Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

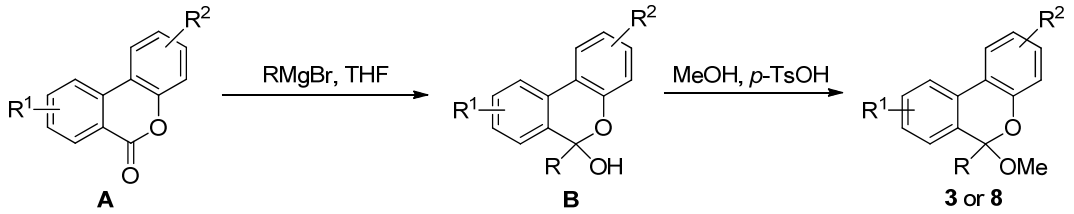
Supporting Information

General methods

Proton (^{1}H NMR) and carbon (^{13}C NMR) nuclear magnetic resonance spectra were recorded at 300 or 500 MHz and 75 or 126 MHz, respectively. The chemical shifts are given in parts per million (ppm) on the delta (δ) scale. The solvent peak was used as a reference value, for ^{1}H NMR: $CDCl_3$ = 7.27 ppm, C_6D_6 = 7.16 ppm; for ^{13}C NMR: $CDCl_3$ = 77.23 ppm, C_6D_6 = 128.06 ppm. Analytical TLC was performed on precoated silica gel GF254 plates. Column chromatography was carried out on silica gel (200–300 mesh). HRMS were carried out on an Orbitrap analyzer. Optical rotations were measured using a 2.5 mL cell with a 10 cm path length on Hanon P850 Automatic Polarimeter and concentrations (c) were reported in g×(100 mL)$^{-1}$. Enantiomeric excesses were determined by HPLC using a Daicel Chiralpak AD-H, OD-H column with hexane/*i*-PrOH as the eluent.

General procedures

Procedure A for the synthesis of ketal substrates



A solution of lactone **A** (1 mmol, 1.0 equiv) and THF (2 mL) was cooled to –78 °C. Then RMgBr (1.2 mmol, 1.2 equiv) was added dropwise, and the reaction was stirred at –78 °C for 5-12 h. H_2O was then added, and the mixture was warmed to room temperature. The aqueous layer was extracted with CH_2Cl_2, and the combined organic layers were washed with sat. brine, dried, filtered and concentrated. The residue was purified by silica gel chromatography (EtOAc/petroleum ether) to give hemiketal **B** as an oil, which was used as such. To a solution of **B** in MeOH was added *p*-TsOH (0.05 mmol, 0.05 equiv). The mixture was then stirred at room temperature for 12 h. K_2CO_3 (0.5 mmol, 0.5 equiv) was added, and the mixture was concentrated. CH_2Cl_2 was added to the resulting solid, and the mixture was filtered through a short pad of Celite. The filtrate was then concentrated. The crude material was then purified by silica gel chromatography (EtOAc/hexanes with 2% Et_3N) to give ketal substrate **3** or **8**.[1]

Procedure B for the asymmetric transfer hydrogenation of 6*H*-benzo[c]chromene-based ketals

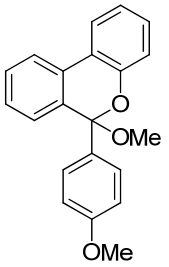
To a solution of ketals **3** or **8** (0.1 mmol, 1.0 eq) in CH_2Cl_2 (0.4 mL) and MTBE (2.6 mL) was added 5 Å molecular sieves (30 mg), Hantzsch ester **6** (0.14 mmol, 1.4 eq), and chiral imidodiphosphoric acid **7i** (5 mol%). The solution was stirred at room temperature for 48 h before it was quenched by saturated aqueous $NaHCO_3$, extracted with EtOAc (10 mL × 3). The combined organic layer was dried over $MgSO_4$, filtered

and evaporated under vacuum. The residue was purified by flash column chromatography to give the desired product.

Procedure C for the asymmetric transfer hydrogenation of 1*H*-isochromene-based ketals

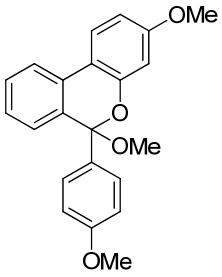
To a solution of **10** (0.1 mmol, 1.0 eq) was added in CH_2Cl_2 (0.4 mL) and MTBE (4.0 mL) was added 5 Å molecular sieves (30 mg), Hantzsch ester **6** (0.14 mmol, 1.4 eq), and chiral imidodiphosphoric acid **7g** (5 mol%). The solution was stirred at room temperature for 48 h before it was quenched by saturated aqueous $NaHCO_3$, extracted with EtOAc (10 mL × 3). The combined organic layer was dried over $MgSO_4$, filtered and evaporated under vacuum. The residue was purified by flash column chromatography to give the desired product.

Analytical data for products



6-Methoxy-6-(4-methoxyphenyl)-6*H*-benzo[*c*]chromene (3a)

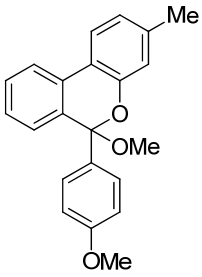
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **3a** (280.2 mg, 88%). ^{1}H NMR (300 MHz, C_6D_6) δ 7.68 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.65–7.56 (m, 3H), 7.21–7.16 (m, 1H), 7.15–7.07 (m, 3H), 7.02–6.90 (m, 2H), 6.82–6.75 (m, 2H), 3.27 (s, 3H), 3.23 (s, 3H); ^{13}C NMR (75 MHz, C_6D_6) δ 160.3, 152.1, 134.9, 132.4, 130.2, 129.8, 129.5, 129.1, 127.8, 127.5, 123.4, 122.6, 122.5, 122.2, 118.30, 113.9, 103.4, 54.8, 51.6; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{21}H_{19}O_3$:319.1329, found 319.1317.



3,6-Dimethoxy-6-(4-methoxyphenyl)-6*H*-benzo[*c*]chromene (3b)

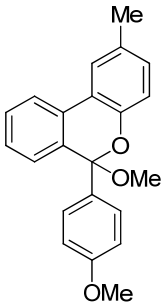
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **3b** (313.1 mg, 90%). ^{1}H NMR (300 MHz, C_6D_6) δ 7.68–7.55 (m, 4H), 7.20–7.16 (m, 1H), 7.16–7.09 (m, 1H), 7.03–6.95 (m, 1H), 6.83–6.76 (m, 3H), 6.65 (dd, *J* = 8.7, 2.6 Hz, 1H), 3.31 (s, 3H), 3.28 (s, 6H); ^{13}C NMR (75 MHz, C_6D_6) δ 161.8, 160.2, 153.5, 133.5, 133.0, 130.5, 129.4, 129.1, 127.6, 126.9, 124.4,

121.44, 115.3, 113.9, 109.5, 103.9, 103.1, 55.0, 54.8, 51.5; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_4$:349.1434, found 349.1445.



6-Methoxy-6-(4-methoxyphenyl)-3-methyl-6*H*-benzo[*c*]chromene (3c)

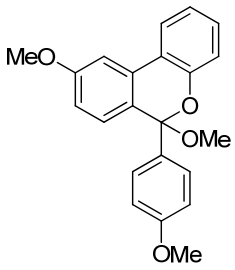
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **3c** (282.4 mg, 85%). ^1H NMR (300 MHz, C_6D_6) δ 7.68–7.58 (m, 4H), 7.22–7.17 (m, 1H), 7.15–7.09 (m, 1H), 7.04–6.96 (m, 2H), 6.83–6.75 (m, 3H), 3.27 (s, 6H), 2.13 (s, 3H); ^{13}C NMR (75 MHz, C_6D_6) δ 160.2, 152.1, 140.0, 134.4, 132.8, 130.4, 129.5, 129.1, 127.6, 127.4, 123.4, 123.22, 121.9, 119.8, 118.7, 113.9, 103.5, 54.8, 51.6, 21.4; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_3$:333.1485, found 333.1476.



6-Methoxy-6-(4-methoxyphenyl)-2-methyl-6*H*-benzo[*c*]chromene (3d)

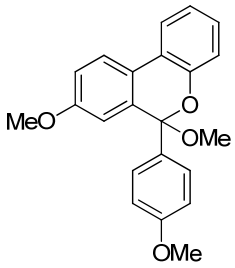
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **3d** (272.3 mg, 82%). ^1H NMR (300 MHz, C_6D_6) δ 7.74–7.63 (m, 3H), 7.59 (d, *J* = 1.4 Hz, 1H), 7.26–7.16 (m, 3H), 7.10–6.96 (m, 2H), 6.89–6.82 (m, 2H), 3.34 (s, 3H), 3.31 (s, 3H), 2.23 (s, 3H); ^{13}C NMR (75 MHz, C_6D_6) δ 160.3,

149.9, 135.1, 132.4, 131.5, 130.5, 130.3, 129.6, 129.0, 127.5, 123.8, 122.4, 122.2, 118.1, 113.9, 103.3, 54.8, 51.6, 21.0; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_3$:333.1485, found 333.1499.



6,9-Dimethoxy-6-(4-methoxyphenyl)-6*H*-benzo[*c*]chromene (3e)

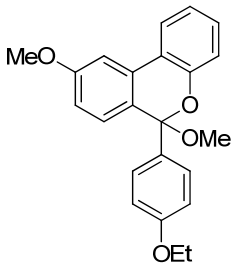
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **3e** (302.2 mg, 87%). ^1H NMR (300 MHz, C_6D_6) δ 7.70–7.61 (m, 3H), 7.33 (d, *J* = 2.5 Hz, 1H), 7.22–7.17 (m, 1H), 7.15–7.10 (m, 1H), 7.10–7.05 (m, 1H), 6.96–6.88 (m, 1H), 6.86–6.78 (m, 2H), 6.63 (dd, *J* = 8.6, 2.5 Hz, 1H), 3.30 (d, *J* = 6.6 Hz, 6H), 3.25 (s, 3H); ^{13}C NMR (75 MHz, C_6D_6) δ 160.7, 160.2, 152.4, 132.9, 131.6, 129.9, 129.5, 129.2, 127.7, 123.4, 122.5, 122.4, 118.3, 113.9, 113.8, 107.2, 103.5, 54.9, 54.8, 51.6; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_4$:349.1434, found 349.1420.



6,8-Dimethoxy-6-(4-methoxyphenyl)-6*H*-benzo[*c*]chromene (3f)

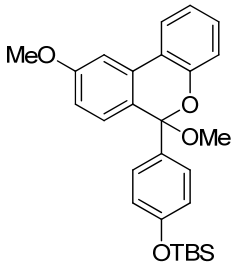
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **3f** (308.7 mg, 89%). ^1H NMR (300 MHz, C_6D_6) δ 7.70–7.61 (m, 3H), 7.58 (d, *J* = 8.6 Hz, 1H), 7.21–7.17 (m, 1H), 7.14–7.06 (m, 1H), 7.01–6.93

(m, 1H), 6.85 (d, J = 2.6 Hz, 1H), 6.83–6.73 (m, 3H), 3.26 (d, J = 4.0 Hz, 6H), 3.19 (s, 3H); ^{13}C NMR (75 MHz, C_6D_6) δ 160.2, 160.0, 151.5, 136.3, 132.6, 129.4, 128.8, 123.8, 123.3, 122.8, 122.6, 122.52, 118.2, 115.3, 113.9, 112.8, 103.5, 54.8, 54.7, 51.6; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_4$: 349.1434, found 349.1427.



6-(4-Ethoxyphenyl)-6,9-dimethoxy-6*H*-benzo[c]chromene (8a)

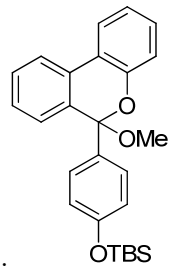
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8a** (325.8 mg, 90%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.71–7.63 (m, 3H), 7.33 (d, J = 1.9 Hz, 1H), 7.20 (d, J = 8.0 Hz, 1H), 7.14–7.07 (m, 2H), 6.96–6.89 (m, 1H), 6.85 (d, J = 8.6 Hz, 2H), 6.62 (dd, J = 8.6, 1.9 Hz, 1H), 3.61–3.53 (m, 2H), 3.30 (s, 3H), 3.26 (s, 3H), 1.10 (t, J = 6.9 Hz, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.7, 159.6, 152.4, 132.8, 131.6, 129.9, 129.5, 129.2, 127.7, 123.4, 122.5, 122.4, 118.3, 114.3, 113.7, 107.2, 103.6, 63.3, 54.9, 51.6, 14.8; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{23}H_{23}O_4$:363.1591, found 363.1596.



Tert-butyl(4-(6,9-dimethoxy-6*H*-benzo[*c*]chromen-6-yl)phenoxy)dimethylsilane (8b)

It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether

(5:95) as eluent to afford **8b** (362.9 mg, 81%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.68–7.62 (m, 3H), 7.32 (d, *J* = 2.5 Hz, 1H), 7.19–7.16 (m, 1H), 7.14–7.09 (m, 1H), 7.06 (d, *J* = 8.6 Hz, 1H), 6.95–6.87 (m, 3H), 6.59 (dd, *J* = 8.6, 2.5 Hz, 1H), 3.31 (s, 3H), 3.24 (s, 3H), 0.99 (s, 9H), 0.10 (d, *J* = 1.7 Hz, 6H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.7, 156.2, 152.4, 133.8, 131.5, 129.9, 129.6, 129.2, 127.5, 123.4, 122.4, 119.9, 118.3, 113.7, 107.2, 103.5, 54.9, 51.7, 25.9, 18.4, -4.4; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{27}H_{33}O_4Si$:449.2143, found 449.2152.



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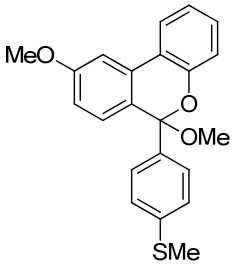
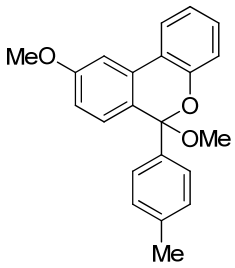
Tert-butyl(4-(6-methoxy-6*H*-benzo[*c*]chromen-6-yl)phenoxy)dimethylsilane (8c)

It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8c** (376.2 mg, 90%). ^{1}H NMR (300 MHz, C_6D_6) δ 7.67 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.64–7.57 (m, 3H), 7.18 (d, *J* = 1.3 Hz, 1H), 7.15–7.08 (m, 3H), 7.01–6.90 (m, 2H), 6.90–6.84 (m, 2H), 3.21 (s, 3H), 0.98 (s, 9H), 0.09 (d, *J* = 0.6 Hz, 6H); ^{13}C NMR (75 MHz, C_6D_6) δ 156.3, 152.1, 134.8, 133.4, 130.1, 129.8, 129.6, 129.1, 127.9, 127.6, 123.4, 122.5, 122.1, 119.9, 118.3, 103.4, 51.7, 25.8, 18.4, -4.4; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{26}H_{31}O_3Si$:419.2037, found 419.2022.



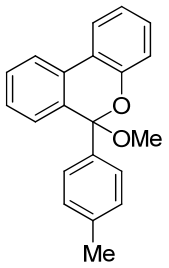
6,9-Dimethoxy-6-(4-(methylthio)phenyl)-6*H*-benzo[*c*]chromene (8d)

It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8d** (327.6 mg, 90%). ^1H NMR (500 MHz, C_6D_6) δ 7.67 (d, *J* = 7.8 Hz, 1H), 7.62 (d, *J* = 8.3 Hz, 2H), 7.35 (d, *J* = 2.3 Hz, 1H), 7.21–7.16 (m, 2H), 7.16–7.11 (m, 2H), 7.04 (d, *J* = 8.6 Hz, 1H), 6.94 (t, *J* = 7.5 Hz, 1H), 6.63 (dd, *J* = 8.6, 2.3 Hz, 1H), 3.32 (s, 3H), 3.23 (s, 3H), 1.98 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.7, 152.2, 139.7, 137.4, 131.5, 130.0, 129.1, 128.7, 127.2, 126.2, 123.4, 122.5, 122.4, 118.3, 113.8, 107.2, 103.3, 54.9, 51.7, 15.0; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_3S$:365.1206, found 365.1211.



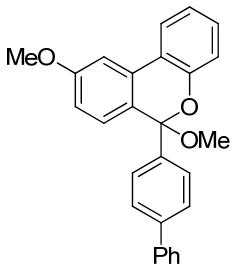
6,9-Dimethoxy-6-(p-tolyl)-6*H*-benzo[*c*]chromene (8e)

It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8e** (295.5 mg, 89%). ^1H NMR (500 MHz, C_6D_6) δ 7.71–7.62 (m, 3H), 7.32 (d, *J* = 2.5 Hz, 1H), 7.21–7.17 (m, 1H), 7.14–7.09 (m, 1H), 7.05 (t, *J* = 8.5 Hz, 3H), 6.95–6.89 (m, 1H), 6.59 (dd, *J* = 8.6, 2.5 Hz, 1H), 3.30 (s, 3H), 3.24 (s, 3H), 2.11 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.7, 152.4, 138.1, 137.9, 131.5, 129.9, 129.2, 129.2, 128.2, 127.5, 123.4, 122.5, 122.4, 118.3, 113.7, 107.2, 103.5, 54.8, 51.7, 21.1; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_3S$:333.1485, found 333.1490.



6-Methoxy-6-(p-tolyl)-6*H*-benzo[*c*]chromene (8f)

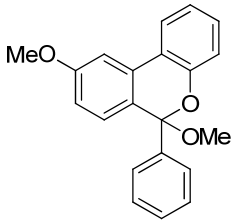
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8f** (247.6 mg, 82%). ^{1}H NMR (300 MHz, C_6D_6) δ 7.68 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.66–7.58 (m, 3H), 7.20–7.16 (m, 1H), 7.15–7.07 (m, 3H), 7.02 (d, *J* = 7.9 Hz, 2H), 6.99–6.90 (m, 2H), 3.22 (s, 3H), 2.09 (s, 3H); ^{13}C NMR (75 MHz, C_6D_6) δ 152.0, 138.2, 137.5, 134.7, 130.1, 129.8, 129.2, 129.1, 128.3, 127.6, 123.4, 122.6, 122.5, 122.2, 118.3, 103.5, 51.7, 21.1; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{21}H_{19}O_3$:319.1329, found 319.1320.



6-([1,1'-Biphenyl]-4-yl)-6,9-dimethoxy-6*H*-benzo[*c*]chromene (8g)

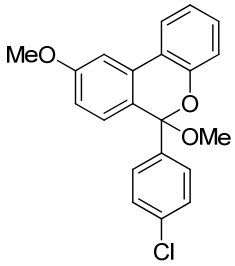
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8g** (358.5 mg, 91%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.81 (d, *J* = 8.2 Hz, 2H), 7.69–7.63 (m, 1H), 7.53 (d, *J* = 8.3 Hz, 2H), 7.50–7.44 (m, 2H), 7.34 (d, *J* = 2.5 Hz, 1H), 7.26–7.18 (m, 3H), 7.15–7.10 (m, 2H), 7.08 (d, *J* = 8.6 Hz, 1H), 6.96–6.90 (m, 1H), 6.60 (dd, *J* = 8.6, 2.5 Hz, 1H), 3.29 (s, 3H), 3.26 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.7, 152.3, 141.7, 141.1, 139.8, 131.5, 130.0, 129.2, 129.1, 128.7, 127.7, 127.5, 127.3, 127.2, 123.5, 122.5, 122.4, 118.3, 113.8, 107.3,

54.8, 51.7; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{27}H_{23}O_3$: 395.1642, found 395.1649.



6,9-Dimethoxy-6-phenyl-6*H*-benzo[*c*]chromene (8h)

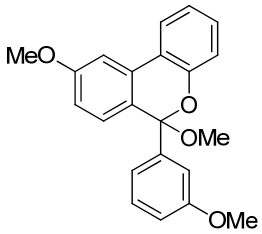
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8h** (286.2 mg, 90%). ^1H NMR (500 MHz, C_6D_6) δ 7.77–7.72 (m, 2H), 7.63 (dd, *J* = 7.8, 1.1 Hz, 1H), 7.32 (d, *J* = 2.5 Hz, 1H), 7.23–7.16 (m, 3H), 7.15–7.08 (m, 2H), 6.99 (d, *J* = 8.6 Hz, 1H), 6.94–6.88 (m, 1H), 6.55 (dd, *J* = 8.6, 2.5 Hz, 1H), 3.28 (s, 3H), 3.21 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.7, 152.3, 140.8, 131.4, 129.9, 129.2, 128.54, 128.4, 128.2, 127.3, 123.4, 122.5, 122.3, 118.3, 113.7, 107.2, 103.4, 54.8, 51.7; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{21}H_{19}O_3$: 319.1329, found 319.1340.



6-(4-Chlorophenyl)-6,9-dimethoxy-6*H*-benzo[*c*]chromene (8j)

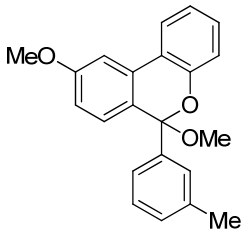
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8j** (302.7 mg, 86%). ^1H NMR (500 MHz, C_6D_6) δ 7.62 (d, *J* = 7.7 Hz, 1H), 7.44 (d, *J* = 8.5 Hz, 2H), 7.30 (d, *J* = 2.2 Hz, 1H), 7.16–7.08 (m, 4H), 6.94–6.89 (m, 1H), 6.86 (d, *J* = 8.6 Hz, 1H), 6.59 (dd, *J* = 8.6, 2.3 Hz, 1H), 3.30 (s,

3H), 3.12 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.8, 152.1, 139.5, 134.7, 131.5, 130.0, 129.6, 129.0, 128.6, 126.6, 123.4, 122.6, 122.1, 118.2, 113.9, 107.2, 103.0, 54.9, 51.6; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{21}H_{18}ClO_3$:353.0939, found 353.0930.



6,9-Dimethoxy-6-(3-methoxyphenyl)-6*H*-benzo[*c*]chromene (8k)

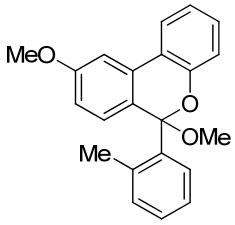
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8k** (361.6 mg, 91%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.64 (d, *J* = 7.8 Hz, 1H), 7.51 (s, 1H), 7.38 (d, *J* = 7.7 Hz, 1H), 7.32 (d, *J* = 2.1 Hz, 1H), 7.21–7.16 (m, 2H), 7.13–7.06 (m, 2H), 6.91 (t, *J* = 7.5 Hz, 1H), 6.82 (dd, *J* = 8.2, 2.2 Hz, 1H), 6.57 (dd, *J* = 8.6, 2.2 Hz, 1H), 3.28 (s, 6H), 3.25 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.3, 160.0, 151.8, 141.9, 131.0, 129.6, 129.1, 128.8, 127.0, 123.1, 122.2, 122.1, 120.3, 118.0, 114.2, 113.4, 113.4, 106.9, 103.1, 54.5, 54.4, 51.4; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_4$:349.1434, found 349.1446.



6,9-Dimethoxy-6-(m-tolyl)-6*H*-benzo[*c*]chromene (8i)

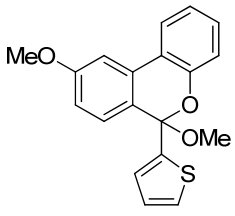
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8i** (308.7 mg, 93%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.70–7.63 (m, 2H), 7.60 (d, *J* = 7.8 Hz, 1H), 7.34 (d, *J* = 1.7 Hz, 1H), 7.18 (t, *J* = 8.0 Hz, 2H),

7.12 (t, *J* = 7.6 Hz, 1H), 7.05 (d, *J* = 8.6 Hz, 1H), 7.00 (d, *J* = 7.5 Hz, 1H), 6.92 (t, *J* = 7.5 Hz, 1H), 6.57 (dd, *J* = 8.6, 1.7 Hz, 1H), 3.29 (s, 3H), 3.24 (s, 3H), 2.11 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.7, 152.3, 140.7, 138.0, 131.4, 129.9, 129.3, 129.3, 129.0, 128.3, 127.4, 125.4, 123.4, 122.5, 122.4, 118.3, 113.7, 107.2, 103.5, 54.9, 51.7, 21.5; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_3$: 333.1485, found 333.1477.



6,9-Dimethoxy-6-(o-tolyl)-6*H*-benzo[*c*]chromene (8m)

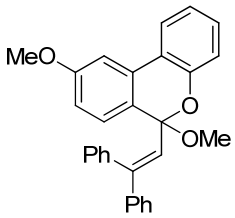
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8m** (285.5 mg, 86%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.95 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.65 (d, *J* = 7.5 Hz, 1H), 7.33 (d, *J* = 2.5 Hz, 1H), 7.21–7.17 (m, 1H), 7.16–7.14 (m, 1H), 7.14–7.09 (m, 2H), 7.09–7.05 (m, 1H), 6.95–6.83 (m, 2H), 6.50 (dd, *J* = 8.6, 2.5 Hz, 1H), 3.28 (s, 3H), 3.22 (s, 3H), 2.22 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.7, 152.4, 139.2, 138.5, 132.7, 131.7, 130.1, 129.0, 128.9, 128.2, 126.1, 125.5, 123.4, 122.3, 121.7, 117.9, 113.9, 106.8, 103.4, 54.8, 51.7, 21.6; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{21}O_3$: 333.1485, found 333.1489.



6,9-Dimethoxy-6-(thiophen-2-yl)-6*H*-benzo[*c*]chromene (8n)

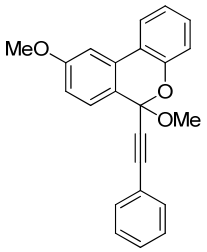
It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8n** (265.7 mg, 82%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.55 (d, *J*

= 7.7 Hz, 1H), 7.30 (d, *J* = 8.6 Hz, 1H), 7.26 (d, *J* = 2.4 Hz, 1H), 7.12 (d, *J* = 8.1 Hz, 1H), 7.06–7.00 (m, 2H), 6.88 (d, *J* = 5.0 Hz, 1H), 6.85 (t, *J* = 7.5 Hz, 1H), 6.68–6.65 (m, 1H), 6.63 (dd, *J* = 8.6, 2.3 Hz, 1H), 3.30 (d, *J* = 3.6 Hz, 6H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.9, 152.0, 145.3, 131.6, 130.0, 128.6, 127.1, 126.8, 126.5, 126.4, 123.3, 122.6, 121.9, 118.4, 114.0, 107.2, 102.7, 54.9, 51.8; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{19}H_{17}O_3S$:325.0893, found 325.0881.



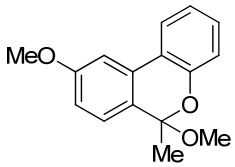
6-(2,2-Diphenylvinyl)-6,9-dimethoxy-6*H*-benzo[*c*]chromene (8o)

It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8o** (247.8 mg, 59%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.47 (d, *J* = 7.6 Hz, 1H), 7.39 (d, *J* = 8.6 Hz, 1H), 7.35–7.29 (m, 2H), 7.18–7.16 (m, 1H), 7.07–7.00 (m, 5H), 7.00–6.95 (m, 1H), 6.92 (s, 1H), 6.88–6.76 (m, 5H), 6.71 (dd, *J* = 8.6, 2.4 Hz, 1H), 3.34 (s, 3H), 3.14 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.5, 152.5, 146.7, 143.3, 139.9, 131.3, 129.9, 129.7, 129.0, 128.5, 128.1, 127.4, 126.8, 126.5, 122.8, 121.6, 120.1, 117.4, 114.3, 54.9, 50.2; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{29}H_{25}O_3$:421.1798, found 421.1791.



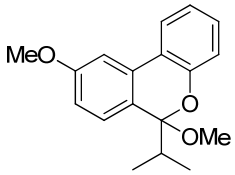
6,9-Dimethoxy-6-(phenylethynyl)-6*H*-benzo[*c*]chromene (8p)

It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8p** (256.5 mg, 75%). ^1H NMR (500 MHz, C_6D_6) δ 8.00 (d, *J* = 8.5 Hz, 1H), 7.58 (dd, *J* = 7.8, 1.1 Hz, 1H), 7.43–7.38 (m, 2H), 7.26 (d, *J* = 2.4 Hz, 1H), 7.20 (dd, *J* = 8.0, 0.7 Hz, 1H), 7.11–7.06 (m, 1H), 6.96–6.91 (m, 3H), 6.91–6.87 (m, 1H), 6.77 (dd, *J* = 8.5, 2.5 Hz, 1H), 3.62 (s, 3H), 3.30 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 161.3, 151.0, 132.3, 129.9, 129.2, 128.6, 128.5, 128.4, 126.1, 123.5, 122.9, 122.5, 122.2, 118.4, 114.0, 107.5, 98.1, 87.8, 85.8, 54.9, 52.2; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{23}H_{18}O_3$:342.1256, found 342.1249.



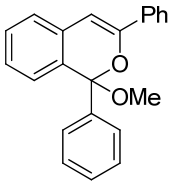
6,9-Dimethoxy-6-methyl-6*H*-benzo[*c*]chromene (8q)

It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8q** (179.2 mg, 70%). ^1H NMR (500 MHz, C_6D_6) δ 7.57 (d, *J* = 7.8 Hz, 1H), 7.26 (s, 1H), 7.20 (d, *J* = 8.5 Hz, 1H), 7.13 (d, *J* = 8.0 Hz, 1H), 7.10–7.04 (m, 1H), 6.89–6.83 (m, 1H), 6.74 (d, *J* = 8.5 Hz, 1H), 3.34 (s, 3H), 3.15 (s, 3H), 1.79 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 160.6, 153.1, 131.5, 129.9, 127.0, 126.9, 123.3, 121.9, 121.3, 118.0, 114.3, 106.8, 102.2, 54.9, 50.3, 26.1; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{16}H_{17}O_3$:257.1172, found 257.1183.



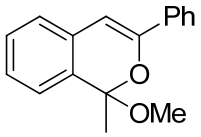
6-Isopropyl-6,9-dimethoxy-6*H*-benzo[*c*]chromene (8r)

It was prepared following the general procedure A and purified by flash chromatography on silica gel by saturated Et_3N using ethyl acetate/petroleum ether (5:95) as eluent to afford **8r** (184.6 mg, 65%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.53 (dd, *J* = 7.8, 1.3 Hz, 1H), 7.27 (d, *J* = 2.5 Hz, 1H), 7.20 (d, *J* = 8.6 Hz, 1H), 7.09–7.02 (m, 2H), 6.84–6.79 (m, 1H), 6.74 (dd, *J* = 8.6, 2.5 Hz, 1H), 3.35 (s, 3H), 3.17 (s, 3H), 2.34–2.24 (m, 1H), 1.22 (d, *J* = 6.8 Hz, 3H), 0.99 (d, *J* = 6.9 Hz, 3H): ^{13}C NMR (126 MHz, C_6D_6) δ 160.6, 154.5, 133.0, 130.2, 128.3, 124.2, 123.1, 121.4, 120.0, 117.5, 114.2, 106.9, 106.3, 54.8, 50.8, 39.4, 16.9, 16.3; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{18}H_{21}O_3$: 285.1485, found 285.1498.



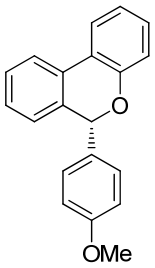
1-Methoxy-1,3-diphenyl-1*H*-isochromene (10a)

^{1}H NMR (500 MHz, C_6D_6) δ 7.64–7.56 (m, 2H), 7.57–7.46 (m, 2H), 7.02–6.96 (m, 3H), 6.95–6.81 (m, 6H), 6.75–6.67 (m, 1H), 6.30 (s, 1H), 3.00 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 150.4, 141.9, 134.6, 131.8, 130.9, 129.0, 129.0, 128.8, 128.5, 128.4, 127.2, 127.0, 125.3, 124.6, 104.5, 100.6, 51.2; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{22}H_{19}O_2$: 315.1380, found 315.1367.



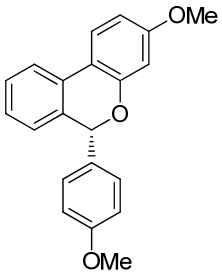
Methoxy-1-methyl-3-phenyl-1*H*-isochromene (10b)

^{1}H NMR (500 MHz, C_6D_6) δ 7.82–7.75 (m, 2H), 7.23 (d, *J* = 7.6 Hz, 1H), 7.21–7.17 (m, 2H), 7.14–7.10 (m, 2H), 7.07–7.02 (m, 1H), 6.99–6.95 (m, 1H), 6.26 (s, 1H), 3.13 (s, 3H), 1.82 (s, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 151.4, 134.9, 132.2, 130.8, 129.0, 128.9, 128.7, 127.1, 125.3, 125.1, 124.6, 103.9, 99.2, 50.4, 27.2; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{17}H1_7O_2$: 253,1223, found 253,1237.



(*R*)-6-(4-Methoxyphenyl)-6*H*-benzo[*c*]chromene (5a)

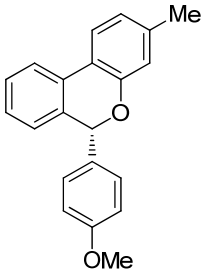
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **5a** (27.5mg, 95%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.86–7.78 (m, 2H), 7.49–7.42 (m, 1H), 7.40–7.34 (m, 2H), 7.32–7.26 (m, 2H), 7.15–7.03 (m, 2H), 6.98–6.89 (m, 3H), 6.20 (s, 1H), 3.82 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.8, 153.8, 134.4, 131.9, 130.2, 129.7, 129.7, 128.5, 127.7, 126.4, 123.2, 122.9, 122.2, 122.2, 118.1, 114.0, 79.4, 55.3; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 215 nm), retention time: t_{minor} = 7.660 min, t_{major} = 9.117 min, ee = 94%; $[\alpha]_D^{25}$ = + 31.2 (c = 0.80, $CHCl_3$).



(*R*)-3-Methoxy-6-(4-methoxyphenyl)-6*H*-benzo[*c*]chromene (5b)

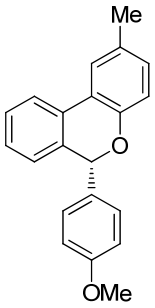
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **5b** (29.9 mg, 94%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.71–7.64 (m, 2H), 7.41–7.34 (m, 1H), 7.30 (d, 2H), 7.21–7.15 (m, 1H), 6.91–6.86 (m, 2H), 6.84 (d, *J* = 7.6 Hz, 1H), 6.62 (dd, *J* = 8.6, 2.5 Hz, 1H), 6.55 (d, *J* = 2.5 Hz, 1H), 6.12 (s, 1H), 3.80 (d, *J* = 7.5 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 161.3, 159.9, 155.1, 133.2, 132.0, 130.5, 129.7, 128.6, 126.8, 126.4, 124.2, 121.5, 116.0, 114.1, 109.1, 102.9, 79.9, 55.6, 55.5;

these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 215 nm), retention time: t_{minor} = 10.447 min, t_{major} = 11.237 min, ee = 92%; $[\alpha]_D^{25}$ = – 27.2 (c = 0.70, $CHCl_3$).



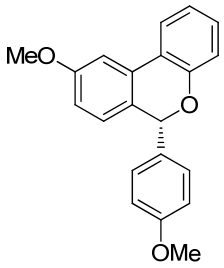
(*R*)-6-(4-Methoxyphenyl)-3-methyl-6*H*-benzo[*c*]chromene (5c)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **5c** (28.7mg, 95%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.74 (d, *J* = 7.7 Hz, 1H), 7.64 (d, *J* = 7.9 Hz, 1H), 7.41–7.35 (m, 1H), 7.34–7.27 (m, 2H), 7.25–7.18 (m, 1H), 6.91–6.84 (m, 4H), 6.81 (s, 1H), 6.12 (s, 1H), 3.80 (s, 3H), 2.32 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.9, 153.7, 140.2, 134.0, 132.1, 130.4, 129.7, 128.52, 127.3, 126.4, 123.1, 123.0, 121.9, 120.2, 118.5, 114.0, 79.5, 55.5, 21.6; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 215 nm), retention time: t_{minor} = 8.340 min, t_{major} = 8.923 min, ee = 95%; $[\alpha]_D^{25}$ = – 7.7 (c = 0.40, $CHCl_3$).



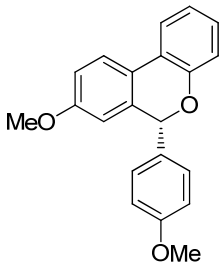
(*R*)-6-(4-Methoxyphenyl)-2-methyl-6*H*-benzo[*c*]chromene (5d)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **5d** (28.4mg, 94%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, *J* = 7.7 Hz, 1H), 7.57 (d, *J* = 1.5 Hz, 1H), 7.42–7.38 (m, 1H), 7.32–7.28 (m, 2H), 7.26–7.21 (m, 1H), 7.03 (dd, *J* = 8.2, 1.8 Hz, 1H), 6.91–6.86 (m, 4H), 6.10 (s, 1H), 3.80 (s, 3H), 2.36 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.8, 151.6, 134.5, 132.0, 131.4, 130.4, 129.7, 128.5, 127.6, 126.4, 123.6, 122.6, 122.2, 117.8, 114.0, 79.4, 55.4, 21.2; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 215 nm), retention time: t_{minor} = 7.110 min, t_{major} = 8.410 min, ee = 93%; $[\alpha]_D^{25}$ = + 30.2 (c = 0.50, $CHCl_3$).



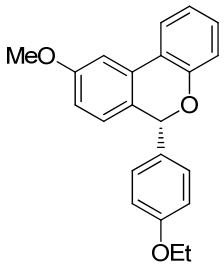
(*R*)-9-Methoxy-6-(4-methoxyphenyl)-6*H*-benzo[*c*]chromene (5e)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **5e** (30.2mg, 95%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.64 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.24–7.19 (m, 3H), 7.16–7.11 (m, 1H), 6.98–6.93 (m, 1H), 6.89 (d, *J* = 8.1 Hz, 1H), 6.83–6.77 (m, 2H), 6.70 (s, 2H), 6.01 (s, 1H), 3.79 (s, 3H), 3.72 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.0, 159.8, 154.0, 132.2, 131.6, 129.9, 129.7, 127.6, 127.1, 123.3, 122.9, 122.1, 118.2, 114.0, 113.2, 107.7, 79.3, 55.6, 55.5; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 215 nm), retention time: t_{minor} = 11.247 min, t_{major} = 12.250 min, ee = 99%; $[\alpha]_D^{25}$ = + 36.0 (c = 0.50, $CHCl_3$).



(*R*)-8-Methoxy-6-(4-methoxyphenyl)-6*H*-benzo[*c*]chromene (5f)

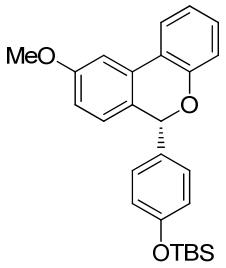
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **5f** (30.5mg, 96%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.74–7.66 (m, 2H), 7.33–7.27 (m, 2H), 7.20–7.13 (m, 1H), 7.05–6.99 (m, 1H), 6.99–6.92 (m, 2H), 6.88 (d, *J* = 8.7 Hz, 2H), 6.42 (d, *J* = 2.5 Hz, 1H), 6.09 (s, 1H), 3.80 (s, 3H), 3.76 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.9, 159.5, 153.0, 136.0, 131.8, 129.7, 128.7, 123.7, 123.24, 123.0, 122.6, 122.2, 118.0, 114.1, 114.0, 112.1, 79.5, 55.5, 55.5; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 15/85, 1.0 mL/min, 254 nm), retention time: t_{minor} = 9.263 min, t_{major} = 11.143 min, ee = 91%; $[\alpha]_D^{25}$ = + 48.1 (c = 0.45, $CHCl_3$).



(*R*)-6-(4-Ethoxyphenyl)-9-methoxy-6*H*-benzo[*c*]chromene (9a)

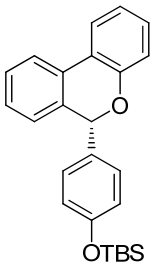
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9a** (32.2mg, 97%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.69 (dd, *J* = 7.7, 1.0 Hz, 1H), 7.26–7.21 (m, 2H), 7.21–7.15 (m, 1H), 7.03–6.98 (m, 1H), 6.95 (d, *J* = 8.0 Hz, 1H), 6.84 (d, *J* = 8.6 Hz, 2H), 6.77–6.71 (m, 2H), 6.05 (s, 1H), 3.99 (q, *J* = 7.0 Hz, 2H), 3.84 (s, 3H), 1.37 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.0,

159.2, 154.0, 132.0, 131.6, 129.9, 129.7, 127.6, 127.1, 123.3, 122.9, 122.1, 118.1, 114.5, 113.2, 107.7, 79.4, 63.6, 55.6, 15.0; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 215 nm), retention time: t_{minor} = 9.087 min, t_{major} = 10.160 min, ee = 97%; $[\alpha]_D^{25}$ = + 42.9 (c = 0.35, $CHCl_3$).



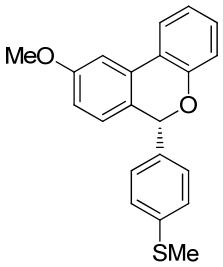
(*R*)-tert-butyl(4-(9-methoxy-6*H*-benzo[*c*]chromen-6-yl)phenoxy)dimethylsilane (9b)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9b** (38.8mg, 93%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.72 (dd, *J* = 7.7, 1.1 Hz, 1H), 7.28 (d, *J* = 2.3 Hz, 1H), 7.25 (s, 1H), 7.25–7.19 (m, 2H), 7.07–7.01 (m, 1H), 6.99 (d, *J* = 8.1 Hz, 1H), 6.85–6.80 (m, 2H), 6.80–6.76 (m, 1H), 6.74 (d, *J* = 8.4 Hz, 1H), 6.06 (s, 1H), 3.87 (s, 3H), 0.99 (s, 9H), 0.20 (s, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.0, 156.0, 154.1, 132.7, 131.6, 129.9, 129.7, 127.6, 127.3, 123.3, 123.0, 122.2, 120.2, 118.1, 113.2, 107.7, 79.5, 55.6, 25.9, 18.4, -4.2; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 2/98, 1.0 mL/min, 254 nm), retention time: t_{minor} = 6.083 min, t_{major} = 6.587 min, ee = 97%; $[\alpha]_D^{25}$ = + 18.4 (c = 0.63, $CHCl_3$).



(*R*)-(4-(6*H*-benzo[*c*]chromen-6-yl)phenoxy)(tert-butyl)dimethylsilane (9c)

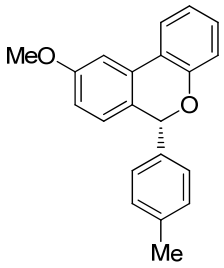
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9c** (34.9mg, 90%). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.82 (d, *J* = 7.7 Hz, 2H), 7.49–7.41 (m, 1H), 7.36–7.24 (m, 4H), 7.14–7.03 (m, 2H), 6.90 (d, *J* = 8.4 Hz, 3H), 6.18 (s, 1H), 1.07 (s, 9H), 0.28 (s, 6H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 156.0, 153.9, 134.6, 132.5, 130.3, 129.7, 129.7, 128.6, 127.8, 126.4, 123.3, 123.0, 122.2, 120.2, 118.1, 79.7, 25.9, 18.4, -4.2; HRMS (EI) *m/z* [M + H]$^{+}$ calculated for $C_{25}H_{29}O_2Si$:389.1931, found 389.1918; HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 2/98, 1.0 mL/min, 215 nm), retention time: t_{minor} = 4.190 min, t_{major} = 5.197 min, ee = 91%; $[\alpha]_D^{25}$ = – 0.034 (c = 0.21, $CHCl_3$).



(*R*)-9-Methoxy-6-(4-(methylthio)phenyl)-6*H*-benzo[*c*]chromene（9d）

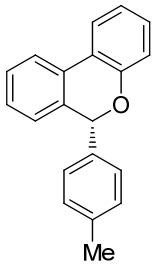
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9d** (32.1mg, 96%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.31–7.27 (m, 3H), 7.24–7.20 (m, 3H), 7.04 (td, *J* = 7.6, 1.1 Hz, 1H), 6.98 (dd, *J* = 8.1, 0.9 Hz, 1H), 6.79 (d, *J* = 1.3 Hz, 2H), 6.09 (s, 1H), 3.88 (s, 3H), 2.47 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.1, 153.8, 138.9, 136.8, 131.5, 130.0, 128.8, 127.6,

126.6, 126.5, 123.3, 122.9, 122.3, 118.2, 113.2, 107.8, 79.2, 55.6, 15.9; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 215 nm), retention time: t_{minor} = 11.460 min, t_{major} = 12.607 min, ee = 97%; $[\alpha]_D^{25}$ = + 20.2 (c = 0.31, $CHCl_3$).



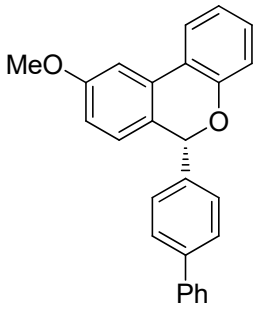
(*R*)-9-Methoxy-6-(p-tolyl)-6*H*-benzo[*c*]chromene (9e)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9e** (28.7mg, 95%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.72 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.28 (d, *J* = 5.2 Hz, 2H), 7.26–7.24 (m, 1H), 7.22 (td, *J* = 8.1, 1.5 Hz, 1H), 7.16 (d, *J* = 8.0 Hz, 2H), 7.04 (td, *J* = 7.6, 1.0 Hz, 1H), 7.01–6.97 (m, 1H), 6.77 (d, *J* = 1.3 Hz, 2H), 6.10 (s, 1H), 3.87 (s, 3H), 2.35 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.0, 154.0, 138.3, 137.1, 131.5, 129.9, 129.3, 128.3, 127.6, 127.0, 123.3, 122.9, 122.1, 118.1, 113.2, 107.7, 79.5, 55.6, 21.4; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 215 nm), retention time: t_{minor} = 9.360 min, t_{major} = 10.117 min, ee = 96%; $[\alpha]_D^{25}$ = + 26.9 (c = 0.25, $CHCl_3$).



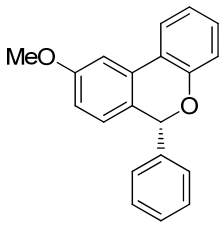
(*R*)-6-(P-tolyl)-6*H*-benzo[*c*]chromene (9f)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9f** (23.9mg, 88%). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.87–7.77 (m, 2H), 7.45 (t, *J* = 7.6 Hz, 1H), 7.38–7.21 (m, 6H), 7.14–7.02 (m, 2H), 6.94 (d, *J* = 7.6 Hz, 1H), 6.21 (s, 1H), 2.41 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.9, 138.3, 136.8, 134.3, 130.2, 129.7, 129.3, 128.6, 128.3, 127.8, 126.4, 123.3, 123.0, 122.2, 122.2, 118.1, 79.7, 21.4; HRMS (EI) *m/z* $[M + H]^+$ calculated for $C_{20}H_{17}O$: 273.1274, found 273.1288; HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 2/98, 1.0 mL/min, 215 nm), retention time: t_{major} = 8.880 min, t_{minor} = 11.030 min, ee = 92%; $[\alpha]_D^{25}$ = – 0.033 (c = 0.18, $CHCl_3$).



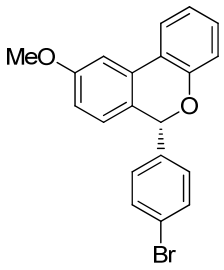
(*R*)-6-([1,1'-Biphenyl]-4-yl)-9-methoxy-6*H*-benzo[*c*]chromene (9g)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9g** (34.6mg, 95%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.75 (dd, *J* = 7.8, 1.3 Hz, 1H), 7.59 (d, *J* = 8.3 Hz, 4H), 7.49–7.42 (m, 4H), 7.38–7.33 (m, 1H), 7.32 (d, *J* = 2.3 Hz, 1H), 7.27–7.23 (m, 1H), 7.10–7.05 (m, 1H), 7.05–7.02 (m, 1H), 6.85 (d, *J* = 8.4 Hz, 1H), 6.83–6.79 (m, 1H), 6.19 (s, 1H), 3.89 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.1, 154.0, 141.4, 140.9, 139.1, 131.5, 123.0, 129.0, 128.7, 127.7, 127.6, 127.4, 127.3, 126.7, 123.4, 122.9, 122.3, 118.2, 113.3, 107.9, 79.4, 55.6; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 215 nm), retention time: t_{minor} = 12.997 min, t_{major} = 15.420 min, ee = 97%; $[\alpha]_D^{25}$ = + 6.6 (c = 0.48, $CHCl_3$)



(*R*)-9-Methoxy-6-phenyl-6*H*-benzo[*c*]chromene (9h)

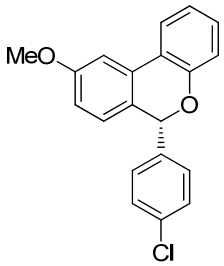
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9h** (27.6mg, 96%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.73 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.41–7.32 (m, 5H), 7.30 (d, *J* = 2.1 Hz, 1H), 7.25–7.20 (m, 1H), 7.08–7.02 (m, 1H), 7.00 (d, *J* = 8.1 Hz, 1H), 6.81–6.74 (m, 2H), 6.13 (s, 1H), 3.88 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.1, 154.0, 140.1, 131.5, 129.9, 128.7, 128.6, 128.3, 127.7, 126.8, 123.3, 122.9, 122.2, 118.1, 113.2, 107.8, 79.7, 55.6; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 3/97, 1.0 mL/min, 254 nm), retention time: t_{major} = 10.873 min, t_{minor} = 11.543 min, ee = 97%; $[\alpha]_D^{25}$ = + 23.1 (c = 0.50, $CHCl_3$).



(*R*)-6-(4-Bromophenyl)-9-methoxy-6*H*-benzo[*c*]chromene (9i)

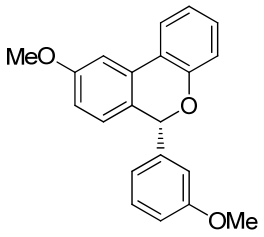
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9i** (34.1mg, 93%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.74–7.68 (m, 1H), 7.47 (d, *J* = 8.4 Hz, 2H), 7.29 (d, *J* = 2.1 Hz, 1H), 7.26–7.21 (m, 3H), 7.07–7.02 (m, 1H), 6.98 (d, *J* = 8.1 Hz, 1H), 6.83–6.75 (m, 2H), 6.09 (s, 1H), 3.88 (s, 3H); ^{13}C NMR (126

MHz, $CDCl_3$) δ 160.2, 153.6, 139.1, 131.8, 131.4, 130.0, 130.0, 127.5, 126.1, 123.4, 122.8, 122.6, 122.4, 118.1, 113.3, 107.9, 78.8, 55.6; these data are consistent with reported literature values.[2] The ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 215 nm), retention time: t_{minor} = 10.563 min, t_{major} = 12.120 min, ee = 98%; $[\alpha]_D^{25}$ = + 19.0 (c = 0.15, $CHCl_3$).



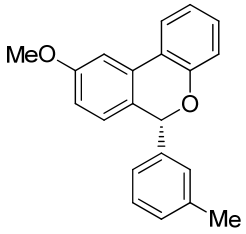
(*R*)-6-(4-Chlorophenyl)-9-methoxy-6*H*-benzo[*c*]chromene (9j)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9j** (29.0mg, 90%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.72 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.34–7.28 (m, 5H), 7.25–7.21 (m, 1H), 7.08–7.03 (m, 1H), 6.99 (dd, *J* = 8.1, 0.9 Hz, 1H), 6.84–6.76 (m, 2H), 6.11 (s, 1H), 3.88 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.2, 153.6, 138.6, 134.3, 131.4, 130.0, 129.7, 128.8, 127.5, 126.1, 123.4, 122.8, 122.4, 118.1, 113.3, 107.9, 78.8, 55.6; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 227 nm), retention time: t_{minor} = 9.683 min, t_{major} = 11.507 min, ee = 93%; $[\alpha]_D^{25}$ = + 17.7 (c = 0.35, $CHCl_3$).



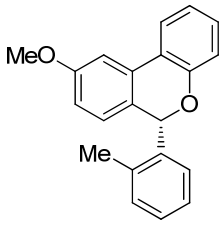
(*R*)-9-Methoxy-6-(3-methoxyphenyl)-6*H*-benzo[*c*]chromene (9k)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9k** (29.6mg, 93%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.69 (dd, *J* = 7.7, 1.0 Hz, 1H), 7.26–7.18 (m, 3H), 7.05–6.97 (m, 2H), 6.95–6.90 (m, 2H), 6.84 (dd, *J* = 7.3, 1.5 Hz, 1H), 6.79–6.73 (m, 2H), 6.07 (s, 1H), 3.84 (s, 3H), 3.74 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.1, 159.9, 154.0, 141.6, 131.5, 129.9, 129.6, 127.6, 126.7, 123.3, 122.9, 122.3, 120.7, 118.1, 114.1, 113.7, 113.2, 107.8, 79.5, 55.6, 55.4; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 215 nm), retention time: t_{major} = 10.530 min, t_{minor} = 11.557 min, ee = 97%; $[\alpha]_D^{25}$ = + 36.0 (c = 0.4, $CHCl_3$).



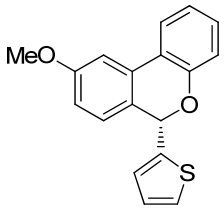
(*R*)-9-Methoxy-6-(m-tolyl)-6*H*-benzo[*c*]chromene (9l)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9l** (28.4mg, 94%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (dd, *J* = 7.8, 1.2 Hz, 1H), 7.32 (d, *J* = 2.3 Hz, 1H), 7.31–7.26 (m, 2H), 7.26–7.24 (m, 1H), 7.22 (d, *J* = 7.6 Hz, 1H), 7.18 (d, *J* = 7.4 Hz, 1H), 7.10–7.06 (m, 1H), 7.04 (d, *J* = 8.1 Hz, 1H), 6.83–6.75 (m, 2H), 6.11 (s, 1H), 3.90 (s, 3H), 2.38 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.0, 154.2, 139.9, 138.4, 131.5, 129.9, 129.4, 129.0, 128.5, 127.7, 127.0, 125.5, 123.3, 122.9, 122.2, 118.1, 113.2, 107.7, 79.8, 55.6, 21.7; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 215 nm), retention time: t_{major} = 8.163 min, t_{minor} = 9.547 min, ee = 96%; $[\alpha]_D^{25}$ = + 21.1 (c = 0.36, $CHCl_3$).



(*R*)-9-Methoxy-6-(o-tolyl)-6*H*-benzo[*c*]chromene (9m)

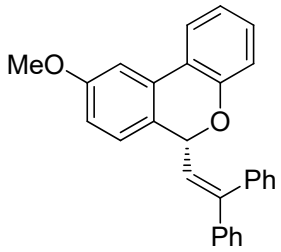
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9m** (27.2mg, 90%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.75 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.32–7.26 (m, 3H), 7.26–7.17 (m, 3H), 7.10–7.04 (m, 1H), 7.01–6.94 (m, 1H), 6.74 (dd, *J* = 8.4, 2.5 Hz, 1H), 6.59 (d, *J* = 8.4 Hz, 1H), 6.28 (s, 1H), 3.87 (s, 3H), 2.41 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.0, 154.6, 137.5, 137.1, 132.0, 130.9, 129.9, 128.9, 128.6, 127.1, 126.6, 126.4, 123.4, 123.1, 122.3, 117.9, 113.3, 107.8, 77.7, 55.6, 19.8; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel AD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 274 nm), retention time: t_{major} = 7.163 min, t_{minor} = 7.850 min, ee = 89%; $[\alpha]_D^{25}$ = – 4.0 (c = 0.22, $CHCl_3$).



(*S*)-9-Methoxy-6-(thiophen-2-yl)-6*H*-benzo[*c*]chromene (9n)

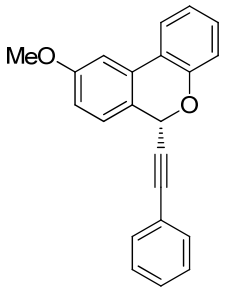
It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9n** (27.6mg, 94%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.73 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.32 (d, *J* = 2.4 Hz, 1H), 7.29–7.26 (m, 1H), 7.26–7.22 (m, 1H), 7.09–7.00 (m, 3H), 6.93–6.89 (m, 1H), 6.89–6.84 (m, 2H), 6.45 (s, 1H), 3.91 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.3, 153.0, 144.2, 130.9, 130.0, 127.3, 127.1, 126.6, 126.5, 126.1, 123.3, 122.6, 122.4, 118.5, 113.4, 107.9, 74.9, 55.6; these data are consistent with

reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 20/80, 1.0 mL/min, 215 nm), retention time: t_{major} = 7.620 min, t_{minor} = 13.467 min, ee = 94%; $[\alpha]_D^{25}$ = + 98.1 (c = 0.38, $CHCl_3$).



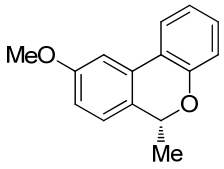
(R)-6-(2,2-Diphenylvinyl)-9-methoxy-6*H*-benzo[*c*]chromene (9o)

It was prepared following the general procedure B and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9o** (35.5mg, 91%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.73–7.69 (m, 1H), 7.41–7.35 (m, 5H), 7.34–7.28 (m, 5H), 7.26 (d, *J* = 2.5 Hz, 1H), 7.25–7.22 (m, 1H), 7.13 (d, *J* = 8.4 Hz, 1H), 7.07–7.03 (m, 2H), 6.86 (dd, *J* = 8.4, 2.5 Hz, 1H), 6.42 (d, *J* = 9.6 Hz, 1H), 5.63 (d, *J* = 9.6 Hz, 1H), 3.88 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.1, 154.2, 146.5, 141.8, 139.0, 131.3, 129.9, 129.9, 128.6, 128.4, 128.2, 128.1, 128.0, 126.7, 126.6, 125.8, 123.4, 122.9, 122.1, 118.0, 113.4, 108.0, 75.3, 55.6; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 15/85, 1.0 mL/min, 254 nm), retention time: t_{minor} = 7.663 min, t_{major} = 13.947 min, ee = 96%; $[\alpha]_D^{25}$ = + 32.0 (c = 0.35, $CHCl_3$).



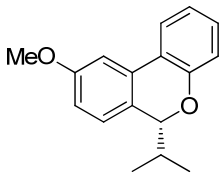
(R)-9-Methoxy-6-(phenylethynyl)-6*H*-benzo[*c*]chromene (9p)

It was prepared following the general procedure A and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9p** (28.7mg, 92%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.74 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.50–7.44 (m, 3H), 7.35–7.26 (m, 5H), 7.26–7.25 (m, 1H), 7.14–7.08 (m, 2H), 6.91 (dd, *J* = 8.4, 2.5 Hz, 1H), 6.06 (s, 1H), 3.89 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.5, 153.6, 132.2, 131.1, 130.0, 129.0, 128.5, 126.6, 124.3, 123.5, 122.9, 122.8, 122.3, 118.2, 113.5, 108.2, 87.9, 85.7, 68.7, 55.7; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 5/95, 1.0 mL/min, 215 nm), retention time: t_{minor} = 18.503 min, t_{major} = 20.887 min,ee = 87%; $[\alpha]_D^{25}$ = + 6.1 (c = 0.30, $CHCl_3$).



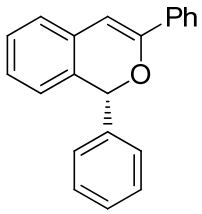
(*R*)-9-Methoxy-6-methyl-6*H*-benzo[*c*]chromene (9q)

It was prepared following the general procedure A and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9q** (21.7mg, 96%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.72 (dd, *J* = 7.7, 1.4 Hz, 1H), 7.29–7.26 (m, 1H), 7.26–7.24 (m, 1H), 7.10 (d, *J* = 8.4 Hz, 1H), 7.08–7.04 (m, 1H), 7.02 (dd, *J* = 8.1, 1.0 Hz, 1H), 6.86 (dd, *J* = 8.4, 2.5 Hz, 1H), 5.25 (q, *J* = 6.5 Hz, 1H), 3.87 (s, 3H), 1.63 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.7, 153.9, 130.8, 129.7, 128.6, 125.3, 123.3, 122.7, 121.9, 117.9, 113.3, 107.8, 73.5, 55.5, 20.4; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 254 nm), retention time: t_{major} = 9.653 min, t_{minor} = 11.207 min, ee = 93%; $[\alpha]_D^{25}$ = – 22.8 (c = 0.28, $CHCl_3$).



(*R*)-6-Isopropyl-9-methoxy-6*H*-benzo[*c*]chromene (9r)

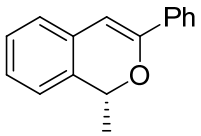
It was prepared following the general procedure A and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **9r** (11.7mg, 92%). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.91 (dd, *J* = 7.7, 1.4 Hz, 1H), 7.51–7.43 (m, 2H), 7.28–7.20 (m, 3H), 7.06 (dd, *J* = 8.3, 2.5 Hz, 1H), 4.93 (d, *J* = 8.4 Hz, 1H), 4.10 (s, 3H), 2.28–2.17 (m, 1H), 1.27 (d, *J* = 6.6 Hz, 3H), 1.09 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.7, 153.3, 130.6, 129.8, 127.7, 126.3, 123.1, 122.9, 121.7, 118.0, 112.9, 107.7, 83.2, 55.6, 32.0, 19.1, 18.8; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 10/90, 1.0 mL/min, 254 nm), retention time: t_{major} = 6.770 min, t_{minor} = 12.690 min, ee = 86%; $[\alpha]_D^{25}$ = – 22.6 (c = 0.46, $CHCl_3$).



(R)-1,3-Diphenyl-1*H*-isochromene (11a)

It was prepared following the general procedure C and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (10:90) as eluent to afford **11a** (26.7mg, 94%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.74 (d, *J* = 7.5 Hz, 2H), 7.20–7.15 (m, 2H), 7.13–7.07 (m, 2H), 7.03–6.98 (m, 1H), 6.95 (d, *J* = 7.5 Hz, 1H), 6.74 (d, *J* = 7.4 Hz, 1H), 6.33 (s, 1H), 5.16 (q, *J* = 6.5 Hz, 1H), 1.44 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 152.7, 140.0, 134.5, 132.0, 130.6, 129.0, 128.7, 128.6, 128.5, 128.5, 128.1, 126.7, 125.6, 125.4, 124.0, 101.3, 80.3; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by

HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 2/98, 1.0 mL/min, 322 nm), retention time: t_{minor} = 7.371 min, t_{major} = 8.010 min, ee = 89%; $[\alpha]_D^{25}$ = –44.1 (c = 0.30, $CHCl_3$).



(R)-1-Methyl-3-phenyl-1*H*-isochromene (11b)

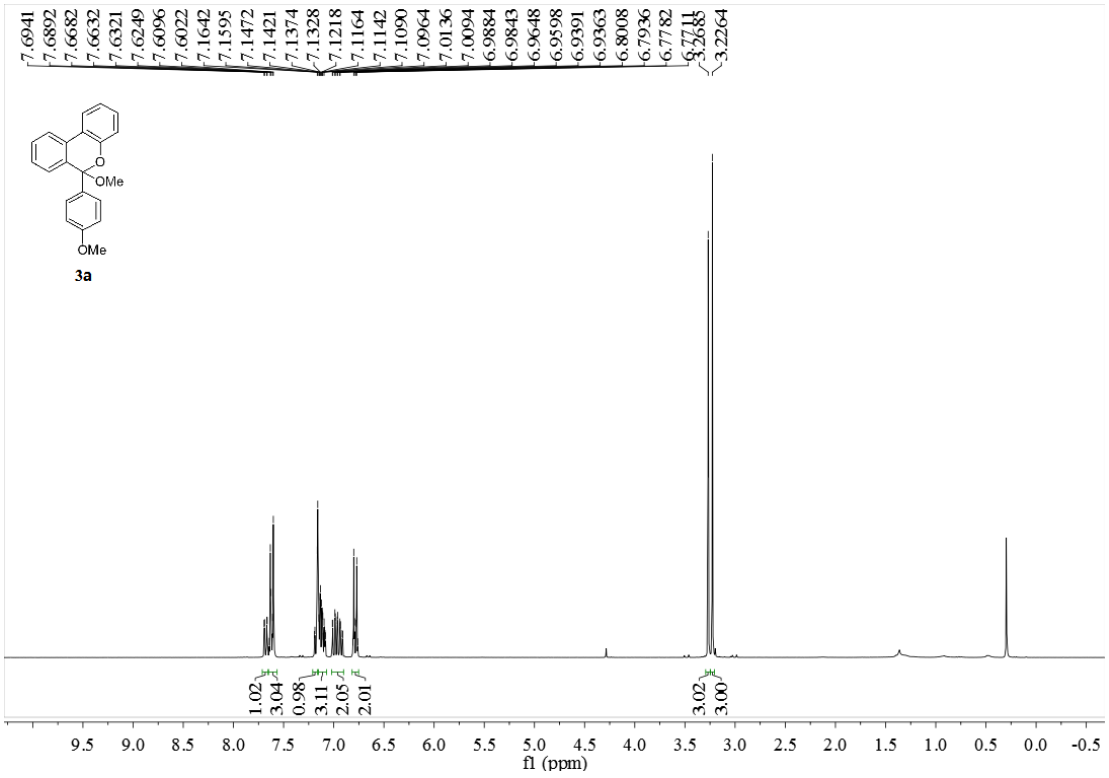
It was prepared following the general procedure C and purified by flash chromatography on silica gel using ethyl acetate/petroleum ether (15:85) as eluent to afford **11b** (20.9mg, 95%). ^{1}H NMR (500 MHz, C_6D_6) δ 7.74 (d, *J* = 7.5 Hz, 2H), 7.20–7.15 (m, 2H), 7.13–7.07 (m, 2H), 7.03–6.98 (m, 1H), 6.95 (d, *J* = 7.5 Hz, 1H), 6.74 (d, *J* = 7.4 Hz, 1H), 6.33 (s, 1H), 5.16 (q, *J* = 6.5 Hz, 1H), 1.44 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (126 MHz, C_6D_6) δ 152.8, 135.3, 132.9, 131.7, 128.9, 128.6, 128.1, 126.8, 125.5, 124.2, 123.5, 101.0, 74.5, 19.6; these data are consistent with reported literature values.[2] HPLC: the ee value was determined by HPLC analysis (Chiralcel OD-H, *i*-PrOH/Hexane = 1/99, 1.0 mL/min, 331 nm), retention time: t_{minor} = 6.763 min, t_{major} = 7.390 min, ee = 91%; $[\alpha]_D^{25}$ = – 33.1 (c = 0.20, $CHCl_3$).

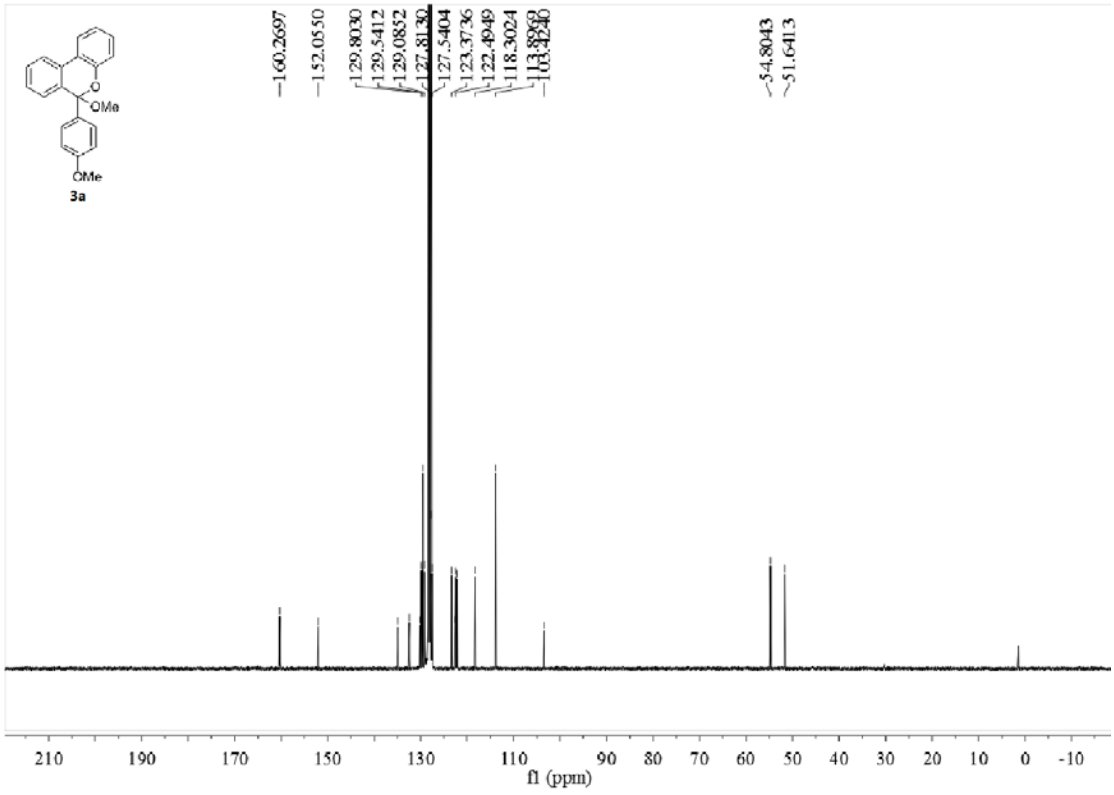
References:

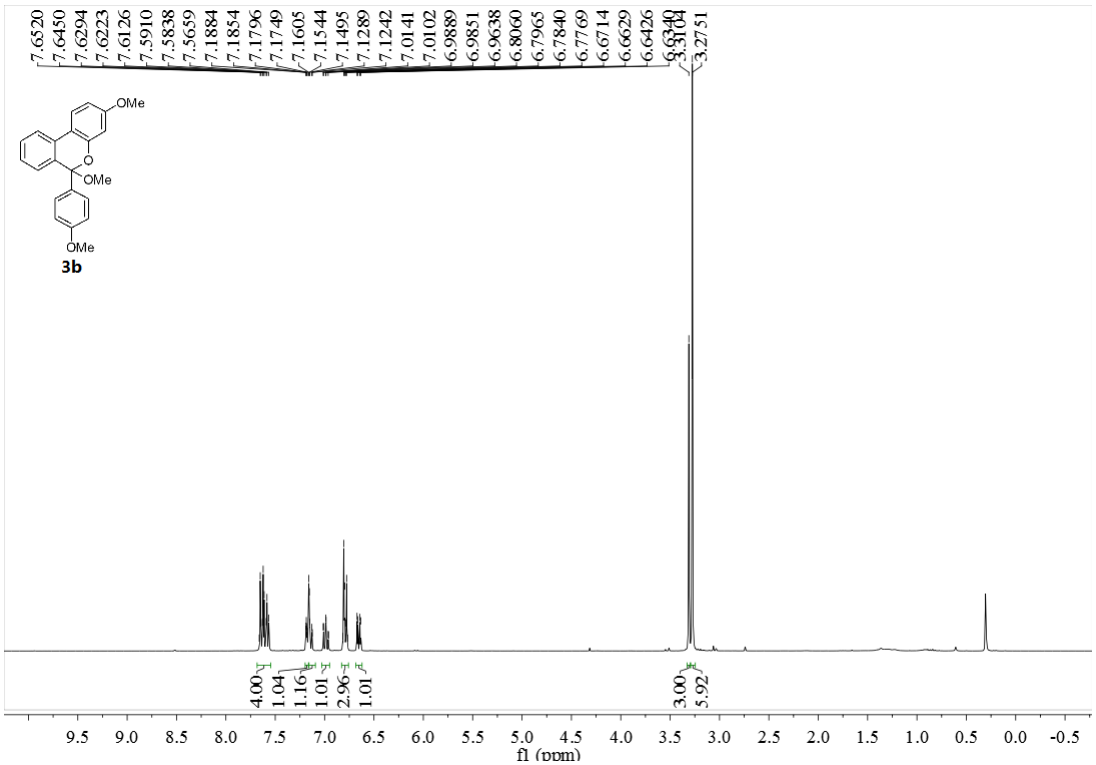
1. S. Dasgupta, T. Rivas, M. P. Watson, *Angew. Chem. Int. Ed.* 2015, **54**, 14154.

2. M. Wan, S. Sun, Y. Li, L. Liu, *Angew. Chem. Int. Ed.* 2017, **56**, 5116.

^{1}H and ^{13}C NMR spectra



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1.01
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1.01
3.00
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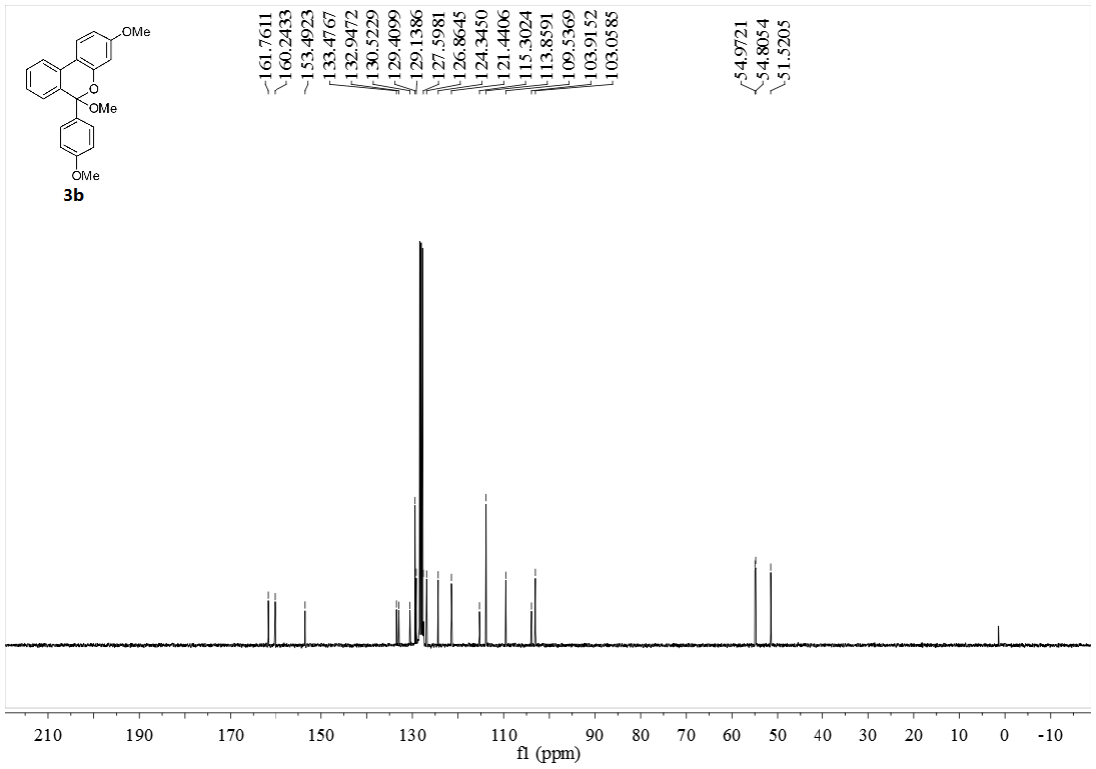
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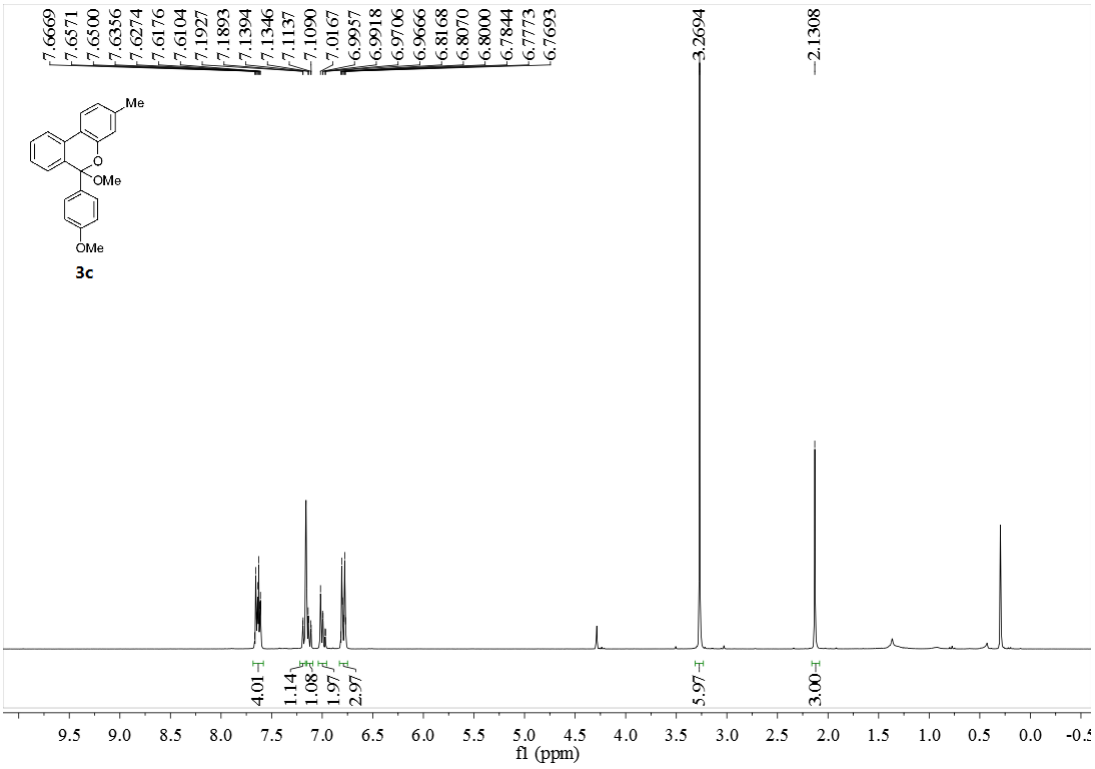
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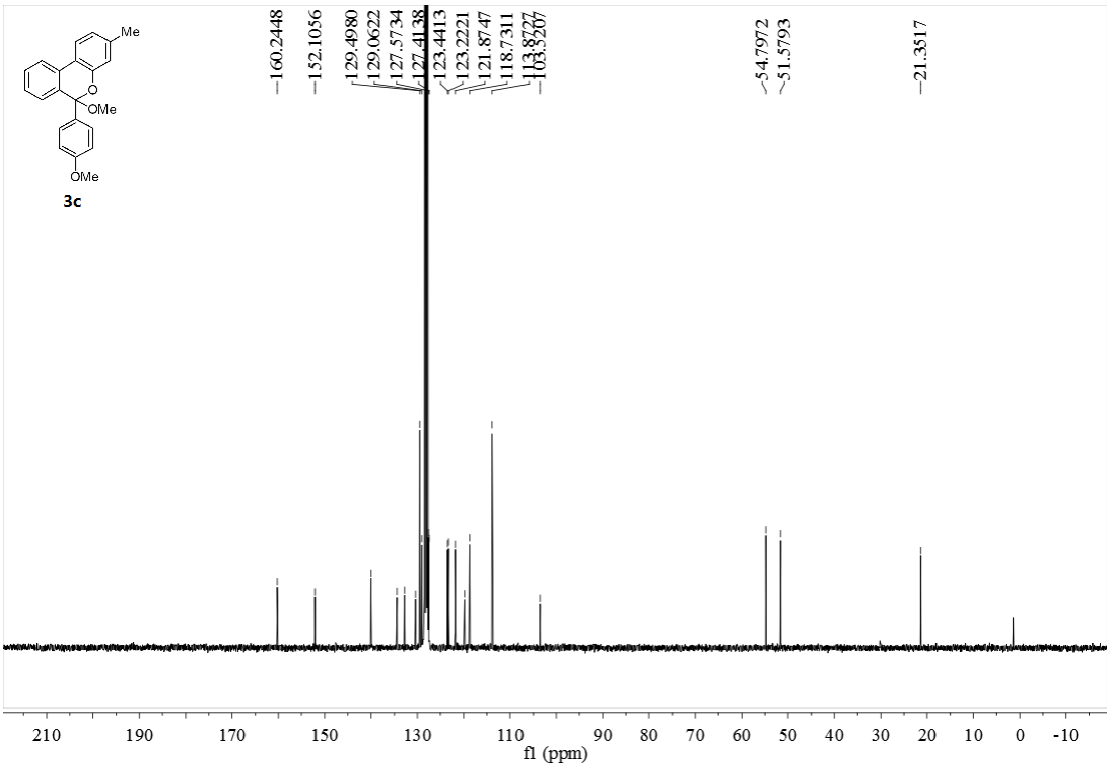
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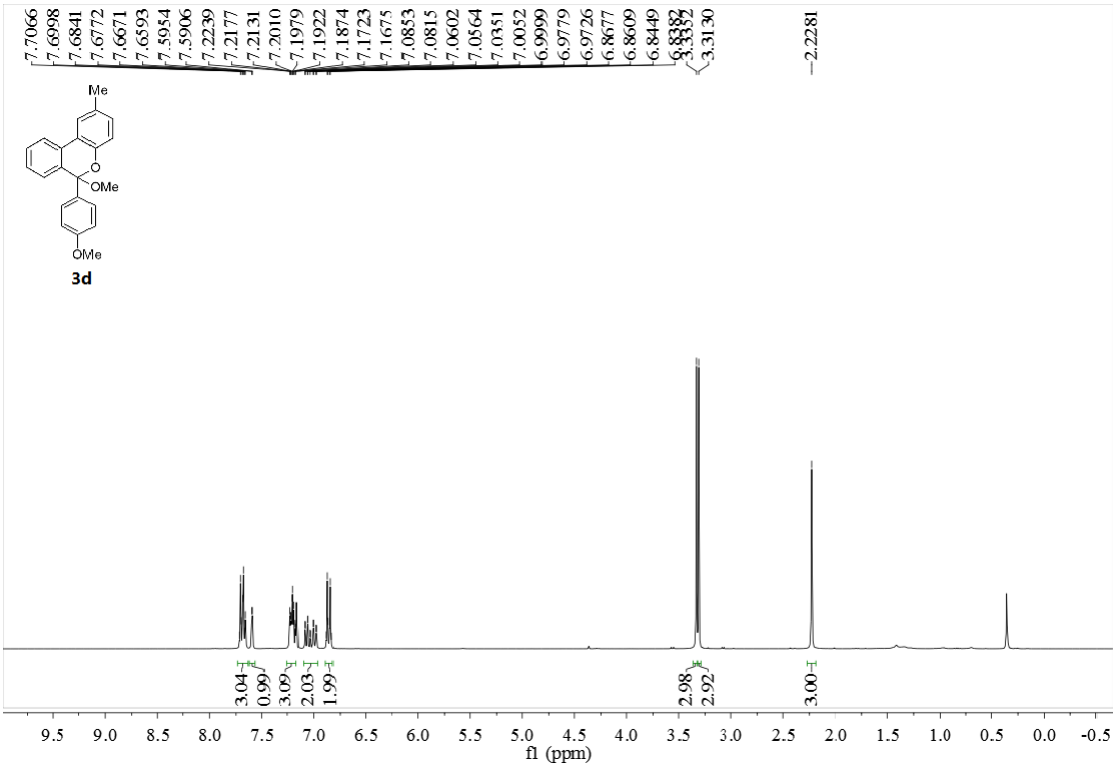
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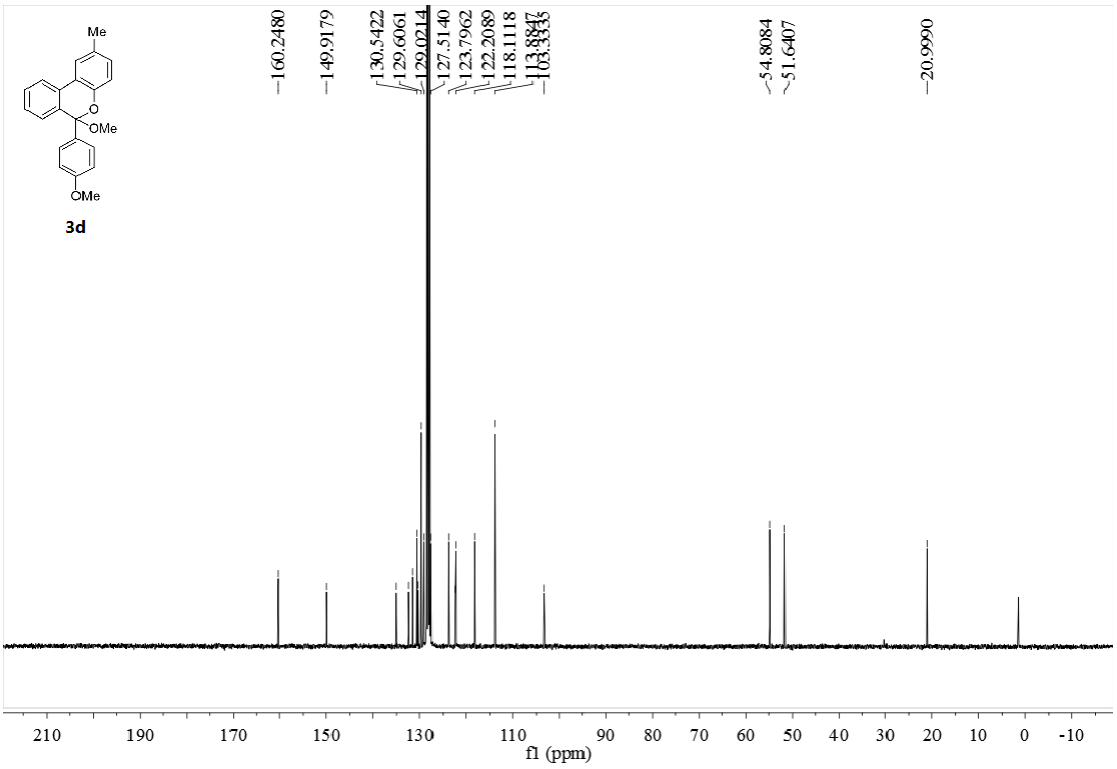
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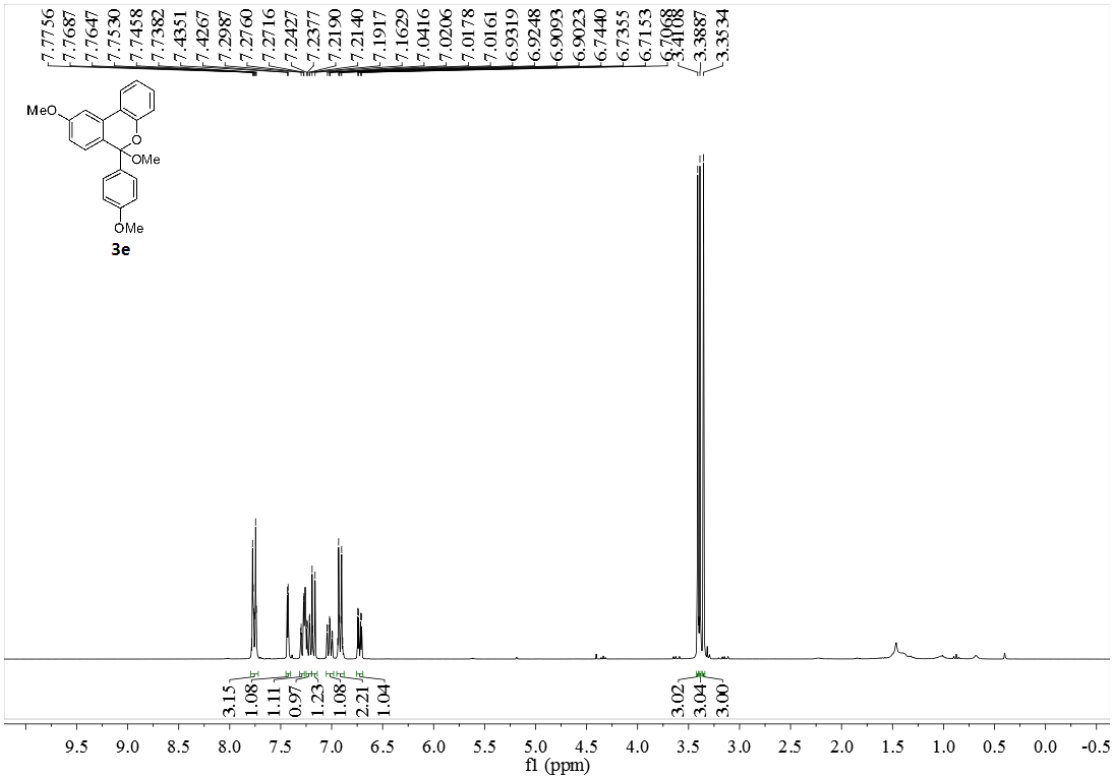
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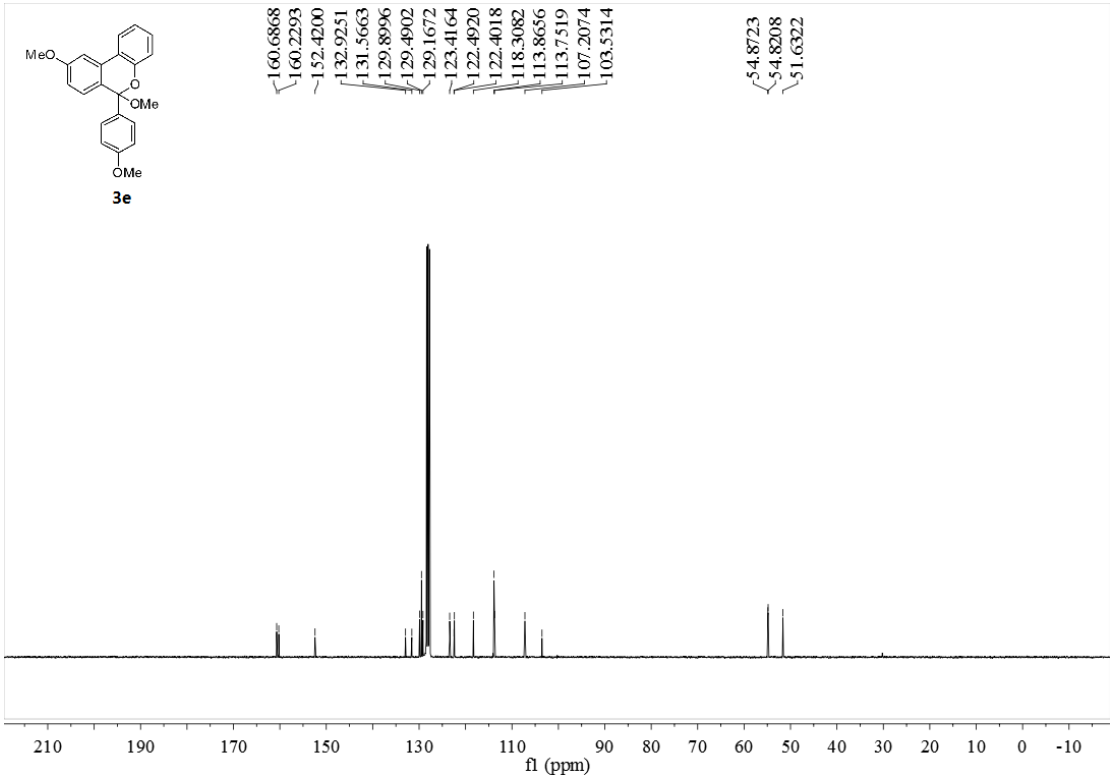
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122.4920
122.4018
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113.8656
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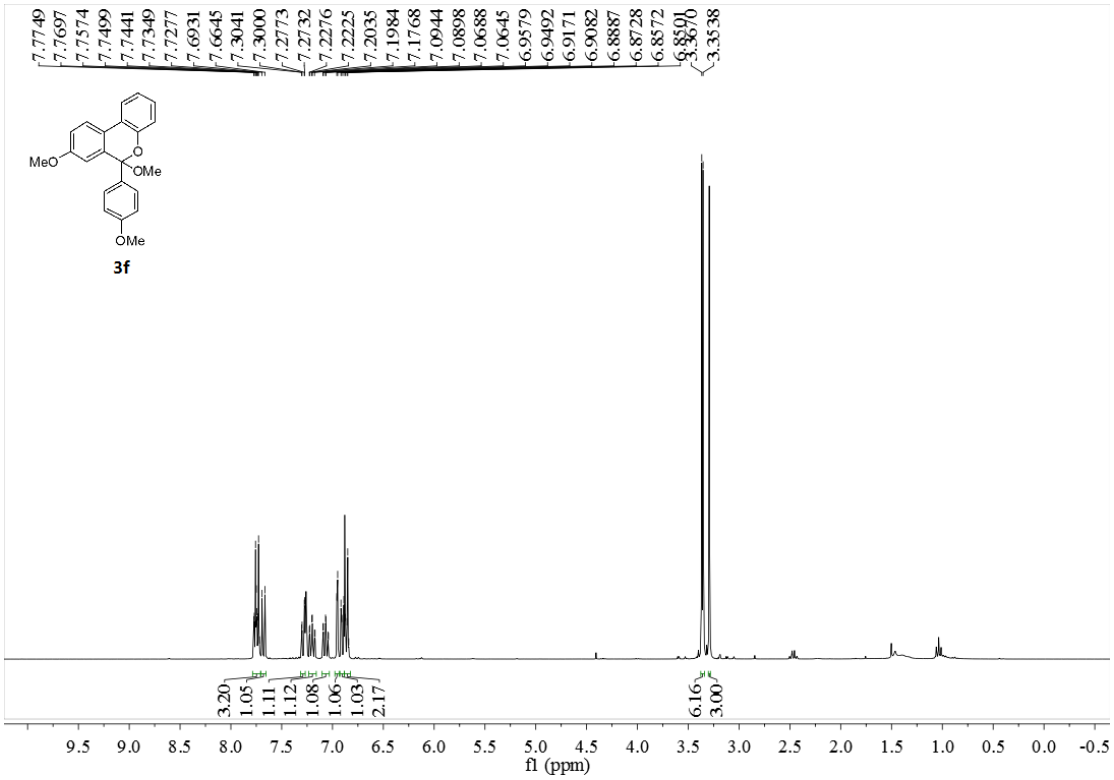
f1 (ppm)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6.9082
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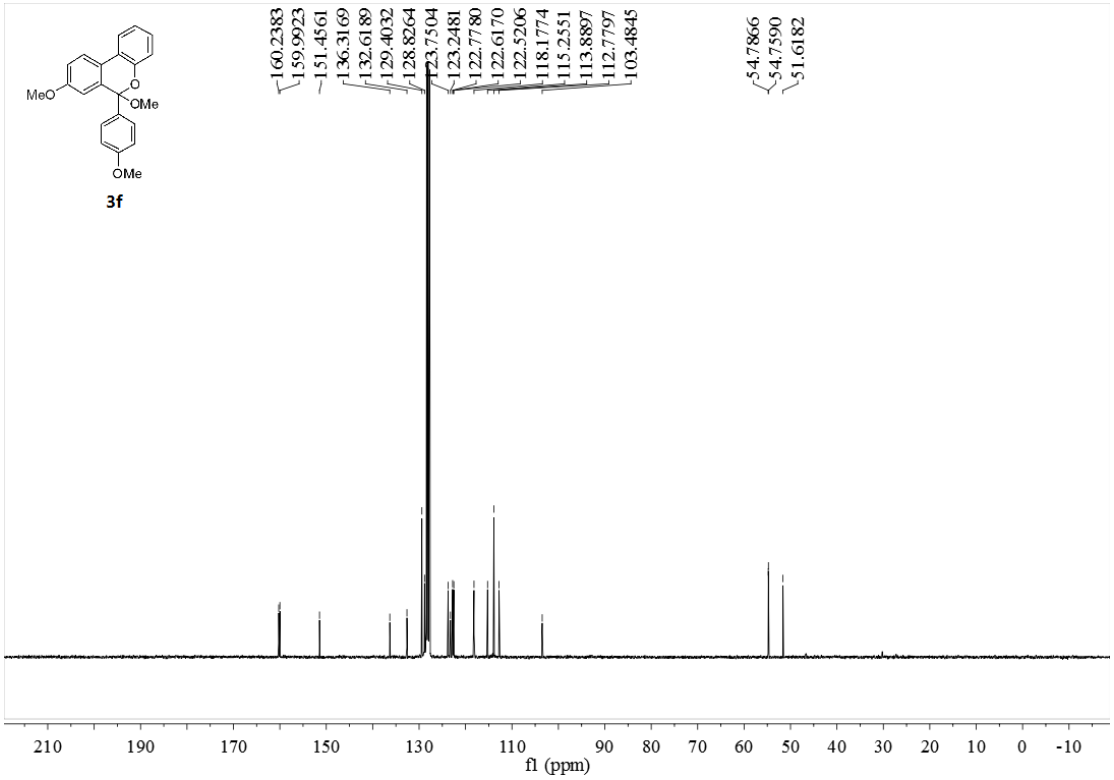
6.8728
6.8572
6.8501
3.3670
3.3538
MeO
OMe
OMe
3f
3.20
1.05
1.11
1.12
1.08
1.06
1.03
2.17
6.16
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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113.8897
112.7797
103.4845
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MeO
OMe
OMe
3f
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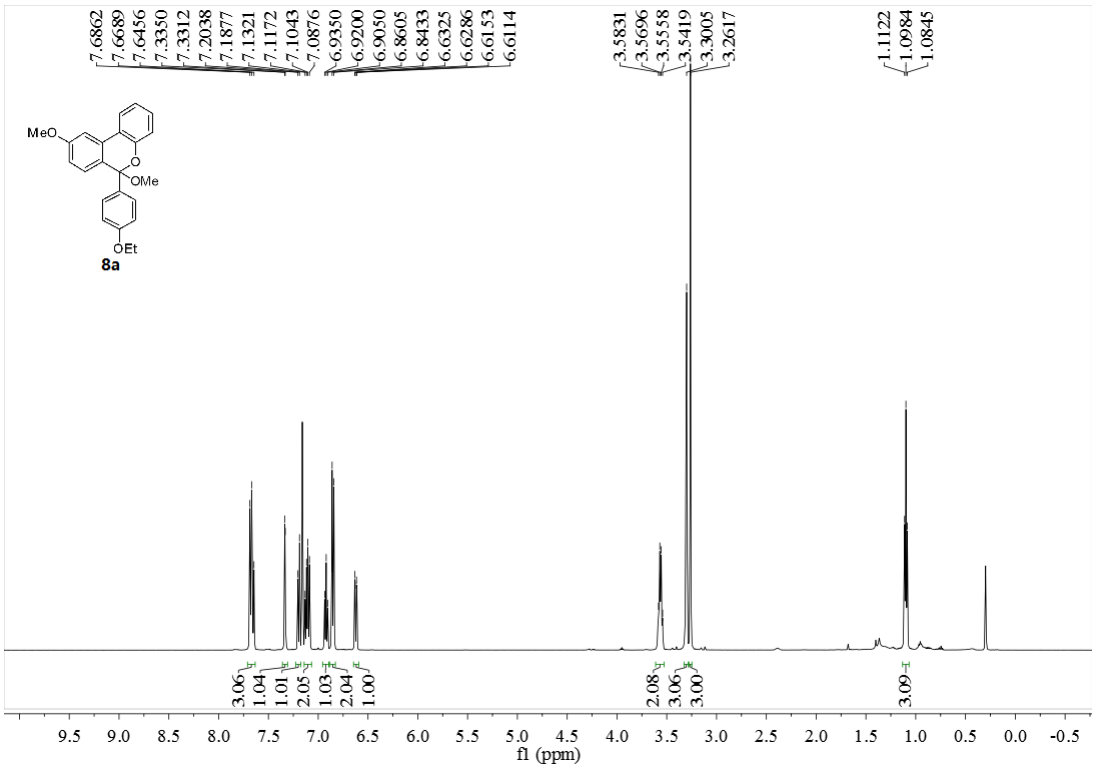
f1 (ppm)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3.2617
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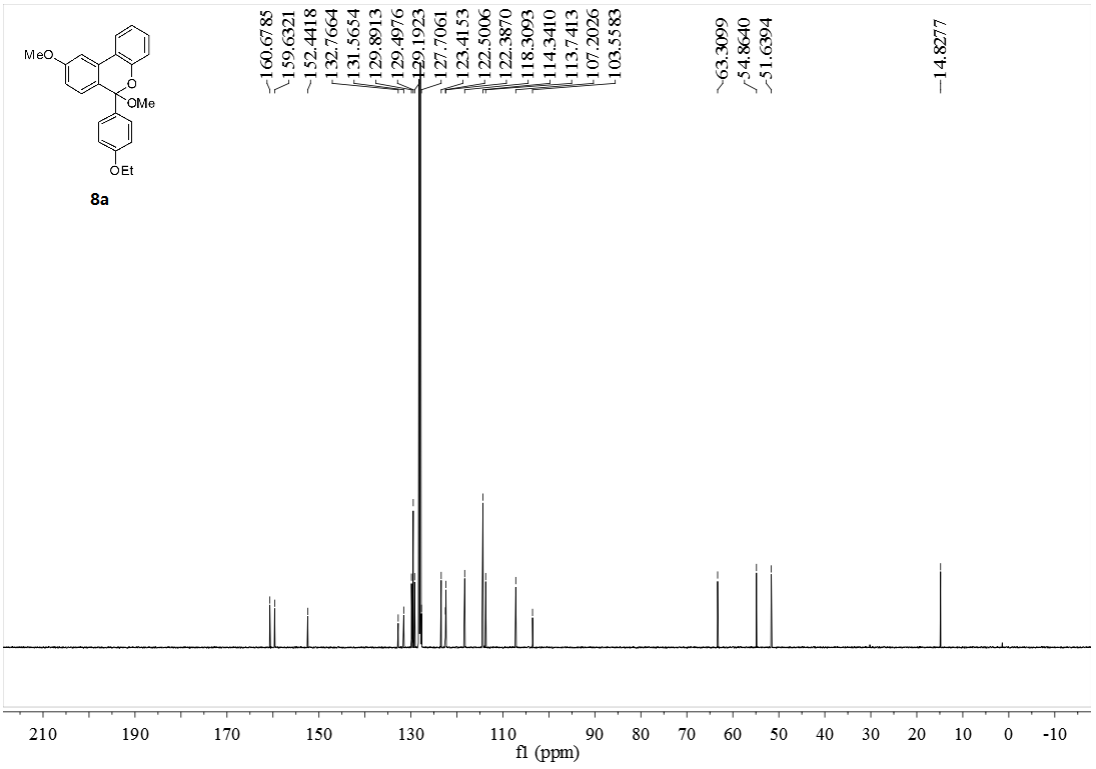
1.0845
MeO
OMe
OEt
8a
3.06
1.04
1.01
2.05
1.03
2.04
1.00
2.08
3.06
3.00
3.09
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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8a
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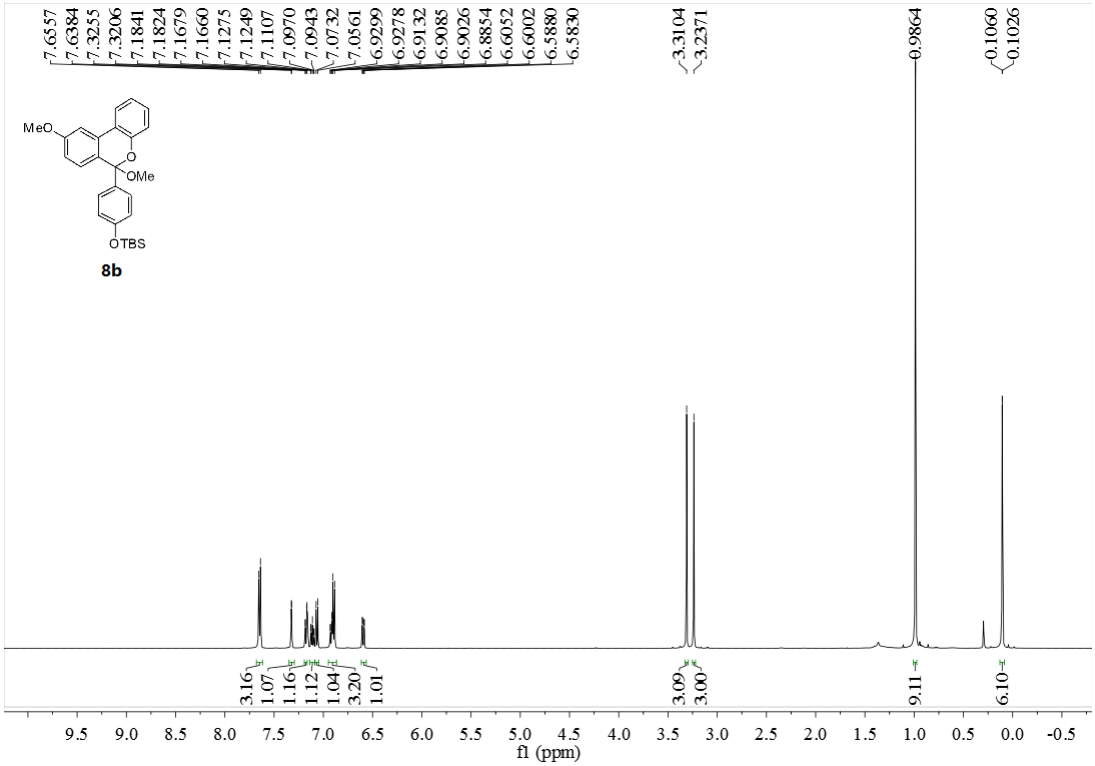
f1 (ppm)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6.9026
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6.6002
6.5880
6.5830
3.3104
3.2371
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0.1026
MeO
OMe
OTBS
8b
3.16
1.07
1.16
1.12
1.04
3.20
1.01
3.09
3.00
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6.10
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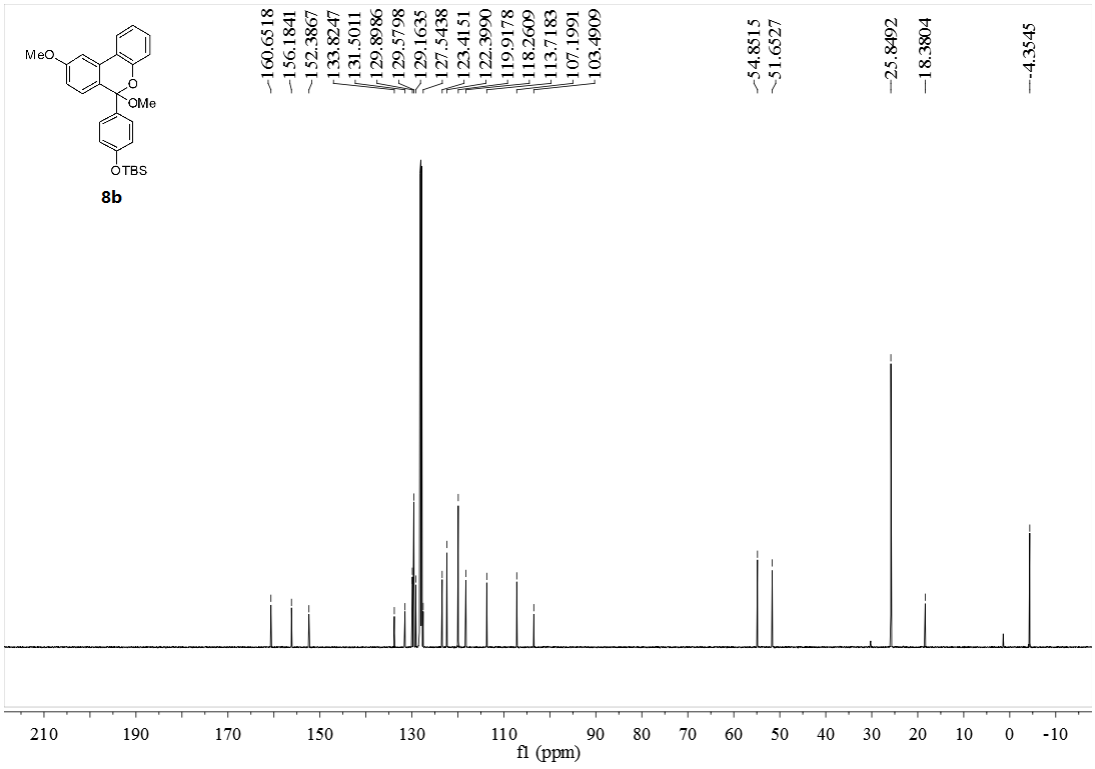
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OTBS
8b
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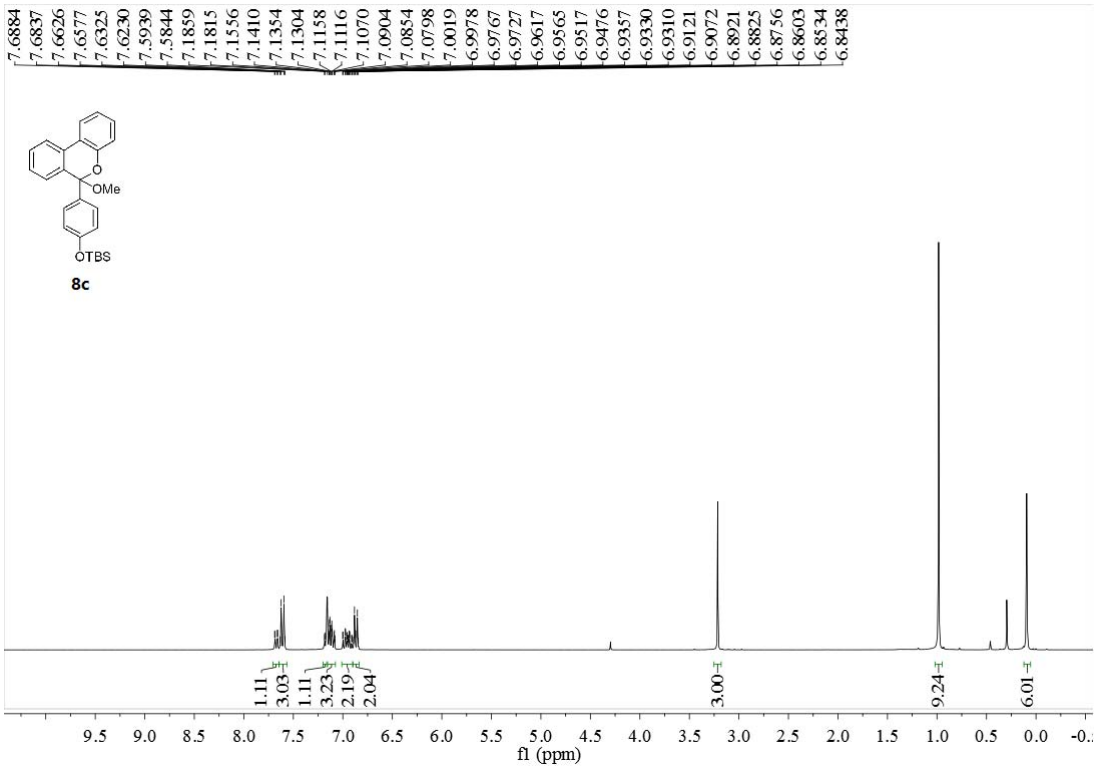
f1 (ppm)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6.8921
6.8825
6.8756
6.8603
6.8534
6.8438
OMe
OTBS
8c
1.11
3.03
1.11
3.23
2.19
2.04
3.00
9.24
6.01
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
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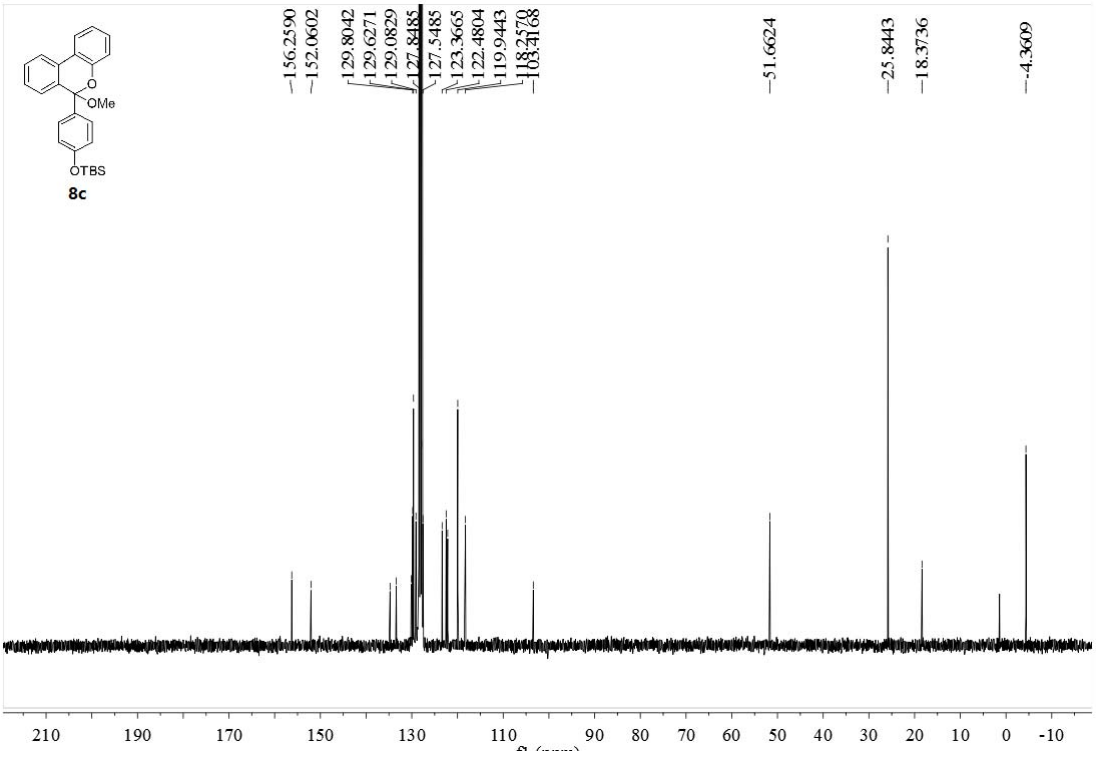
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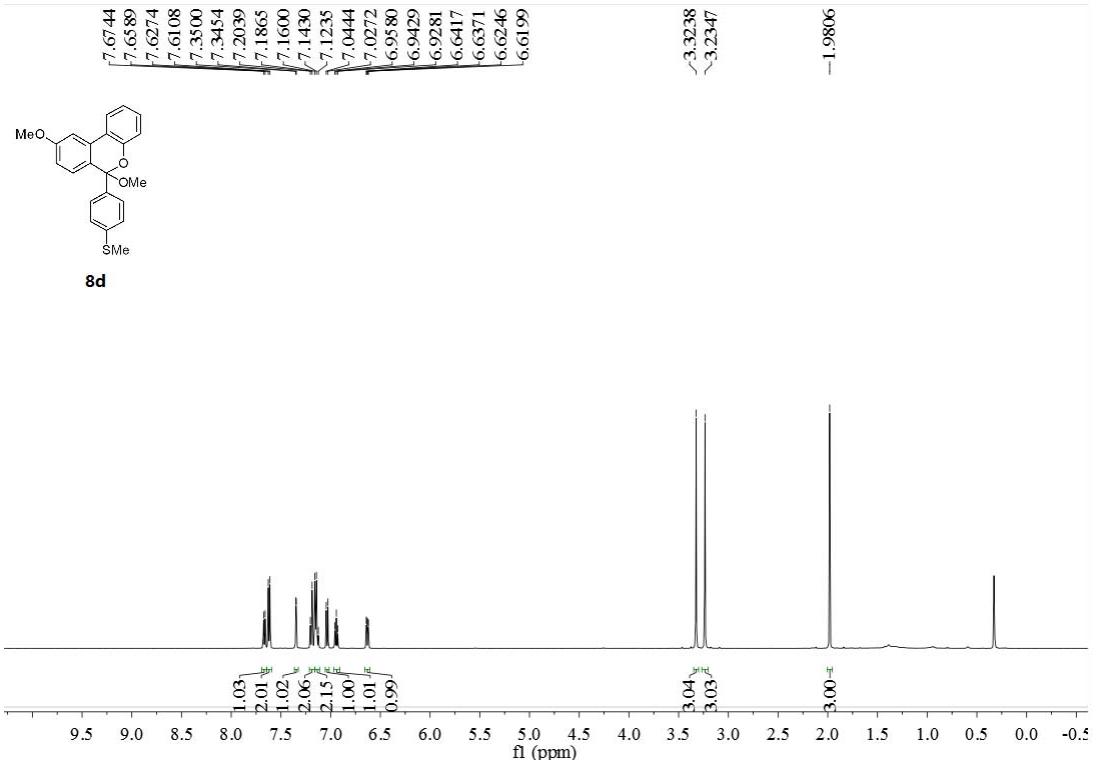
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7.0272
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6.9281
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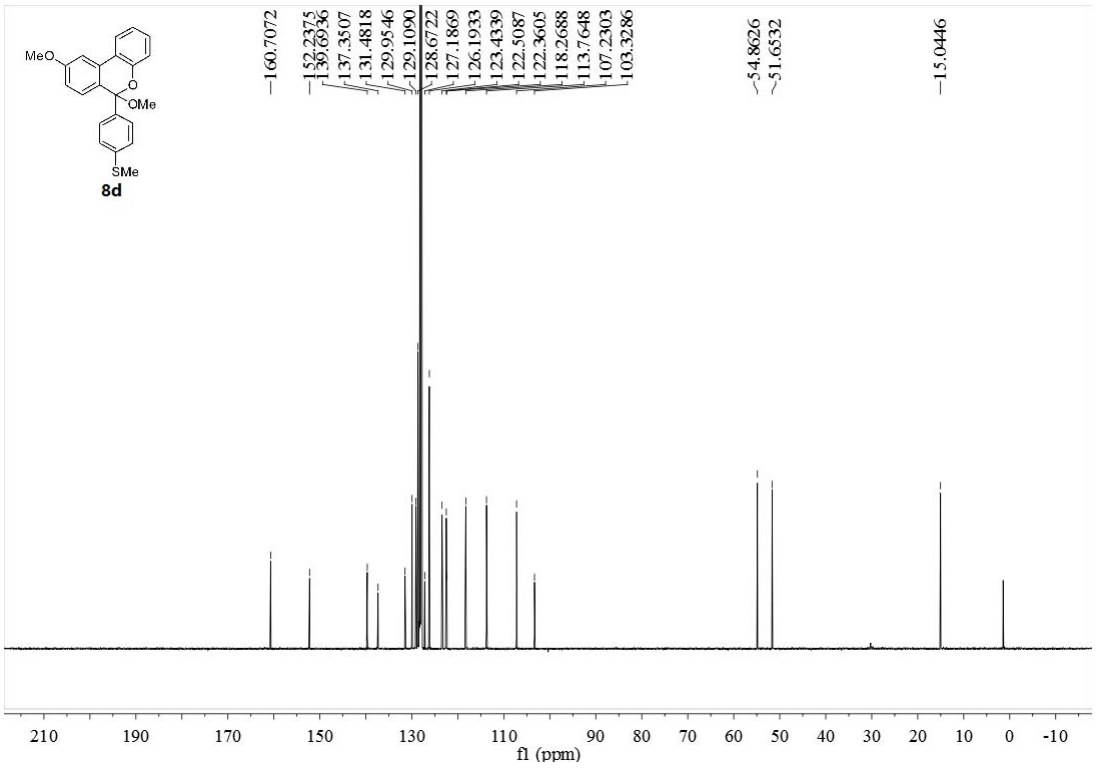
6.6371
6.6246
6.6199
3.3238
3.3247
1.9806
MeO
OMe
SMe
8d
1.03
2.01
1.02
2.06
2.15
1.00
1.01
0.99
3.04
3.03
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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8d
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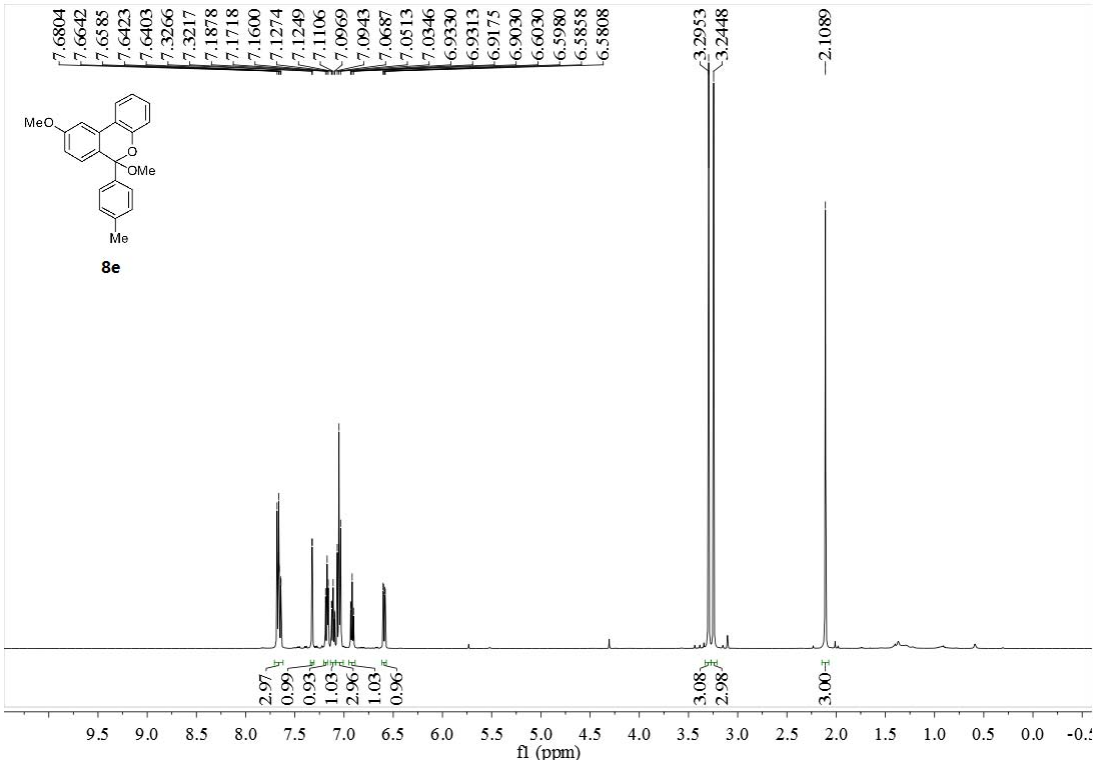
f1 (ppm)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6.5980
6.5858
6.5808
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OMe
Me
8e
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0.99
0.93
1.03
2.96
1.03
0.96
3.08
2.98
3.00
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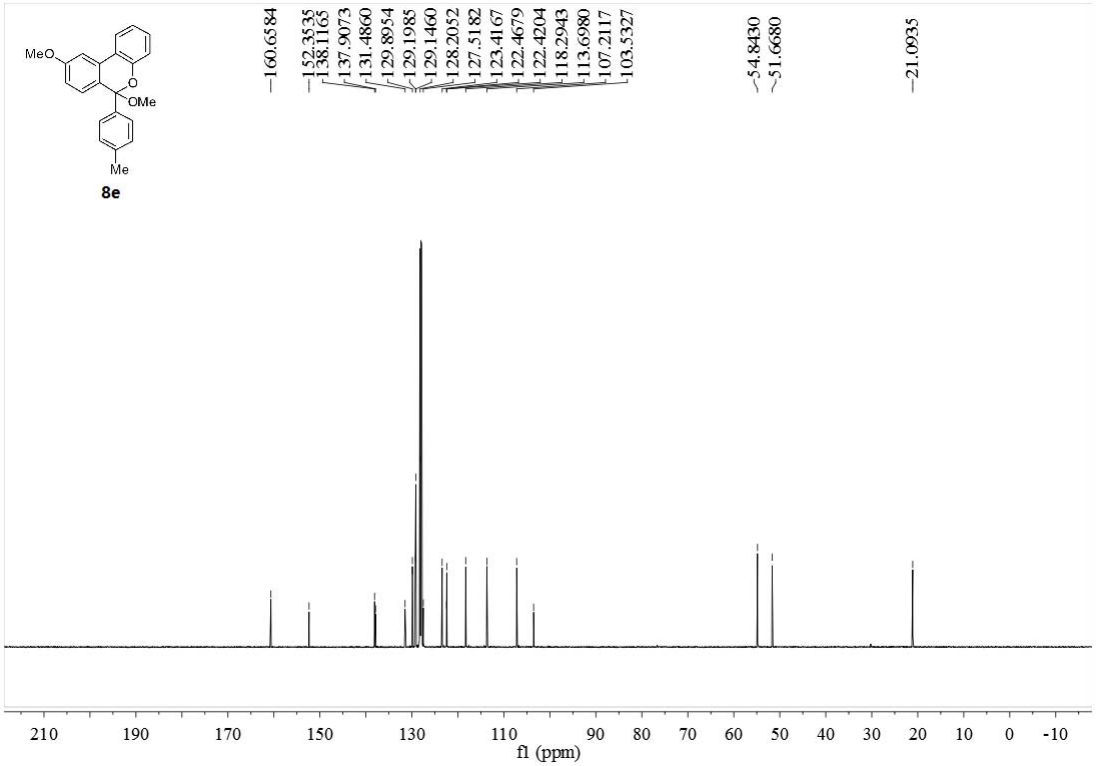
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OMe
Me
8e
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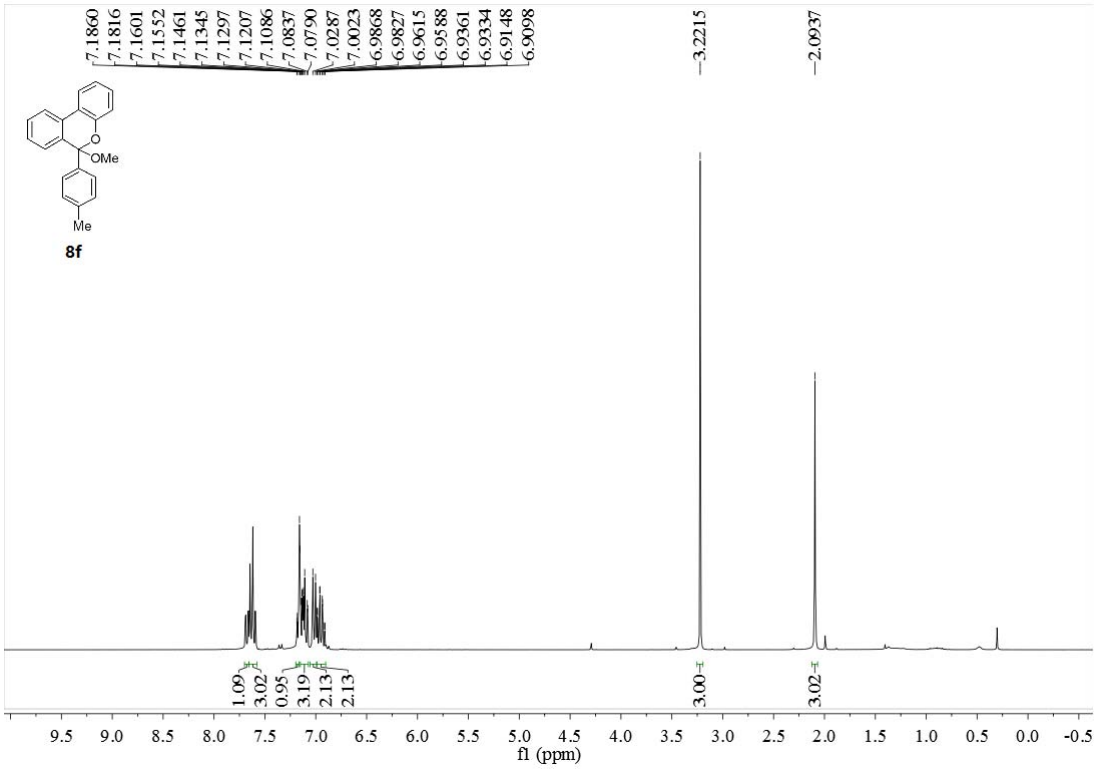
f1 (ppm)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6.9334
6.9148
6.9098
3.2215
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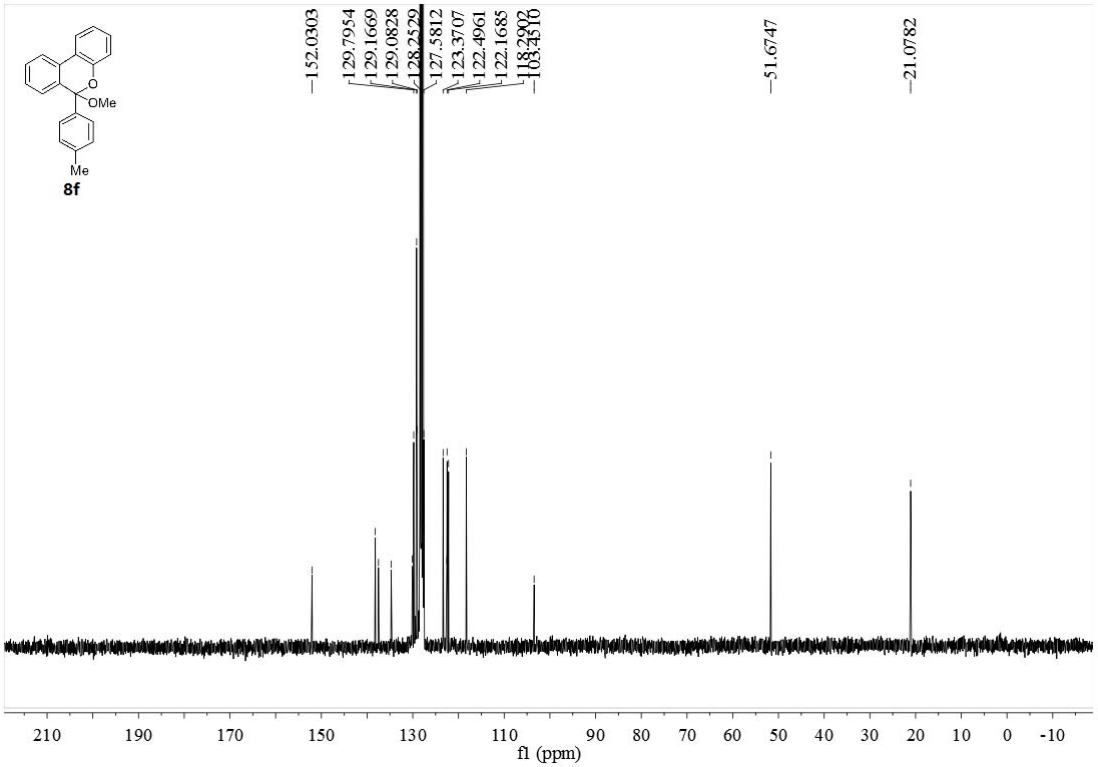
2.13
3.00
3.02
fl (ppm)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OMe
Me
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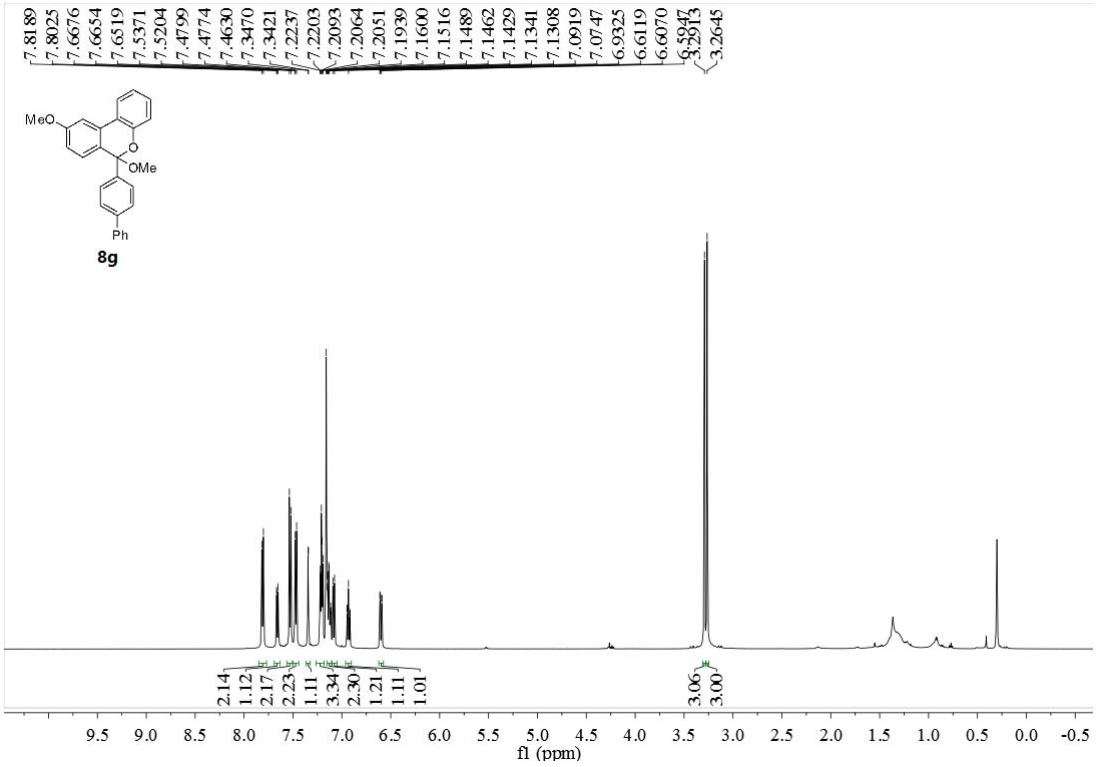
fl (ppm)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Ph
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3.06
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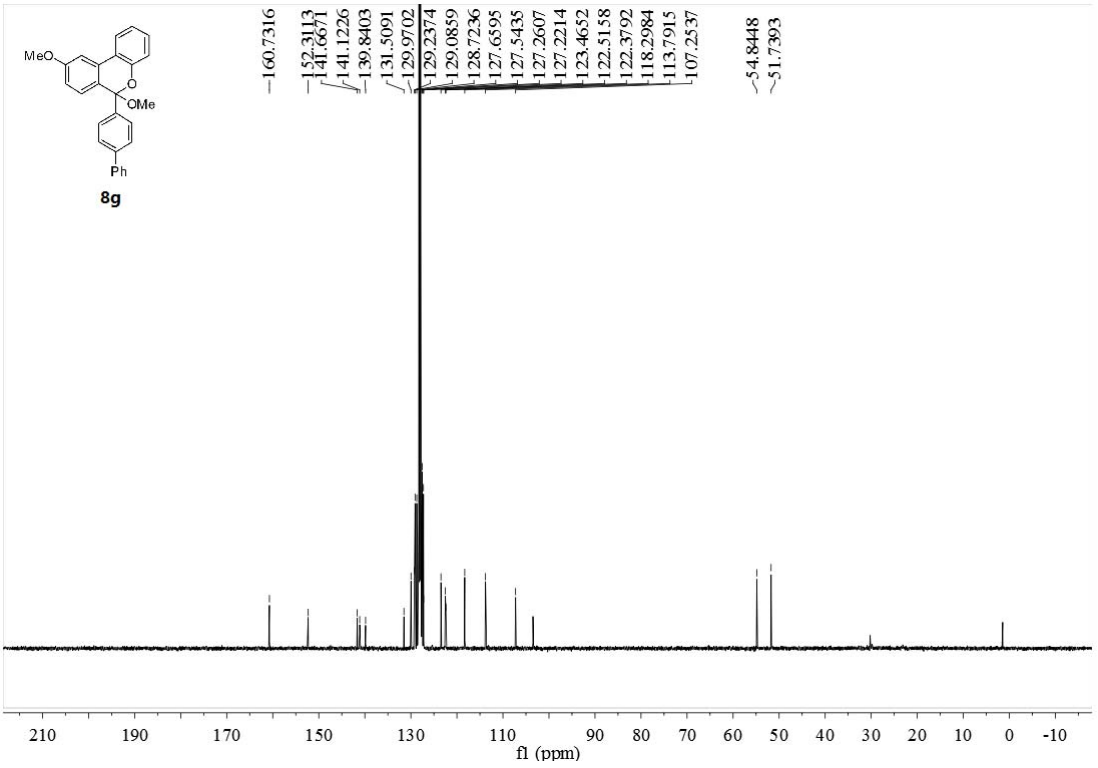
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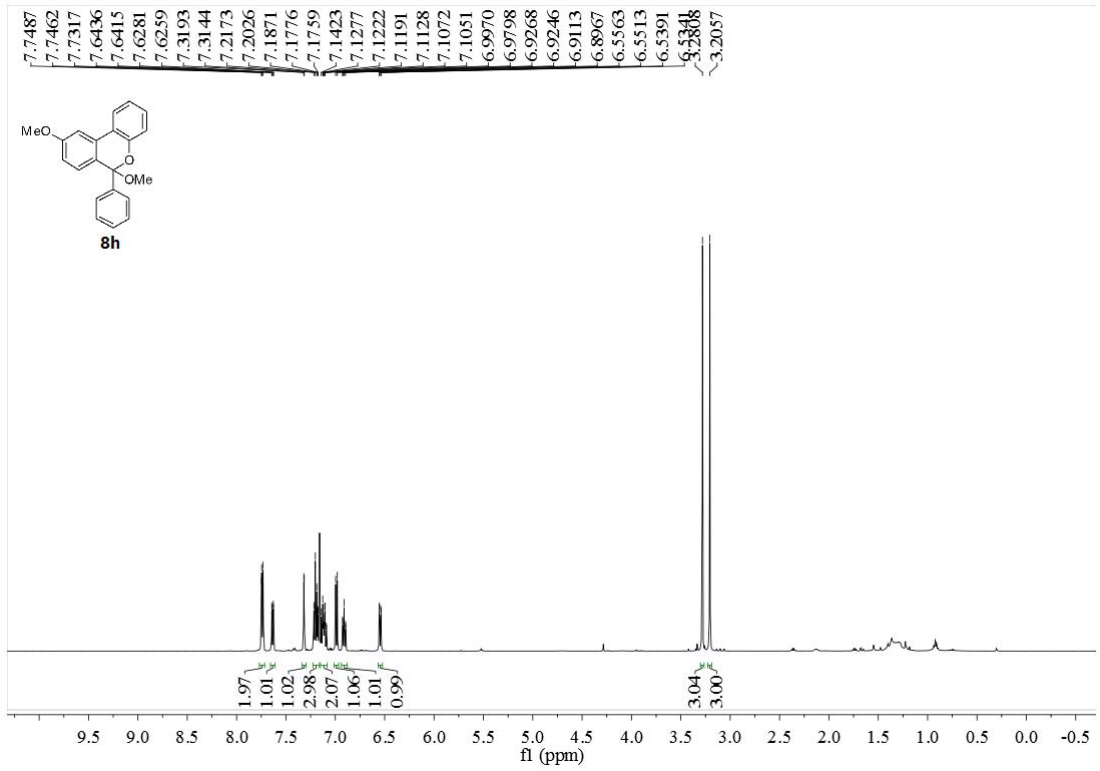
f1 (ppm)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OMe
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1.02
2.98
2.07
1.06
1.01
0.99
3.04
3.00
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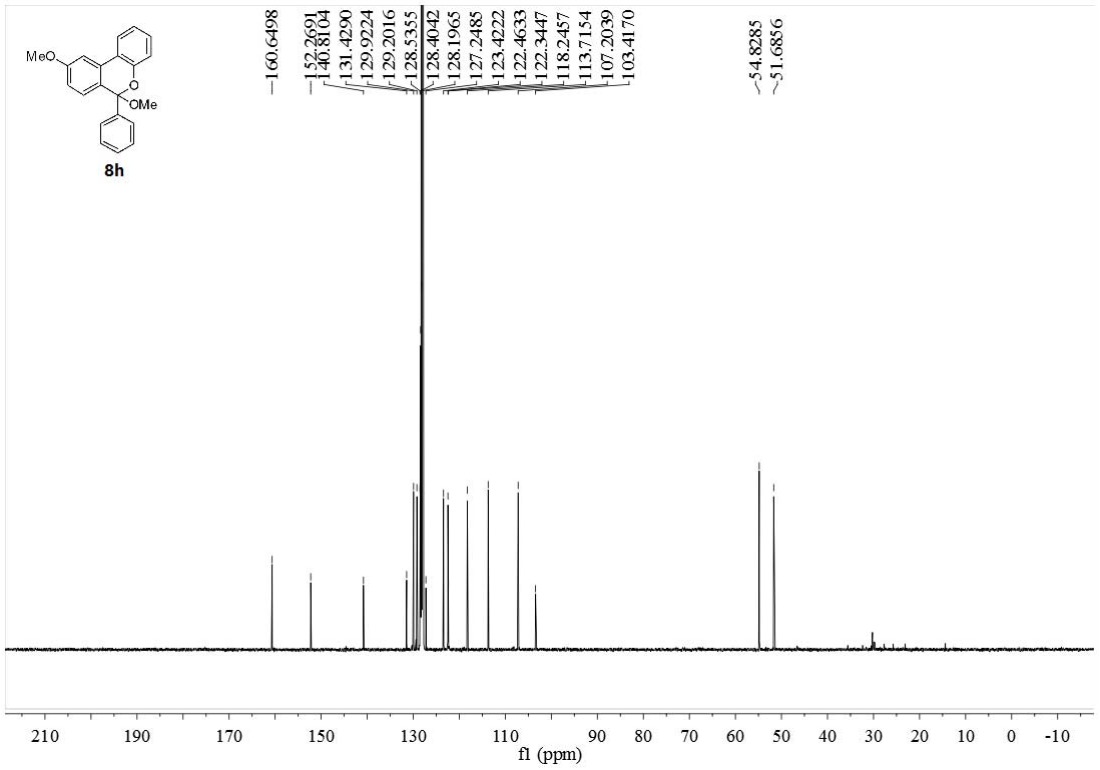
f1 (ppm)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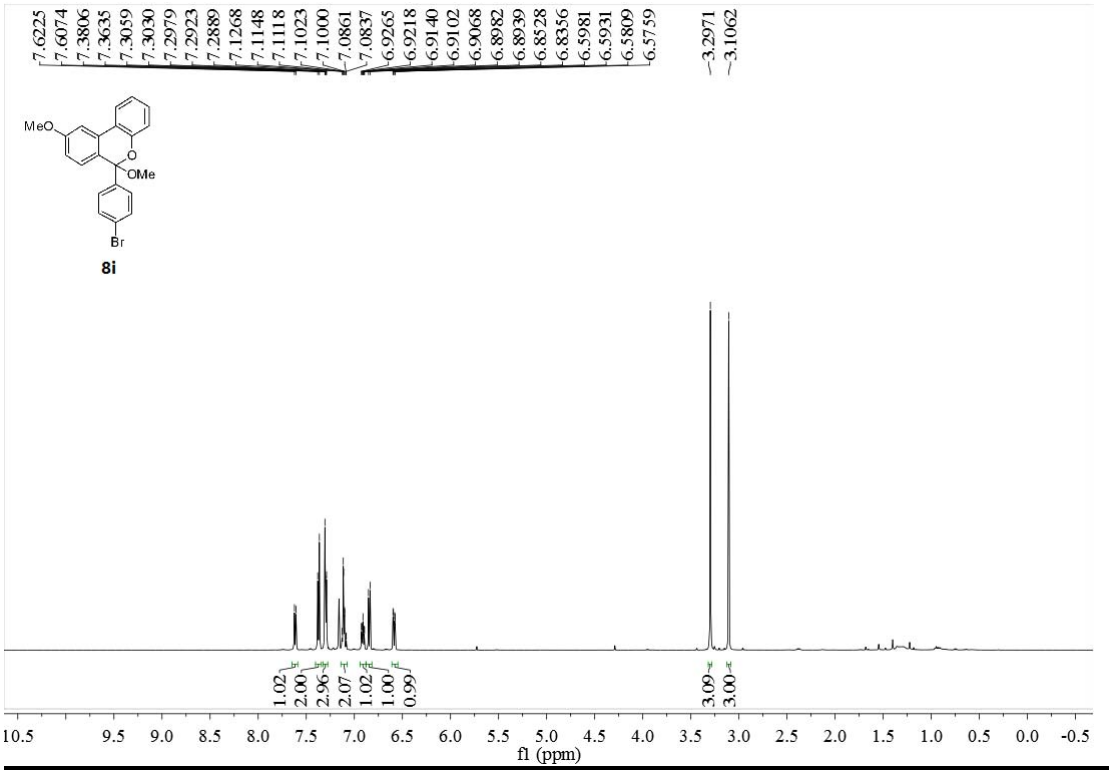
f1 (ppm)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3.2971
3.1062
MeO
OMe
Br
8i
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1.00
0.99
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3.00
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7.0
6.5
6.0
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5.0
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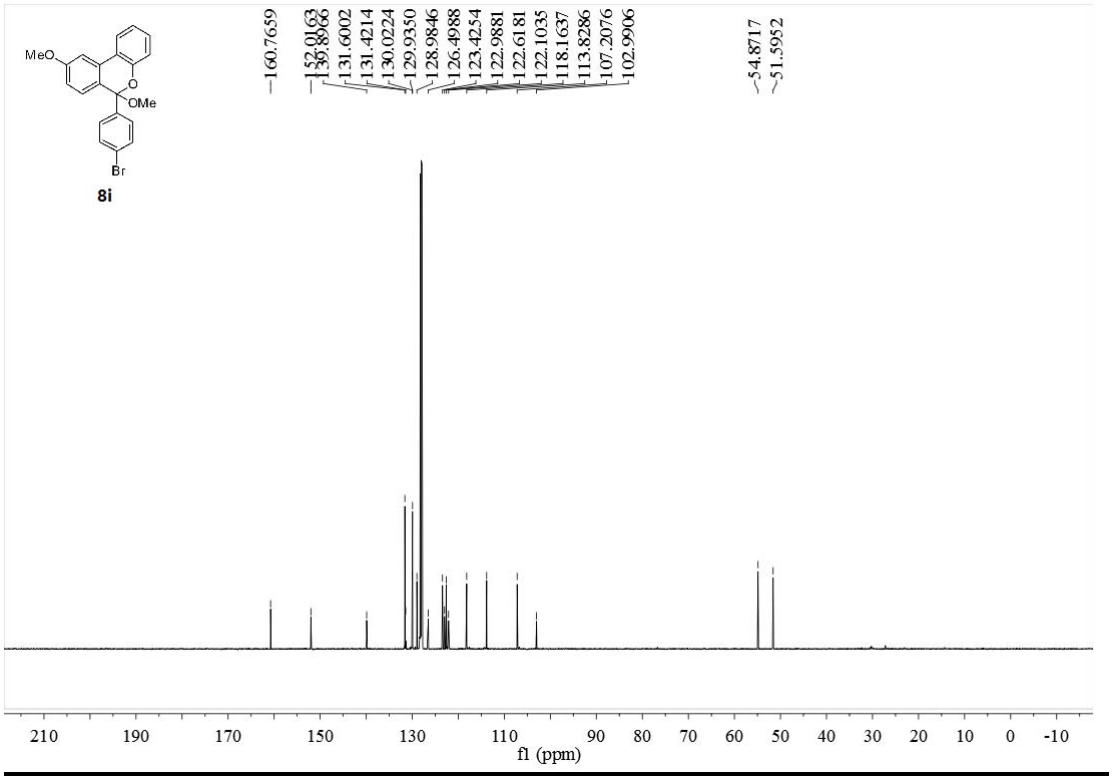
-0.5
f1 (ppm)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MeO
OMe
Br
8i
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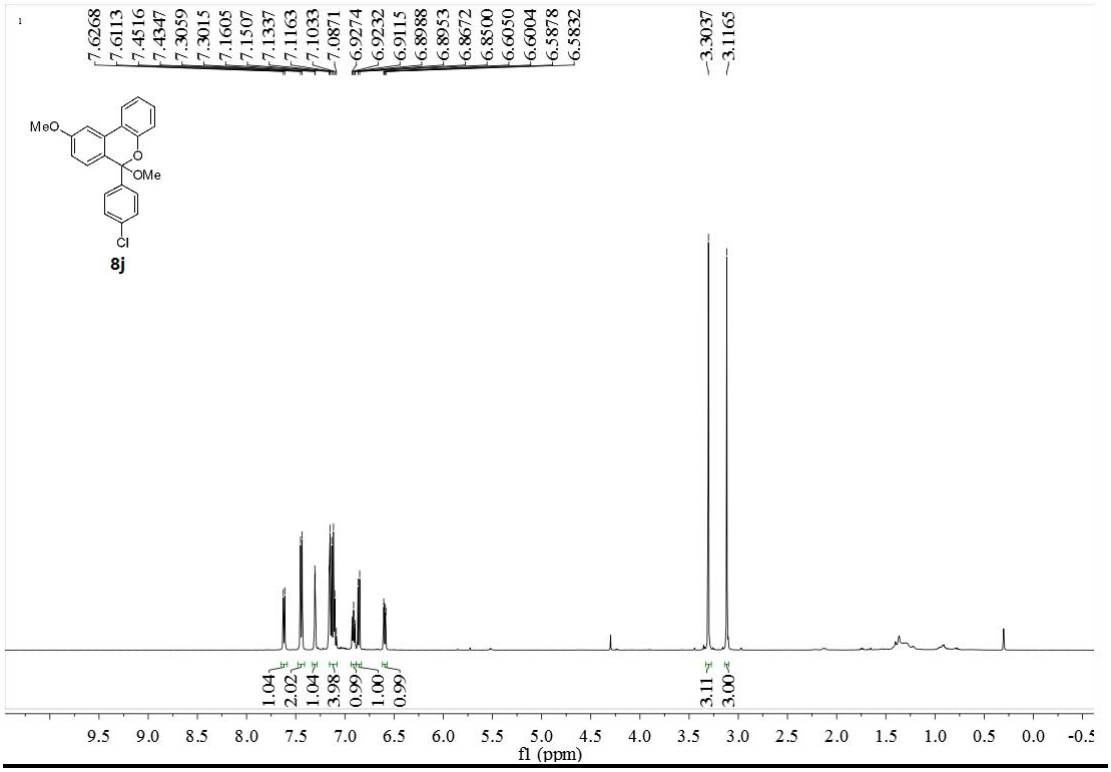
130
110
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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OMe
Cl
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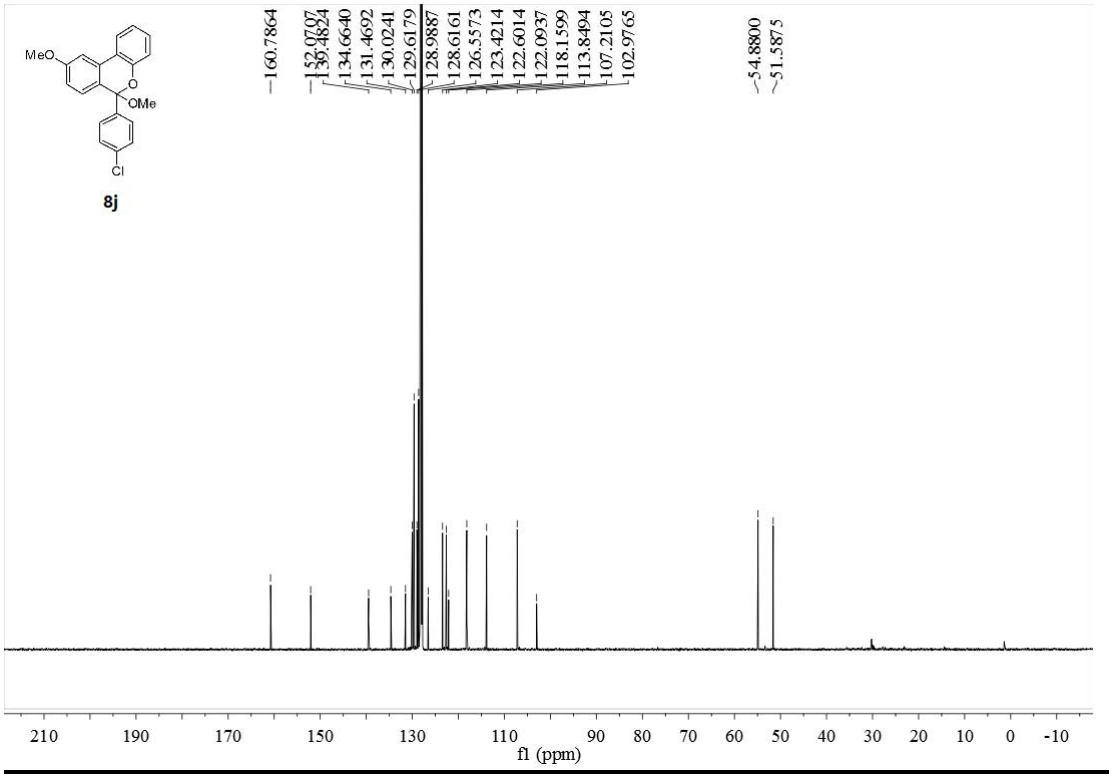
2.02
1.04
3.98
0.99
1.00
0.99
3.11
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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122.6014
122.0937
118.1599
113.8494
107.2105
102.9765
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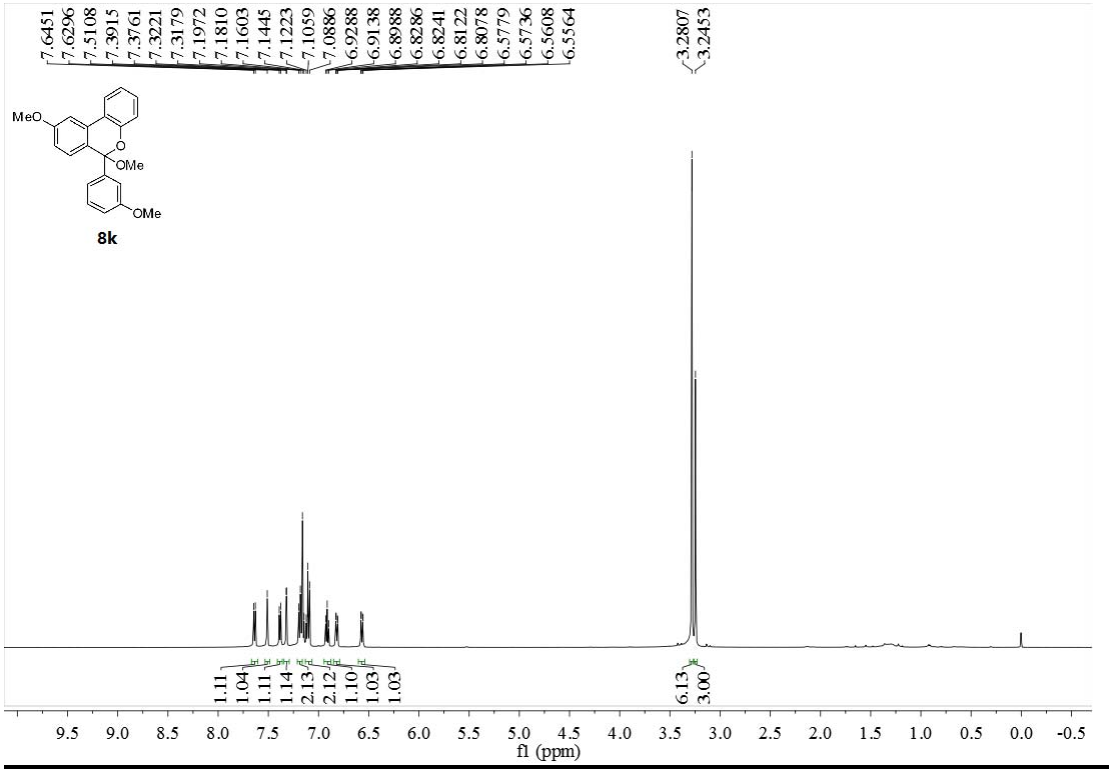
51.5875
MeO
OMe
Cl
8j
210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.1445
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7.1059
7.0886
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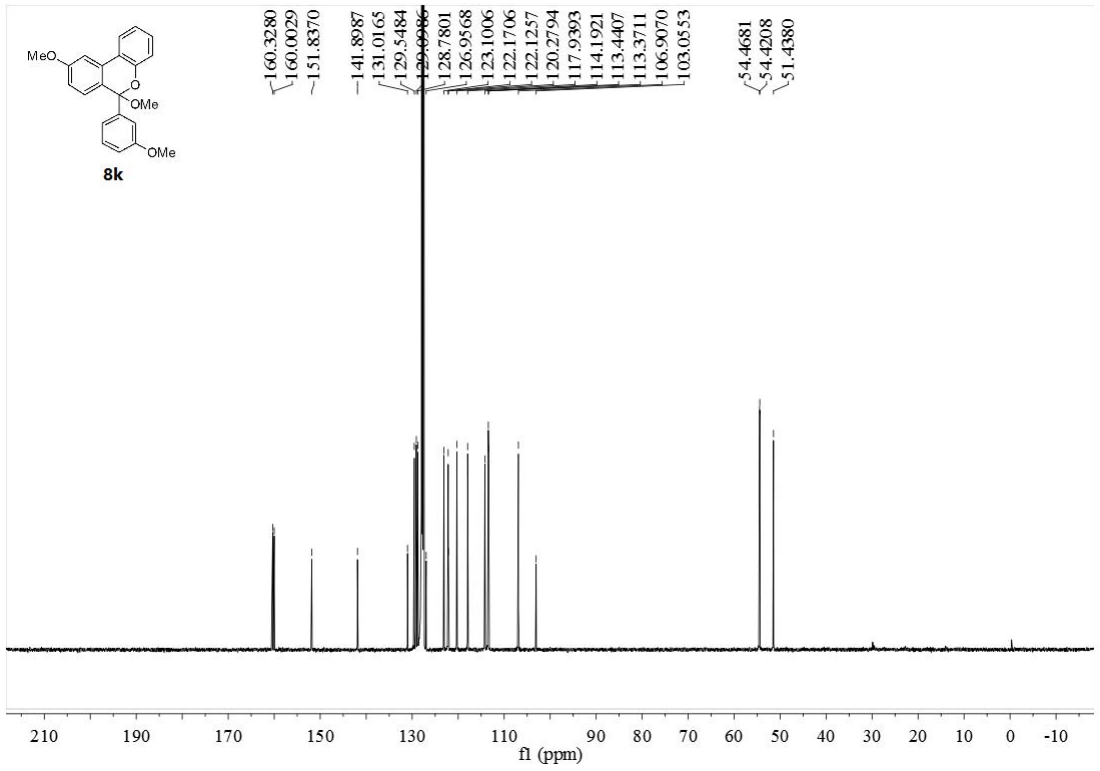
6.9138
6.8988
6.8286
6.8241
6.8122
6.8078
6.5779
6.5736
6.5608
6.5564
3.2807
3.2453
MeO
OMe
OMe
8k
1.11
1.04
1.11
1.14
2.13
2.12
1.10
1.03
1.03
6.13
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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OMe
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120.2794
117.9393
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113.4407
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51.4380
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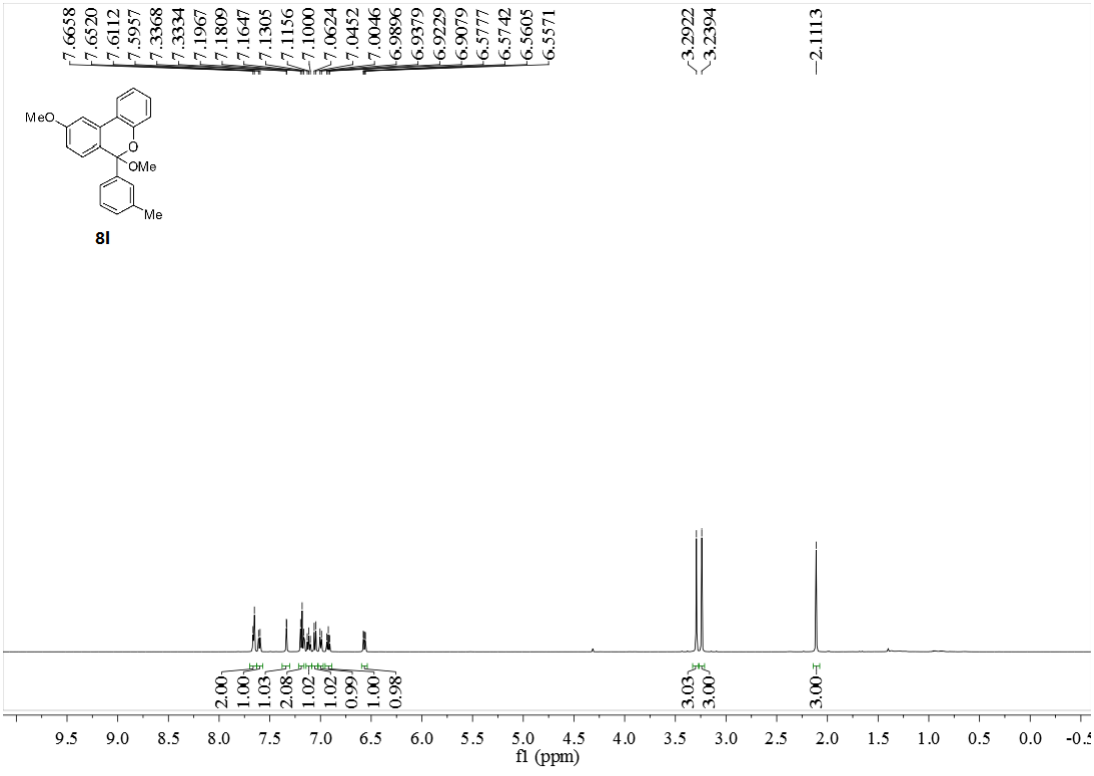
f1 (ppm)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7.1000
7.0624
7.0452
7.0046
6.9896
6.9379
6.9229
6.9079
6.5777
6.5742
6.5605
6.5571
3.2922
3.2394
2.1113
MeO
OMe
Me
8l
2.00
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1.02
1.02
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1.00
0.98
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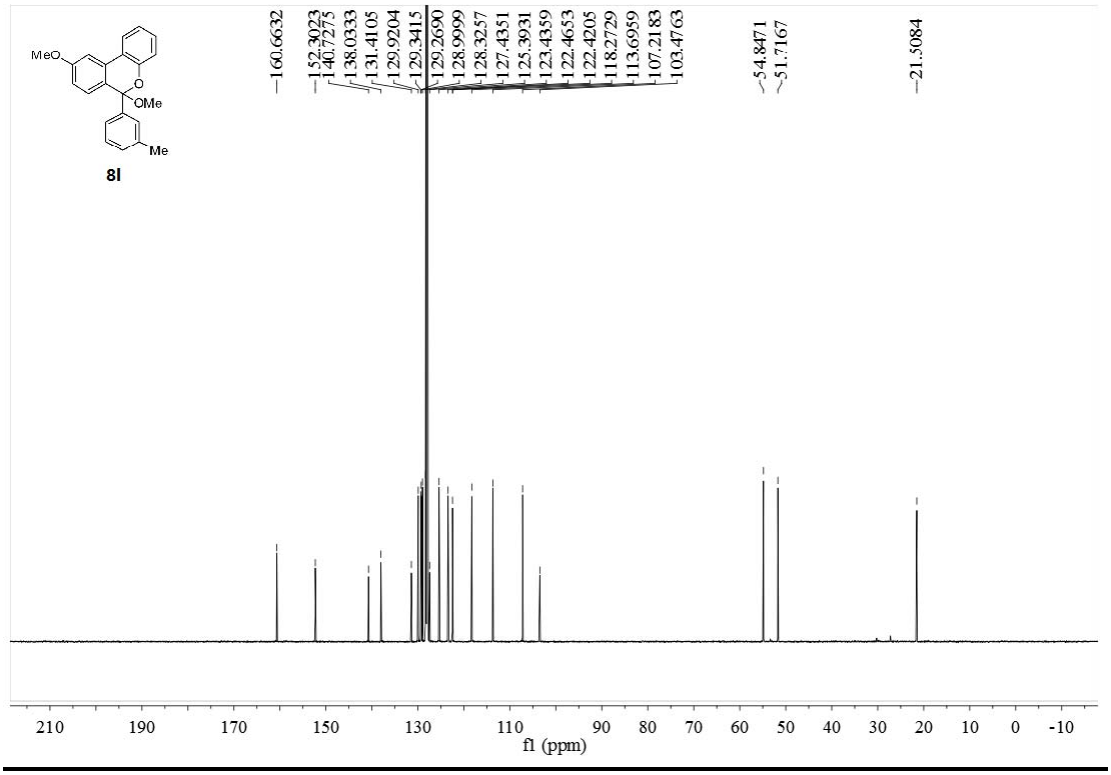
3.00
fl (ppm)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122.4205
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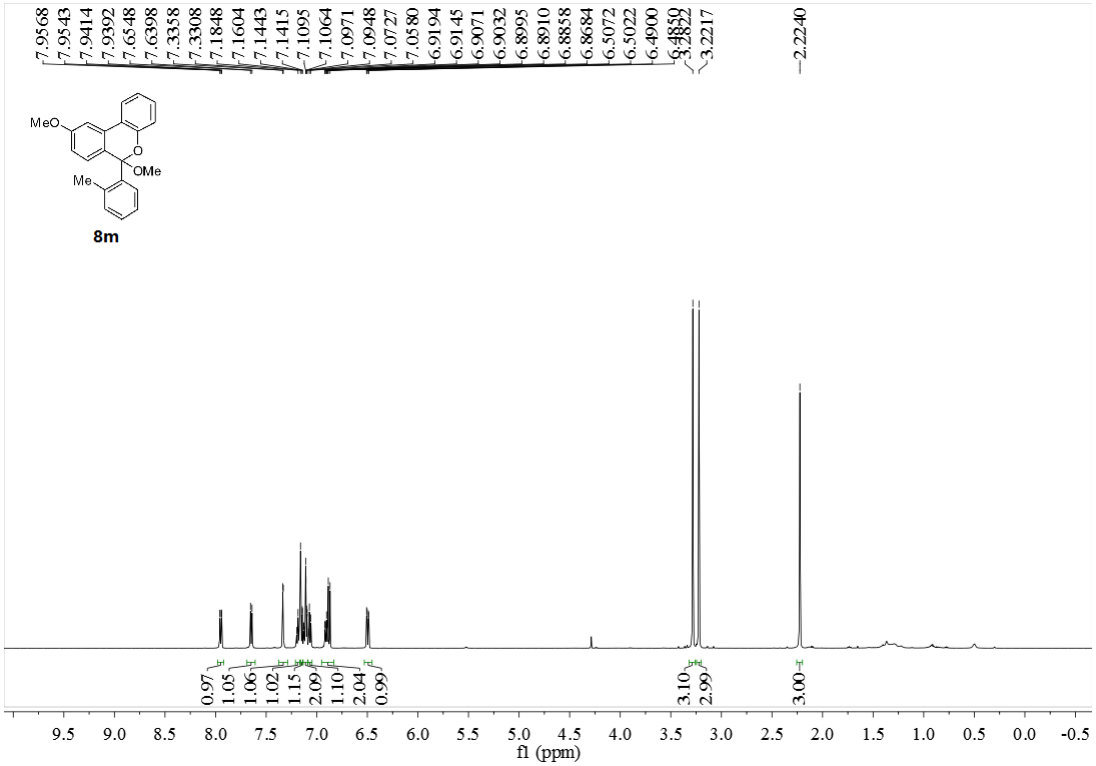
MeO
OMe
Me
8l
fl (ppm)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7.1443
7.1415
7.1095
7.1064
7.0971
7.0948
7.0727
7.0580
6.9194
6.9145
6.9071
6.9032
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6.8858
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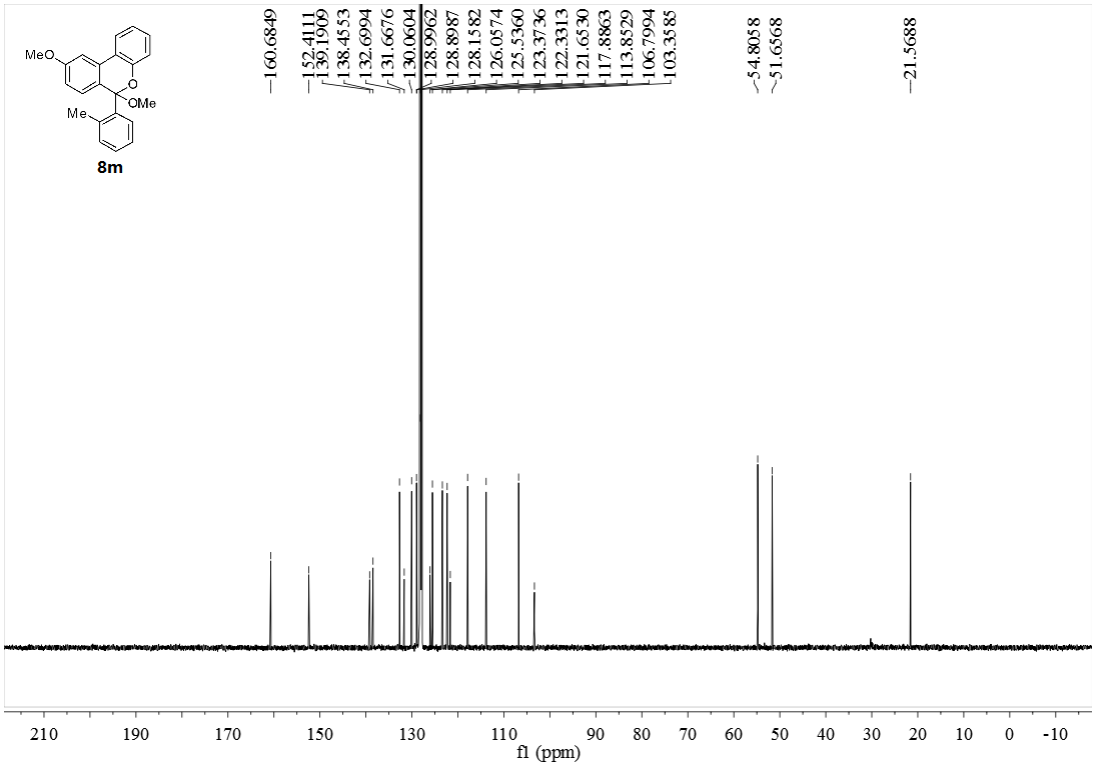
6.5072
6.5022
6.4900
3.2217
2.2240
MeO
OMe
Me
8m
0.97
1.05
1.06
1.02
1.15
2.09
1.10
2.04
0.99
3.10
2.99
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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125.5360
123.3736
122.3313
121.6530
117.8863
113.8529
106.7994
103.3585
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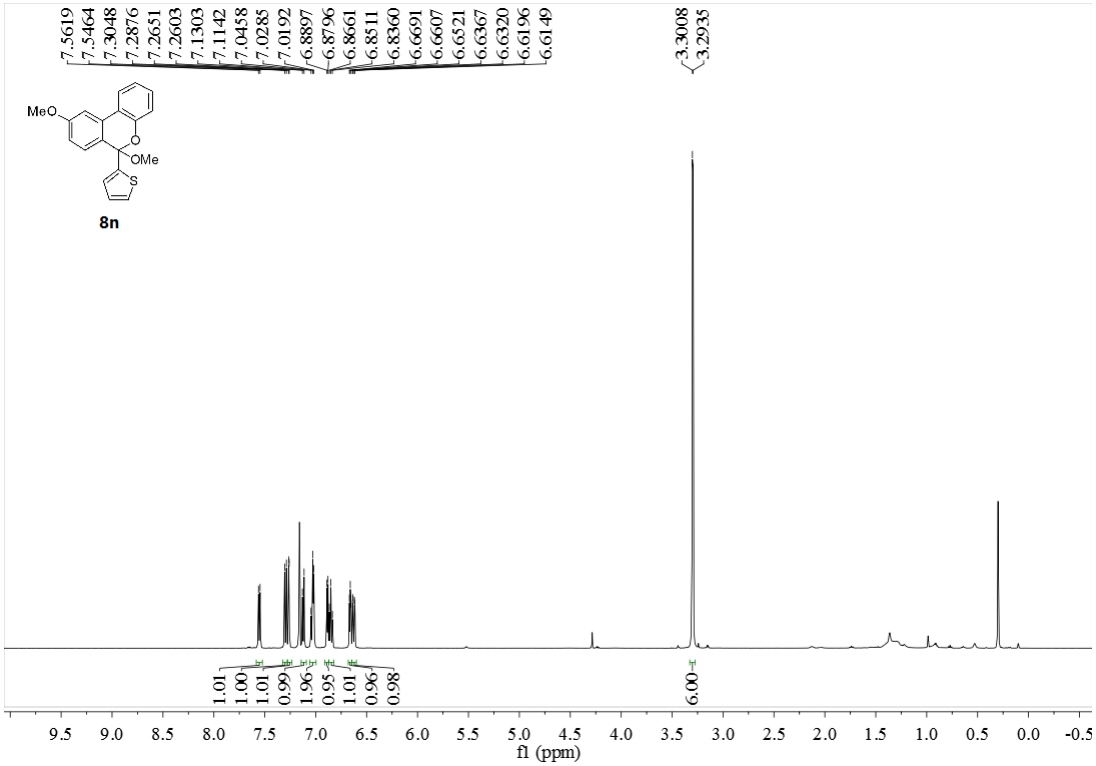
21.5688
MeO
OMe
Me
8m
210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.1303
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7.0285
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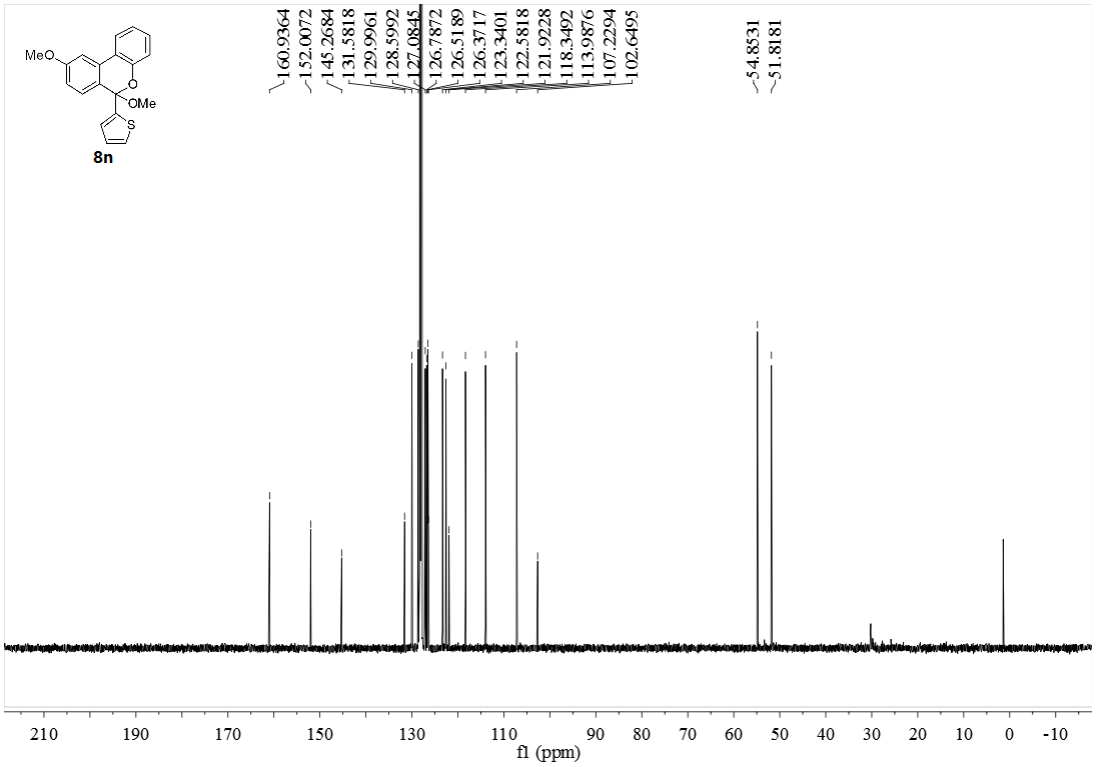
6.8897
6.8796
6.8661
6.8511
6.8360
6.6691
6.6607
6.6521
6.6367
6.6320
6.6196
6.6149
3.3008
3.2935
MeO
OMe
S
8n
1.01
1.00
1.01
0.99
1.96
0.95
1.01
0.96
0.98
6.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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123.3401
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121.9228
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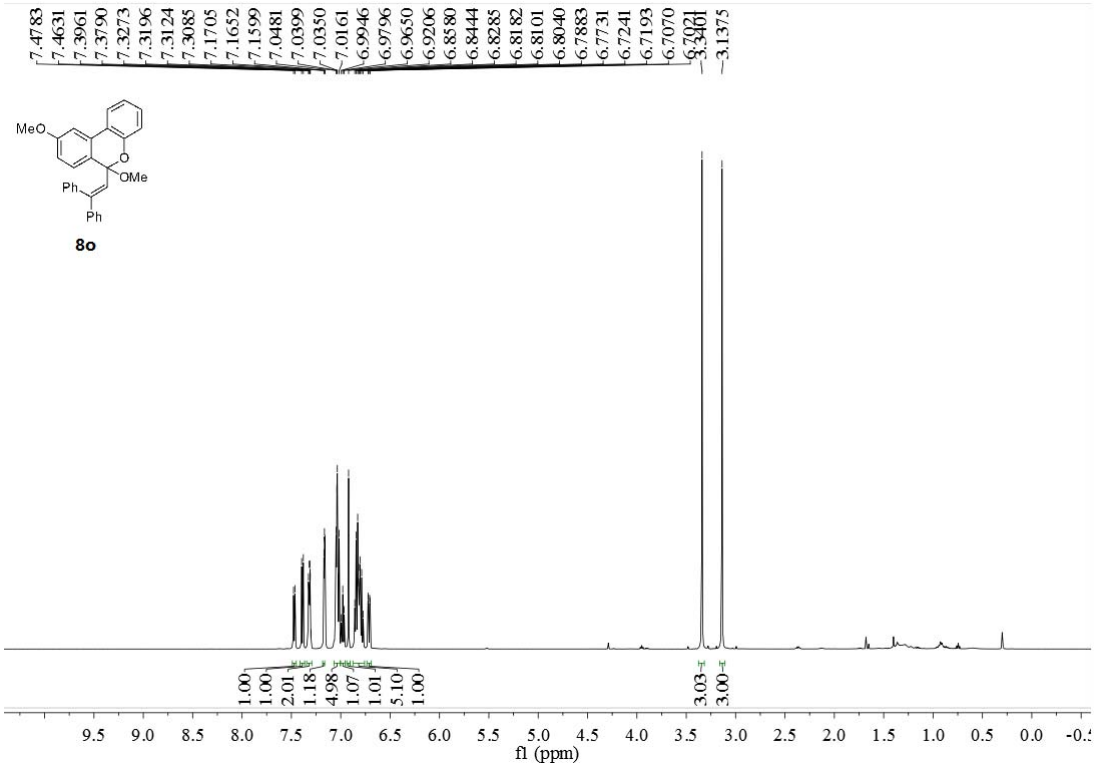
54.8531
51.8181
210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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6.7021
3.3401
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MeO
OMe
Ph
Ph
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1.00
2.01
1.18
4.98
1.07
1.01
5.10
1.00
3.03
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
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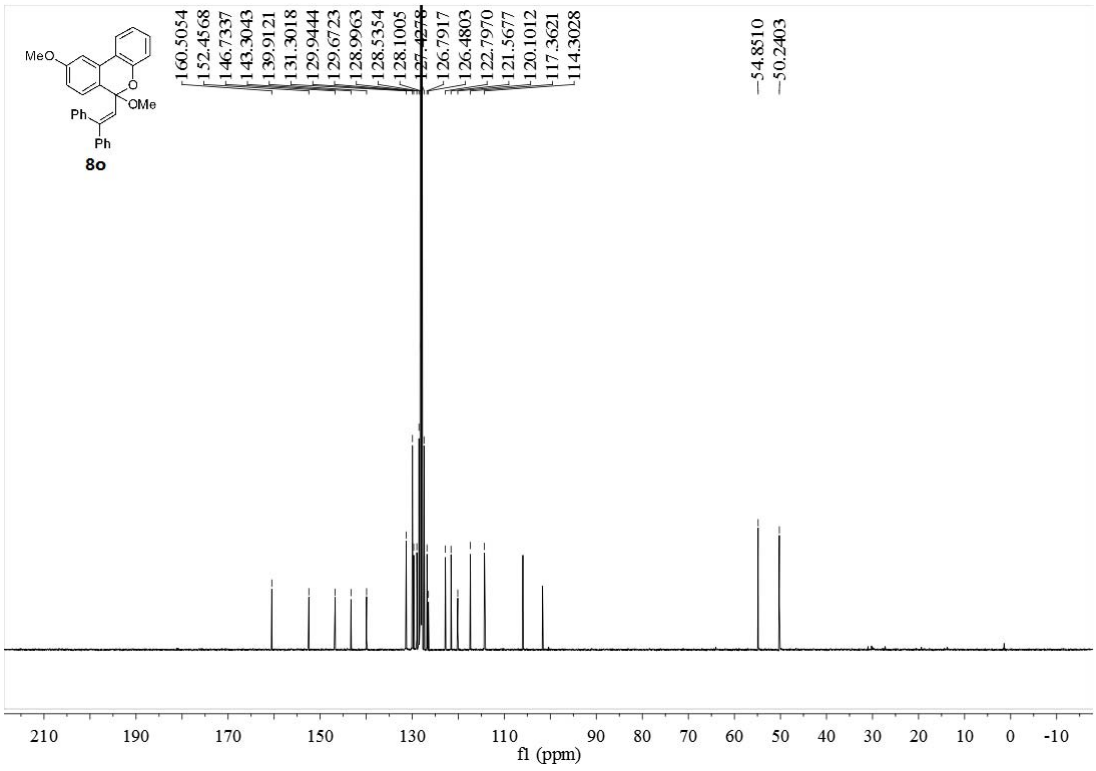
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121.5677
120.1012
117.3621
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MeO
OMe
Ph
Ph
8o
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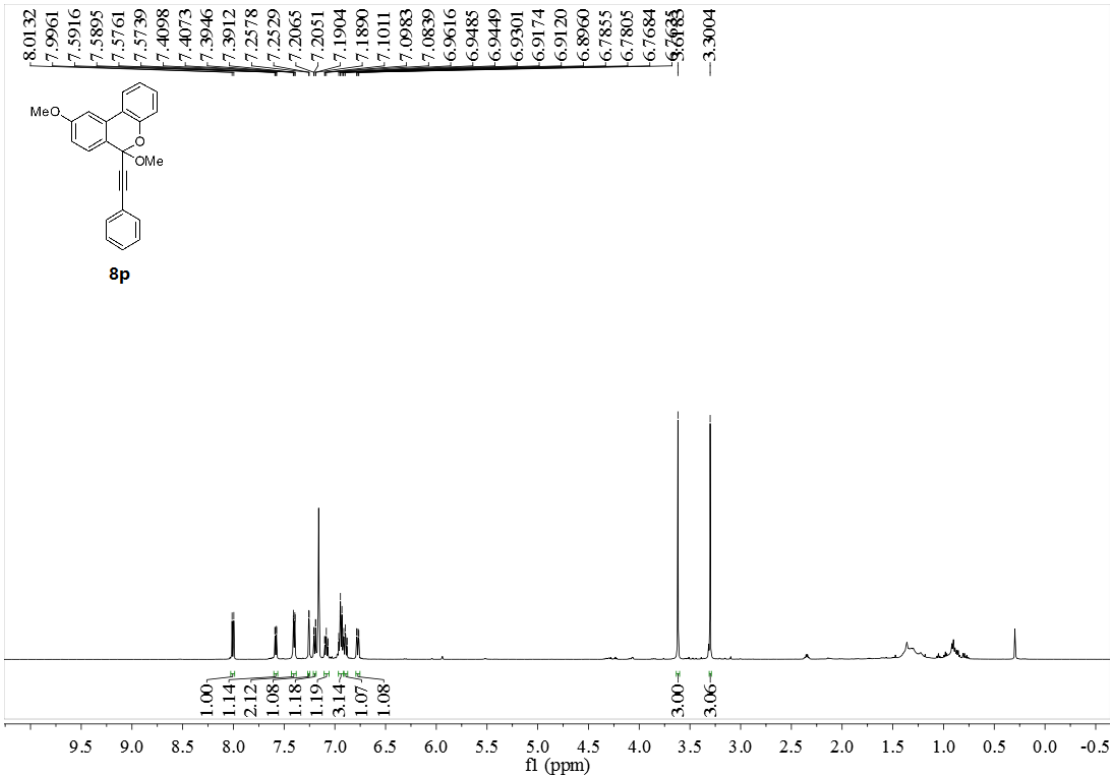
f1 (ppm)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7.0839
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6.9485
6.9449
6.9301
6.9174
6.9120
6.8960
6.7855
6.7805
6.7684
6.7633
3.3004
MeO
OMe
8p
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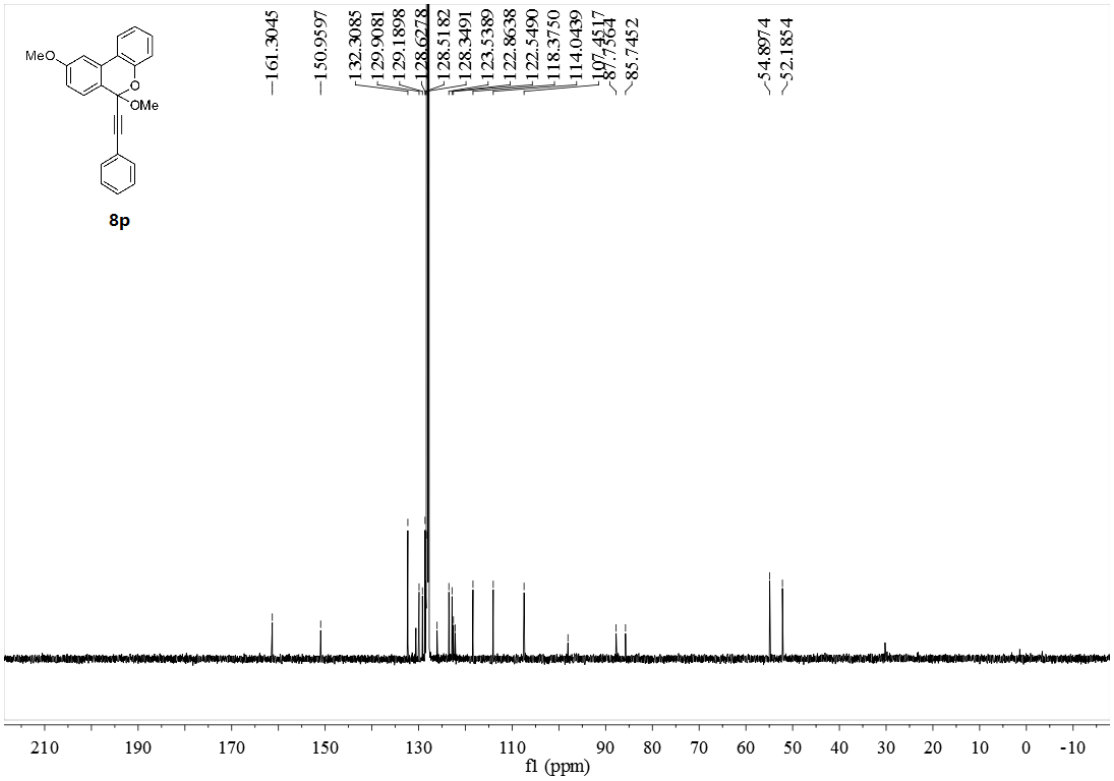
1.14
2.12
1.08
1.18
1.19
3.14
1.07
1.08
3.00
3.06
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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OMe
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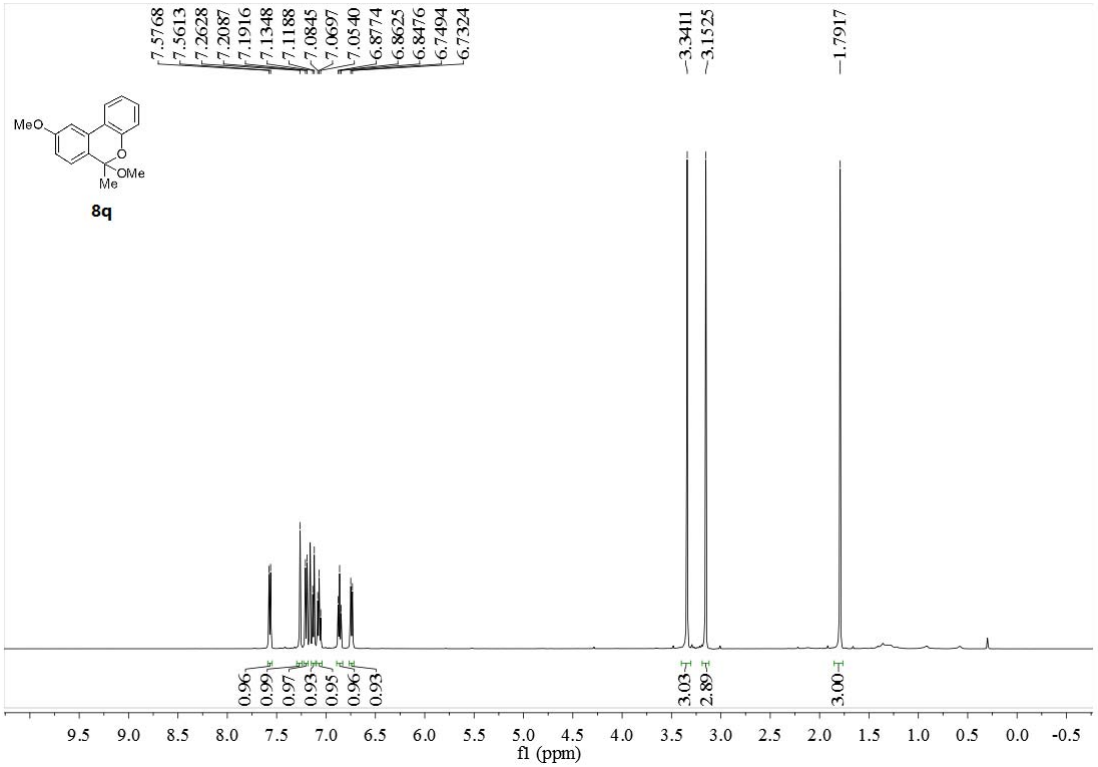
f1 (ppm)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3.3411
3.1525
1.7917
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OMe
Me
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0.93
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0.93
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2.89
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9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
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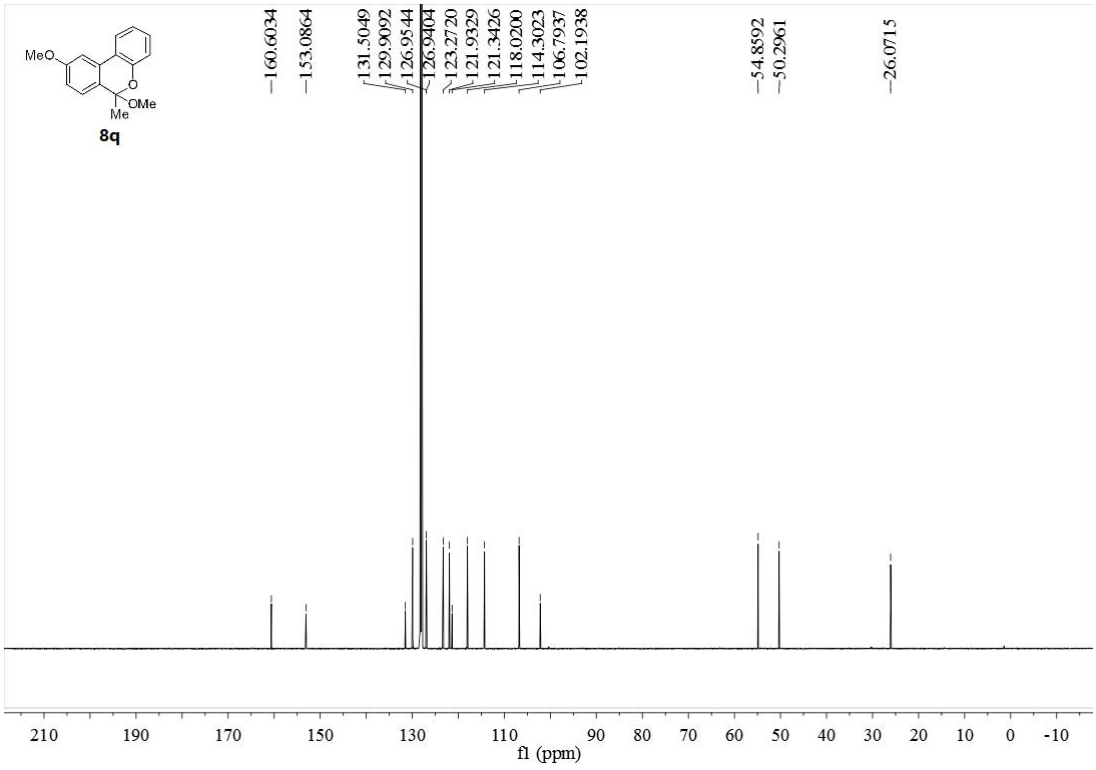
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MeO
OMe
Me
8q
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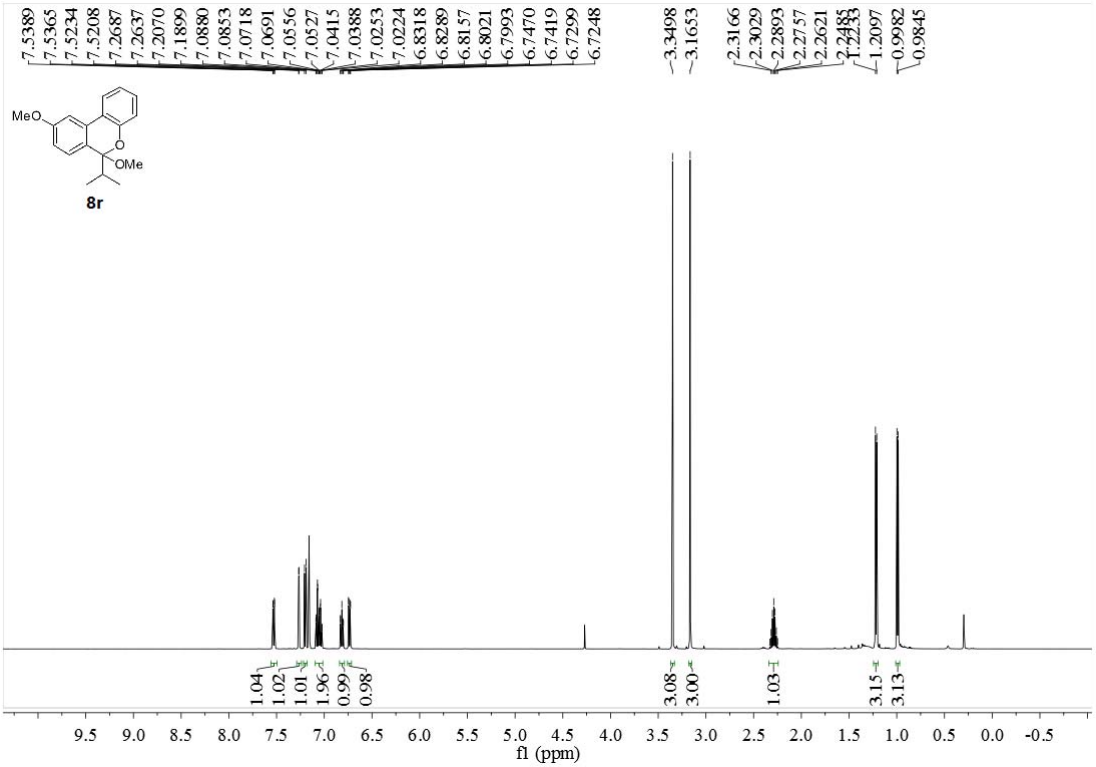
f1 (ppm)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OMe
8r
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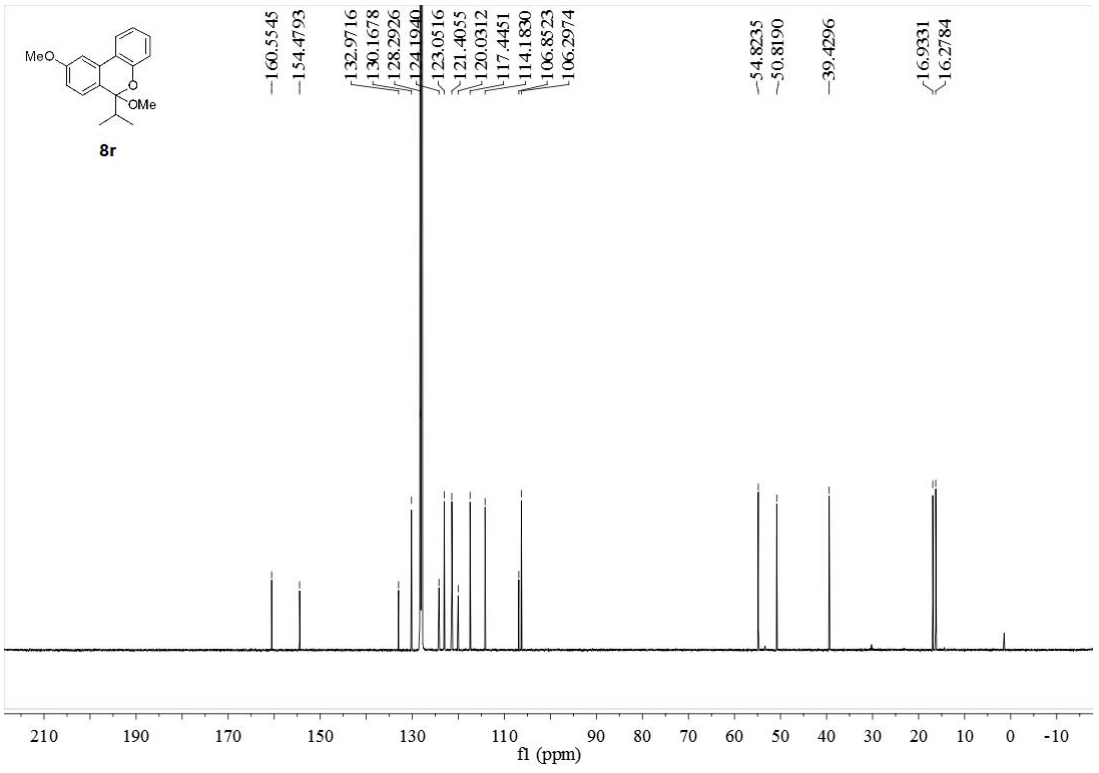
1.02
1.01
1.96
0.99
0.98
3.08
3.00
1.03
3.15
3.13
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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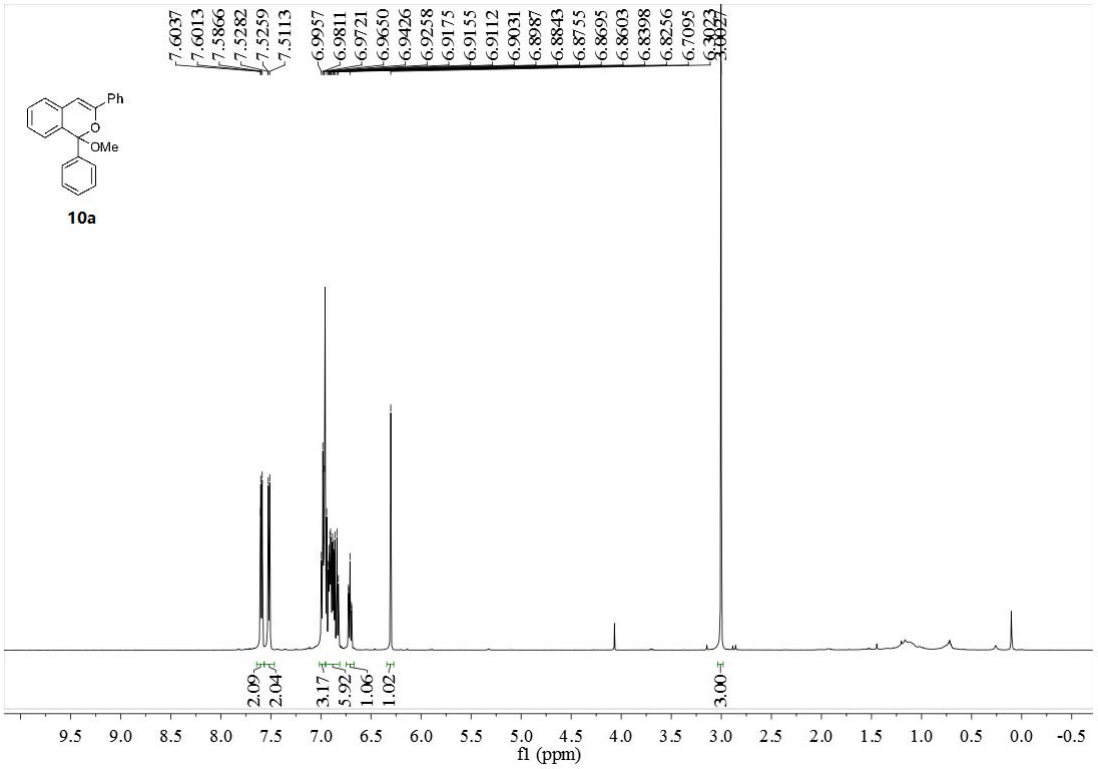
f1 (ppm)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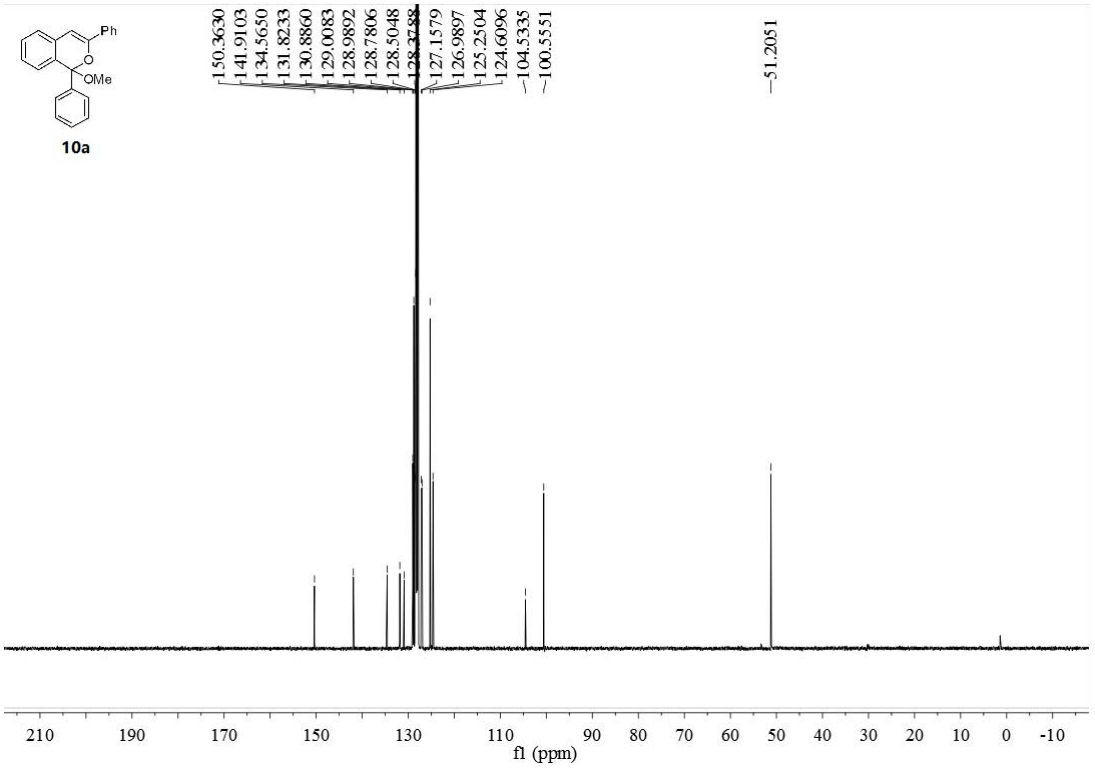
6.7095
3.3023
3.3027
Ph
OMe
10a
2.09
2.04
3.17
5.92
1.06
1.02
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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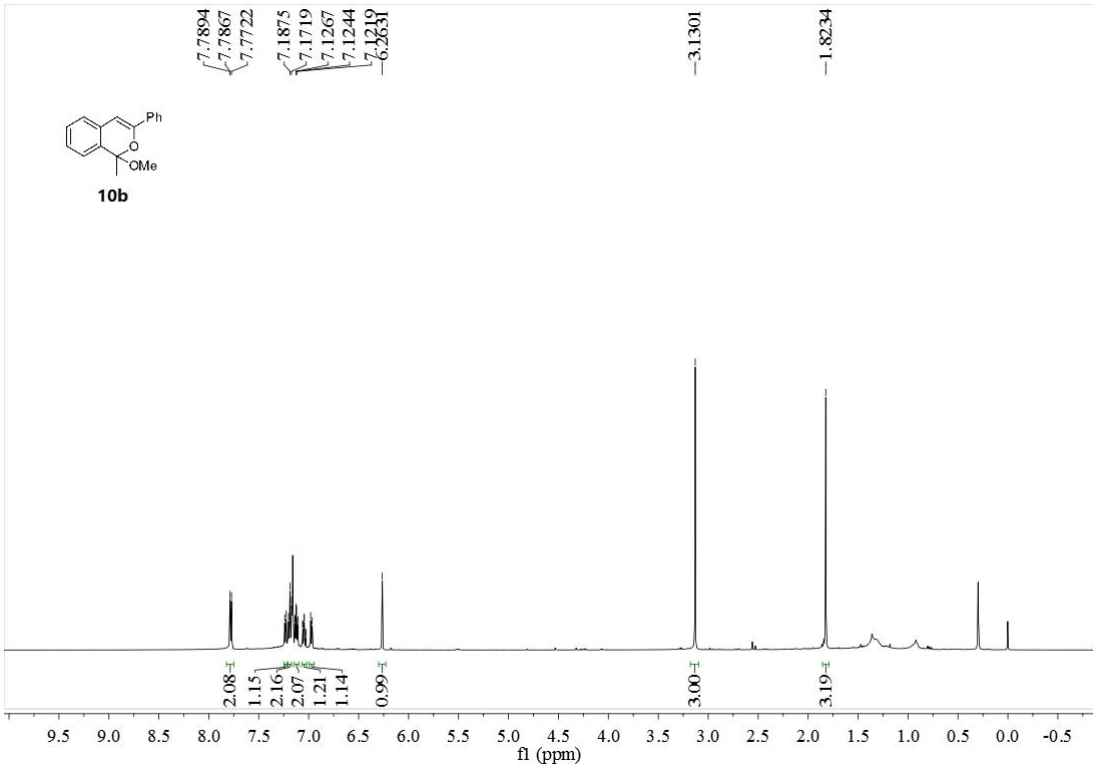
f1 (ppm)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3.1301
1.8234
Ph
O
OMe
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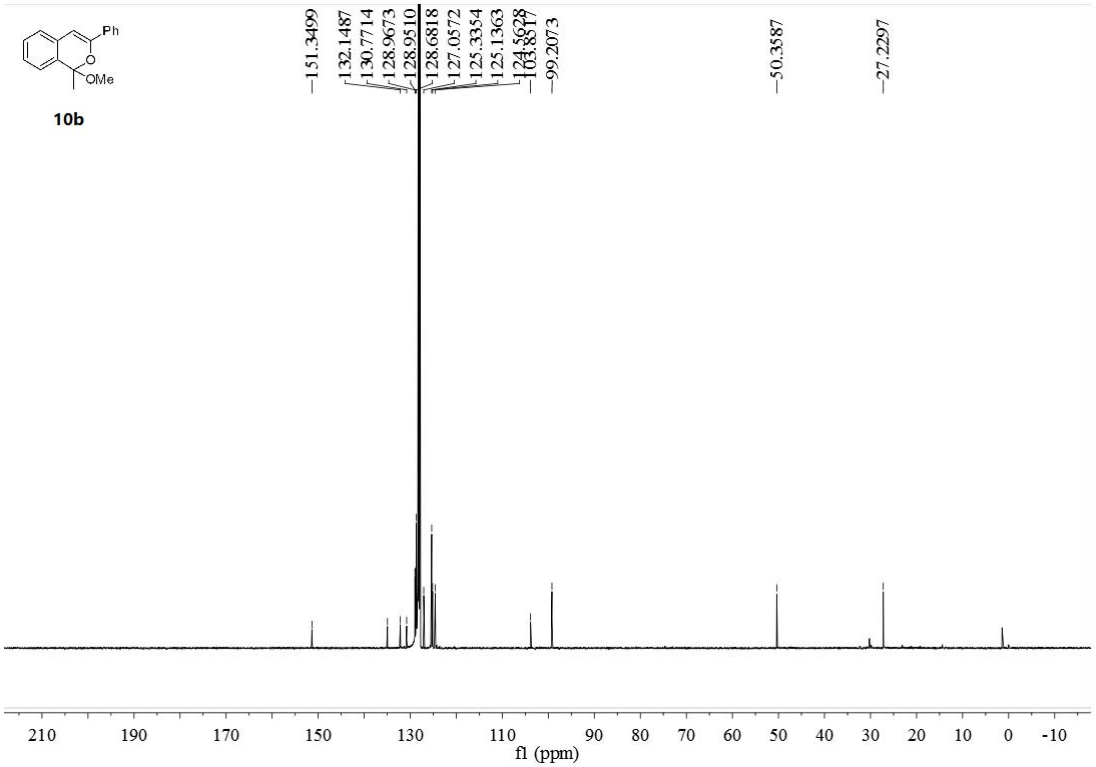
2.08
1.15
2.16
2.07
1.21
1.14
0.99
3.00
3.19
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


Ph
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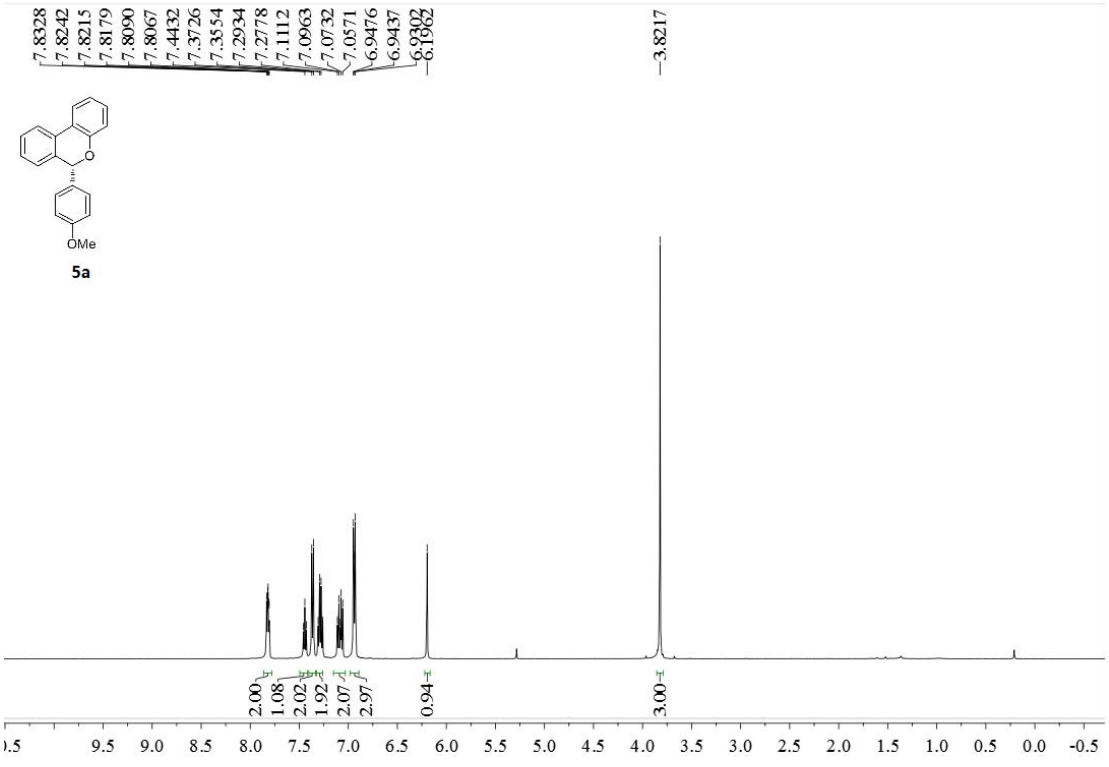
27.2297
210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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3.8217
OMe
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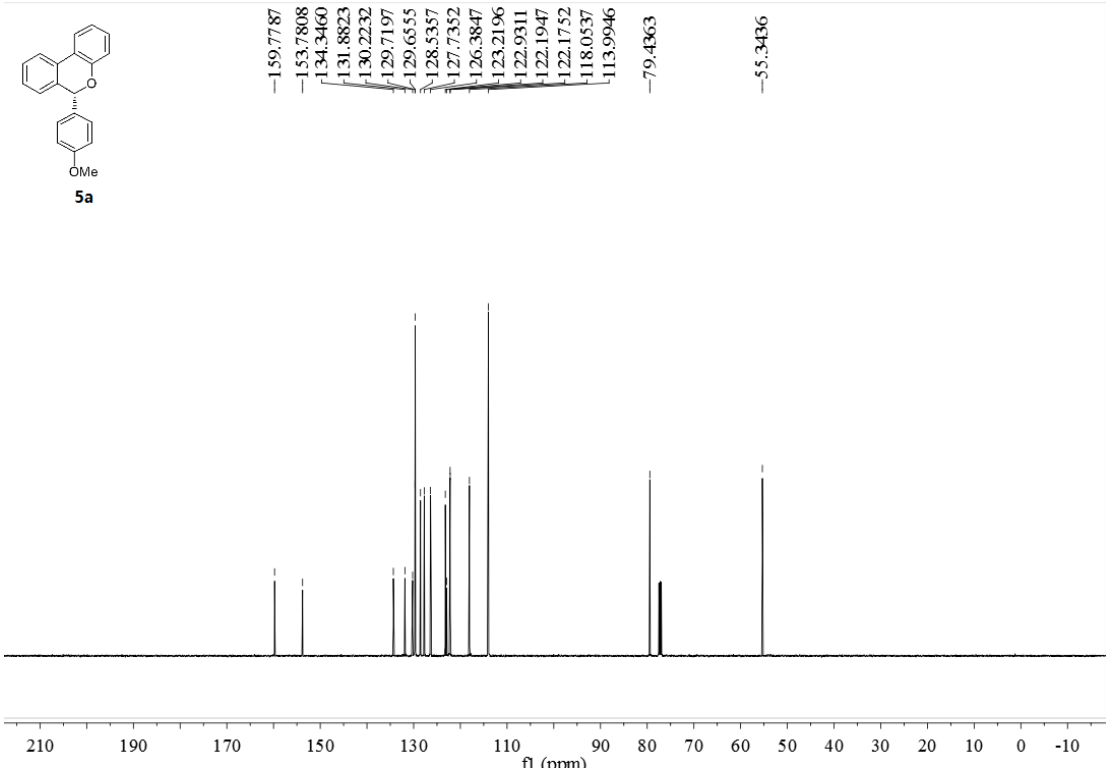
1.08
2.02
1.92
2.07
2.97
0.94
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5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OMe
5a
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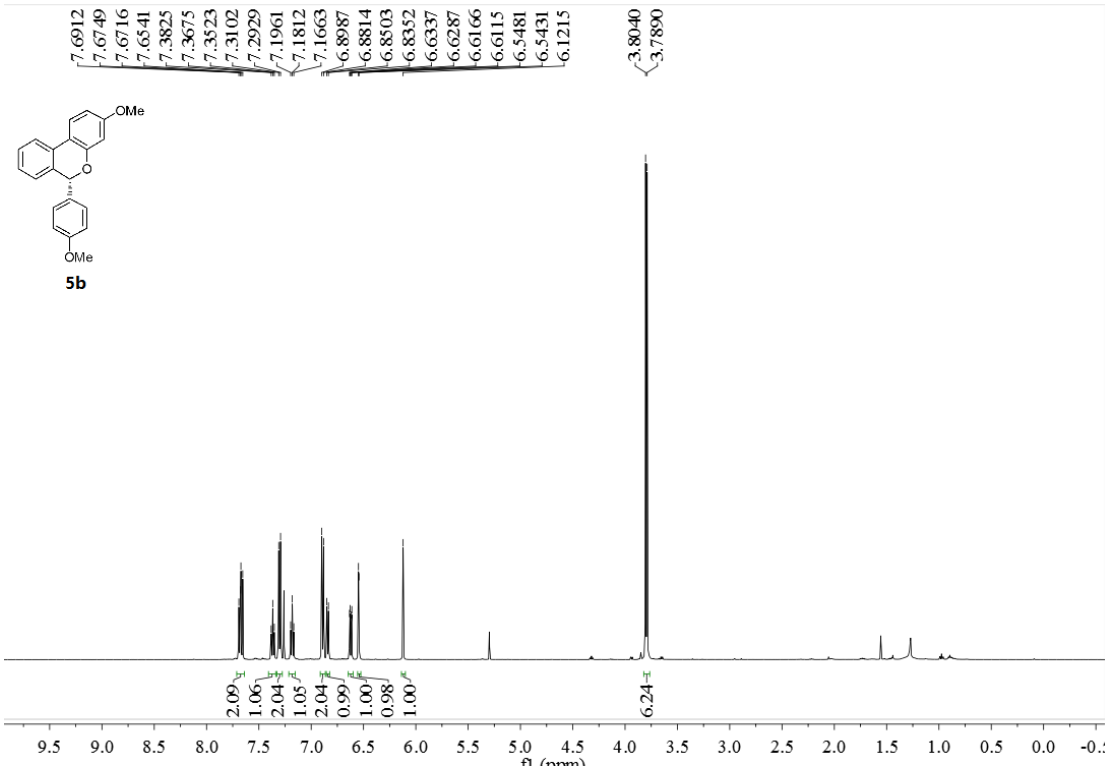
f1 (ppm)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OMe
OMe
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1.06
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1.05
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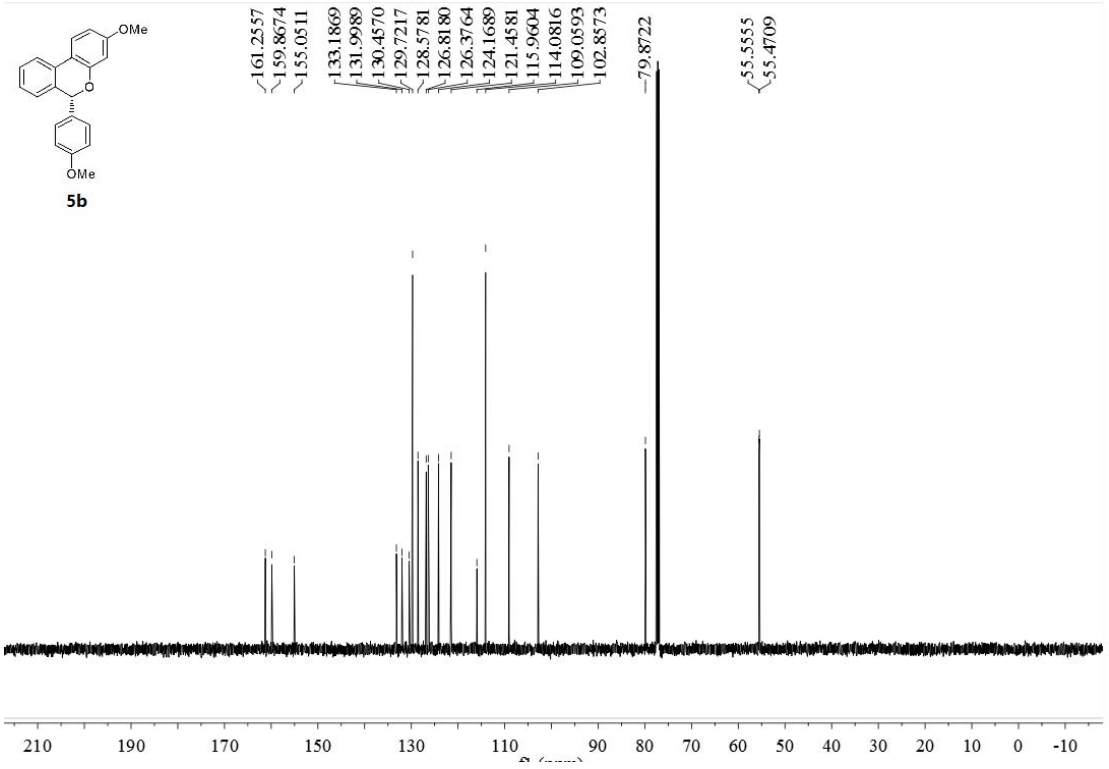
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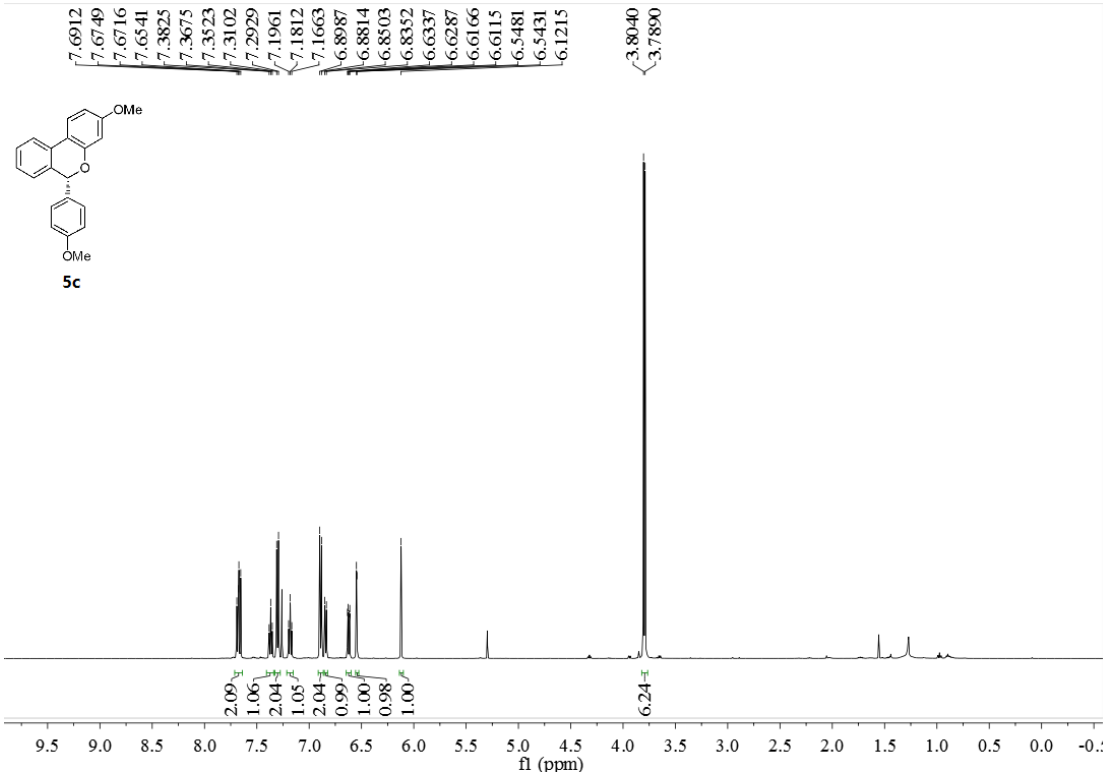
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OMe
OMe
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9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
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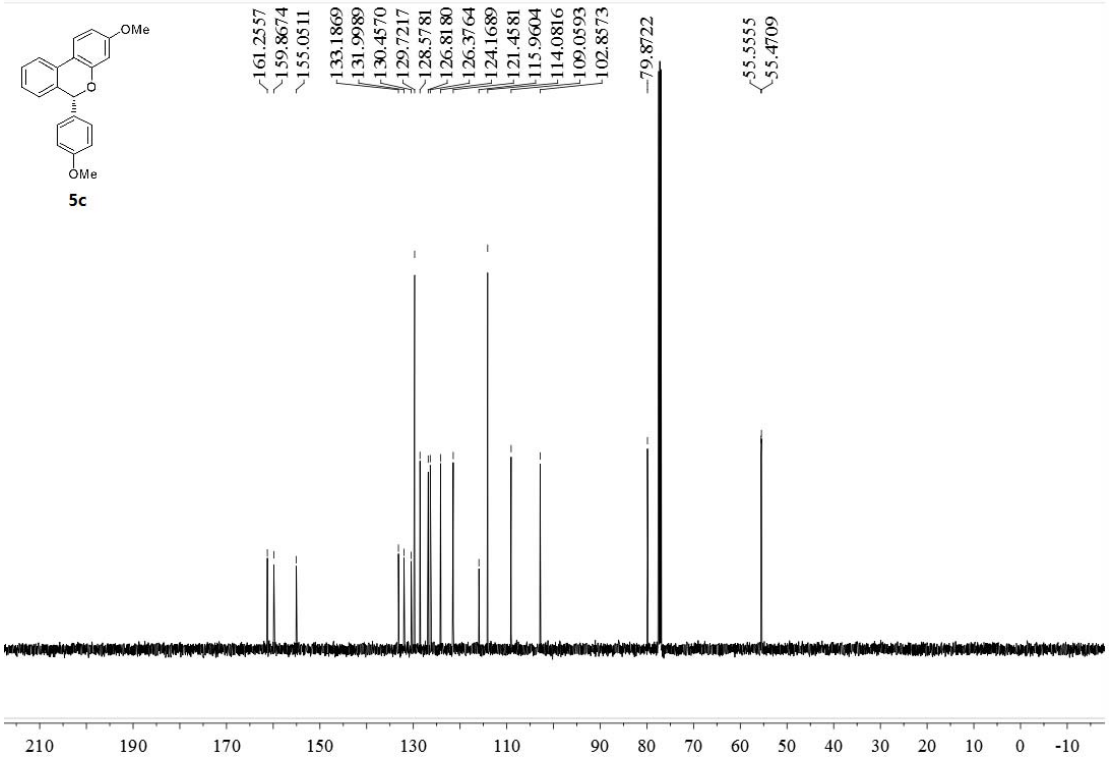
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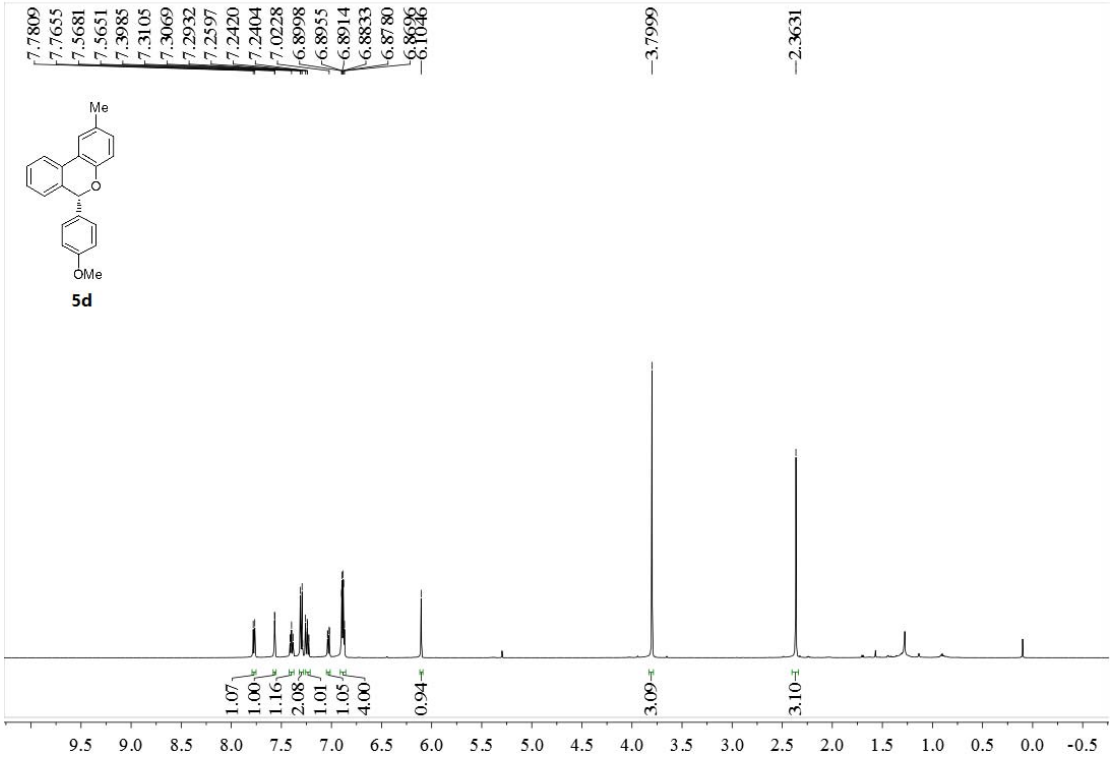
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3.10
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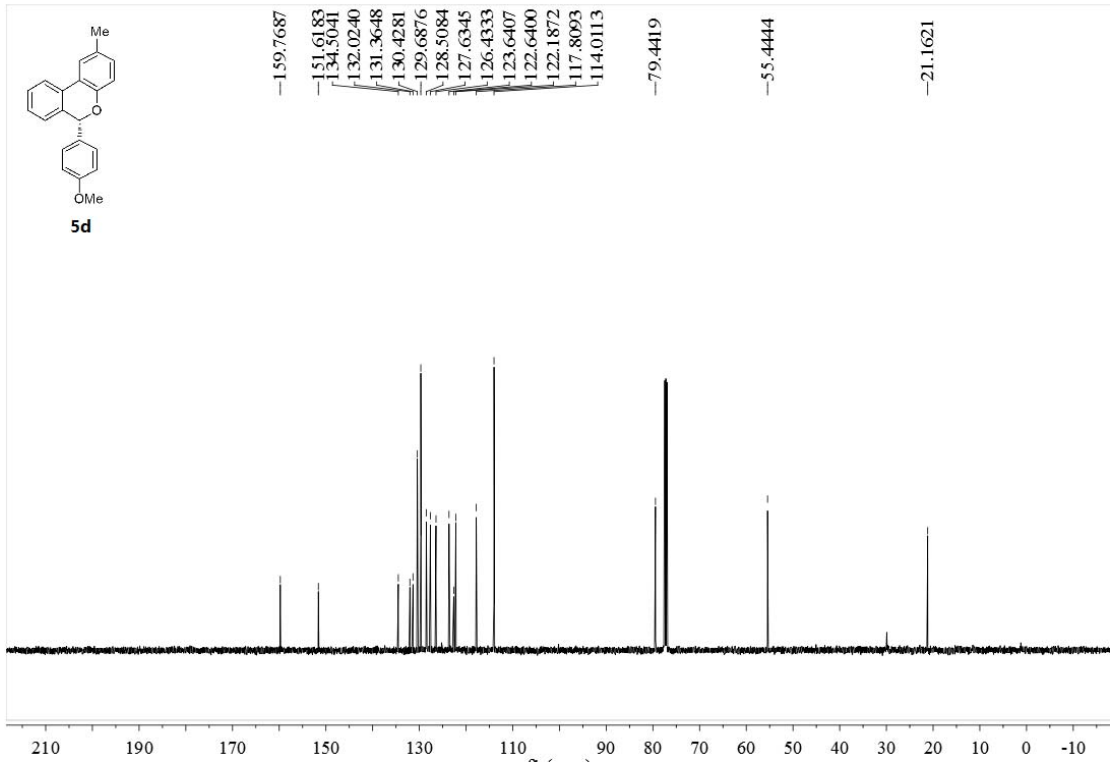
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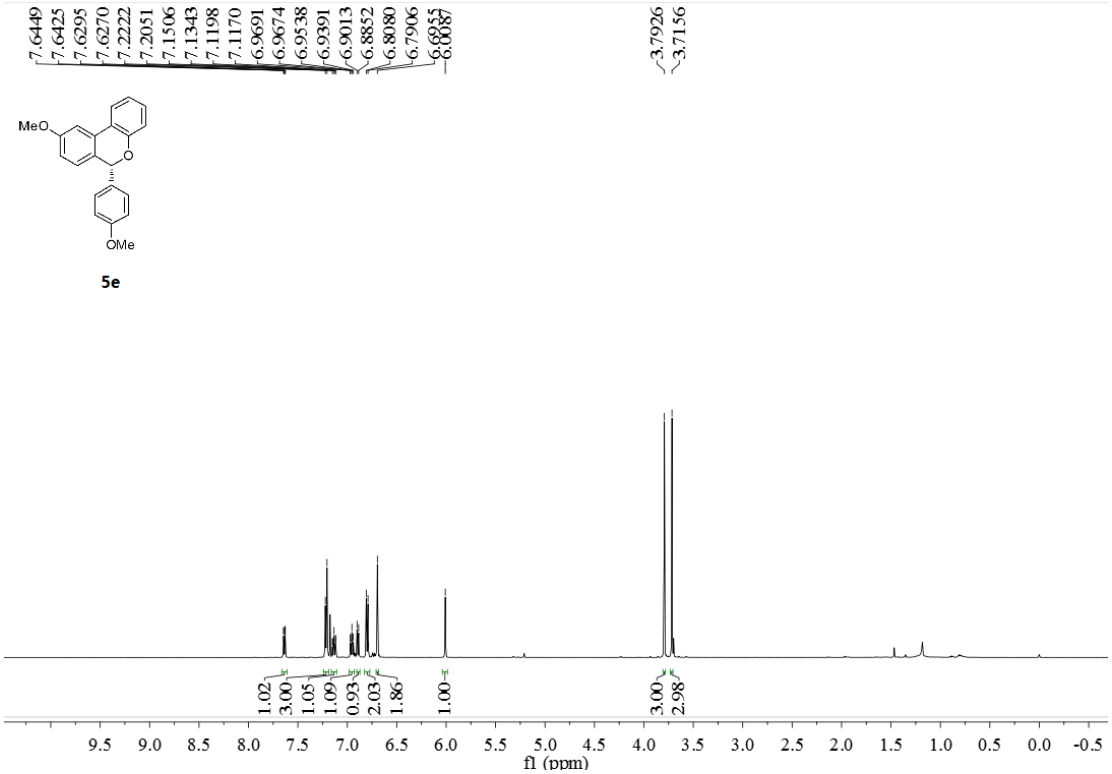
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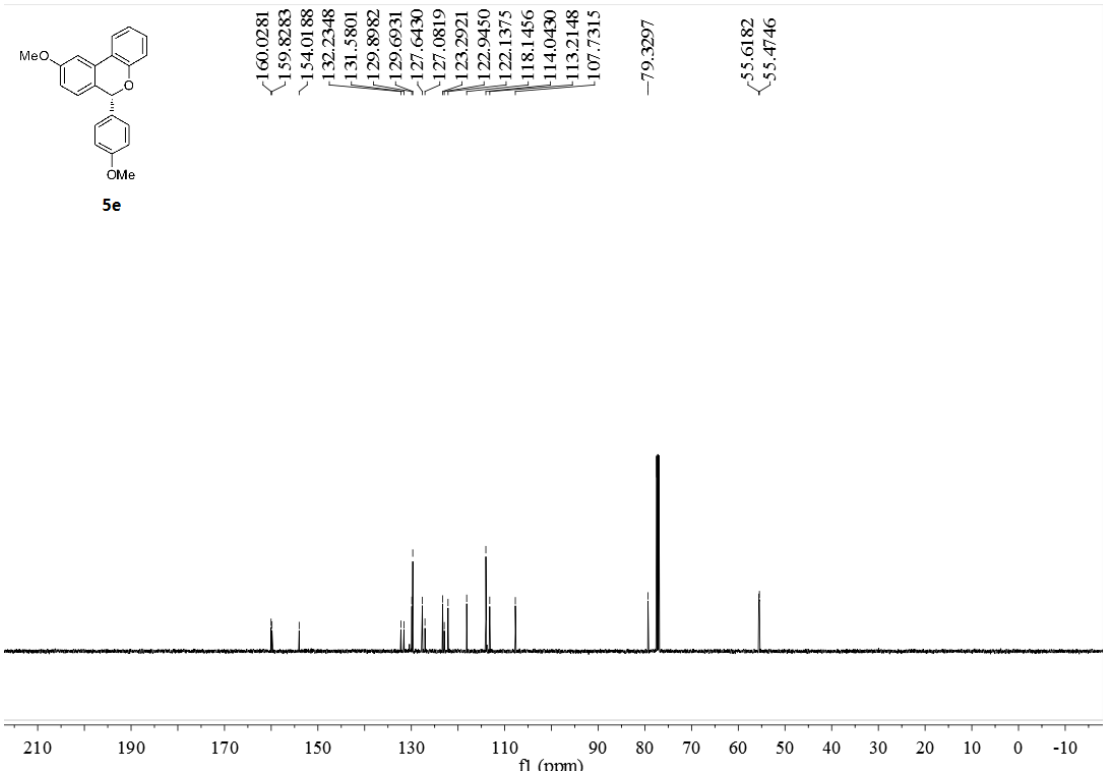
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f1 (ppm)

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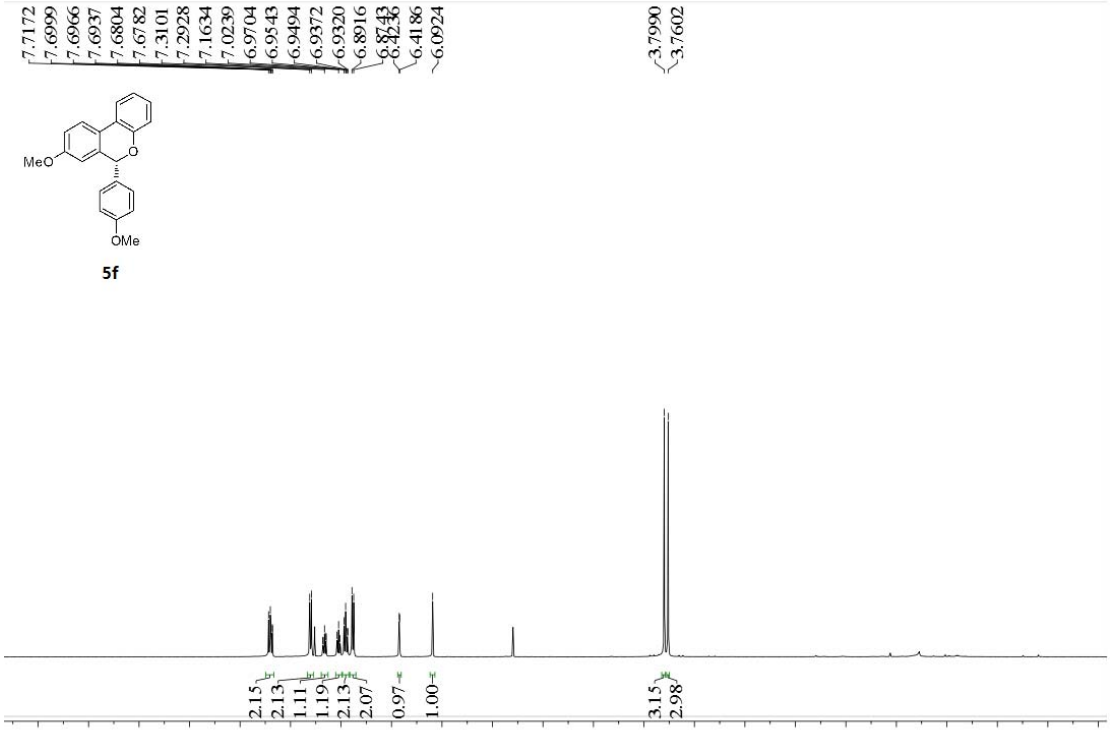
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1.19
2.13
2.07
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1.00
3.15
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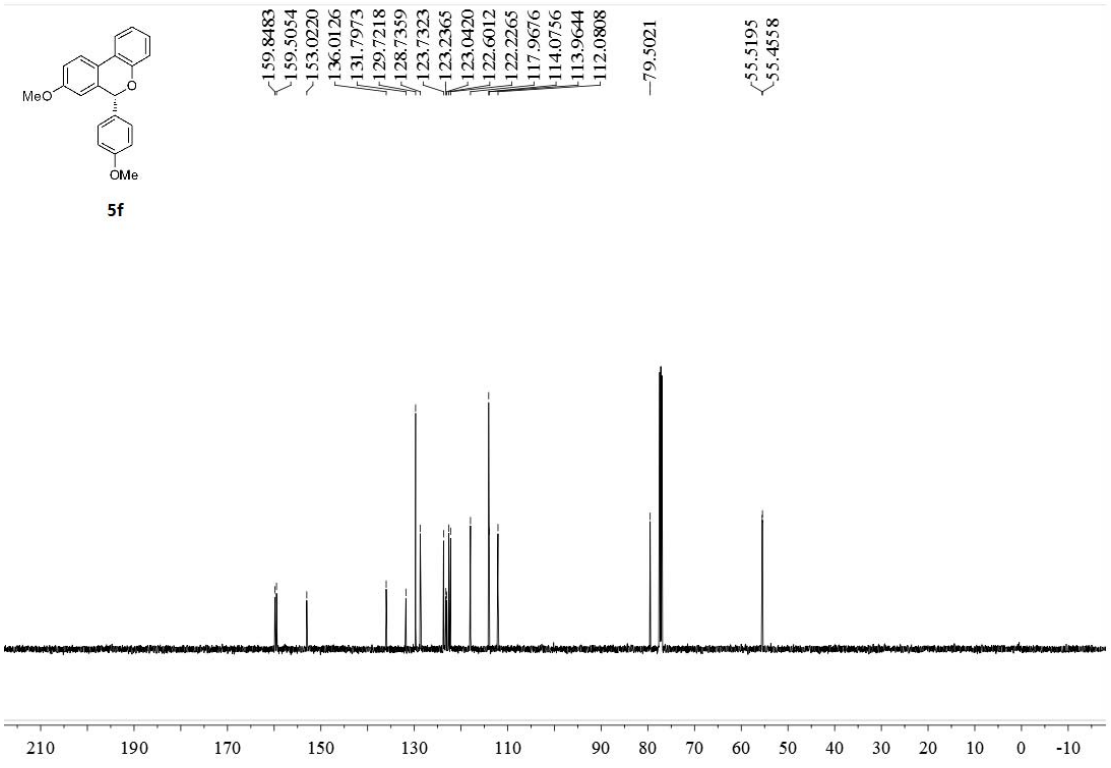
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OMe
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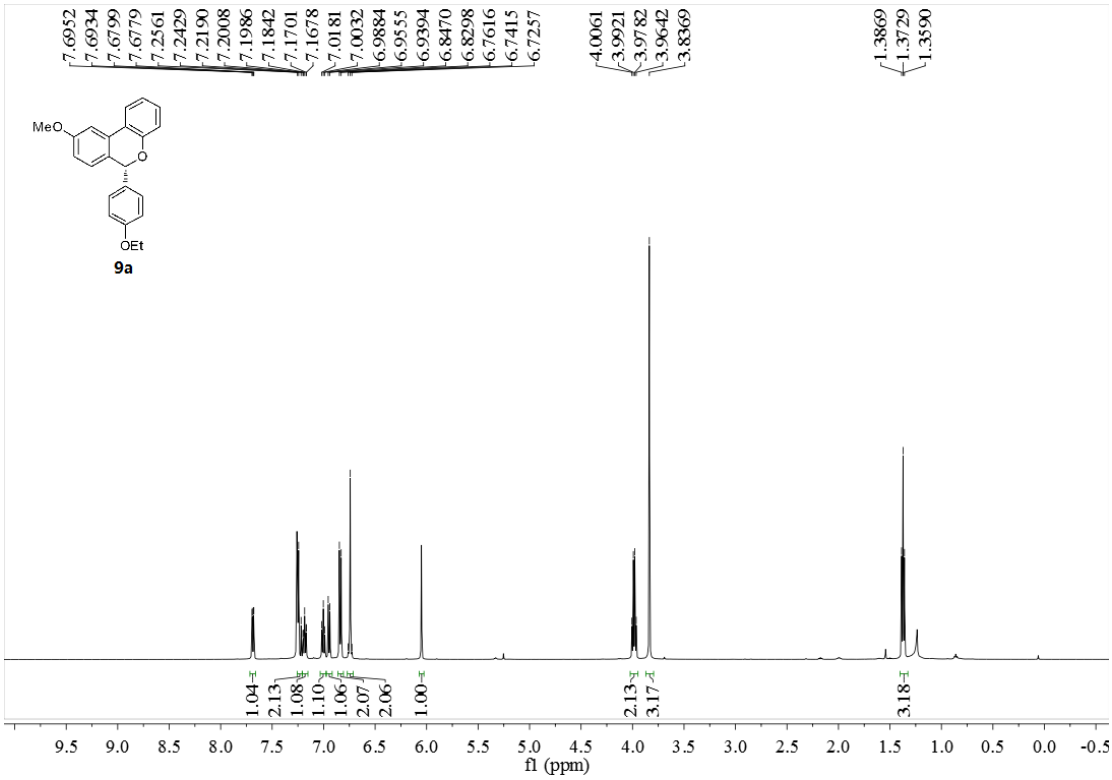
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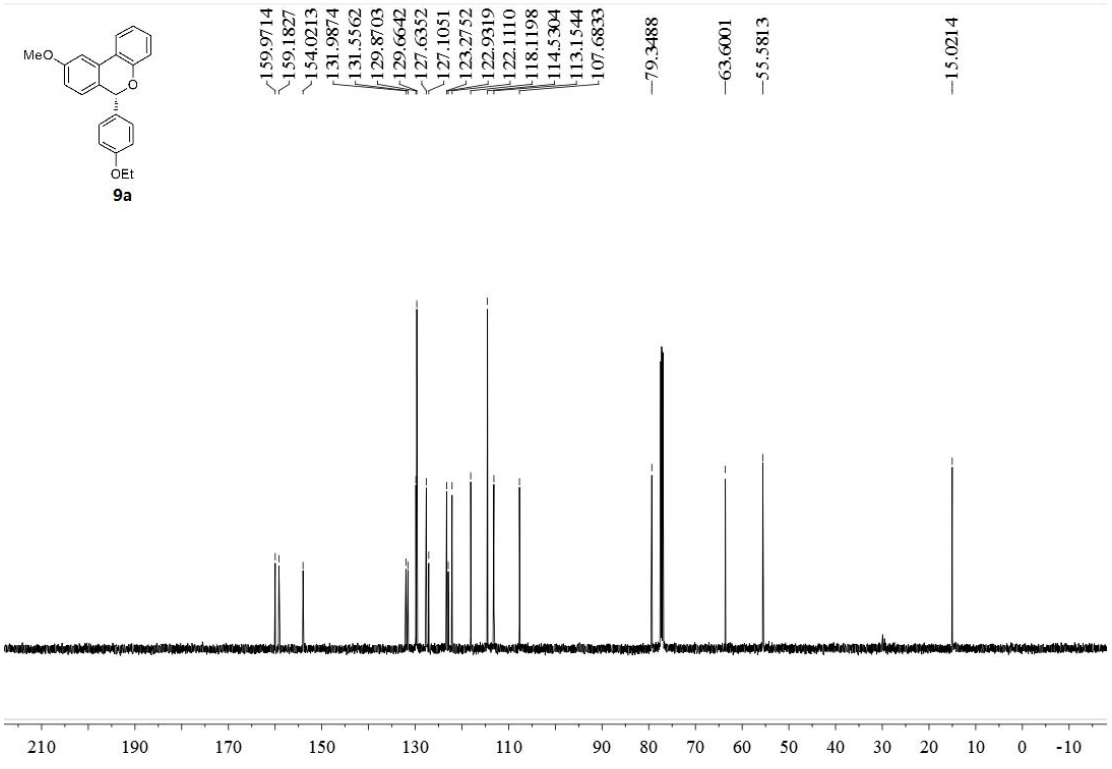
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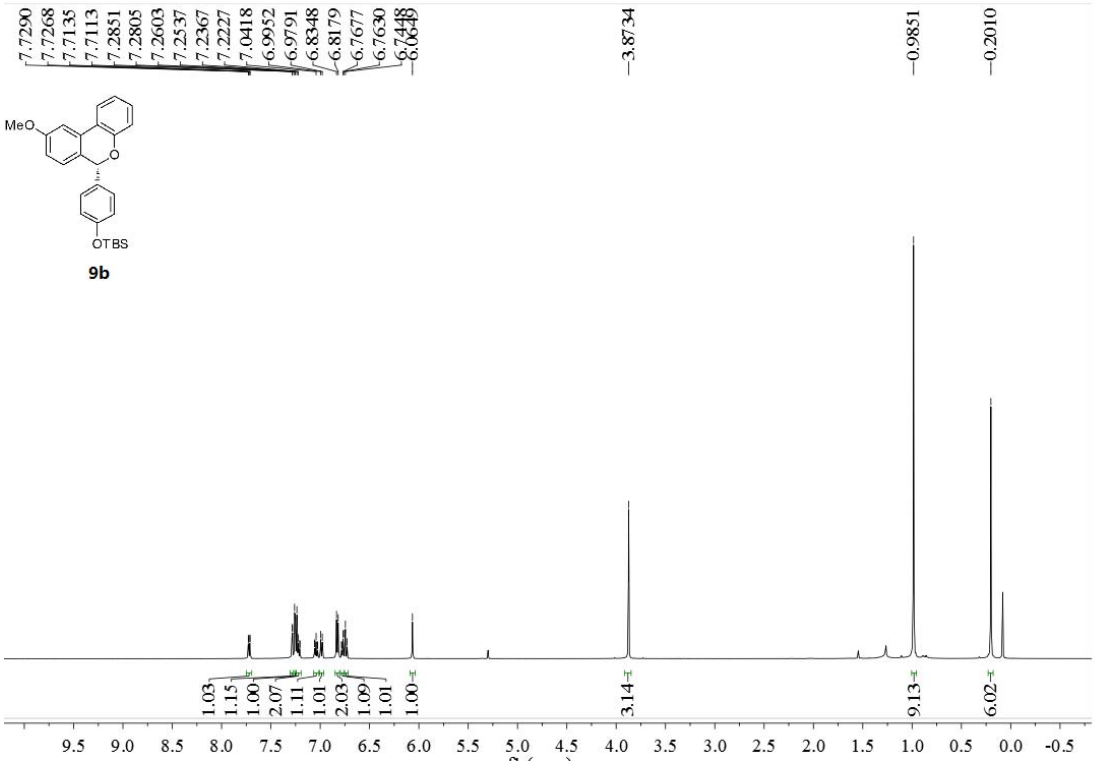
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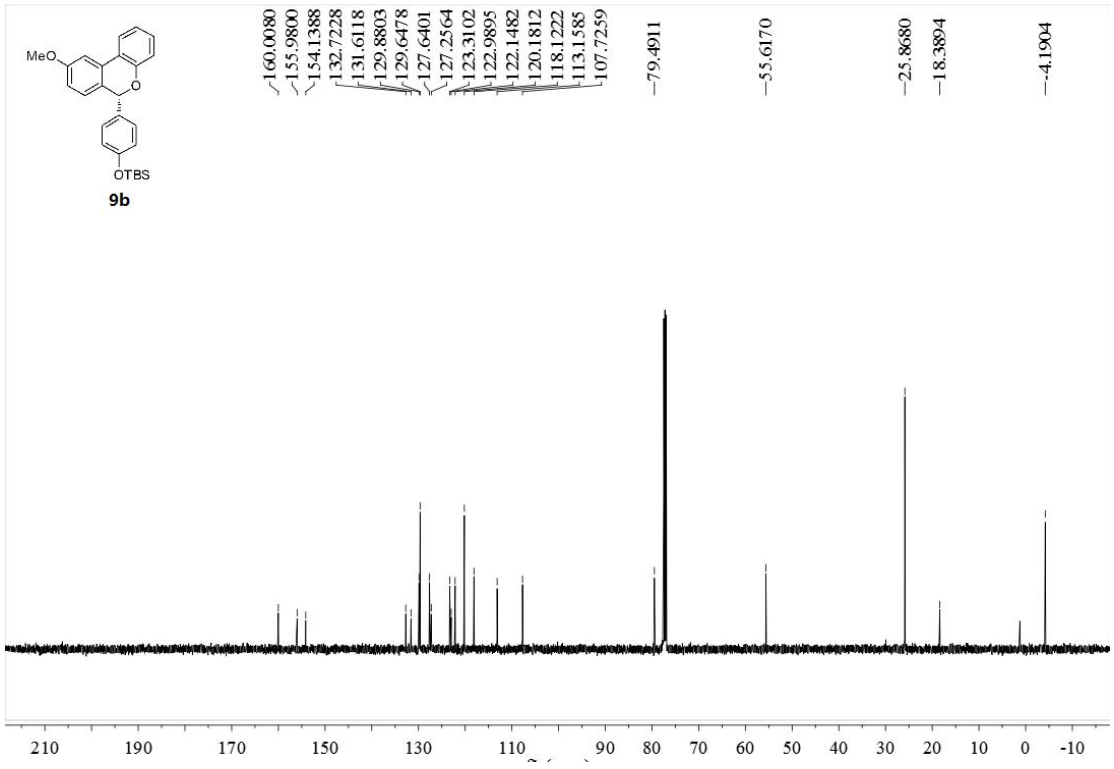
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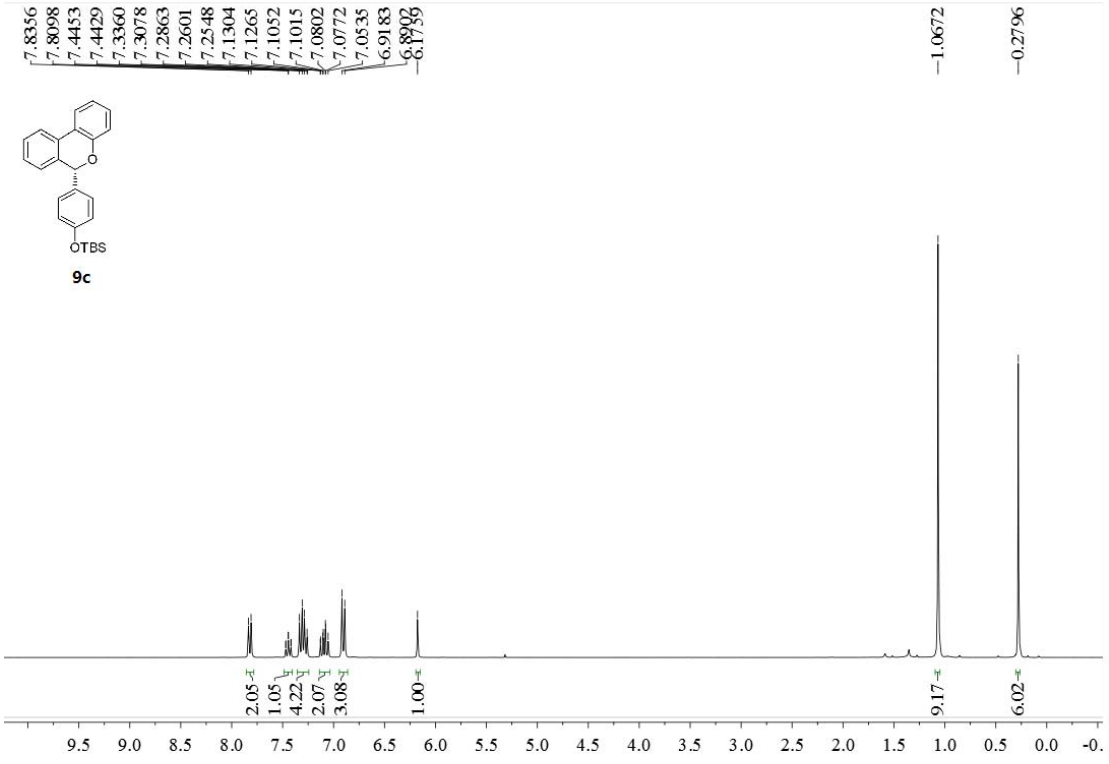
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3.08
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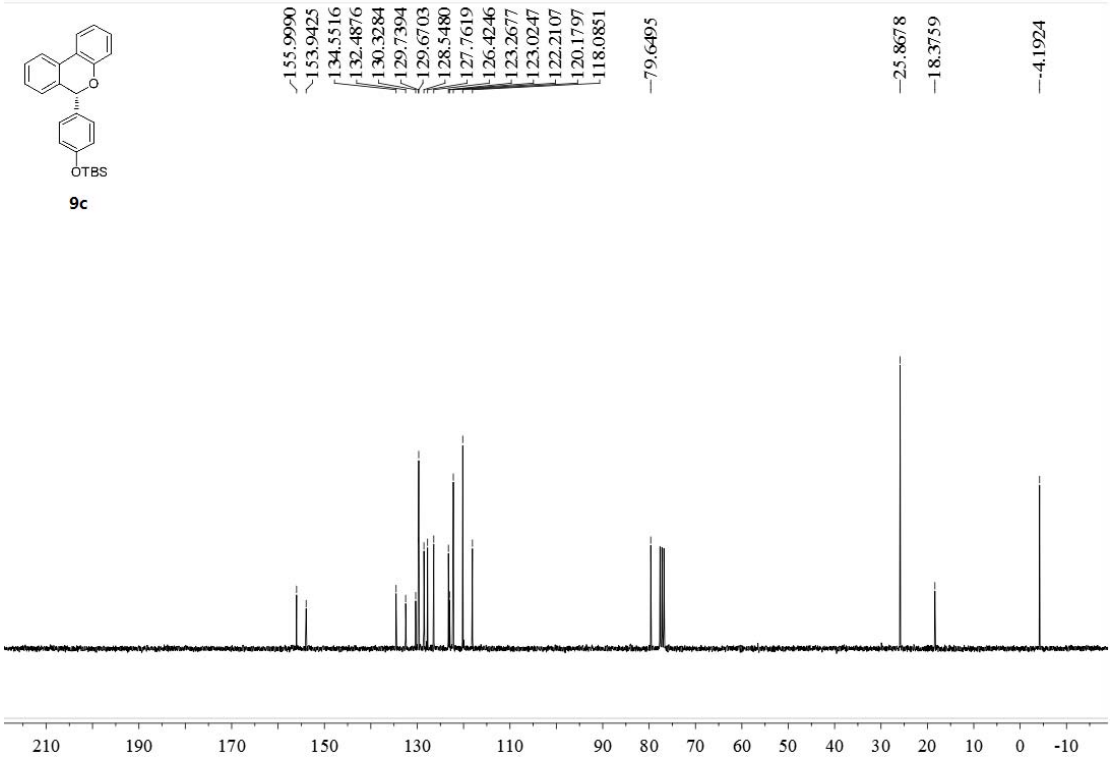
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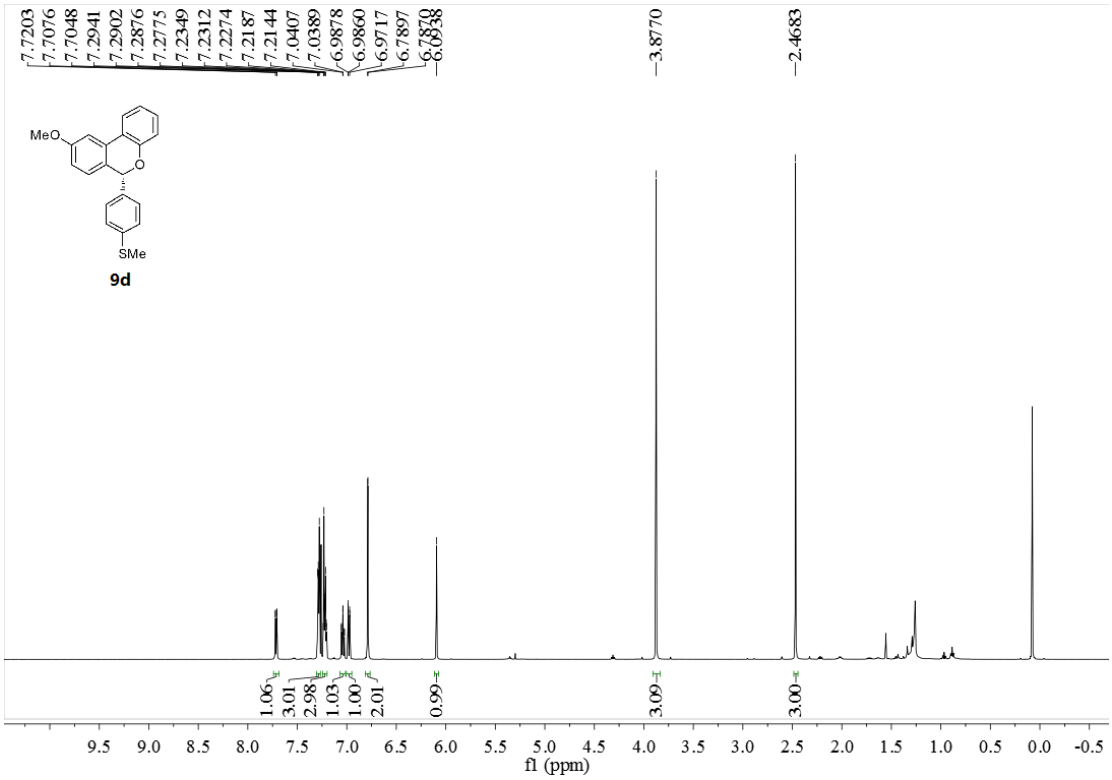
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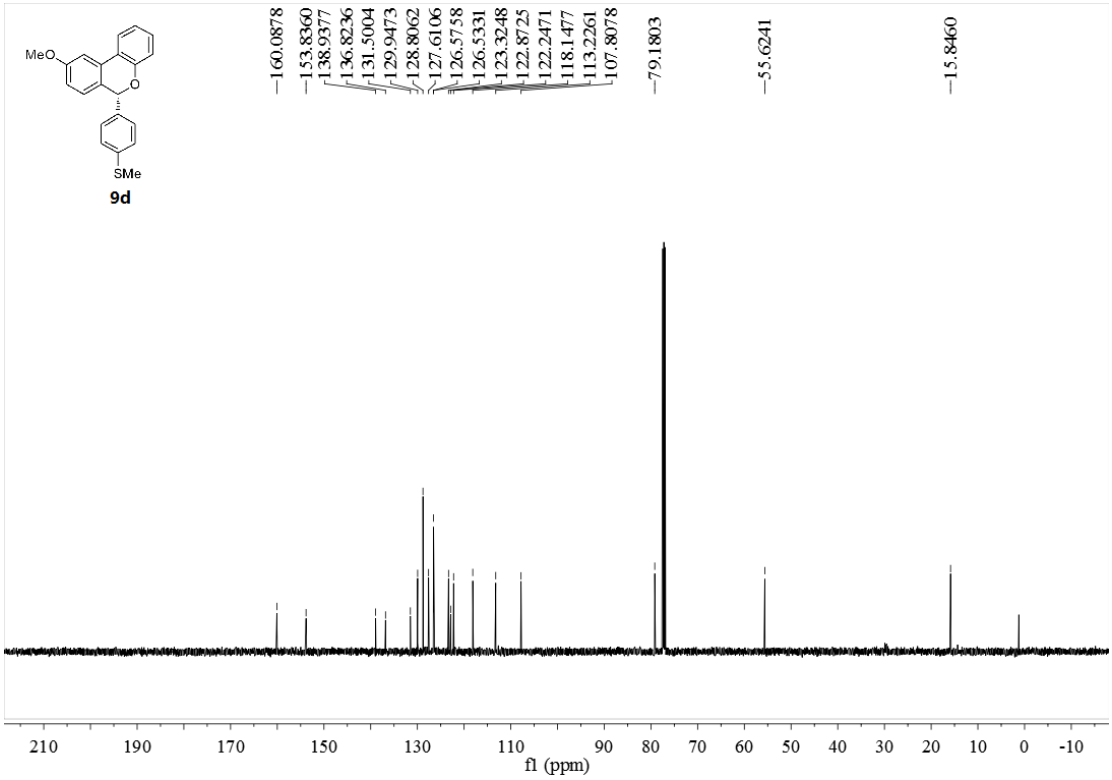
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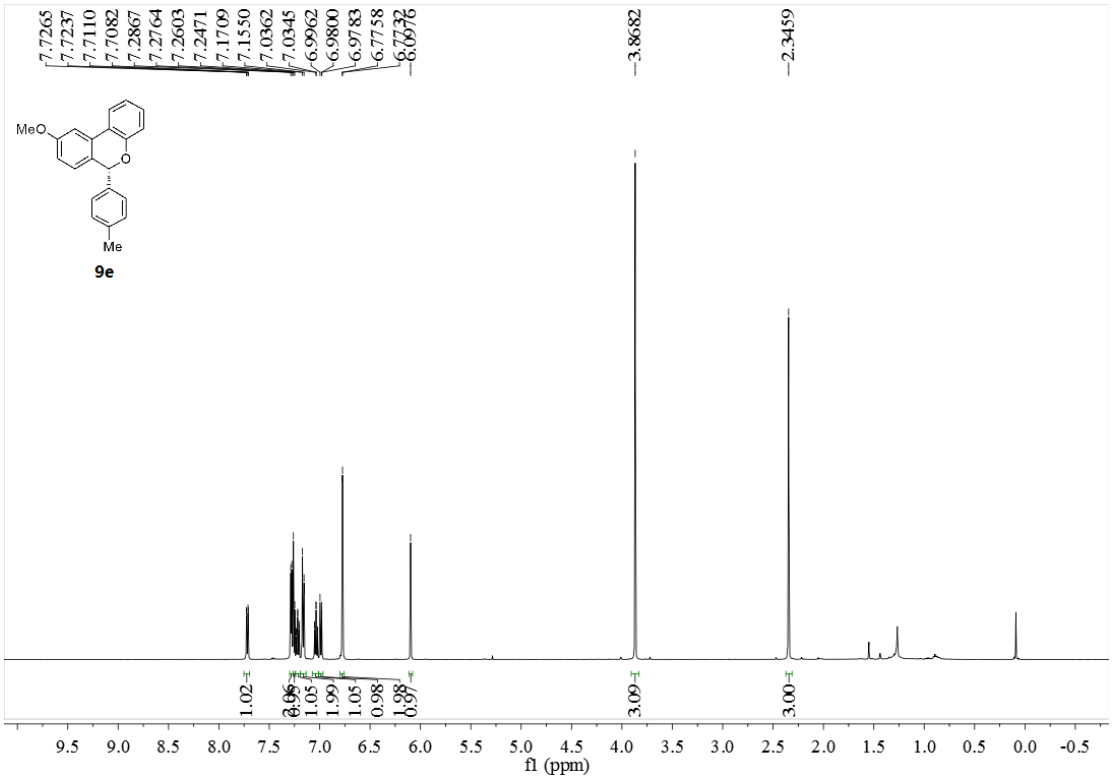
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Me
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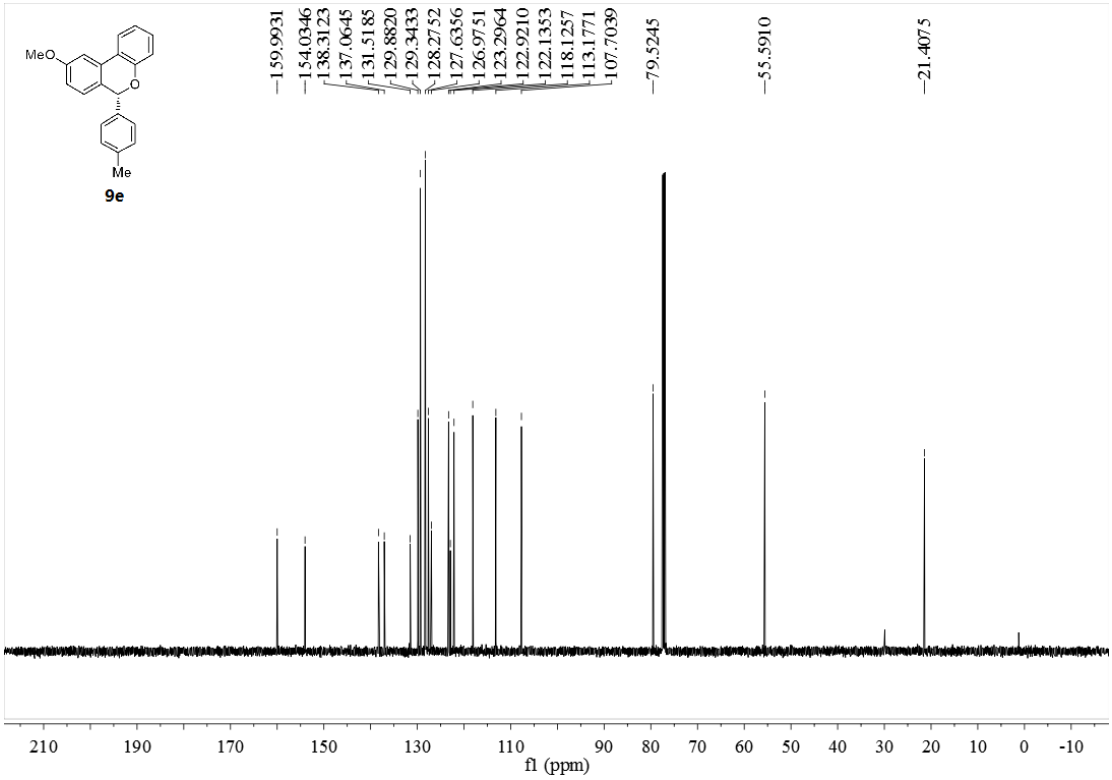
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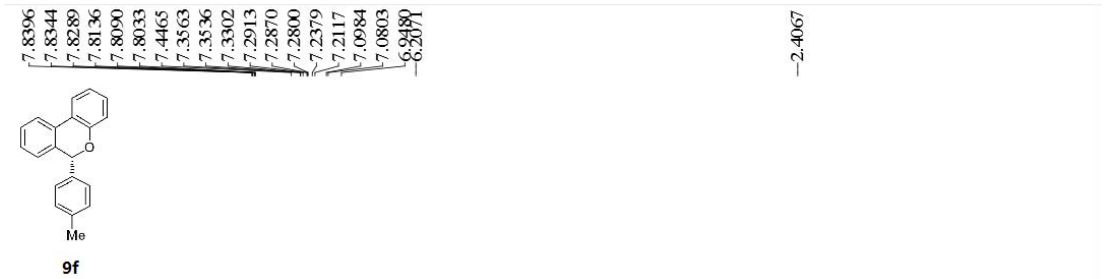
f1 (ppm)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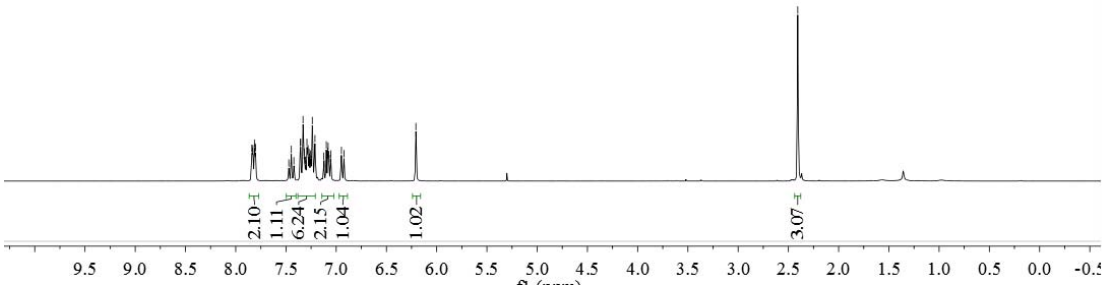
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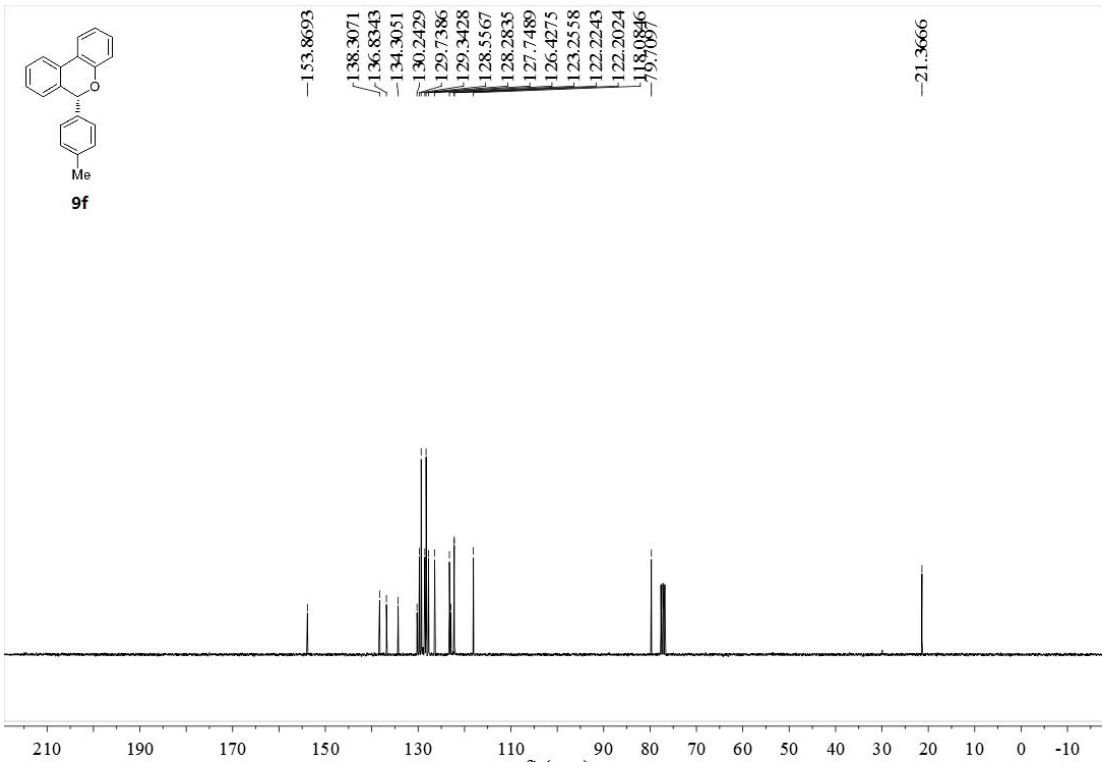
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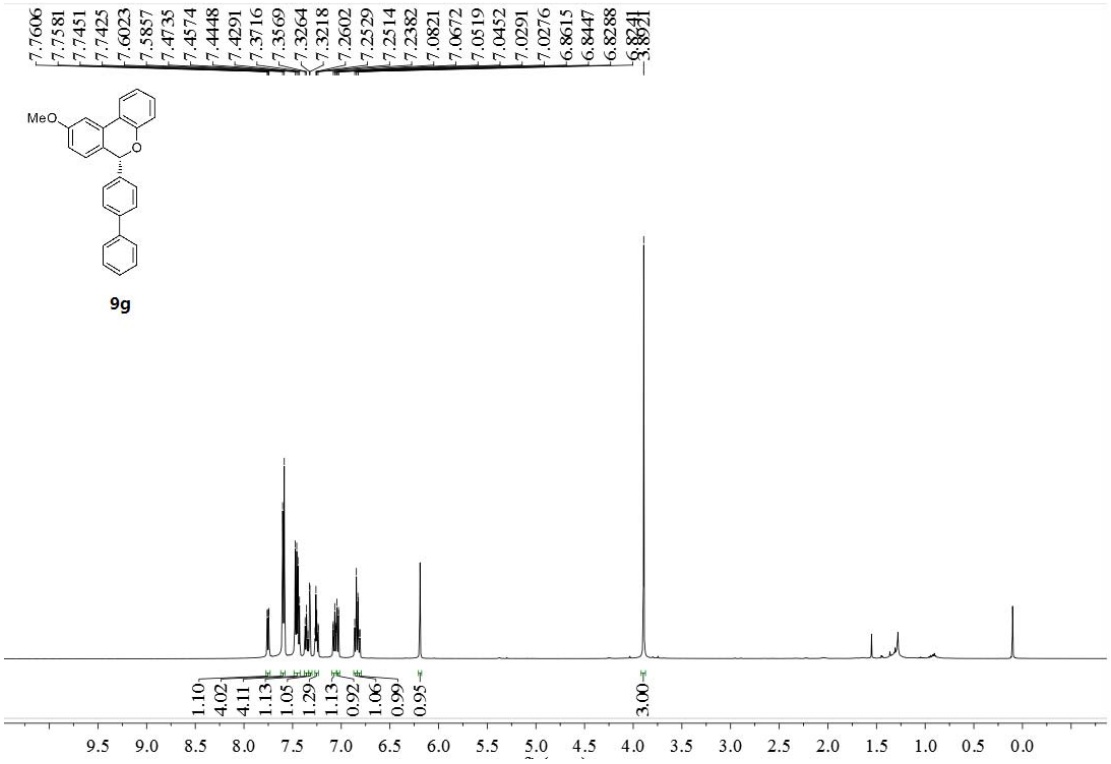
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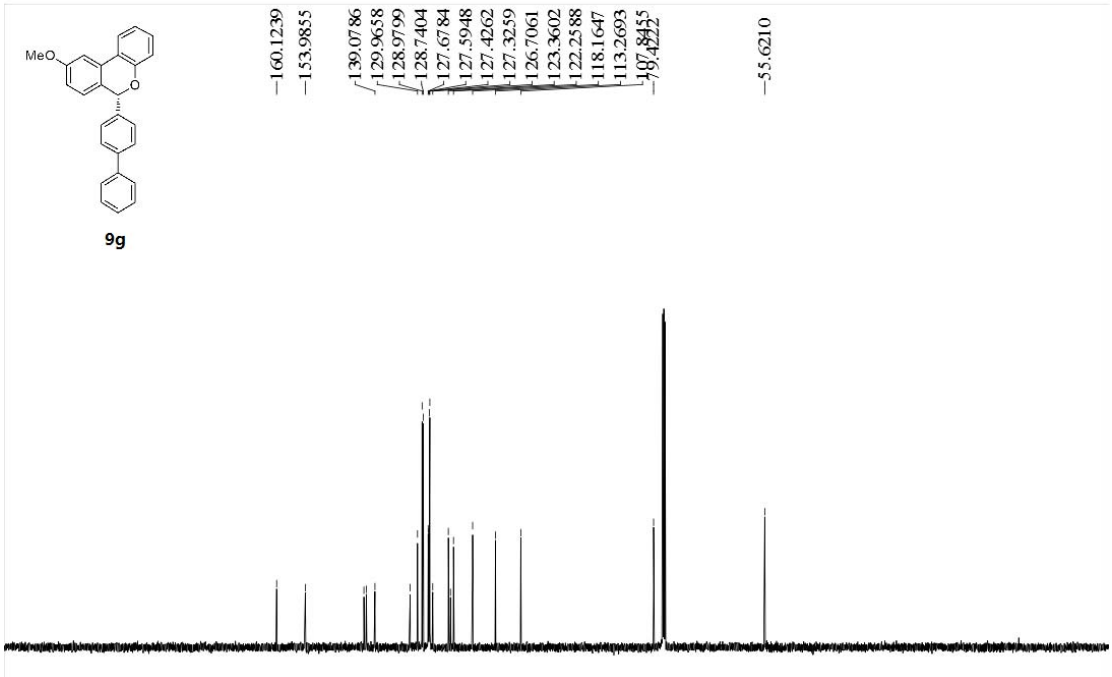
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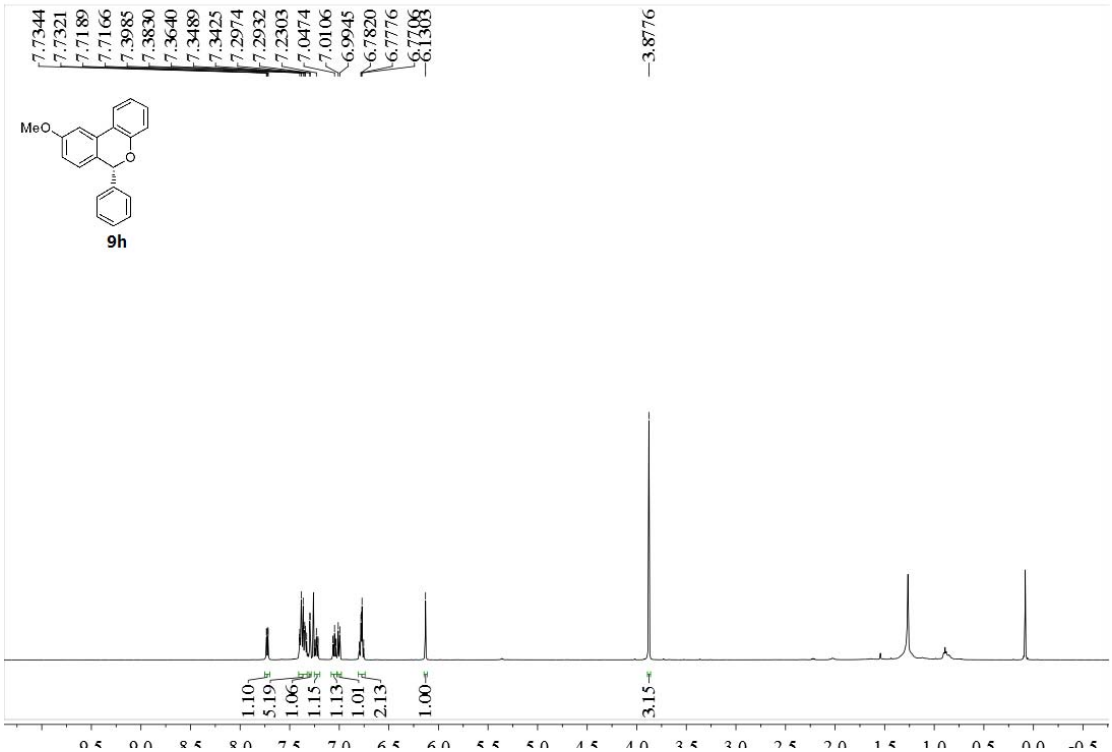
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6.7706
6.1303
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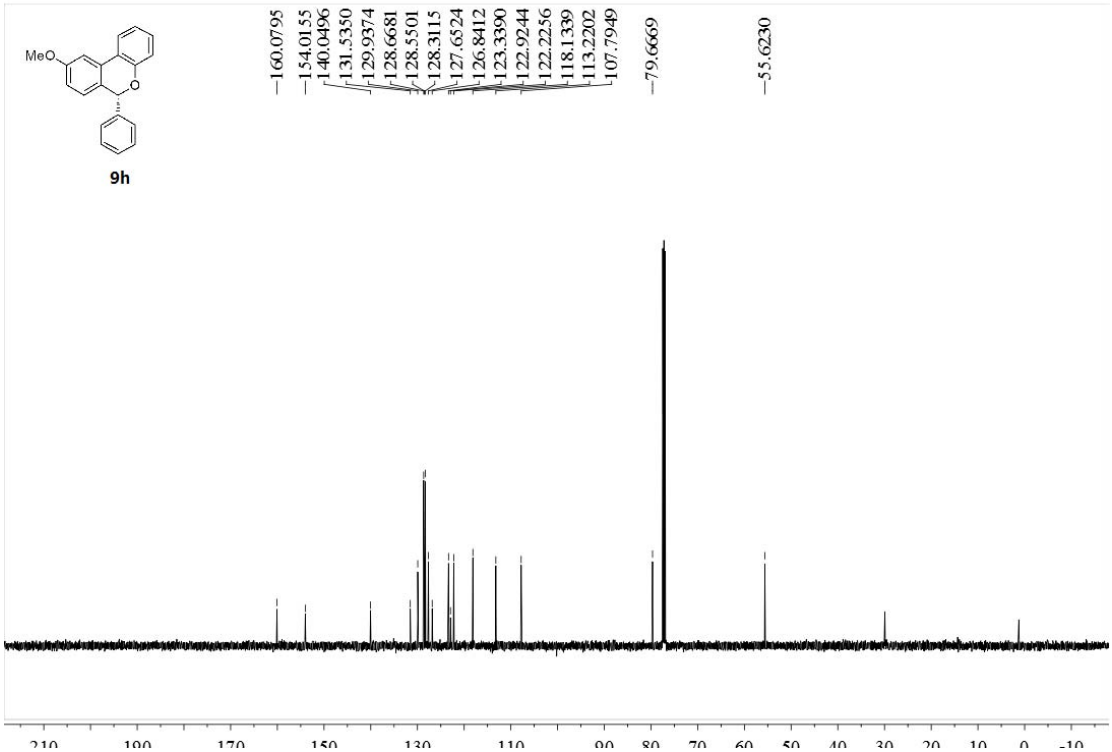
1.06
1.15
1.13
1.01
2.13
1.00
3.15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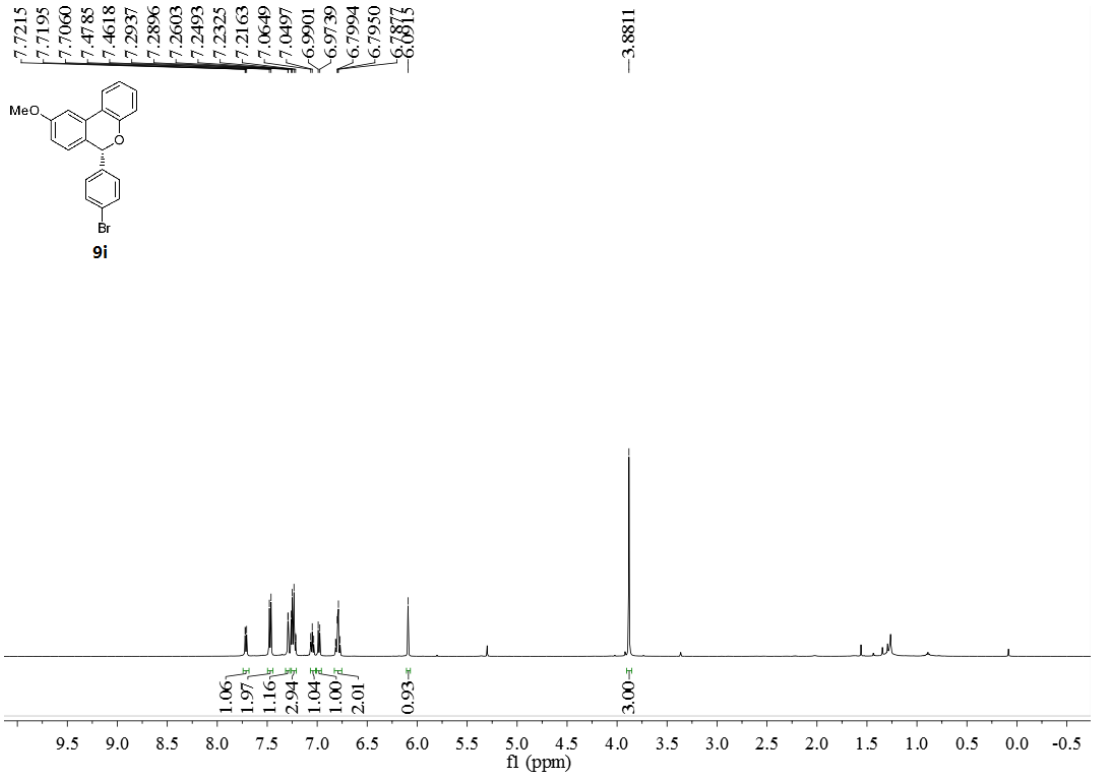
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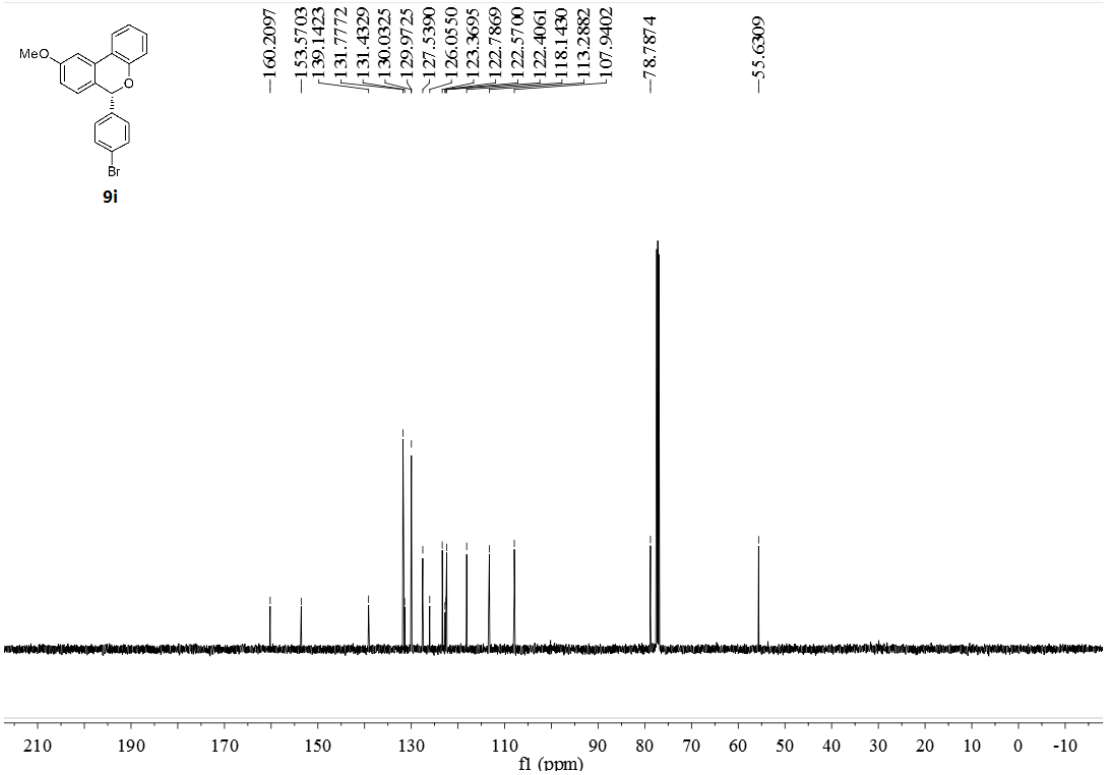
7.2163
7.0649
7.0497
6.9901
6.9739
6.7994
6.7950
6.7877
6.7815
3.8811
MeO
O
Br
9i
1.06
1.97
1.16
2.94
1.04
1.00
2.01
0.93
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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122.5700
122.4061
118.1430
113.2882
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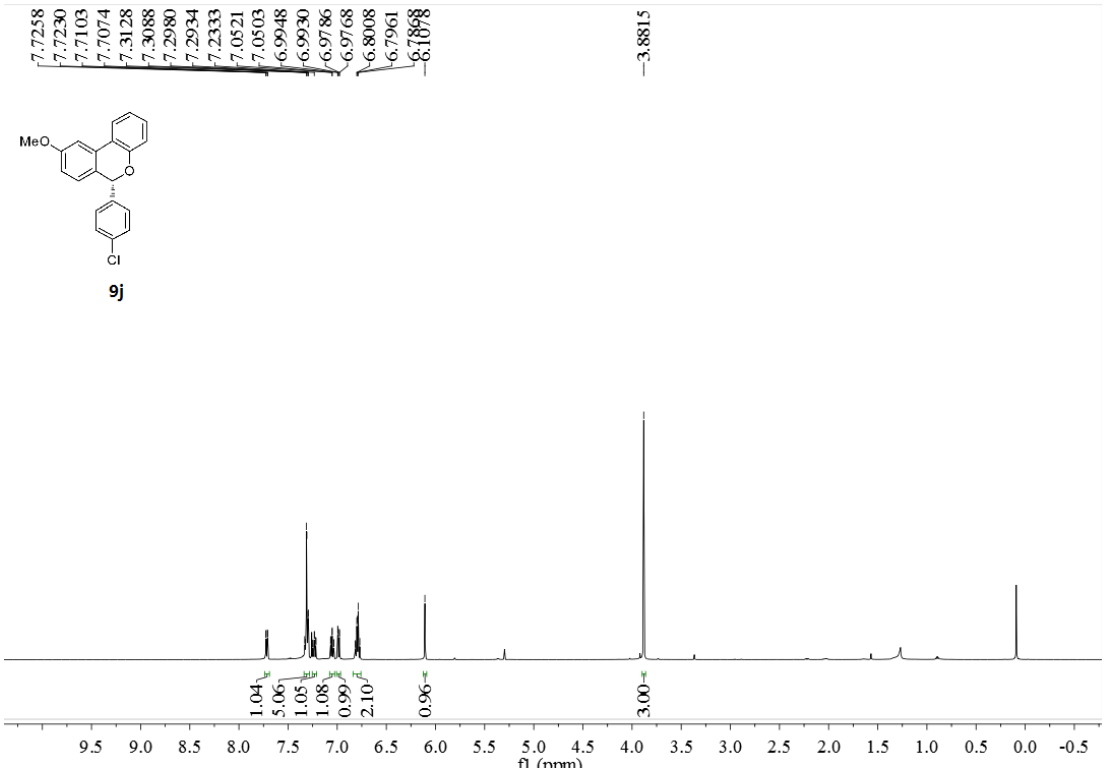
MeO
O
Br
9i
210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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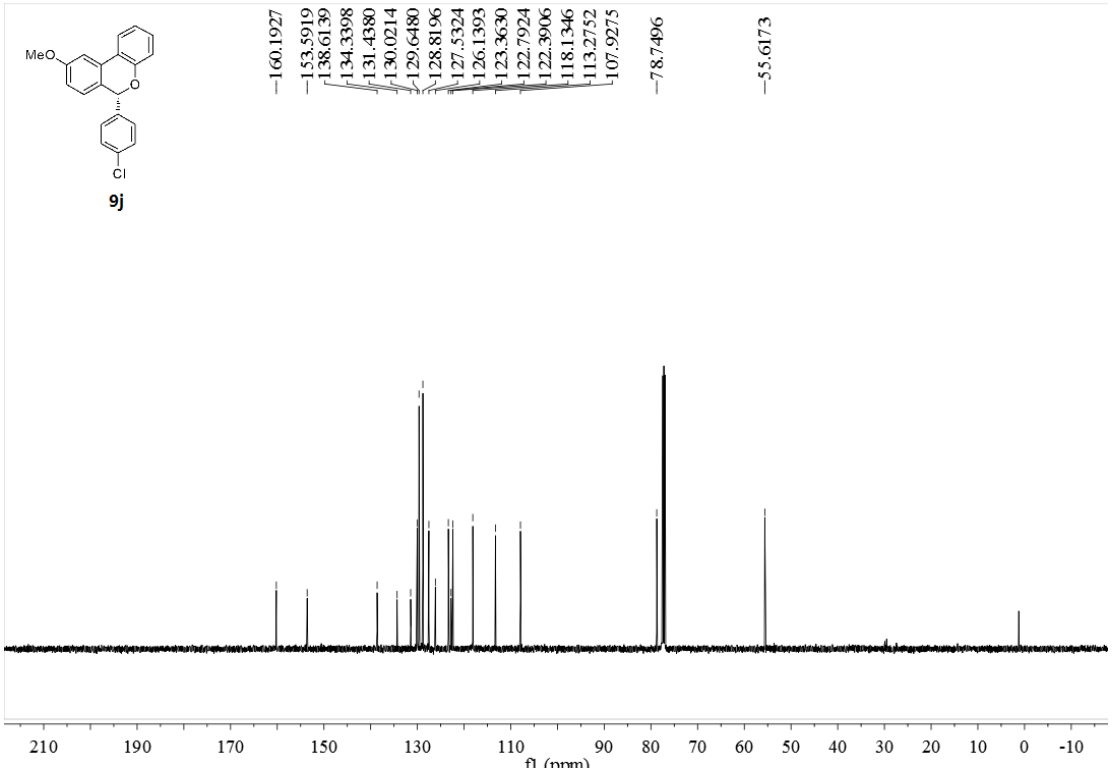
7.2333
7.0521
7.0503
6.9948
6.9930
6.9786
6.9768
6.8008
6.7961
6.7868
6.7678
3.8815
MeO
O
Cl
1.04
5.06
1.05
1.08
0.99
2.10
0.96
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

9j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131.4380
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129.6480
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127.5324
126.1393
123.3630
122.7924
122.3906
118.1346
113.2752
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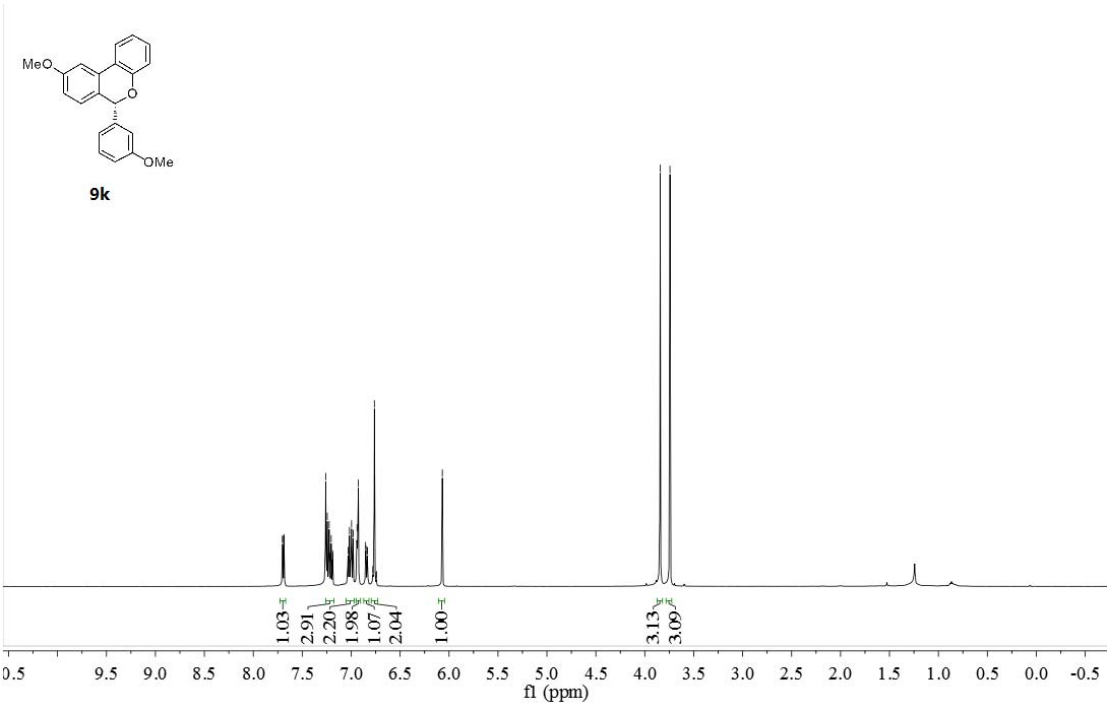
55.6173
MeO
O
Cl
210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

9j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OMe
9k
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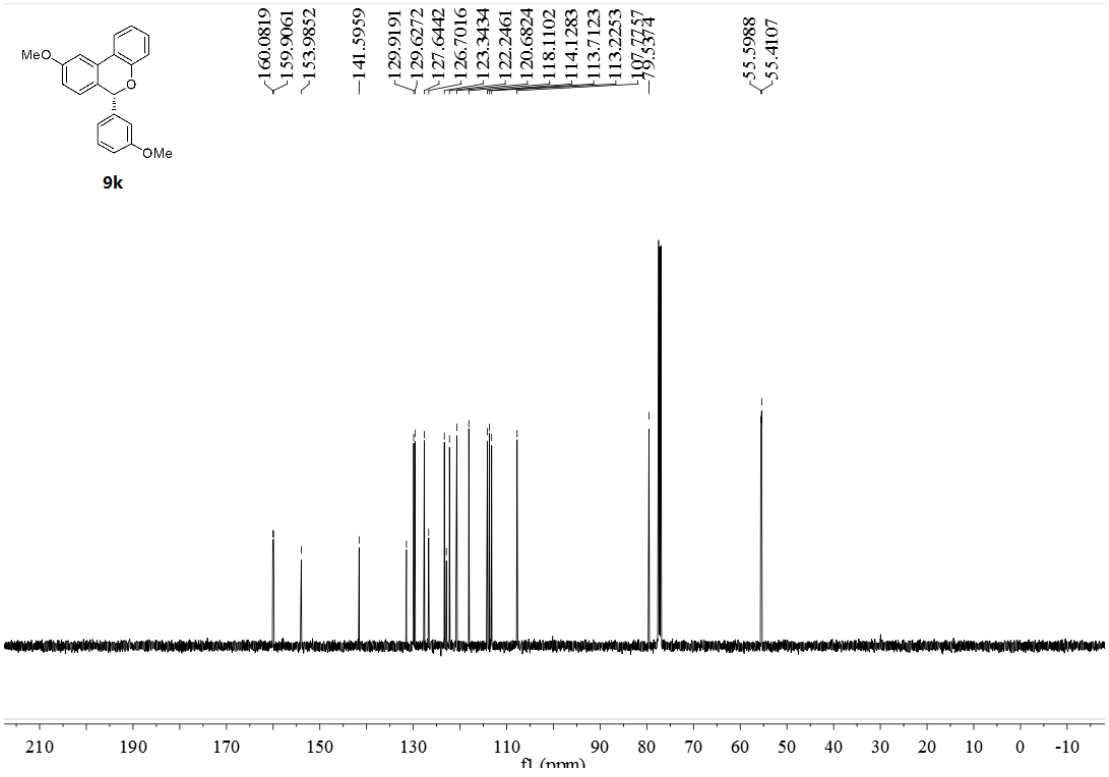
2.20
1.98
1.07
2.04
1.00
3.13
3.09
f1 (ppm)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OMe
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79.5374
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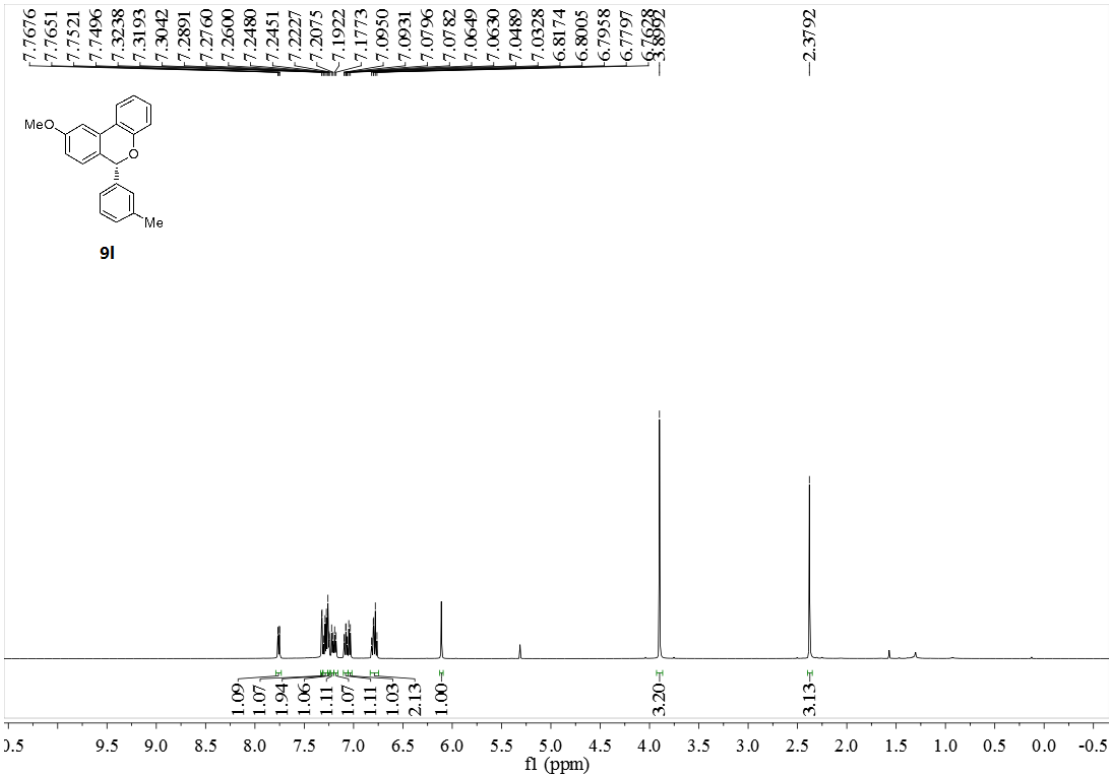
f1 (ppm)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7.2480
7.2451
7.2227
7.2075
7.1922
7.1773
7.0950
7.0931
7.0796
7.0782
7.0649
7.0630
7.0489
7.0328
6.8174
6.8005
6.7958
6.7797
3.8892
2.3792
MeO
Me
1.09
1.07
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1.06
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1.07
1.11
1.03
2.13
1.00
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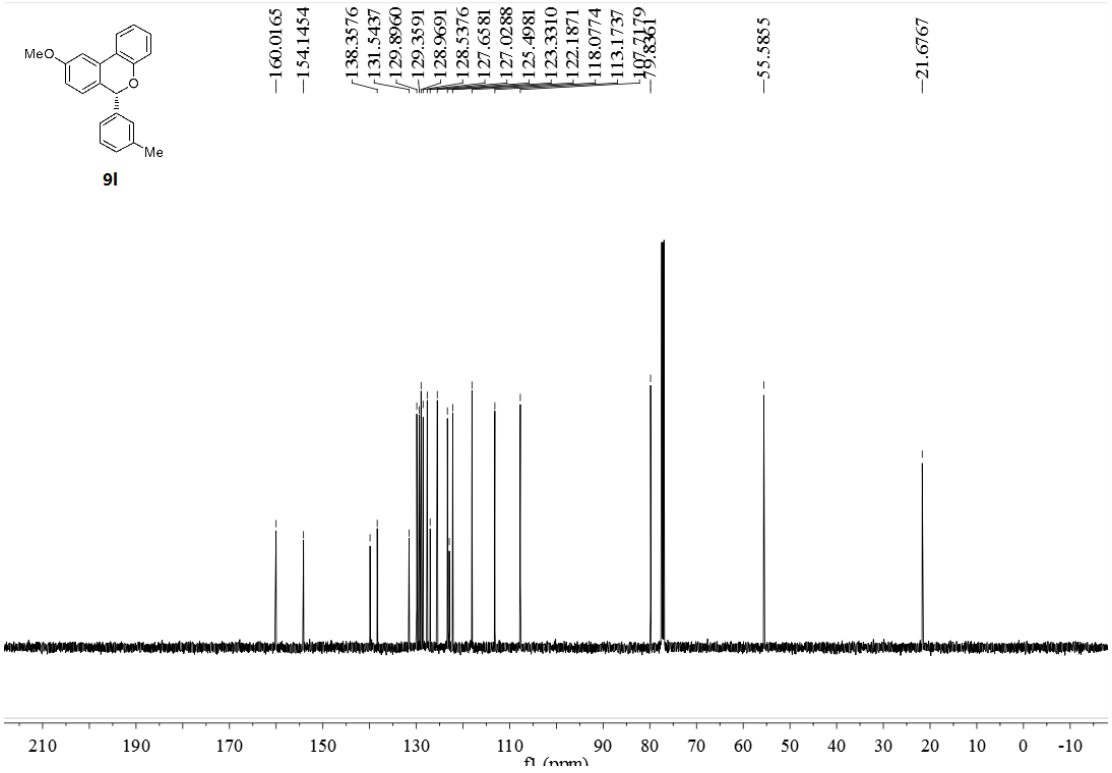
3.13
fl (ppm)

9l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128.9691
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127.6581
127.0288
125.4981
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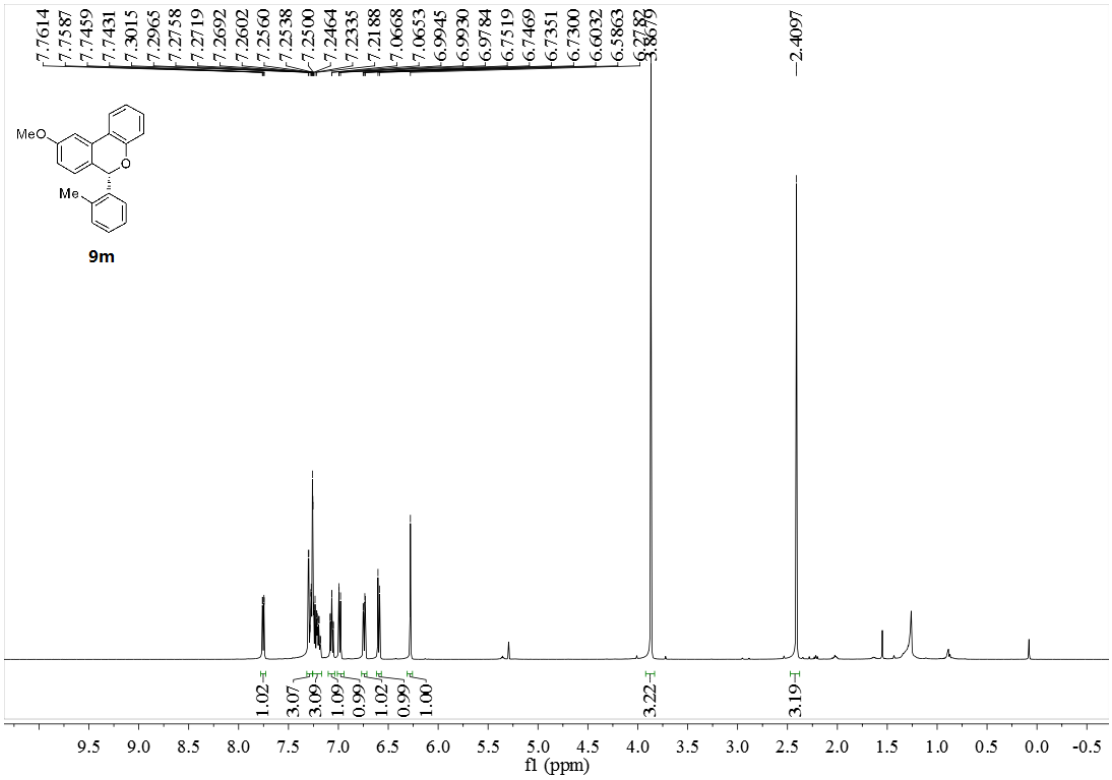
118.0774
113.1737
77.3179
55.5855
21.6767
MeO
Me
fl (ppm)

9l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7.7459
7.7431
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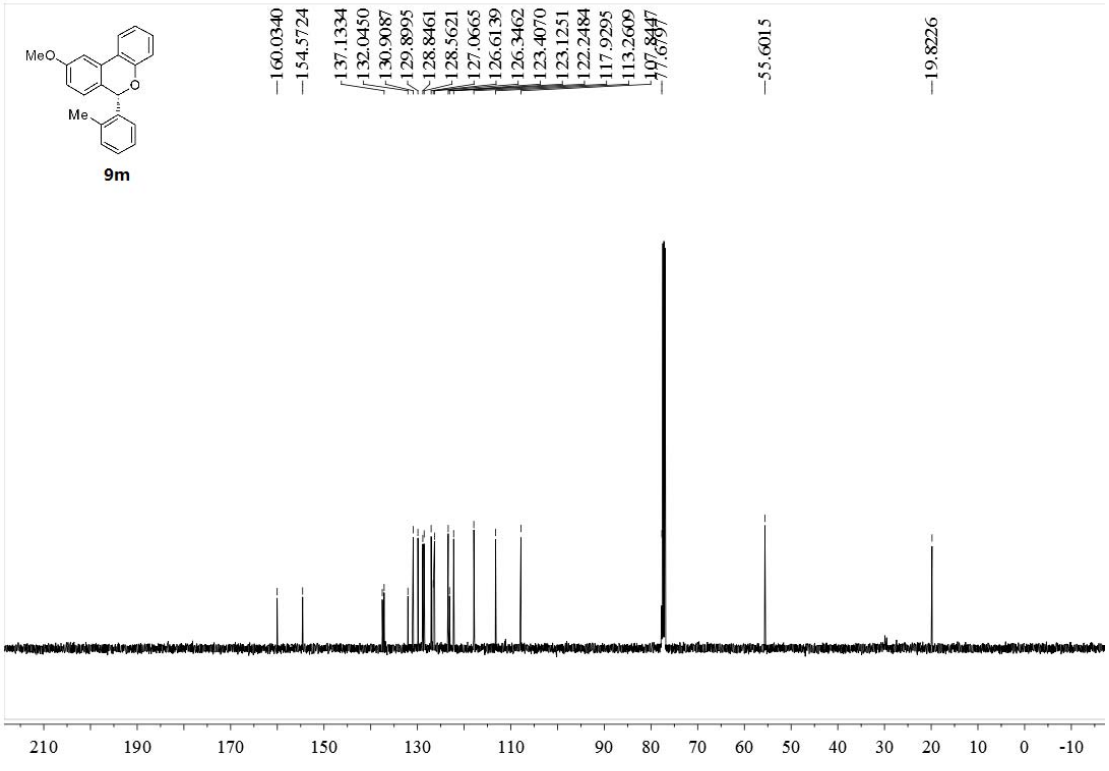
7.2692
7.2602
7.2560
7.2538
7.2500
7.2464
7.2335
7.2188
7.0668
7.0653
6.9945
6.9930
6.9784
6.7519
6.7469
6.7351
6.7300
6.6032
6.5863
3.8679
2.4097
MeO
Me
9m
1.02
3.07
3.09
1.09
0.99
1.02
0.99
1.00
3.22
3.19
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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Me
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126.3462
123.4070
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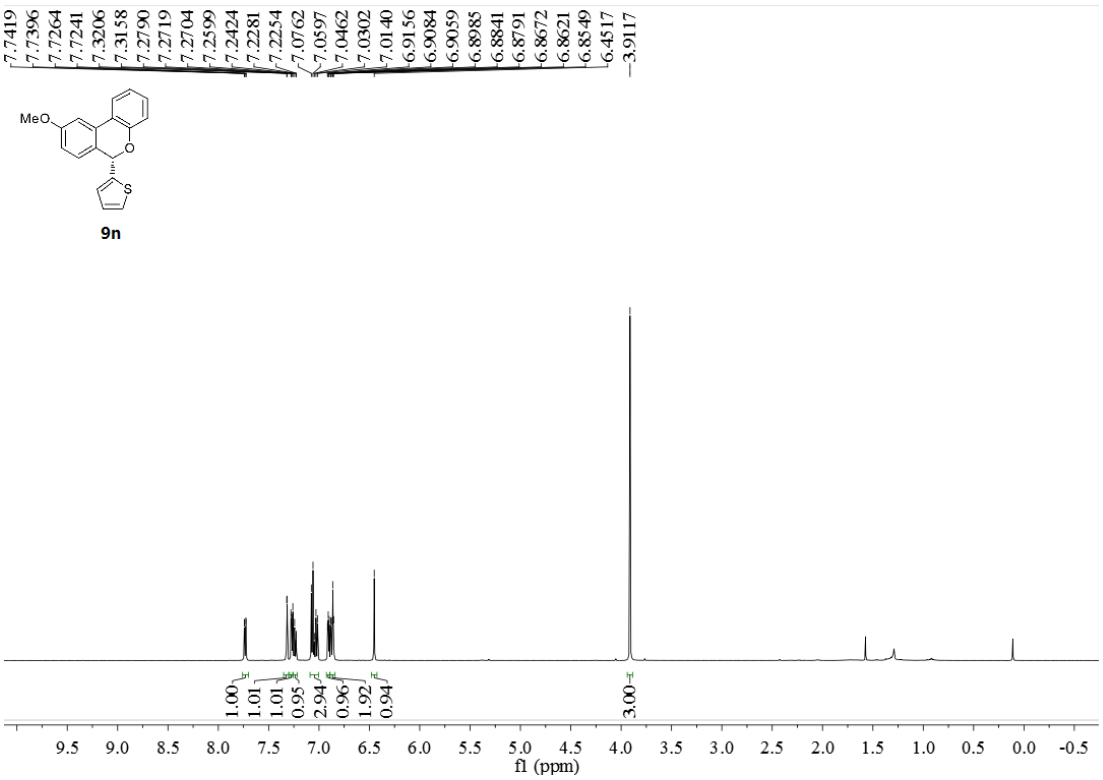
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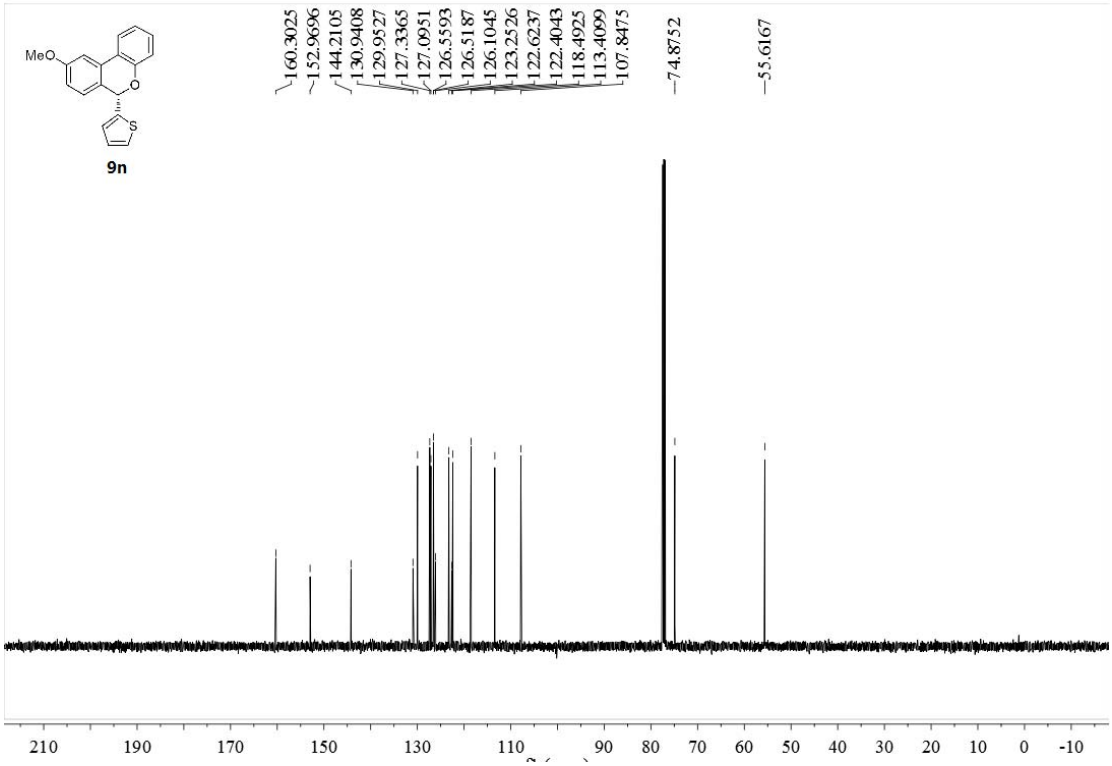
7.2424
7.2281
7.2254
7.0762
7.0597
7.0462
7.0302
7.0140
6.9156
6.9084
6.9059
6.8985
6.8841
6.8791
6.8672
6.8621
6.8549
6.4517
3.9117
MeO
O
S
9n
1.00
1.01
1.01
0.95
2.94
0.96
1.92
0.94
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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O
S
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126.5187
126.1045
123.2526
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113.4099
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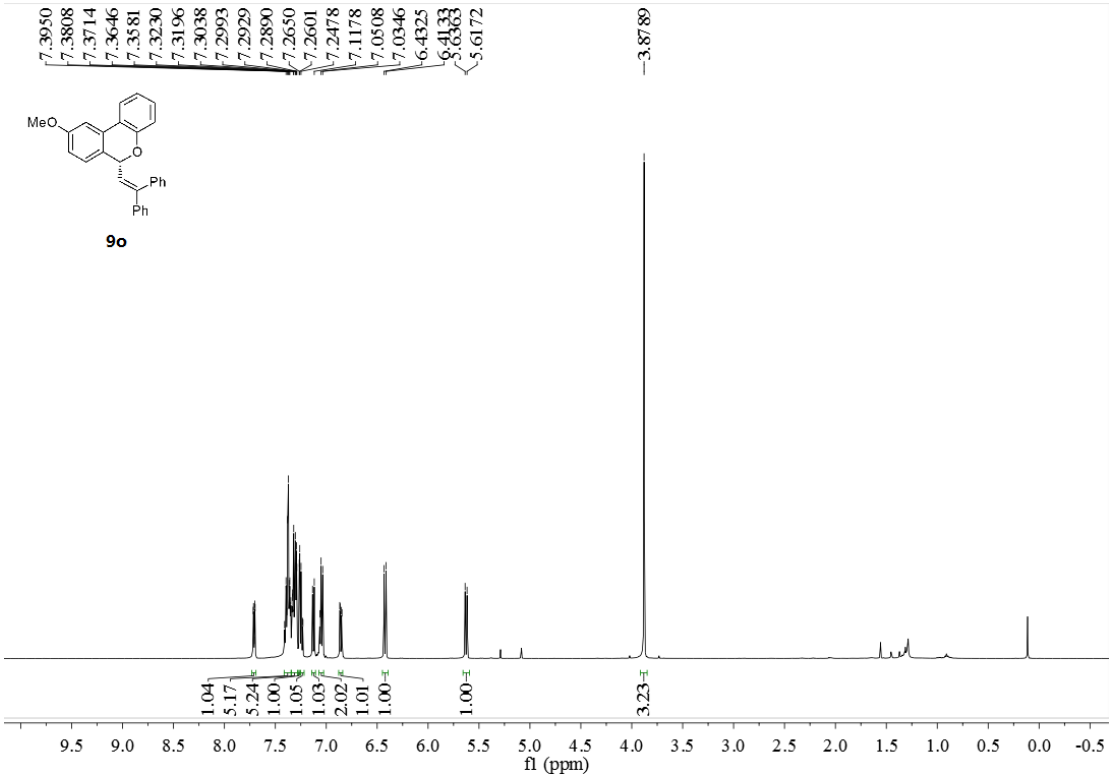
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7.3196
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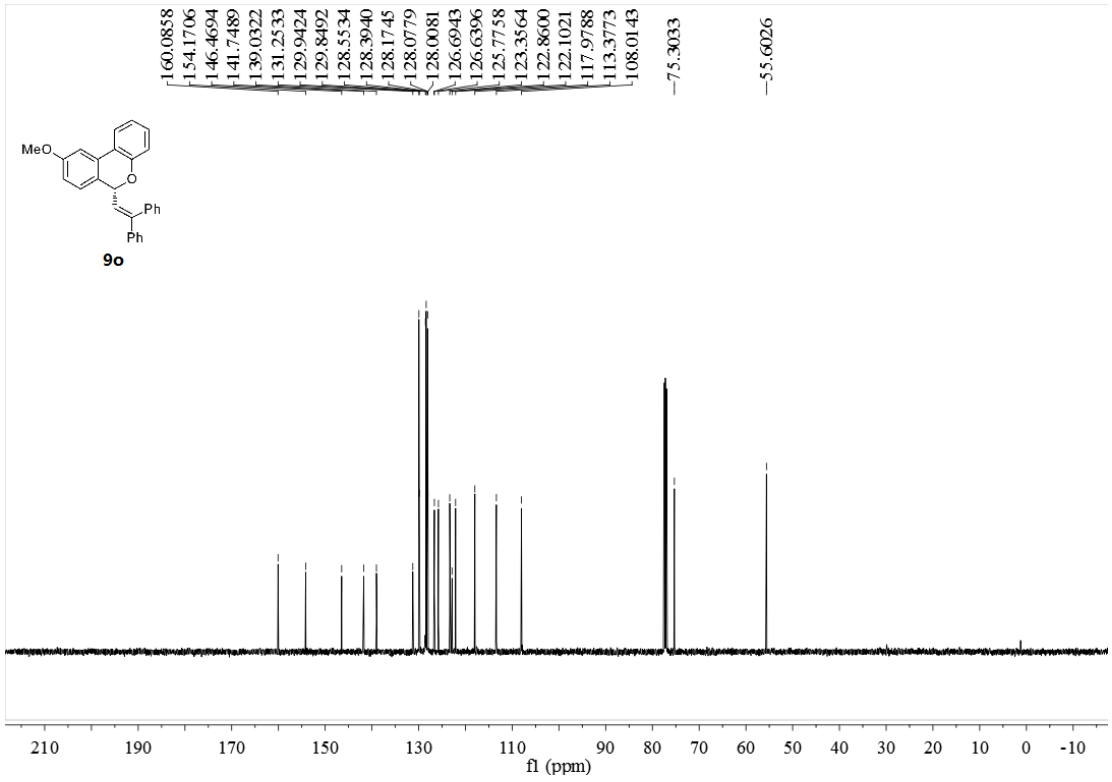
7.2929
7.2890
7.2650
7.2601
7.2478
7.1178
7.0508
7.0346
6.4325
6.4133
6.3363
5.6172
3.8789
MeO
O
Ph
Ph
1.04
5.17
5.24
1.00
1.05
1.03
2.02
1.01
1.00
1.00
3.23
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

9o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117.9788
113.3773
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MeO
O
Ph
Ph
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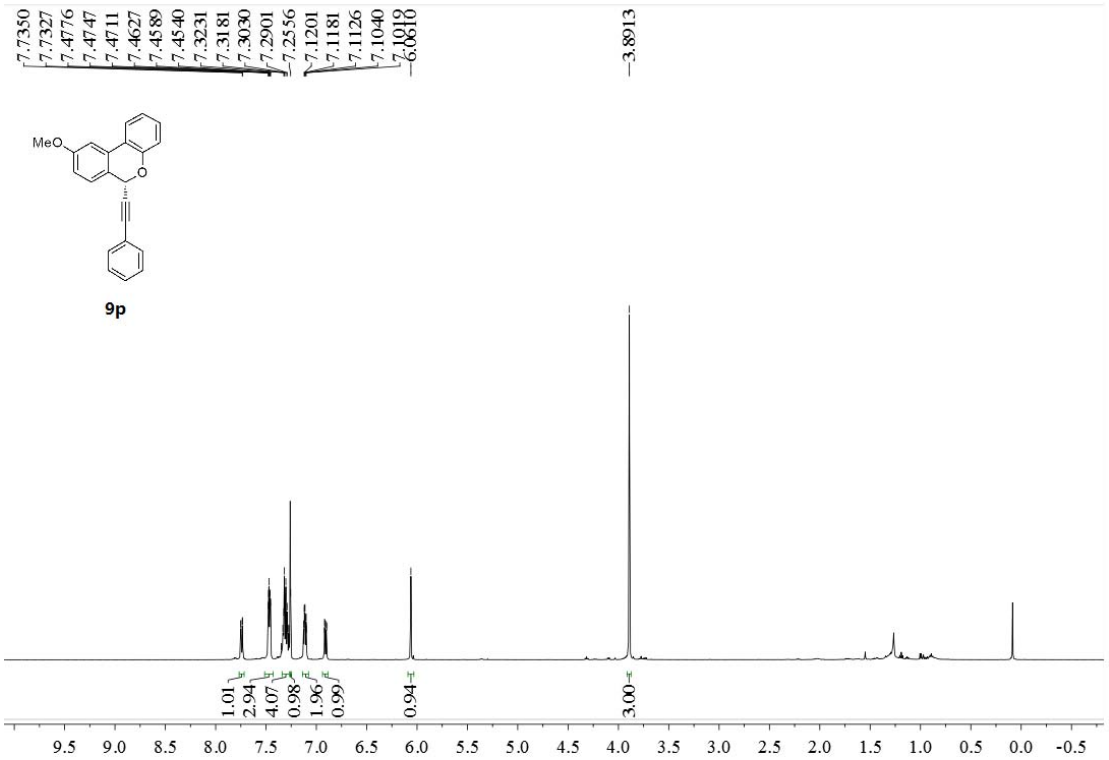
f1 (ppm)

9o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7.4540
7.3231
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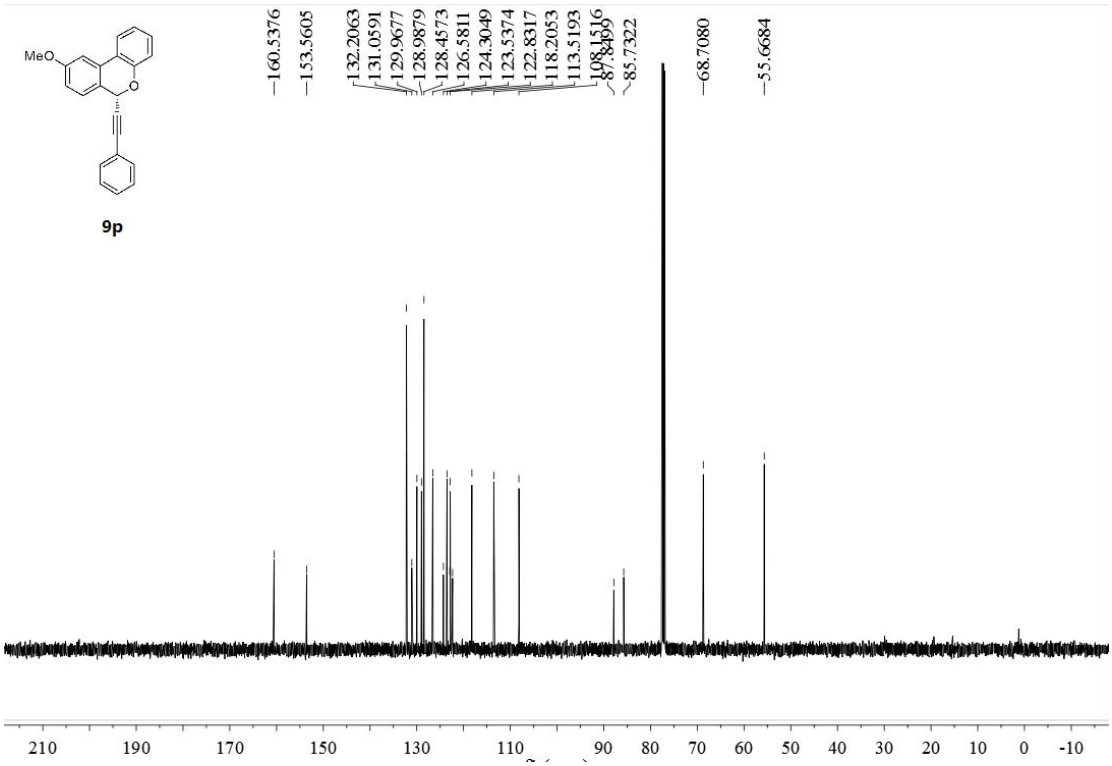
7.3030
7.2901
7.2556
7.1201
7.1181
7.1126
7.1040
7.1019
6.0610
3.8913
MeO
9p
1.01
2.94
4.07
0.98
1.96
0.99
0.94
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5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122.8317
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113.5193
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85.7322
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55.6684
MeO
9p
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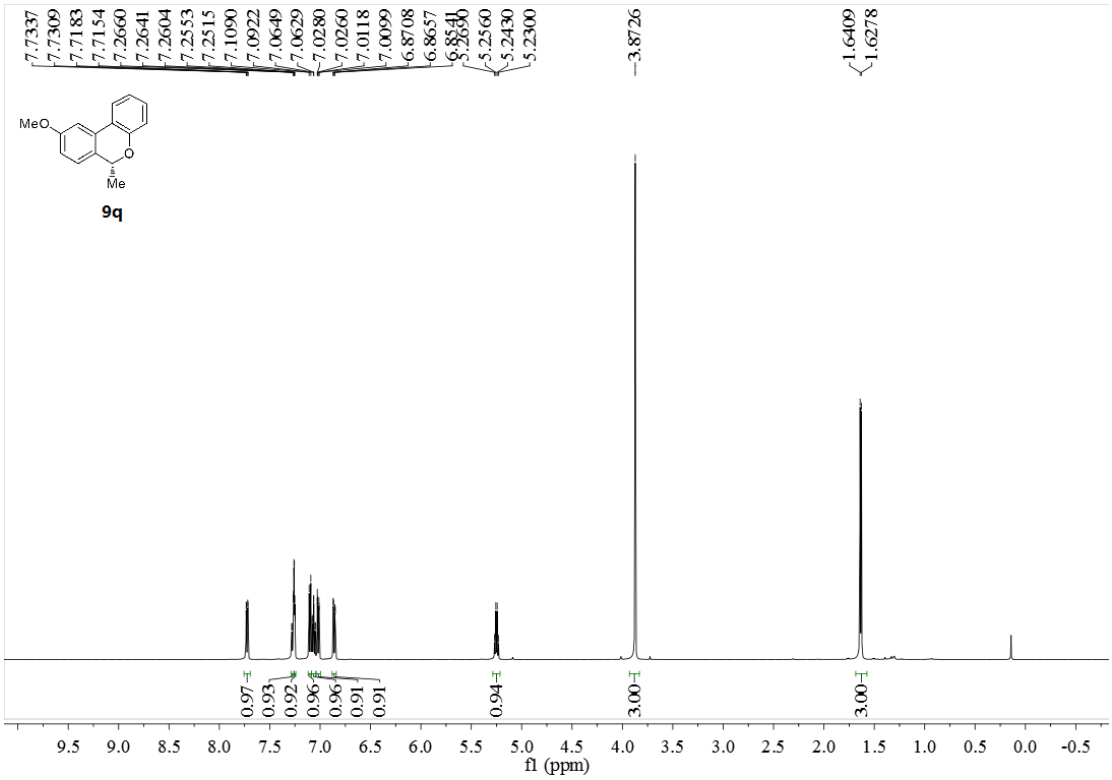
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7.2604
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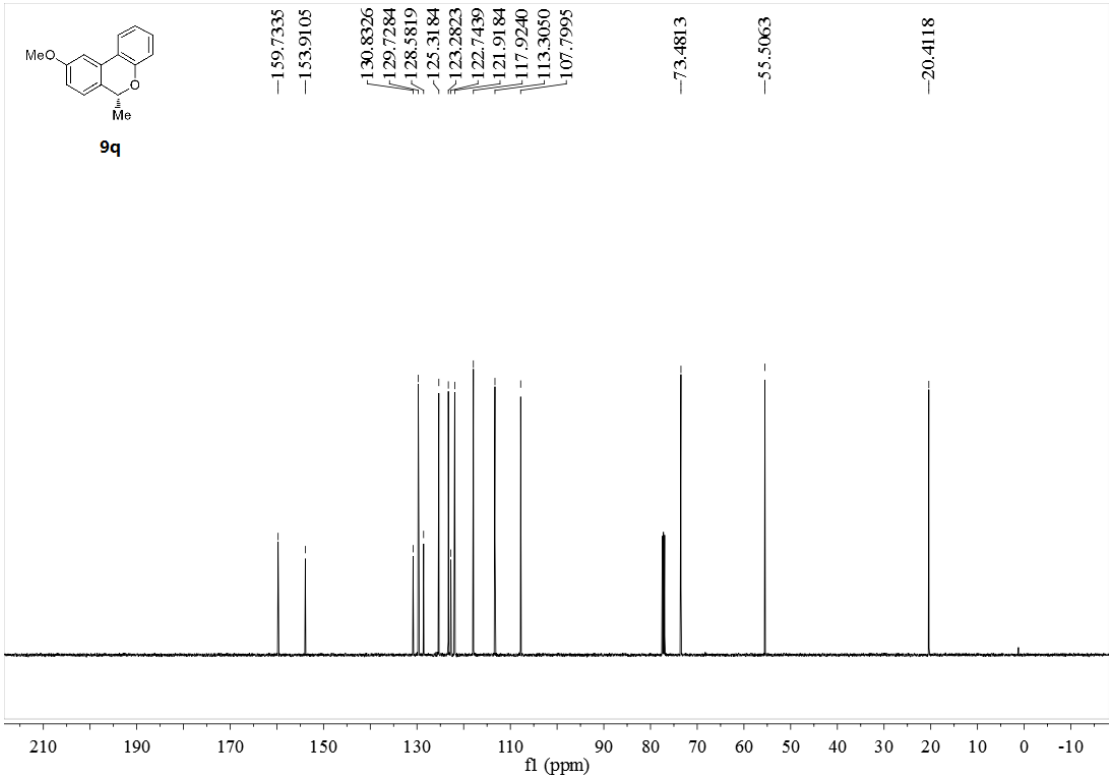
7.2515
7.1090
7.0922
7.0649
7.0629
7.0280
7.0260
7.0118
7.0099
6.8708
6.8657
5.2560
5.2430
5.2300
3.8726
1.6409
1.6278
MeO
O
Me
9q
0.97
0.93
0.92
0.96
0.96
0.91
0.91
0.94
3.00
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


MeO
O
Me
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123.2823
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121.9184
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73.4813
55.5063
20.4118
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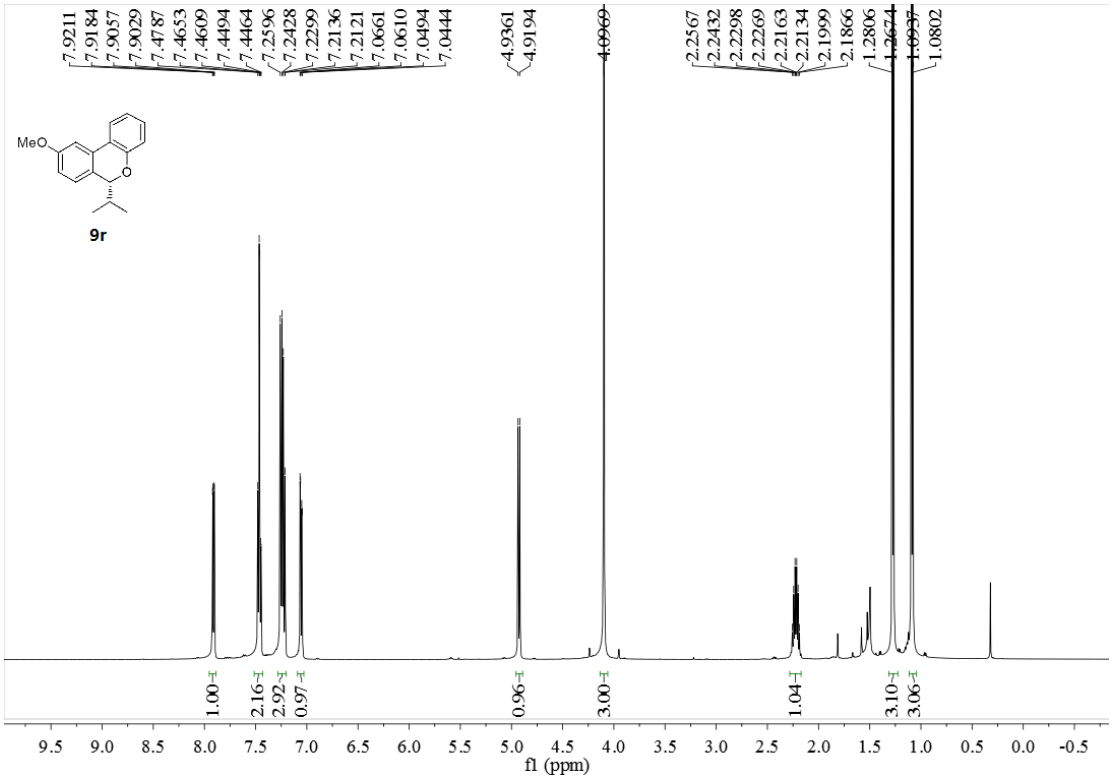
f1 (ppm)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7.2299
7.2136
7.2121
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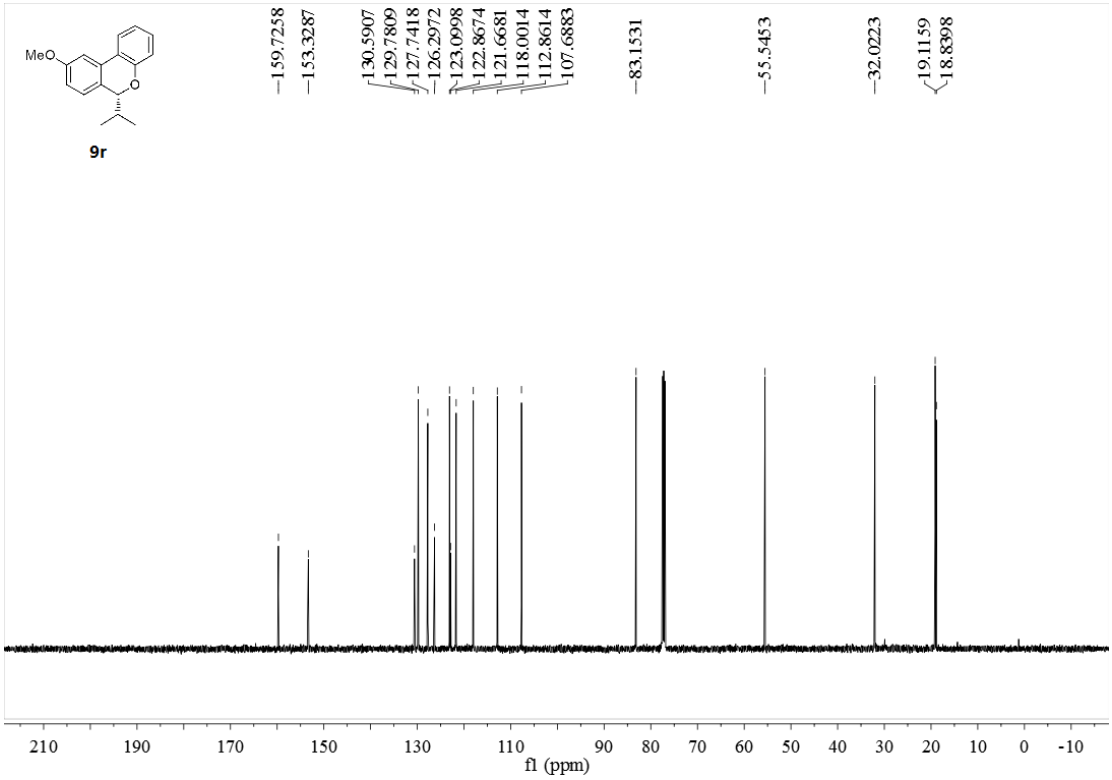
7.0444
4.9361
4.9194
4.0969
2.2567
2.2432
2.2298
2.2269
2.2163
2.2134
2.1999
2.1866
1.2806
1.2674
1.0937
1.0802
MeO
O
9r
1.00
2.16
2.92
0.97
0.96
3.00
1.04
3.10
3.06
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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112.8614
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19.1159
18.8398
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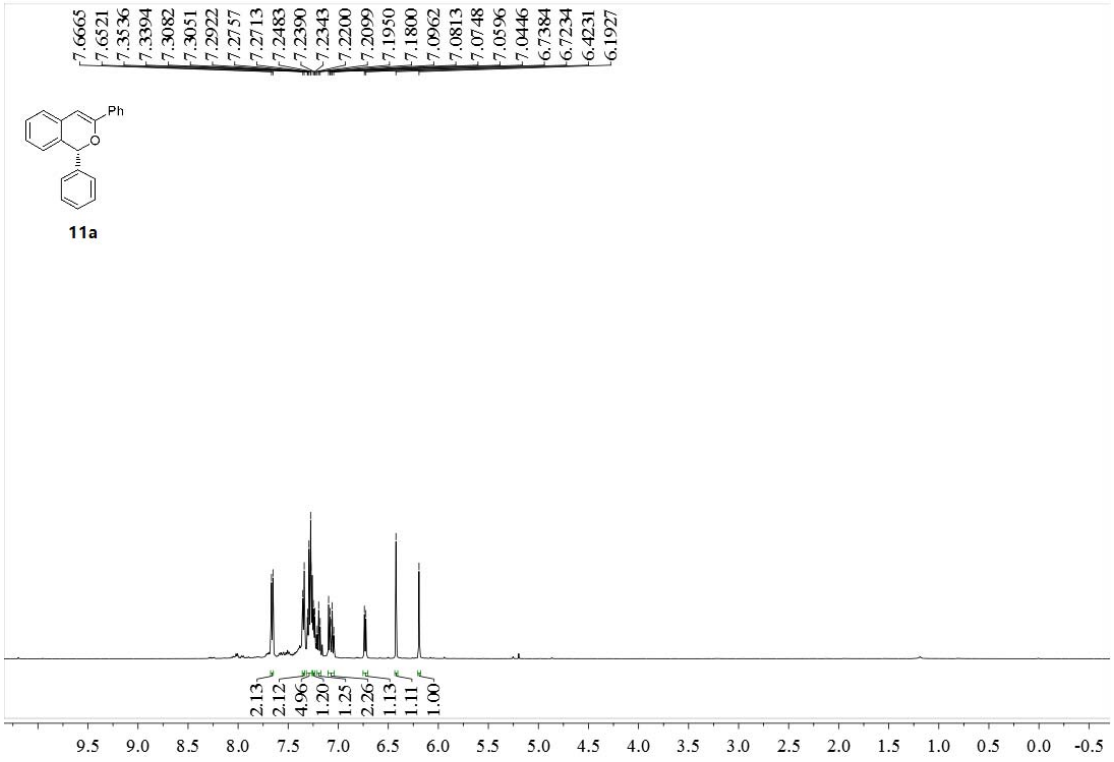
f1 (ppm)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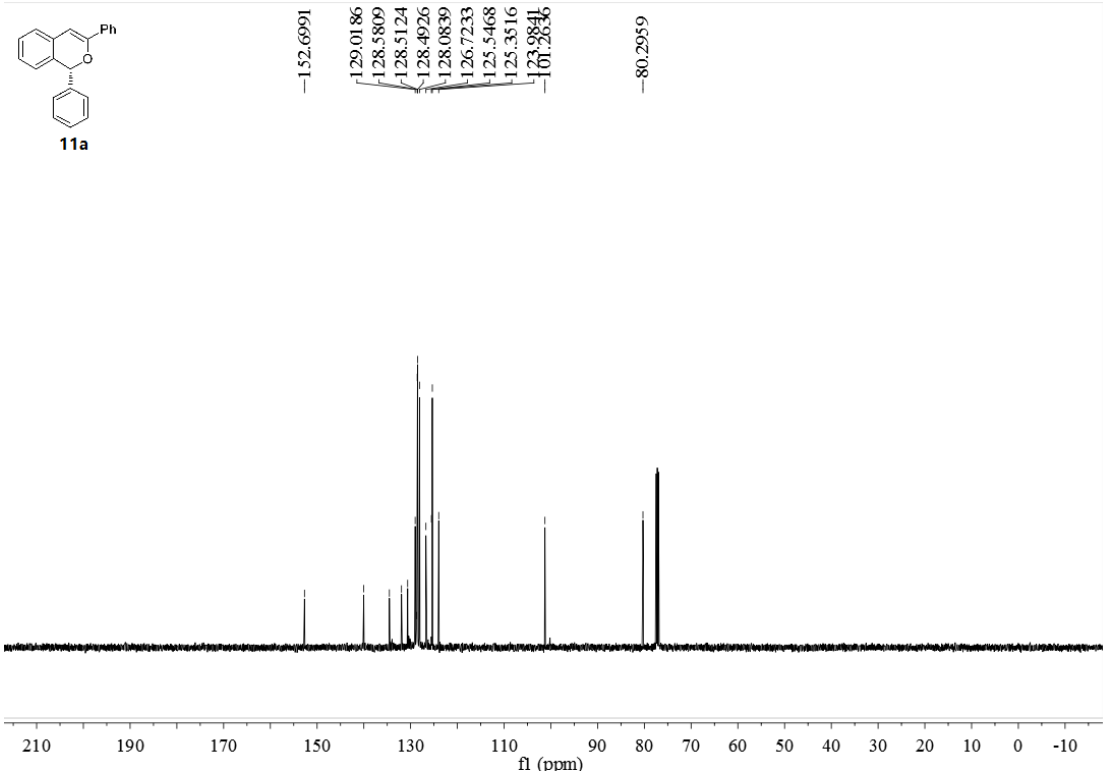
7.2343
7.2200
7.2099
7.1950
7.1800
7.0962
7.0813
7.0748
7.0596
7.0446
6.7384
6.7234
6.4231
6.1927
Ph
O
11a
2.13
2.12
4.96
1.20
1.25
2.26
1.13
1.11
1.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5


Ph
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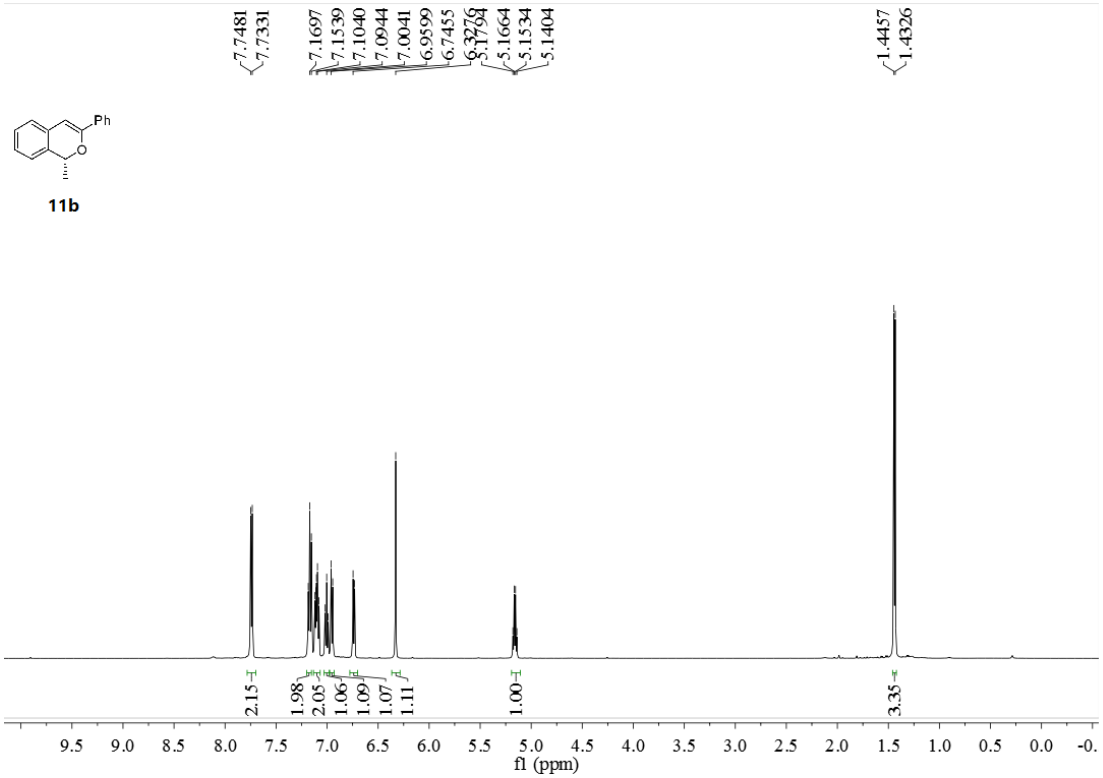
f1 (ppm)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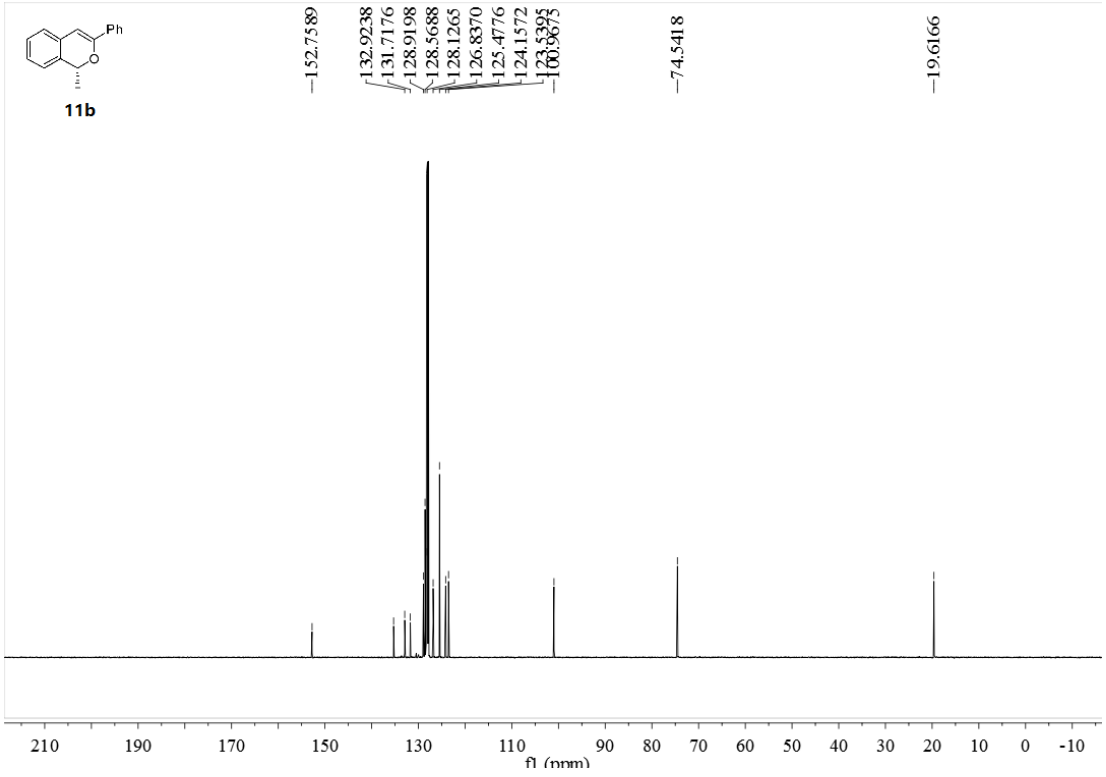
5.1664
5.1534
5.1404
1.4457
1.4326
Ph
O
11b
2.15
1.98
2.05
1.06
1.09
1.07
1.11
1.00
3.35
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.
f1 (ppm)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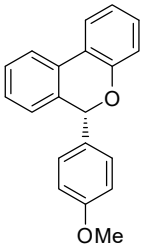
74.5418
19.6166
210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

HPLC data



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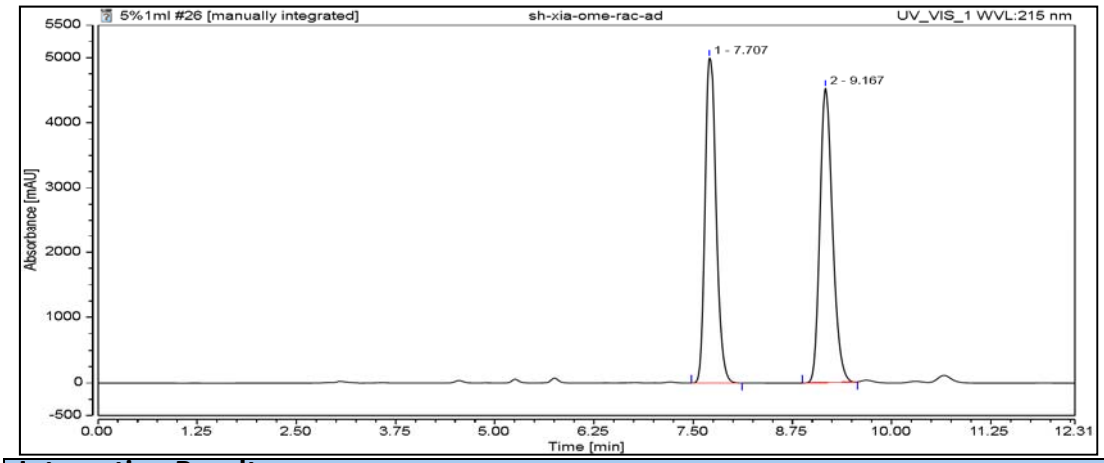
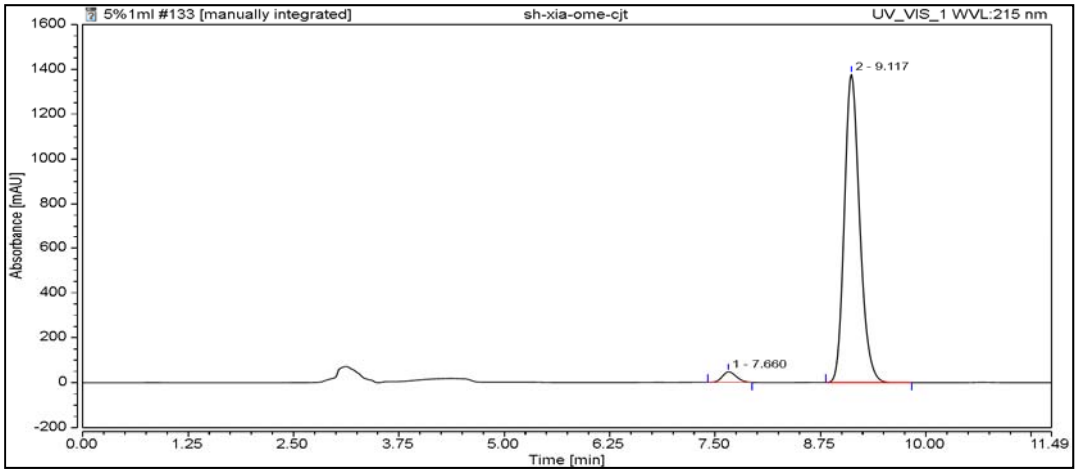
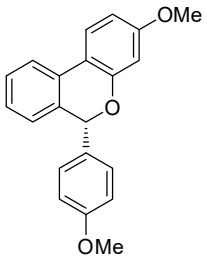


Integration Results					
No.	Peak Name	Retention Time	Area	Relative Area	Amount
1		7.707	809.698	49.18	n.a.
2		9.167	836.590	50.82	n.a.
Total:			**1646.289**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.660	8.991	3.01	n.a.
2		9.117	289.949	96.99	n.a.
Total:			**298.939**	**100.00**	



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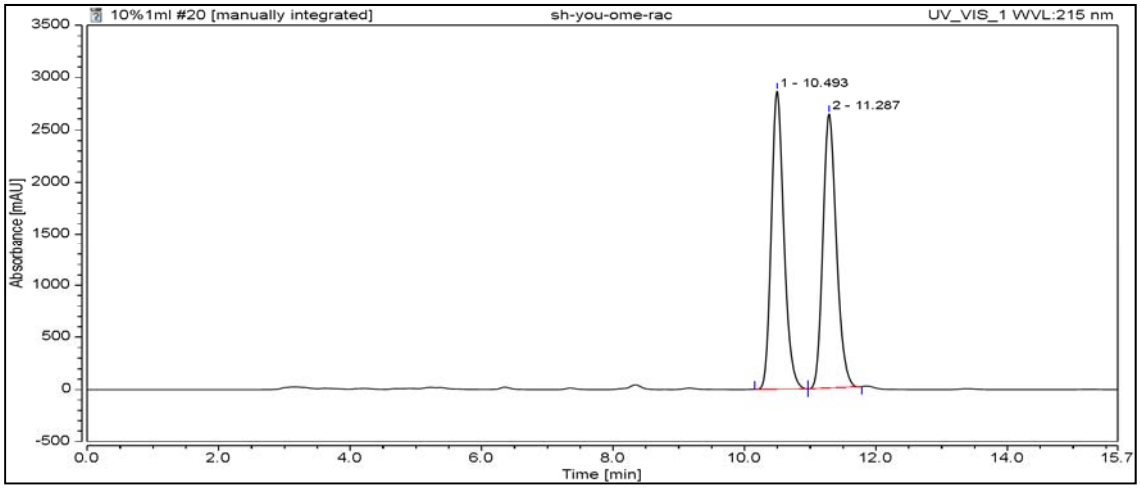
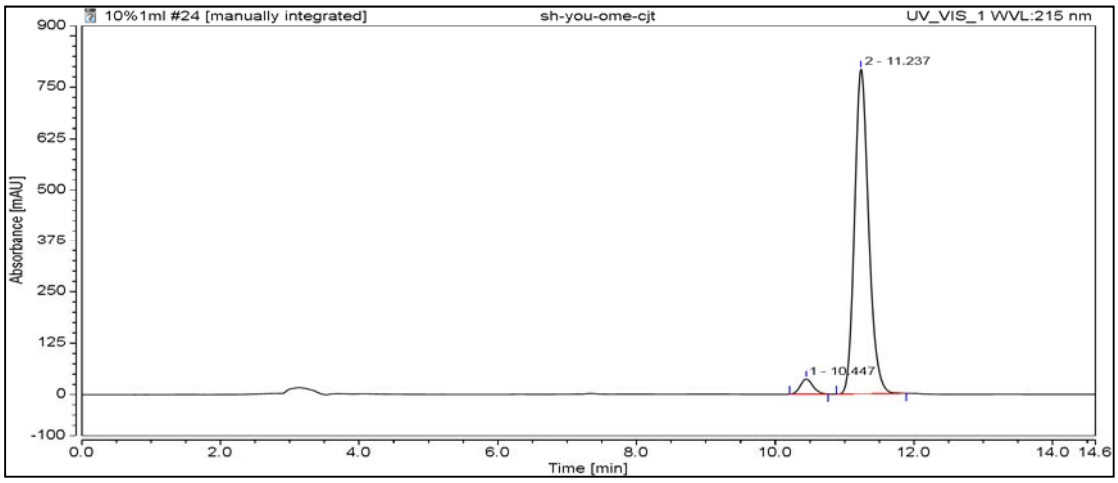
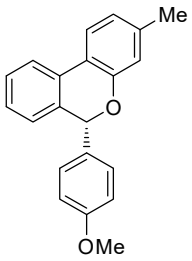


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		10.493	634.646	50.36	n.a.
2		11.287	625.683	49.64	n.a.
Total:			**1260.329**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		10.447	7.770	4.00	n.a.
2		11.237	186.400	96.00	n.a.
Total:			**194.170**	**100.00**	



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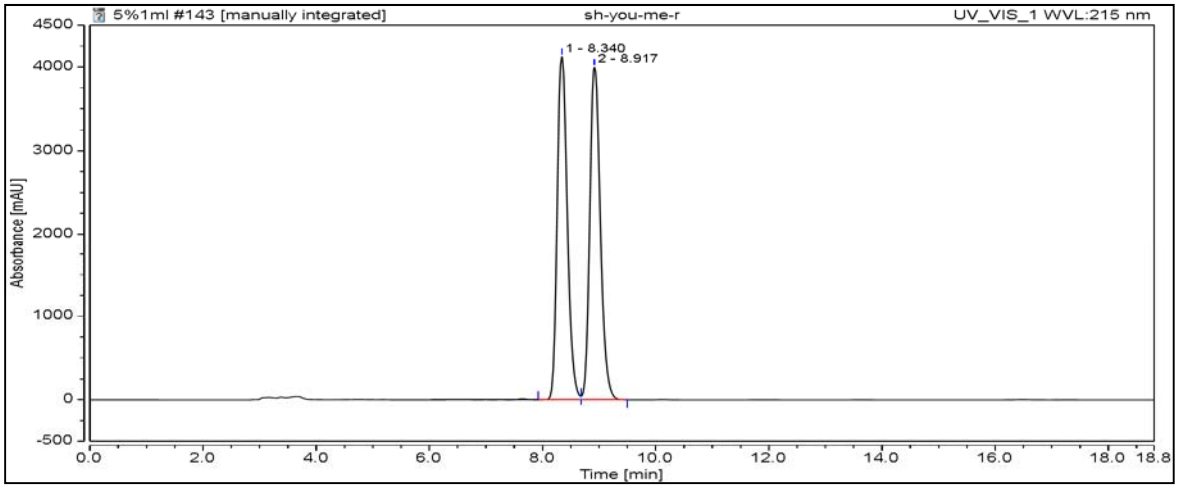
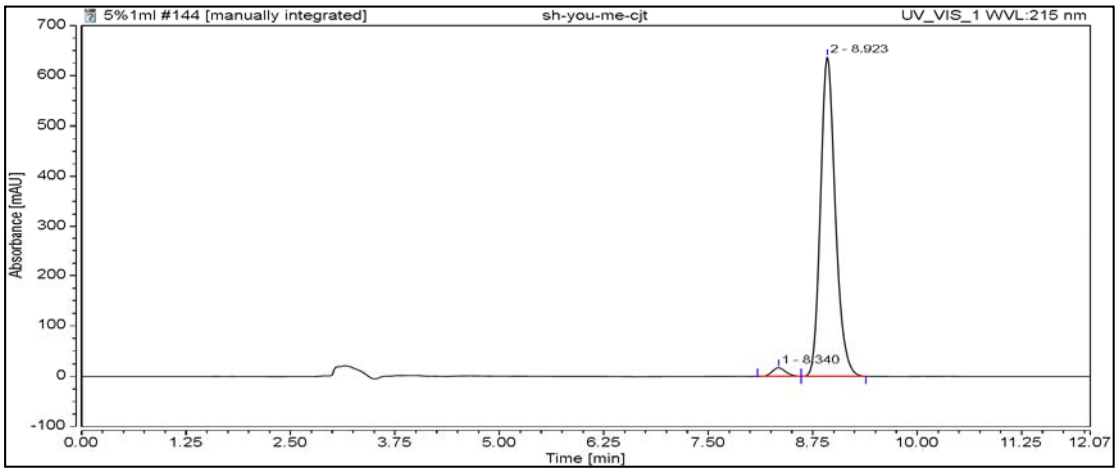
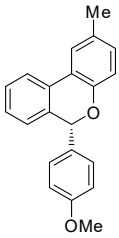


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		8.340	855.540	49.67	n.a.
2		8.917	866.784	50.33	n.a.
Total:			**1722.323**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		8.340	3.231	2.40	n.a.
2		8.923	131.116	97.60	n.a.
Total:			**134.347**	**100.00**	



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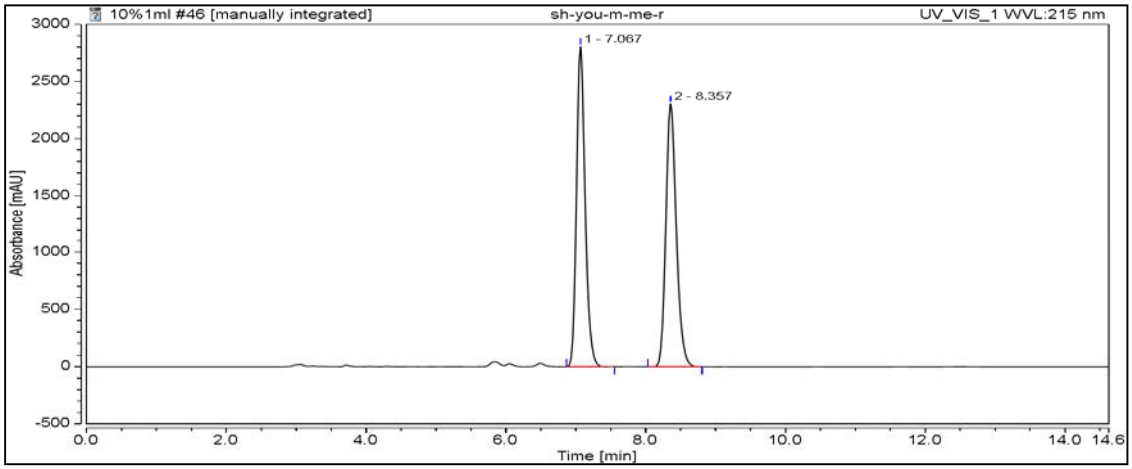
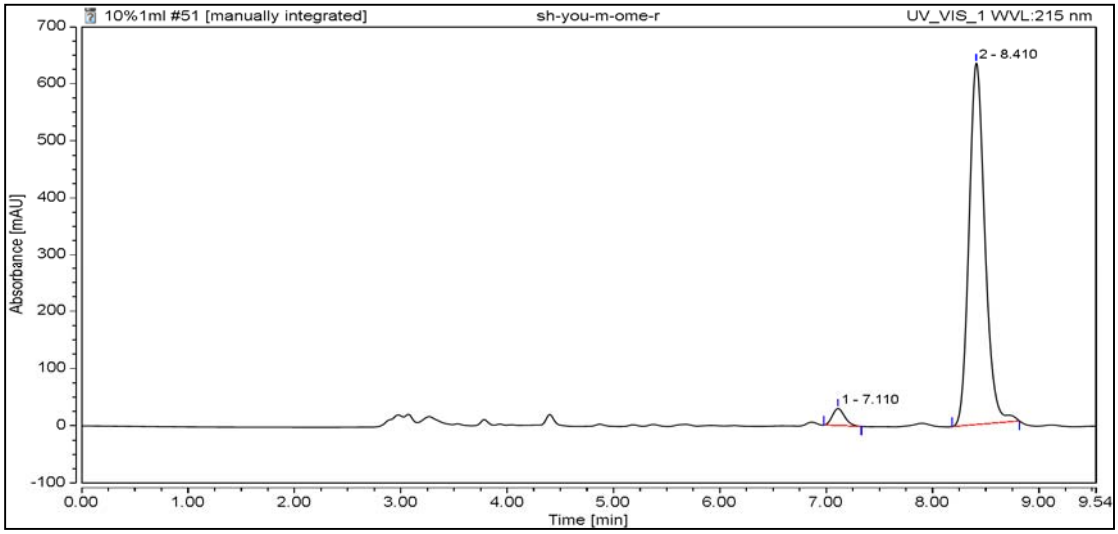
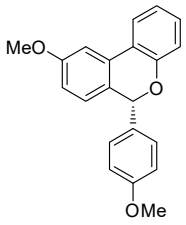


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.067	399.309	50.11	n.a.
2		8.357	397.516	49.89	n.a.
Total:			**796.825**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.110	4.003	3.52	n.a.
2		8.410	109.641	96.48	n.a.
Total:			**113.644**	**100.00**	



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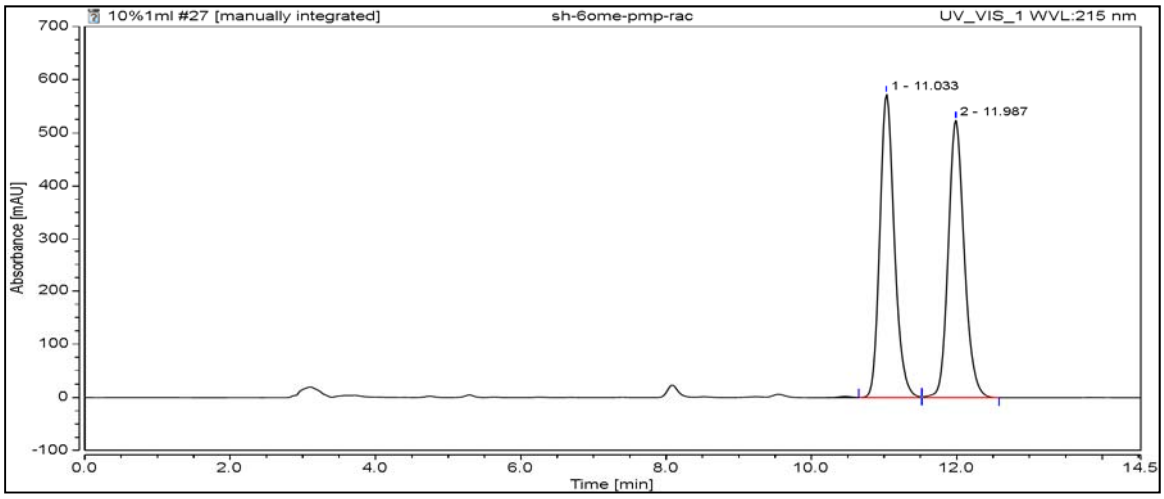
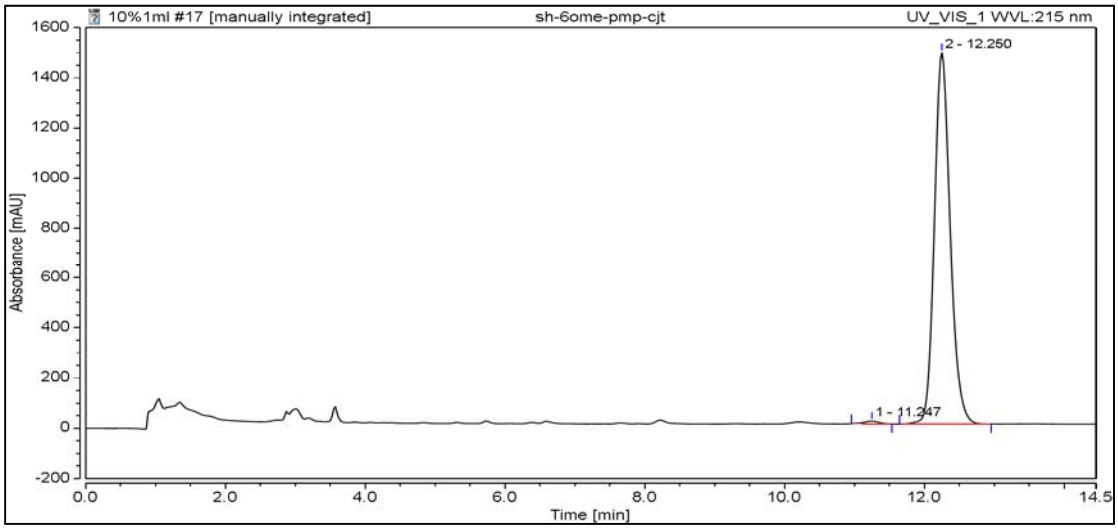
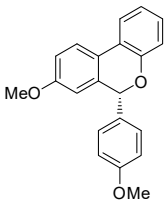


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		11.033	133.261	49.92	n.a.
2		11.987	133.691	50.08	n.a.
Total:			**266.952**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		11.247	2.615	0.67	n.a.
2		12.250	388.984	99.33	n.a.
Total:			**391.599**	**100.00**	



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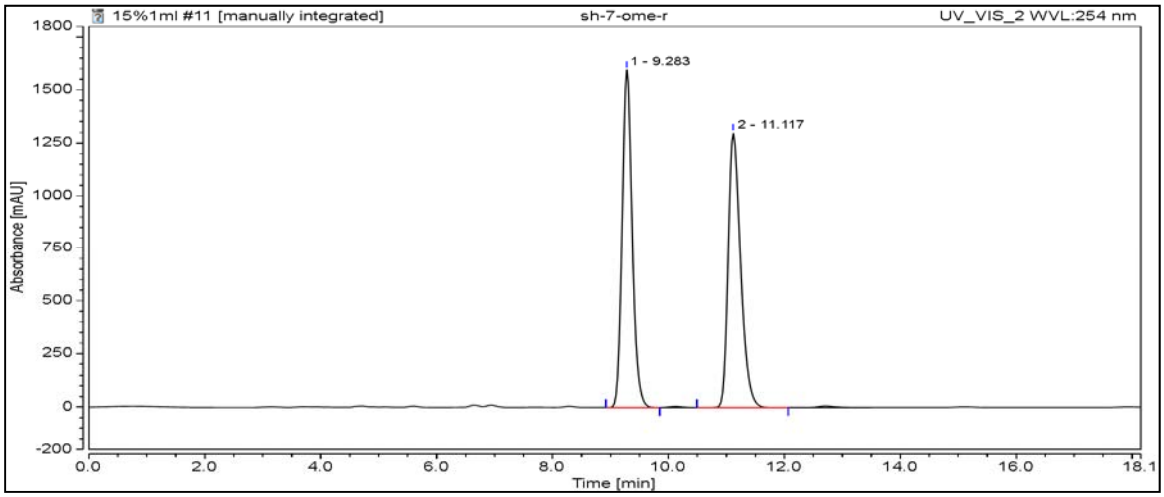
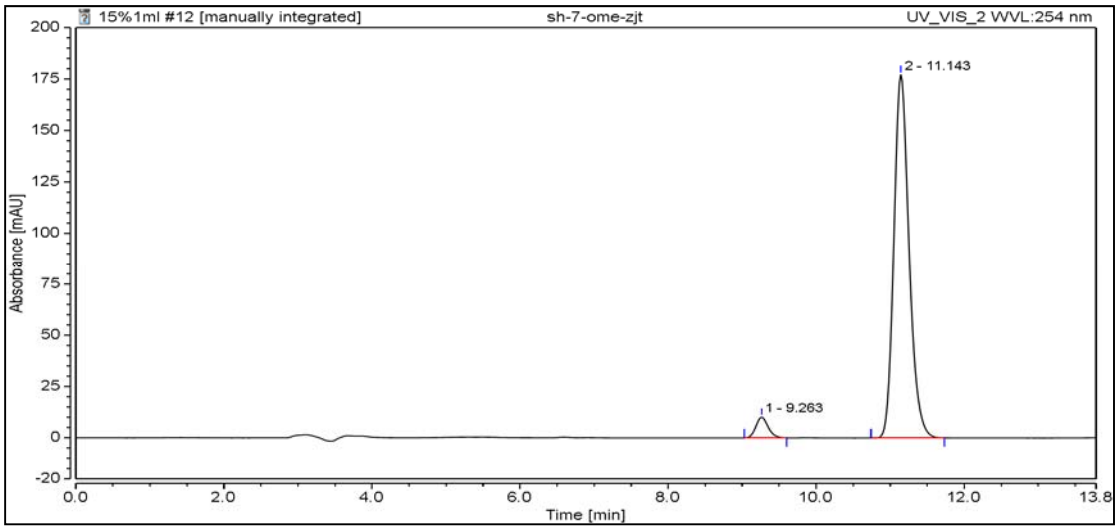
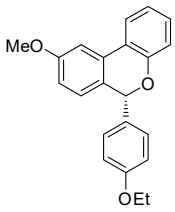


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.283	319.992	49.84	n.a.
2		11.117	322.066	50.16	n.a.
Total:			**642.059**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.263	1.947	4.42	n.a.
2		11.143	42.139	95.58	n.a.
Total:			**44.086**	**100.00**	



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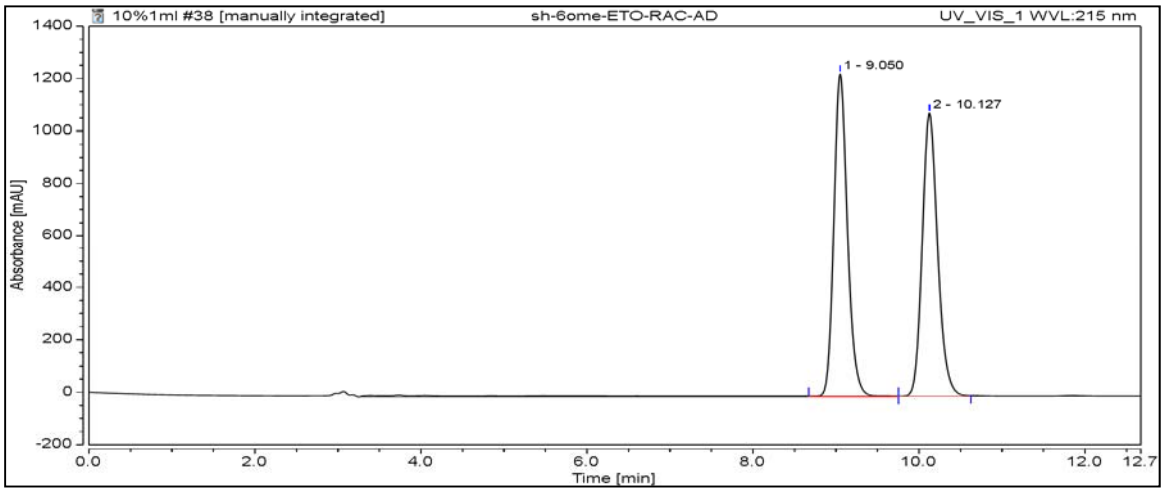
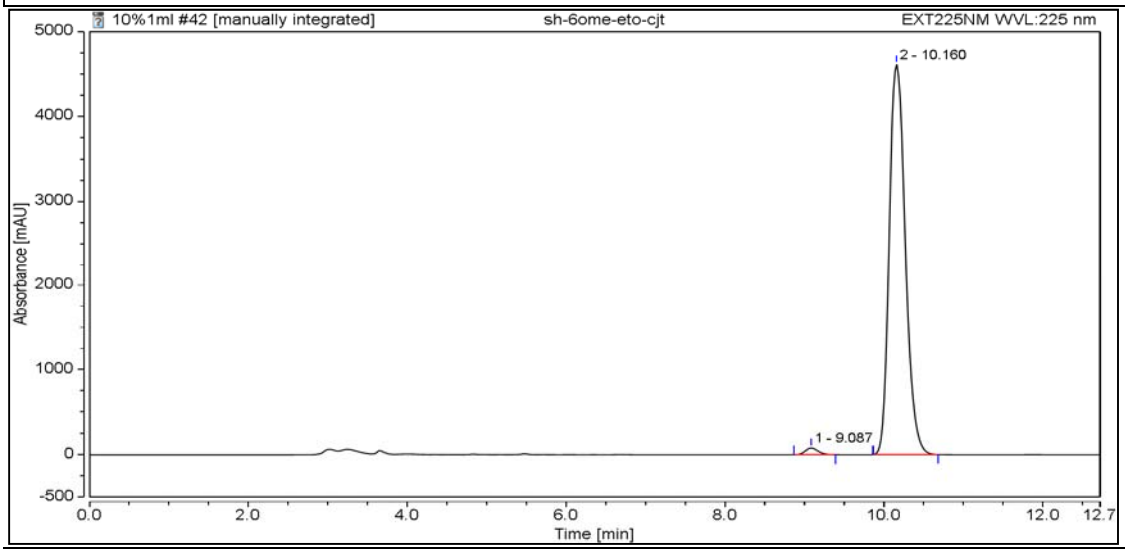
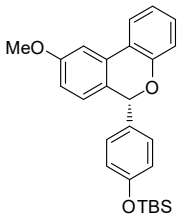


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.050	233.646	50.05	n.a.
2		10.127	233.212	49.95	n.a.
Total:			**466.858**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.087	14.977	1.37	n.a.
2		10.160	1077.915	98.63	n.a.
Total:			**1092.892**	**100.00**	



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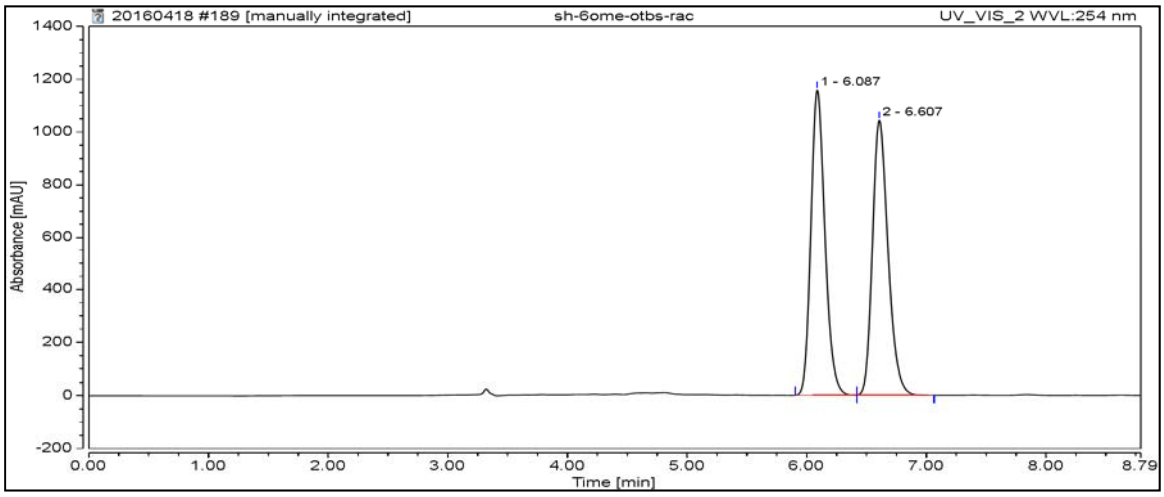
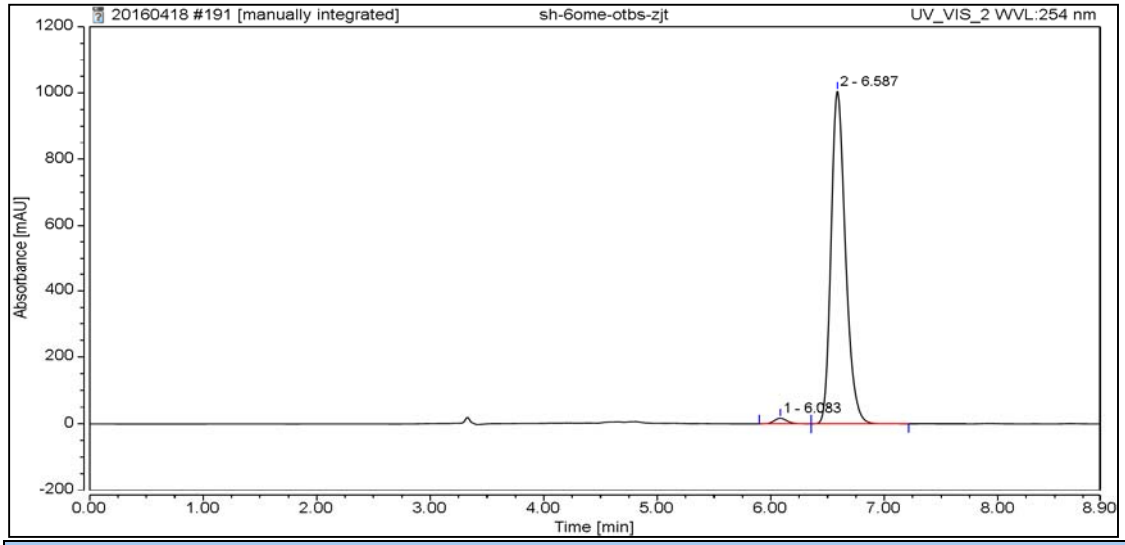
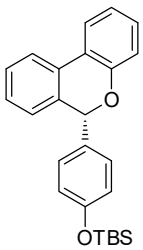


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		6.087	156.850	50.01	n.a.
2		6.607	156.762	49.99	n.a.
Total:			**313.612**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		6.083	2.272	1.51	n.a.
2		6.587	147.877	98.49	n.a.
Total:			**150.149**	**100.00**	



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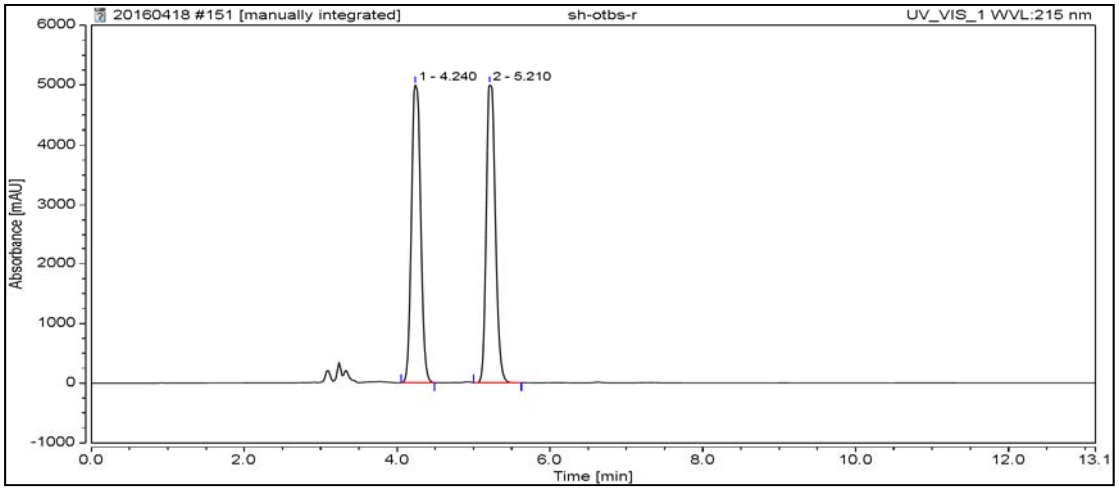
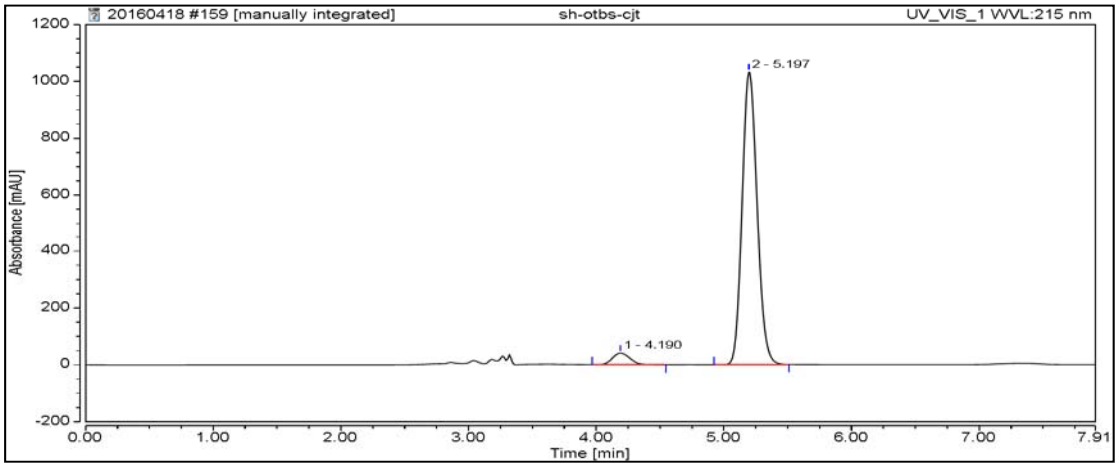
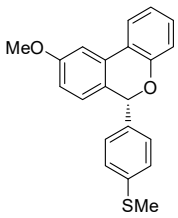


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		4.240	696.600	50.28	n.a.
2		5.210	688.898	49.72	n.a.
Total:			**1385.498**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		4.190	6.481	4.42	n.a.
2		5.197	140.224	95.58	n.a.
Total:			**146.705**	**100.00**	



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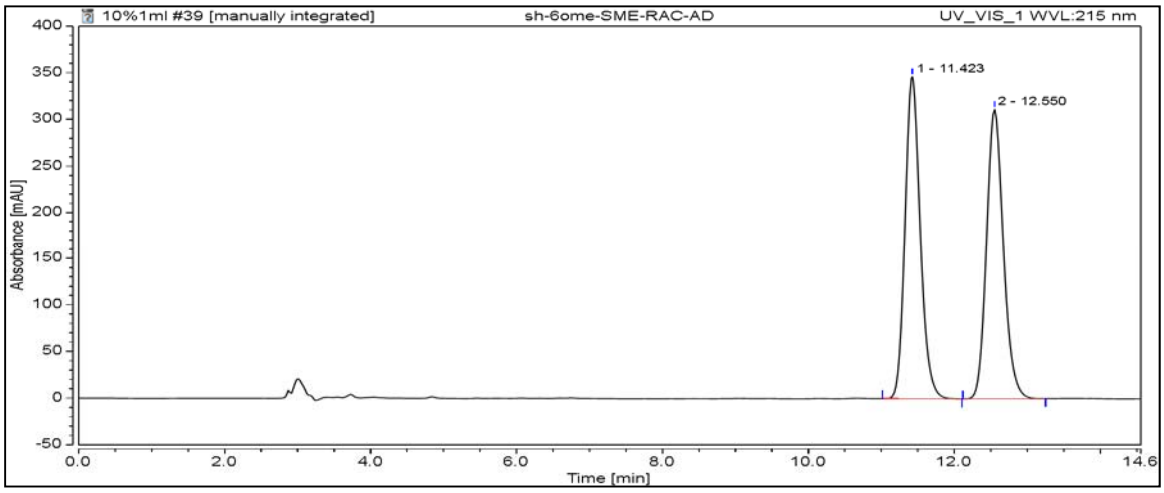
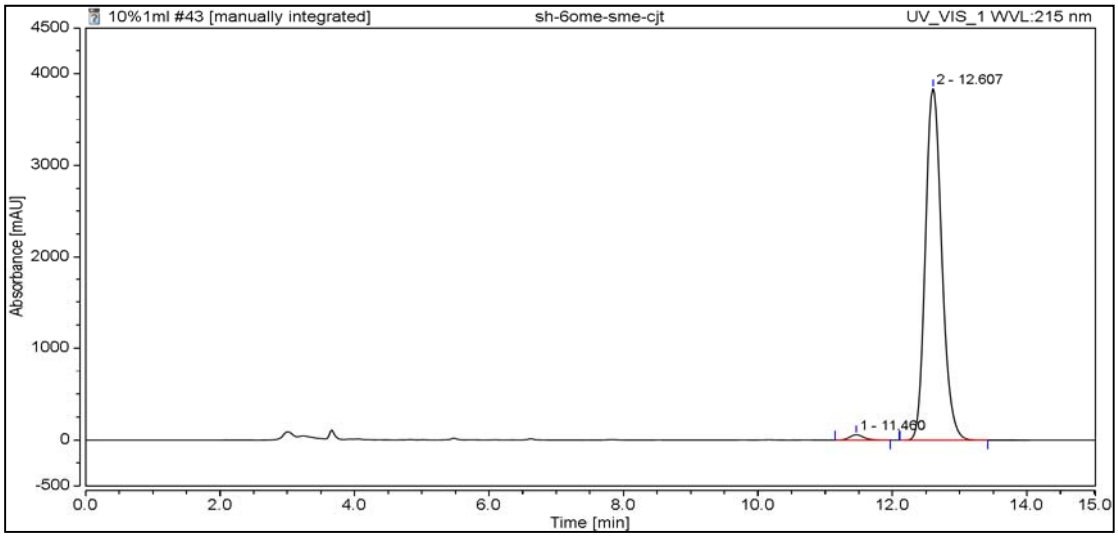
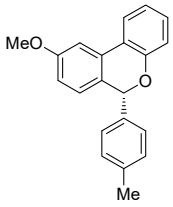


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		11.423	83.545	50.05	n.a.
2		12.550	83.391	49.95	n.a.
Total:			**166.937**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		11.460	14.148	1.29	n.a.
2		12.607	1084.288	98.71	n.a.
Total:			**1098.436**	**100.00**	



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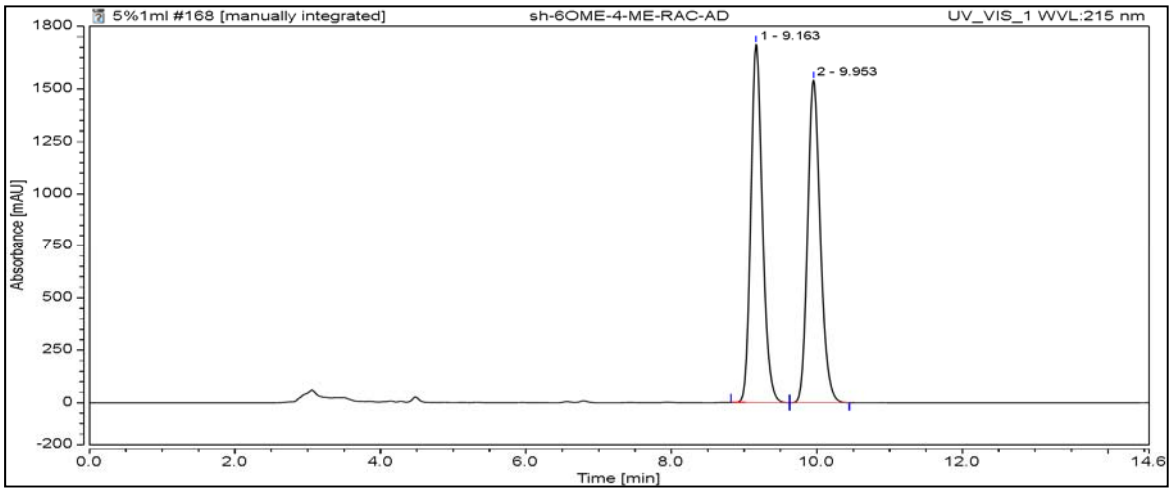
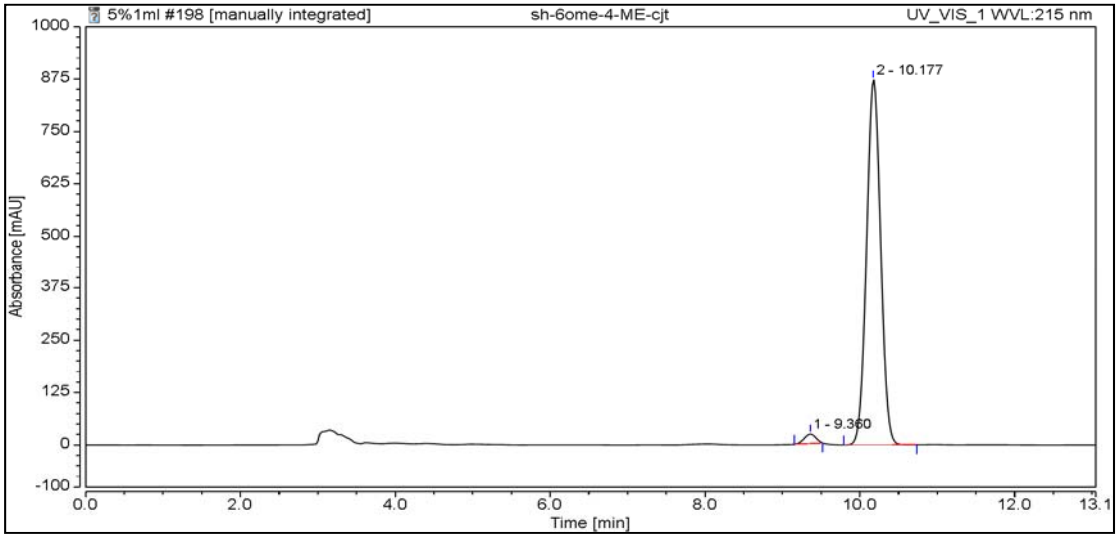
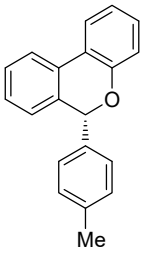


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.163	315.893	50.31	n.a.
2		9.953	312.048	49.69	n.a.
Total:			**627.941**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.360	3.944	2.10	n.a.
2		10.177	183.769	97.90	n.a.
Total:			**187.713**	**100.00**	



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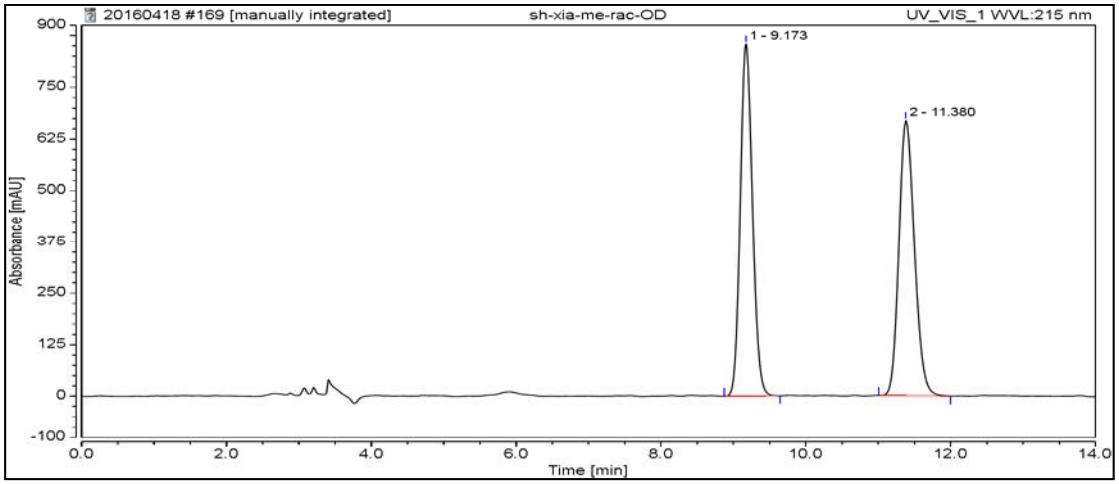
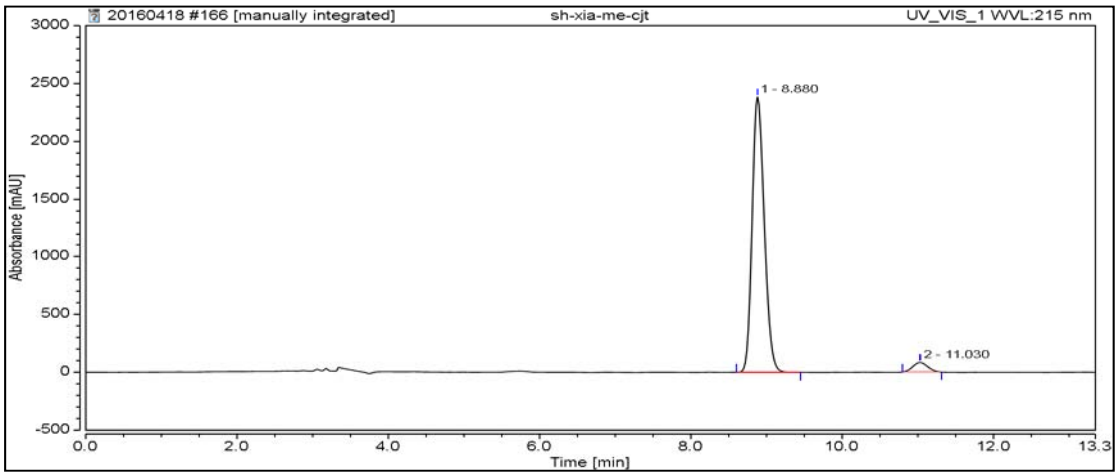
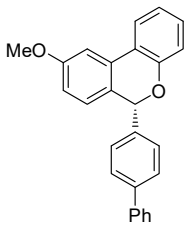


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.173	166.695	50.05	n.a.
2		11.380	166.393	49.95	n.a.
Total:			**333.088**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		8.880	443.200	95.92	n.a.
2		11.030	18.873	4.08	n.a.
Total:			**462.073**	**100.00**	



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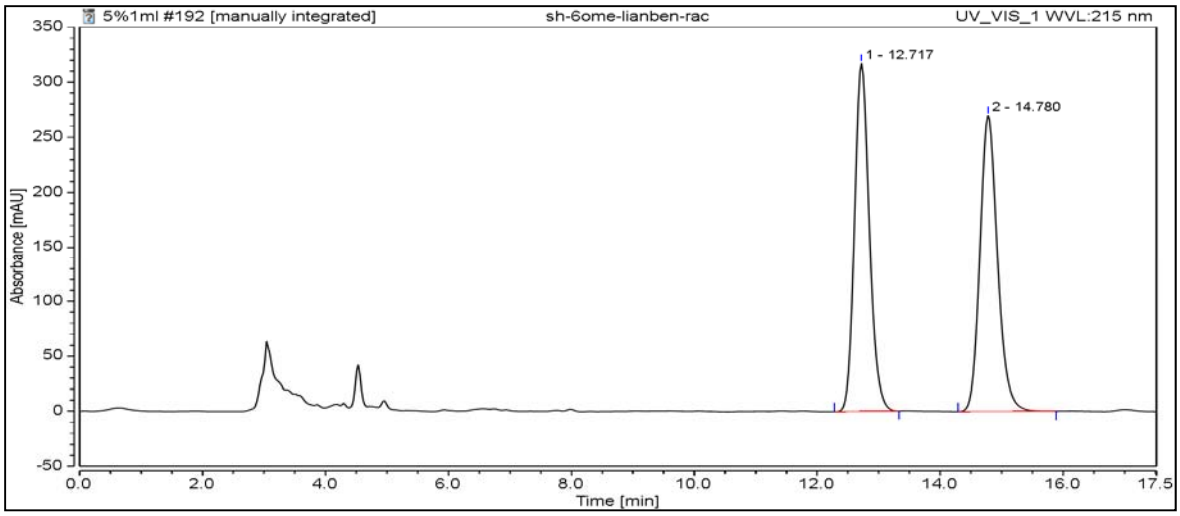
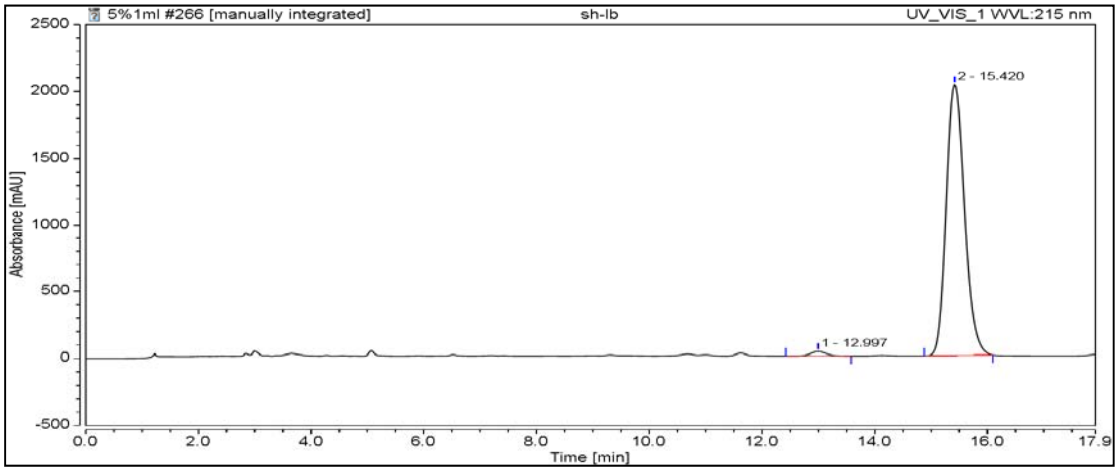
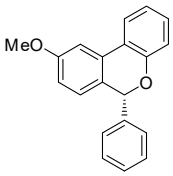


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		12.717	88.683	49.77	n.a.
2		14.780	89.497	50.23	n.a.
Total:			**178.180**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		12.997	11.264	1.45	n.a.
2		15.420	765.019	98.55	n.a.
Total:			**776.283**	**100.00**	



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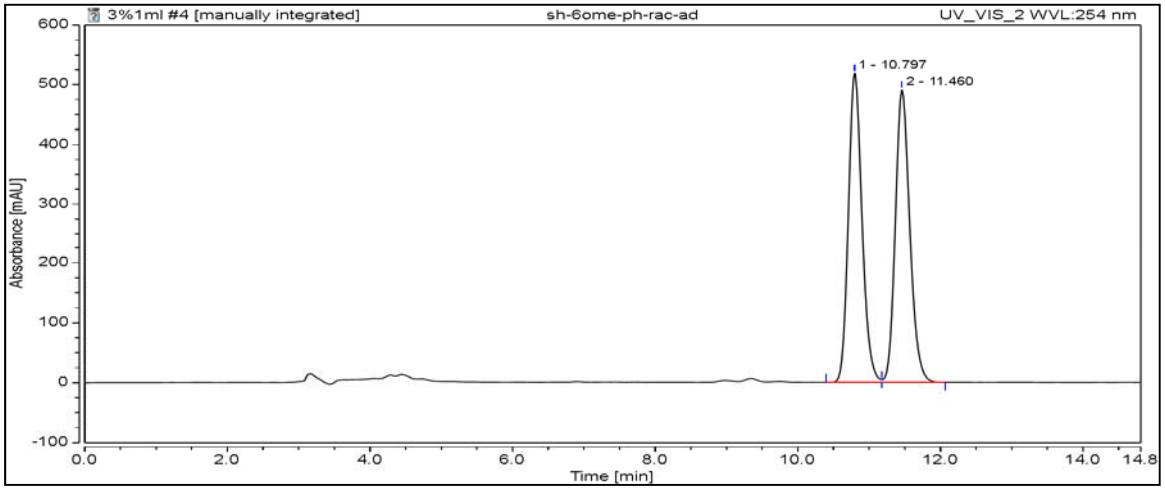
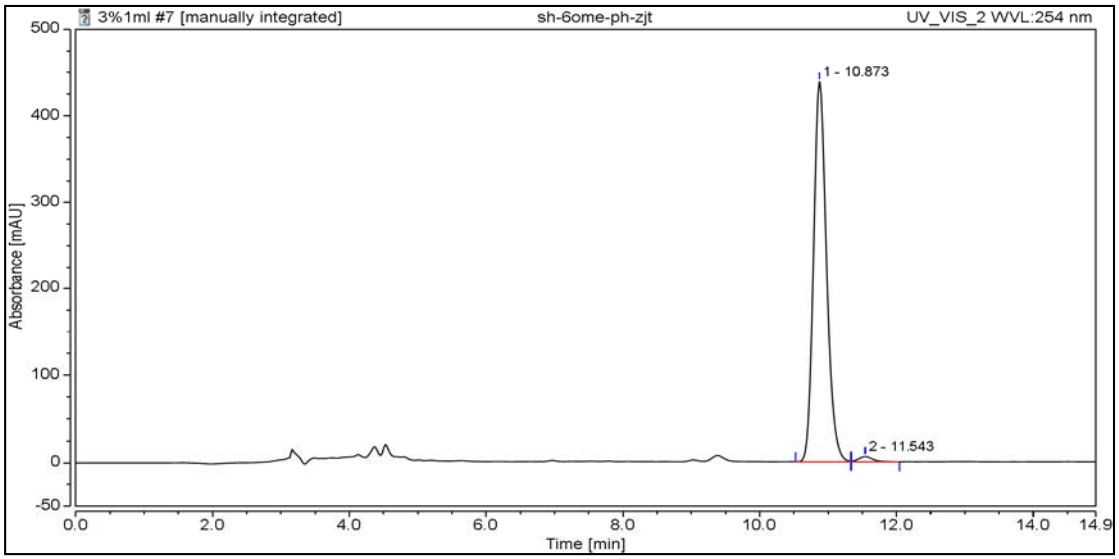
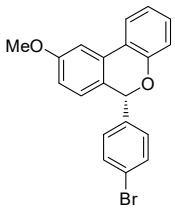


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		10.797	114.658	49.87	n.a.
2		11.460	115.242	50.13	n.a.
Total:			**229.900**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		10.873	96.193	98.51	n.a.
2		11.543	1.455	1.49	n.a.
Total:			**97.648**	**100.00**	



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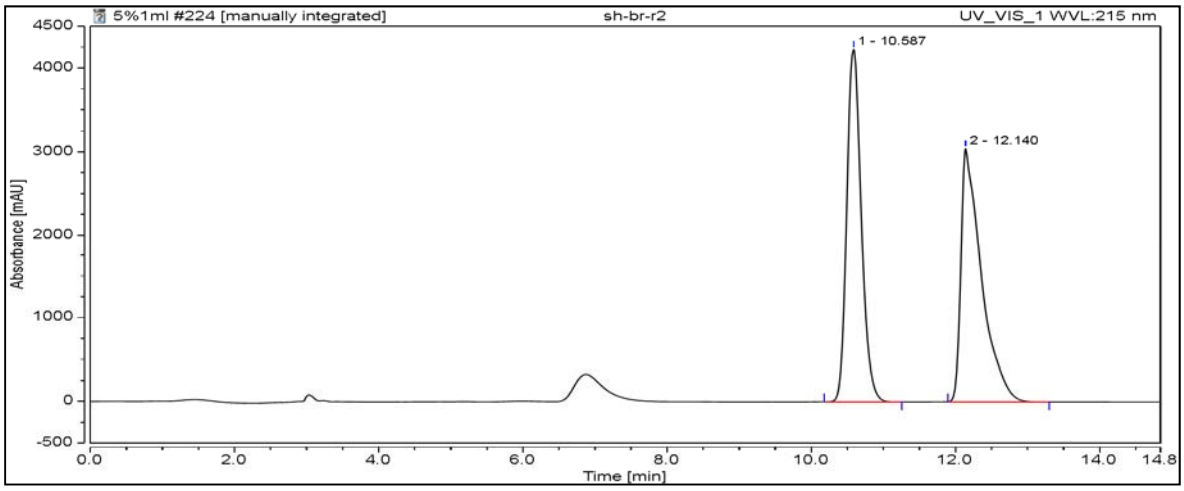
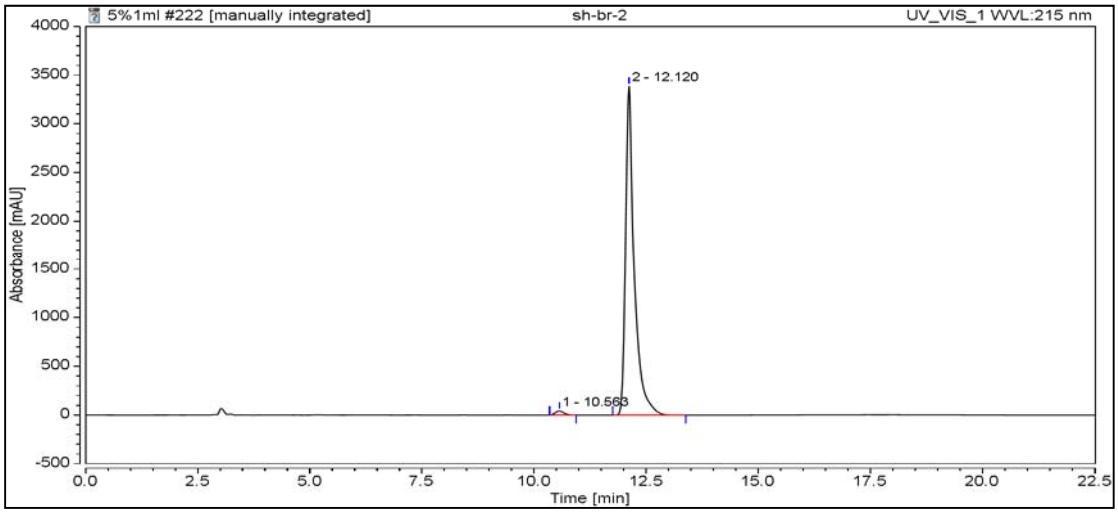
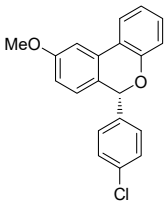


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		10.587	985.597	49.71	n.a.
2		12.140	996.951	50.29	n.a.
Total:			**1982.548**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		10.563	9.108	1.18	n.a.
2		12.120	759.975	98.82	n.a.
Total:			**769.083**	**100.00**	



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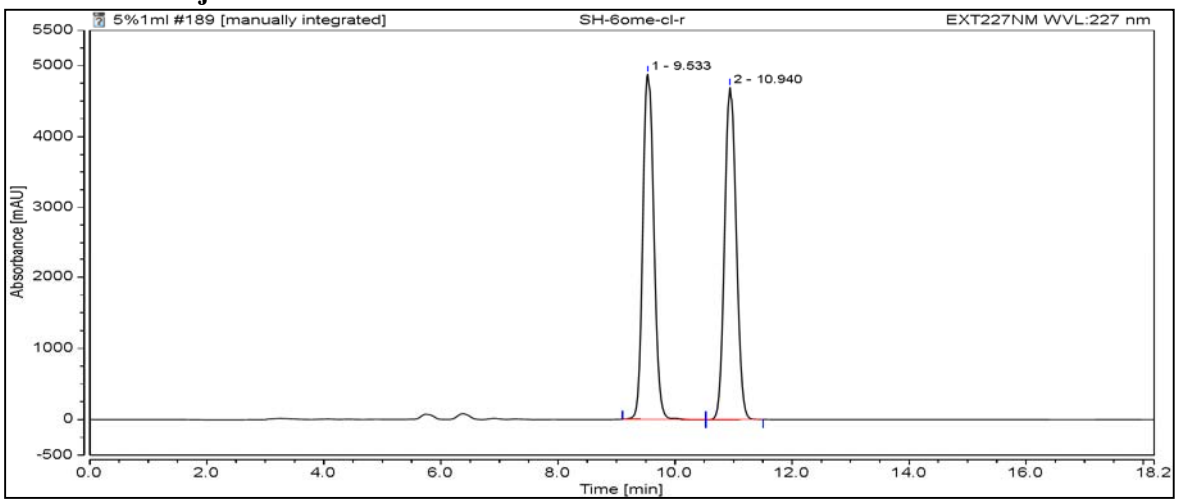
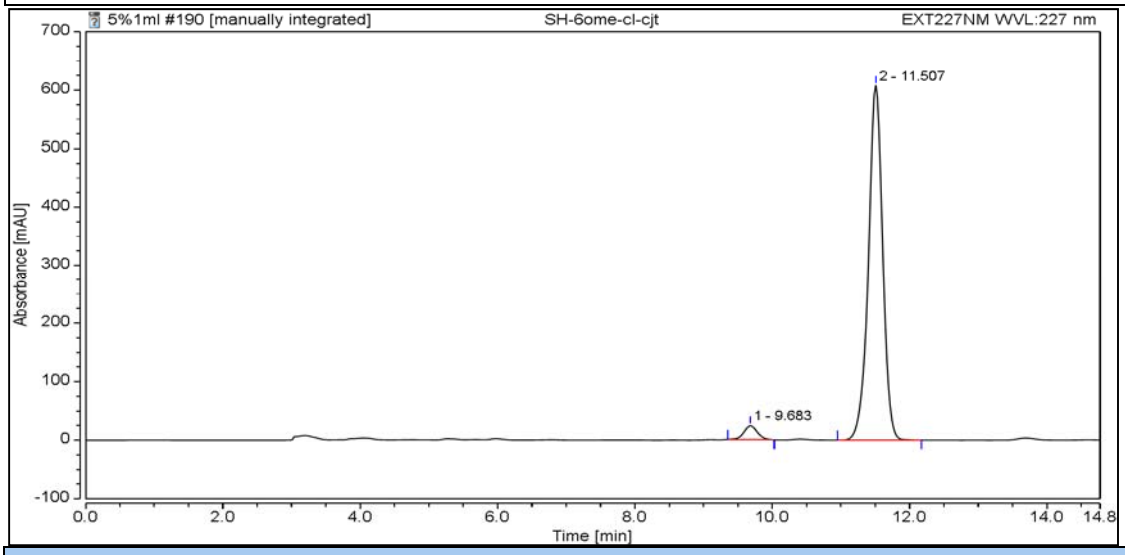


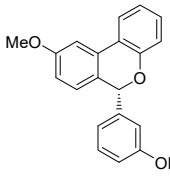
Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.533	1069.043	49.72	n.a.
2		10.940	1080.913	50.28	n.a.
Total:			**2149.956**	**100.00**	



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.683	5.417	3.57	n.a.
2		11.507	146.410	96.43	n.a.
Total:			**151.827**	**100.00**	



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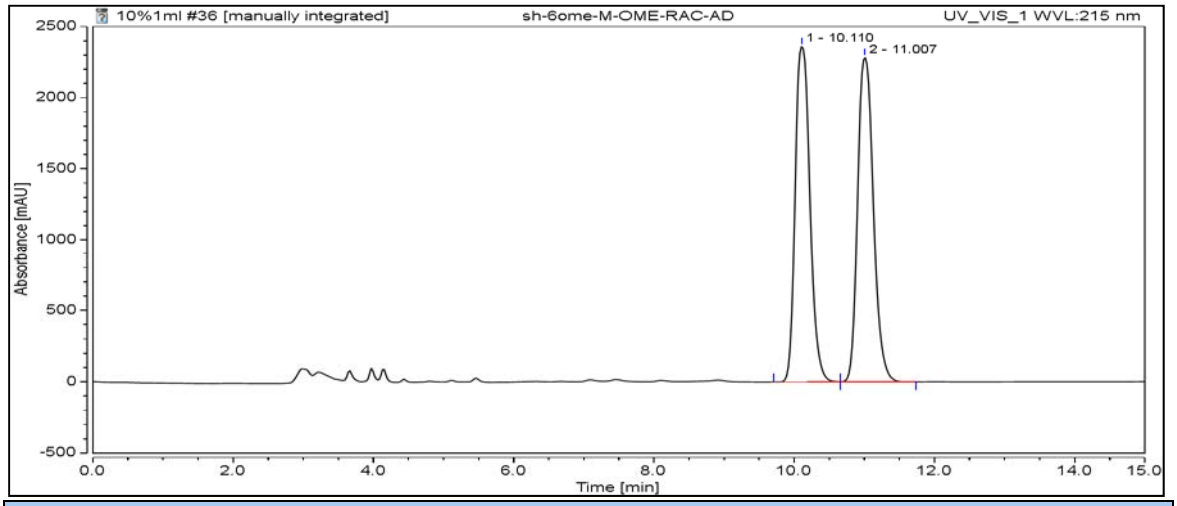
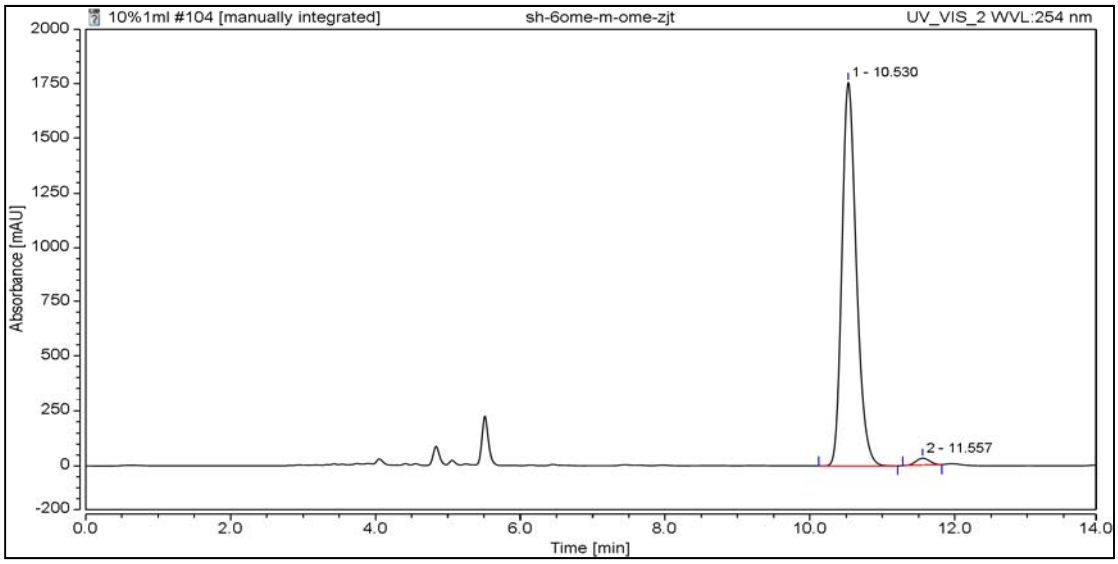
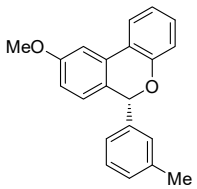


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		10.110	575.315	49.18	n.a.
2		11.007	594.391	50.82	n.a.
Total:			**1169.706**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		10.530	403.866	98.31	n.a.
2		11.557	6.927	1.69	n.a.
Total:			**410.793**	**100.00**	



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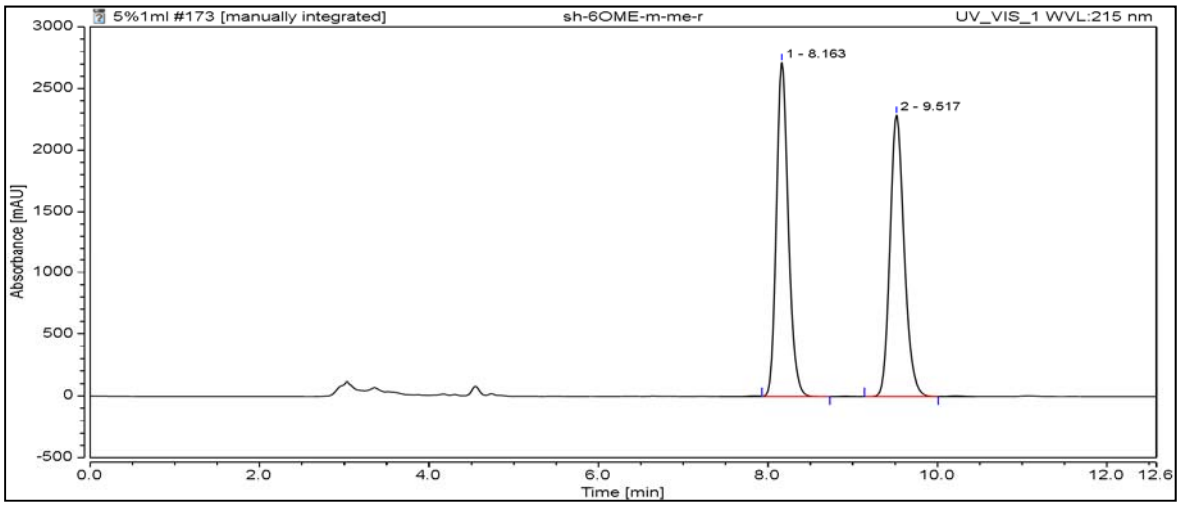
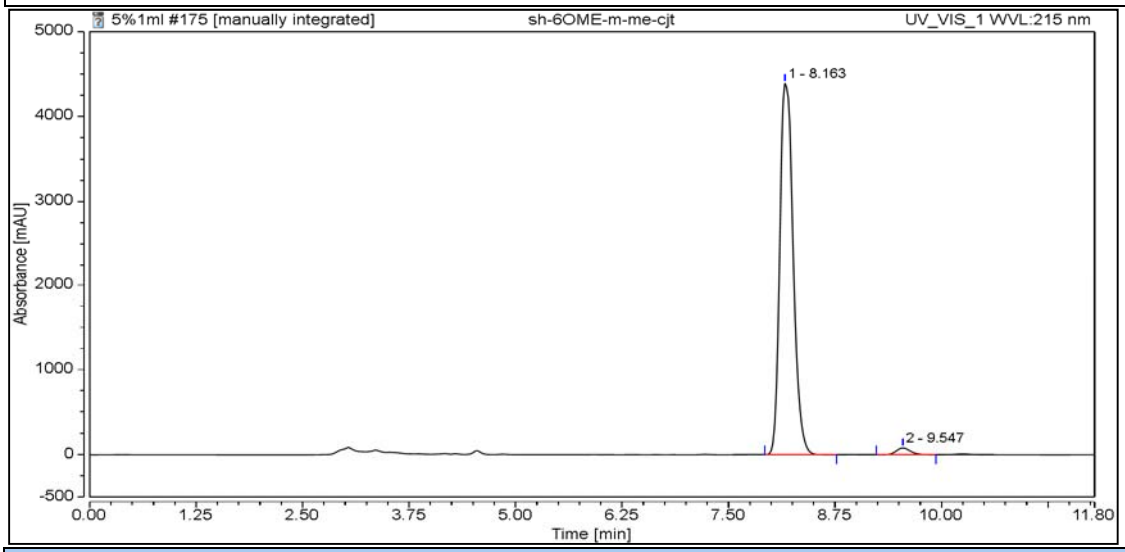
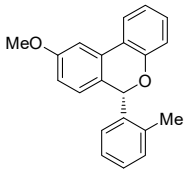


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		8.163	441.638	49.86	n.a.
2		9.517	444.170	50.14	n.a.
Total:			**885.808**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		8.163	799.829	98.03	n.a.
2		9.547	16.058	1.97	n.a.
Total:			**815.888**	**100.00**	



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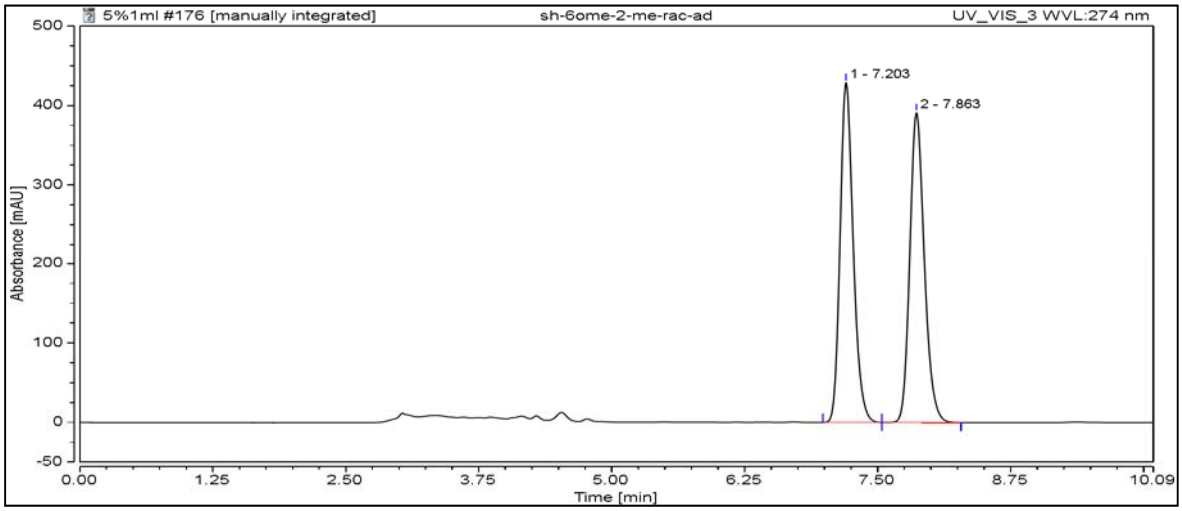
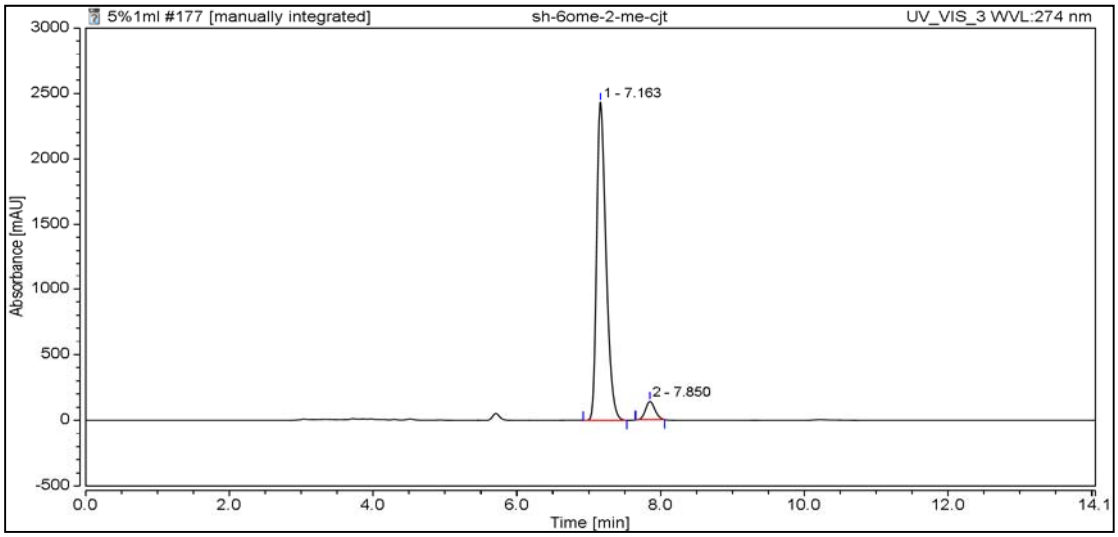
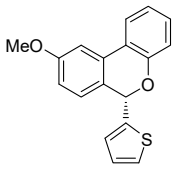


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.203	61.420	49.83	n.a.
2		7.863	61.827	50.17	n.a.
Total:			**123.248**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.163	366.496	94.46	n.a.
2		7.850	21.500	5.54	n.a.
Total:			**387.996**	**100.00**	



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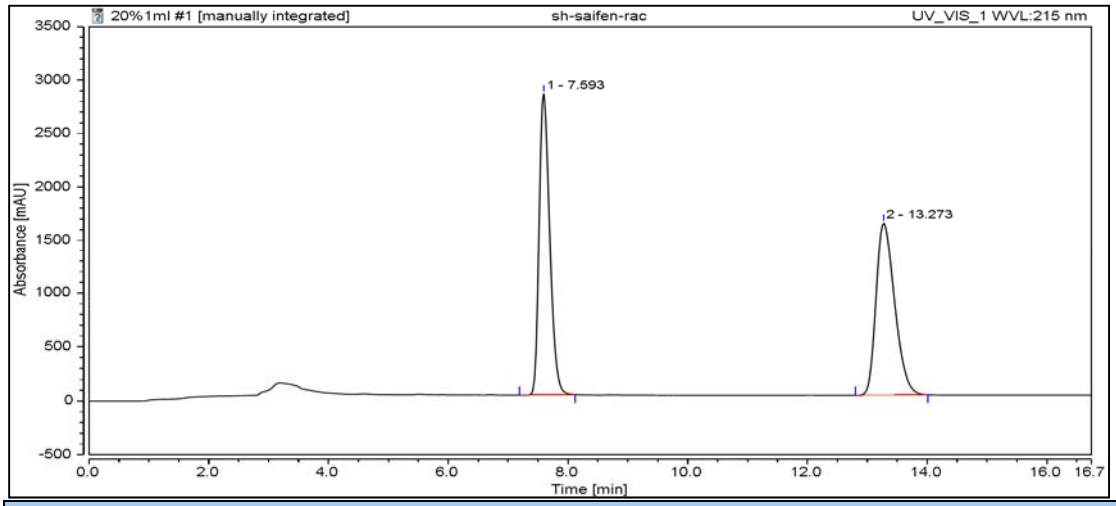
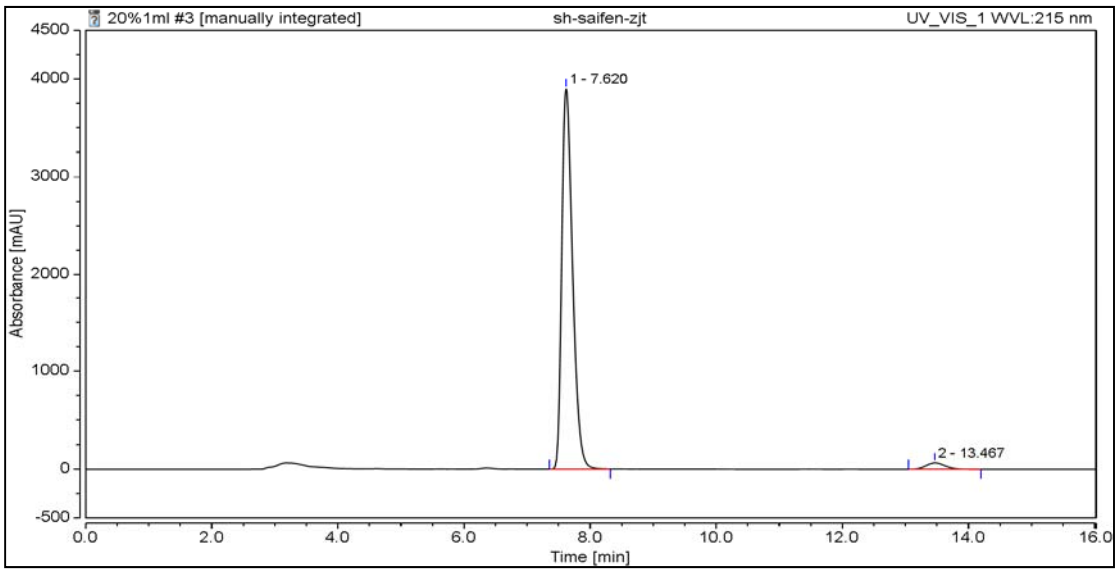
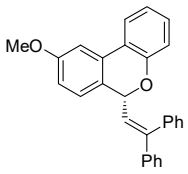


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.593	573.902	49.92	n.a.
2		13.273	575.670	50.08	n.a.
Total:			**1149.573**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.620	773.509	97.12	n.a.
2		13.467	22.968	2.88	n.a.
Total:			**796.477**	**100.00**	



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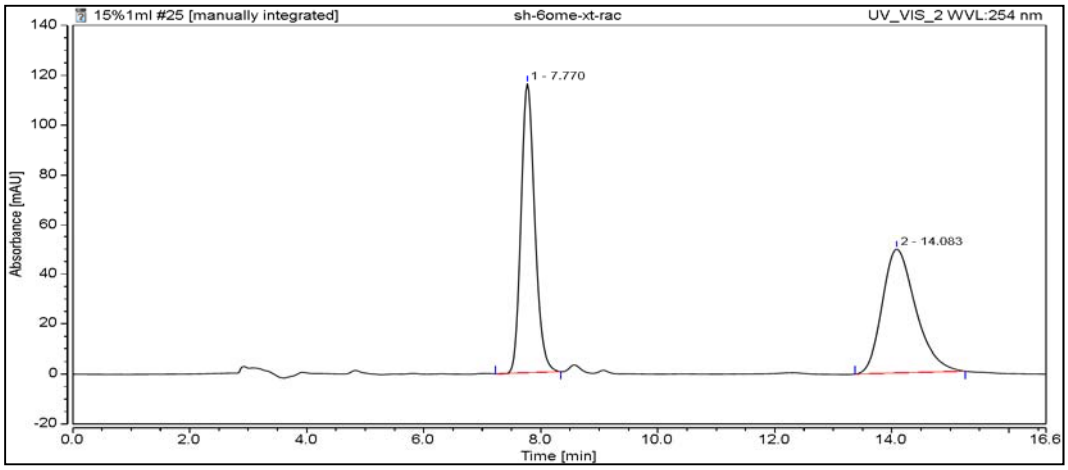
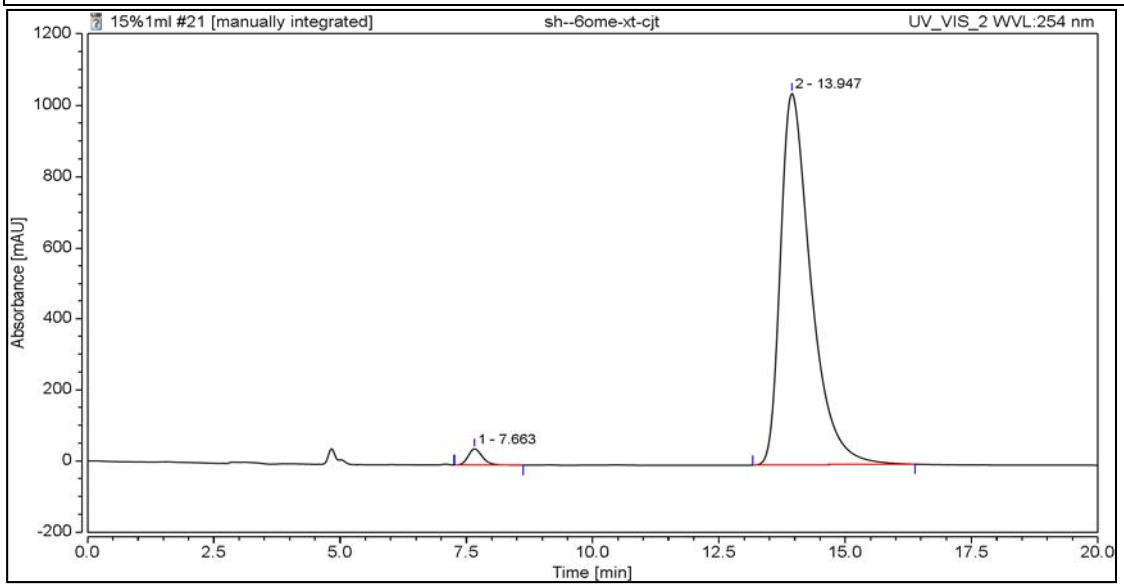
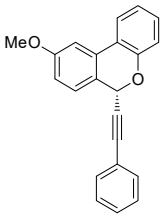


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.770	31.646	49.17	n.a.
2		14.083	32.717	50.83	n.a.
Total:			**64.363**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.663	14.770	1.98	n.a.
2		13.947	730.832	98.02	n.a.
Total:			**745.603**	**100.00**	



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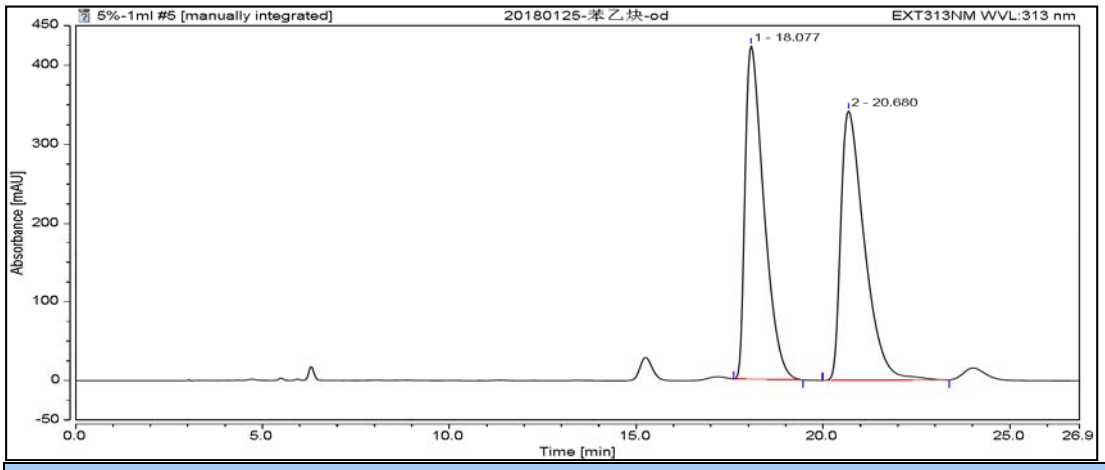
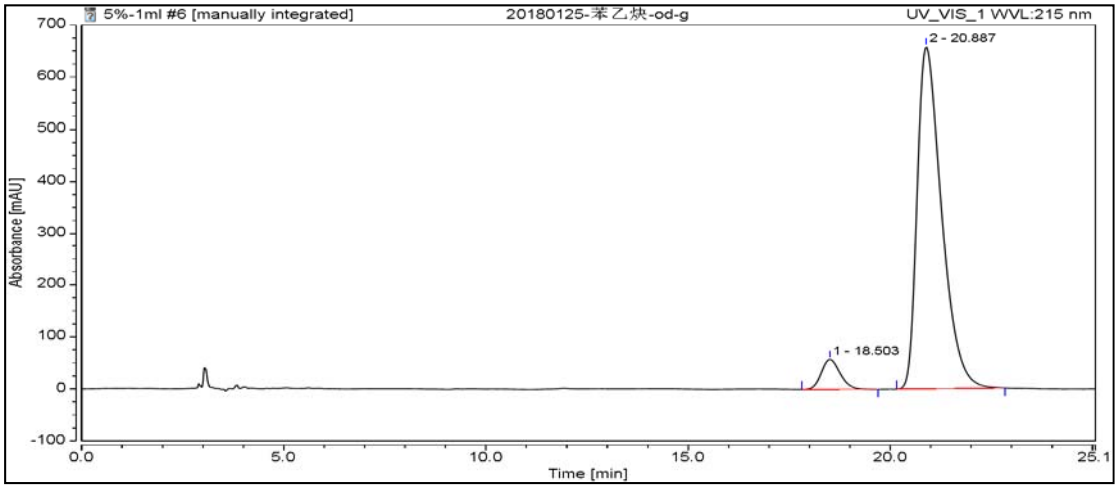
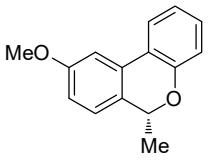


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		18.077	246.366	49.62	n.a.
2		20.680	250.152	50.38	n.a.
Total:			**496.518**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		18.503	30.954	6.29	n.a.
2		20.887	461.332	93.71	n.a.
Total:			**492.286**	**100.00**	



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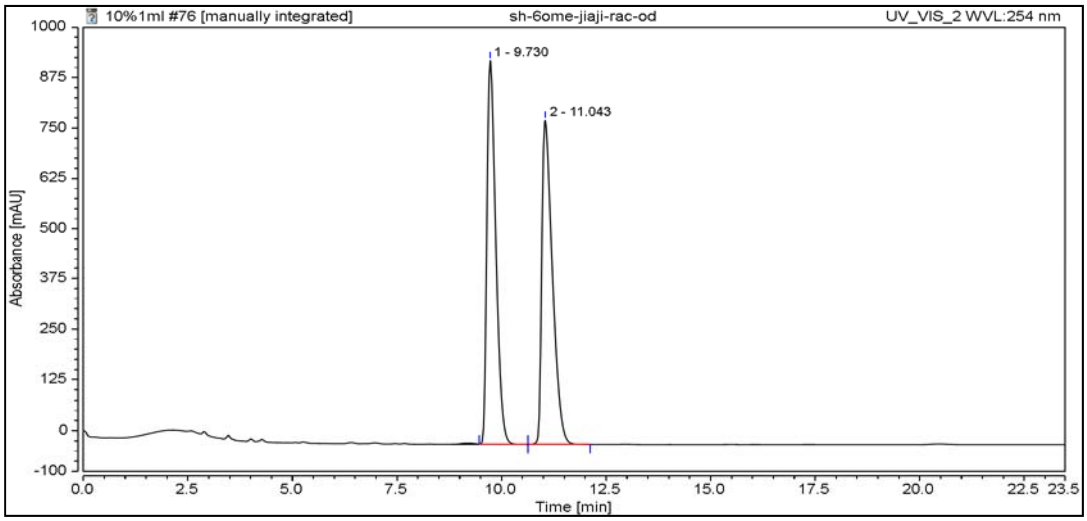
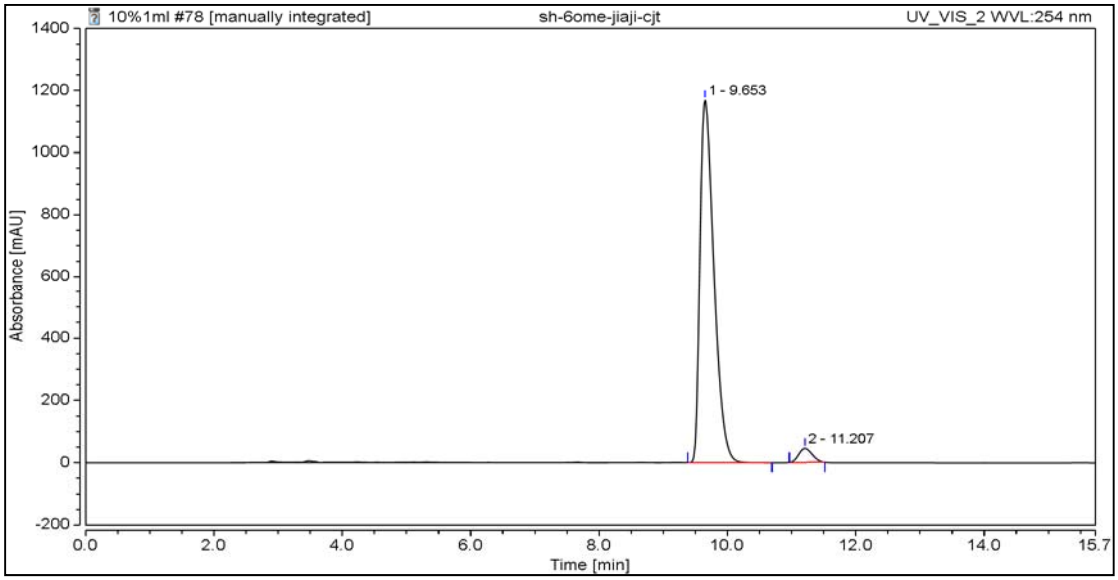
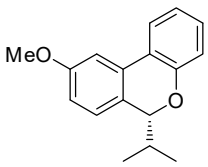


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.730	234.518	49.89	n.a.
2		11.043	235.542	50.11	n.a.
Total:			**470.060**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		9.653	294.879	96.43	n.a.
2		11.207	10.910	3.57	n.a.
Total:			**305.790**	**100.00**	



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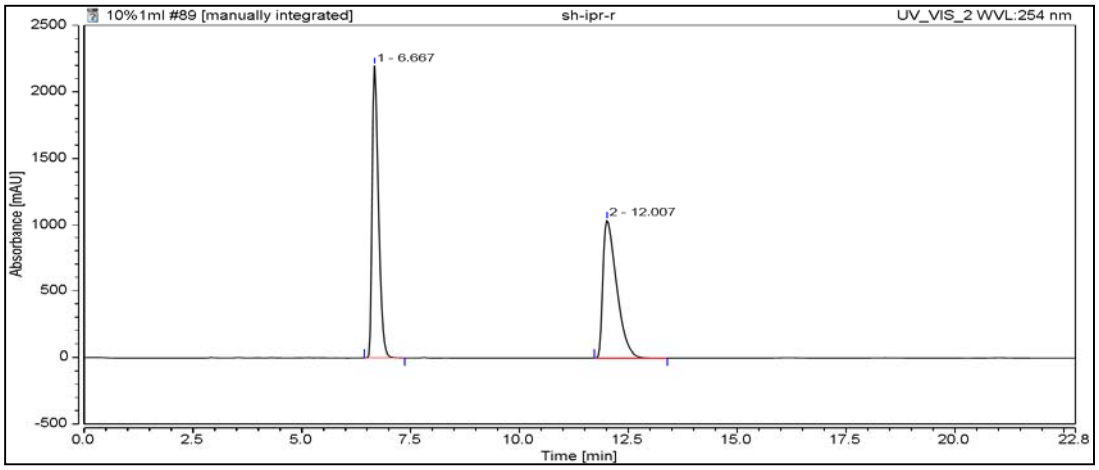
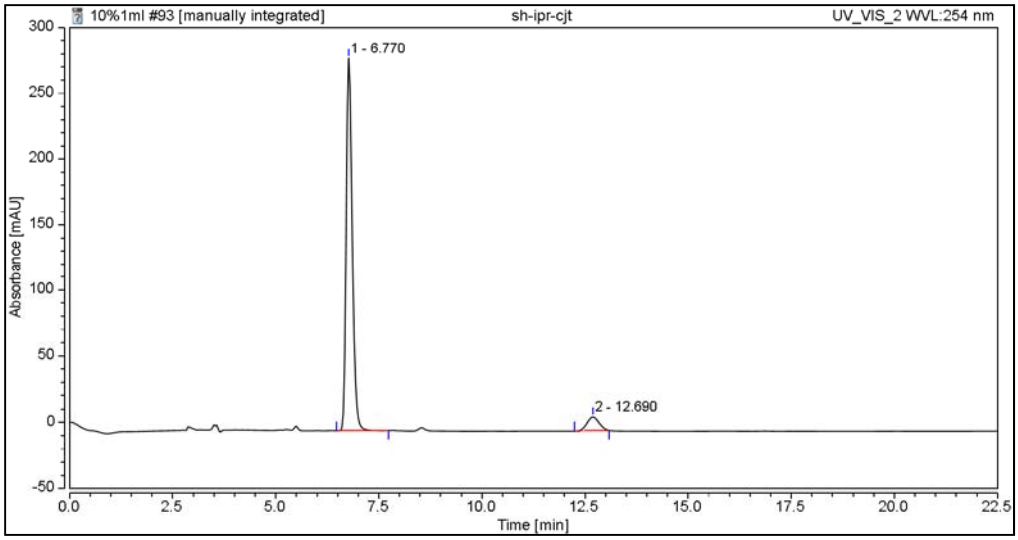
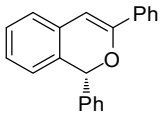


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		6.667	371.722	49.65	n.a.
2		12.007	376.916	50.35	n.a.
Total:			**748.639**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		6.770	47.976	93.11	n.a.
2		12.690	3.549	6.89	n.a.
Total:			**51.525**	**100.00**	



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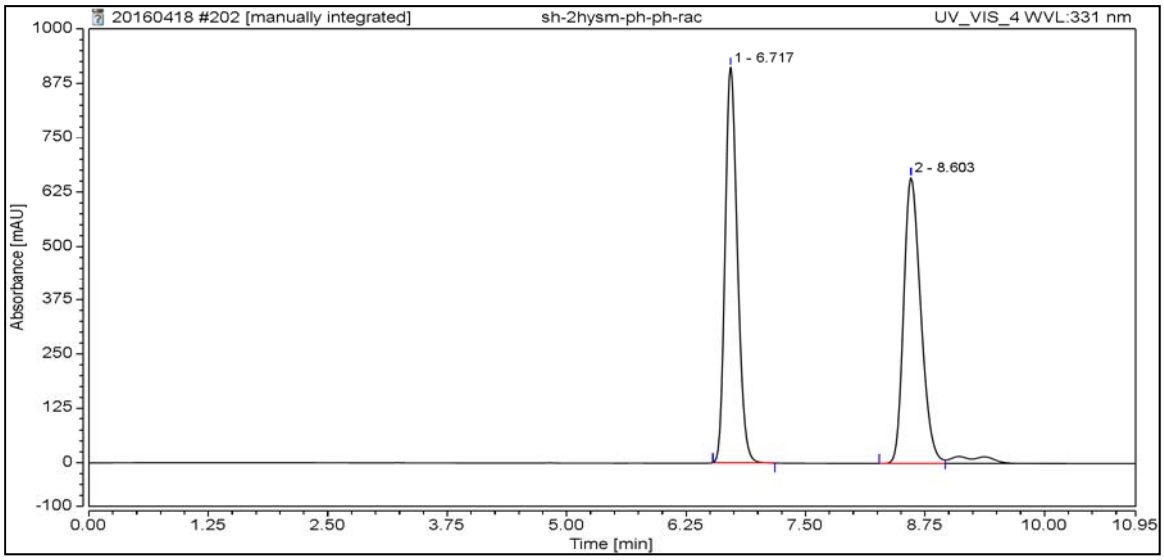
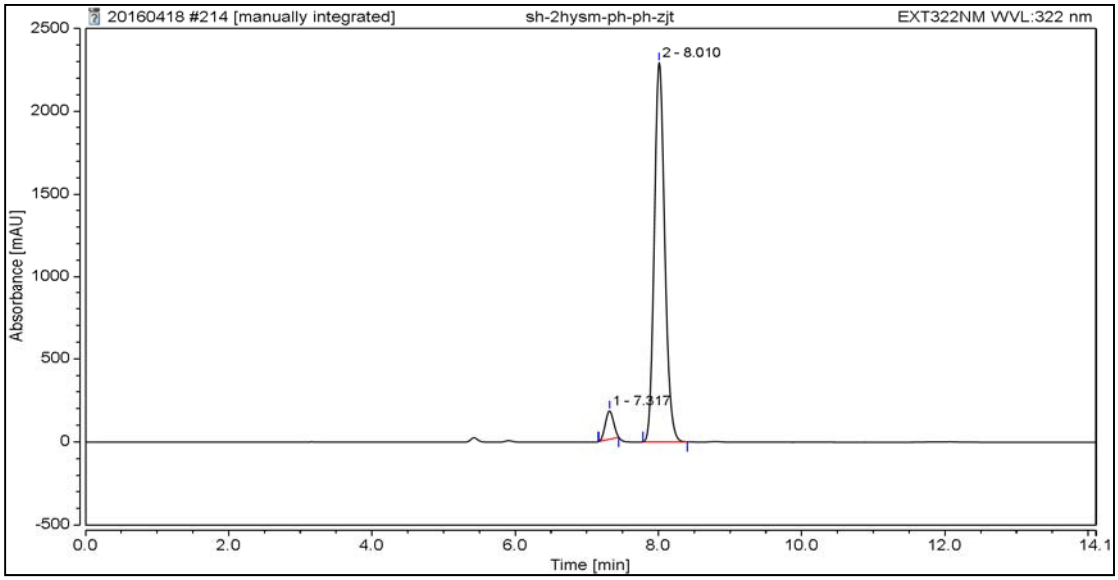
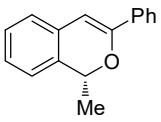


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		6.717	135.792	49.84	n.a.
2		8.603	136.676	50.16	n.a.
Total:			**272.467**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		7.317	22.777	5.57	n.a.
2		8.010	386.469	94.43	n.a.
Total:			**409.246**	**100.00**	



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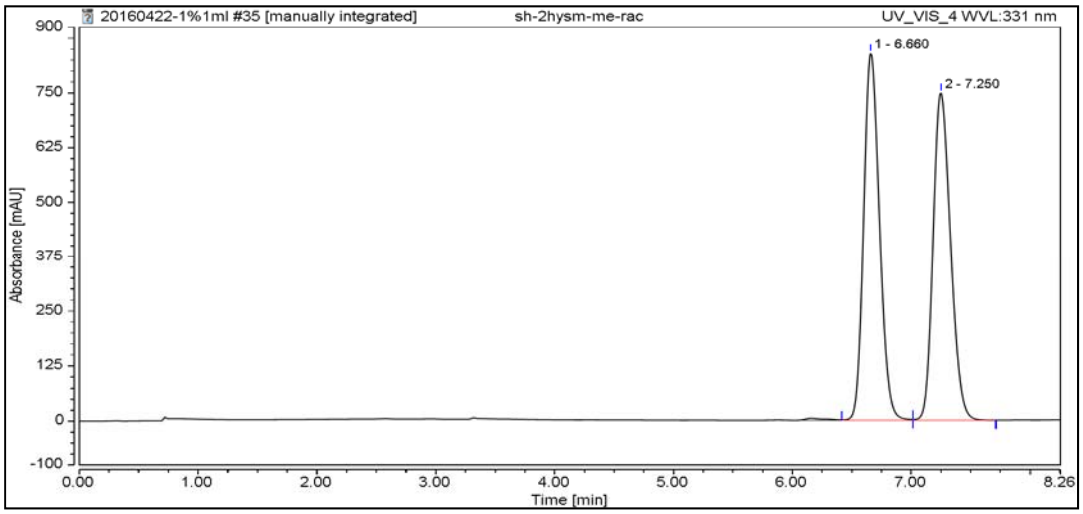
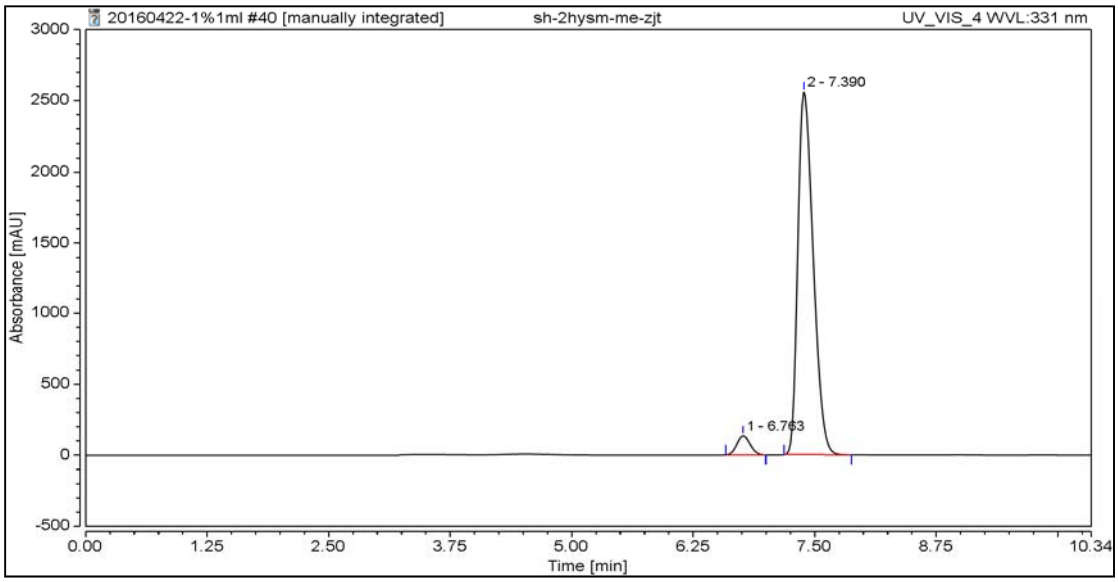


Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		6.660	129.319	50.42	n.a.
2		7.250	127.151	49.58	n.a.
Total:			**256.469**	**100.00**	



Integration Results					
No.	Peak Name	Retention Time min	Area mAU*min	Relative Area %	Amount n.a.
1		6.763	21.202	4.31	n.a.
2		7.390	470.182	95.69	n.a.
Total:			**491.385**	**100.00**	