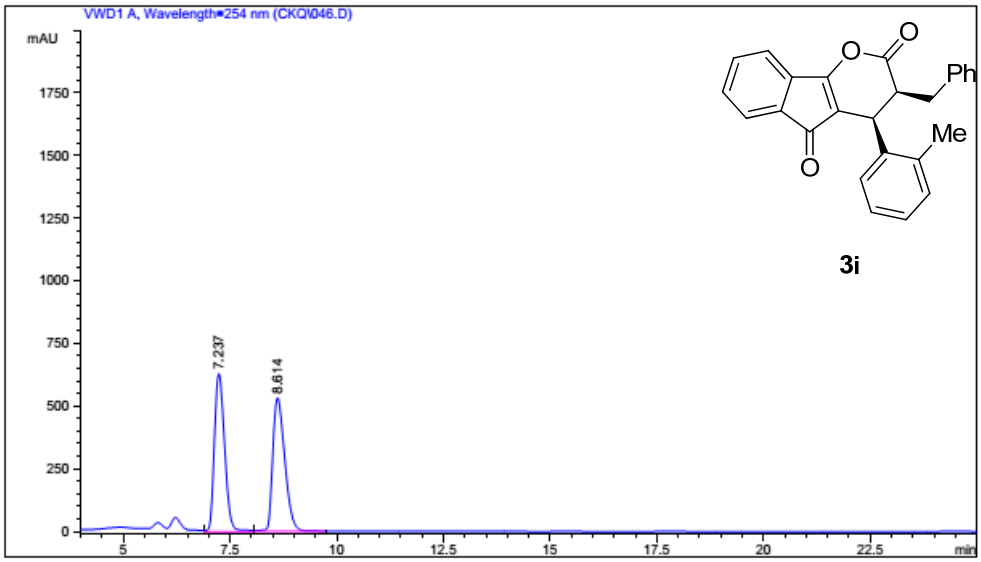
Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.508	MM	0.3628	3859.26587	177.31168	50.5715
2	17.036	MM	0.6440	3772.03760	97.61858	49.4285
Totals :				7631.30347	274.93026	



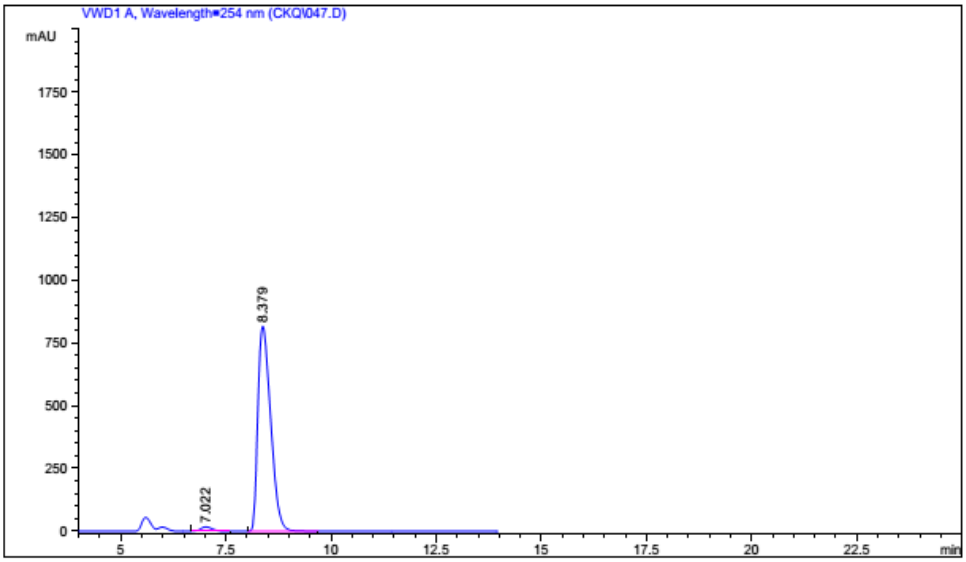
Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.145	VV	0.5319	186.31311	4.95513	1.5484
2	16.557	BB	0.5972	1.18462e4	308.05206	98.4516
Totals :				1.20325e4	313.00719	



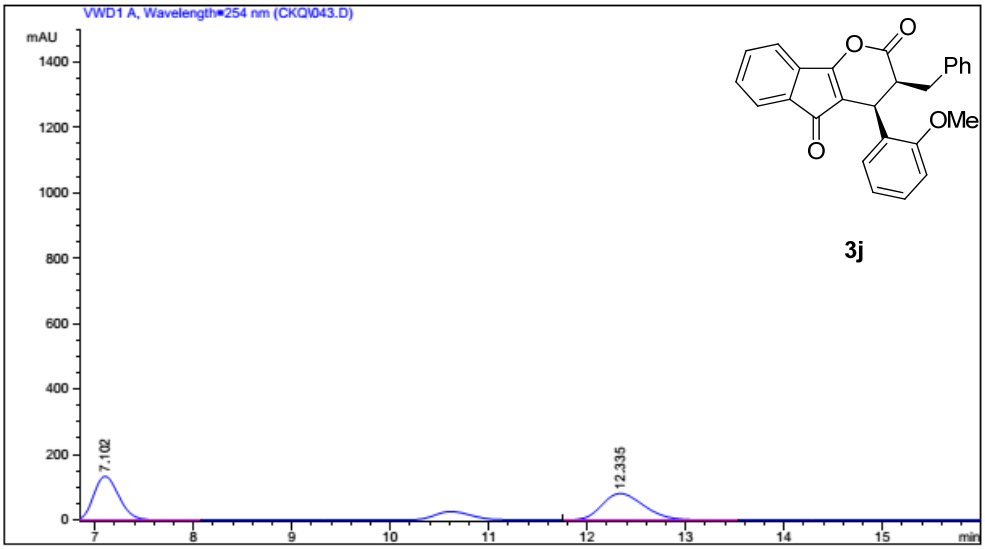
Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.237	VV	0.2642	1.04923e4	629.86584	49.9546
2	8.614	VB	0.3115	1.05113e4	533.36584	50.0454
Totals :				2.10036e4	1163.23169	



Signal 1: VWD1 A, Wavelength=254 nm

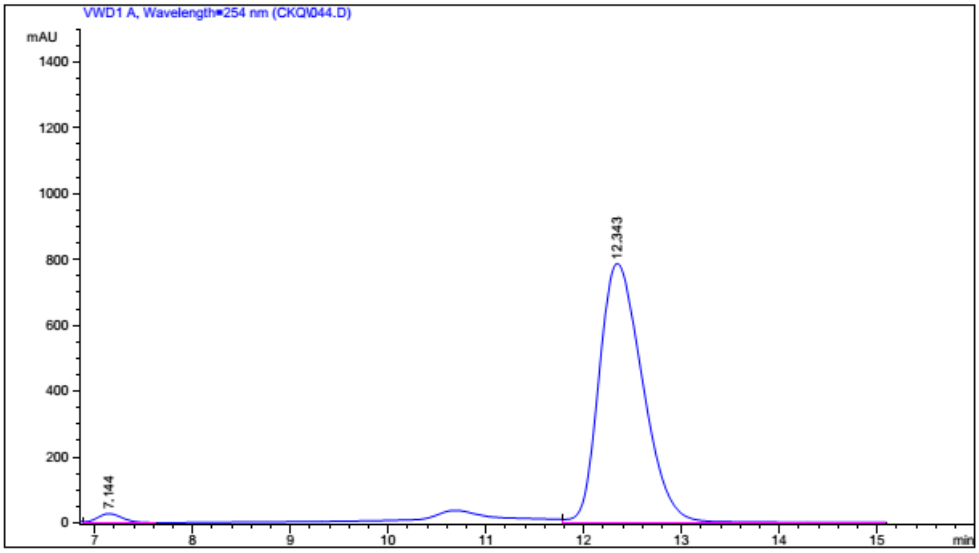
Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.022	BB	0.3009	341.75986	17.70912	1.9405
2	8.379	BB	0.3341	1.72703e4	816.68665	98.0595
Totals :				1.76121e4	834.39577	



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.102	VB	0.2768	2372.89575	133.78534	49.7292
2	12.335	BB	0.4633	2398.73779	81.38552	50.2708

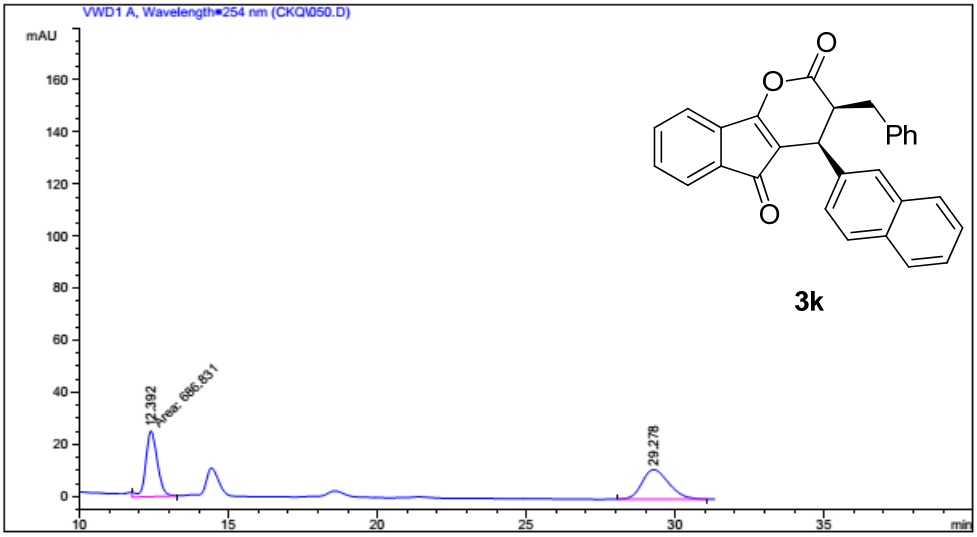
Totals : 4771.63354 215.17086



Signal 1: VWD1 A, Wavelength=254 nm

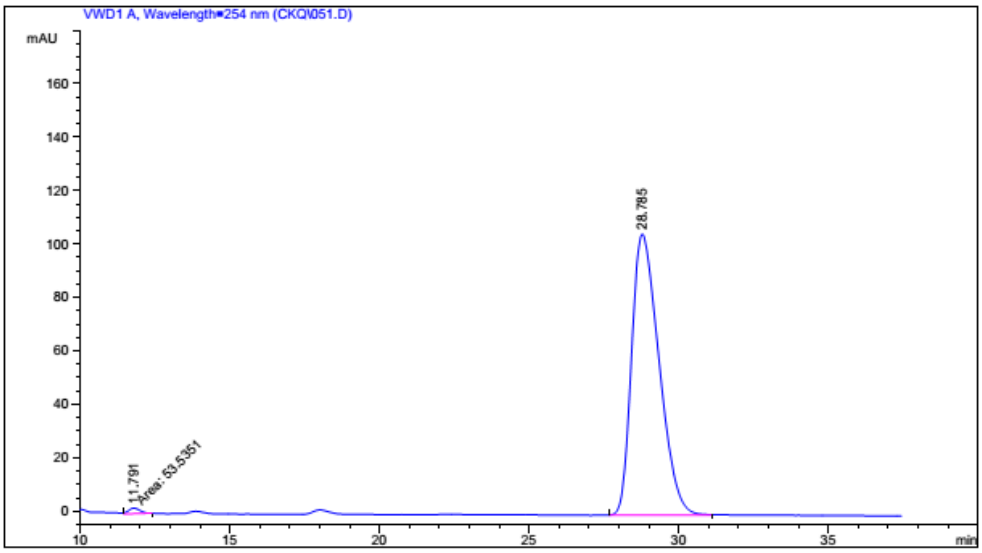
Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.144	VV	0.2865	540.55304	29.11505	2.1450
2	12.343	VBA	0.4901	2.46599e4	788.36188	97.8550

Totals : 2.52004e4 817.47693



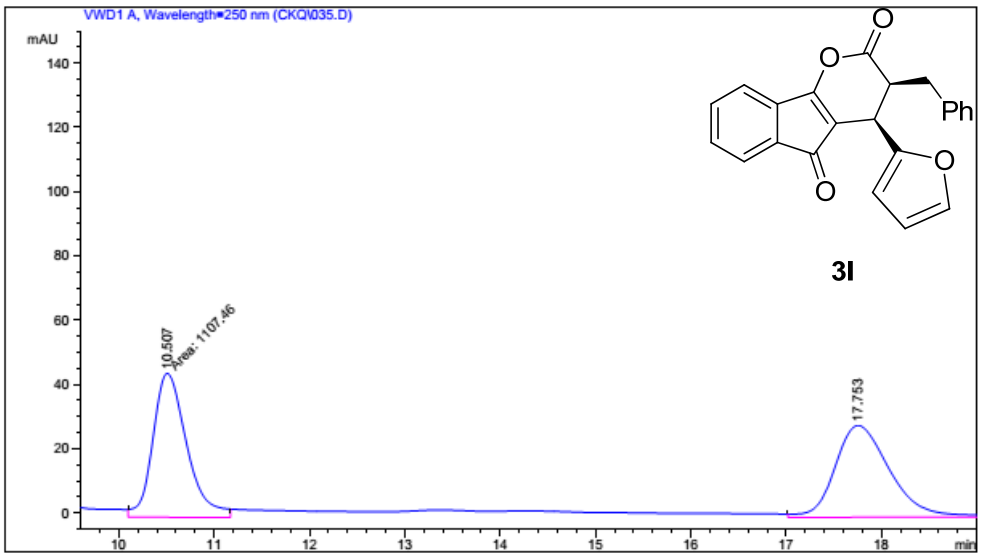
Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.392	MM	0.4540	686.83081	25.21660	49.1754
2	29.278	BB	0.9664	709.86456	11.33640	50.8246
Totals :				1396.69537	36.55300	



Signal 1: VWD1 A, Wavelength=254 nm

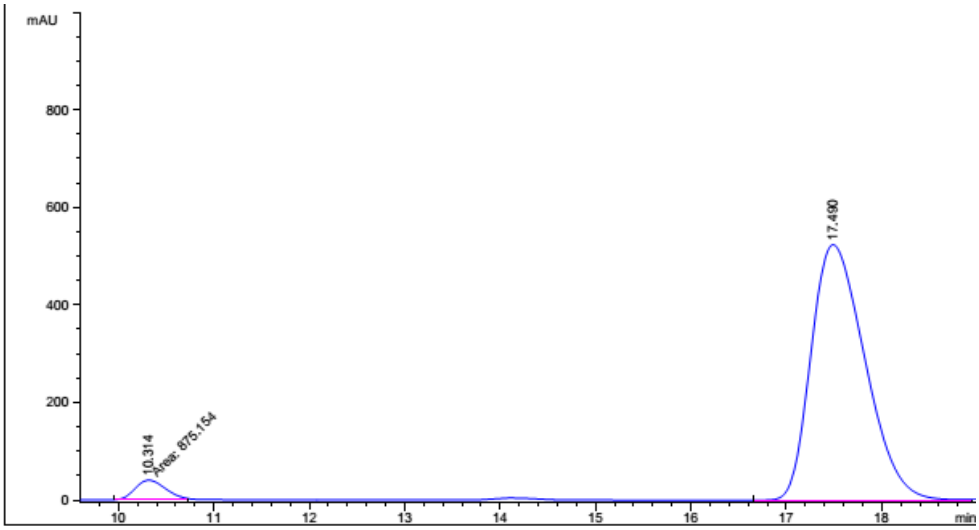
Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	11.791	MM	0.4242	53.53511	2.10350	0.7938
2	28.785	BB	0.9872	6690.70947	105.11819	99.2062
Totals :				6744.24459	107.22169	



Signal 1: VWD1 A, Wavelength=250 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.507	MM	0.4116	1107.45813	44.84256	49.3850
2	17.753	VV	0.6119	1135.03906	28.57982	50.6150

Totals : 2242.49719 73.42238

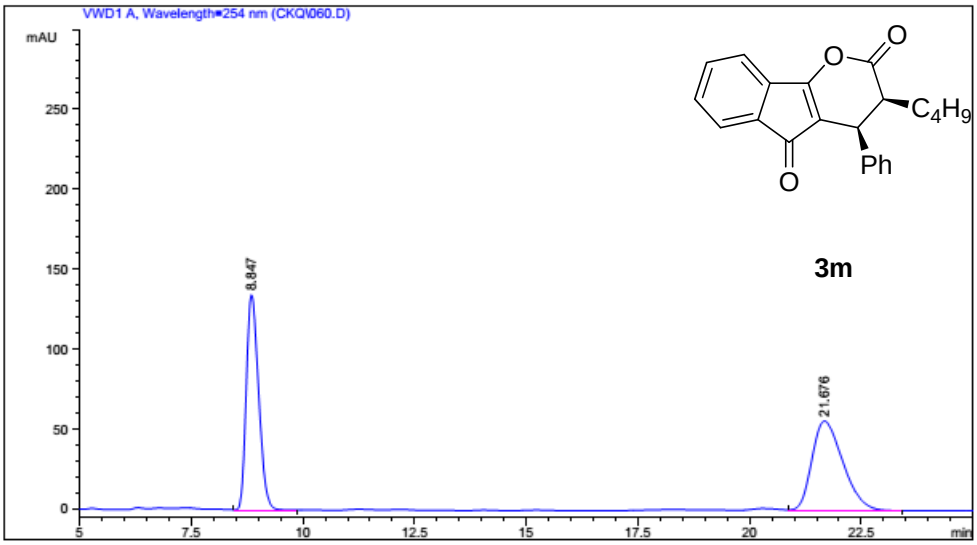


Signal 1: VWD1 A, Wavelength=250 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	10.314	MM	0.3647	875.15436	39.99582	4.0882
2	17.490	VV	0.6203	2.05318e4	523.90674	95.9118

Totals : 2.14069e4 563.90256

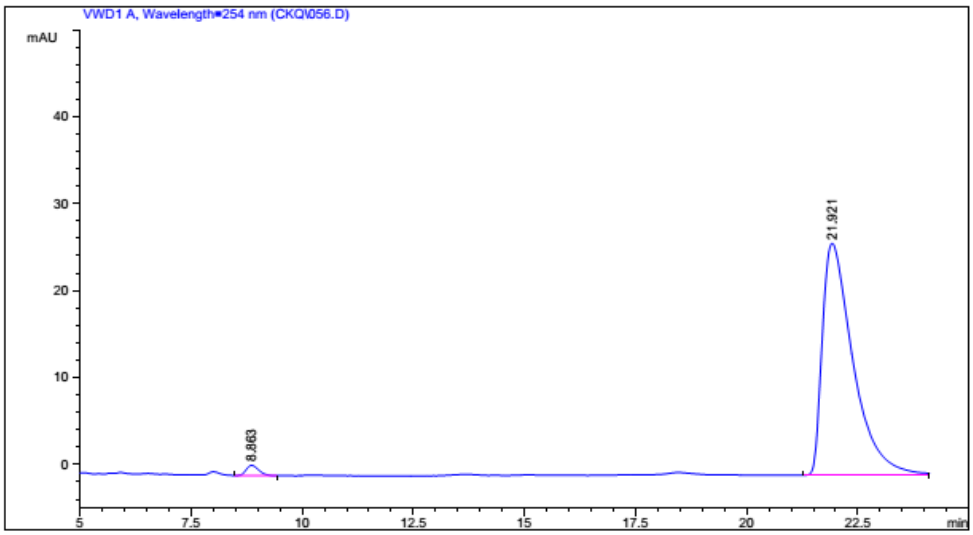
*** End of Report ***



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.847	VB	0.3050	2619.57764	135.01904	49.2036
2	21.676	VB	0.7522	2704.37671	56.04406	50.7964

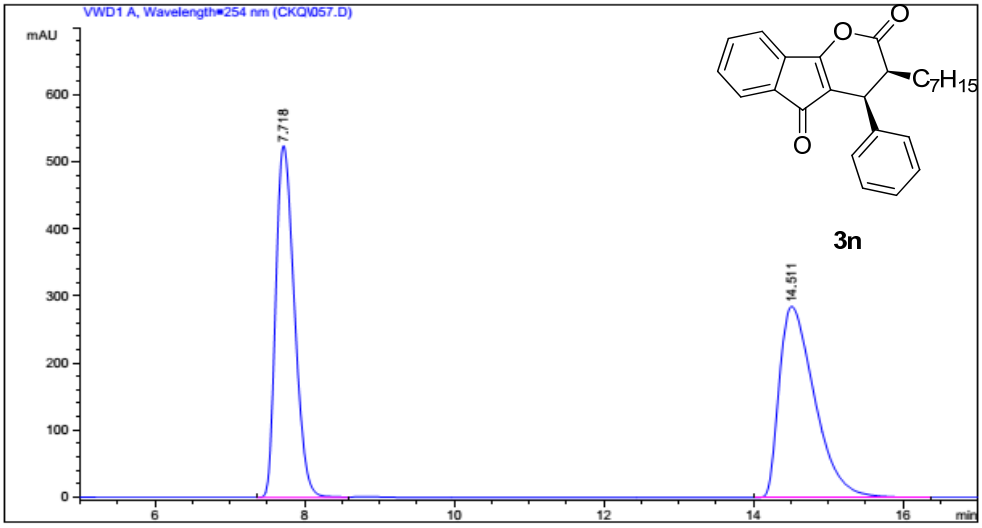
Totals : 5323.95435 191.06310



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.863	BB	0.3129	23.10641	1.18021	1.7674
2	21.921	BBA	0.7300	1284.27917	26.70242	98.2326

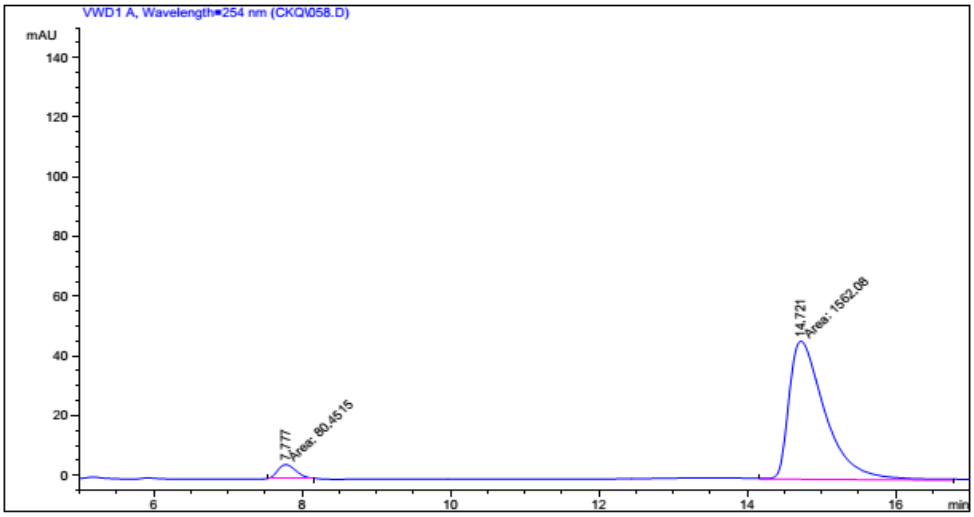
Totals : 1307.38559 27.88263



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.718	VV	0.2715	9063.87109	524.55243	49.1490
2	14.511	VB	0.5150	9377.73633	284.93484	50.8510

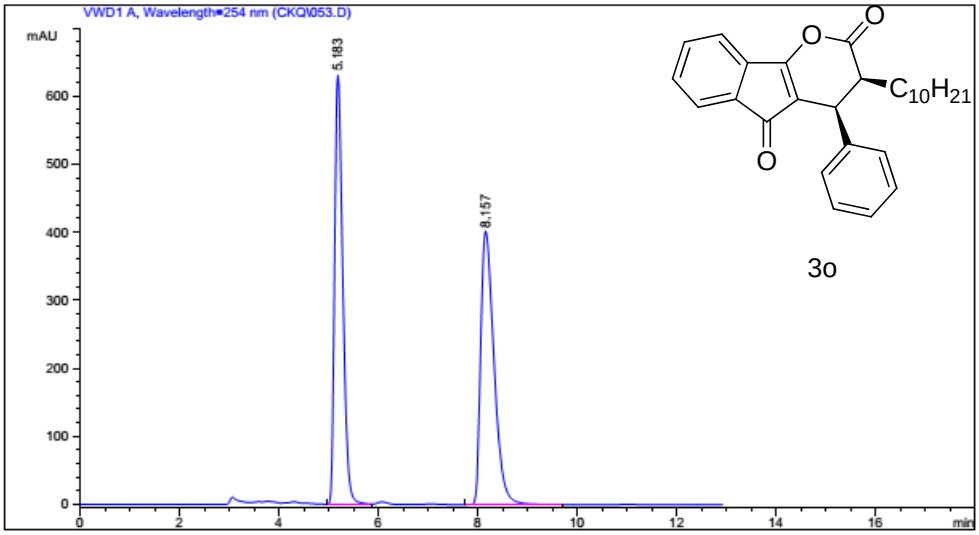
Totals : 1.84416e4 809.48727



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	7.777	MM	0.2848	80.45146	4.70843	4.8980
2	14.721	MM	0.5625	1562.08057	46.28295	95.1020

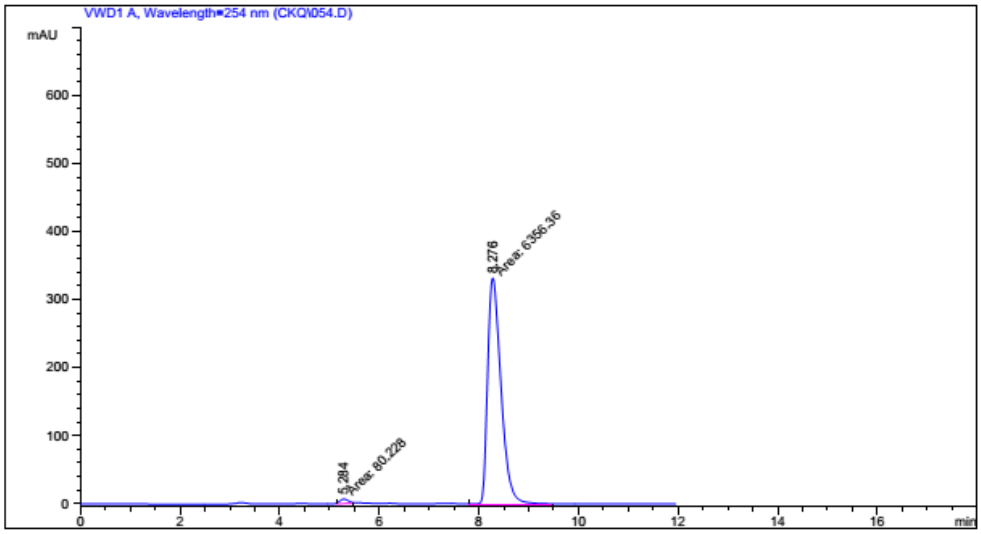
Totals : 1642.53203 50.99138



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	5.183	VV	0.1781	7198.24512	631.40192	49.1743
2	8.157	BB	0.2858	7439.98730	401.96634	50.8257

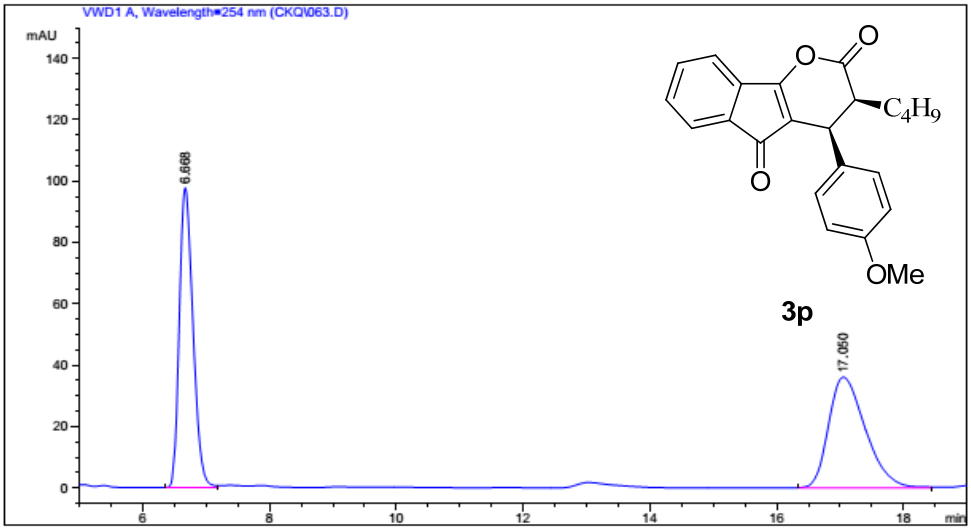
Totals : 1.46382e4 1033.36826



Signal 1: VWD1 A, Wavelength=254 nm

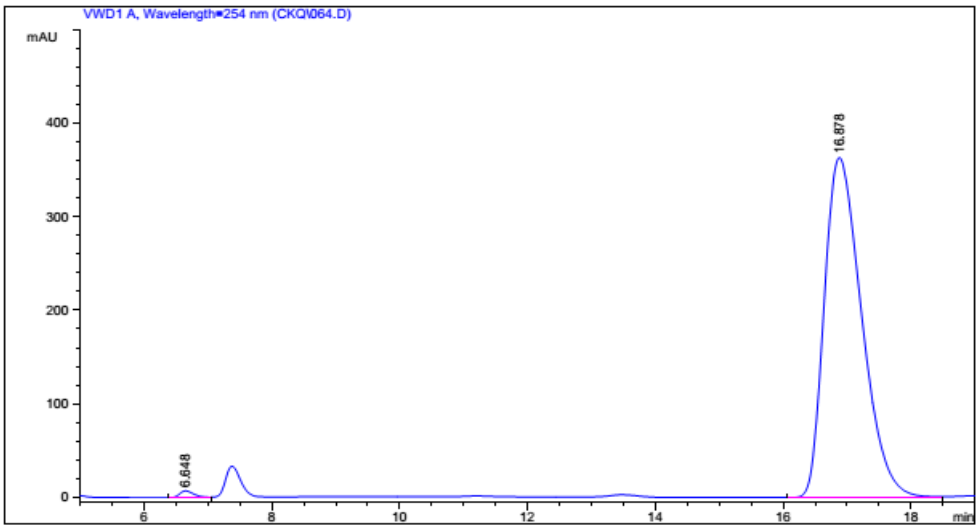
Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	5.284	MM	0.1958	80.22803	6.82960	1.2464
2	8.276	MM	0.3169	6356.35889	334.27701	98.7536

Totals : 6436.58691 341.10661



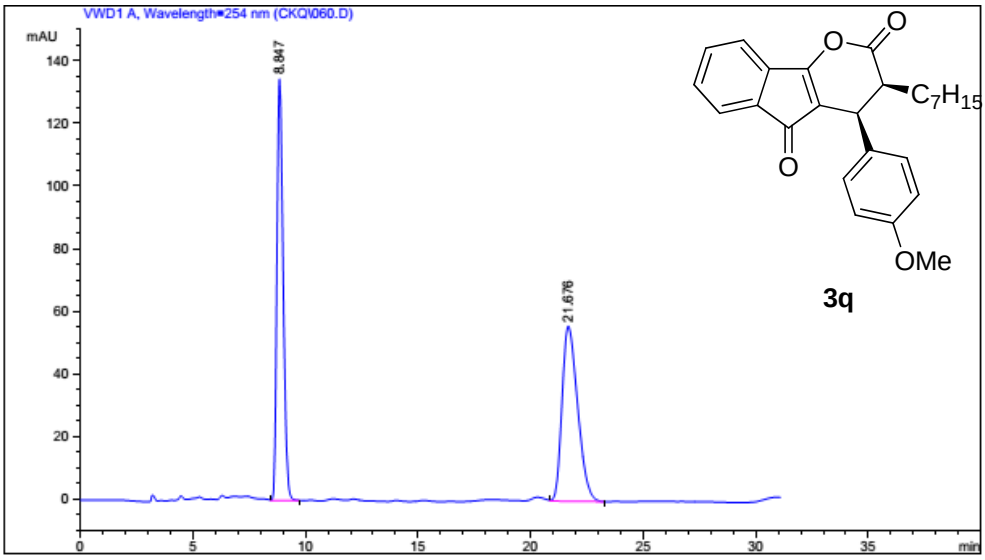
Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.668	BV	0.2350	1455.70264	97.67773	49.9320
2	17.050	BB	0.6228	1459.66943	36.12666	50.0680
Totals :				2915.37207	133.80439	



Signal 1: VWD1 A, Wavelength=254 nm

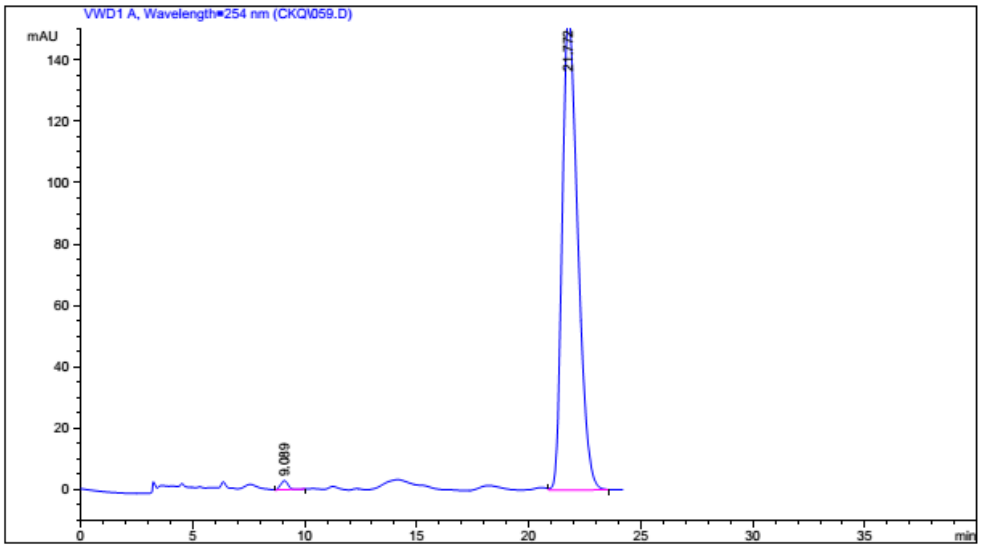
Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.648	BV	0.2430	122.85062	7.63569	0.8248
2	16.878	VV	0.6404	1.47715e4	363.26697	99.1752
Totals :				1.48943e4	370.90266	



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.847	VB	0.3028	2587.64844	134.66537	49.0441
2	21.676	VB	0.7503	2688.52100	55.90675	50.9559

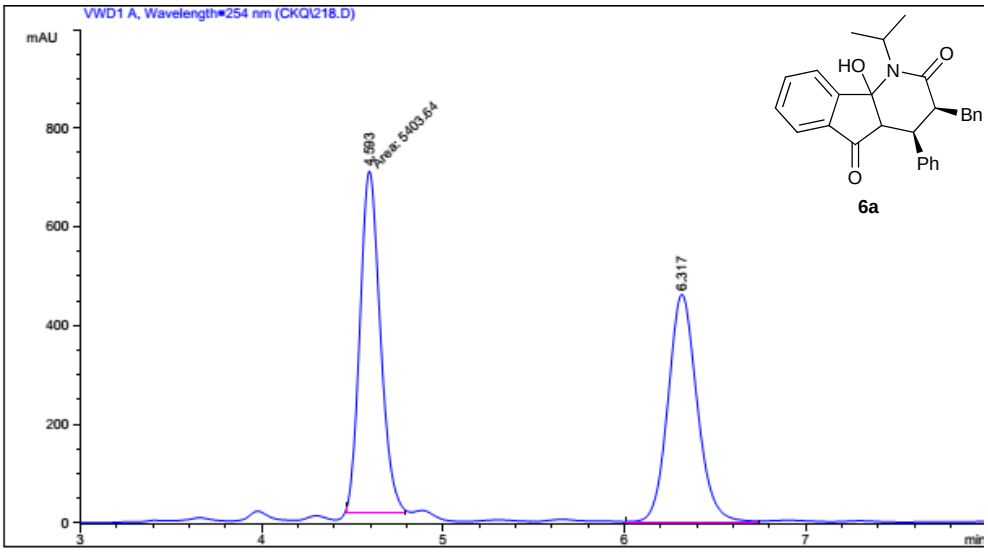
Totals : 5276.16943 190.57213



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	9.089	VB	0.3377	65.08744	2.93126	0.8658
2	21.772	VB	0.7533	7452.11865	154.14529	99.1342

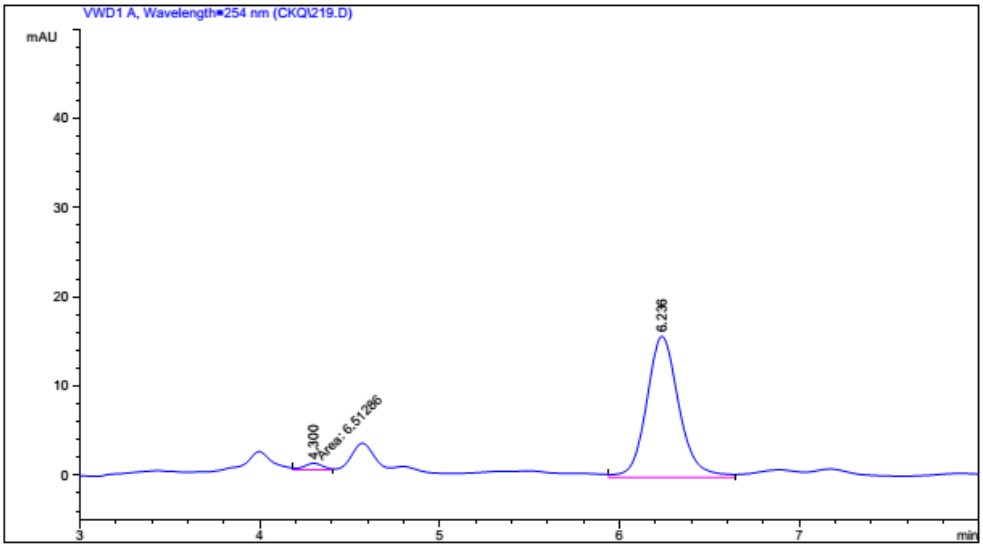
Totals : 7517.20609 157.07655



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	4.593	MM	0.1297	5403.63867	694.37732	50.7805
2	6.317	VV	0.1726	5237.53369	463.38394	49.2195

Totals : 1.06412e4 1157.76126



Signal 1: VWD1 A, Wavelength=254 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	4.300	MM	0.1321	6.51286	8.21896e-1	3.1769
2	6.236	VV	0.1903	198.49126	15.79730	96.8231

Totals : 205.00412 16.61920