Supporting Information

Catalytic asymmetric synthesis of chiral phenols in ethanol with recyclable rhodium catalyst

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Contents

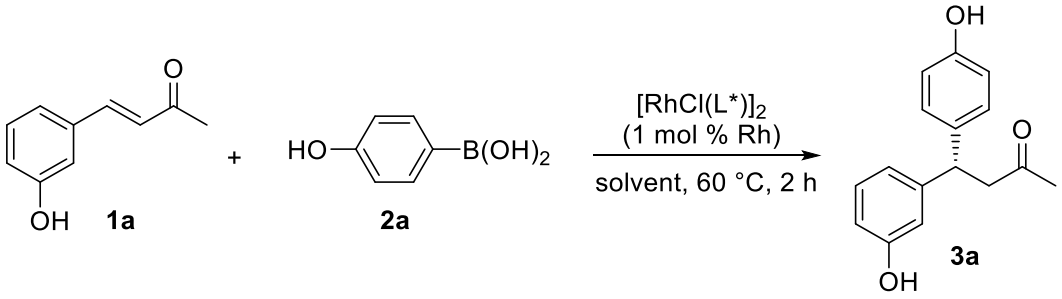
1. General Information

All air-sensitive manipulations were carried out with standard Schlenk techniques under nitrogen or argon. NMR spectra were recorded on Bruker AVANCE AV-500 spectrometer (500 MHz for ^{1}H, 125 MHz for ^{13}C), Bruker AVANCE AV-400 spectrometer (400 MHz for ^{1}H, 101 MHz for ^{13}C) or Bruker AVANCE AV-300 spectrometer (300 MHz for ^{1}H, 75 MHz for ^{13}C). Chemical shifts were reported in δ (ppm) referenced to the residual solvent peak of $CDCl_3$ (δ 7.26) for ^{1}H NMR and $CDCl_3$ (δ 77.0) for ^{13}C NMR. Multiplicity was indicated as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), br (broad). Coupling constants were reported in Hertz (Hz). Specific rotations were measured on an ANTON PAAR MCP 100 automatic polarimeter. High resolution mass spectra (HRMS) were obtained on Thermo Scientific LTQ Orbitrap XL (ESI). For thin layer chromatography (TLC), Yantai pre-coated TLC plates (HSGF 254) were used, and compounds were visualized with a UV light at 254 nm. Further visualization was achieved by staining with $KMnO_4$ followed by heating. Column chromatography separations were performed on silica gel (300–400 mesh). Enantiomeric excesses (*ee*) were determined by HPLC analysis on SHIMADZU HPLC system with Daicel chiral columns.

2. Materials

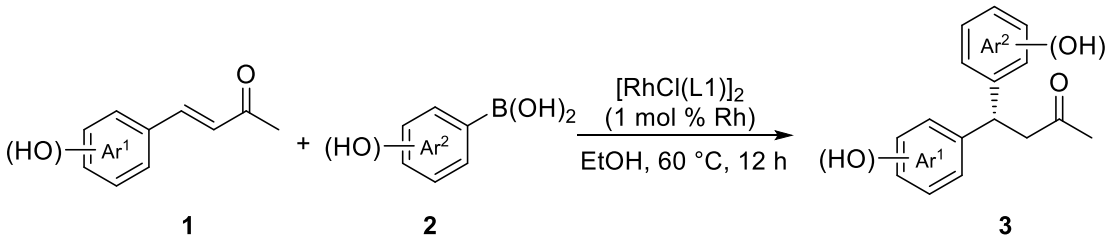
Toluene was distilled over benzophenone ketyl under N_2. 1,4-Dioxane, 1,2-dichloroethane, EtOH and THF (Extra Dry, with molecular sieves, stabilized with BHT, water ≤50 ppm (by K.F.)) were purchased from commercial supplier and used as received. Rhodium complex $[Rh(OH)(cod)]_2$[1] was prepared according to the reported procedures. Catalysts $[RhCl(L1)]_2$,[2] $[RhCl(L2)]_2$[2], $[RhCl(L3)]_2$[3] and $[RhCl((R,R)\text{-Ph-bod})]_2$[4] were prepared according to the literature procedures. All the organoboronic acids were purchased from commercial suppliers and used as received.

3. A General Procedure for Table 1



$[RhCl(L)]_2$ (1.0 μmol, 1 mol % Rh), **1a** (0.20 mmol) and **2a** (0.30 mmol) were placed in an oven-dried Schlenk tube under nitrogen. Solvent was added, and the reaction was stirred at 60 ℃ for 2 h. Upon completion, the mixture was passed through a short pad of silica gel with EtOAc as the eluent. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel chromatography with petroleum ether/EtOAc (v/v = 3/1) to give **3a**.

4. Procedures for Table 2 & Table 3

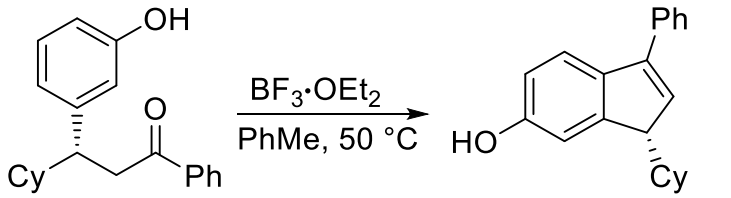


$[RhCl(L1)]_2$ (0.95 mg, 1.0 μmol, 1 mol % Rh) and **2** (0.30 mmol) were placed in an oven-dried Schlenk tube under nitrogen. EtOH (0.4 mL), **1** (0.20 mmol) and another portion of EtOH (0.6 mL) was added successively, and the reaction was stirred at 60 ℃ for 12 h. Upon completion, the solution was passed through a short pad of silica gel with EtOAc as the eluent. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel chromatography with petroleum ether/EtOAc (v/v = 3/1) to give **3**.

A general procedure for dehydration of hemiacetal product

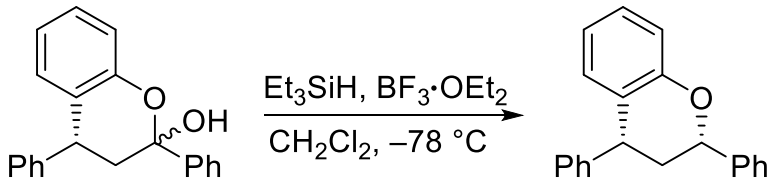
$TsOH{\cdot}H_2O$ (0.02 mmol), the hemiacetal product (0.20 mmol) and 4 Å MS (0.20 g) were placed in an oven-dried Schlenk tube under nitrogen. Toluene (1.0 mL) was added, and the mixture was then heated to 100 °C for 3 h. Upon completion, the mixture was passed through a short pad of silica gel with EtOAc as the eluent. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel chromatography with petroleum ether/EtOAc (v/v = 20/1) to give chromene.

5. Procedures for Scheme 2



4l; 97% ee　　**6**; 90%, 97% ee

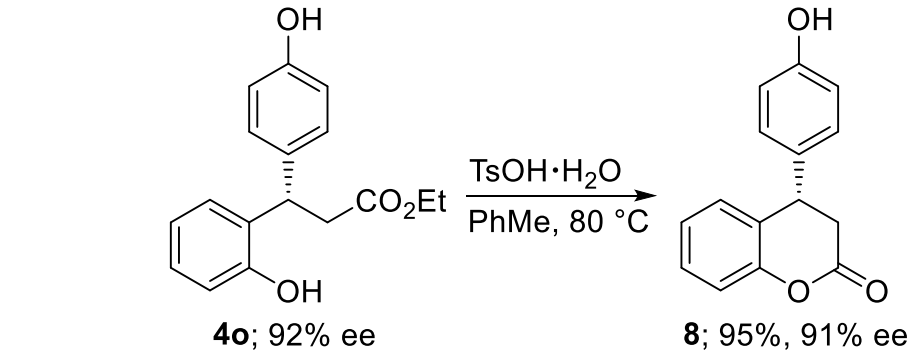
$BF_3{\cdot}OEt_2$ (74.0 μL, 0.60 mmol) and enantioenriched **4l** (49.0 mg, 0.20 mmol, 97% ee) were placed in an oven-dried Schlenk tube under nitrogen. Toluene (1.0 mL) was added and the reaction was stirred at 50 ℃ for 12 h. Upon completion, the mixture was passed through a short pad of silica gel with EtOAc as the eluent. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel chromatography with petroleum ether/EtOAc (v/v = 10/1) to give **6** (52.2 mg, 90% yield, 97% ee) as a pale yellow solid.



4m; 99% ee　　**7**; 90%, >20:1 d.r., 99% ee

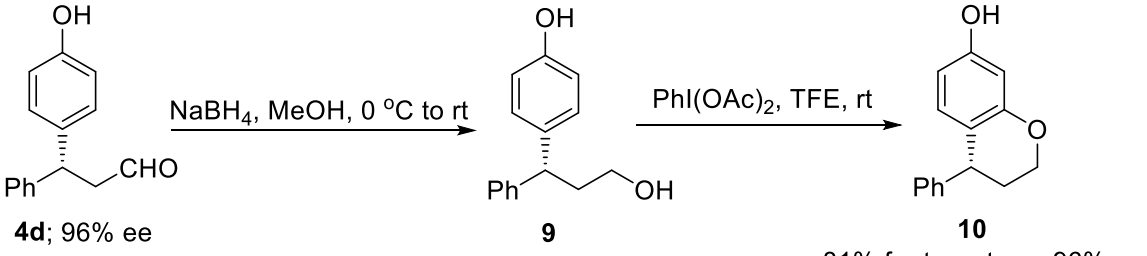
Enantioenriched **4m** (60.5 mg, 0.20 mmol, 99% ee) was dissolved in CH_2Cl_2 (2 mL). The solution was cooled to –78 ℃ , and then silane (3.0 mmol) was added followed by the addition of $BF_3{\cdot}OEt_2$ (0.80 mmol). After 1 h, the reaction was warmed

to rt and the solvent was removed. The residue was purified by column chromatography with petroleum ether/EtOAc (v/v = 20/1) to give **7** (51.4 mg, 90% yield, dr > 20:1, 99% ee) as a white solid.



4o; 92% ee　　**8**; 95%, 91% ee

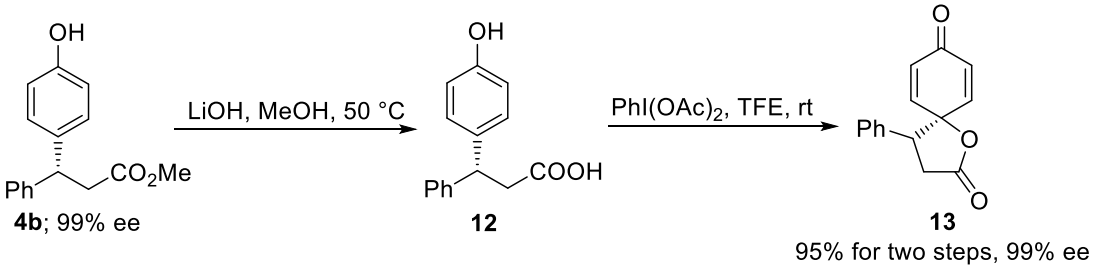
$TsOH{\cdot}H_2O$ (0.04 mmol) and enantioenriched **4o** (57.3 mg, 0.20 mmol, 92% ee) were placed in an oven-dried Schlenk tube under nitrogen. Toluene (1.0 mL) was added and the reaction was stirred at 80 ℃ for 12 h. Upon completion, the mixture was passed through a short pad of silica gel with EtOAc as the eluent. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel chromatography with petroleum ether/EtOAc (v/v = 4/1) to give **8** (45.6 mg, 95% yield, 91% ee) as a white solid.



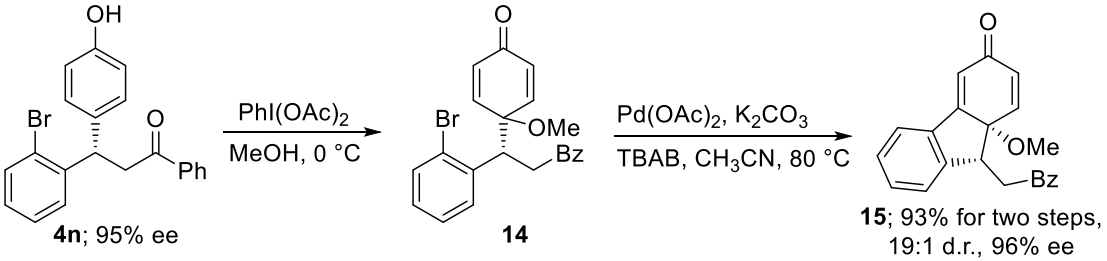
4d; 96% ee　　**9**　　**10**

81% for two steps, 96% ee

Enantioenriched **4d** (45.2 mg, 0.20 mmol, 96% ee) was dissolved in MeOH (2 mL), and $NaBH_4$ (0.40 mmol) was added at 0 °C. Then the reaction was allowed to warm to rt and stirred for 2 h. Upon completion, the solvent was removed on a rotary evaporator, the residue was subjected to silica gel chromatography with petroleum ether/EtOAc (v/v = 1/1) to give **9**, which was directly dissolved in CF_3CH_2OH (1.0 mL), and $PhI(OAc)_2$ (77.3 mg, 0.24 mmol) was added. The reaction was stirred at rt for 2 h. The mixture was purified by flash gel column chromatography eluting with petroleum ether /EtOAc (v/v = 10:1) to give **10** (36.6 mg, 81% yield, 96% ee) as a pale yellow solid.



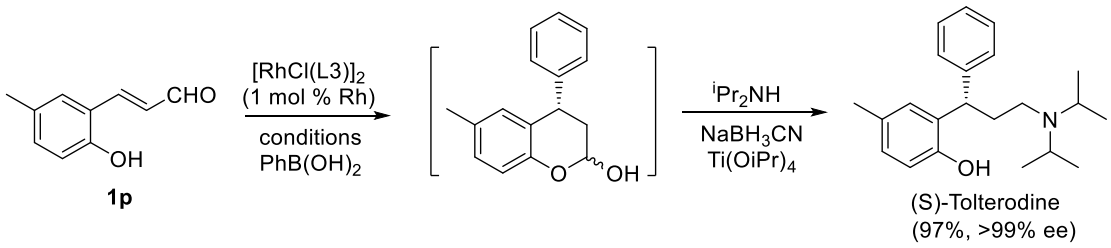
Enantioenriched **4b** (51.3 mg, 0.20 mmol, 99% ee) was dissolved in MeOH (2.0 mL)/H_2O (1.0 mL), and $LiOH{\cdot}H_2O$ (0.80 mmol) was added. The reaction was stirred at 50 ^oC for 6 h. Upon completion, it was cooled to room temperature and 2N HCl (10 mL) was added. The mixture was extracted with CH_2Cl_2 (8 mL*3). The combined organic extracts were dried over $MgSO_4$, filtered, and concentrated under vacuum to give the crude carboxylic acid, which was used for the next step without further purification. Intermediate **12** was dissolved in CF_3CH_2OH (1.0 mL), and $PhI(OAc)_2$ (77.3 mg, 0.24 mmol) was added. The reaction mixture was stirred at rt for 1 h. The solvent was removed on a rotary evaporator, and the residue was purified by flash gel column chromatography eluting with petroleum ether /EtOAc (v/v = 2:1) to give **13** (45.6 mg, 95% yield, 99% ee) as a pale yellow solid.



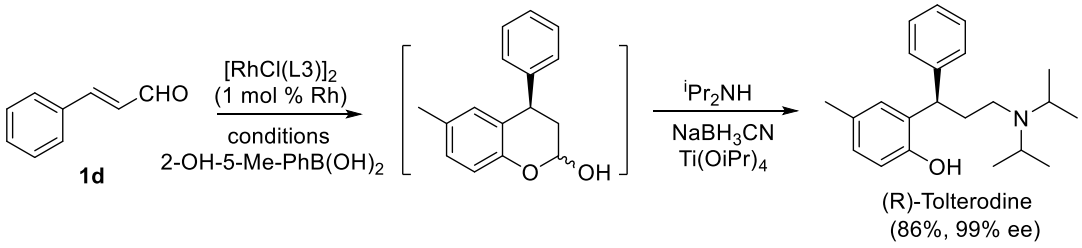
Enantioenriched **4n** (76.3 mg, 0.20 mmol, 96% ee) was reacted with $PhI(OAc)_2$ (77.3 mg, 0.24 mmol) in MeOH (1.0 mL) at 0 ℃ for 4 h. Upon completion, the solvent was removed on a rotary evaporator, the residue was subjected to silica gel chromatography with petroleum ether/EtOAc (v/v = 10/1) to get **14**. Then intermediate **14**, $Pd(OAc)_2$ (0.02 mmol), K_2CO_3 (0.80 mmol) and TBAB (0.20 mmol) were placed in an oven-dried Schlenk tube under nitrogen. CH_3CN (1.0 mL) were added, and the reaction was stirred at 80 ℃ for 6 h. Upon completion, the mixture was passed through a short pad of silica gel with EtOAc as the eluent. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel

chromatography with petroleum ether/EtOAc (v/v = 10/1) to give **15** (61.4 mg, 93% yield, 19:1 dr, 96% ee) as a pale yellow solid. The configuration of the newly generated stereocenter of **15** was assigned by NOE study (see part 9, NMR spectra).

6. Procedures for Scheme 3



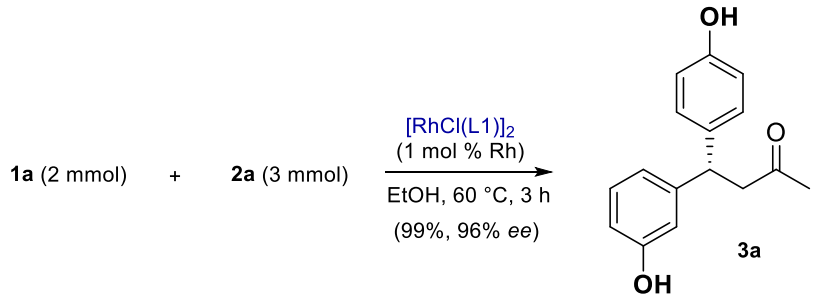
$[RhCl(L3)]_2$ (0.8 mg, 1.0 μmol, 1 mol % Rh), **1** (0.20 mmol) and **2** (0.30 mmol) were placed in an oven-dried Schlenk tube under nitrogen. EtOH (0.4 mL), KOH (0.56 mg, 10 μmol, in 0.1 mL H_2O) and another portion of EtOH (0.6 mL) were added successively, and the reaction was stirred at 60 ℃ for 12 h. Upon completion, the mixture was passed through a short pad of silica gel with EtOAc as the eluent. The solvent was removed on a rotary evaporator. The residue was dissolved in THF (0.5 mL) and transferred to an oven-dried Schlenk tube containing $Ti(O^iPr)_4$ (0.60 mmol), $^iPr_2NH$ (1.0 mmol) and $NaBH_3CN$ (0.60 mmol) under nitrogen. Then 0.5 mL of THF was added and the reaction was stirred at 70 ℃ for 12 h. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel chromatography with petroleum ether/EtOAc/Et_3N (v/v = 70/30/1) to give the product.



$[RhCl(L3)]_2$ (0.8 mg, 1.0 μmol, 1 mol % Rh), **1q** (0.20 mmol) and 2-OH-5-Me-PhB$(OH)_2$ (0.80 mmol) were placed in an oven-dried Schlenk tube under nitrogen. EtOH (0.4 mL), KOH (0.56 mg, 10 μmol, in 0.1 mL H_2O) and another portion of EtOH (0.6 mL) were added successively, and the reaction was stirred at 60 ℃ for 12 h. Upon completion, the mixture was passed through a short pad of silica gel

with EtOAc as the eluent. The solvent was removed on a rotary evaporator. The residue was dissolved in THF (0.5 mL) and transferred to an oven-dried Schlenk tube containing $Ti(O^iPr)_4$ (0.60 mmol), $^iPr_2NH$ (1.0 mmol) and $NaBH_3CN$ (0.60 mmol) under nitrogen. Then 0.5 mL of THF was added and the reaction was stirred at 70 ℃ for 12 h. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel chromatography with petroleum ether/EtOAc/Et_3N (v/v = 70/30/1) to give the product.

7. Procedures for Scheme 4

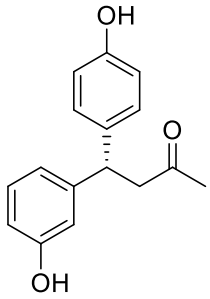


$[RhCl(L1)]_2$ (9.5 mg, 1 mol % Rh), **1a** (2.0 mmol) and **2a** (3.0 mmol) were placed in an oven-dried Schlenk tube under nitrogen. EtOH (4.0 mL) was added, and the reaction was stirred at 60 ℃ for 3 h. Upon completion, the solution was passed through a short pad of silica gel with EtOAc as the eluent. The solvent was removed on a rotary evaporator, and the crude product was subjected to silica gel chromatography with petroleum ether/EtOAc (v/v = 3/1 to 2/1) to give **3** and a mixture of recovered catalyst and phenol.

Recycling of the catalyst: **1a** (2.0 mmol) and **2a** (3.0 mmol) were placed in an oven-dried Schlenk tube under nitrogen, an ethanol solution (4.0 mL) of the recovered catalyst with phenol was added. The reaction was stirred at 60 ℃ for 3 h. The workup was the same as above.

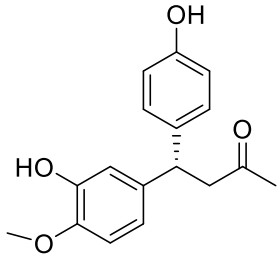
8. Characterization of the Products

(*S*)-4-(3-Hydroxyphenyl)-4-(4-hydroxyphenyl)butan-2-one (**3a**)



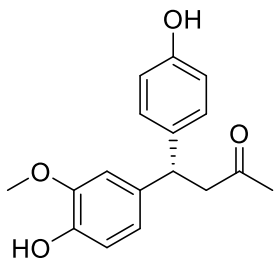
Compound 3a. (99% yield, 97% ee (*S*)). White solid, 51.2 mg at 0.20 mmol scale. The ee of **3a** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 9.0 min (*S*), t_{minor} = 7.6 min (*R*)); $[\alpha]^{20}_{D}$ –0.85 (*c* 0.47, CH_3OH) for 97% ee (*S*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 2.05 (s, 3H), 3.13 (d, *J* = 7.5 Hz, 2H) , 4.28 (t, *J* = 7.4 Hz, 1H), 6.56 (d, *J* = 7.9 Hz, 1H), 6.63 – 6.70 (m, 4H), 7.02 – 7.07 (m, 3H), 9.23 (s, 1H), 9.26 (s, 1H); ^{13}C NMR (75 MHz, d_6-DMSO) δ 30.6, 45.2, 49.2, 113.4, 114.9, 115.5, 118.4, 128.9, 129.7, 135.1, 146.9, 156.1, 157.7, 207.3. HRMS (ESI) calcd for $C_{16}H_{16}NaO_3^+$ $[M+Na]^+$ 279.0992, found 279.0995.

(*S*)-4-(3-Hydroxy-4-methoxyphenyl)-4-(4-hydroxyphenyl)butan-2-one (**3b**)



Compound 3b. (99% yield, >99% ee (*S*)). White solid, 57.2 mg at 0.20 mmol scale. The ee of **3b** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 24.0 min (*S*), t_{minor} = 15.9 min (*R*)); $[\alpha]^{20}_{D}$ +1.6 (*c* 0.61, CH_3OH) for >99% ee (*S*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 2.03 (s, 3H), 3.07 (d, *J* = 7.7 Hz, 2H), 3.70 (s, 3H), 4.23 (t, *J* = 7.7 Hz, 1H), 6.62 – 6.68 (m, 4H), 6.76 – 6.80 (m, 1H), 7.01 – 7.05 (m, 2H), 8.76 (s, 1H), 9.16 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 30.1, 44.2, 49.0, 55.7, 112.2, 115.0, 117.7, 128.3, 135.0, 137.7, 145.9, 146.3, 155.5, 206.9. HRMS (ESI) calcd for $C_{17}H_{18}NaO_4^+$ $[M+Na]^+$ 309.1097, found 309.1098.

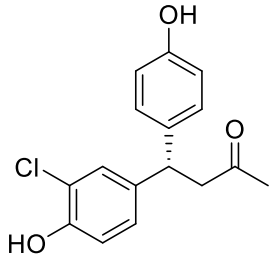
(*S*)-4-(4-Hydroxy-3-methoxyphenyl)-4-(4-hydroxyphenyl)butan-2-one (**3c**)



Compound 3c. (99% yield, 96% ee (*S*)). White solid, 57.2 mg at 0.20 mmol scale. The ee of **3c** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 70/30, 210 nm, t_{major} = 11.8 min (*S*), t_{minor} = 12.8 min (*R*)); $[\alpha]^{20}_{D}$ –6.7 (*c* 1.1, CH_3OH) for 96% ee

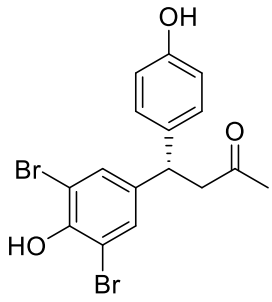
(*S*). ^{1}H NMR (500 MHz, d_6-DMSO) δ 2.06 (s, 3H), 3.16 (d, *J* = 7.8 Hz, 2H), 3.77 (s, 3H), 4.33 (t, *J* = 7.7 Hz, 1H), 6.67 – 6.74 (m, 4H), 6.86 (d, *J* = 1.5 Hz, 1H), 7.12 (d, *J* = 8.5 Hz, 2H), 8.71 (s, 1H), 9.19 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 30.2, 44.6, 49.2, 55.7, 112.0, 115.1, 115.4, 119.6, 128.3, 135.2, 136.0, 144.8, 147.4, 155.5, 207.0. HRMS (ESI) calcd for $C_{17}H_{18}NaO_4^+$ $[M+Na]^+$ 309.1097, found 309.1098.

(*S*)-4-(3-Chloro-4-hydroxyphenyl)-4-(4-hydroxyphenyl)butan-2-one (**3d**)



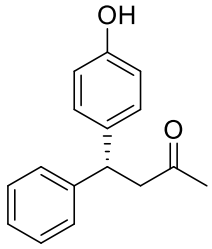
Compound 3d. (87% yield, 95% ee (*S*)). White solid, 50.9 mg at 0.20 mmol scale. The ee of **3d** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 8.7 min (*S*), t_{minor} = 9.6 min (*R*)); $[\alpha]^{20}_D$ +1.1 (*c* 0.45, CH_3OH) for 95% ee (*S*). ^{1}H NMR (500 MHz, d_6-DMSO) δ 2.06 (s, 3H), 3.15 (d, *J* = 7.8 Hz, 2H), 4.30 (t, *J* = 7.7 Hz, 1H), 6.69 (d, *J* = 8.4 Hz, 2H), 6.88 (d, *J* = 8.3 Hz, 1H), 7.03 – 7.09 (m, 3H), 7.21 (d, *J* = 1.8 Hz, 1H), 9.20 (s, 1H), 9.89 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 30.1, 43.6, 48.7, 115.1, 116.5, 119.3, 126.9, 128.3, 128.5, 134.6, 137.0, 151.1, 155.6, 206.7. HRMS (ESI) calcd for $C_{16}H_{15}NaClO_3^+$ $[M+Na]^+$ 313.0602, found 313.0598.

(*S*)-4-(3,5-Dibromo-4-hydroxyphenyl)-4-(4-hydroxyphenyl)butan-2-one (**3e**)



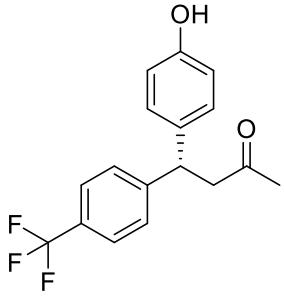
Compound 3e. (85% yield, 95% ee (*S*)). White solid, 70 mg at 0.20 mmol scale. The ee of **3e** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 8.9 min (*S*), t_{minor} = 11.0 min (*R*)); $[\alpha]^{20}_D$ –2.0 (*c* 0.68, CH_3OH) for 95% ee (*S*). ^{1}H NMR (500 MHz, d_6-DMSO) δ 2.07 (s, 3H), 3.14 – 3.27 (m, 2H), 4.32 (t, *J* = 7.6 Hz, 1H), 6.70 (d, *J* = 8.4 Hz, 2H), 7.11 (d, *J* = 8.4 Hz, 2H), 7.44 (s, 2H), 9.24 (s, 1H), 9.68 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 30.0, 43.2, 48.2, 111.8, 115.2, 128.3, 131.0, 134.0, 139.8, 148.7, 155.7, 206.5. HRMS (ESI) calcd for $C_{16}H_{14}Na^{79}Br_2O_3^+$ $[M+Na]^+$ 434.9202, found 434.9207.

(*R*)-4-(4-Hydroxyphenyl)-4-phenylbutan-2-one (**3f**)



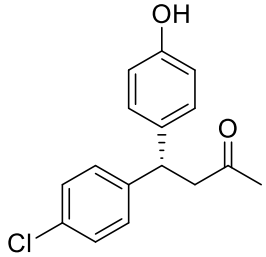
Compound 3f. (99% yield, 97% ee (*R*)). White solid, 48 mg at 0.20 mmol scale. The ee of **3f** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 8.2 min (*R*), t_{minor} = 7.3 min (*S*)); $[\alpha]^{20}_D$ +0.85 (*c* 0.45, CH_3OH) for 97% ee (*R*). ^1H NMR (300 MHz, d_6-DMSO) δ 2.05 (s, 3H), 3.19 (d, *J* = 7.7 Hz, 2H), 4.38 (t, *J* = 7.7 Hz, 1H), 6.68 (d, *J* = 8.3 Hz, 2H), 7.08 – 7.16 (m, 3H), 7.22 – 7.29 (m, 4H), 9.25 (s, 1H); ^{13}C NMR (101 MHz, d_6-DMSO) δ 30.6, 45.3, 49.1, 115.6, 126.4, 127.9, 128.8, 128.9, 135.1, 145.5, 156.1, 207.3. HRMS (ESI) calcd for $C_{16}H_{16}NaO_2^+$ $[M+Na]^+$ 263.1043, found 263.1040.

(*R*)-4-(4-Hydroxyphenyl)-4-(4-(trifluoromethyl)phenyl)butan-2-one (**3g**)



Compound 3g. (99% yield, 96% ee (*R*)). White solid, 61.6 mg at 0.20 mmol scale. The ee of **3g** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 5.4 min (*R*), t_{minor} = 6.7 min (*S*)); $[\alpha]^{20}_D$ +5.9 (*c* 0.47, CH_3OH) for 96% ee (*R*). ^1H NMR (300 MHz, d_6-DMSO) δ 2.06 (s, 3H), 3.15 – 3.36 (m, 2H), 4.48 (t, *J* = 7.6 Hz, 1H), 6.69 (d, *J* = 8.4 Hz, 2H), 7.10 (d, *J* = 8.4 Hz, 2H), 7.49 (d, *J* = 8.1 Hz, 2H), 7.60 (d, *J* = 8.2 Hz, 2H), 9.25 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 30.5, 45.0, 48.6, 115.7, 125.6 (q, *J* = 3.7 Hz), 127.0, 127.3, 128.7, 128.9, 134.2, 150.4, 156.3, 206.9. HRMS (ESI) calcd for $C_{17}H_{15}NaF_3O_2^+$ $[M+Na]^+$ 331.0916, found 331.0915.

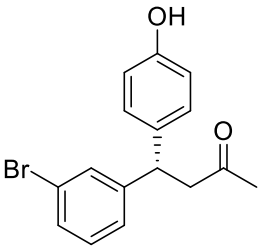
(*S*)-4-(4-Chlorophenyl)-4-(4-hydroxyphenyl)butan-2-one (**3h**)



Compound 3h. (99% yield, 97% ee (*S*)). White solid, 54.8 mg at 0.20 mmol scale. The ee of **3h** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 6.8 min (*S*), t_{minor} = 6.5 min (*R*)); $[\alpha]^{20}_D$ +6.2 (*c* 0.54, CH_3OH) for 97% ee (*S*). ^1H NMR (300 MHz, d_6-DMSO) δ 2.05 (s, 3H), 3.08 – 3.28 (m, 2H), 4.38 (t, *J* = 7.6 Hz,

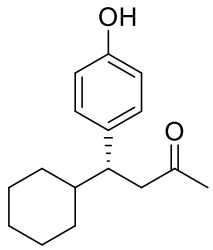
1H), 6.68 (d, *J* = 8.4 Hz, 2H), 7.07 (d, *J* = 8.4 Hz, 2H), 7.29 (s, 4H), 9.23 (s, 1H); ^{13}C NMR (126MHz, d_6-DMSO) δ 30.6, 44.5, 48.9, 115.7, 128.6, 128.8, 129.7, 131.0, 134.6, 144.6, 156.2, 207.0. HRMS (ESI) calcd for $C_{16}H_{15}NaClO_2^+$ $[M+Na]^+$ 297.0653, found 297.0645.

(*S*)-4-(3-Bromophenyl)-4-(4-hydroxyphenyl)butan-2-one (**3i**)



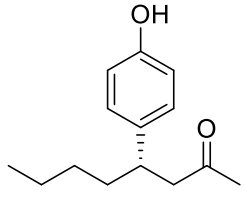
Compound 3i. (99% yield, 96% ee). Pale yellow solid, 63.6 mg at 0.20 mmol scale. The ee of **3i** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 6.7 min (*S*), t_{minor} = 8.4 min (*R*)); $[\alpha]^{20}_D$ –0.78 (*c* 0.52, CH_3OH) for 96% ee (*S*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 2.06 (s, 3H), 3.12 – 3.33 (m, 2H), 4.38 (t, *J* = 7.6 Hz, 1H), 6.69 (d, *J* = 8.4 Hz, 2H), 7.11 (d, *J* = 8.4 Hz, 2H), 7.17 – 7.25 (m, 1H), 7.26 – 7.36 (m, 2H), 7.47 (s, 1H), 9.27 (s, 1H). ^{13}C NMR (101 MHz, d_6-DMSO) δ 30.6, 44.8, 48.6, 115.7, 122.1, 126.9, 128.9, 129.3, 130.7, 130.9, 134.4, 148.5, 156.3, 207.0. HRMS (ESI) calcd for $C_{16}H_{15}Na^{79}BrO_2^+$ $[M+Na]^+$ 341.0148, found 341.0149. HRMS (ESI) calcd for $C_{16}H_{15}Na^{81}BrO_2^+$ $[M+Na]^+$ 343.0127, found 343.0131.

(*R*)-4-Cyclohexyl-4-(4-hydroxyphenyl)butan-2-one (**3j**)



Compound 3j. (99% yield, 99% ee (*R*)). White solid, 49.2 mg at 0.20 mmol scale. The ee of **3j** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 7.4 min (*R*), t_{minor} = 9.9 min (*S*)); $[\alpha]^{20}_D$ +25 (*c* 0.48, CH_3OH) for 99% ee (*R*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 0.68 – 1.41 (m, 7H), 1.55 – 1.73 (m, 4H), 1.92 (s, 3H), 2.62 – 2.82 (m, 3H), 6.64 (d, *J* = 8.3 Hz, 2H), 6.91 (d, *J* = 8.3 Hz, 2H), 9.10 (s, 1H); ^{13}C NMR (75 MHz, d_6-DMSO) δ 25.8, 25.95, 25.98, 30.0, 30.5, 42.7, 45.6, 46.7, 114.7, 128.9, 133.3, 155.4, 207.7. HRMS (ESI) calcd for $C_{16}H_{22}NaO_2^+$ $[M+Na]^+$ 269.1512, found 269.1509.

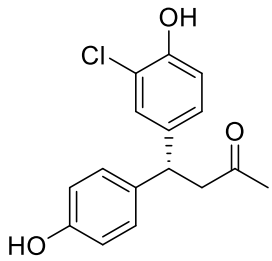
(*S*)-4-(4-Hydroxyphenyl)octan-2-one (**3k**)



Compound 3k. (99% yield, 97% ee (*S*)). Colorless oil, 44.0 mg at 0.20 mmol scale. The ee of **3k** was determined by HPLC

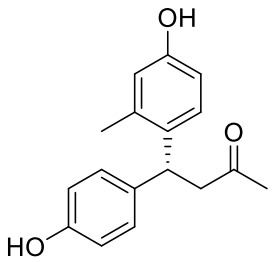
analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 90/10, 210 nm, t_{major} = 7.1 min (*S*), t_{minor} = 7.7 min (*R*)); $[\alpha]^{20}_D$ +14 (*c* 0.55, CH_3OH) for 97% ee (*S*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 0.78 (t, *J* = 7.0 Hz, 3H), 1.03 – 1.23 (m, 4H), 1.34 – 1.51 (m, 2H), 1.96 (s, 3H), 2.57 – 2.72 (m, 2H), 2.82 – 3.0 (m, 1H), 6.67 (d, *J* = 8.1 Hz, 2H), 6.97 (d, *J* = 8.1 Hz, 2H), 9.11 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 13.8, 22.0, 29.0, 30.1, 35.9, 39.7, 50.2, 115.0, 128.1, 134.7, 155.4, 207.4. HRMS (ESI) calcd for $C_{14}H_{20}NaO_2^+$ $[M+Na]^+$ 243.1356, found 243.1356.

(*R*)-4-(3-Chloro-4-hydroxyphenyl)-4-(4-hydroxyphenyl)butan-2-one (**3l**)



Compound 3l. (96% yield, 97% ee). White solid, 55.7 mg at 0.20 mmol scale. The ee of **3l** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 9.4 min (*R*), t_{minor} = 8.6 min (*S*)); $[\alpha]^{20}_D$ −1.8 (*c* 0.66, CH_3OH) for 97% ee (*R*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 2.05 (s, 3H), 3.15 (d, *J* = 7.9 Hz, 2H), 4.29 (t, *J* = 7.7 Hz, 1H), 6.69 (d, *J* = 8.5 Hz, 2H), 6.88 (d, *J* = 8.3 Hz, 1H), 7.00 – 7.12 (m, 3H), 7.21 (d, *J* = 2.1 Hz, 1H), 9.25 (s, 1H), 9.96 (s, 1H). ^{13}C NMR (101 MHz, d_6-DMSO) δ 30.6, 44.1, 49.1, 115.6, 116.9, 119.8, 127.4, 128.8, 129.0, 135.1, 137.5, 151.6, 156.1, 207.3. HRMS (ESI) calcd for $C_{16}H_{15}NaClO_3^+$ $[M+Na]^+$ 313.0602, found 313.0598.

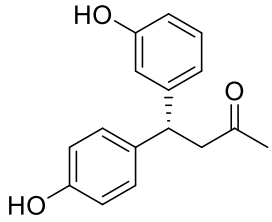
(*R*)-4-(4-Hydroxy-2-methylphenyl)-4-(4-hydroxyphenyl)butan-2-one (**3m**)



Compound 3m. (84% yield, >99% ee). White solid, 45.4 mg at 0.20 mmol scale. The ee of **3m** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 7.1 min (*R*), t_{minor} = 6.3 min (*S*)); $[\alpha]^{20}_D$ −52 (*c* 0.51, CH_3OH) for >99% ee (*R*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 2.02 (s, 3H), 2.17 (s, 3H), 2.97 – 3.15 (m, 2H), 4.44 (t, *J* = 7.6 Hz, 1H), 6.48 – 6.59 (m, 2H), 6.64 (d, *J* = 8.5 Hz, 2H), 6.98 (d, *J* = 8.5 Hz, 2H), 7.05 (d, *J* = 8.3 Hz, 1H), 9.08 (s, 1H), 9.17 (s, 1H). ^{13}C NMR (101 MHz, d_6-DMSO) δ 20.0, 30.6, 40.4, 50.0, 113.1, 115.4, 117.5, 127.6, 129.0, 133.4, 135.1,

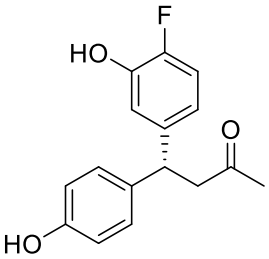
137.0, 155.6, 155.8, 207.5. HRMS (ESI) calcd for $C_{17}H_{18}NaO_3^+$ $[M+Na]^+$ 293.1148, found 293.1146.

(*R*)-4-(3-Hydroxyphenyl)-4-(4-hydroxyphenyl)butan-2-one (**ent-3a**)



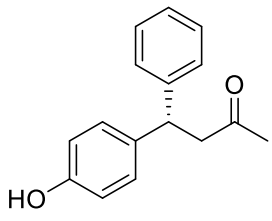
Compound ent-3a. (99% yield, 96% ee (*R*)). White solid, 51.2 mg at 0.20 mmol scale. The ee of **ent-3a** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 7.2 min (*R*), t_{minor} = 8.6 min (*S*)); $[\alpha]^{20}_D$ +0.52 (*c* 0.44, CH_3OH) for 96% ee (*R*). ^{1}H NMR (400 MHz, CD_3OD) δ 2.05 (s, 3H), 3.13 (d, *J* = 7.5 Hz, 2H), 4.37 (t, *J* = 7.8 Hz, 1H), 6.55 – 6.64 (m, 1H), 6.64 – 6.76 (m, 4H), 7.00 – 7.14 (m, 3H); ^{13}C NMR (101 MHz, CD_3OD) δ 29.2, 45.4, 49.2, 112.8, 114.3, 114.8, 118.5, 128.4, 129.1, 134.9, 146.2, 155.4, 157.1, 209.2. HRMS (ESI) calcd for $C_{16}H_{16}NaO_3^+$ $[M+Na]^+$ 279.0992, found 279.0995.

(*R*)-4-(4-Fluoro-3-hydroxyphenyl)-4-(4-hydroxyphenyl)butan-2-one (**3n**)



Compound 3n. (82% yield, 94% ee). White solid, 45.0 mg at 0.20 mmol scale. The ee of **3n** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 7.3 min (*R*), t_{minor} = 8.6 min (*S*)); $[\alpha]^{20}_D$ –0.57 (*c* 0.35, CH_3OH) for 94% ee (*R*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 2.05 (s, 3H), 3.11 (d, *J* = 7.7 Hz, 2H), 4.27 (t, *J* = 7.7 Hz, 1H), 6.64 – 6.71 (m, 3H), 6.79 (dd, *J* = 8.6, 2.1 Hz, 1H), 6.99 (dd, *J* = 11.3, 8.4 Hz, 1H), 7.05 (d, *J* = 8.5 Hz, 2H), 9.24 (s, 1H), 9.69 (s, 1H). ^{13}C NMR (101 MHz, d_6-DMSO) δ 30.6, 44.5, 49.2, 115.6, 116.1 (d, *J* = 18.0 Hz), 117.4 (d, *J* = 2.4 Hz), 118.4 (d, *J* = 6.4 Hz), 128.8, 135.0, 142.0 (d, *J* = 3.3 Hz), 144.8 (d, *J* = 12.4 Hz), 151.1 (d, *J* = 239.7 Hz), 156.1, 207.3. HRMS (ESI) calcd for $C_{16}H_{15}NaFO_3^+$ $[M+Na]^+$ 297.0897, found 297.0899.

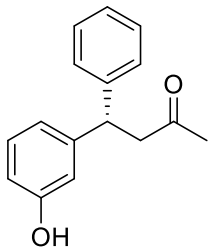
(*S*)-4-(4-Hydroxyphenyl)-4-phenylbutan-2-one (**ent-3f**)



Compound ent-3f. (99% yield, 94% ee (*S*)). White solid, 48 mg at 0.20 mmol scale. The ee of **enti-3f** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min,

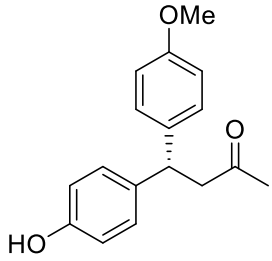
hexane/isopropanol = 80/20, 210 nm, t_{major} = 7.3 min (*S*), t_{minor} = 8.6 min (*R*)); $[\alpha]^{20}_D$ −1.3 (*c* 0.44, CH_3OH) for 94% ee (*S*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 2.05 (s, 3H), 3.13 – 3.26 (m, 2H), 4.38 (t, *J* = 7.7 Hz, 1H), 6.68 (d, *J* = 8.4 Hz, 2H), 7.08 – 7.16 (m, 3H), 7.23 – 7.29 (m, 4H), 9.23 (s, 1H); ^{13}C NMR (101 MHz, d_6-DMSO) δ 30.6, 45.3, 49.1, 115.6, 126.4, 127.9, 128.8, 128.9, 135.1, 145.5, 156.1, 207.3. HRMS (ESI) calcd for $C_{16}H_{16}NaO_2^+$ $[M+Na]^+$ 263.1043, found 263.1040.

(*S*)-4-(3-Hydroxyphenyl)-4-phenylbutan-2-one (**3p**)



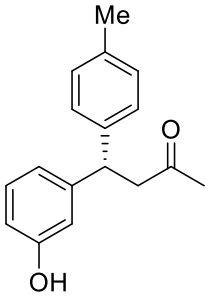
Compound 3p. (98% yield, 96% ee (*S*)). White solid, 47.1 mg at 0.20 mmol scale. The ee of **3p** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 7.7 min (*S*), t_{minor} = 6.9 min (*R*)); $[\alpha]^{20}_D$ −1.1 (*c* 0.56, CH_3OH) for 96% ee (*S*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 2.07 (s, 3H), 3.22 (d, *J* = 7.7 Hz, 2H), 4.40 (t, *J* = 7.7 Hz, 1H), 6.57 – 6.60 (m, 1H), 6.67 – 6.69 (m, 1H), 6.74 (d, *J* = 7.7 Hz, 1H), 7.07 (t, *J* = 7.8 Hz, 1H), 7.13 – 7.19 (m, 1H), 7.24 – 7.31 (m, 4H), 9.31 (s, 1H); ^{13}C NMR (101 MHz, d_6-DMSO) δ 30.6, 45.9, 48.8, 113.58, 115.1, 118.6, 126.5, 128.0, 128.8, 129.8, 144.9, 146.3, 157.8, 207.1. HRMS (ESI) calcd for $C_{16}H_{16}NaO_2^+$ $[M+Na]^+$ 263.1043, found 263.1040.

(*R*)-4-(4-Hydroxyphenyl)-4-(4-methoxyphenyl)butan-2-one (**3q**)



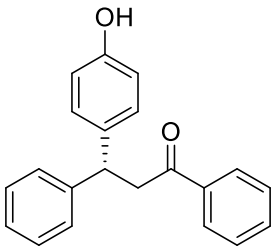
Compound 3q. (99% yield, 97% ee (*R*)). White solid, 54.1 mg at 0.20 mmol scale. The ee of **3q** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 8.3 min (*R*), t_{minor} = 9.5 min (*S*)); $[\alpha]^{20}_D$ −2.5 (*c* 0.52, CH_3OH) for 97% ee (*R*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 2.02 (s, 3H), 3.12 (d, *J* = 7.7 Hz, 2H), 3.69 (s, 3H), 4.31 (t, *J* = 7.6 Hz, 1H), 6.65 (d, *J* = 8.2 Hz, 2H), 6.81 (d, *J* = 8.2 Hz, 2H), 7.05 (d, *J* = 8.0 Hz, 2H), 7.16 (d, *J* = 8.1 Hz, 2H), 9.16 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 30.1, 44.0, 49.0, 54.9, 113.6, 115.0, 128.2, 128.3, 135.0, 137.0, 155.5, 157.4, 206.8. HRMS (ESI) calcd for $C_{17}H_{18}NaO_3^+$ $[M+Na]^+$ 293.1148, found 293.1149.

(*S*)-4-(3-Hydroxyphenyl)-4-(p-tolyl)butan-2-one (**3r**)



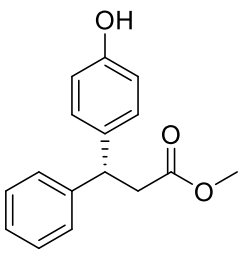
Compound 3r. (99% yield, 97% ee (*S*)). White solid, 50.8 mg at 0.20 mmol scale. The ee of **3r** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 6.9 min (*S*), t_{minor} = 6.3 min (*R*)); $[\alpha]^{20}_D$ –2.7 (*c* 0.52, CH_3OH) for 97% ee (*S*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 2.06 (s, 3H), 2.24 (s, 3H), 3.18 (d, *J* = 7.7 Hz, 2H), 4.35 (t, *J* = 7.7 Hz, 1H), 6.57 (dd, *J* = 7.9, 2.0 Hz, 1H), 6.64 – 6.67 (m, 1H), 6.71 (d, *J* = 7.7 Hz, 1H), 7.03 – 7.09 (m, 3H), 7.15 – 7.18 (m, 2H), 9.29 (s, 1H); ^{13}C NMR (101 MHz, d_6-DMSO) δ 21.0, 30.6, 45.5, 48.8, 113.5, 115.0, 118.5, 127.9, 129.4, 129.7, 135.5, 141.8, 146.5, 157.8, 207.2. HRMS (ESI) calcd for $C_{16}H_{18}NaO_2^+$ $[M+Na]^+$ 277.1199, found 277.1199.

(*R*)-3-(4-Hydroxyphenyl)-1,3-diphenylpropan-1-one (**4a**)



Compound 4a. (99% yield, 95% ee (*R*)). White solid, 60.4 mg at 0.20 mmol scale. The ee of **4a** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 90/10, 210 nm, t_{major} = 15.0 min (*R*), t_{minor} = 14.1 min (*S*)); $[\alpha]^{20}_D$ +3.1 (*c* 0.58, CH_3OH) for 95% ee (*R*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 3.76 – 3.90 (m, 2H), 4.60 (t, *J* = 7.4 Hz, 1H), 6.69 (d, *J* = 8.4 Hz, 2H), 7.13 (t, *J* = 7.3 Hz, 1H), 7.19 (d, *J* = 8.4 Hz, 2H), 7.25 (t, *J* = 7.6 Hz, 2H), 7.36 (d, *J* = 7.6 Hz, 2H), 7.50 (t, *J* = 7.6 Hz, 2H), 7.62 (t, *J* = 7.3 Hz, 1H), 8.02 (d, *J* = 7.5 Hz, 2H), 9.24 (s, 1H); ^{13}C NMR (101 MHz, d_6-DMSO) δ 44.1, 45.5, 115.6, 126.3, 128.0, 128.7, 129.05, 129.14, 133.6, 135.4, 137.3, 145.8, 156.1, 198.7. HRMS (ESI) calcd for $C_{21}H_{18}NaO_2^+$ $[M+Na]^+$ 325.1199, found 325.1200.

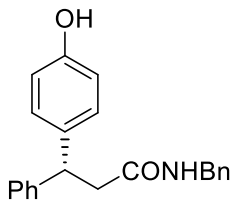
Methyl (*R*)-3-(4-hydroxyphenyl)-3-phenylpropanoate (**4b**)



Compound 4b. (99% yield, 99% ee (*R*)). Pale yellow oil, 51.2 mg at 0.20 mmol scale. The ee of **4b** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 85/15, 210 nm, t_{major} = 6.3 min (*R*), t_{minor} = 5.8 min (*S*)); $[\alpha]^{20}_D$

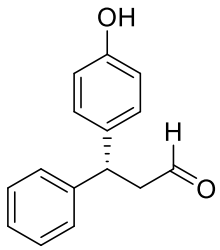
+1.5 (*c* 0.55, CH_3OH) for 99% ee (*R*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 3.00 – 3.14 (m, 2H), 3.49 (s, 3H), 4.36 (t, *J* = 8.0 Hz, 1H), 6.67 – 6.71 (m, 2H), 7.10 – 7.18 (m, 3H), 7.24 – 7.31 (m, 4H), 9.26 (s, 1H); ^{13}C NMR (101 MHz, d_6-DMSO) δ 40.2, 46.3, 51.7, 115.6, 126.6, 127.8, 128.8, 134.6, 144.9, 156.2, 172.2. HRMS (ESI) calcd for $C_{16}H_{16}NaO_3^+$ $[M+Na]^+$ 279.0992, found 279.0987.

(*R*)-N-benzyl-3-(4-hydroxyphenyl)-3-phenylpropanamide (**4c**)



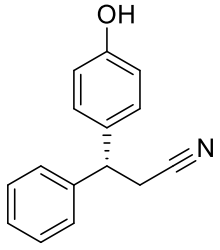
Compound 4c. (92% yield, 98% ee (*R*)). White solid, 60.9 mg at 0.20 mmol scale. The ee of **4c** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 70/30, 210 nm, t_{major} = 6.6 min (*R*), t_{minor} = 6.0 min (*S*)); $[\alpha]^{20}_D$ +0.2 (*c* 0.49, CH_3OH) for 98% ee (*R*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 2.89 (d, *J* = 8.0 Hz, 2H), 4.14 – 4.29 (m, 2H), 4.45 (t, *J* = 8.0 Hz, 1H), 6.71 (d, *J* = 8.4 Hz, 2H), 6.86 – 6.90 (m, 2H), 7.10 (d, *J* = 8.4 Hz, 2H), 7.17 – 7.21 (m, 4H), 7.24 – 7.29 (m, 4H), 8.34 (t, *J* = 5.7 Hz, 1H), 9.24 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 41.7, 41.7, 46.2, 115.1, 125.9, 126.4, 126.7, 127.5, 128.0, 128.2, 128.5, 134.4, 139.2, 144.8, 155.7, 170.3. HRMS (ESI) calcd for $C_{22}H_{22}NO_2^+$ $[M+H]^+$ 332.1645, found 332.1641.

(*R*)-3-(4-Hydroxyphenyl)-3-phenylpropanal (**4d**)



Compound 4d. (91% yield, 96% ee (*R*)). White solid, 41.2 mg at 0.20 mmol scale. The ee of **4d** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 8.3 min (*R*), t_{minor} = 9.4 min (*S*)); $[\alpha]^{20}_D$ –10 (*c* 0.40, CH_3OH) for 96% ee (*R*). ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.08 – 3.22 (m, 2H), 4.59 (t, *J* = 7.8 Hz, 1H), 6.70 – 6.80 (m, 2H), 7.05 – 7.15 (m, 2H), 7.19 – 7.25 (m, 3H), 7.27 – 7.35 (m, 2H), 9.75 (t, *J* = 2.0 Hz, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 44.2, 49.6, 115.7, 126.7, 127.6, 128.8, 128.9, 135.0, 143.6, 154.5, 202.4. HRMS (ESI) calcd for $C_{15}H_{14}NaO_2^+$ $[M+Na]^+$ 249.0886, found 249.0885.

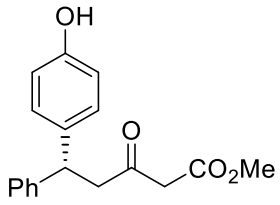
(*R*)-3-(4-Hydroxyphenyl)-3-phenylpropanenitrile (**4e**)



Compound 4e. (67% yield, 80% ee (*R*)). White solid, 41.2 mg at 0.20 mmol scale. The ee of **4e** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 90/10,

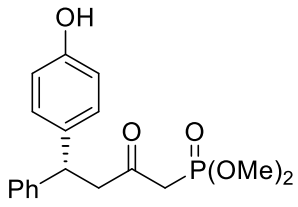
210 nm, t_{major} = 14.3 min (*R*), t_{minor} = 13.5 min (*S*)); $[\alpha]^{20}_D$ +0.98 (*c* 0.31, CH_3OH) for 80% ee (*R*). ^1H NMR (400 MHz, d_6-DMSO) δ 3.27 (d, *J* = 8.1 Hz, 2H), 4.32 (t, *J* = 8.1 Hz, 1H), 6.72 (d, *J* = 8.4 Hz, 2H), 7.16 (d, *J* = 8.5 Hz, 2H), 7.19 – 7.25 (m, 1H), 7.29 – 7.38 (m, 4H), 9.36 (s, 1H); ^{13}C NMR (101 MHz, d_6-DMSO) δ 23.4, 46.3, 115.7, 120.3, 127.2, 127.8, 128.96, 128.97, 133.1, 143.4, 156.7. HRMS (ESI) calcd for $C_{15}H_{13}NaNO^+$ $[M+Na]^+$ 246.0889, found 246.0894.

Methyl (*R*)-5-(4-hydroxyphenyl)-3-oxo-5-phenylpentanoate (**4f**)



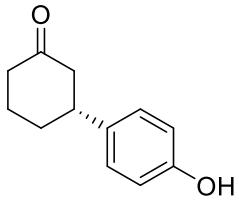
Compound 4f. (99% yield, >99% ee (*R*)). White solid, 59.6 mg at 0.20 mmol scale. The ee of **4f** was determined by HPLC analysis: (Chiralcel IB column, 1.0 mL/min, hexane/isopropanol = 85/15, 210 nm, t_{major} = 19.4 min (*R*), t_{minor} = 46.1 min (*S*)); $[\alpha]^{20}_D$ +6.3 (*c* 0.40, CH_3OH) for >99% ee (*R*). ^1H NMR (300 MHz, d_6-DMSO) δ 3.32 (d, *J* = 7.5 Hz, 2H), 3.53 – 3.65 (m, 5H), 4.37 (t, *J* = 7.5 Hz, 1H), 6.67 (d, *J* = 8.3 Hz, 2H), 7.07 (d, *J* = 8.4 Hz, 2H), 7.11 – 7.19 (m, 1H), 7.25 (d, *J* = 4.2 Hz, 4H), 9.19 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 44.3, 48.0, 48.8, 51.7, 115.1, 125.9, 127.3, 128.2, 128.3, 134.3, 144.7, 155.6, 167.4, 201.5. HRMS (ESI) calcd for $C_{18}H_{18}NaO_4^+$ $[M+Na]^+$ 321.1097, found 321.1098.

Dimethyl (*R*)-(4-(4-hydroxyphenyl)-2-oxo-4-phenylbutyl)phosphonate (**4g**)



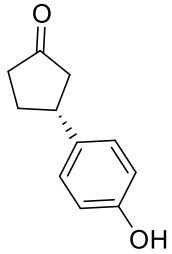
Compound 4g. (96% yield, 96% ee (*R*)). White solid, 66.8 mg at 0.20 mmol scale. The ee of **4g** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 15.2 min (*R*), t_{minor} = 14.2 min (*S*)); $[\alpha]^{20}_D$ +2.5 (*c* 0.52, CH_3OH) for 96% ee (*R*). ^1H NMR (300 MHz, d_6-DMSO) δ 3.20 – 3.38 (m, 4H), 3.59 (s, 3H), 3.63 (s, 3H), 4.39 (t, *J* = 7.4 Hz, 1H), 6.67 (d, *J* = 8.3 Hz, 2H), 7.07 (d, *J* = 8.4 Hz, 2H), 7.12 – 7.17 (m, 1H), 7.25 (d, *J* = 4.2 Hz, 4H), 9.20 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 40.8, 44.1, 49.1, 52.5, 52.5, 125.9, 127.4, 128.2, 128.4, 134.4, 144.8, 155.6, 200.20, 200.24. HRMS (ESI) calcd for $C_{18}H_{22}O_5P^+$ $[M+H]^+$ 349.1199, found 349.1203.

(*R*)-3-(4-Hydroxyphenyl)cyclohexan-1-one (**4h**)



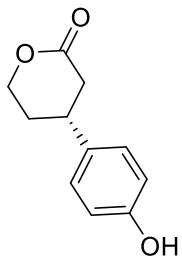
Compound 4h. (99% yield, 98% ee (*R*)). White solid, 38.1 mg at 0.20 mmol scale. The ee of **4h** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 10.0 min (*R*), t_{minor} = 11.1 min (*S*)); $[\alpha]^{20}_{D}$ +6.4 (*c* 0.39, CH_3OH) for 98% ee (*R*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 1.55 – 1.92 (m, 3H), 1.93 – 2.06 (m, 1H), 2.17 – 2.33 (m, 2H), 2.33 – 2.47 (m, 1H), 2.56 (t, *J* = 13.1 Hz, 1H), 2.86 (t, *J* = 11.5 Hz, 1H), 6.70 (d, *J* = 8.2 Hz, 2H), 7.06 (d, *J* = 8.0 Hz, 2H), 9.20 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 25.4, 33.0, 40.9, 43.6, 49.1, 115.6, 127.9, 135.6, 156.2, 210.7. HRMS (ESI) calcd for $C_{12}H_{15}O_2^+$ $[M+H]^+$ 191.1067, found 191.1061.

(*R*)-3-(4-Hydroxyphenyl)cyclopentan-1-one (**4i**)



Compound 4i. (99% yield, 99% ee (*R*)). White solid, 35.2 mg at 0.20 mmol scale. The ee of **4i** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 90/10, 210 nm, t_{major} = 15.1 min (*R*), t_{minor} = 14.1 min (*S*)); $[\alpha]^{20}_{D}$ +74 (*c* 0.42, CH_3OH) for 99% ee (*R*). ^{1}H NMR (300 MHz, d_6-Acetone) δ 2.29 – 2.47 (m, 1H), 2.62 – 2.82 (m, 4H), 2.90 – 3.05 (m, 1H), 3.70 – 3.91 (m, 1H), 7.26 (d, *J* = 8.4 Hz, 2H), 7.62 (d, *J* = 8.4 Hz, 2H), 8.61 (s, 1H); ^{13}C NMR (126 MHz, d_6-Acetone) δ 32.1, 39.2, 42.3, 46.4, 116.0, 128.6, 135.4, 156.7, 217.4. HRMS (ESI) calcd for $C_{11}H_{12}NaO_2^+$ $[M+Na]^+$ 199.0730, found 199.0730.

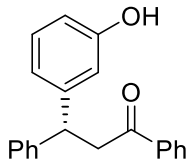
(*R*)-4-(4-Hydroxyphenyl)tetrahydro-2H-pyran-2-one (**4j**)



Compound 4j. (98% yield, 84% ee (*R*)). White solid, 37.7 mg at 0.20 mmol scale. The ee of **4j** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 70/30, 210 nm, t_{major} = 19.0 min (*R*), t_{minor} = 23.5 min (*S*)); $[\alpha]^{20}_{D}$ –6.3 (*c* 0.33, CH_3OH) for 84% (*R*). ^{1}H NMR (400 MHz, d_6-Acetone) δ 1.94 – 2.17 (m, 2H), 2.51 – 2.61 (m, 1H), 2.72 – 2.82 (m, 1H), 3.18 – 3.29 (m, 1H), 4.49 – 4.33 (m, 2H), 6.63 – 6.93 (m, 2H), 7.10 – 7.20 (m, 2H), 8.29 (s, 1H); ^{13}C NMR (101 MHz,

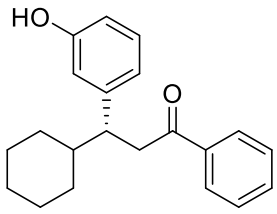
d_6-Acetone) δ 30.4, 36.6, 37.7, 68.3, 115.4, 127.6, 134.9, 156.2, 170.0. HRMS (ESI) calcd for $C_{11}H_{12}NaO_3^+$ $[M+Na]^+$ 215.0679, found 215.0680.

(*R*)-3-(3-Hydroxyphenyl)-1,3-diphenylpropan-1-one (**4k**)



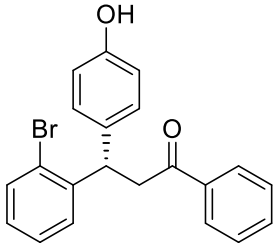
Compound 4k. (99% yield, 94% ee (*R*)). White solid, 60.4 mg at 0.20 mmol scale. The ee of **4k** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 90/10, 210 nm, t_{major} = 16.1 min (*R*), t_{minor} = 12.8 min (*S*)); $[\alpha]^{20}_D$ –2.3 (*c* 0.60, CH_3OH) for 94% ee (*R*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 3.84 (d, *J* = 7.3 Hz, 2H), 4.60 (t, *J* = 7.3 Hz, 1H), 6.59 (d, *J* = 7.9 Hz, 1H), 6.73 – 6.87 (m, 2H), 7.06 (t, *J* = 7.8 Hz, 1H), 7.14 (t, *J* = 7.1 Hz, 1H), 7.26 (t, *J* = 7.4 Hz, 2H), 7.37 (d, *J* = 7.4 Hz, 2H), 7.50 (t, *J* = 7.5 Hz, 2H), 7.61 (t, *J* = 7.1 Hz, 1H), 8.02 (d, *J* = 7.5 Hz, 2H), 9.28 (s, 1H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 43.4, 45.7, 113.0, 114.7, 118.2, 126.0, 127.6, 128.0, 128.2, 128.6, 129.2, 133.1, 136.8, 144.6, 146.0, 157.3, 197.9. HRMS (ESI) calcd for $C_{21}H_{18}NaO_2^+$ $[M+Na]^+$ 325.1199, found 325.1200.

(*R*)-3-Cyclohexyl-3-(3-hydroxyphenyl)-1-phenylpropan-1-one (**4l**)



Compound 4l. (99% yield, 97% ee (*R*)). White solid, 61.6 mg at 0.20 mmol scale. The ee of **4l** was determined by HPLC analysis: (Chiralcel IB column, 1.0 mL/min, hexane/isopropanol = 90/10, 254 nm, t_{major} = 5.3 min (*R*), t_{minor} = 9.3 min (*S*)); $[\alpha]^{20}_D$ +11 (*c* 0.47, CH_3OH) for 97% ee (*R*). ^{1}H NMR (300 MHz, $CDCl_3$) δ 0.77 – 1.33 (m, 5H), 1.47 – 1.70 (m, 4H), 1.71 – 1.92 (m, 2H), 3.08– 3.22 (m, 1H), 3.25 – 3.50 (m, 2H), 6.58 (s, 1H), 6.64 – 6.80 (m, 3H), 7.10 (t, *J* = 7.8 Hz, 1H), 7.43 (t, *J* = 7.5 Hz, 2H), 7.54 (t, *J* = 7.3 Hz, 1H), 7.82 – 7.97 (m, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 26.4, 26.6, 30.9, 31.4, 42.6, 43.1, 47.2, 113.3, 115.6, 120.4, 128.2, 128.6, 129.2, 133.1, 137.1, 145.5, 155.8, 200.9. HRMS (ESI) calcd for $C_{21}H_{24}NaO_2^+$ $[M+Na]^+$ 331.1669, found 331.1668.

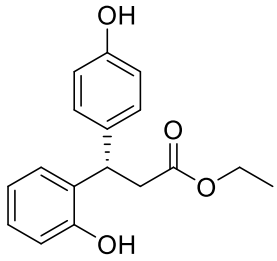
(*S*)-3-(2-Bromophenyl)-3-(4-hydroxyphenyl)-1-phenylpropan-1-one (**4n**)



Compound 4n. (99% yield, 95% ee (*S*)). White solid, 76.0 mg at 0.20 mmol scale. The ee of **4n** was determined by HPLC

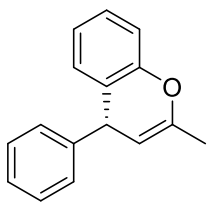
analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 7.2 min (*S*), t_{minor} = 7.6 min (*R*)); $[\alpha]^{20}_D$ –0.55 (*c* 0.73, CH_3OH) for 95% ee (*S*). ^1H NMR (400 MHz, $CDCl_3$) δ 3.49 – 3.66 (m, 2H), 5.10 (t, *J* = 7.3 Hz, 1H), 6.22 (s, 1H), 6.49 – 6.61 (m, 2H), 6.86 – 7.01 (m, 3H), 7.10 (d, *J* = 4.7 Hz, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.44 (t, *J* = 7.2 Hz, 2H), 7.83 (d, *J* = 8.1 Hz, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 44.3, 44.5, 115.6, 124.8, 127.7, 128.0, 128.2, 128.8, 129.3, 133.4, 133.5, 133.9, 136.7, 143.4, 154.6, 198.8. HRMS (ESI) calcd for $C_{21}H_{17}Na^{79}BrO_2^+$ $[M+Na]^+$ 403.0304, found 403.0313. HRMS (ESI) calcd for $C_{21}H_{17}Na^{81}BrO_2^+$ $[M+Na]^+$ 405.0284, found 405.0297.

Ethyl (*S*)-3-(2-hydroxyphenyl)-3-(4-hydroxyphenyl)propanoate (**4o**)



Compound 4o. (98% yield, 92% ee (*S*)). White solid, 56.1 mg at 0.20 mmol scale. The ee of **4o** was determined by HPLC analysis: (Chiralcel IB column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 6.7 min (*S*), t_{minor} = 10.5 min (*R*)); $[\alpha]^{20}_D$ –27 (*c* 0.57, CH_3OH) for 92% ee (*S*). ^1H NMR (300 MHz, d_6-DMSO) δ 1.04 (t, *J* = 6.9 Hz, 3H), 2.97 (d, *J* = 7.9 Hz, 2H), 3.95 (q, *J* = 6.8 Hz, 2H), 4.70 (t, *J* = 7.9 Hz, 1H), 6.61 – 6.82 (m, 4H), 6.90 – 7.02 (m, 1H), 7.03 – 7.18 (m, 3H), 9.17 (s, 1H), 9.39 (s, 1H); ^{13}C NMR (75 MHz, d_6-DMSO) δ 14.4, 39.66, 39.74, 60.0, 115.3, 115.5, 119.3, 127.4, 128.0, 129.1, 131.0, 134.2, 154.8, 156.0, 171.9. HRMS (ESI) calcd for $C_{17}H_{18}NaO_4^+$ $[M+Na]^+$ 309.1097, found 309.1102.

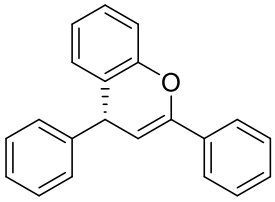
(*R*)-2-Methyl-4-phenyl-4H-chromene (**5a**)



Compound 5a. (99% yield, >99% ee (*R*)). White solid, 44.4 mg at 0.20 mmol scale. The ee of **5a** was determined by HPLC analysis: (Chiralcel IB column, 1.0 mL/min, hexane/isopropanol = 98/2, 254 nm, t_{major} = 4.4 min (*R*), t_{minor} = 4.1 min (*S*)); $[\alpha]^{20}_D$ +107 (*c* 0.31, CH_3OH) for >99% ee (*R*). ^1H NMR (400 MHz, d_6-DMSO) δ 1.95 (s, 3H), 4.67 (d, *J* = 2.4 Hz, 1H), 4.87 (dd, *J* = 4.0, 1.0 Hz, 1H), 6.93 – 6.99 (m, 3H), 7.13 – 7.23 (m, 4H), 7.28 – 7.32 (m, 2H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 18.8, 39.7, 100.4, 116.0,

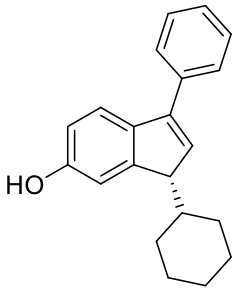
123.0, 123.2, 126.3, 127.5, 127.8, 128.4, 129.6, 146.5, 146.9, 150.4. HRMS (ESI) calcd for $C_{16}H_{15}O^+$ $[M+H]^+$ 223.1117, found 223.1112.

(*R*)-2,4-Diphenyl-4H-chromene (**5b**)



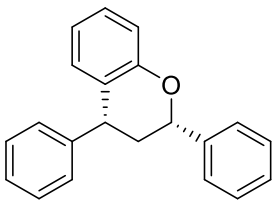
Compound 5b. (99% yield, 99% ee (*R*)). White solid, 56.8 mg at 0.20 mmol scale. The ee of **5b** was determined by HPLC analysis: (Chiralcel IB column, 1.0 mL/min, hexane/isopropanol = 98/2, 254 nm, t_{major} = 5.2 min (*R*), t_{minor} = 4.9 min (*S*)); $[\alpha]^{20}_D$ +0.26 (*c* 0.49, CH_3OH) for 99% ee (*R*). ^{1}H NMR (400 MHz, d_6-DMSO) δ 4.90 (d, *J* = 4.5 Hz, 1H), 5.84 (d, *J* = 4.5 Hz, 1H), 6.96 – 7.06 (m, 2H), 7.14 – 7.24 (m, 3H), 7.27 – 7.35 (m, 4H), 7.35 – 7.47 (m, 3H), 7.71 – 7.83 (m, 2H); ^{13}C NMR (126 MHz, d_6-DMSO) δ 39.8, 101.0, 116.4, 123.2, 123.6, 124.2, 126.5, 127.7, 127.9, 128.4, 128.6, 129.5, 133.3, 146.4, 147.0, 150.3. HRMS (ESI) calcd for $C_{21}H_{17}O^+$ $[M+H]^+$ 285.1274, found 285.1275.

(*S*)-1-Cyclohexyl-3-phenyl-1H-inden-6-ol (**6**)



Compound 6. (90% yield, 97% ee). Pale yellow solid, 52.2 mg at 0.20 mmol scale. The ee of **6** was determined by HPLC analysis: (Chiralcel IB column, 1.0 mL/min, hexane/isopropanol = 90/10, 254 nm, t_{major} = 5.1 min (*S*), t_{minor} = 5.5 min (*R*)); $[\alpha]^{20}_D$ +33 (*c* 0.40, CH_3OH) for 97% ee (*S*). ^{1}H NMR (300 MHz, d_6-DMSO) δ 0.81 – 0.97 (m, 1H), 1.02 – 1.15 (m, 2H), 1.20 – 1.33 (m, 3H), 1.50 – 1.65 (m, 2H), 1.67 – 1.79 (m, 1H), 1.82 – 1.98 (m, 2H), 3.23 – 3.38 (m, 1H), 6.43 (d, *J* = 1.6 Hz, 1H), 6.71 (dd, *J* = 8.2, 1.9 Hz, 1H), 6.94 (s, 1H), 7.27 (d, *J* = 8.2 Hz, 1H), 7.31 – 7.39 (m, 1H), 7.39 – 7.50 (m, 2H), 7.57 (d, *J* = 7.2 Hz, 2H), 9.27 (s, 1H). ^{13}C NMR (75 MHz, d_6-DMSO) δ 26.38, 26.45, 26.8, 28.2, 32.0, 40.8, 54.8, 111.8, 113.5, 120.6, 127.5, 127.8, 129.0, 131.6, 134.9, 136.2, 143.7, 149.8, 156.0. HRMS (ESI) calcd for $C_{21}H_{23}O^+$ $[M+H]^+$ 291.1743, found 291.1745.

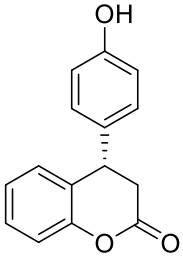
(2*S*,4*R*)-2,4-Diphenylchromane (**7**)



Compound 7. (90% yield, dr > 20:1, 99% ee). White solid, 51.4 mg at 0.20 mmol scale. The ee of **7** was determined by

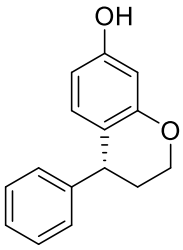
HPLC analysis: (Chiralcel ID column, 1.0 mL/min, hexane/isopropanol = 98/2, 210 nm, t_{major} = 5.5 min (*S*), t_{minor} = 5.9 min (*R*)); $[\alpha]^{20}_D$ –58 (*c* 0.51, CH_3OH) for 99% ee (4*R*). ^1H NMR (400 MHz, $CDCl_3$) δ 2.29 – 2.42 (m, 1H), 2.45 – 2.53 (m, 1H), 4.43 (dd, *J* = 12.1, 5.9 Hz, 1H), 5.18 – 5.39 (m, 1H), 6.82 – 6.92 (m, 2H), 7.04 (d, *J* = 8.1 Hz, 1H), 7.18 – 7.24 (m, 1H), 7.28 – 7.35 (m, 3H), 7.39 (t, *J* = 7.3 Hz, 3H), 7.47 (t, *J* = 7.4 Hz, 2H), 7.56 (d, *J* = 7.4 Hz, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 40.7, 43.6, 78.2, 117.1, 120.6, 125.8, 126.2, 126.8, 127.8, 128.1, 128.6, 128.7, 129.9, 141.3, 144.6, 155.6. HRMS (ESI) calcd for $C_{21}H_{19}O^+$ $[M+H]^+$ 287.1430, found 287.1428.

(*S*)-4-(4-Hydroxyphenyl)chroman-2-one (**8**)



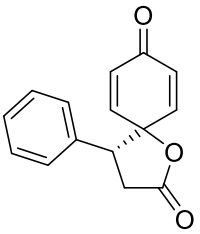
Compound 8. (95% yield, 91% ee). White solid, 45.6 mg at 0.20 mmol scale. The ee of **8** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 254 nm, t_{major} = 8.4 min (*S*), t_{minor} = 7.5 min (*R*)); $[\alpha]^{20}_D$ +18 (*c* 0.33, CH_3OH) for 91% ee (*S*). ^1H NMR (300 MHz, $CDCl_3$) δ 2.85 – 3.03 (m, 2H), 4.20 (t, *J* = 6.6 Hz, 1H), 6.70 (d, *J* = 8.4 Hz, 2H), 6.84 – 6.97 (m, 3H), 6.97 – 7.09 (m, 2H), 7.16 – 7.27 (m, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 37.2, 39.8, 116.0, 117.1, 124.8, 126.1, 128.3, 128.66, 128.73, 132.0, 151.5, 155.3, 168.5. HRMS (ESI) calcd for $C_{15}H_{13}O_3^+$ $[M+H]^+$ 241.0859, found 241.0865.

(*R*)-4-Phenylchroman-7-ol (**10**)



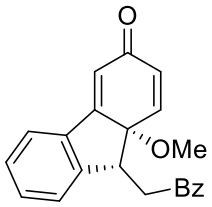
Compound 10. (81% yield, 96% ee). Pale yellow solid, 36.6 mg at 0.20 mmol scale. The ee of **10** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 90/10, 210 nm, t_{major} = 7.8 min (*R*), t_{minor} = 7.6 min (*S*)); $[\alpha]^{20}_D$ +22 (*c* 0.14, CH_3OH) for 96% ee (*R*). ^1H NMR (300 MHz, $CDCl_3$) δ 2.03 – 2.19 (m, 1H), 2.24 – 2.42 (m, 1H), 4.09 – 4.27 (m, 3H), 6.32 (d, *J* = 2.6 Hz, 1H), 6.60 – 6.70 (m, 1H), 6.75 – 6.84 (m, 1H), 7.19 (d, *J* = 7.1 Hz, 2H), 7.23 – 7.40 (m, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 31.8, 41.4, 64.0, 115.3, 116.4, 117.5, 125.4, 126.6, 128.5, 128.6, 145.4, 149.0, 149.2. HRMS (ESI) calcd for $C_{15}H_{15}O_2^+$ $[M+H]^+$ 227.1067, found 227.1064.

(*R*)-4-Phenyl-1-oxaspiro[4.5]deca-6,9-diene-2,8-dione (**13**)



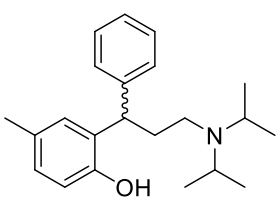
Compound 13. (95% yield, 99% ee). Pale yellow solid, 45.6 mg at 0.20 mmol scale. The ee of **13** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 210 nm, t_{major} = 14.6 min (*R*), t_{minor} = 16.5 min (*S*)); $[\alpha]^{20}_{D}$ +43 (*c* 0.57, CH_3OH) for 99% ee (*R*). ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.05 – 3.15 (m, 1H), 3.17 – 3.29 (m, 1H), 3.88 (dd, *J* = 10.9, 8.6 Hz, 1H), 6.02 (dd, *J* = 10.3, 1.9 Hz, 1H), 6.37 (dd, *J* = 10.1, 1.9 Hz, 1H), 6.61 (dd, *J* = 10.3, 3.2 Hz, 1H), 6.98 (dd, *J* = 10.1, 3.2 Hz, 1H), 7.07 – 7.17 (m, 2H), 7.30 – 7.36 (m, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ 32.8, 50.0, 81.8, 127.4, 128.7, 128.9, 130.2, 130.5, 133.6, 143.0, 145.6, 174.2, 184.2. HRMS (ESI) calcd for $C_{15}H_{13}O_3^+$ $[M+H]^+$ 241.0859, found 241.0865.

(9*R*,9a*R*)-9a-Methoxy-9-(2-oxo-2-phenylethyl)-9,9a-dihydro-3H-fluoren-3-one (**15**)



Compound 15. (93% yield, dr = 19:1, 96% ee). Pale yellow solid, 61.4 mg at 0.20 mmol scale. The ee of **15** was determined by HPLC analysis: (Chiralcel IF column, 1.0 mL/min, hexane/isopropanol = 80/20, 254 nm, t_{major} = 7.3 min (*R*), t_{minor} = 8.8 min (*S*)); $[\alpha]^{20}_{D}$ −69 (*c* 0.29, CH_3OH) for 96% ee (9*R*). ^{1}H NMR (500 MHz, d_6-DMSO) δ 2.67 (d, *J* = 14.0 Hz, 1H), 2.95 (s, 3H), 3.17 (dd, *J* = 13.9, 8.4 Hz, 1H), 4.01 (d, *J* = 8.2 Hz, 1H), 6.30 (dd, *J* = 9.9, 1.6 Hz, 1H), 6.76 (d, *J* = 1.5 Hz, 1H), 6.94 (dd, *J* = 6.5, 2.9 Hz, 2H), 7.13 – 7.21 (m, 3H), 7.24 (d, *J* = 7.3 Hz, 1H), 7.33 – 7.42 (m, 2H), 7.48 (d, *J* = 9.9 Hz, 1H), 7.89 (d, *J* = 7.3 Hz, 1H). ^{13}C NMR (126 MHz, d_6-DMSO) δ 48.1, 50.3, 50.7, 87.1, 111.9, 120.5, 123.5, 126.0, 126.1, 128.0, 128.5, 129.9, 132.2, 136.4, 141.4, 144.9, 149.2, 160.0, 186.8. HRMS (ESI) calcd for $C_{22}H_{18}NaO_3^+$ $[M+Na]^+$ 353.1148, found 353.1154.

Tolterodine[5]



(*S*)-Tolterodine. (97% yield, >99% ee). Colorless oil, 63.0 mg at 0.20 mmol scale. The ee of **(*S*)-Tolterodine** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 99.5/0.5, 210 nm, t_{major} = 9.2

min (*S*); $[\alpha]^{20}_{D}$ −27 (*c* 0.23, MeOH) for 99% ee. [lit.[5] value for the *S* enantiomer: $[\alpha]^{20}_{D}$ −27 (*c* 1.0, CH_3OH).] **(*R*)-Tolterodine**. (86% yield, 99% ee). Colorless oil, 55.9 mg at 0.20 mmol scale. The ee of **(*R*)-Tolterodine** was determined by HPLC analysis: (Chiralcel IC column, 1.0 mL/min, hexane/isopropanol = 99.5/0.5, 210 nm, t_{major} = 9.9 min (*R*), t_{minor} = 9.4 min (*S*); $[\alpha]^{20}_{D}$ +25 (*c* 0.11, MeOH) for 99% ee. [lit.[5] value for the *R* enantiomer: $[\alpha]^{20}_{D}$ +26 (*c* 1.0, CH_3OH)]. ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.12 (d, *J* = 6.7 Hz, 6H), 1.17 (d, *J* = 6.7 Hz, 6H), 2.10 – 2.15 (m, 1H), 2.16 (s, 3H), 2.37 – 2.48 (m, 2H), 2.69 – 2.80 (m, 1H), 3.18 – 3.34 (m, 2H), 4.53 (dd, *J* = 11.1, 3.9 Hz, 1H), 6.60 (s, 1H), 6.79 – 6.92 (m, 2H), 7.23 – 3.34 (m, 1H), 7.32 – 7.39 (m, 4H).

9. References

[1] Uson, R.; Oro, L. A.; Cabeza, J. A. *Inorg. Synth.* **1985**, *23*, 126.

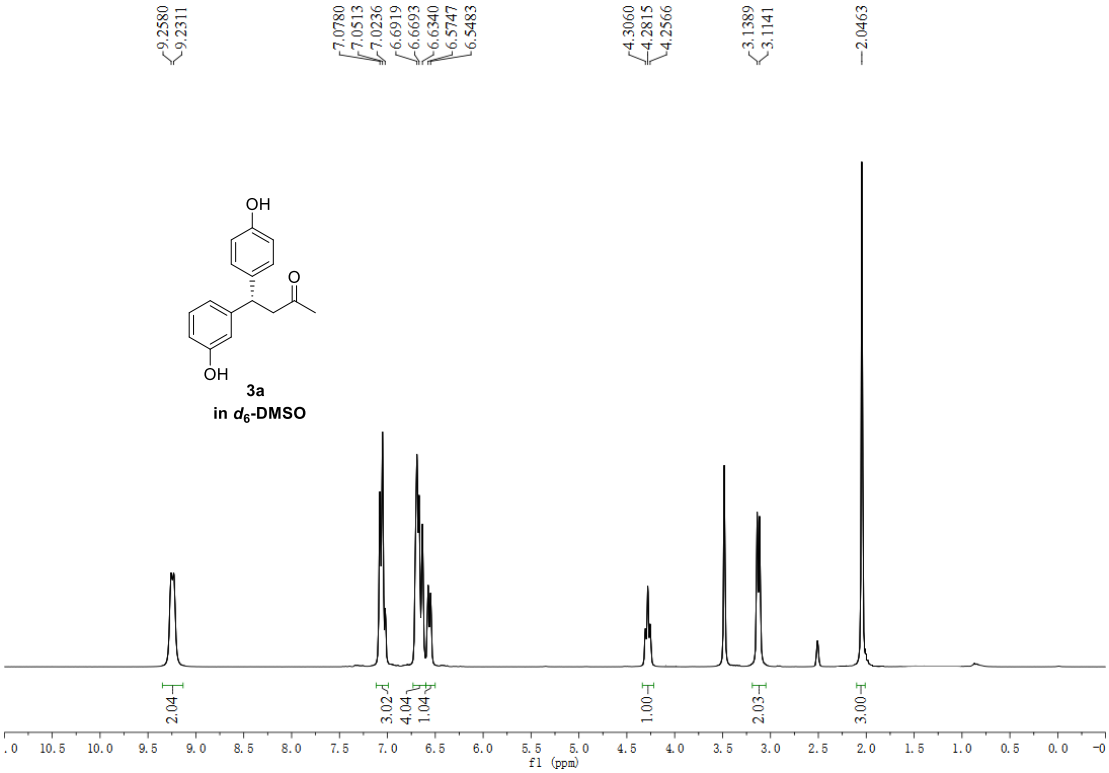
[2] (a) Nishimura, T.; Noishiki, A.; Tsui, G. C.; Hayashi, T. *J. Am. Chem. Soc.* **2012**, *134*, 5056. (b) Okamoto, K.; Hayashi, T.; Rawal, V. H. *Org. Lett.* **2008,** *10*, 4387. (c) Okamoto, K.; Hayashi, T.; Rawal, V. H. *Chem. Commun.* **2009**, 4815.

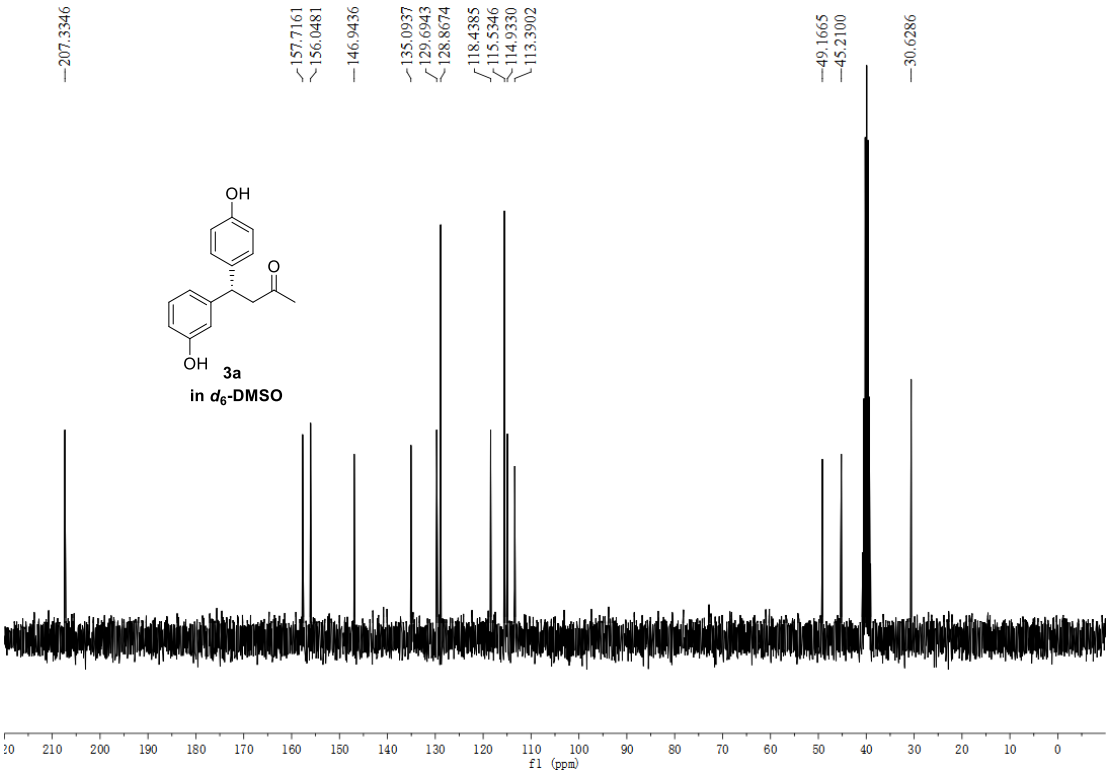
[3] Hatano, M.; Nishimura, T. *Angew. Chem. Int. Ed*. **2015**, *54*, 10949; *Angew.Chem.* **2015**, *127*, 11099.

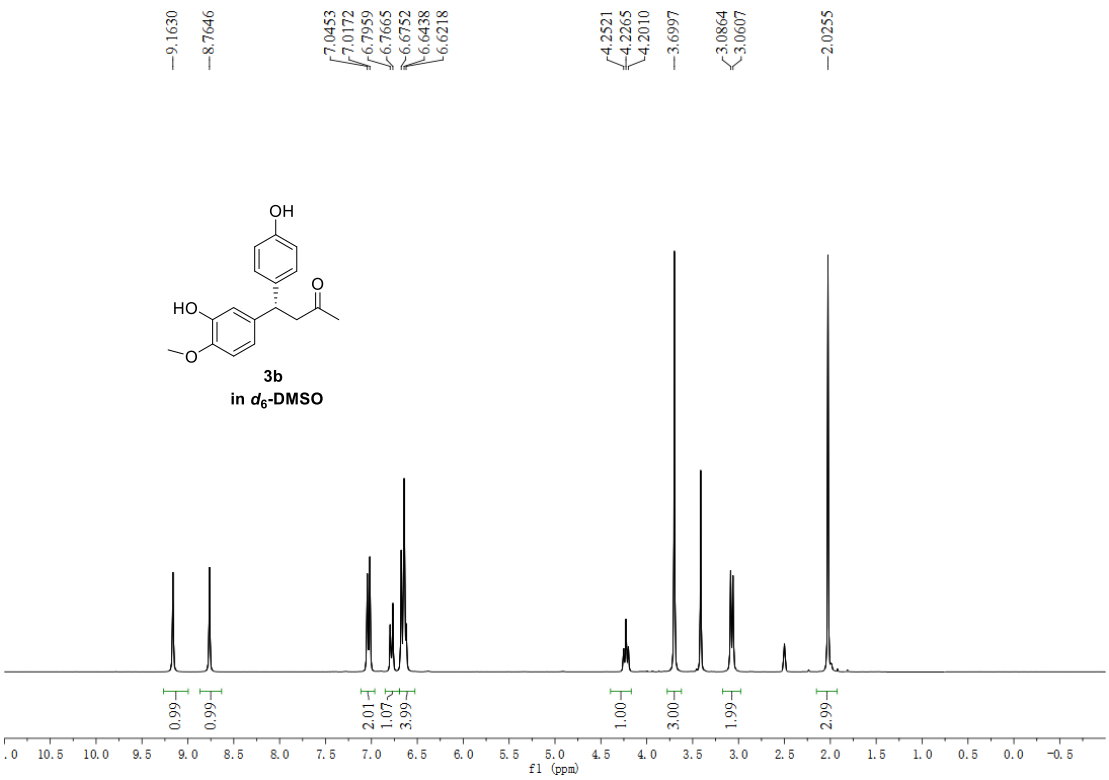
[4] (a) Tokunaga, N.; Otomaru, Y.; Okamoto, K.; Ueyama, K.; Shintani, R.; Hayashi, T. *J. Am. Chem. Soc.* **2004**, *126*, 13584. (b) Otomaru, Y.; Okamoto, K.; Shintani, R.; Hayashi, T. *J. Org. Chem.* **2005**, *70*, 2503. (c) Abele, S.; Inauen, R.; Spielvogel, D.; Moessner, C. *J. Org. Chem.* **2012**, *77*, 4765.

[5] Daniela, B.; Airton, S.; Jason, T.; Carlos, C. *Org. Lett.* **2012,** *14*, 6036.

10.NMR Spectra



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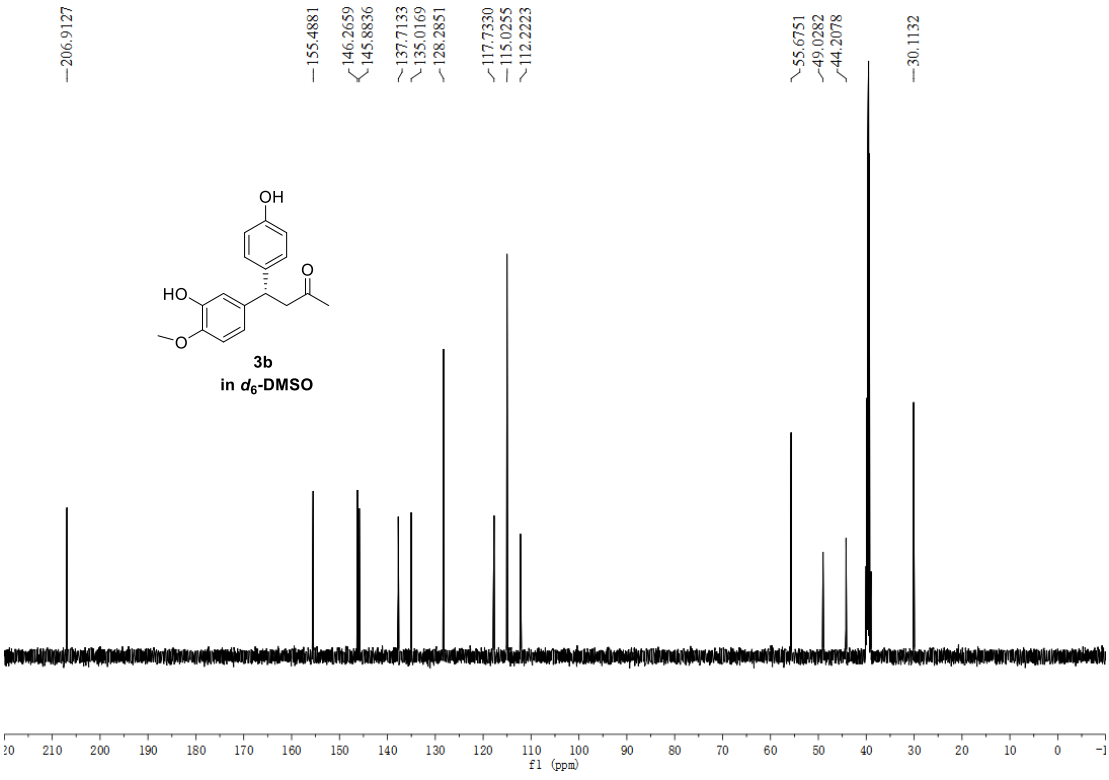
4.2265
4.2010
3.6997
3.0864
3.0607
2.0255
OH
HO
O
O
3b
in d_6-DMSO
0.99
0.99
2.01
1.07
3.99
1.00
3.00
1.99
2.99
f1 (ppm)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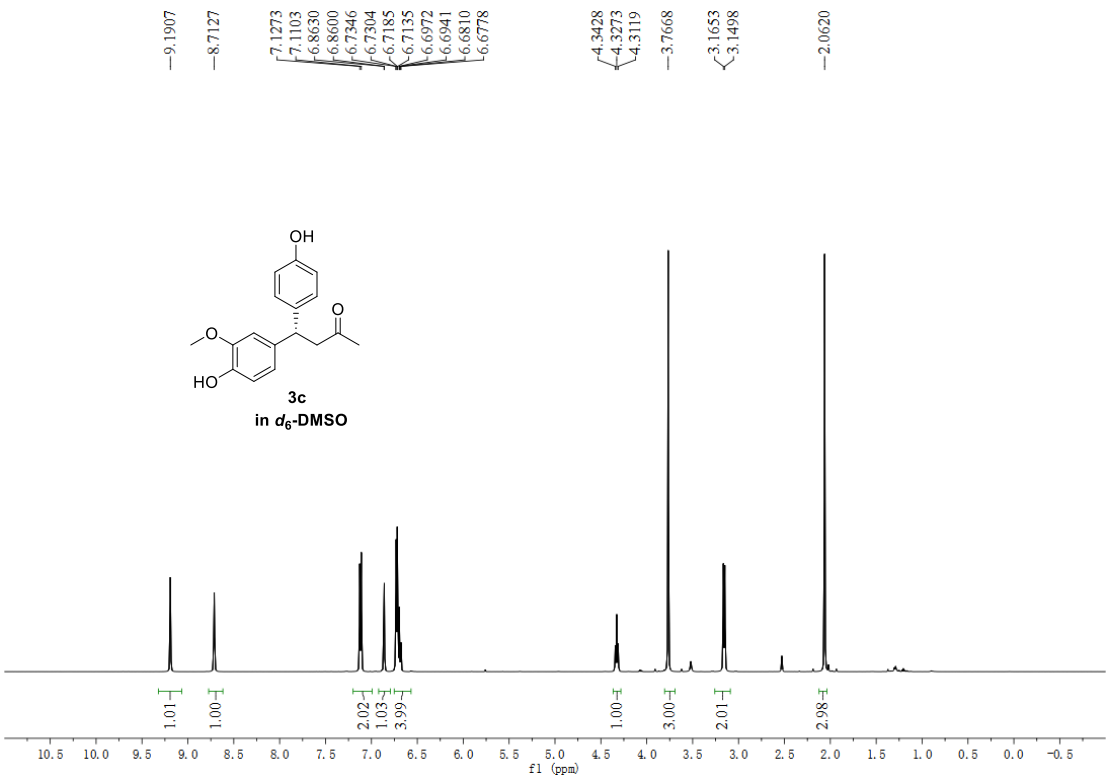
OH
HO
O
O
3b
in d_6-DMSO
f1 (ppm)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6.6810
6.6778
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4.3273
4.3119
3.7668
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3.1498
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O
O
HO
3c
in d_6-DMSO
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1.00
3.00
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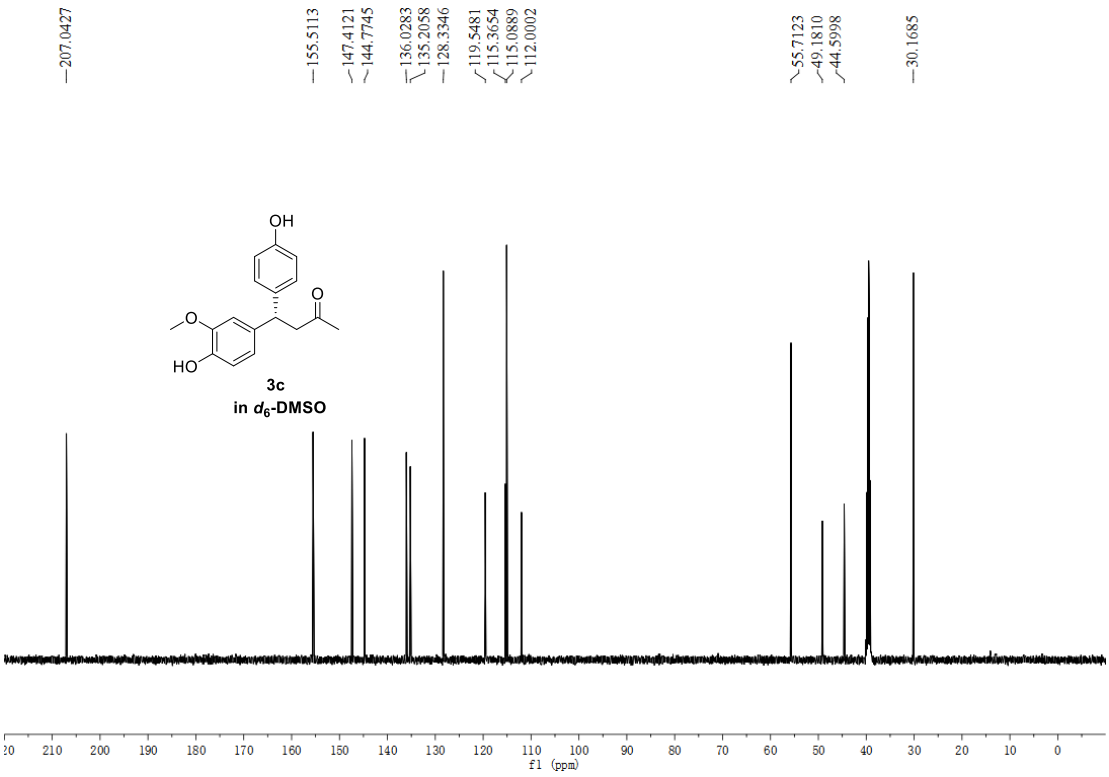
2.98
f1 (ppm)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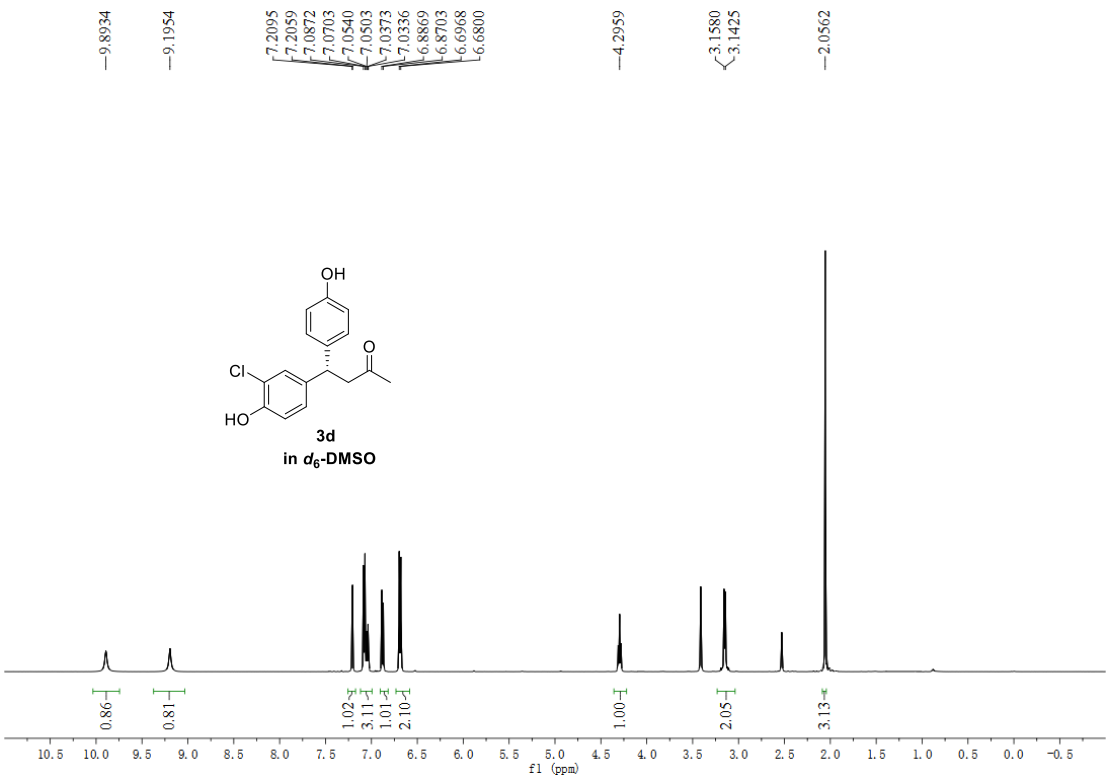
O
O
HO
3c
in d_6-DMSO
f1 (ppm)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Cl
HO
O
3d
in d_6-DMSO
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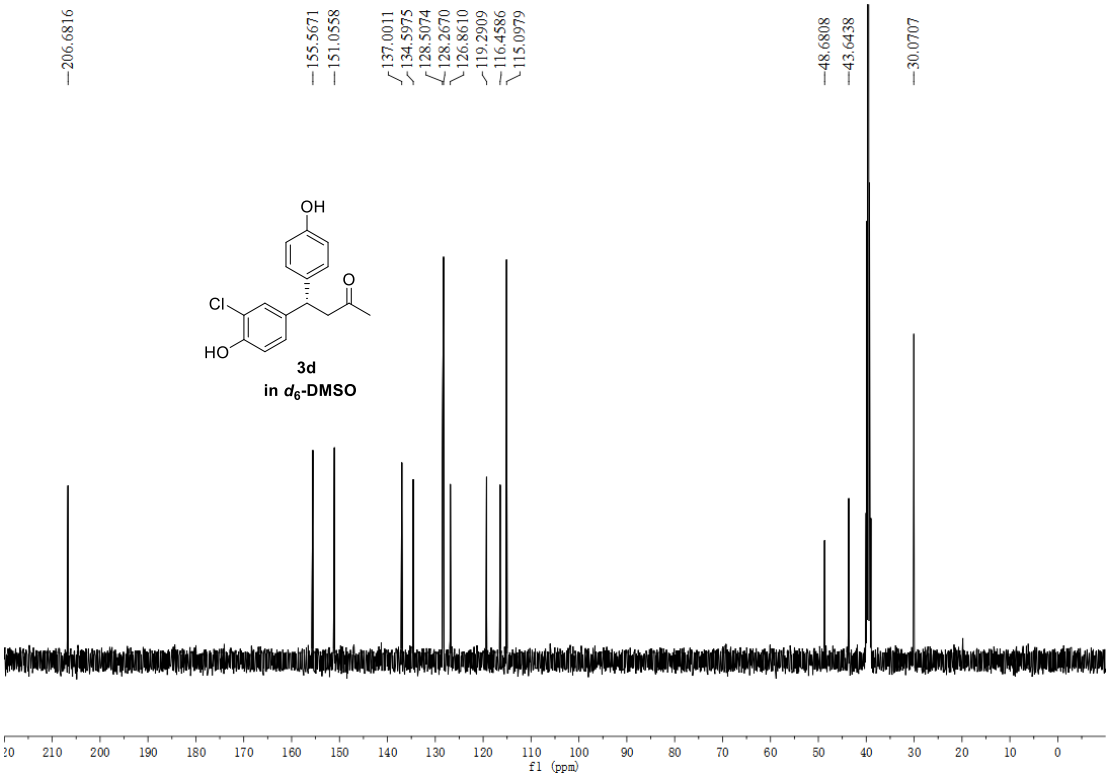
3.13
f1 (ppm)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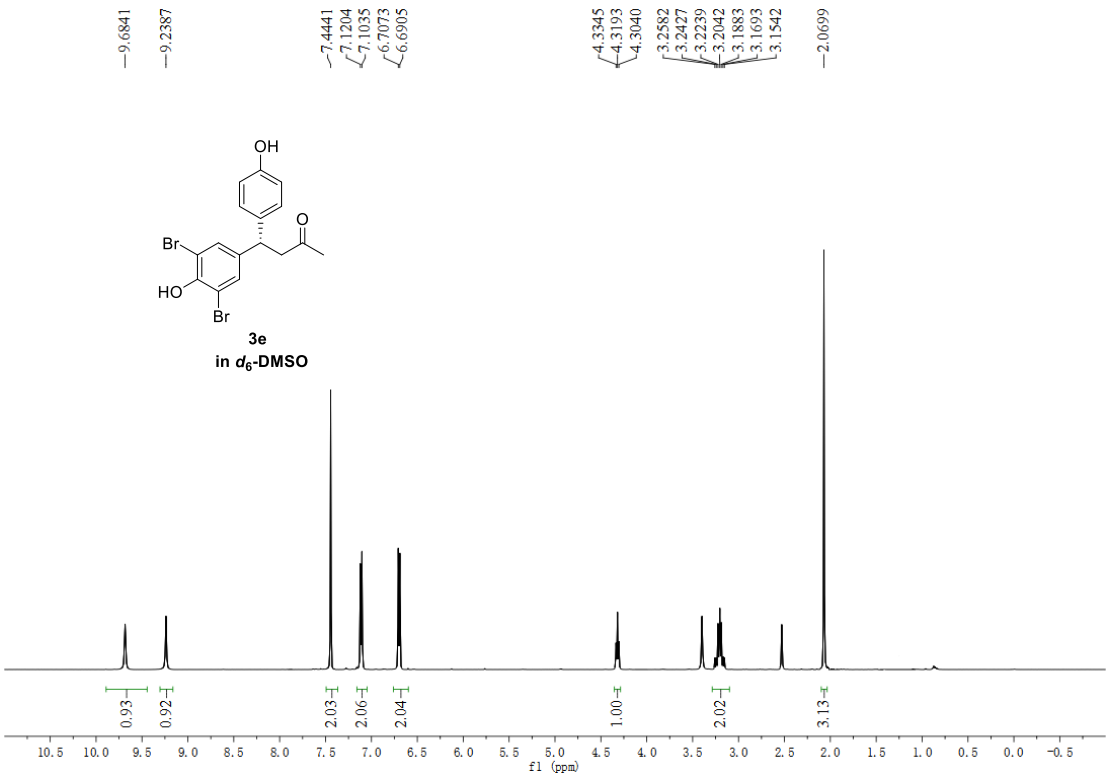
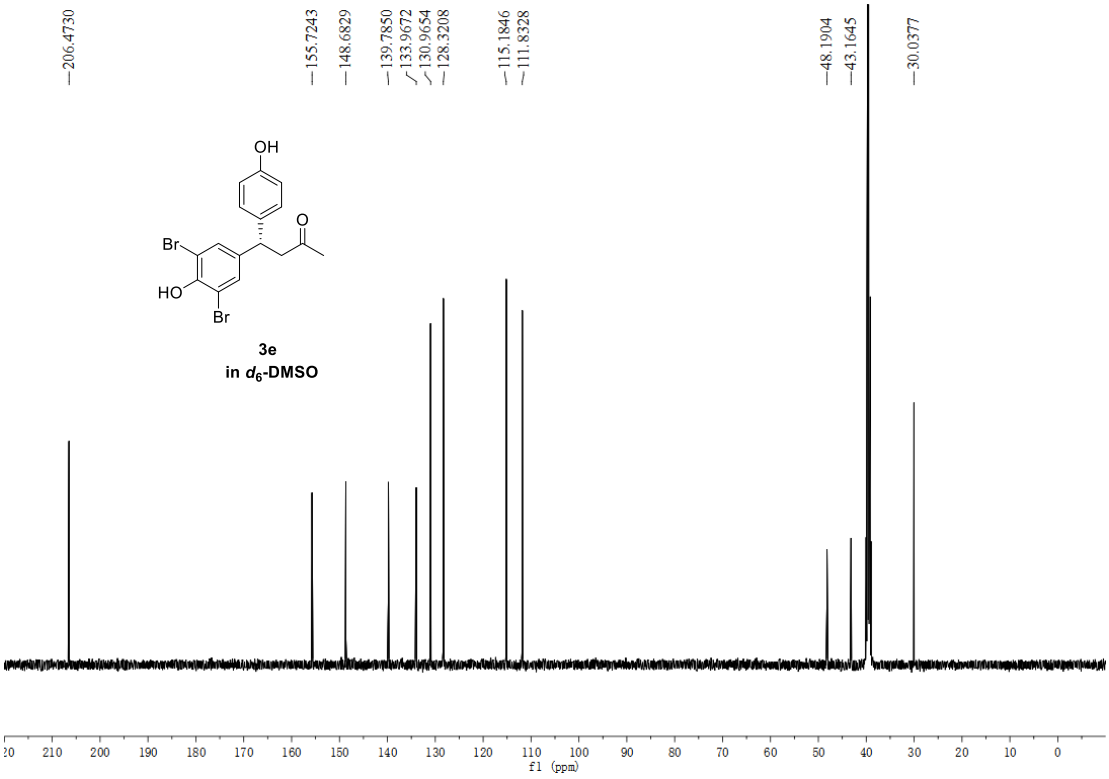
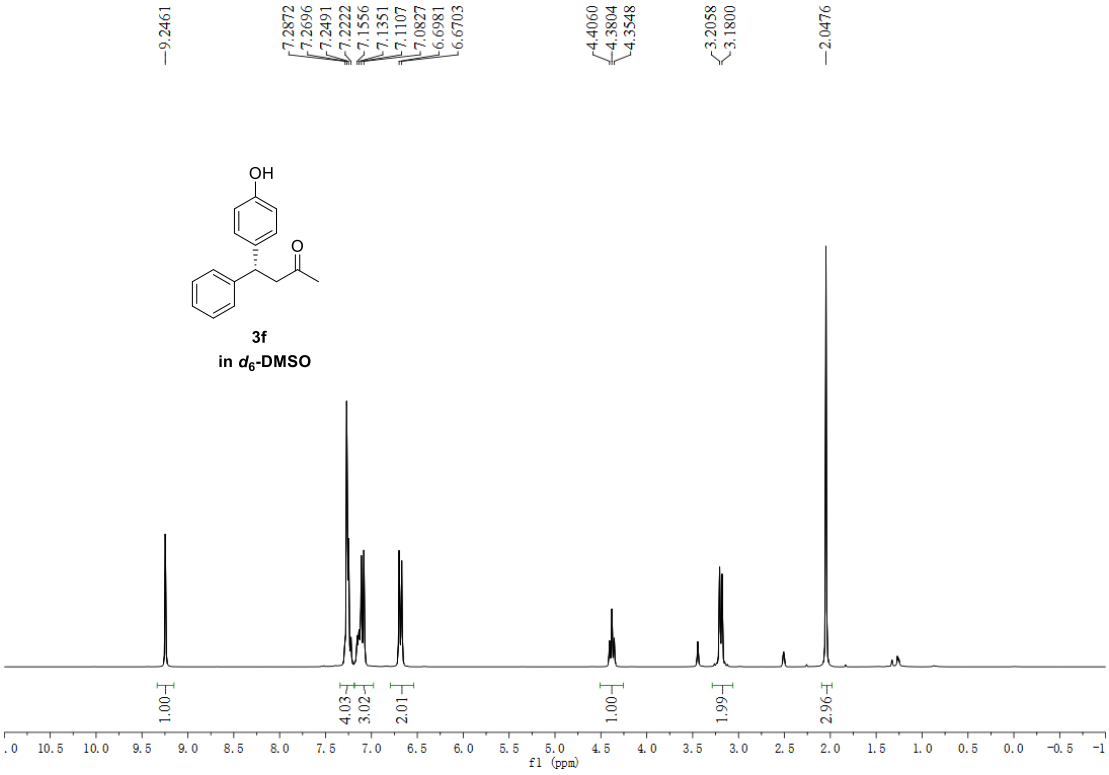
HO
O
3d
in d_6-DMSO
f1 (ppm)



3e
in d_6-DMSO



3e
in d_6-DMSO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3.1800
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O
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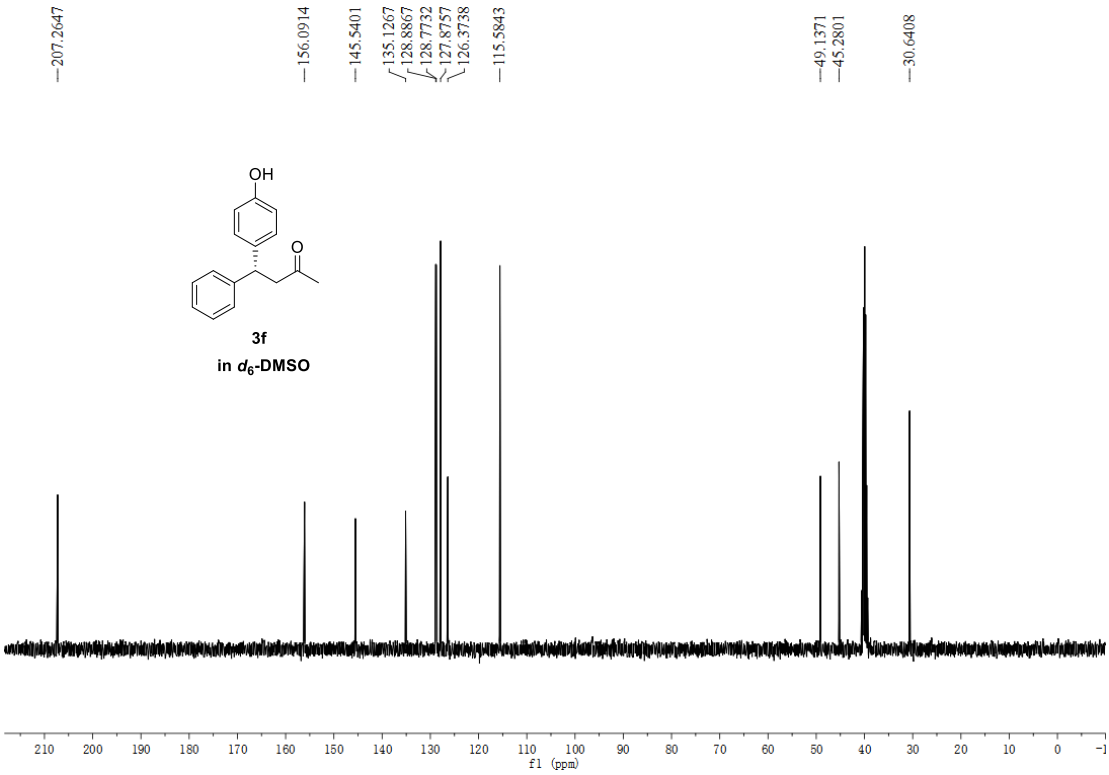
f1 (ppm)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OH
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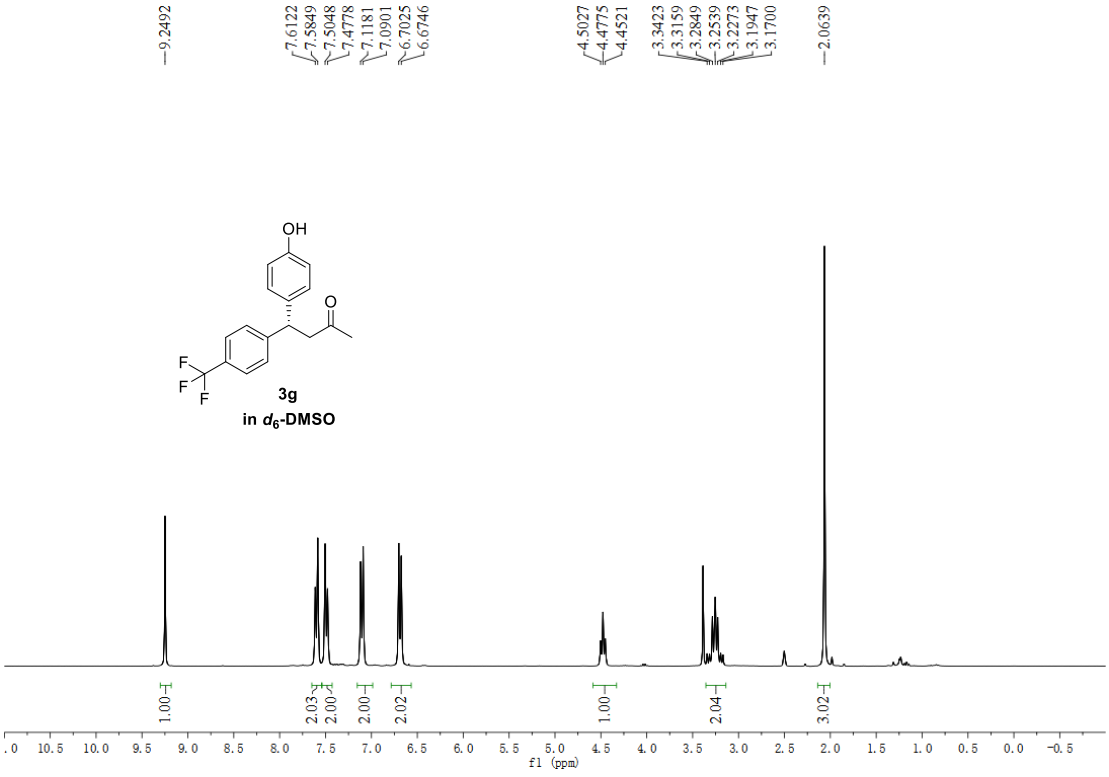
in d_6-DMSO
f1 (ppm)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3.2849
3.2539
3.2273
3.1947
3.1700
2.0639
OH
O
F
F
F
3g
in d_6-DMSO
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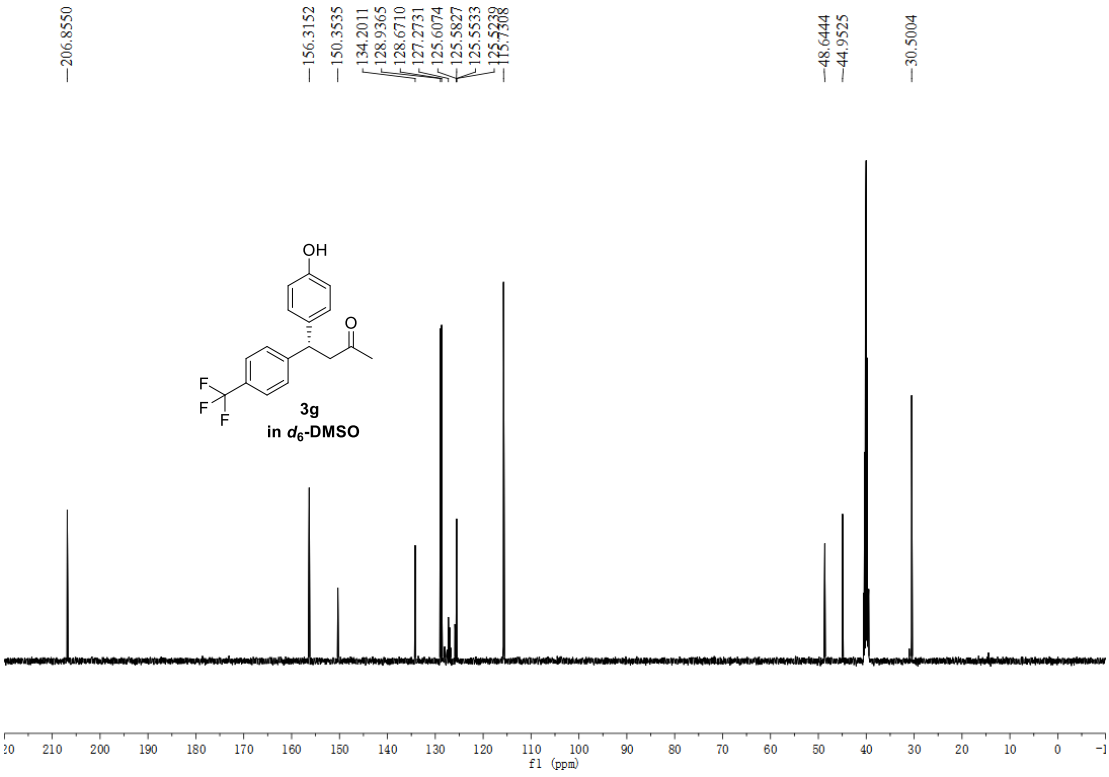
2.03
2.00
2.00
2.02
1.00
2.04
3.02
f1 (ppm)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128.6710
127.2731
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125.5827
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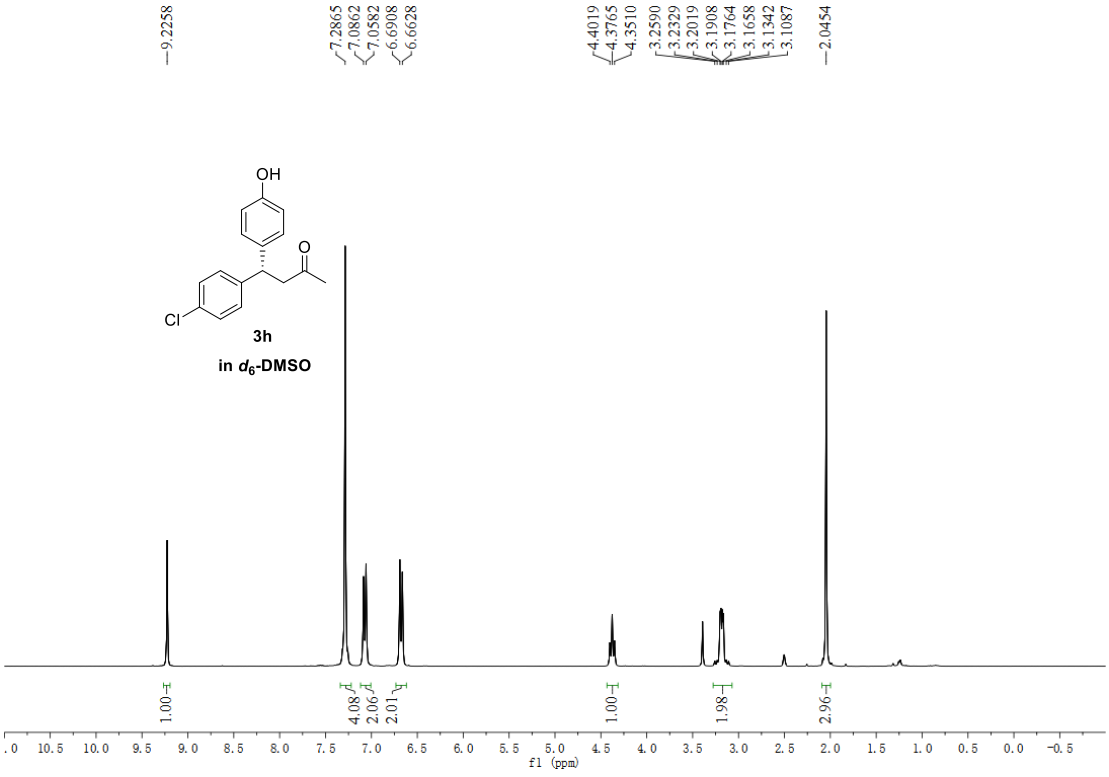
44.9525
30.5004
OH
O
F
F
F
3g
in d_6-DMSO
f1 (ppm)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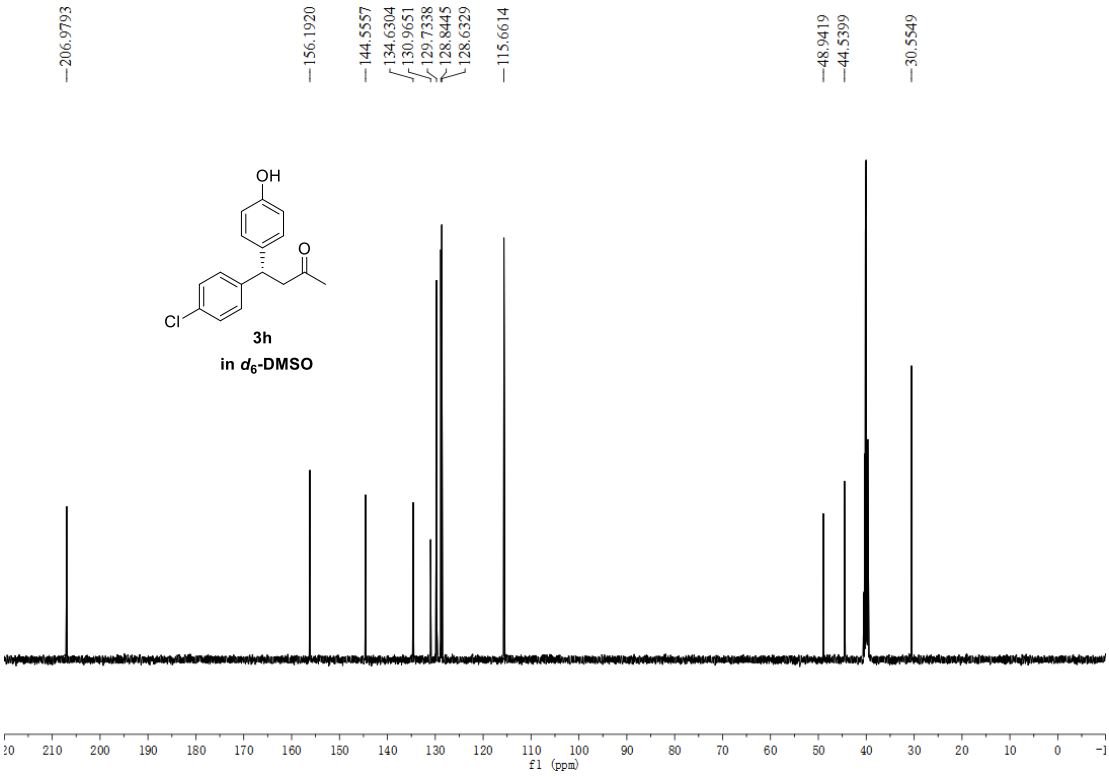
3.2329
3.2019
3.1908
3.1764
3.1658
3.1342
3.1087
2.0454
OH
O
Cl
3h
in d_6-DMSO
1.00
4.08
2.06
2.01
1.00
1.98
2.96
f1 (ppm)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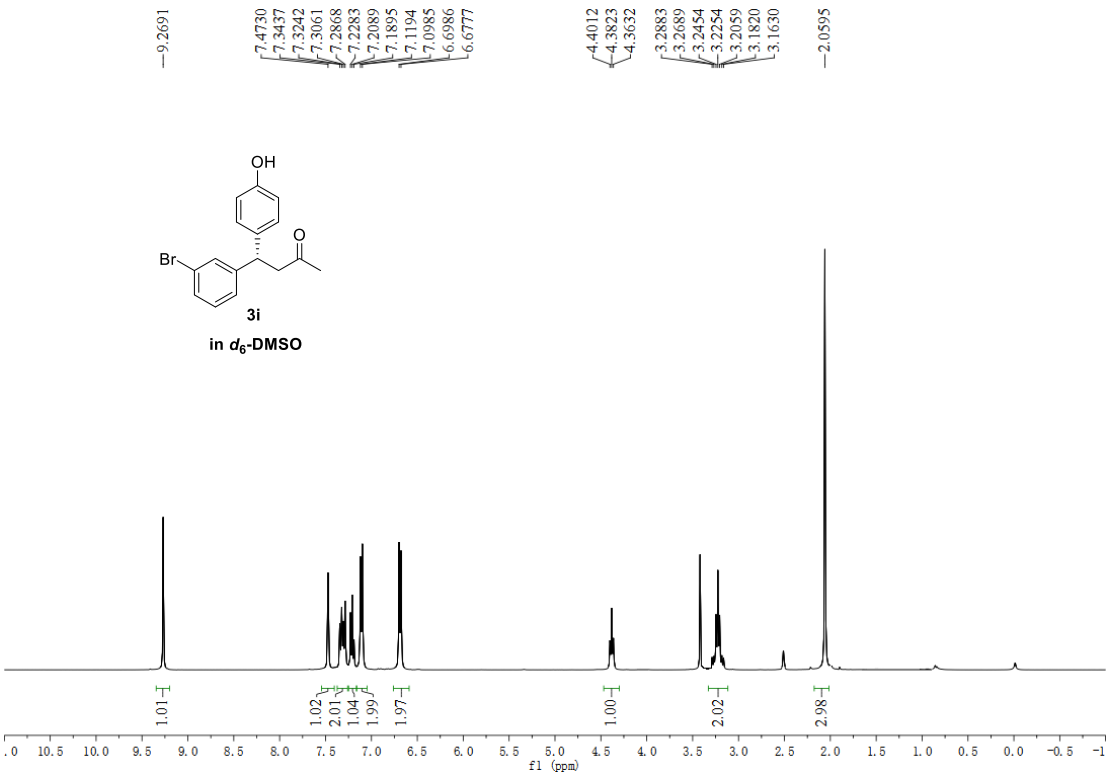
30.5549
OH
O
Cl
3h
in d_6-DMSO
f1 (ppm)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7.1895
7.1194
7.0985
6.6986
6.6777
4.4012
4.3823
4.3632
3.2883
3.2689
3.2454
3.2254
3.2059
3.1820
3.1630
2.0595
OH
O
Br
3i
in d_6-DMSO
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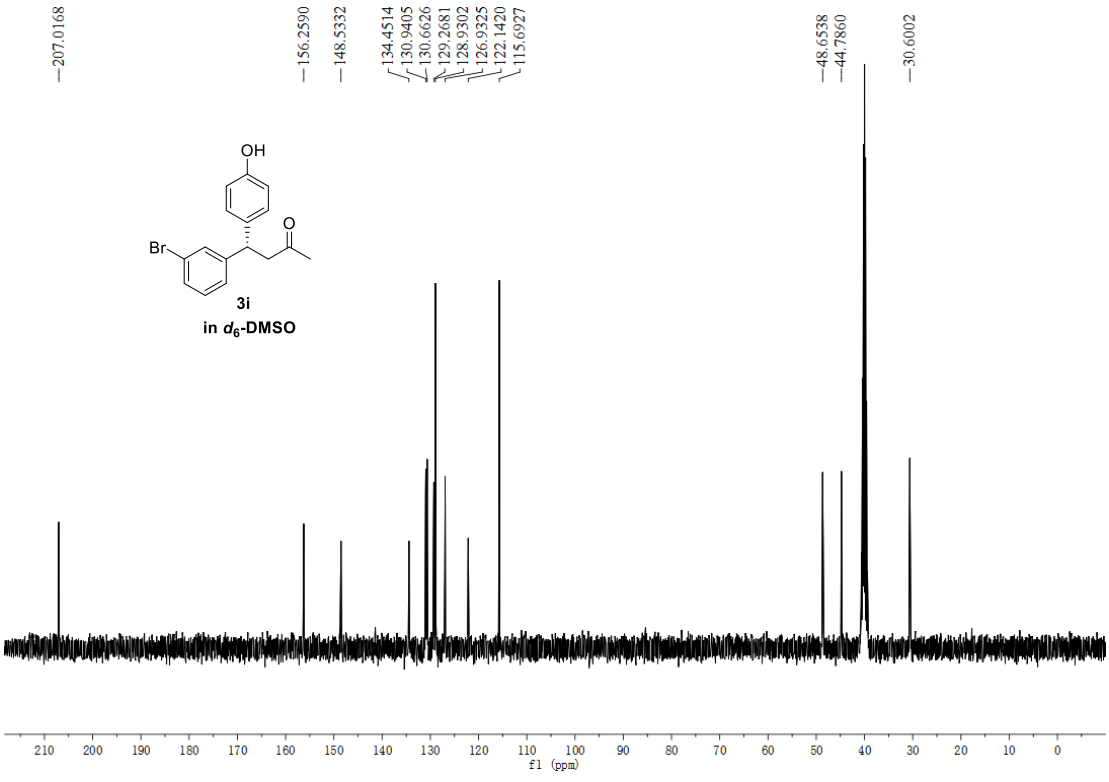
1.02
2.01
1.04
1.99
1.97
1.00
2.02
2.98
f1 (ppm)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129.2681
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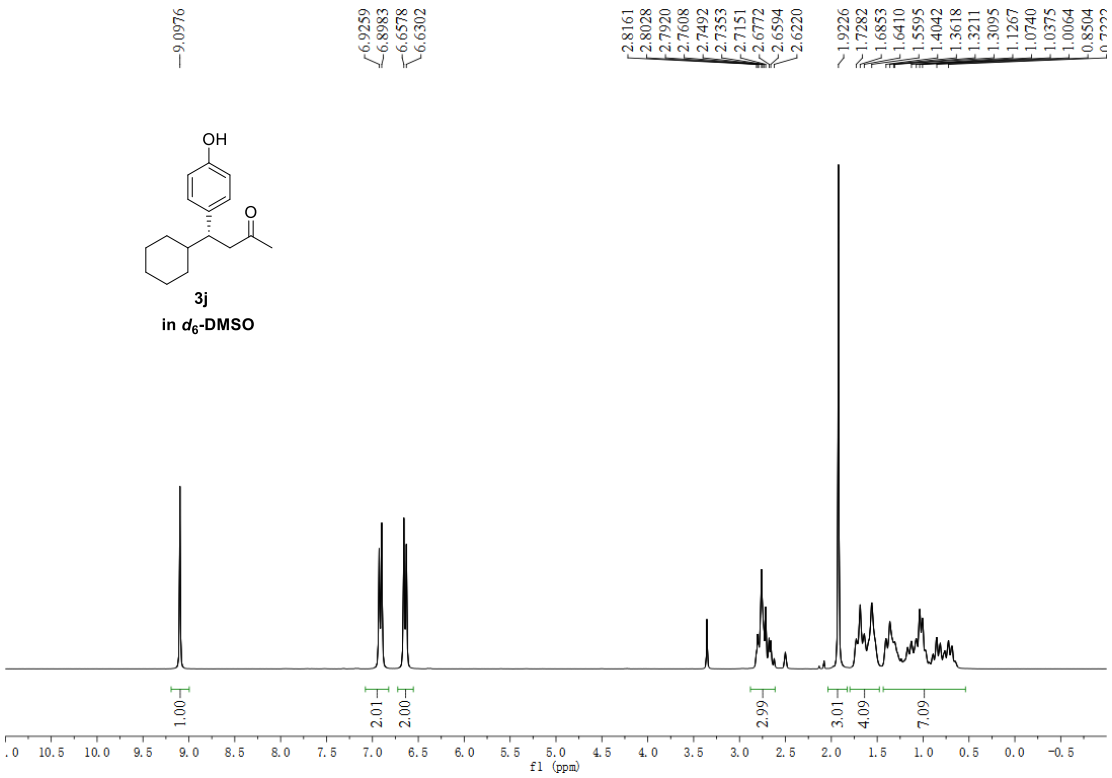
48.6538
44.7860
30.6002
OH
O
Br
3i
in d_6-DMSO
f1 (ppm)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6.8983
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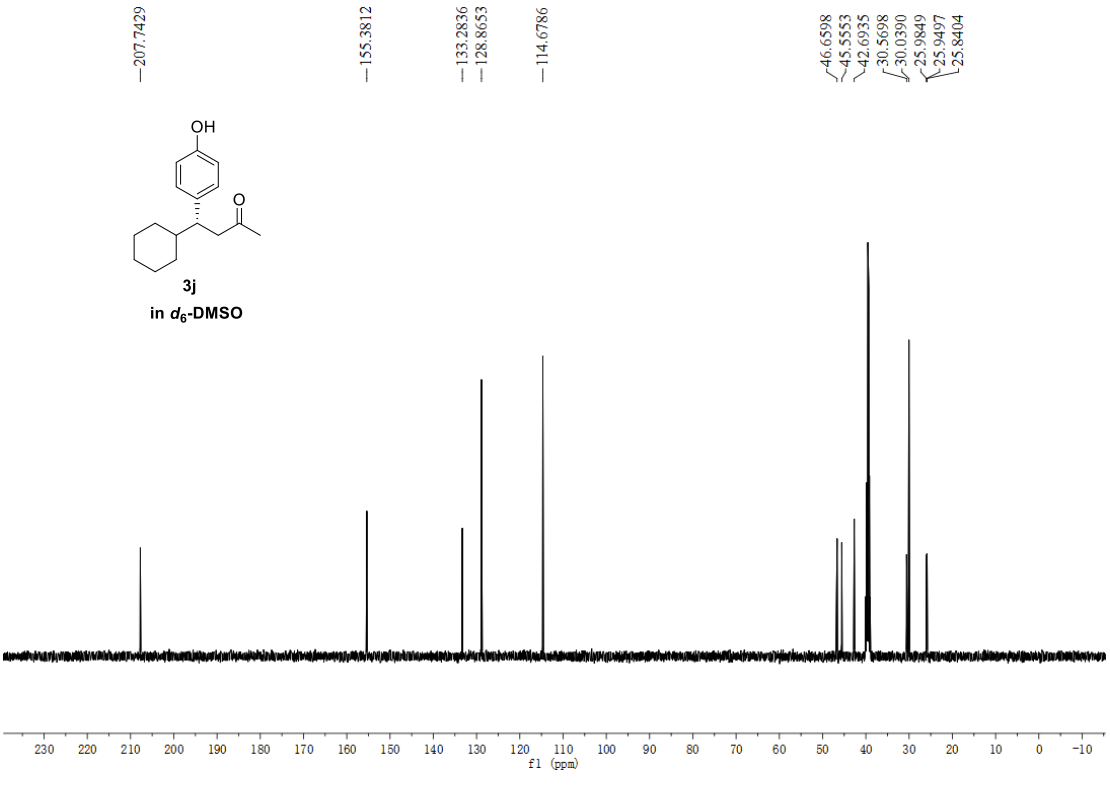
6.6302
2.8161
2.8028
2.7920
2.7608
2.7492
2.7353
2.7151
2.6772
2.6594
2.6220
1.9226
1.7282
1.6853
1.6410
1.5595
1.4042
1.3618
1.3211
1.3095
1.1267
1.0740
1.0375
1.0064
0.8504
OH
O
3j
in d_6-DMSO
1.00
2.01
2.00
2.99
3.01
4.09
7.09
f1 (ppm)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45.5553
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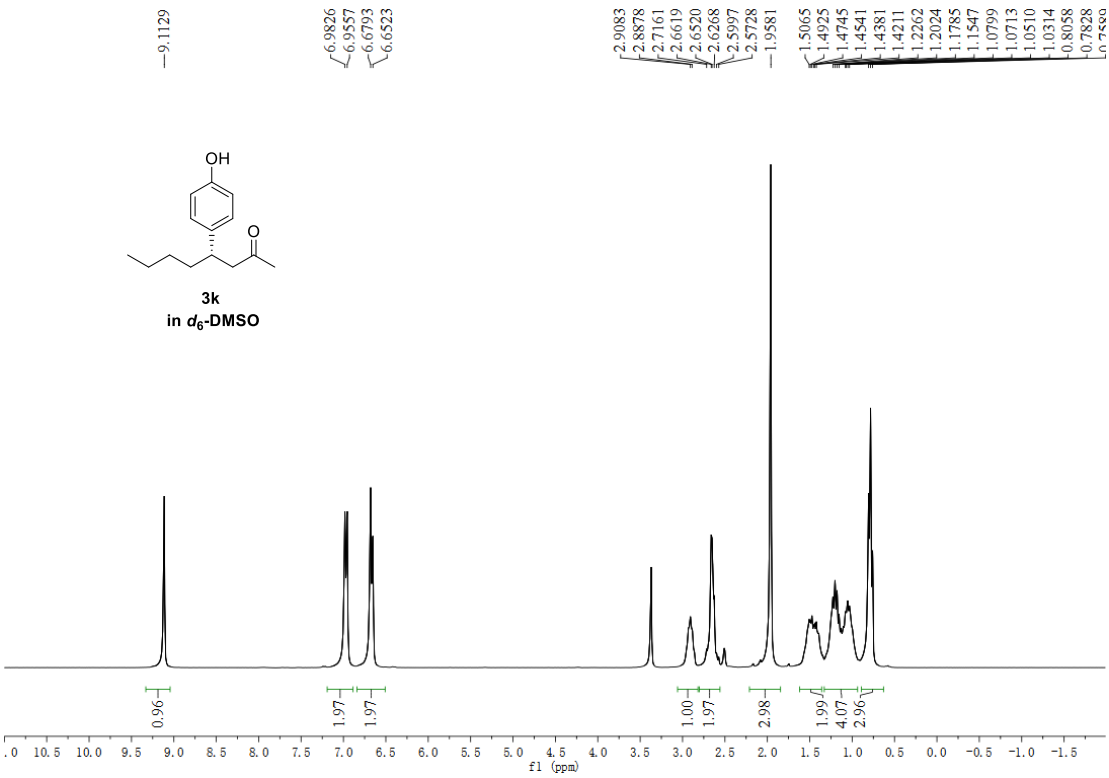
30.0390
25.9849
25.9497
25.8404
OH
O
3j
in d_6-DMSO
f1 (ppm)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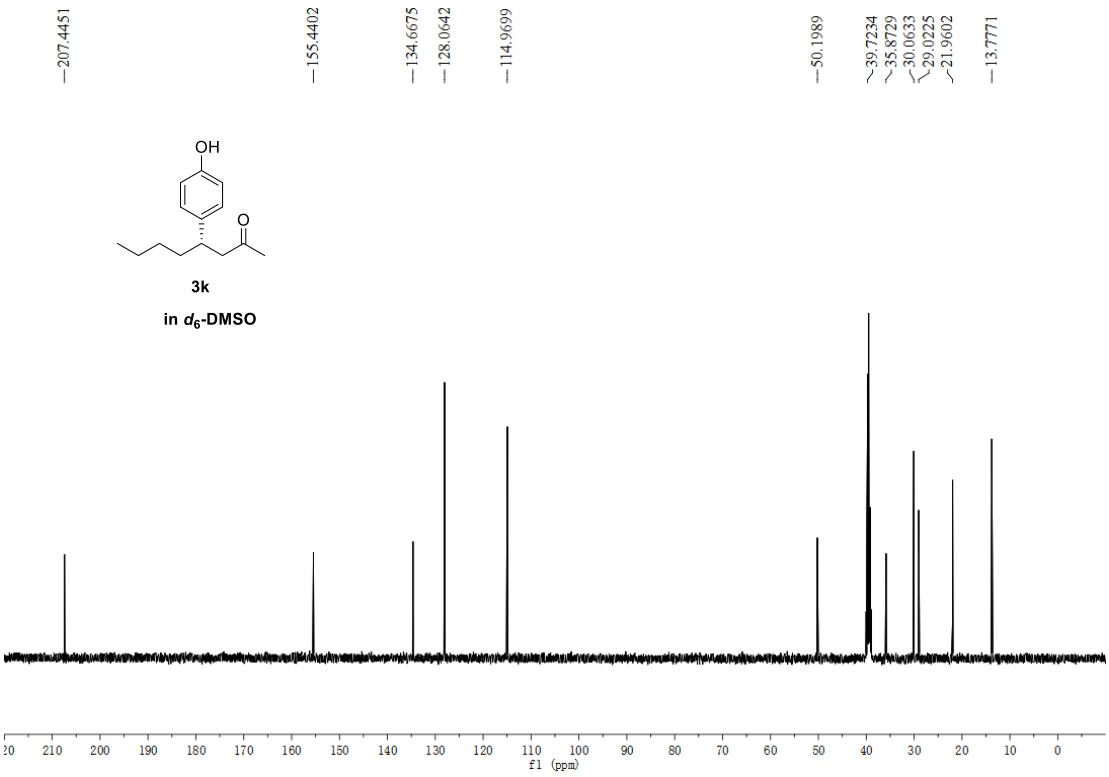
6.9557
6.6793
6.6523
2.9083
2.8878
2.7161
2.6619
2.6520
2.6268
2.5997
2.5728
1.9581
1.5065
1.4925
1.4745
1.4541
1.4381
1.4211
1.2262
1.2024
1.1785
1.1547
1.0799
1.0713
1.0510
1.0314
0.8058
0.7828
OH
O
3k
in d_6-DMSO
0.96
1.97
1.97
1.00
1.97
2.98
1.99
4.07
2.96
f1 (ppm)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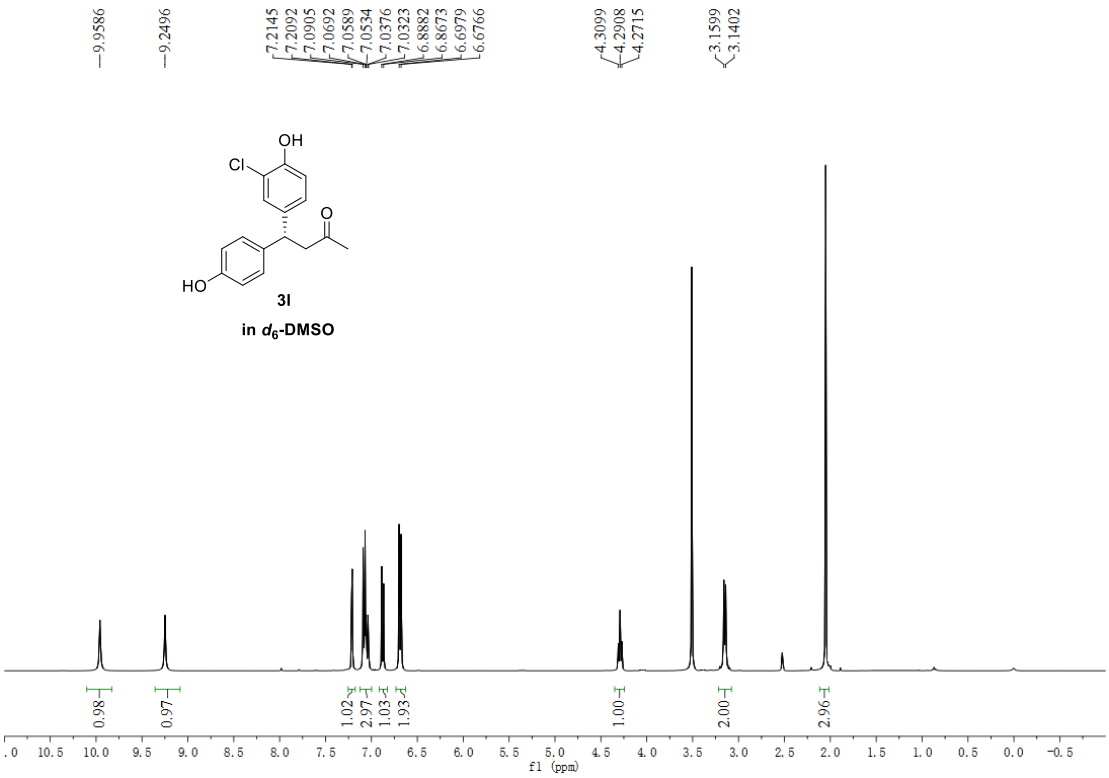
134.6675
128.0642
114.9699
50.1989
39.7234
35.8729
30.0633
29.0225
21.9602
13.7771
OH
O
3k
in d_6-DMSO
f1 (ppm)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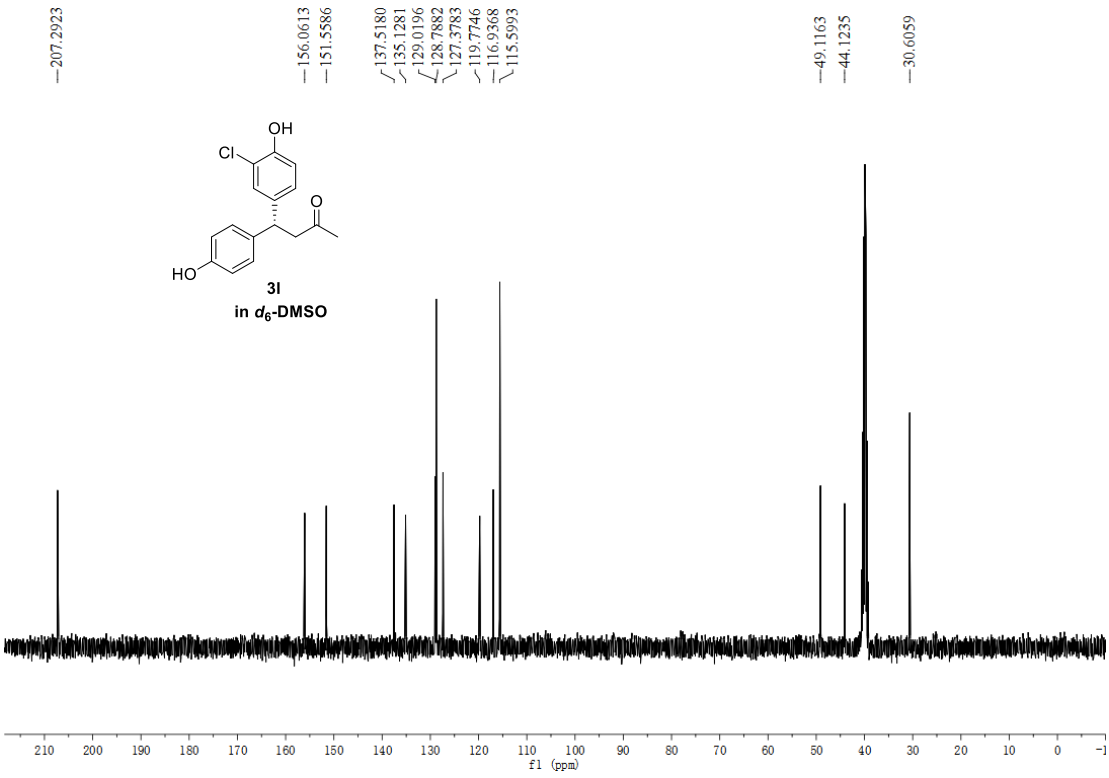
9.2496
7.2145
7.2092
7.0905
7.0692
7.0589
7.0534
7.0376
7.0323
6.8882
6.8673
6.6979
6.6766
4.3099
4.2908
4.2715
3.1599
3.1402
OH
Cl
O
HO
3l
in d_6-DMSO
0.98
0.97
1.02
2.97
1.03
1.93
1.00
2.00
2.96
f1 (ppm)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128.7882
127.3783
119.7746
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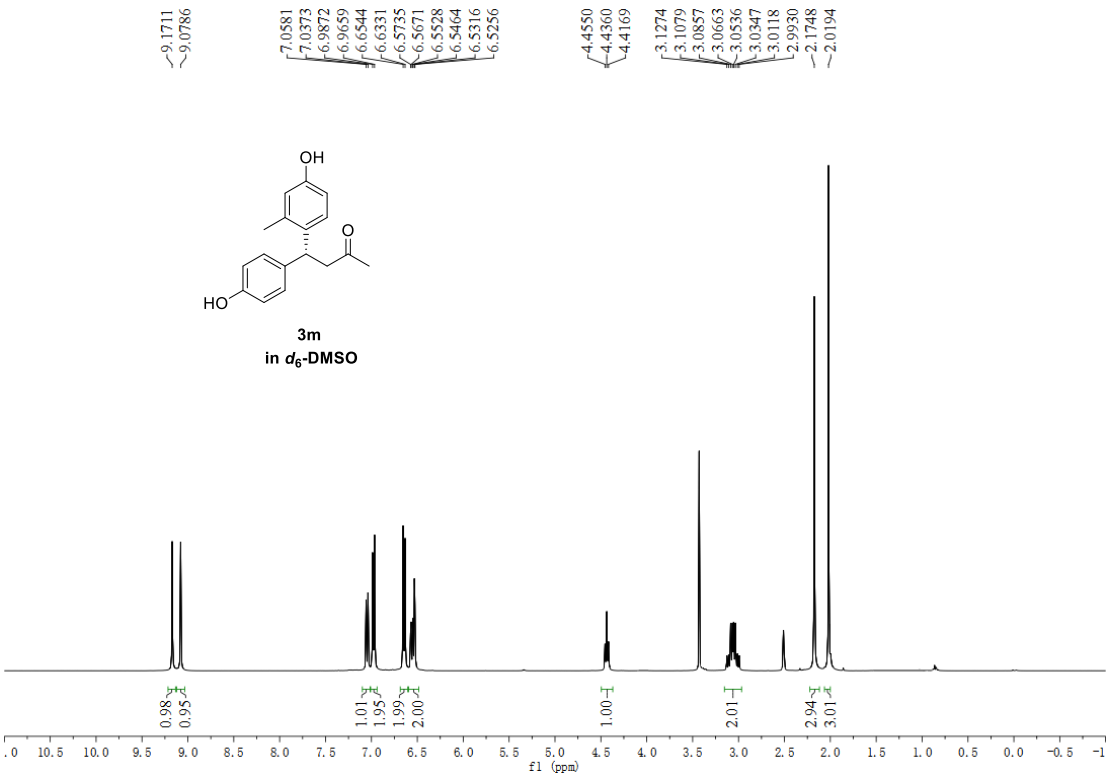
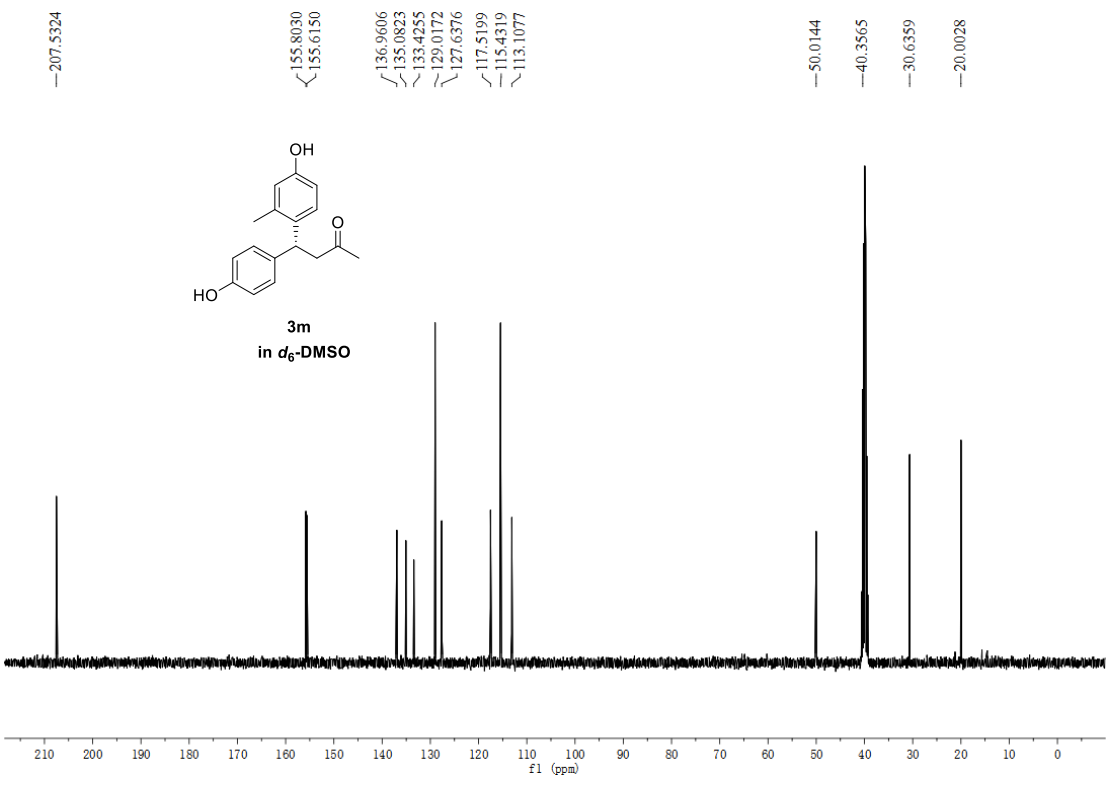
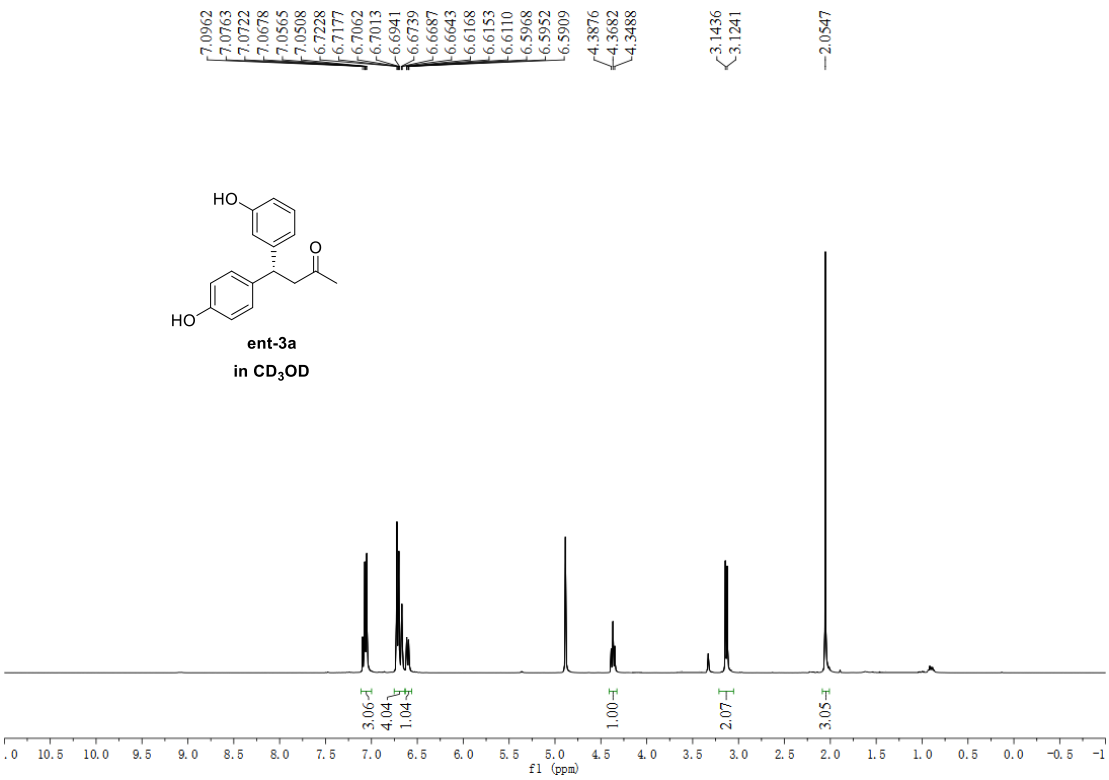
115.5993
49.1163
44.1235
30.6059
OH
Cl
O
HO
3l
in d_6-DMSO
f1 (ppm)



3m
in d_6-DMSO



3m
in d_6-DMSO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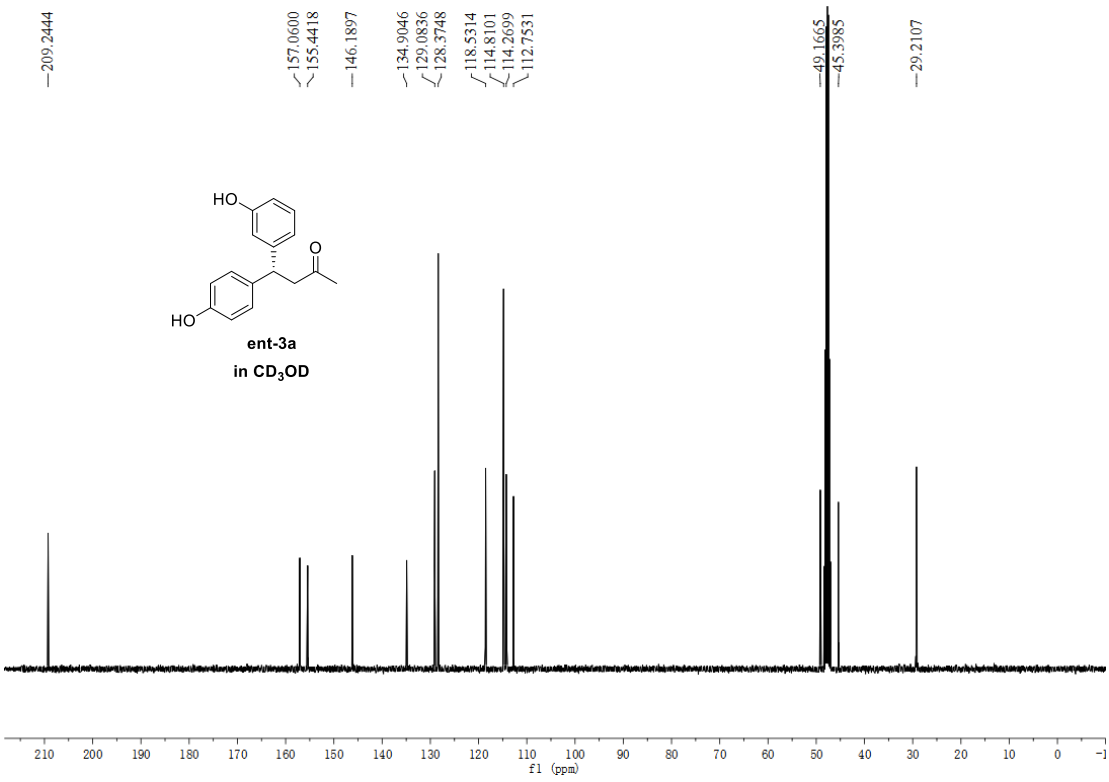
6.7013
6.6941
6.6739
6.6687
6.6643
6.6168
6.6153
6.6110
6.5968
6.5952
6.5909
4.3876
4.3682
4.3488
3.1436
3.1241
2.0547
HO
O
HO
ent-3a
in CD3OD
3.06
4.04
1.04
1.00
2.07
3.05
f1 (ppm)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128.3748
118.5314
114.8101
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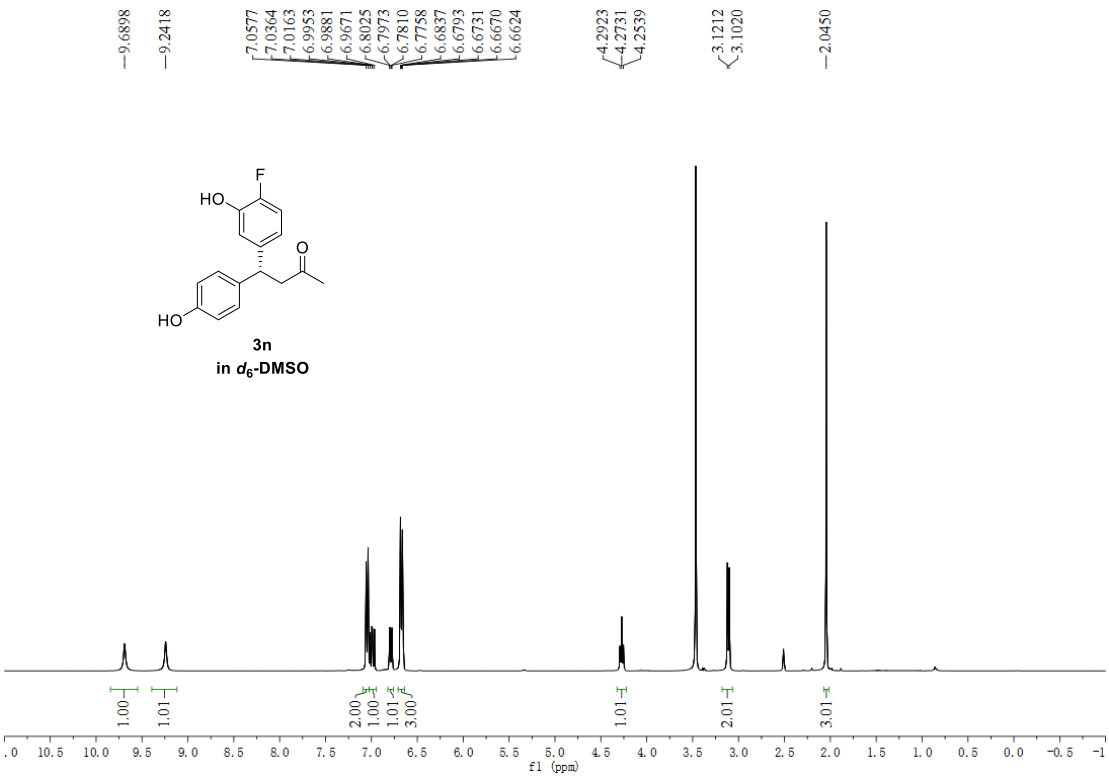
49.1665
45.3985
29.2107
HO
O
HO
ent-3a
in CD3OD
f1 (ppm)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7.0163
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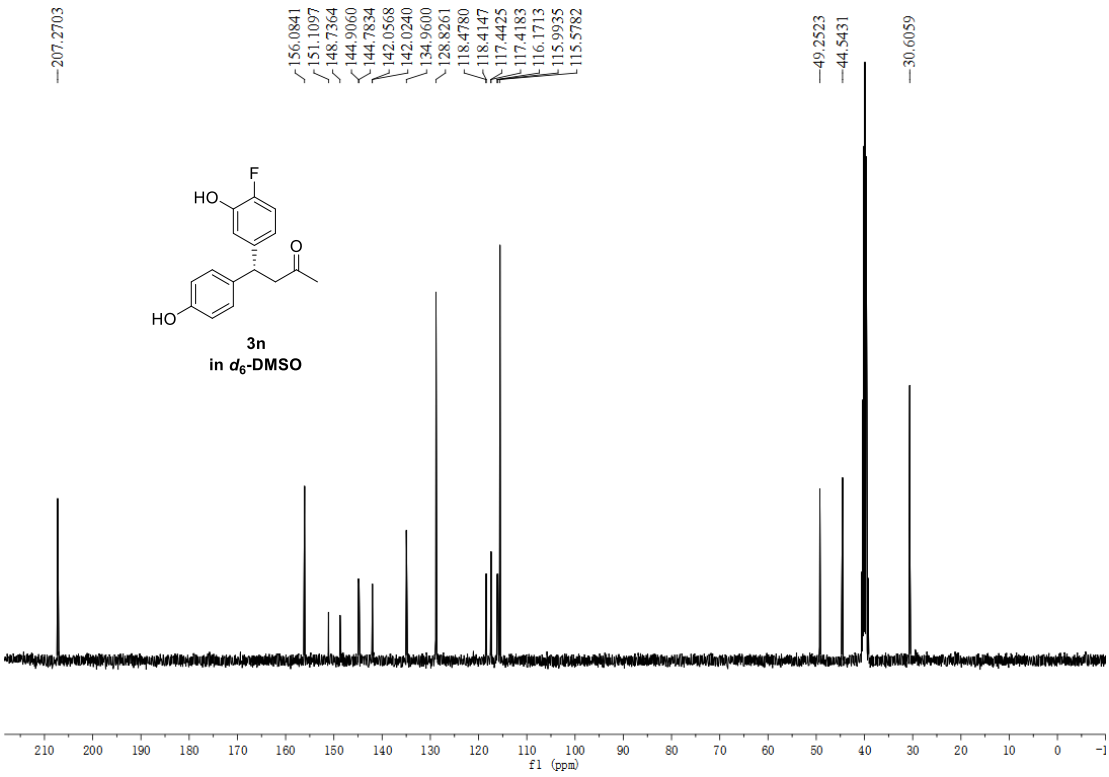
6.9881
6.9671
6.8025
6.7973
6.7810
6.7758
6.6837
6.6793
6.6731
6.6670
6.6624
4.2923
4.2731
4.2539
3.1212
3.1020
2.0450
F
HO
O
HO
3n
in d_6-DMSO
1.00
1.01
2.00
1.00
1.01
3.00
1.01
2.01
3.01
f1 (ppm)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142.0240
134.9600
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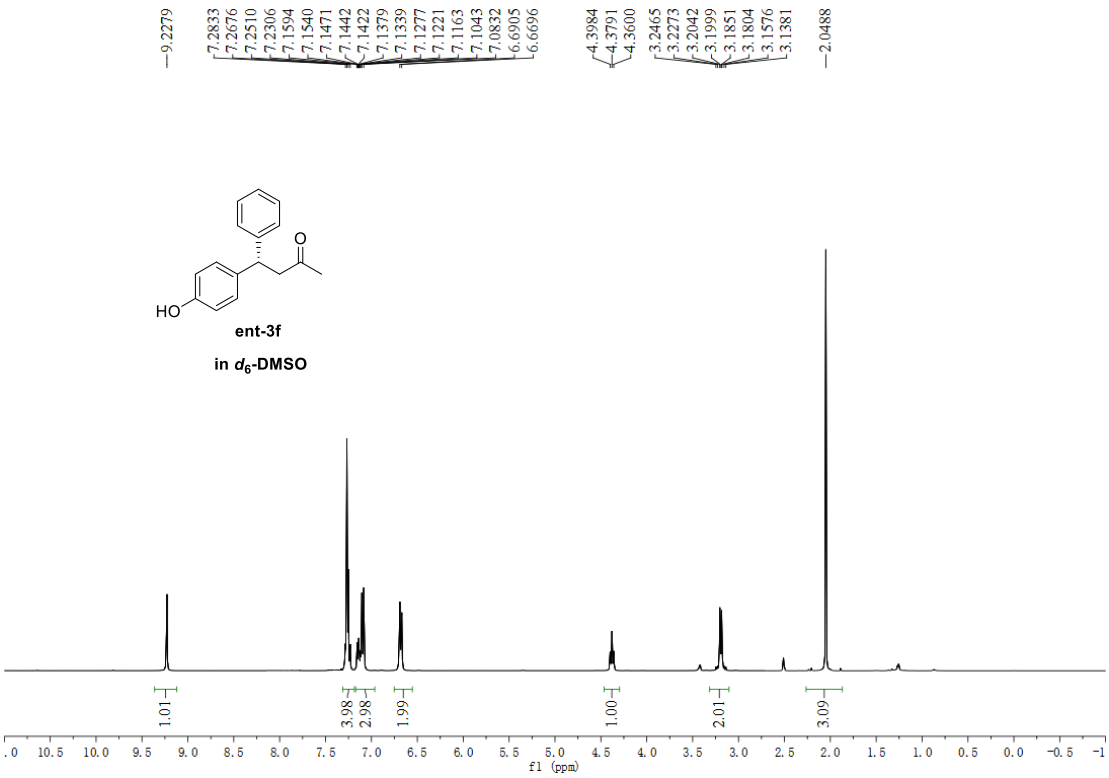
118.4780
118.4147
117.4425
117.4183
116.1713
115.9935
115.5782
49.2523
44.5431
30.6059
F
HO
O
HO
3n
in d_6-DMSO
f1 (ppm)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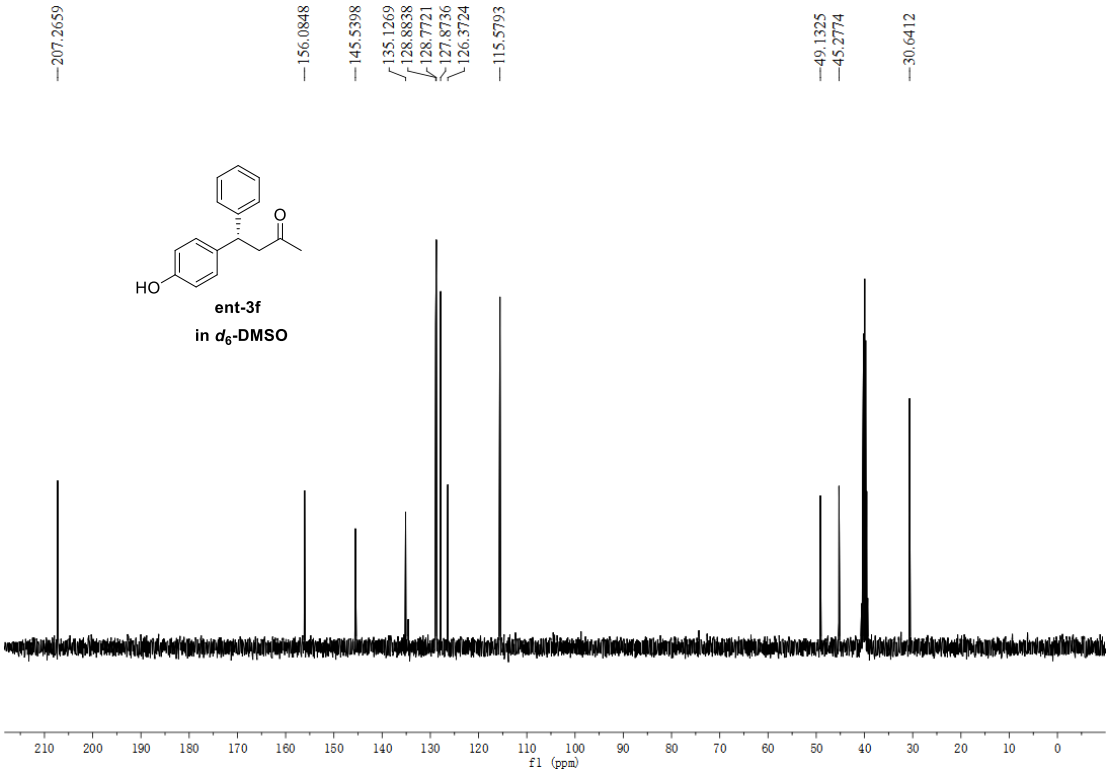
7.1379
7.1339
7.1277
7.1221
7.1163
7.1043
7.0832
6.6905
6.6696
4.3984
4.3791
4.3600
3.2465
3.2273
3.2042
3.1999
3.1851
3.1804
3.1576
3.1381
2.0488
HO
O
ent-3f
in d_6-DMSO
1.01
3.98
2.98
1.99
1.00
2.01
3.09
f1 (ppm)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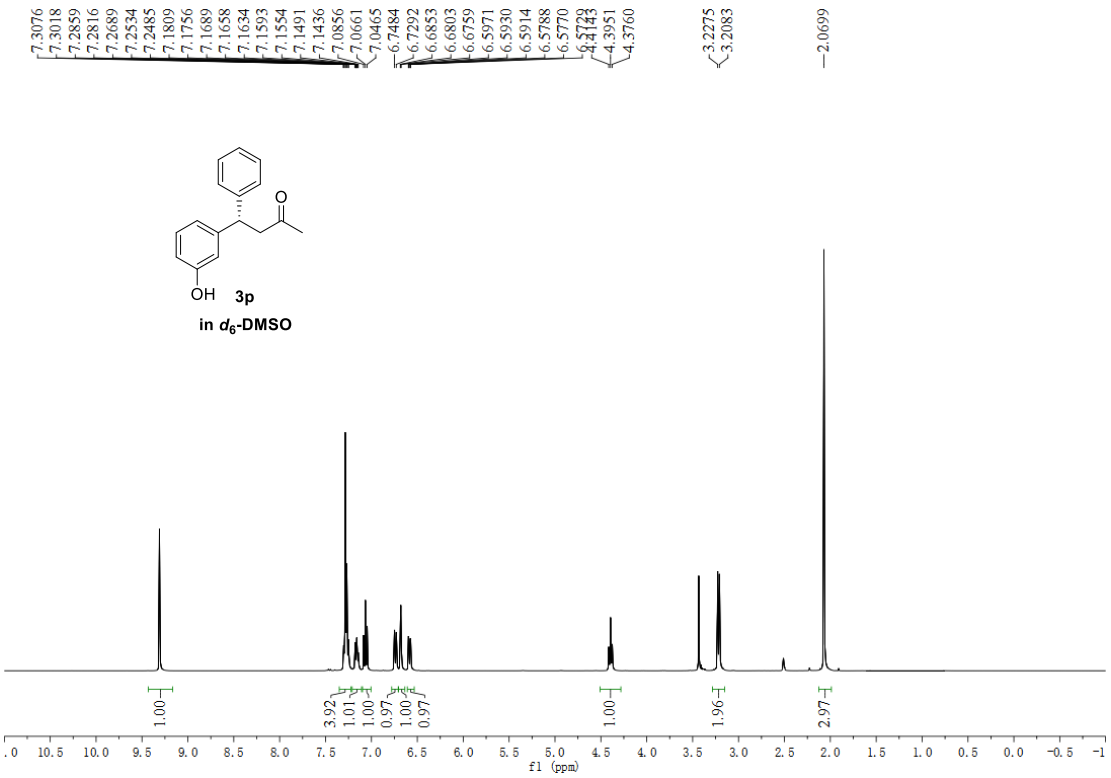
HO
O
ent-3f
in d_6-DMSO
f1 (ppm)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7.1634
7.1593
7.1554
7.1491
7.1436
7.0856
7.0661
7.0465
6.7484
6.7292
6.6853
6.6803
6.6759
6.5971
6.5930
6.5914
6.5788
6.5770
6.5729
4.4143
4.3951
4.3760
3.2275
3.2083
2.0699
O
OH
3p
in d_6-DMSO
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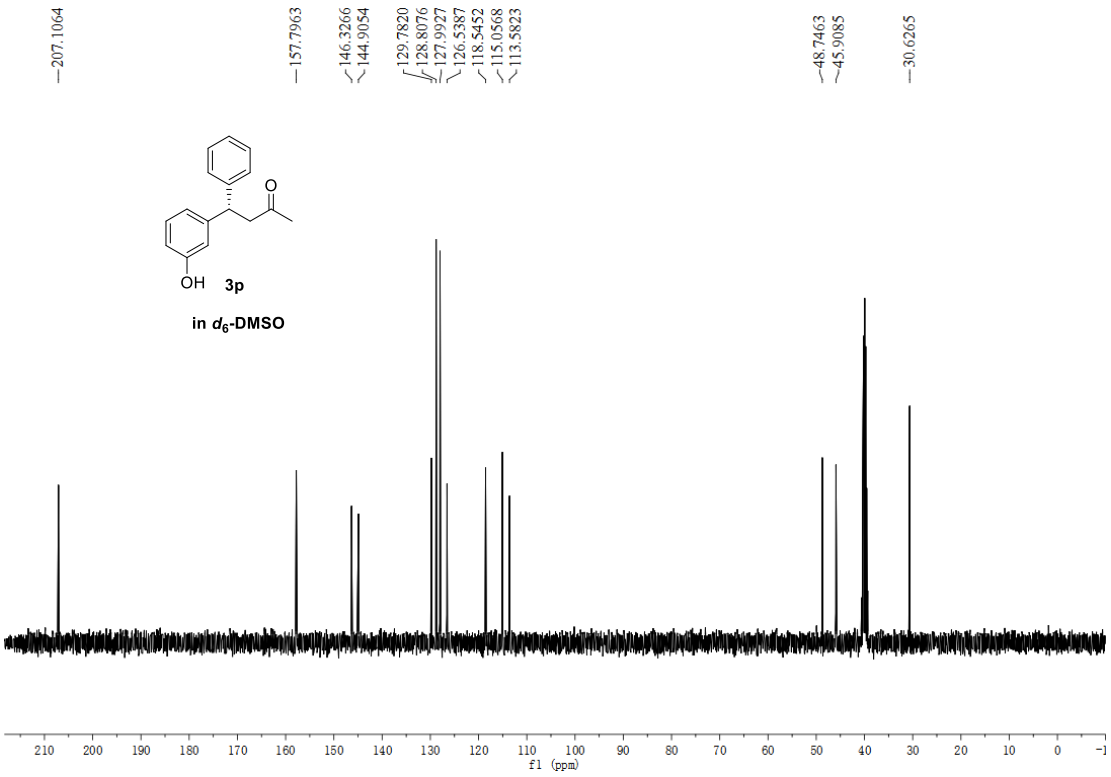
1.01
1.00
0.97
1.00
0.97
1.00
1.96
2.97
f1 (ppm)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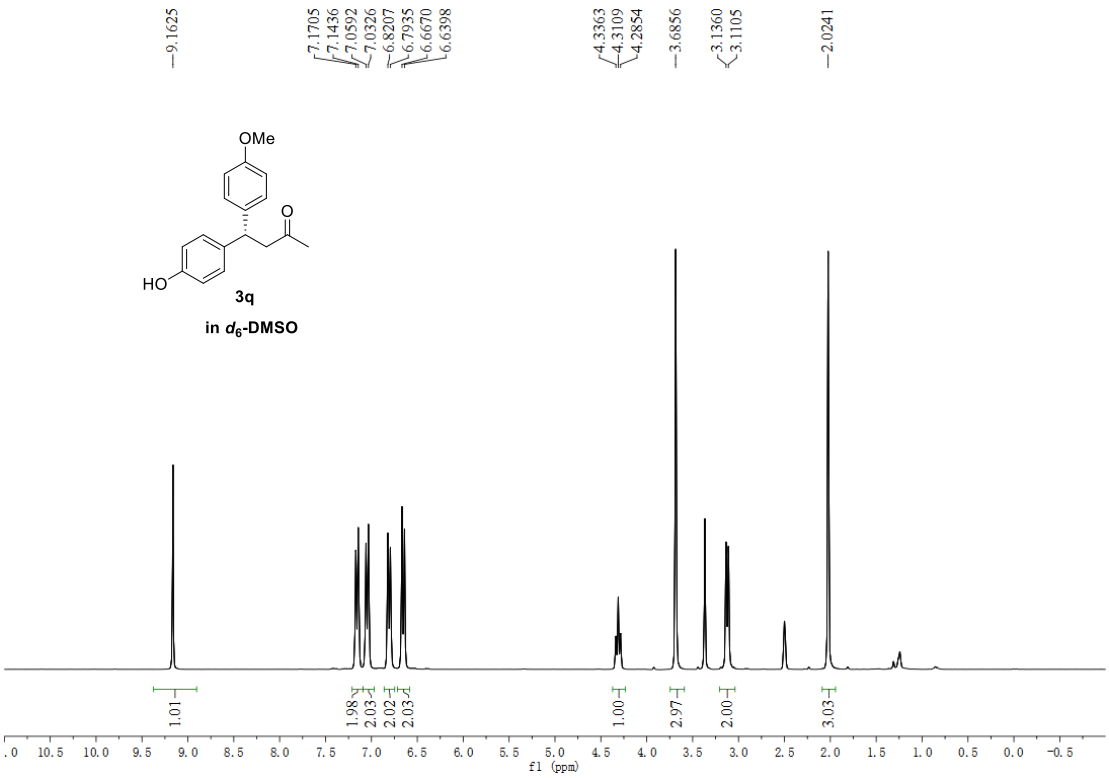
45.9085
30.6265
O
OH
3p
in d_6-DMSO
f1 (ppm)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6.7935
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6.6398
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4.3109
4.2854
3.6856
3.1360
3.1105
2.0241
OMe
O
HO
3q
in d_6-DMSO
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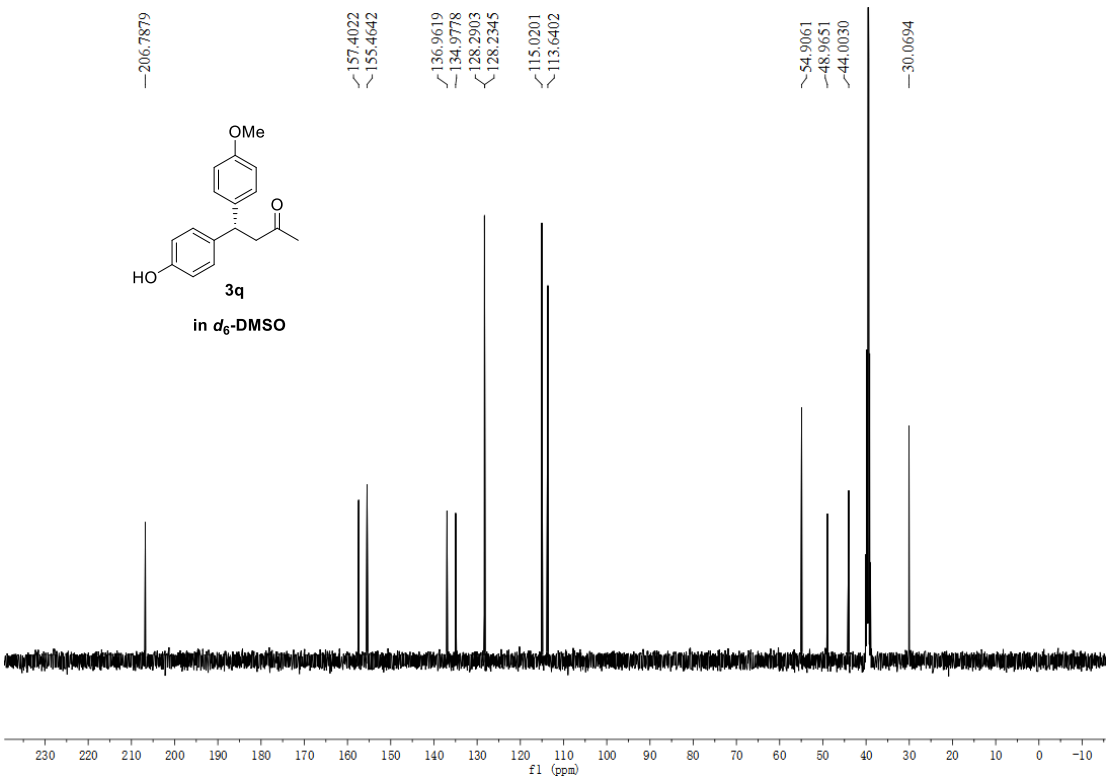
1.98
2.03
2.02
2.03
1.00
2.97
2.00
3.03
f1 (ppm)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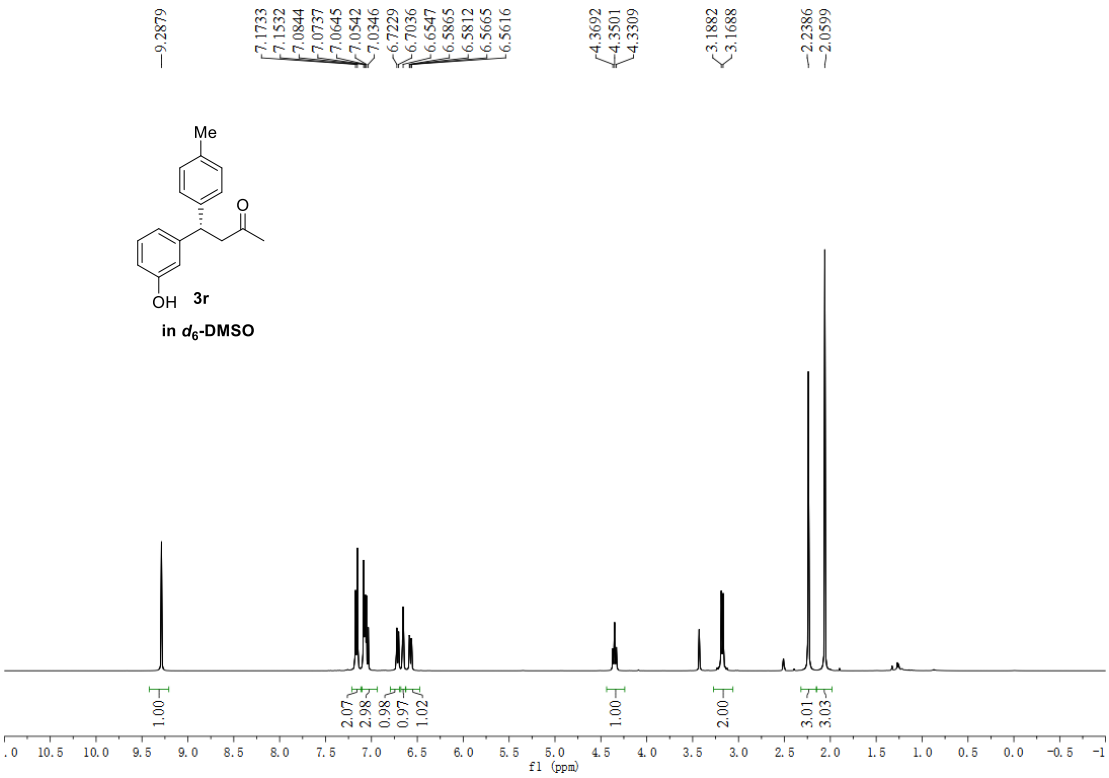
30.0694
OMe
O
HO
3q
in d_6-DMSO
f1 (ppm)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7.0542
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6.7229
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6.6547
6.5865
6.5812
6.5665
6.5616
4.3692
4.3501
4.3309
3.1882
3.1688
2.2386
2.0599
Me
O
OH
3r
in d_6-DMSO
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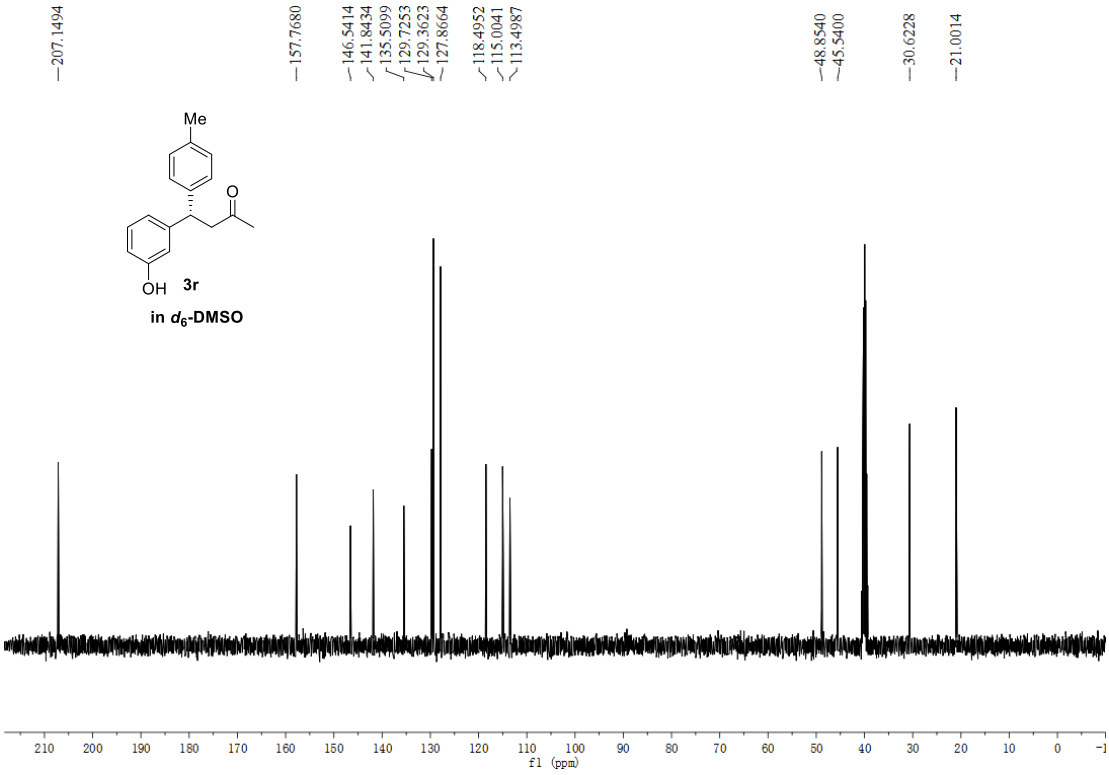
2.07
2.98
0.98
0.97
1.02
1.00
2.00
3.01
3.03
f1 (ppm)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45.5400
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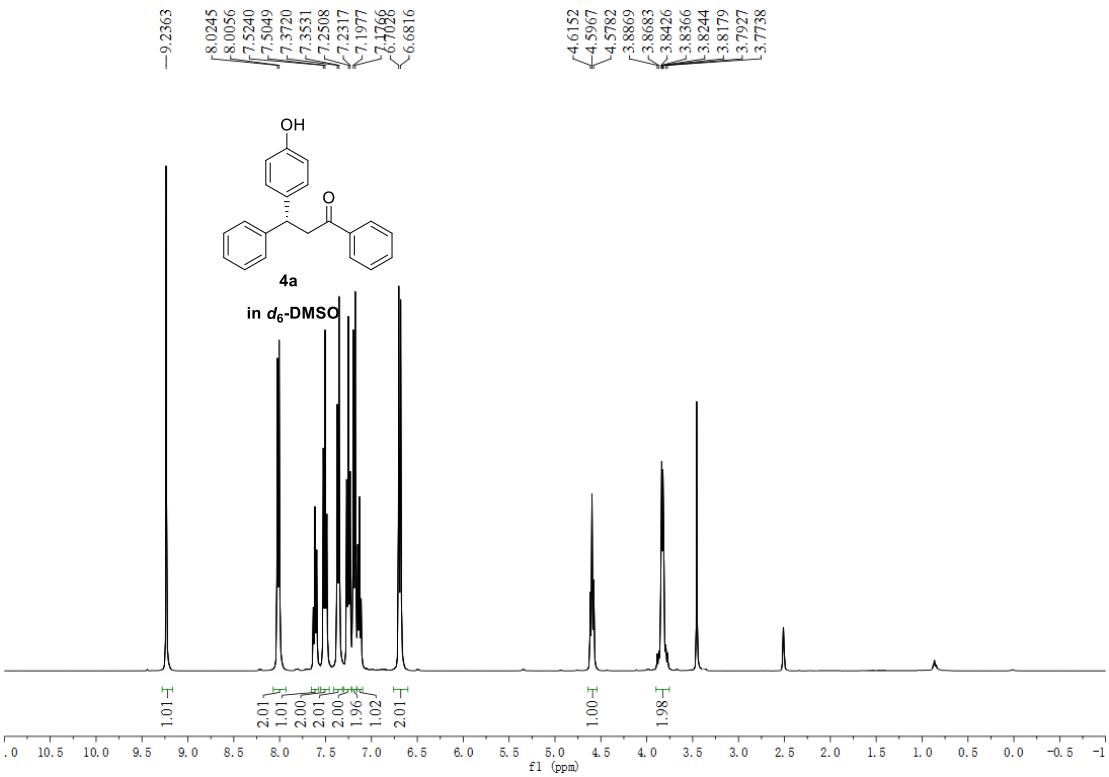
21.0014
Me
O
OH
3r
in d_6-DMSO
f1 (ppm)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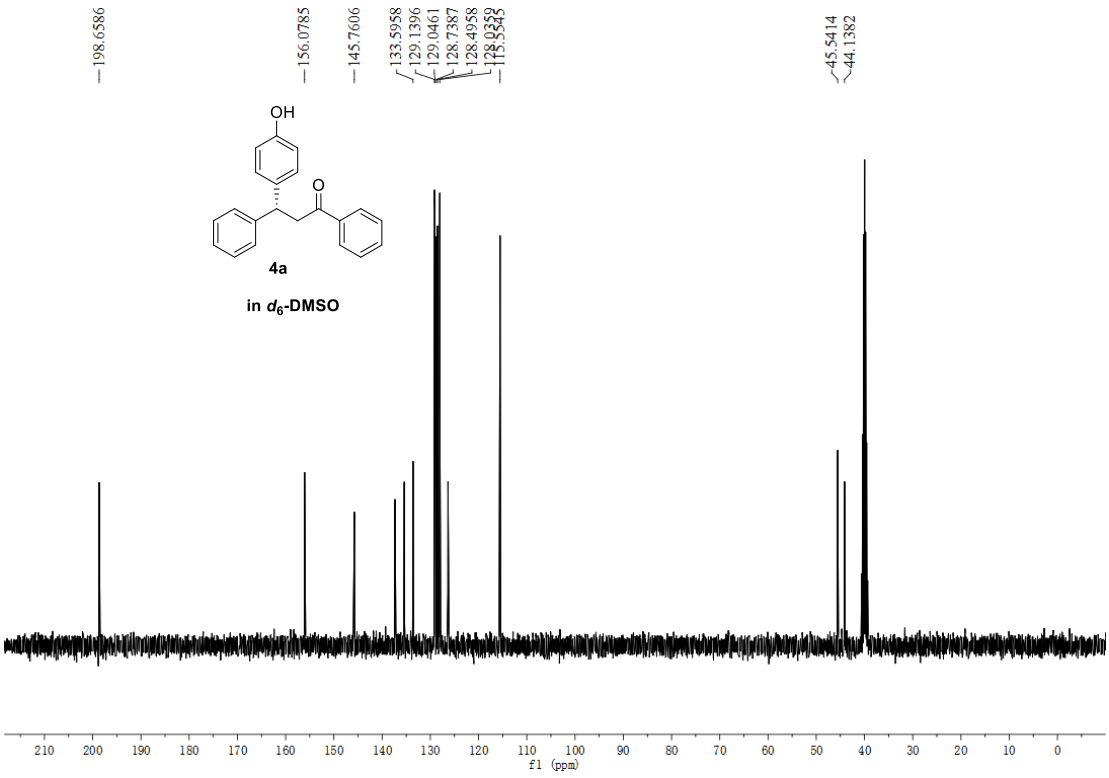
7.3531
7.2508
7.2317
7.1977
6.7026
6.6816
4.6152
4.5967
4.5782
3.8869
3.8683
3.8426
3.8366
3.8244
3.8179
3.7927
3.7738
OH
O
4a
in d_6-DMSO
1.01
2.01
1.01
2.00
2.01
2.00
1.96
1.02
2.01
1.00
1.98
f1 (ppm)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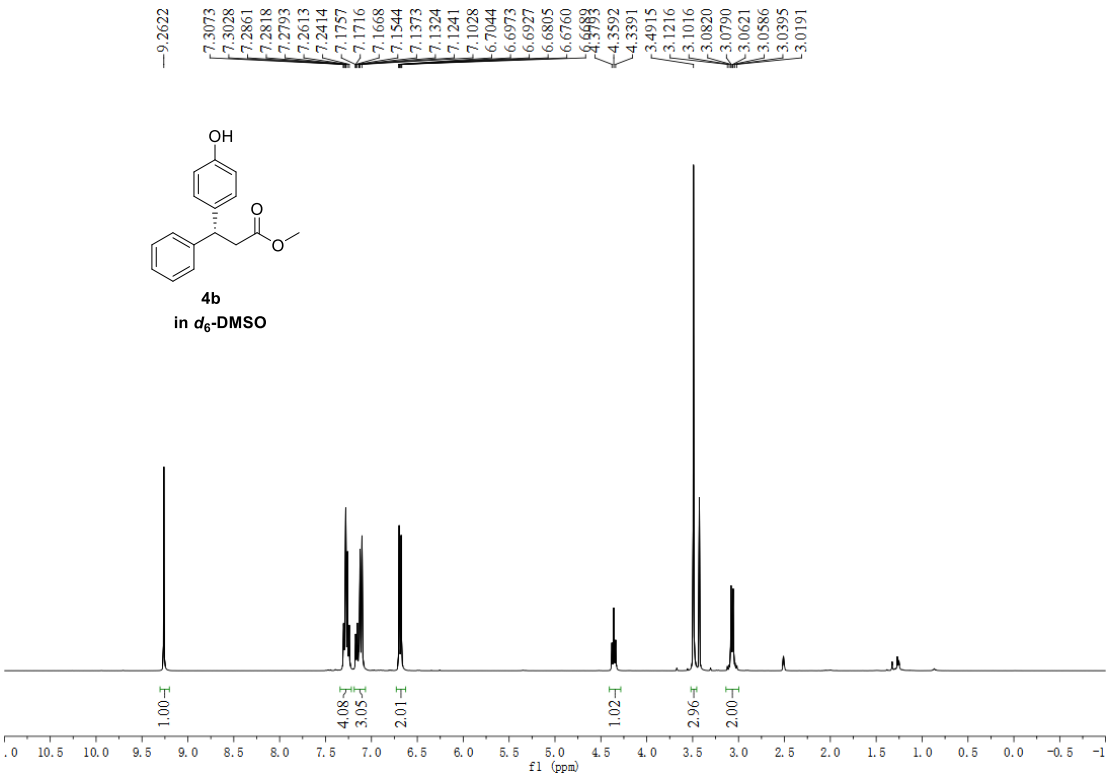
45.5414
44.1382
OH
O
4a
in d_6-DMSO
f1 (ppm)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7.2613
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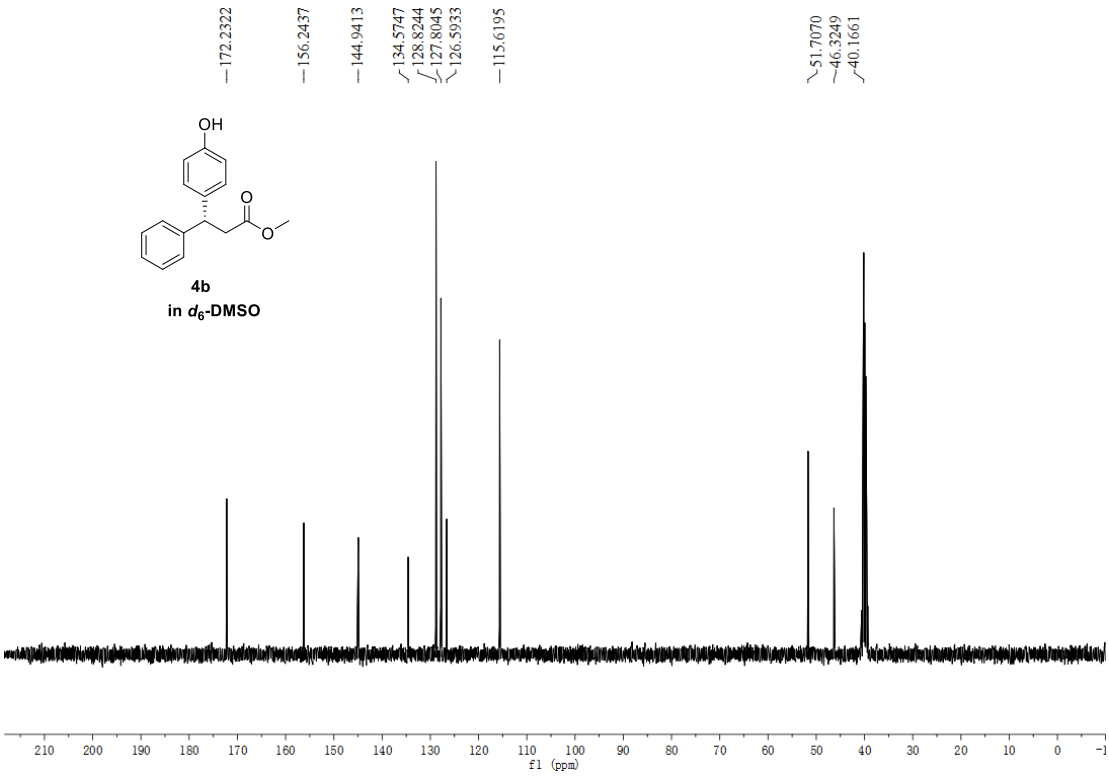
7.1668
7.1544
7.1373
7.1324
7.1241
7.1028
6.7044
6.6973
6.6927
6.6805
6.6760
6.6688
4.3793
4.3592
4.3391
3.4915
3.1216
3.1016
3.0820
3.0790
3.0621
3.0586
3.0395
3.0191
OH
O
O
4b
in d_6-DMSO
1.00
4.08
3.05
2.01
1.02
2.96
2.00
f1 (ppm)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128.8244
127.8045
126.5933
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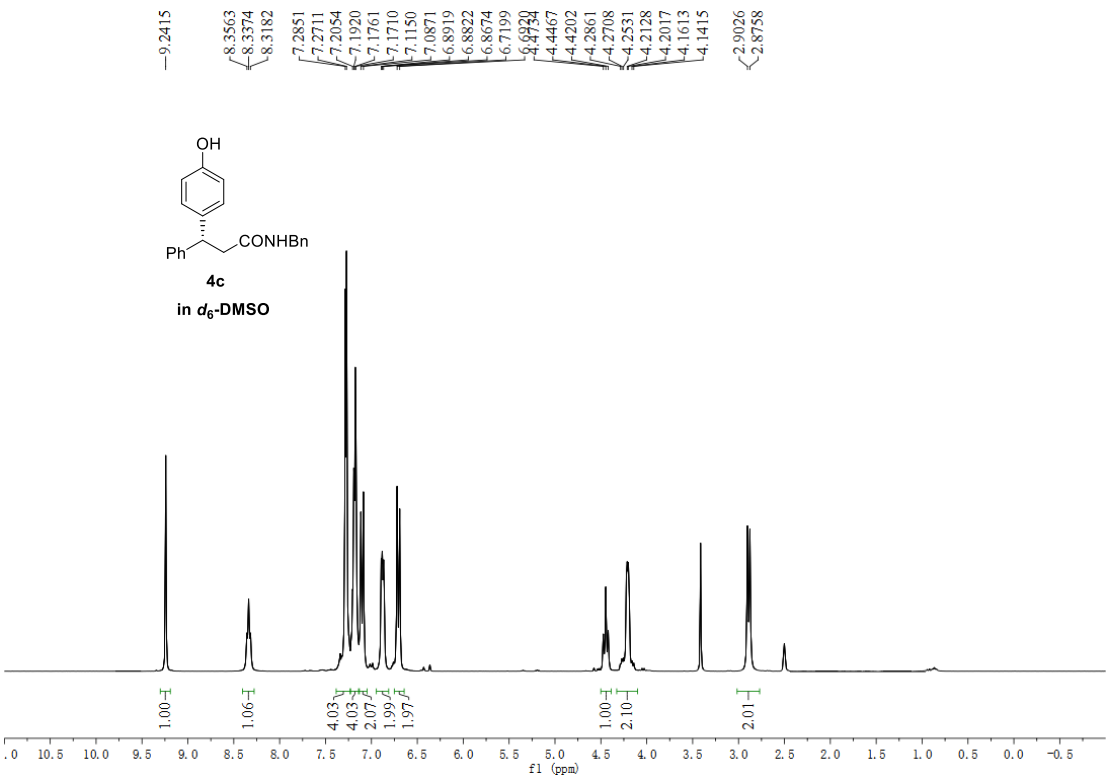
51.7070
46.3249
40.1661
OH
O
O
4b
in d_6-DMSO
f1 (ppm)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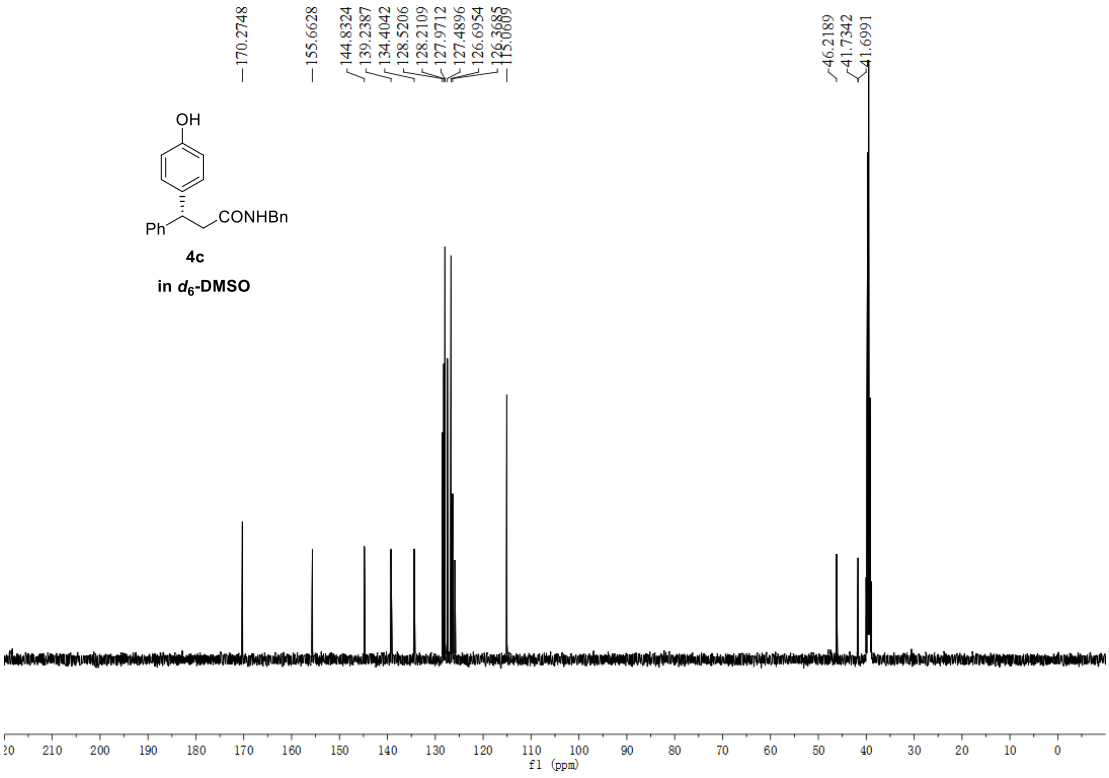
8.3374
8.3182
7.2851
7.2711
7.2054
7.1920
7.1761
7.1710
7.1150
7.0871
6.8919
6.8822
6.8674
6.7199
6.6920
4.4734
4.4467
4.4202
4.2861
4.2708
4.2531
4.2128
4.2017
4.1613
4.1415
2.9026
2.8758
OH
Ph
CONHBn
4c
in d_6-DMSO
1.00
1.06
4.03
4.03
2.07
1.99
1.97
1.00
2.10
2.01
f1 (ppm)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139.2387
134.4042
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128.2109
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127.4896
126.6954
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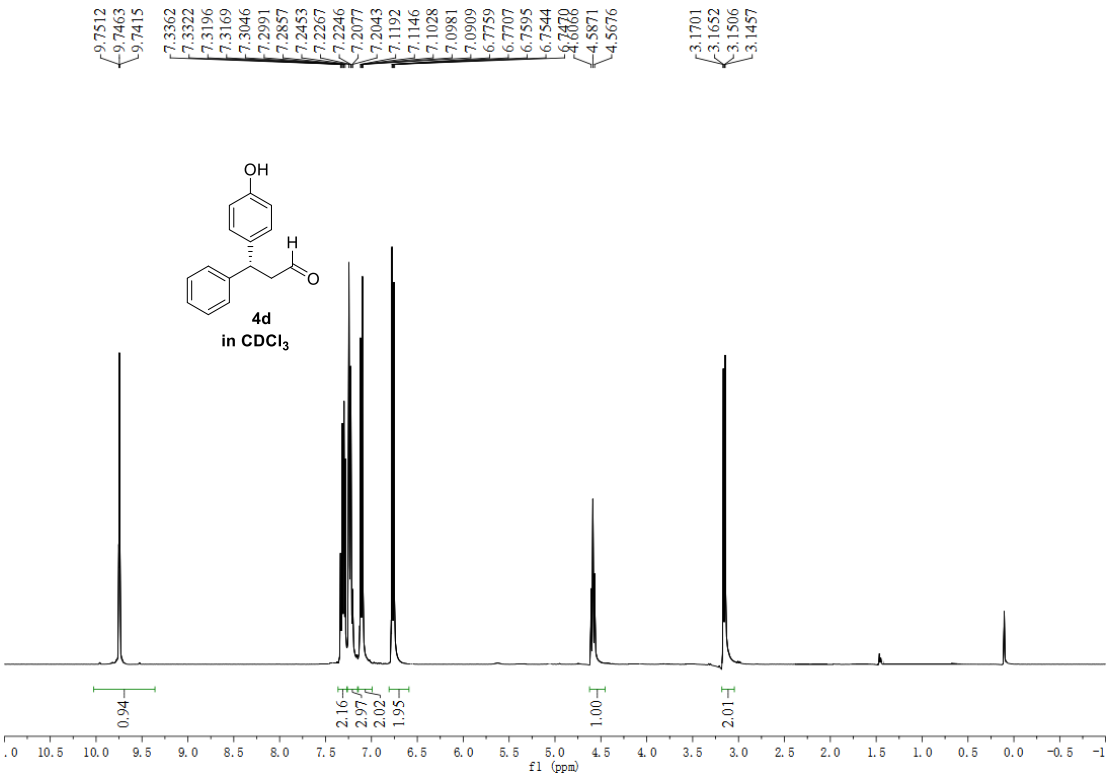
115.0809
46.2189
41.7342
41.6991
OH
Ph
CONHBn
4c
in d_6-DMSO
f1 (ppm)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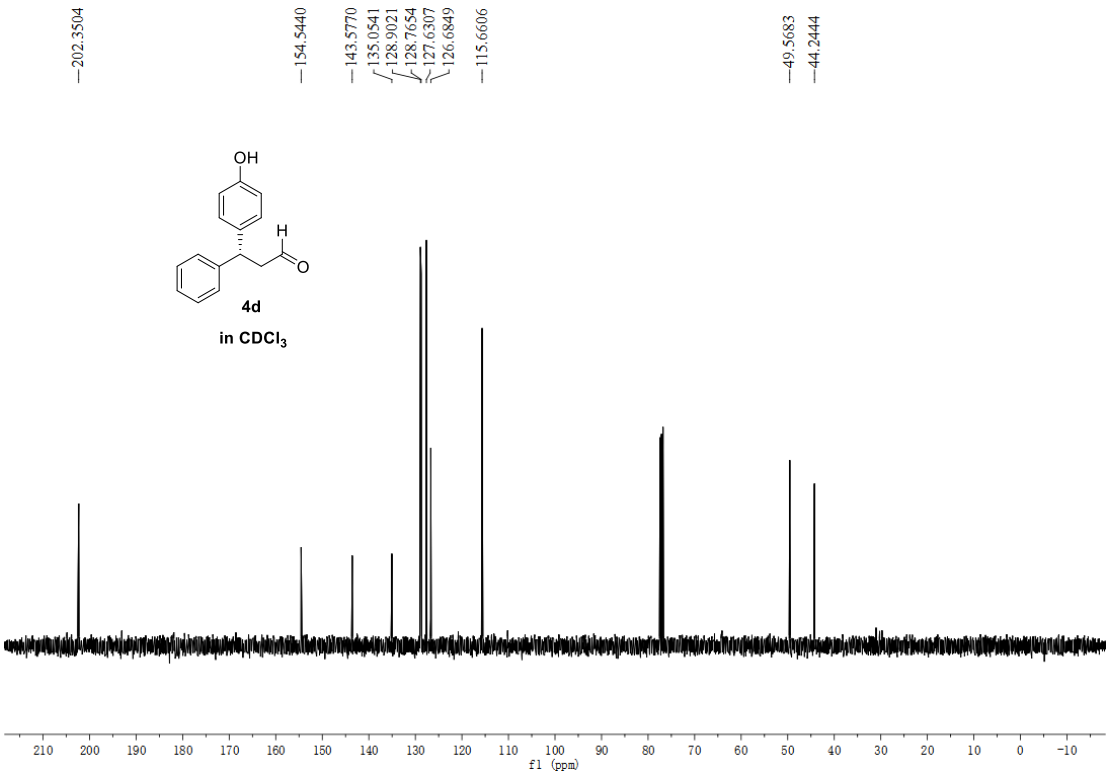
9.7415
7.3362
7.3322
7.3196
7.3169
7.3046
7.2991
7.2857
7.2453
7.2267
7.2246
7.2077
7.2043
7.1192
7.1146
7.1028
7.0981
7.0909
6.7759
6.7707
6.7595
6.7544
6.7470
6.7422
4.6088
4.5871
4.5676
3.1701
3.1652
3.1506
3.1457
OH
H
O
4d
in CDCl3
0.94
2.16
2.97
2.02
1.95
1.00
2.01
f1 (ppm)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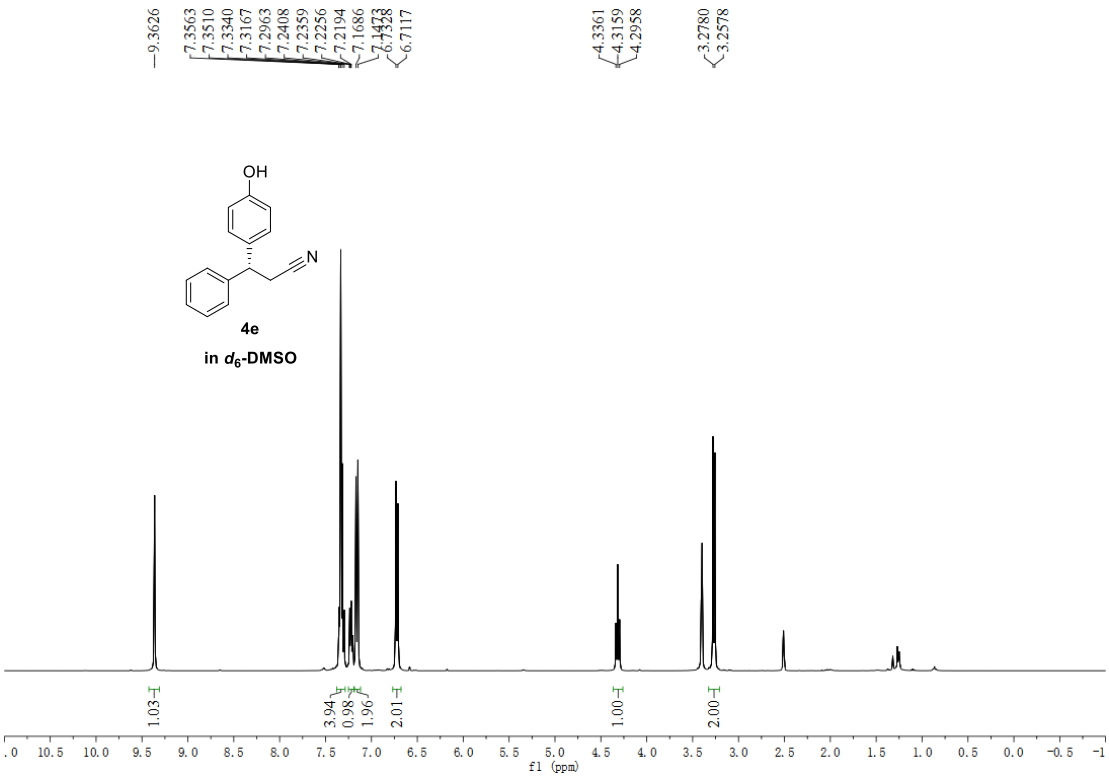
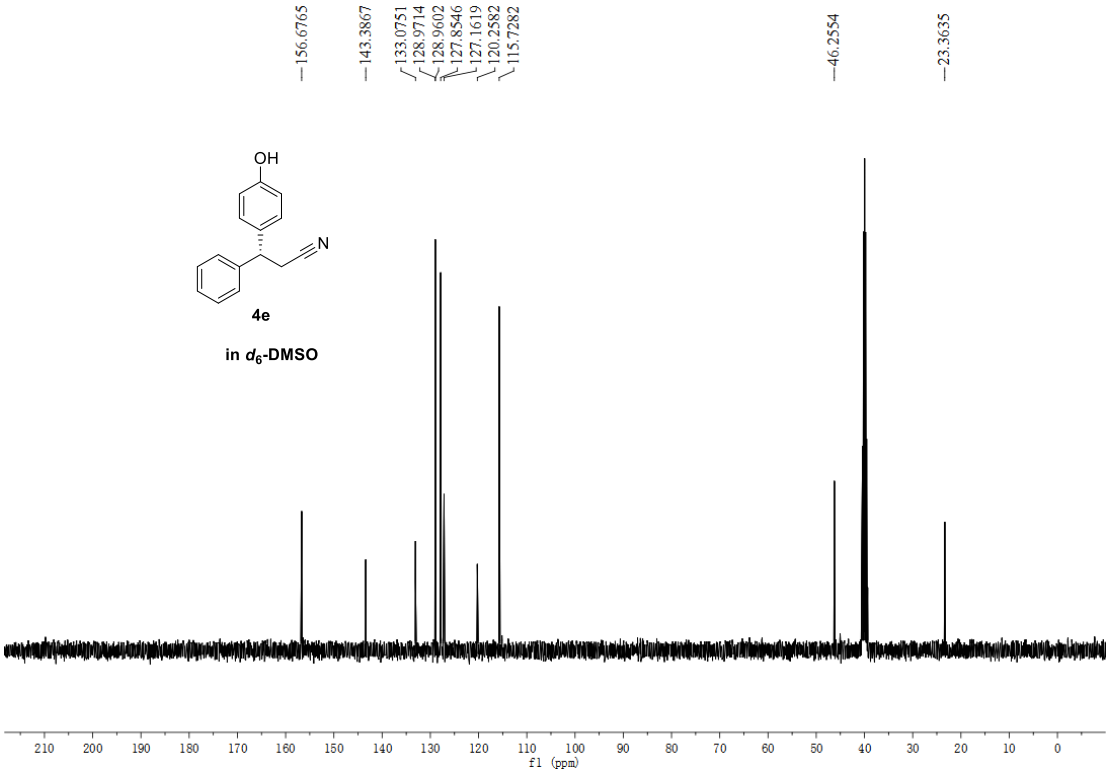
154.5440
143.5770
135.0541
128.9021
128.7654
127.6307
126.6849
115.6606
49.5683
44.2444
OH
H
O
4d
in CDCl3
f1 (ppm)


9.3626
7.3563
7.3510
7.3340
7.3167
7.2963
7.2408
7.2359
7.2256
7.2194
7.1686
6.7328
6.7117
4.3361
4.3159
4.2958
3.2780
3.2578
OH
N
4e
in d_6-DMSO
1.03
3.94
0.98
1.96
2.01
1.00
2.00
f1 (ppm)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143.3867
133.0751
128.9714
128.9602
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127.1619
120.2582
115.7282
46.2554
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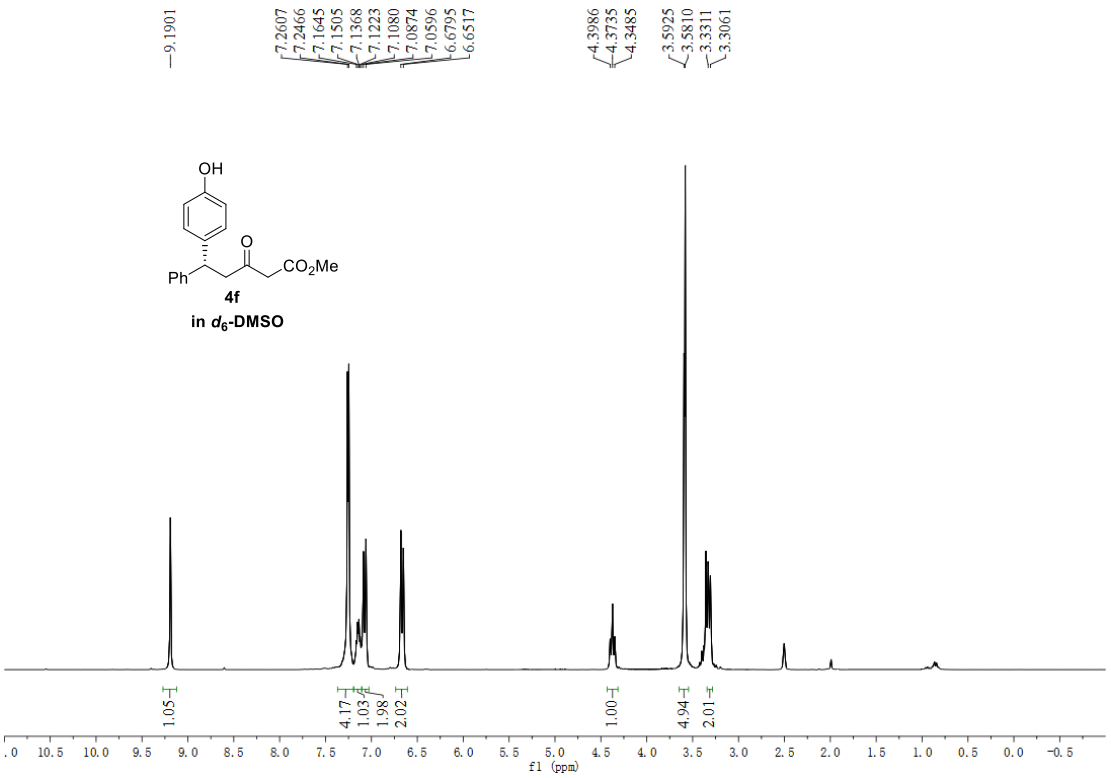
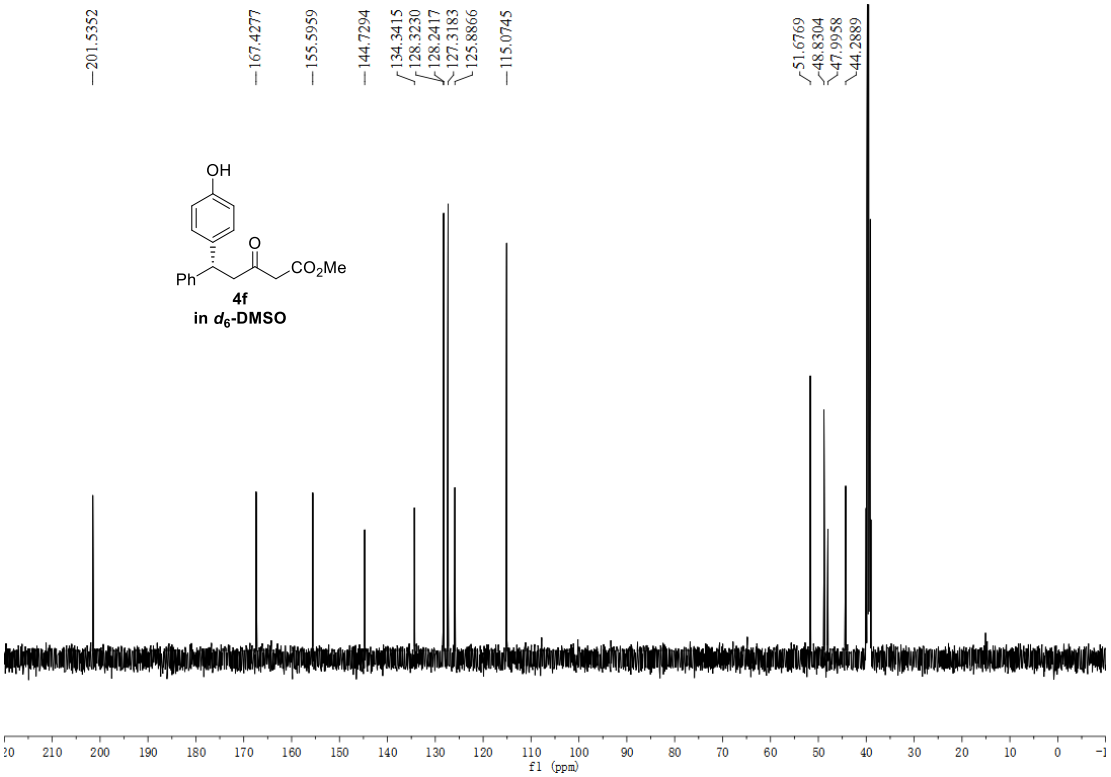
OH
N
4e
in d_6-DMSO
f1 (ppm)


9.1901
7.2607
7.2466
7.1645
7.1505
7.1368
7.1223
7.1080
7.0874
7.0596
6.6795
6.6517
4.3986
4.3735
4.3485
3.5925
3.5810
3.3311
3.3061
OH
O
CO2Me
Ph
4f
in d6-DMSO
1.05
4.17
1.03
1.98
2.02
1.00
4.94
2.01
f1 (ppm)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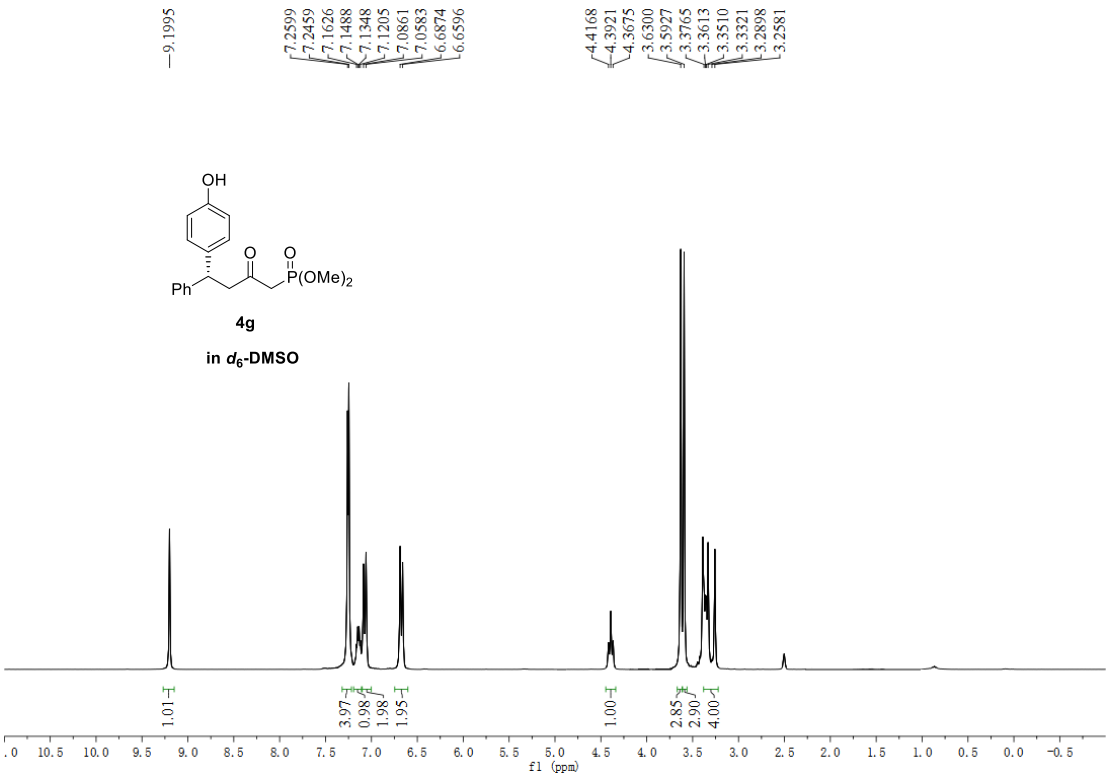
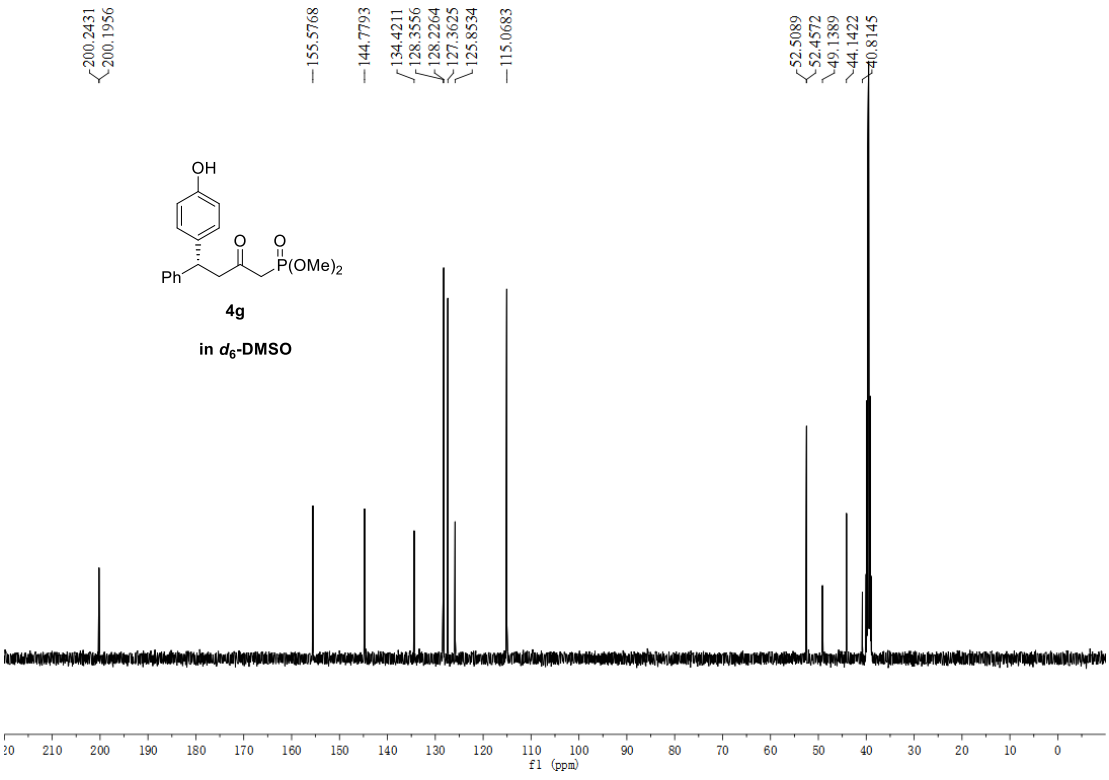
167.4277
155.5959
144.7294
134.3415
128.3230
128.2417
127.3183
125.8866
115.0745
51.6769
48.8304
47.9958
44.2889
OH
O
CO2Me
Ph
4f
in d6-DMSO
f1 (ppm)


9.1995
7.2599
7.2459
7.1626
7.1488
7.1348
7.1205
7.0861
7.0583
6.6874
6.6596
4.4168
4.3921
4.3675
3.6300
3.5927
3.3765
3.3613
3.3510
3.3321
3.2898
3.2581
OH
O
O
P(OMe)2
Ph
4g
in d6-DMSO
1.01
3.97
0.98
1.98
1.95
1.00
2.85
2.90
4.00
f1 (ppm)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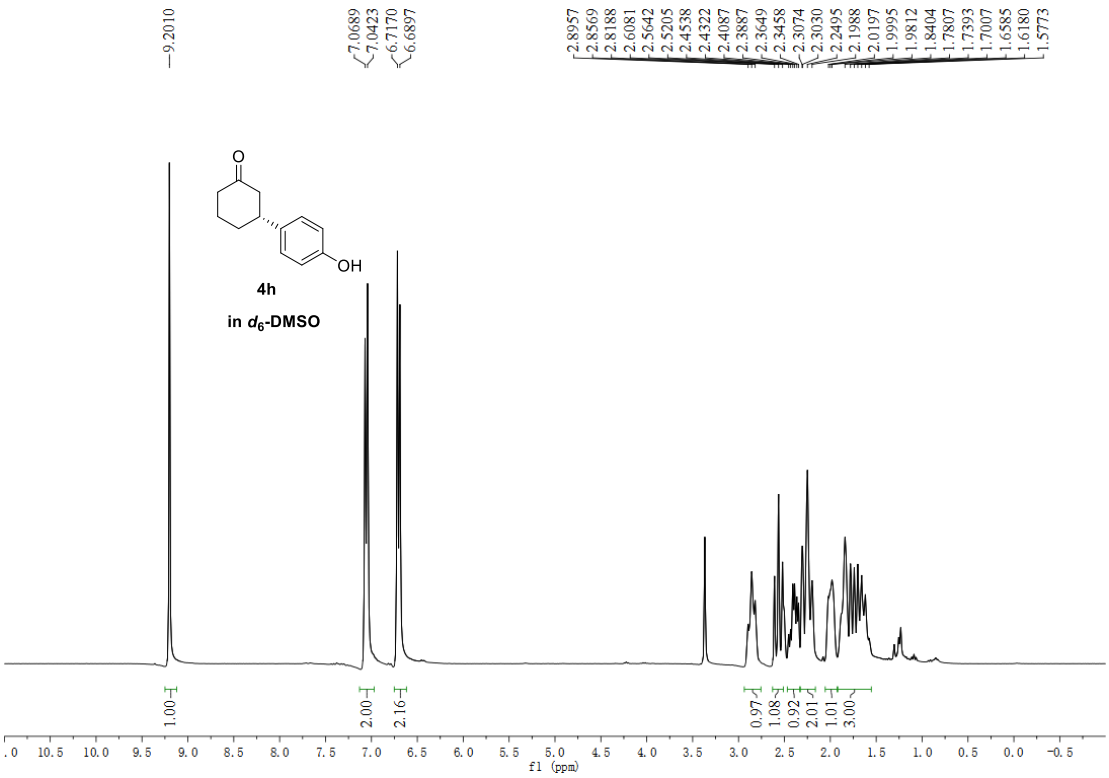
155.5768
144.7793
134.4211
128.3556
128.2264
127.3625
125.8534
115.0683
52.5089
52.4572
49.1389
44.1422
40.8145
OH
O
O
P(OMe)2
Ph
4g
in d6-DMSO
f1 (ppm)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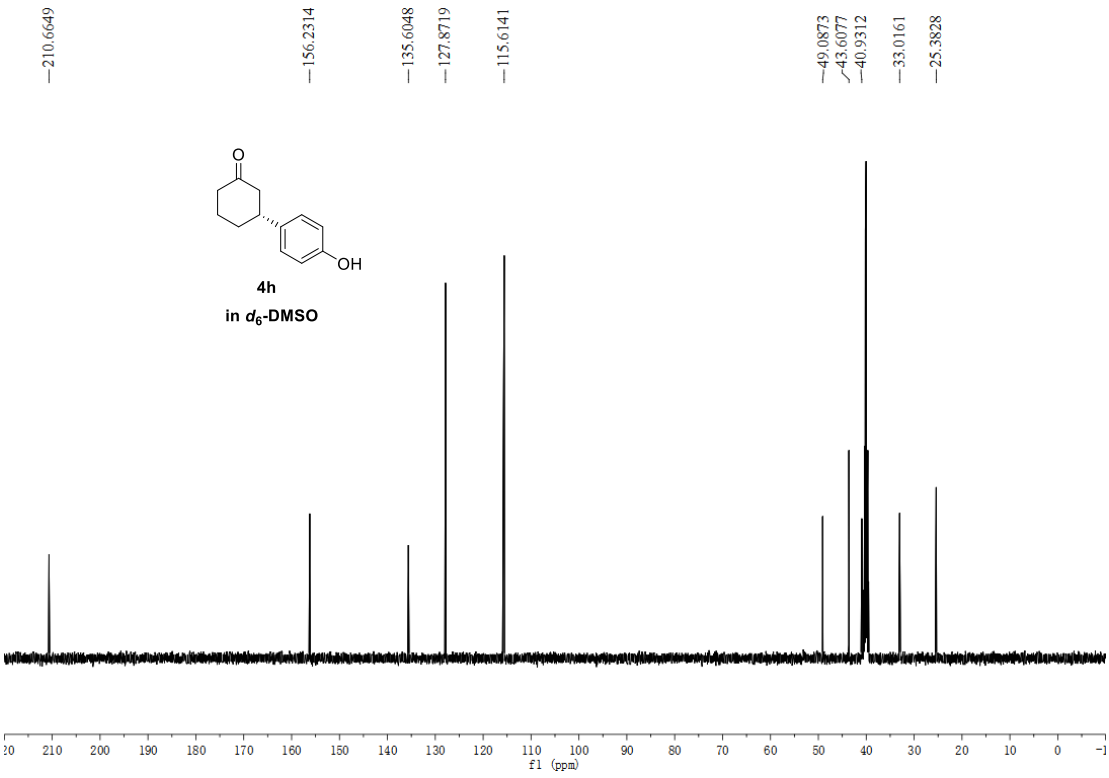
7.0689
7.0423
6.7170
6.6897
2.8957
2.8569
2.8188
2.6081
2.5642
2.5205
2.4538
2.4322
2.4087
2.3887
2.3649
2.3458
2.3074
2.3030
2.2495
2.1988
2.0197
1.9995
1.9812
1.8404
1.7807
1.7393
1.7007
1.6585
1.6180
1.5773
OH
4h
in d_6-DMSO
1.00
2.00
2.16
0.97
1.08
0.92
2.01
1.01
3.00
f1 (ppm)


210.6649
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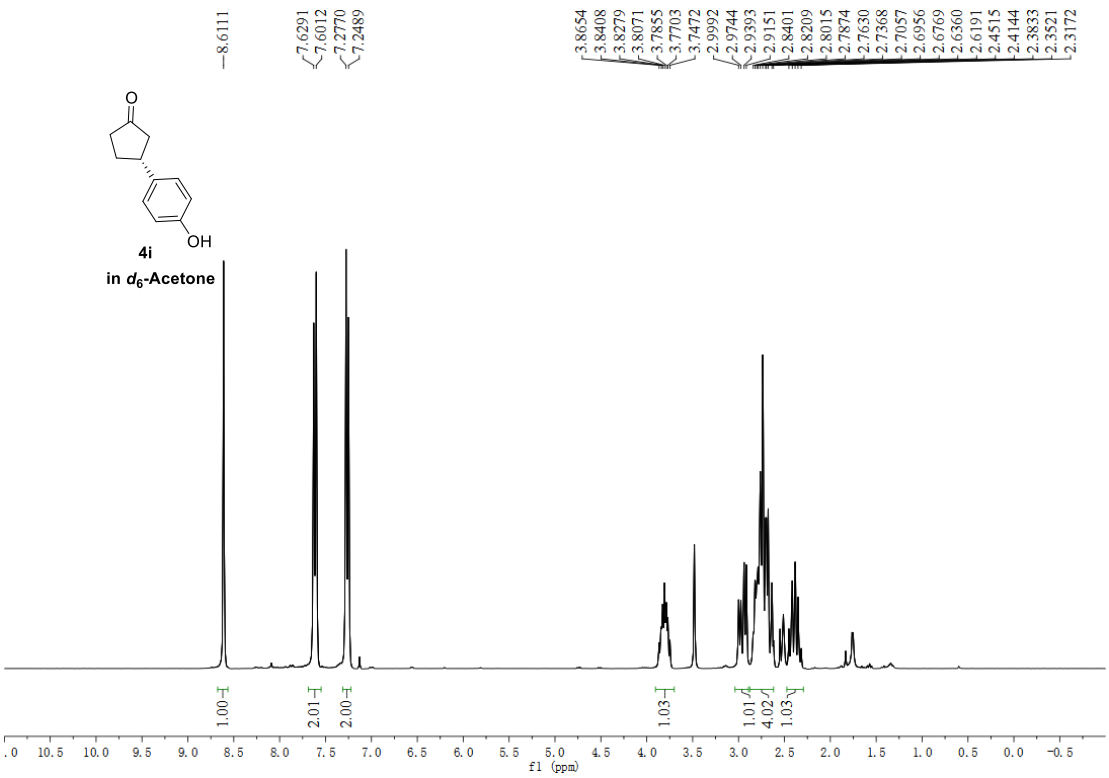
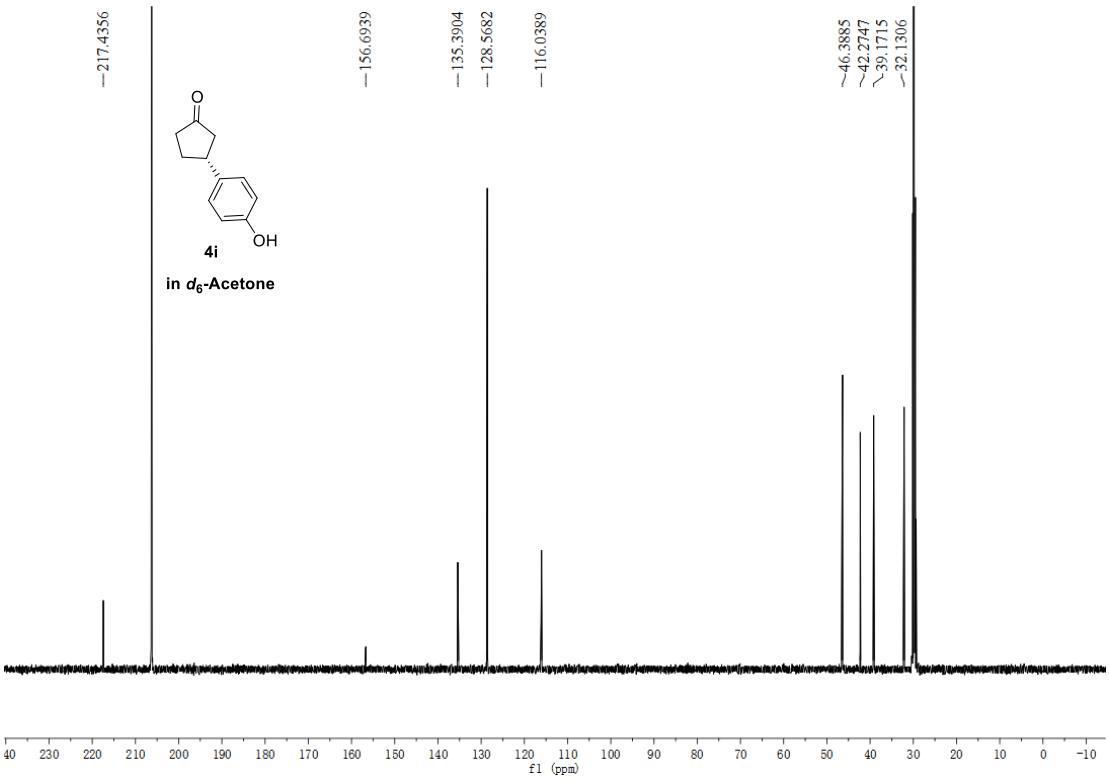
135.6048
127.8719
115.6141
49.0873
43.6077
40.9312
33.0161
25.3828
OH
4h
in d_6-DMSO
f1 (ppm)


8.6111
7.6291
7.6012
7.2770
7.2489
3.8654
3.8408
3.8279
3.8071
3.7855
3.7703
3.7472
2.9992
2.9744
2.9393
2.9151
2.8401
2.8209
2.8015
2.7874
2.7630
2.7368
2.7057
2.6956
2.6769
2.6360
2.6191
2.4515
2.4144
2.3833
2.3521
2.3172
OH
4i
in d_6-Acetone
1.00
2.01
2.00
1.03
1.01
4.02
1.03
f1 (ppm)


217.4356
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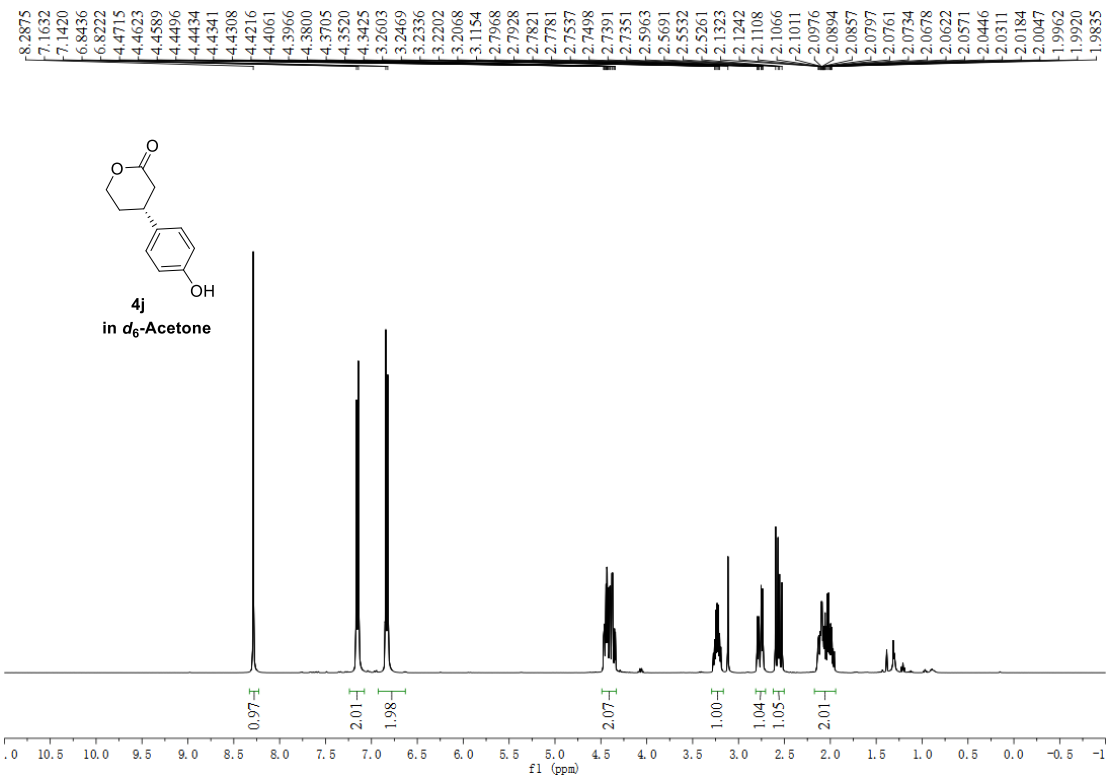
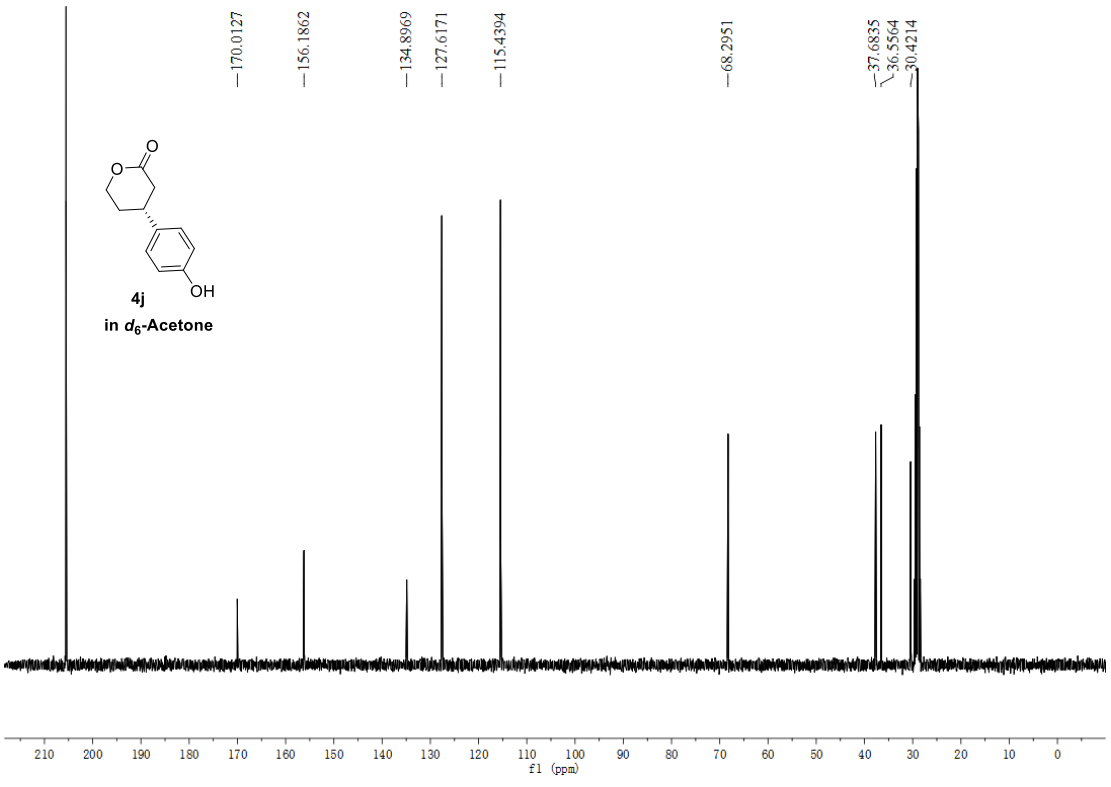
135.3904
128.5682
116.0389
46.3885
42.2747
39.1715
32.1306
OH
4i
in d_6-Acetone
f1 (ppm)


8.2875
7.1632
7.1420
6.8436
6.8222
4.4715
4.4623
4.4589
4.4496
4.4434
4.4341
4.4308
4.4216
4.4061
4.3966
4.3800
4.3705
4.3520
4.3425
3.2603
3.2469
3.2336
3.2202
3.2068
3.1154
2.7968
2.7928
2.7821
2.7781
2.7537
2.7498
2.7391
2.7351
2.5963
2.5691
2.5532
2.5261
2.1323
2.1242
2.1108
2.1066
2.1011
2.0976
2.0894
2.0857
2.0797
2.0761
2.0734
2.0678
2.0622
2.0571
2.0446
2.0311
2.0184
2.0047
1.9962
1.9920
1.9835
4j
in d_6-Acetone
0.97
2.01
1.98
2.07
1.00
1.04
1.05
2.01
f1 (ppm)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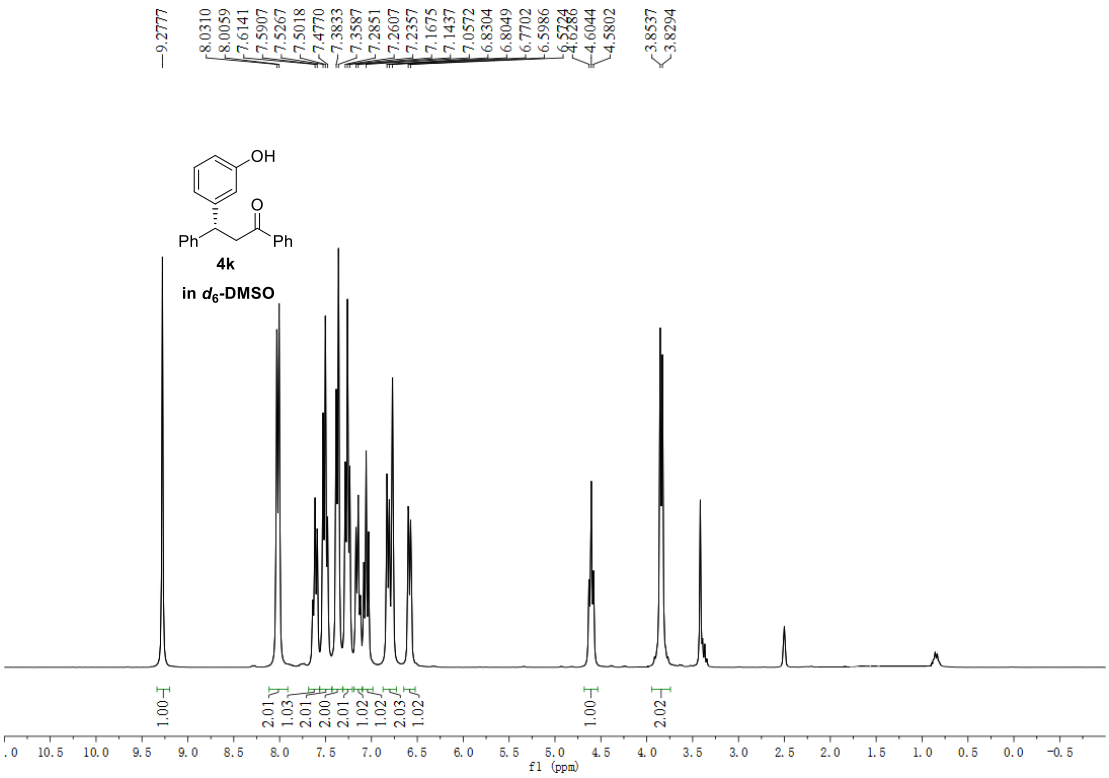
134.8969
127.6171
115.4394
68.2951
37.6835
36.5564
30.4214
4j
in d_6-Acetone
f1 (ppm)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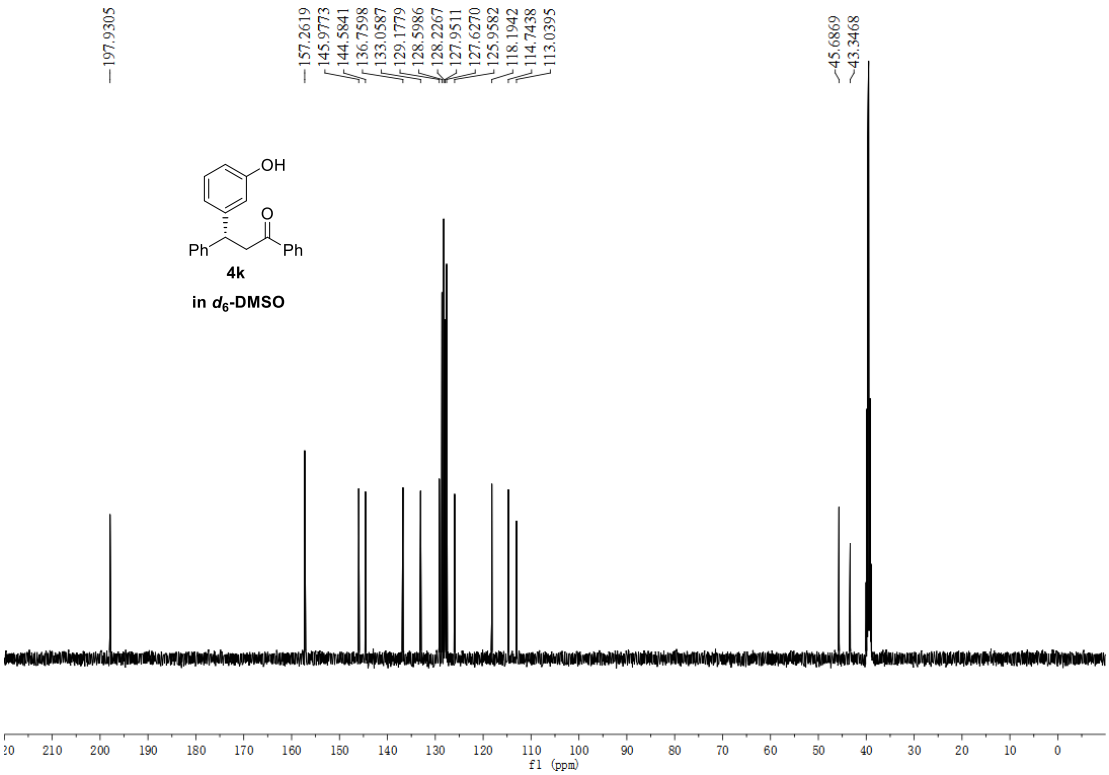
8.0310
8.0059
7.6141
7.5907
7.5267
7.5018
7.4770
7.3833
7.3587
7.2851
7.2607
7.2357
7.1675
7.1437
7.0572
6.8304
6.8049
6.7702
6.5986
6.5224
6.4286
4.6044
4.5802
3.8537
3.8294
OH
O
Ph
Ph
4k
in d_6-DMSO
1.00
2.01
1.03
2.01
2.00
2.01
1.02
1.02
2.03
1.02
1.00
2.02
f1 (ppm)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145.9773
144.5841
136.7598
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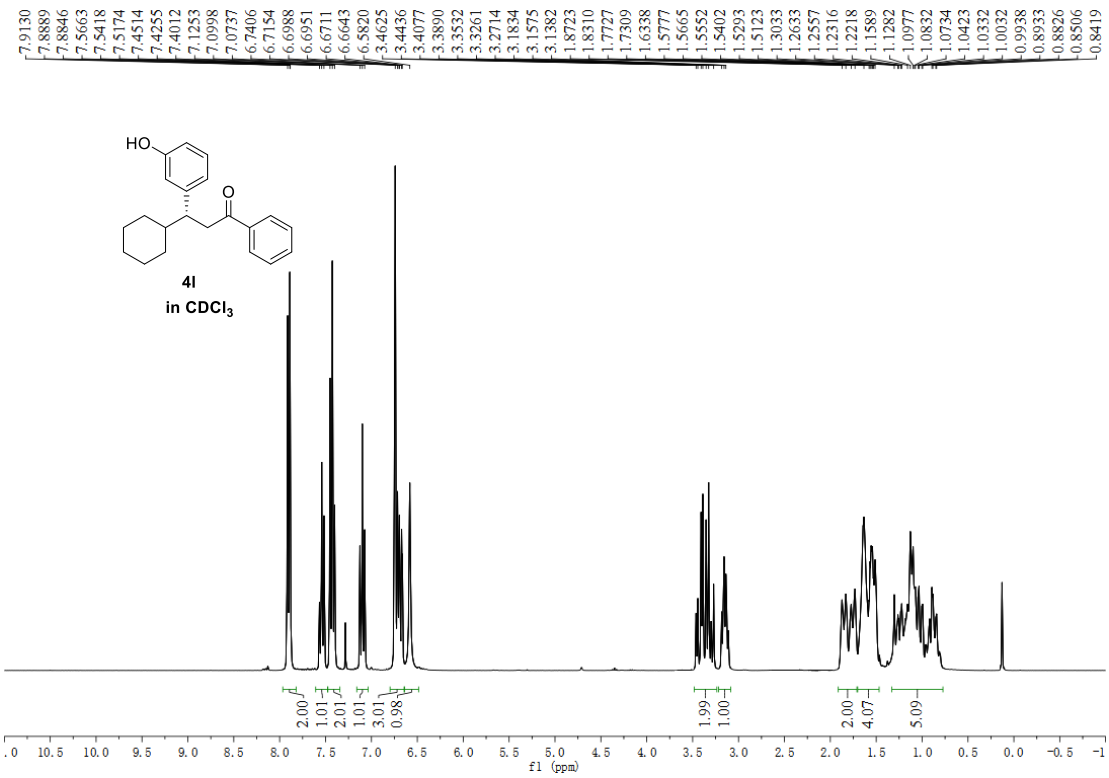
129.1779
128.5986
128.2267
127.9511
127.6270
125.9582
118.1942
114.7438
113.0395
45.6869
43.3468
OH
O
Ph
Ph
4k
in d_6-DMSO
f1 (ppm)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7.8846
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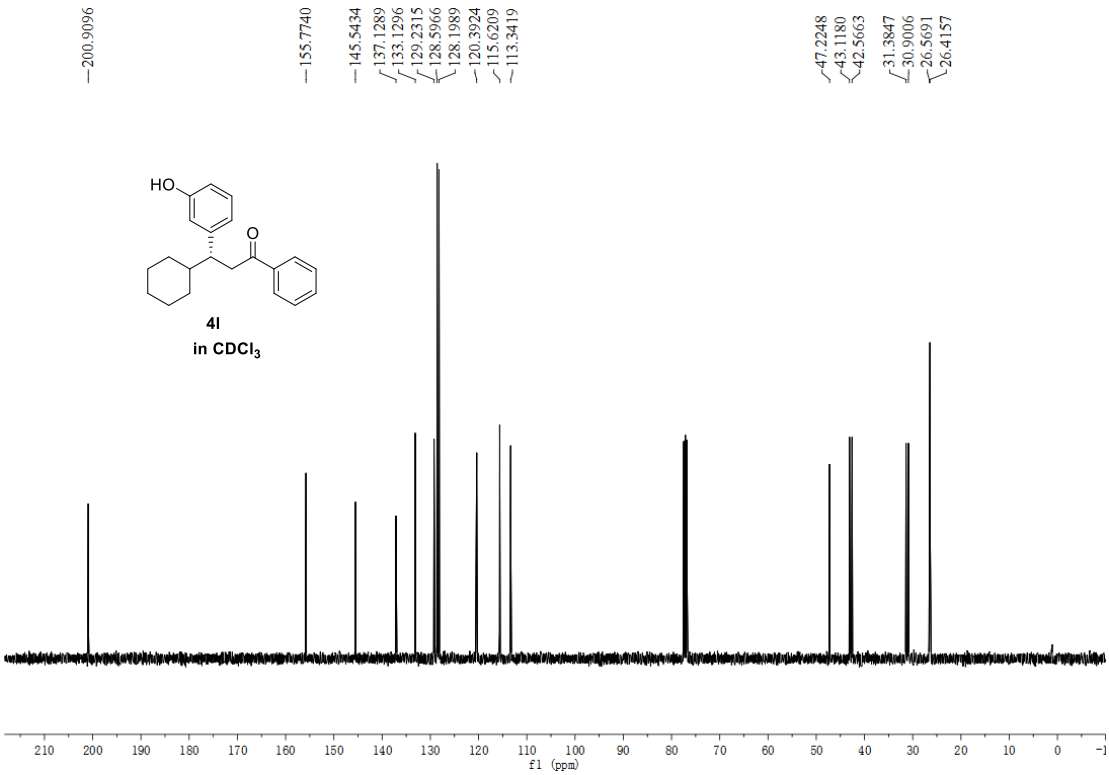
7.4514
7.4255
7.4012
7.1253
7.0998
7.0737
6.7406
6.7154
6.6988
6.6951
6.6711
6.6643
6.5820
3.4625
3.4436
3.4077
3.3890
3.3532
3.3261
3.2714
3.1834
3.1575
3.1382
1.8723
1.8310
1.7727
1.7309
1.6338
1.5777
1.5665
1.5552
1.5402
1.5293
1.5123
1.3033
1.2633
1.2557
1.2316
1.2218
1.1589
1.1282
1.0977
1.0832
1.0734
1.0423
1.0332
1.0032
0.9938
0.8933
0.8826
0.8506
0.8419
HO
O
4l
in CDCl3
2.00
1.01
2.01
1.01
3.01
0.98
1.99
1.00
2.00
4.07
5.09
f1 (ppm)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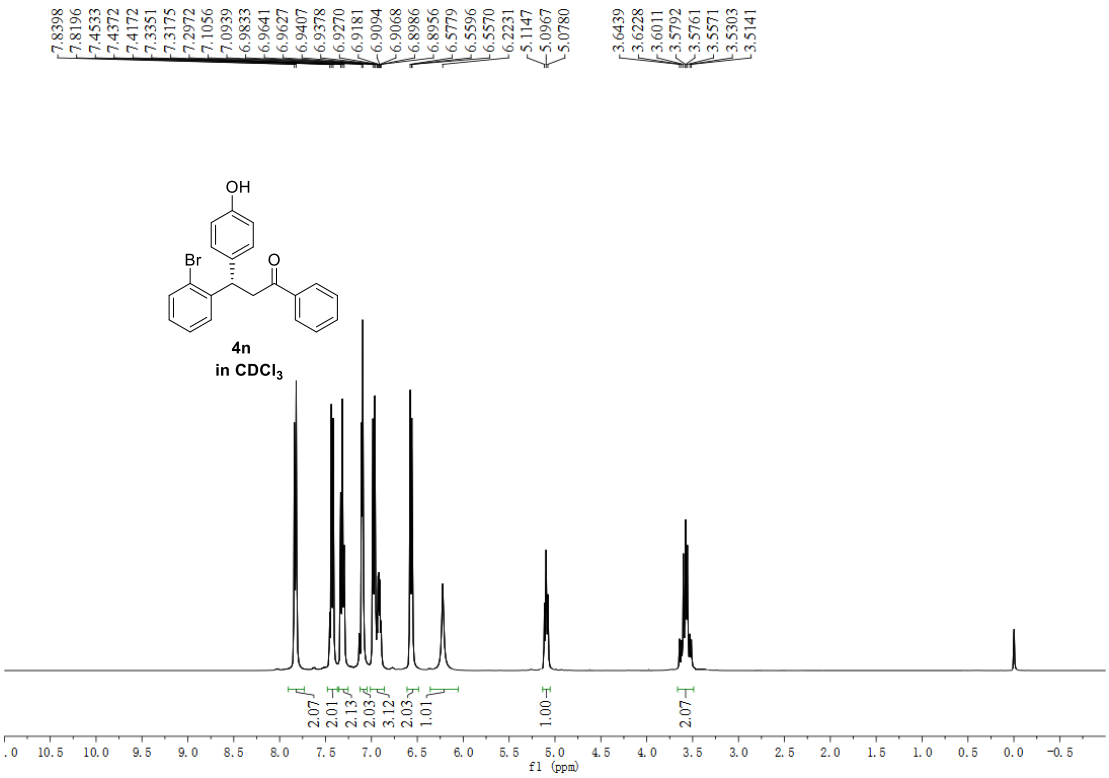
133.1296
129.2315
128.5966
128.1989
120.3924
115.6209
113.3419
47.2248
43.1180
42.5663
31.3847
30.9006
26.5691
26.4157
HO
O
4l
in CDCl3
f1 (ppm)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7.4533
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7.4172
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7.3175
7.2972
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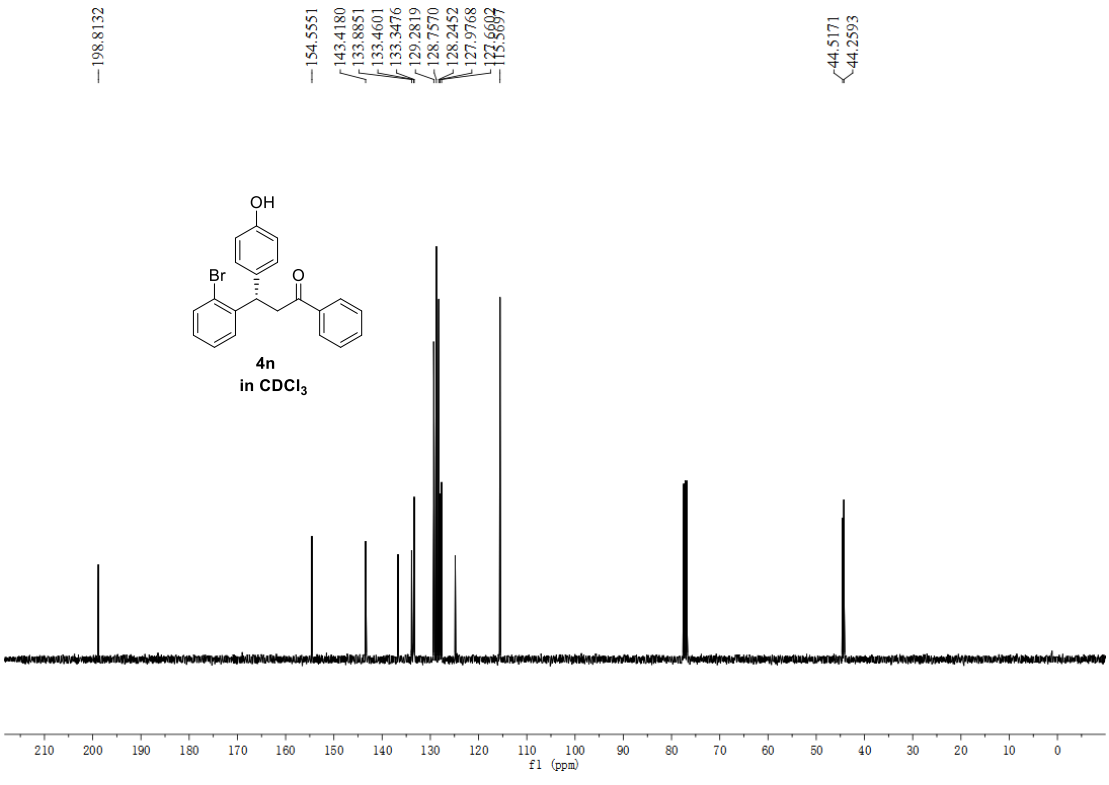
7.0939
6.9833
6.9641
6.9627
6.9407
6.9378
6.9270
6.9181
6.9094
6.9068
6.8986
6.8956
6.5779
6.5596
6.5570
6.2231
5.1147
5.0967
5.0780
3.6439
3.6228
3.6011
3.5792
3.5761
3.5571
3.5303
3.5141
OH
Br
O
4n
in CDCl3
2.07
2.01
2.13
2.03
3.12
2.03
1.01
1.00
2.07
f1 (ppm)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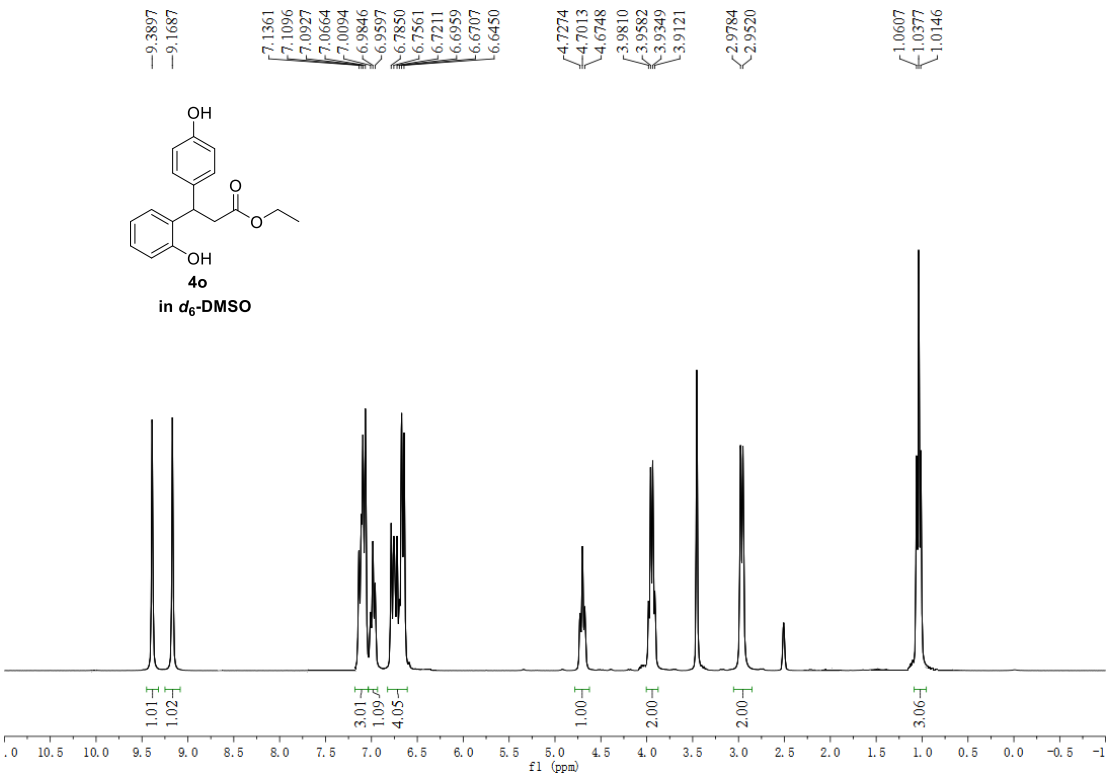
143.4180
133.8851
133.4601
133.3476
129.2819
128.7570
128.2452
127.9768
44.5171
44.2593
OH
Br
O
4n
in CDCl3
f1 (ppm)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7.1096
7.0927
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7.0094
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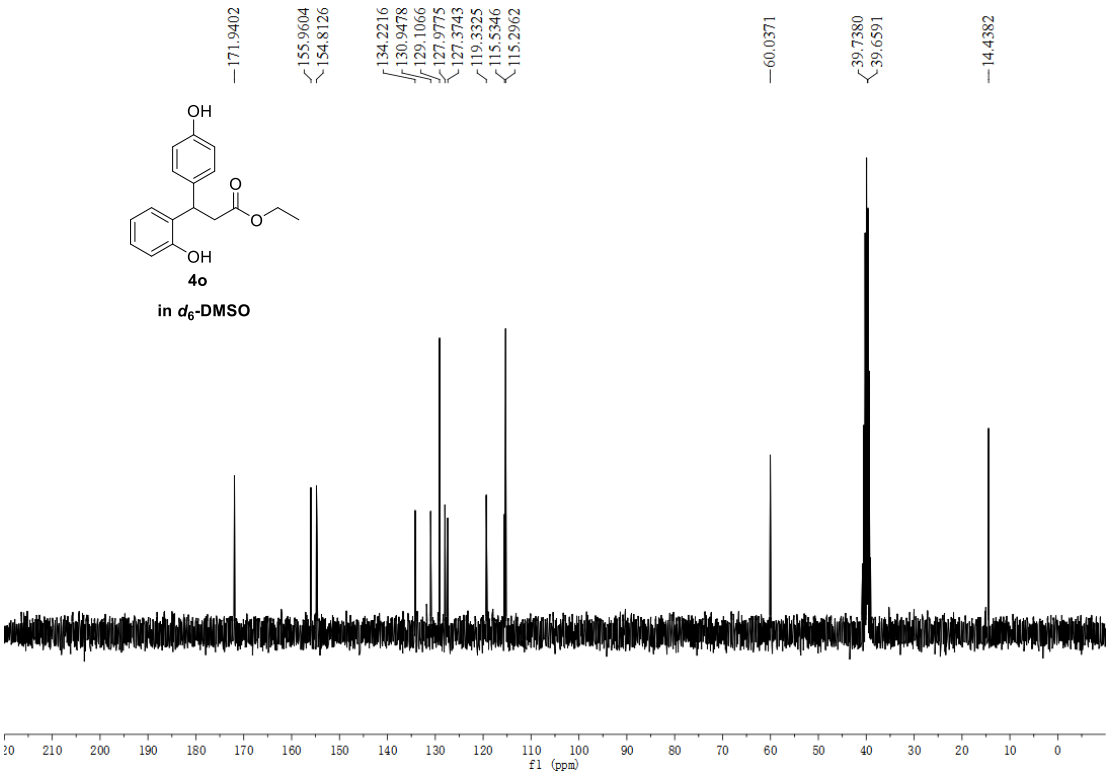
6.9597
6.7850
6.7561
6.7211
6.6959
6.6707
6.6450
4.7274
4.7013
4.6748
3.9810
3.9582
3.9349
3.9121
2.9784
2.9520
1.0607
1.0377
1.0146
OH
O
O
OH
4o
in d_6-DMSO
1.01
1.02
3.01
1.09
4.05
1.00
2.00
2.00
3.06
f1 (ppm)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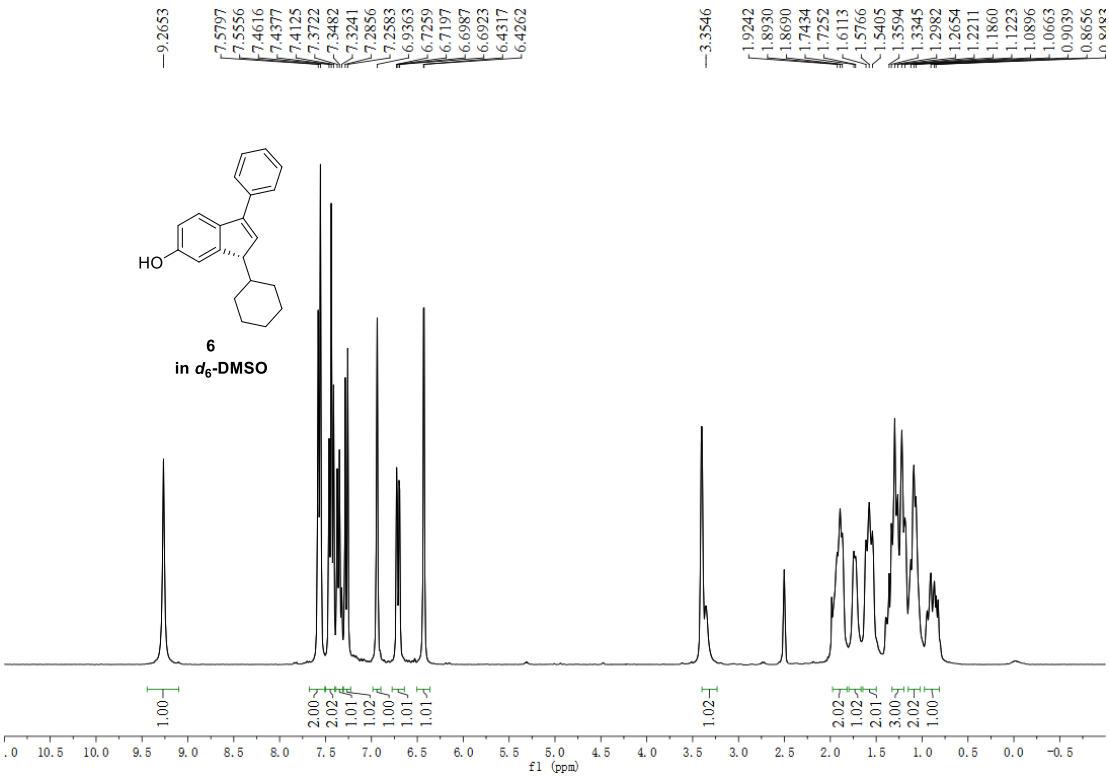
127.9775
127.3743
119.3325
115.5346
115.2962
60.0371
39.7380
39.6591
14.4382
OH
O
O
OH
4o
in d_6-DMSO
f1 (ppm)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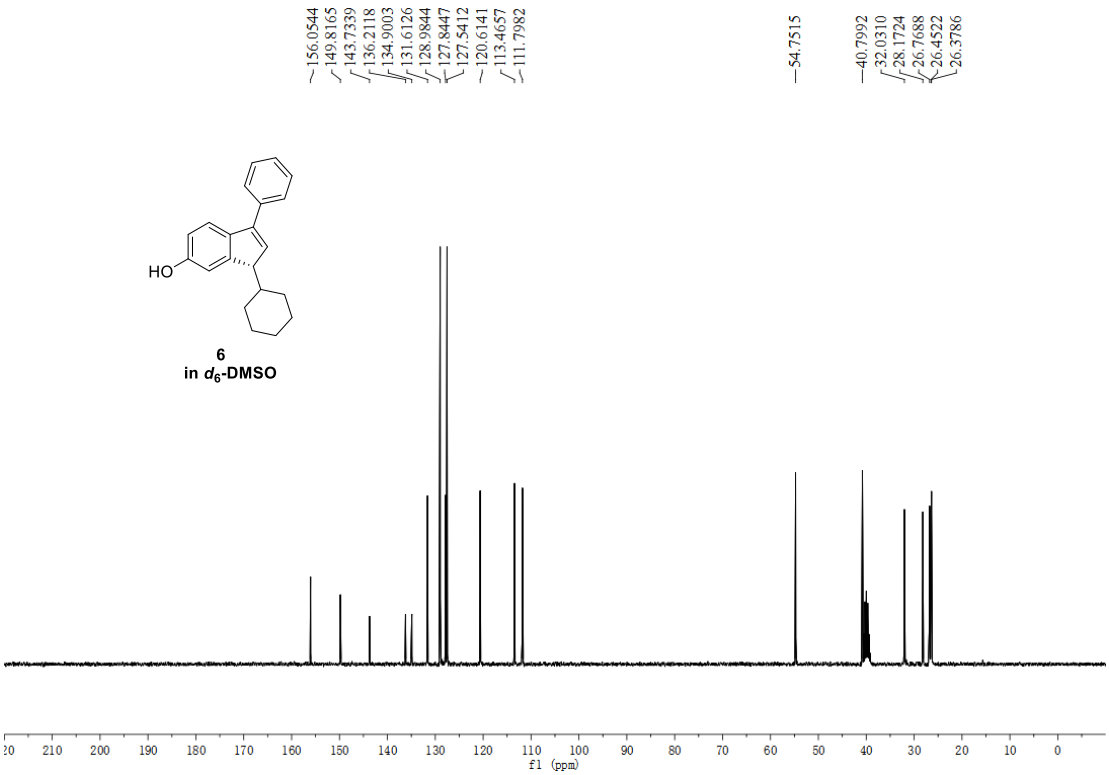
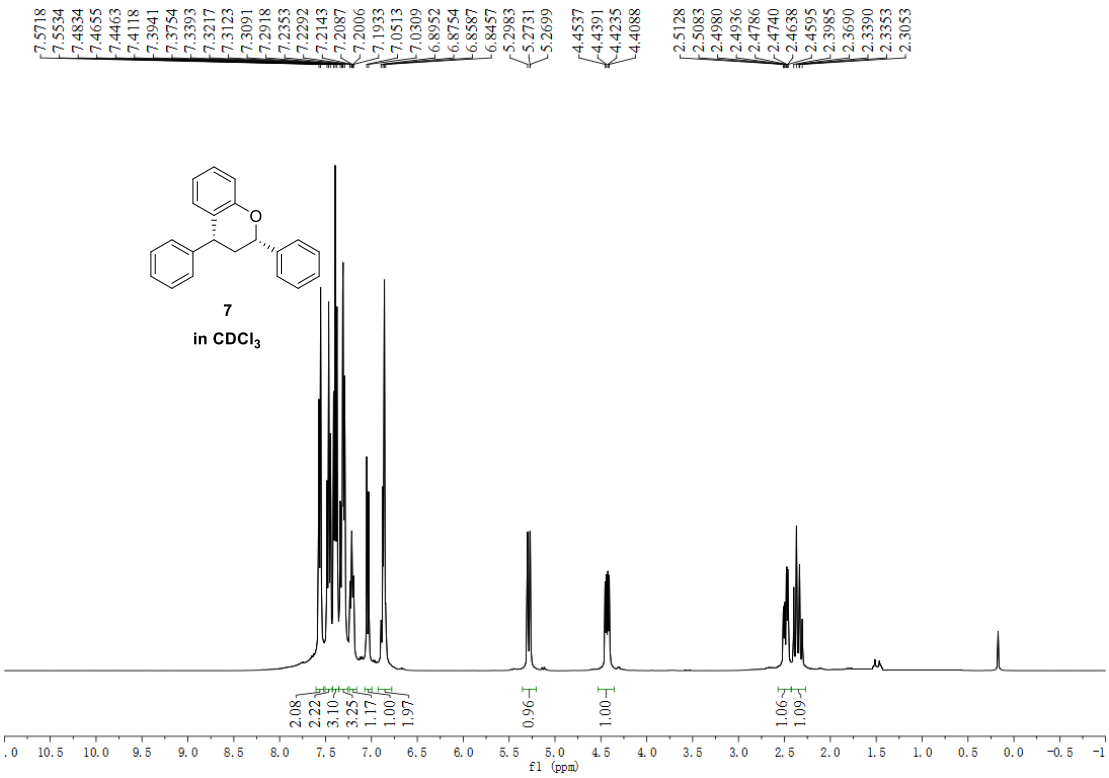
7.5556
7.4616
7.4377
7.4125
7.3722
7.3482
7.3241
7.2856
7.2583
6.9363
6.7259
6.7197
6.6987
6.6923
6.4317
6.4262
3.3546
1.9242
1.8930
1.8690
1.7434
1.7252
1.6113
1.5766
1.5405
1.3594
1.3345
1.2982
1.2654
1.2211
1.1860
1.1223
1.0896
1.0663
0.9039
0.8656
HO
6
in d_6-DMSO
1.00
2.00
2.02
1.01
1.02
1.00
1.01
1.01
1.02
2.02
1.02
2.01
3.00
2.02
1.00
f1 (ppm)


156.0544
149.8165
143.7339
136.2118
134.9003
131.6126
128.9844
127.8447
127.5412
120.6141
113.4657
111.7982
54.7515
40.7992
32.0310
28.1724
26.7688
26.4522
26.3786
HO
6
in d_6-DMSO
f1 (ppm)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7.4118
7.3941
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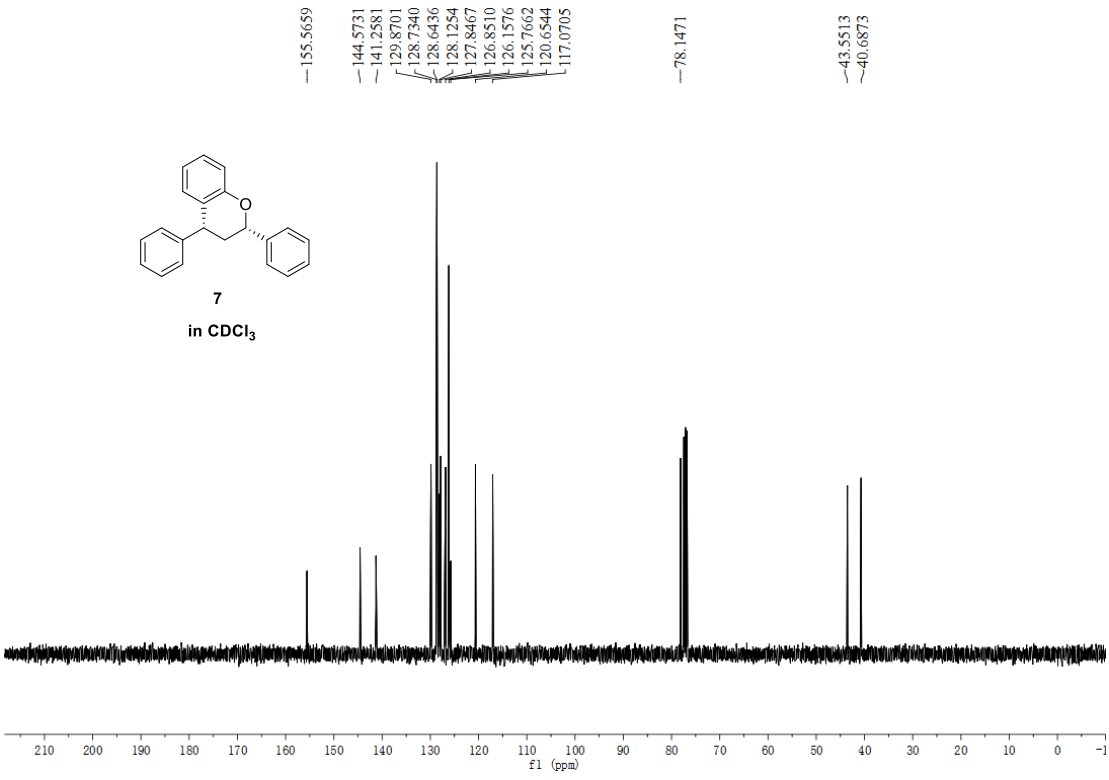
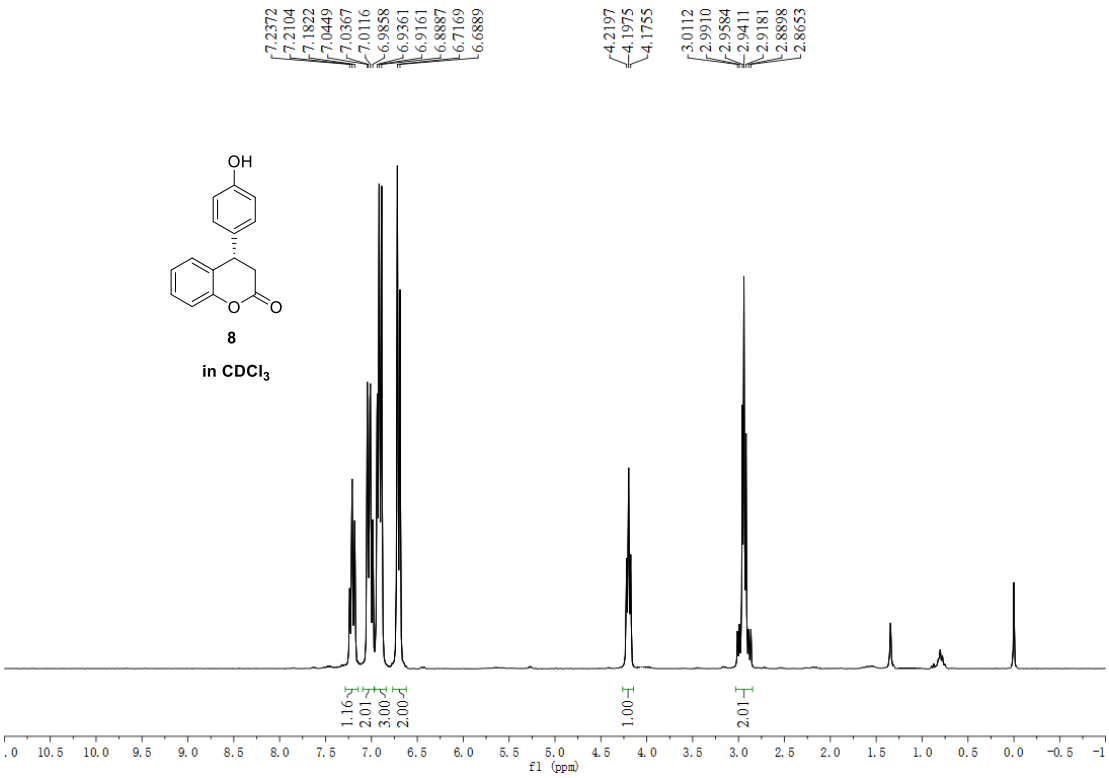
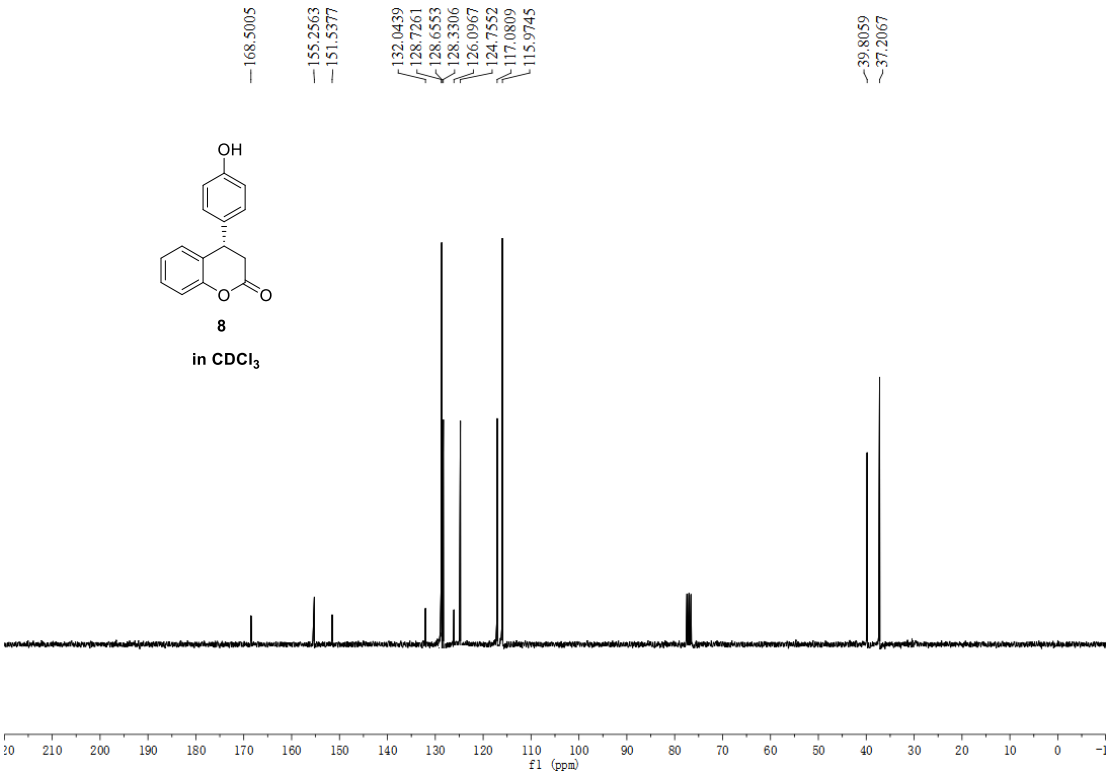
7.3393
7.3217
7.3123
7.3091
7.2918
7.2353
7.2292
7.2143
7.2087
7.2006
7.1933
7.0513
7.0309
6.8952
6.8754
6.8587
6.8457
5.2983
5.2731
5.2699
4.4537
4.4391
4.4235
4.4088
2.5128
2.5083
2.4980
2.4936
2.4786
2.4740
2.4638
2.4595
2.3985
2.3690
2.3390
2.3353
2.3053
7
in CDCl3
2.08
2.22
3.10
3.25
1.17
1.00
1.97
0.96
1.00
1.06
1.09
f1 (ppm)


155.5659
144.5731
141.2581
129.8701
128.7340
128.6436
128.1254
127.8467
126.8510
126.1576
125.7662
120.6544
117.0705
78.1471
43.5513
40.6873
7
in CDCl3
f1 (ppm)


7.2372
7.2104
7.1822
7.0449
7.0367
7.0116
6.9858
6.9361
6.9161
6.8887
6.7169
6.6889
4.2197
4.1975
4.1755
3.0112
2.9910
2.9584
2.9411
2.9181
2.8898
2.8653
OH
O
O
8
in CDCl3
1.16
2.01
3.00
2.00
1.00
2.01
f1 (ppm)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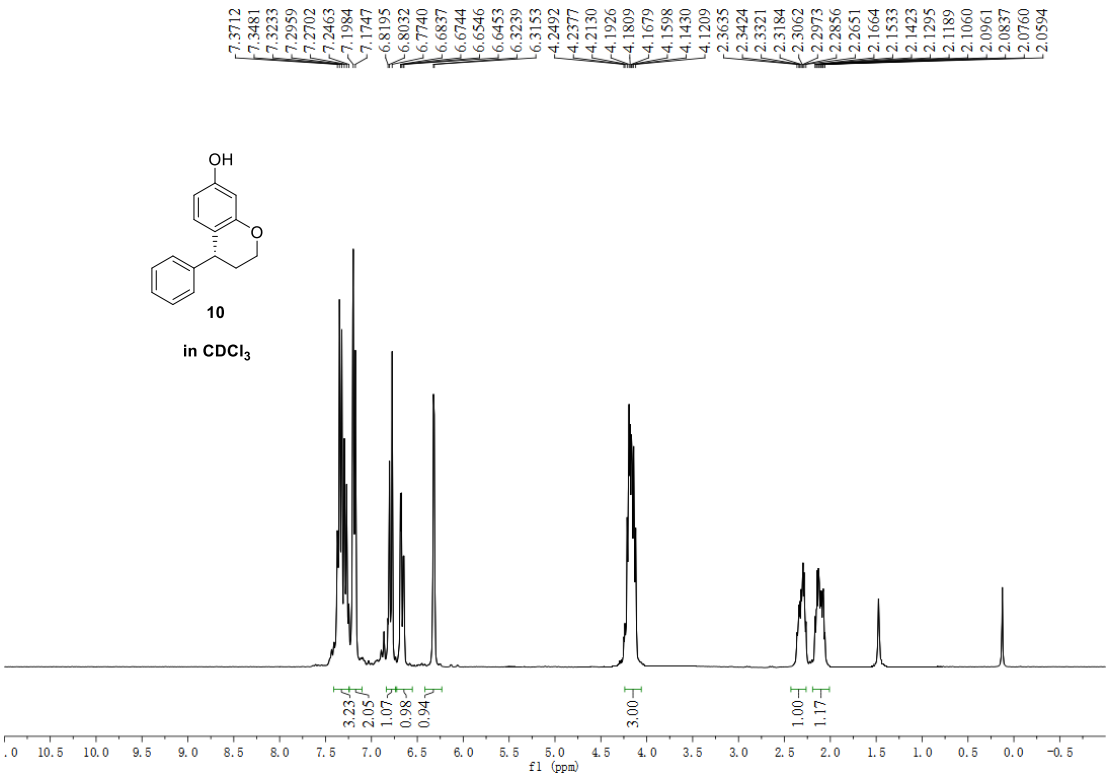
155.2563
151.5377
132.0439
128.7261
128.6553
128.3306
126.0967
124.7552
117.0809
115.9745
39.8059
37.2067
OH
O
O
8
in CDCl3
f1 (ppm)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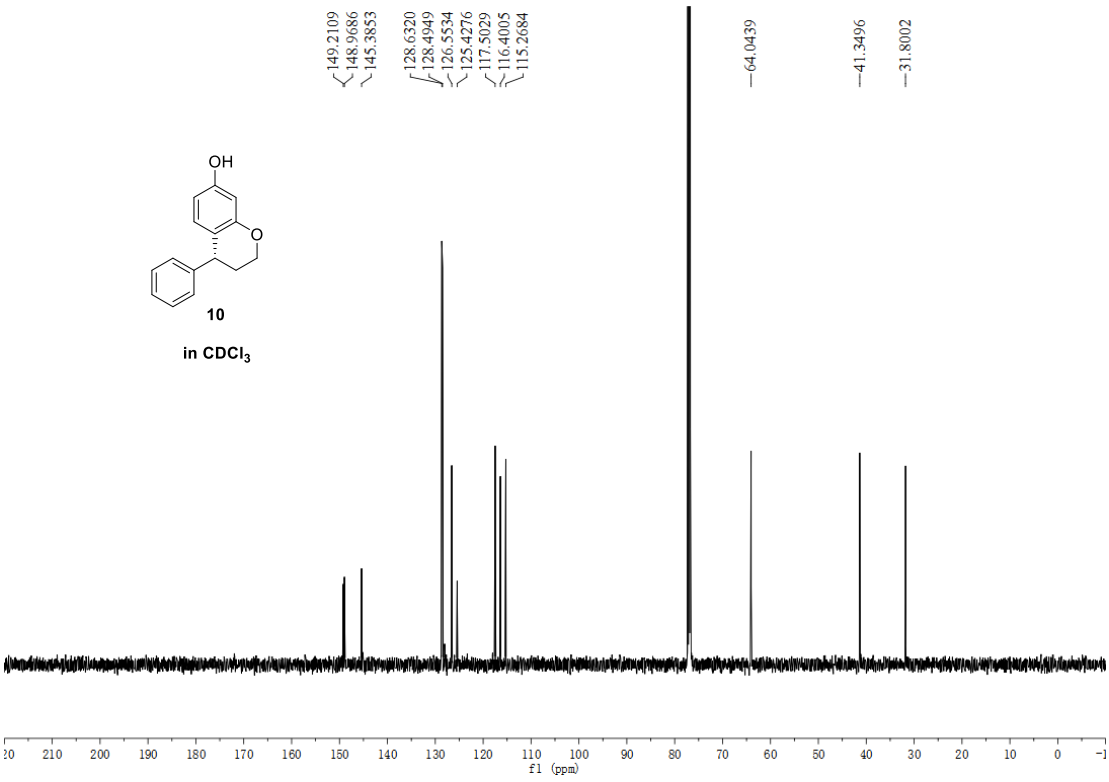
7.3233
7.2959
7.2702
7.2463
7.1984
7.1747
6.8195
6.8032
6.7740
6.6837
6.6744
6.6546
6.6453
6.3239
6.3153
4.2492
4.2377
4.2130
4.1926
4.1809
4.1679
4.1598
4.1430
4.1209
2.3635
2.3424
2.3321
2.3184
2.3062
2.2973
2.2856
2.2651
2.1664
2.1533
2.1423
2.1295
2.1189
2.1060
2.0961
2.0837
2.0760
2.0594
OH
O
10
in CDCl3
3.23
2.05
1.07
0.98
0.94
3.00
1.00
1.17
f1 (ppm)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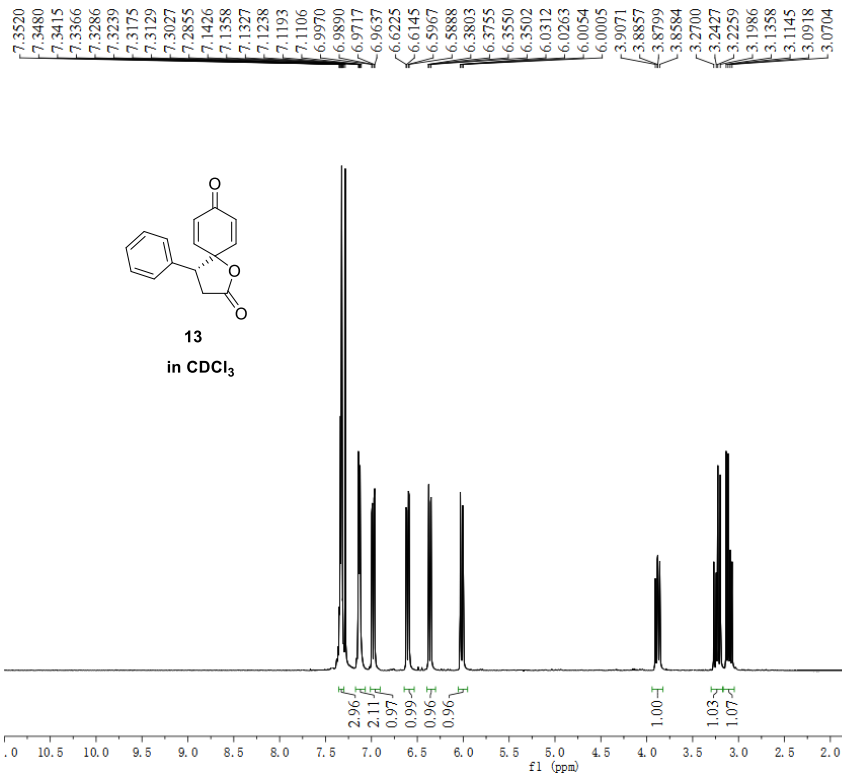
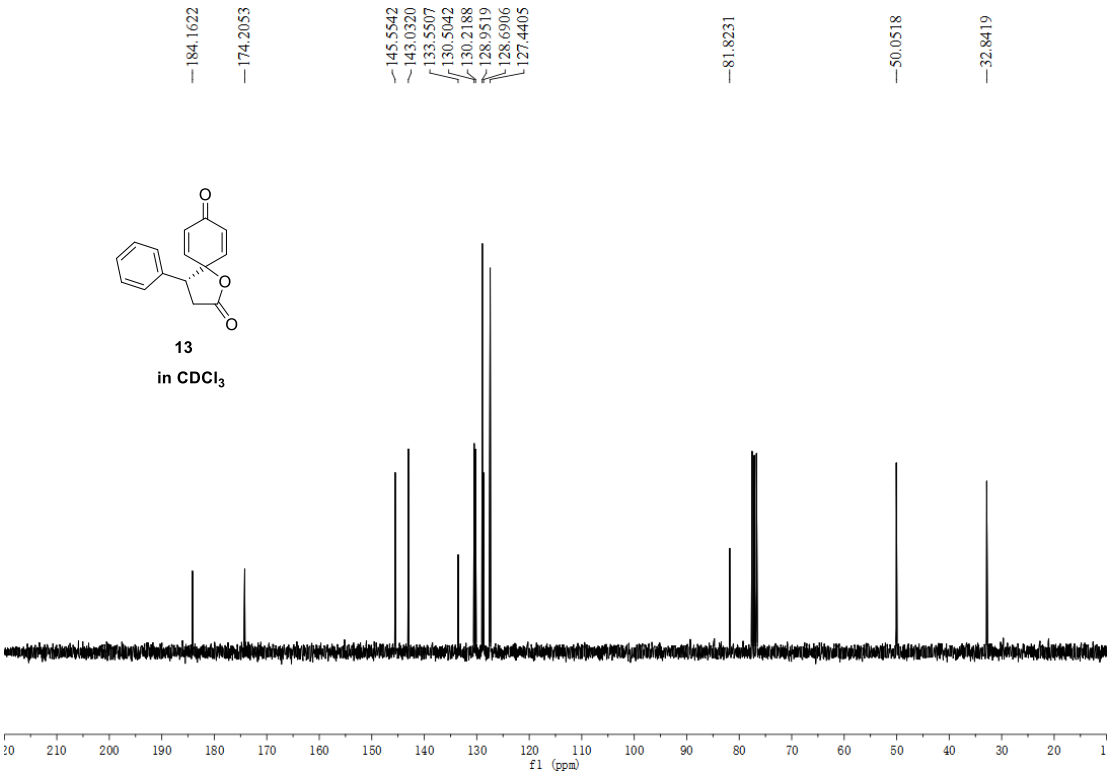
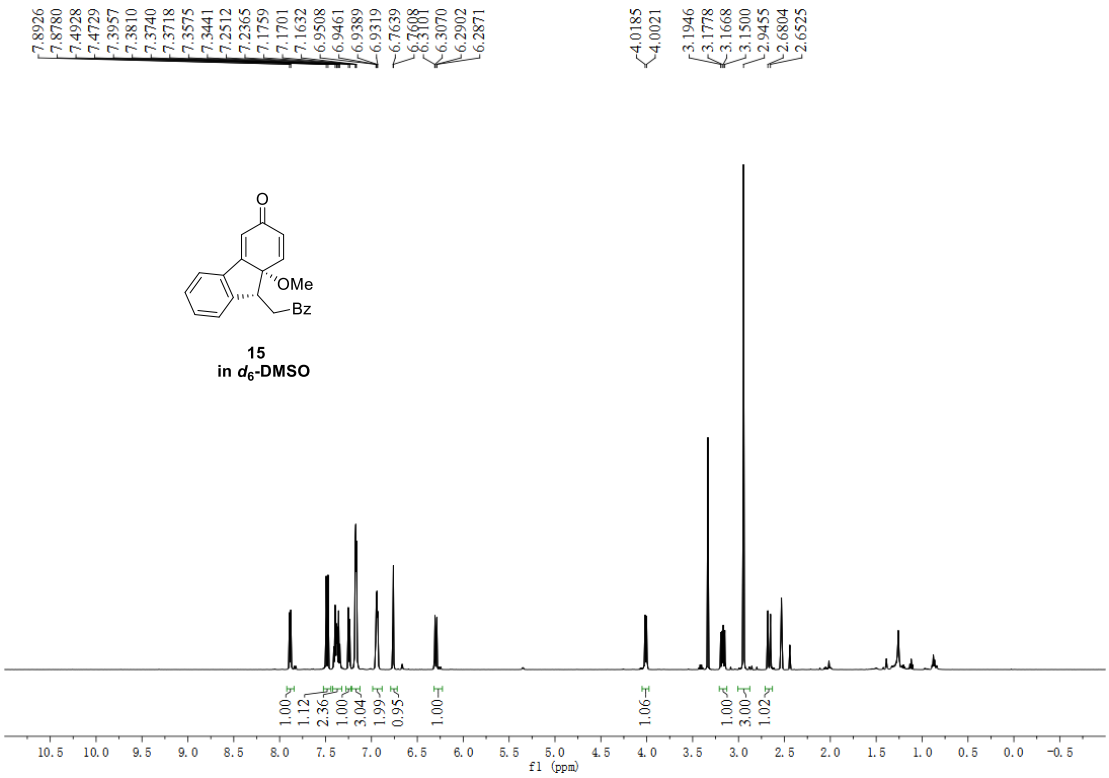
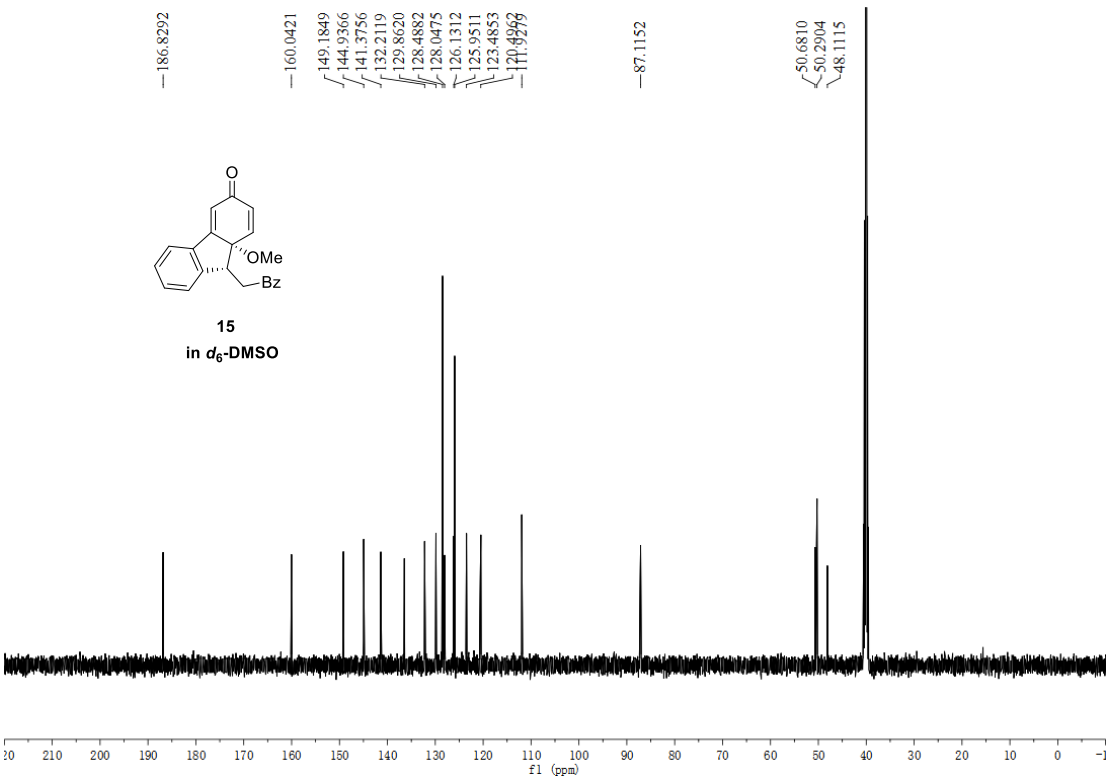
148.9686
145.3853
128.6320
128.4949
126.5534
125.4276
117.5029
116.4005
115.2684
64.0439
41.3496
31.8002
OH
O
10
in CDCl3
f1 (ppm)


7.3520
7.3480
7.3415
7.3366
7.3286
7.3239
7.3175
7.3129
7.3027
7.2855
7.1426
7.1358
7.1327
7.1238
7.1193
7.1106
6.9970
6.9890
6.9717
6.9637
6.6225
6.6145
6.5967
6.5888
6.3803
6.3755
6.3550
6.3502
6.0312
6.0263
6.0054
6.0005
3.9071
3.8857
3.8799
3.8584
3.2700
3.2427
3.2259
3.1986
3.1358
3.1145
3.0918
3.0704
13
in CDCl3
2.96
2.11
0.97
0.99
0.96
0.96
1.00
1.03
1.07
f1 (ppm)


184.1622
174.2053
145.5542
143.0320
133.5507
130.5042
130.2188
128.9519
128.6906
127.4405
81.8231
50.0518
32.8419
13
in CDCl3
f1 (ppm)


7.8926
7.8780
7.4928
7.4729
7.3957
7.3810
7.3740
7.3718
7.3575
7.3441
7.2512
7.2365
7.1759
7.1701
7.1632
6.9508
6.9461
6.9389
6.9319
6.7639
6.7608
6.3101
6.3070
6.2902
6.2871
4.0185
4.0021
3.1946
3.1778
3.1668
3.1500
2.9455
2.6804
2.6525
O
OMe
Bz
15
in d_6-DMSO
1.00
1.12
2.36
1.00
3.04
1.99
0.95
1.00
1.06
1.00
3.00
1.02
f1 (ppm)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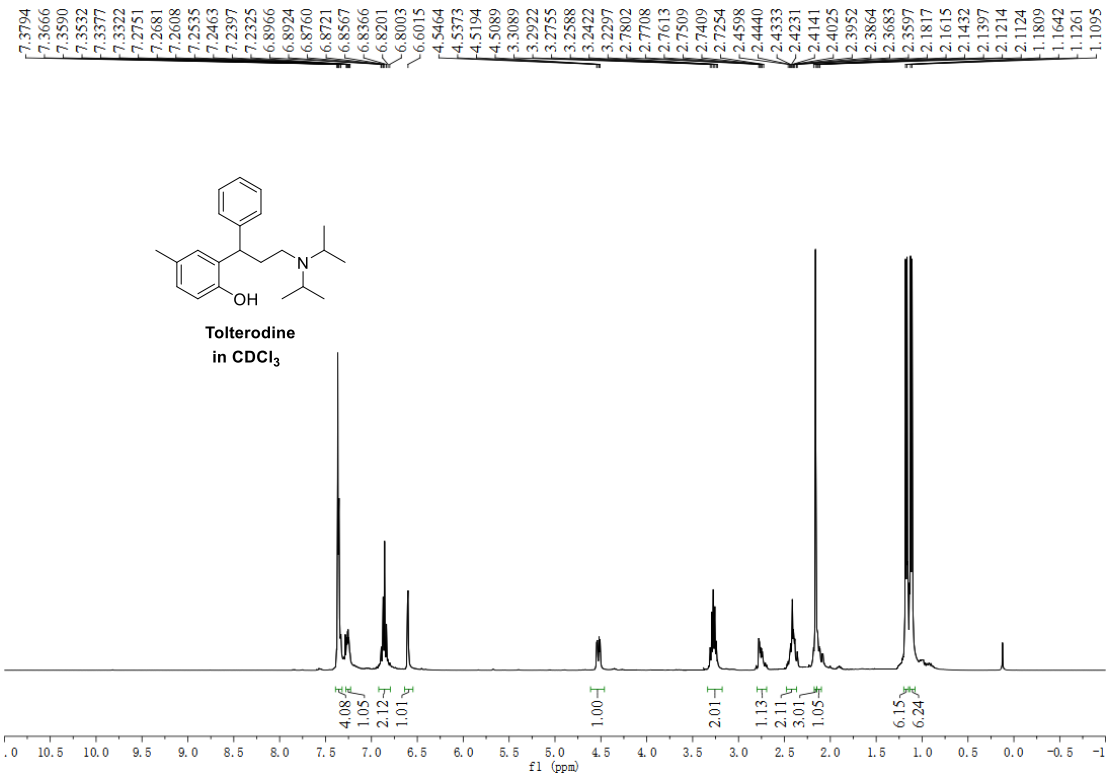
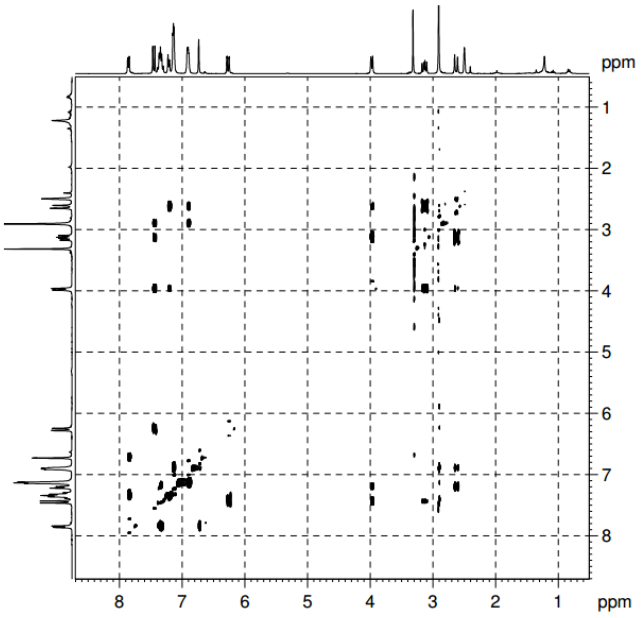
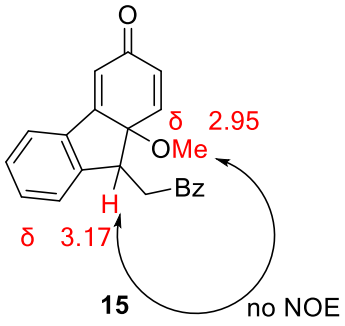
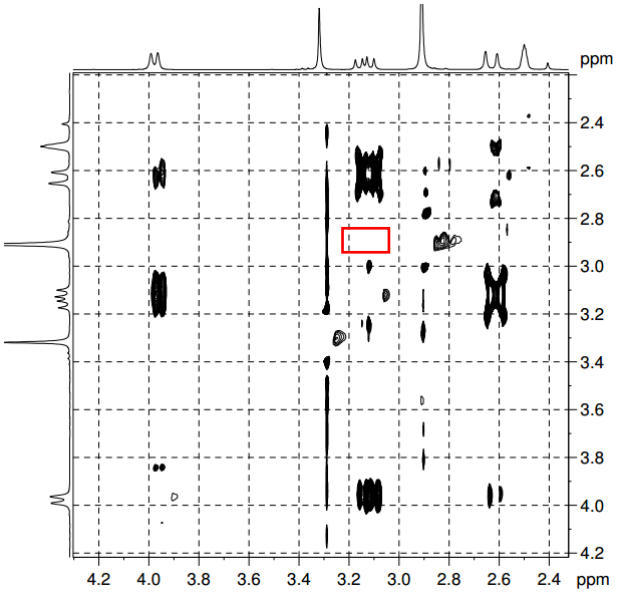
160.0421
149.1849
144.9366
141.3756
132.2119
129.8620
128.4882
128.0475
126.1312
125.9511
123.4853
120.4962
111.9279
87.1152
50.6810
50.2904
48.1115
O
OMe
Bz
15
in d_6-DMSO
f1 (ppm)

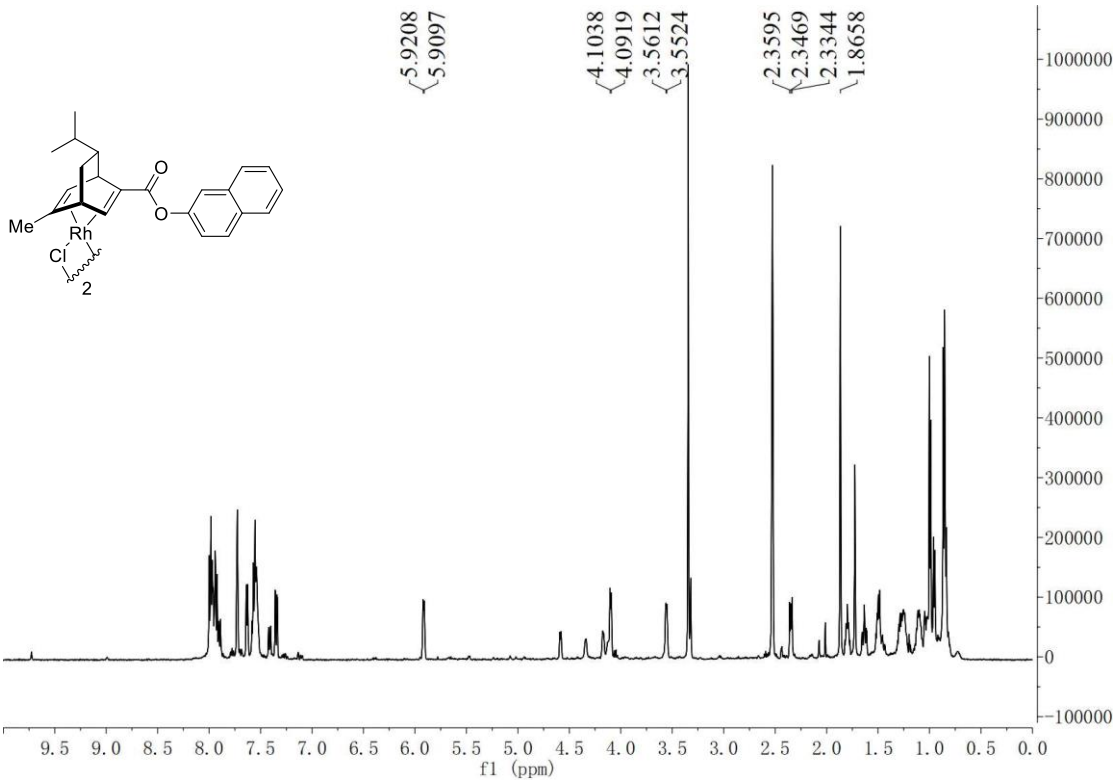

7.3794
7.3666
7.3590
7.3532
7.3377
7.3322
7.2751
7.2681
7.2608
7.2535
7.2463
7.2397
7.2325
6.8966
6.8924
6.8760
6.8721
6.8567
6.8366
6.8201
6.8003
6.6015
4.5464
4.5373
4.5194
4.5089
3.3089
3.2922
3.2755
3.2588
3.2422
3.2297
2.7802
2.7708
2.7613
2.7509
2.7409
2.7254
2.4598
2.4440
2.4333
2.4231
2.4141
2.4025
2.3952
2.3864
2.3683
2.3597
2.1817
2.1615
2.1432
2.1397
2.1214
2.1124
1.1809
1.1642
1.1261
1.1095
N
OH
Tolterodine
in CDCl3
4.08
1.05
2.12
1.01
1.00
2.01
1.13
2.11
3.01
1.05
6.15
6.24
f1 (ppm)

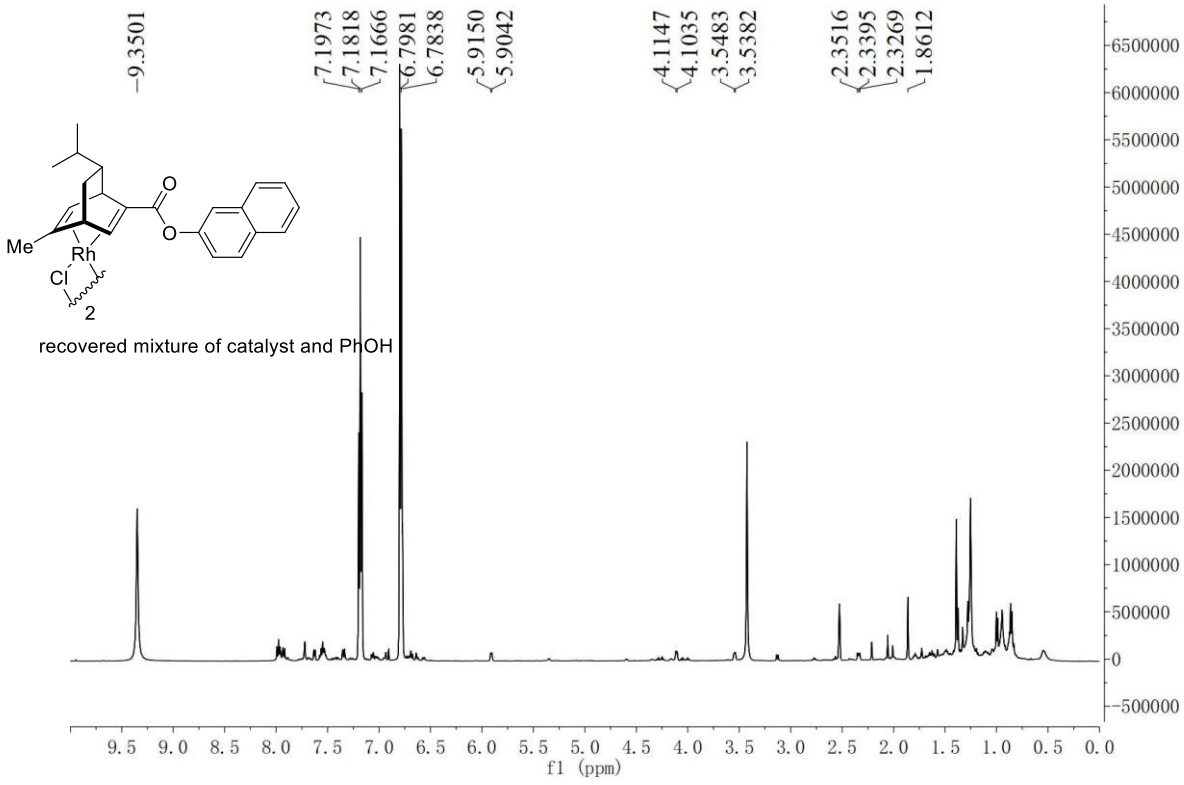
15 NOESY DMSO 303K AV-300



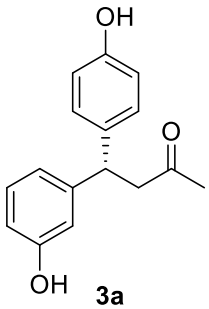




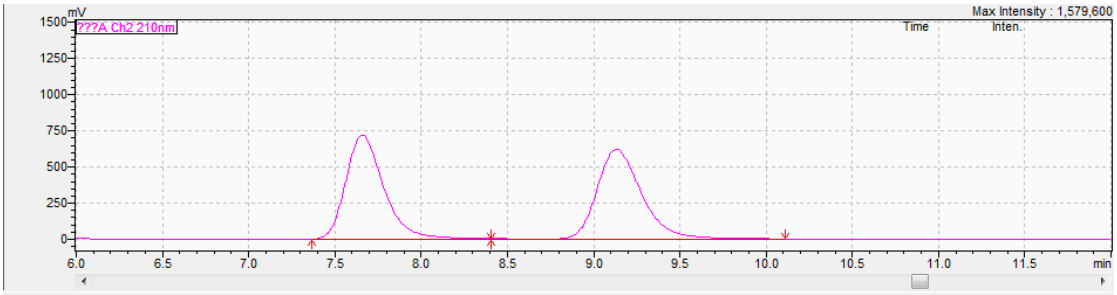

5.9208
5.9097
4.1038
4.0919
3.5612
3.5524
2.3595
2.3469
2.3344
1.8658
Me
Rh
Cl
2
O
O
f1 (ppm)


9.3501
7.1973
7.1818
7.1666
6.7981
6.7838
5.9150
5.9042
4.1147
4.1035
3.5483
3.5382
2.3516
2.3395
2.3269
1.8612
Me
Rh
Cl
2
O
O
recovered mixture of catalyst and PhOH
f1 (ppm)

11.HPLC Charts



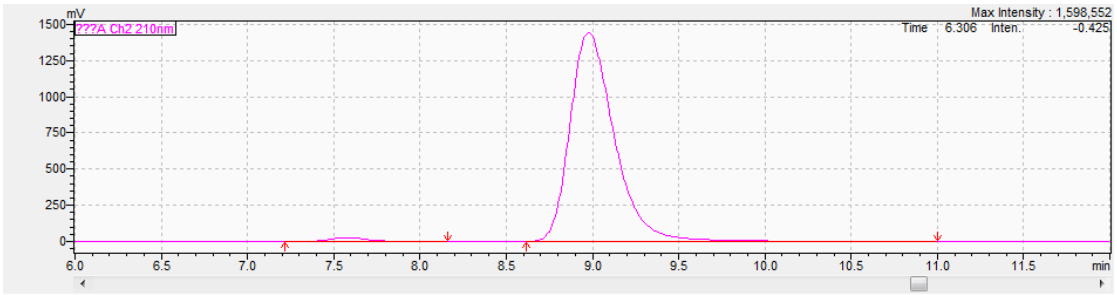
3a



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

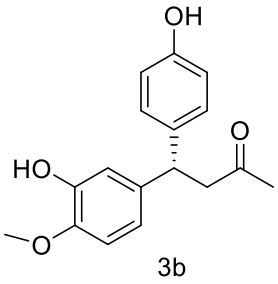
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.659	11038992	718343	49.881	49.881
2	9.132	11091715	618238	50.119	50.119
Total		22130707	1336582	100.000	100.000



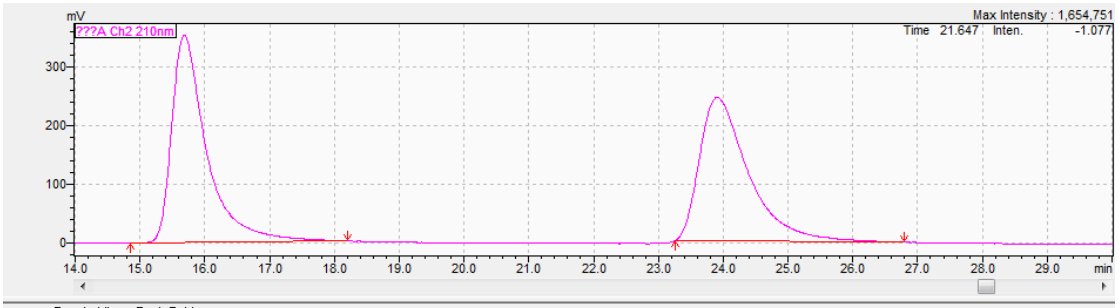
Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.576	428398	28274	1.632	1.632
2	8.978	25825008	1444473	98.368	98.368
Total		26253406	1472747	100.000	100.000



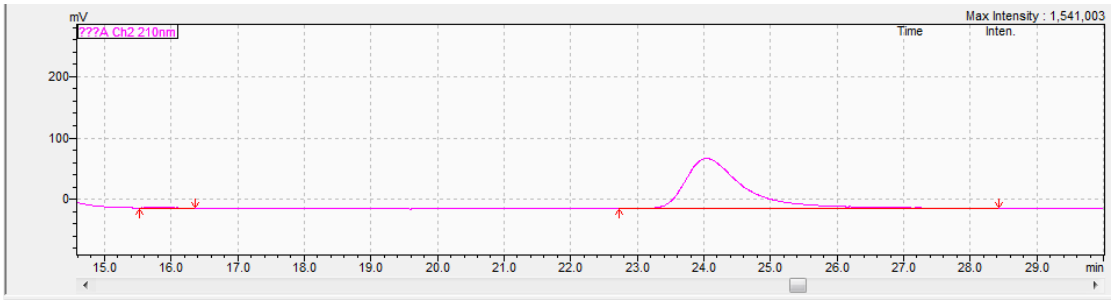
3b



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

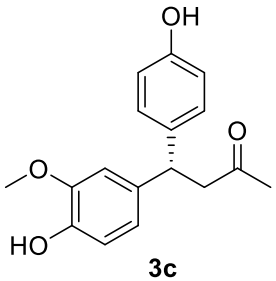
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	15.684	13173779	352997	50.718	50.718
2	23.910	12800698	244281	49.282	49.282
Total		25974477	597278	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	15.895	21362	784	0.423	0.423
2	24.039	5032119	81857	99.577	99.577
Total		5053481	82641	100.000	100.000



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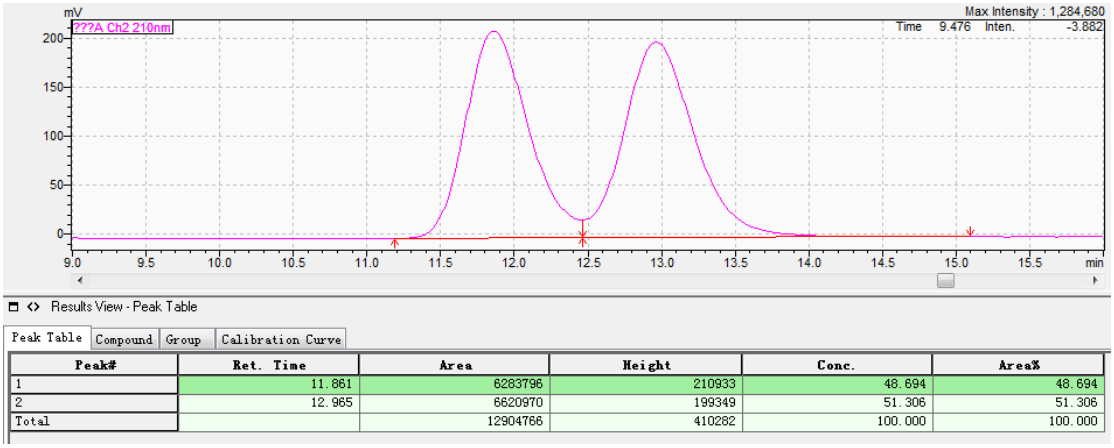
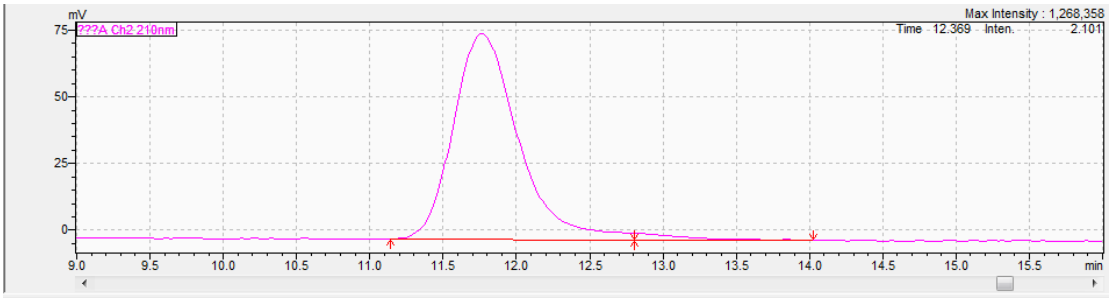


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

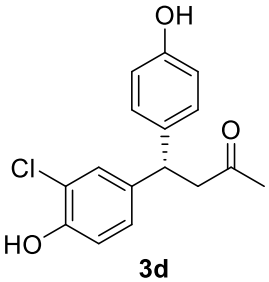
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	11.861	6283796	210933	48.694	48.694
2	12.965	6620970	199349	51.306	51.306
Total		12904766	410282	100.000	100.000



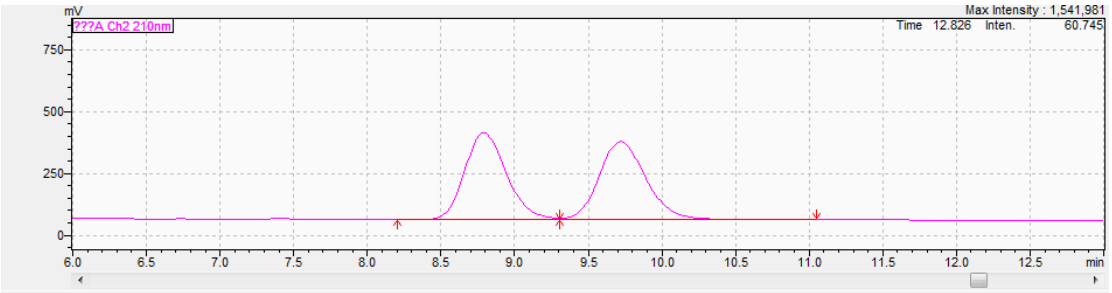
Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	11.763	2382758	77140	97.759	97.759
2	12.836	54621	2507	2.241	2.241
Total		2437380	79647	100.000	100.000



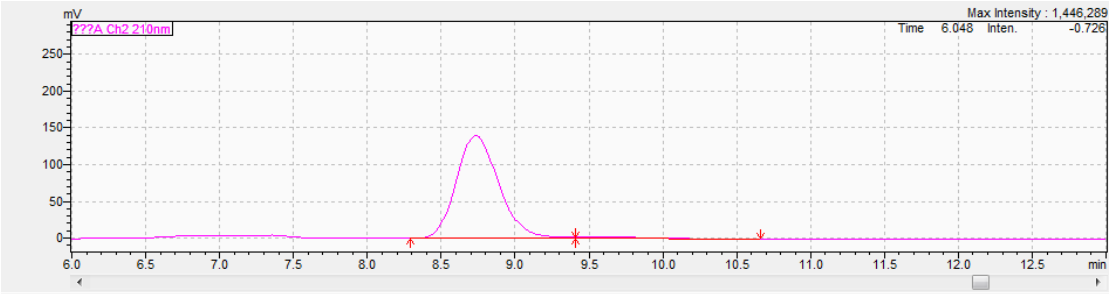
3d



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

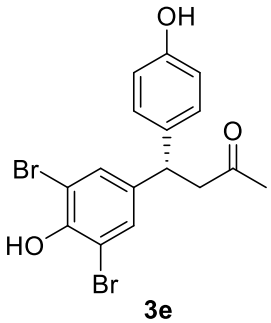
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.791	6927301	351849	49.575	49.575
2	9.720	7046148	316632	50.425	50.425
Total		13973449	668481	100.000	100.000



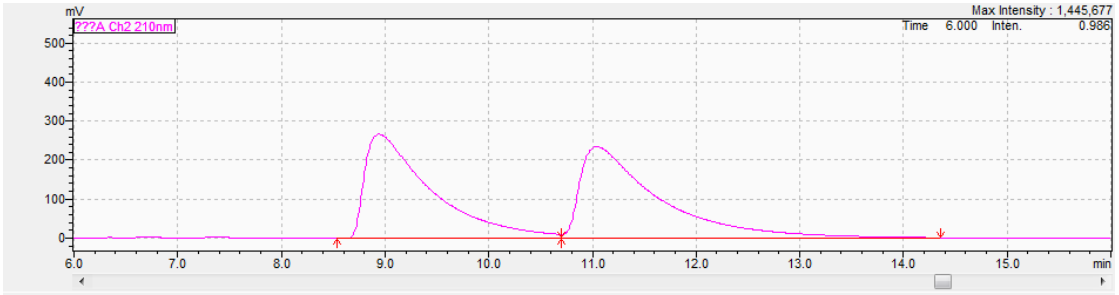
Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.734	2809742	140020	97.625	97.625
2	9.656	68353	2734	2.375	2.375
Total		2878095	142754	100.000	100.000



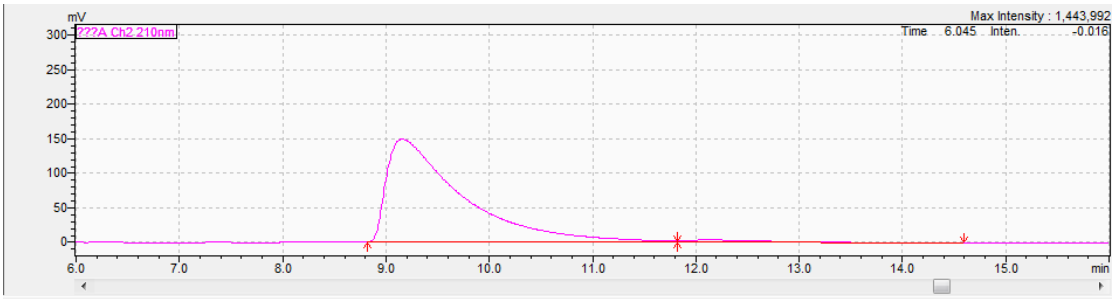
3e



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

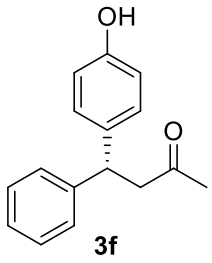
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.941	11893692	267462	49.303	49.303
2	11.040	12229977	235293	50.697	50.697
Total		24123669	502755	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	9.159	7486376	148417	97.241	97.241
2	12.118	212394	3427	2.759	2.759
Total		7698770	151844	100.000	100.000



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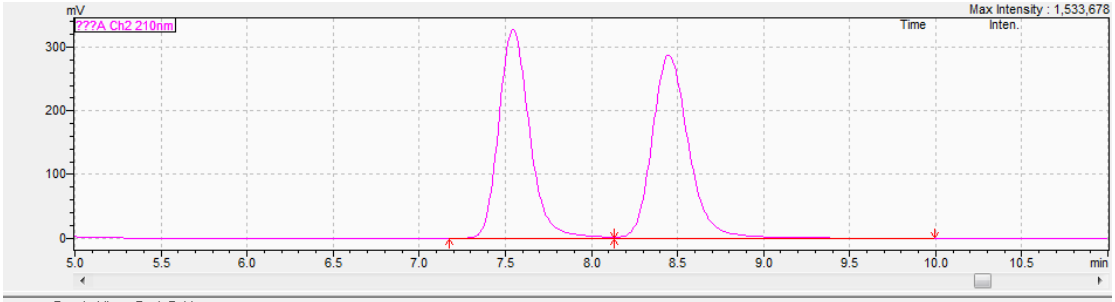
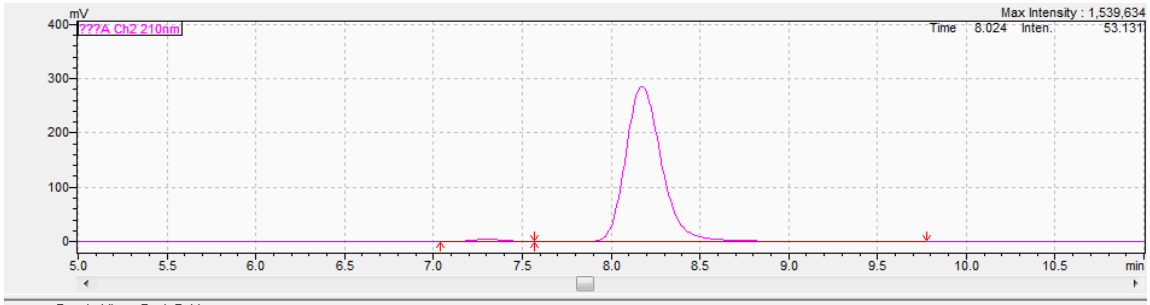


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

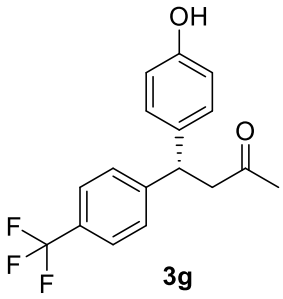
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.545	4080886	327735	49.204	49.204
2	8.450	4212946	287270	50.796	50.796
Total		8293831	615005	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.300	54684	4625	1.343	1.343
2	8.175	4017989	286292	98.657	98.657
Total		4072672	290917	100.000	100.000



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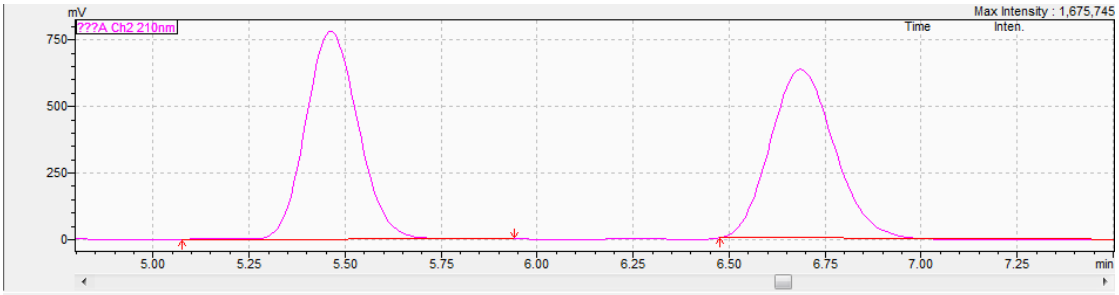
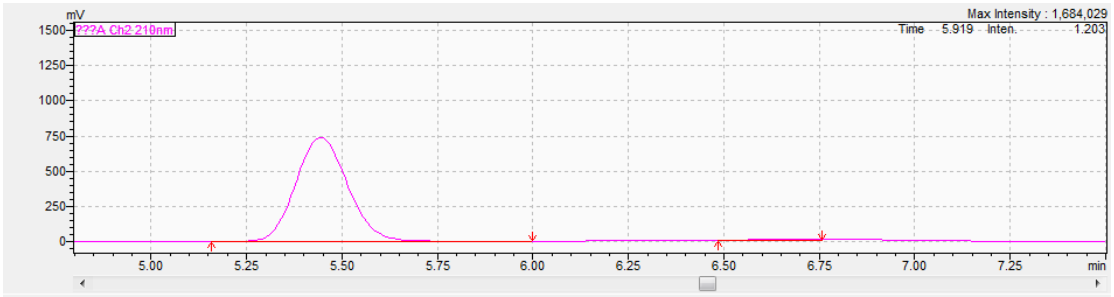


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

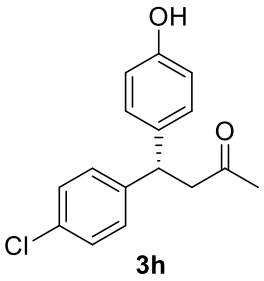
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.463	7398488	779153	50.499	50.499
2	6.686	7252257	632926	49.501	49.501
Total		14650745	1412079	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.444	6940434	737649	98.156	98.156
2	6.666	130409	12296	1.844	1.844
Total		7070843	749945	100.000	100.000



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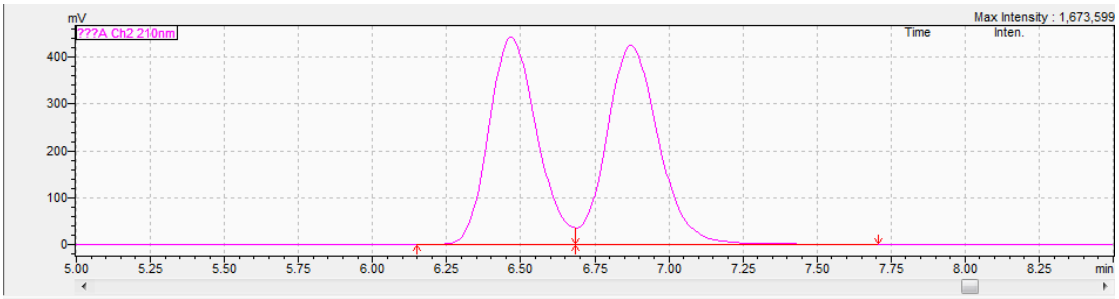
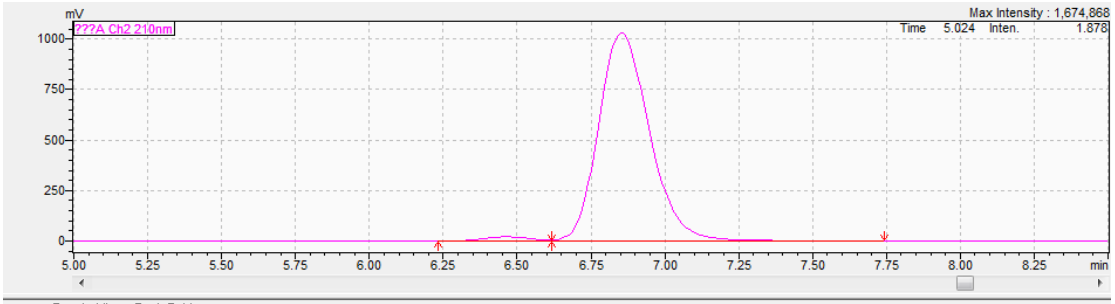


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

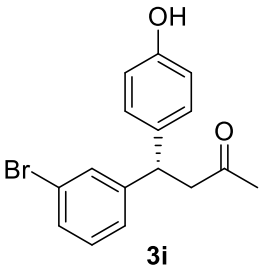
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.467	4968949	443090	49.002	49.002
2	6.872	5171320	425343	50.998	50.998
Total		10140269	868433	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.464	212219	20109	1.695	1.695
2	6.854	12308663	1029905	98.305	98.305
Total		12520883	1050014	100.000	100.000



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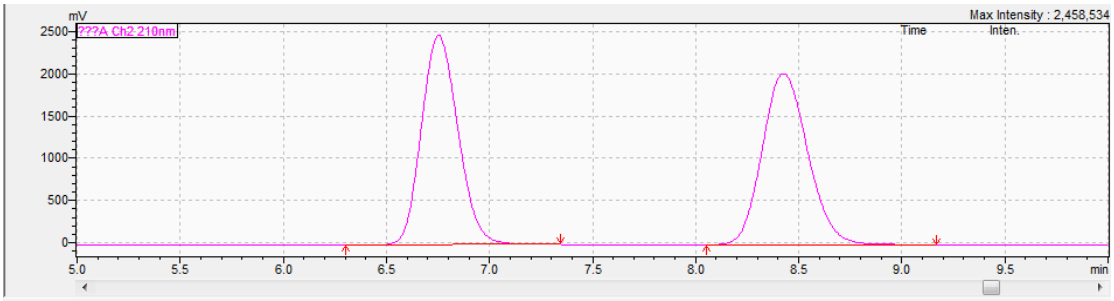
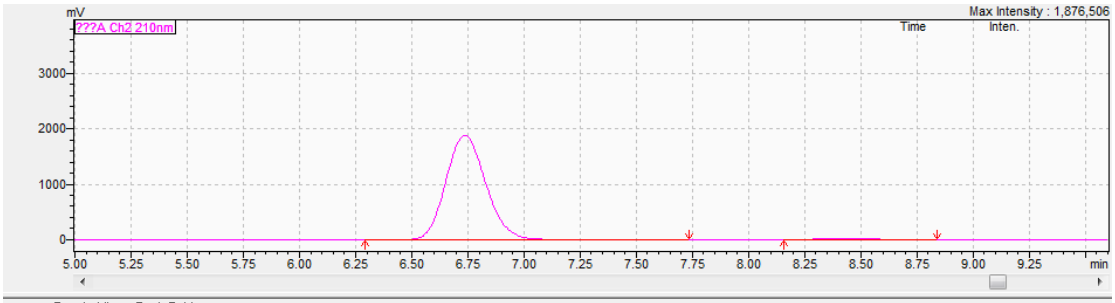


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

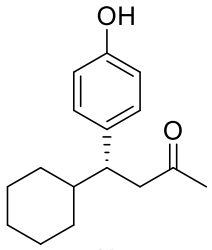
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.753	30564644	2482461	49.691	49.691
2	8.426	30944334	2026228	50.309	50.309
Total		61508978	4508688	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.735	23217684	1877624	98.351	98.351
2	8.432	389398	27141	1.649	1.649
Total		23607082	1904765	100.000	100.000



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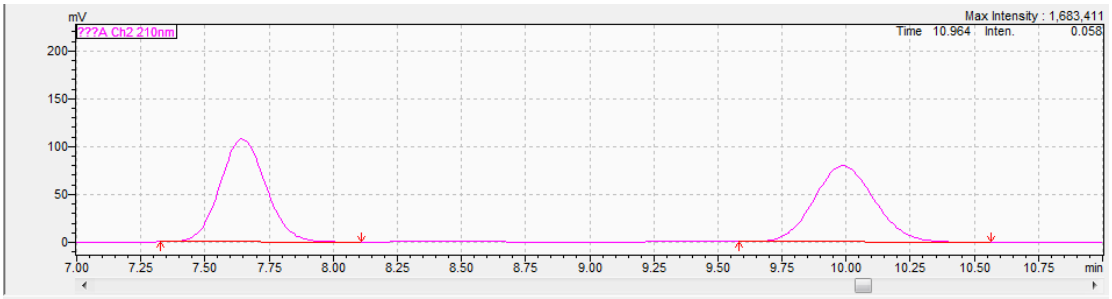
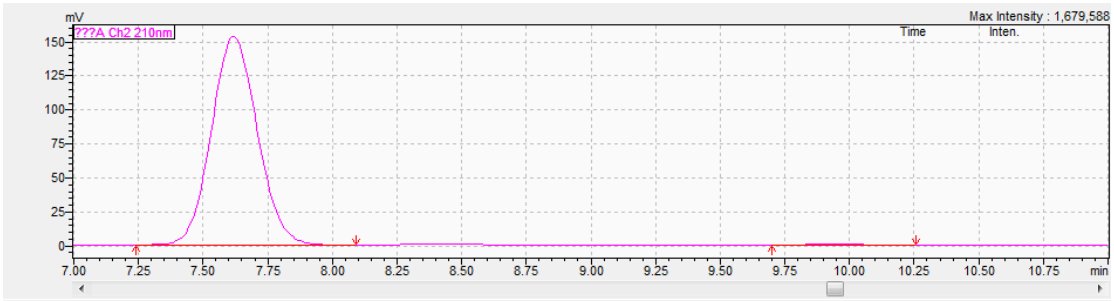


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

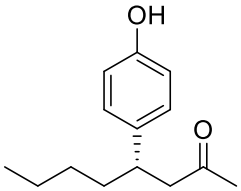
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.645	1332048	107285	50.626	50.626
2	9.988	1299130	79207	49.374	49.374
Total		2631178	186493	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.618	1891917	153238	99.389	99.389
2	9.938	11633	870	0.611	0.611
Total		1903551	154108	100.000	100.000



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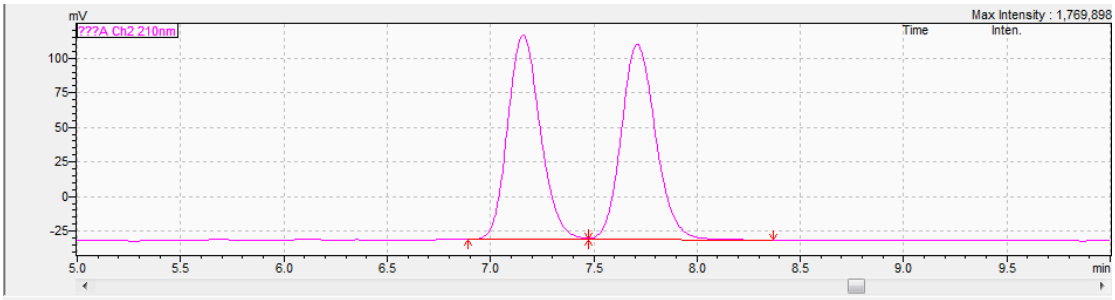
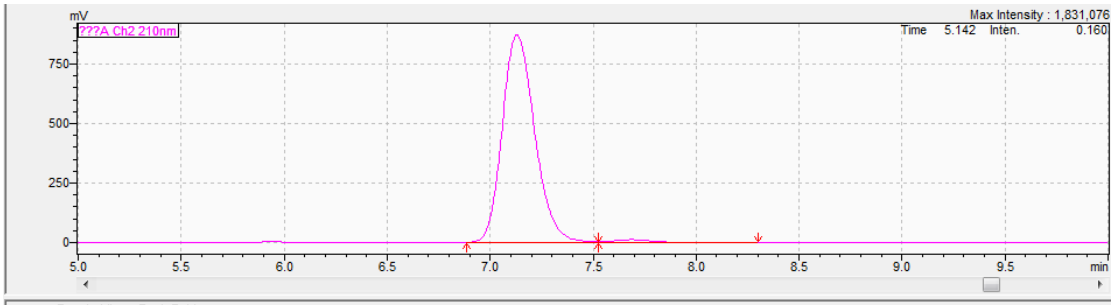


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

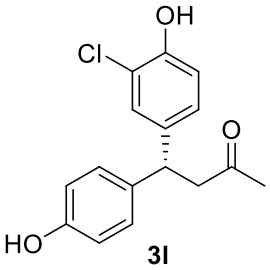
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.157	1614050	147707	49.727	49.727
2	7.711	1631796	141034	50.273	50.273
Total		3245846	288742	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.130	9554335	872310	98.428	98.428
2	7.687	152628	11888	1.572	1.572
Total		9706963	884199	100.000	100.000



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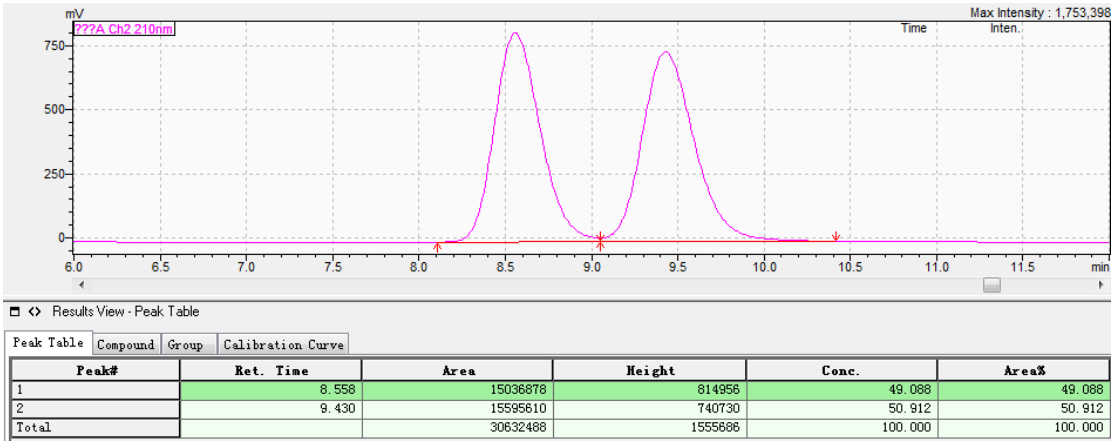
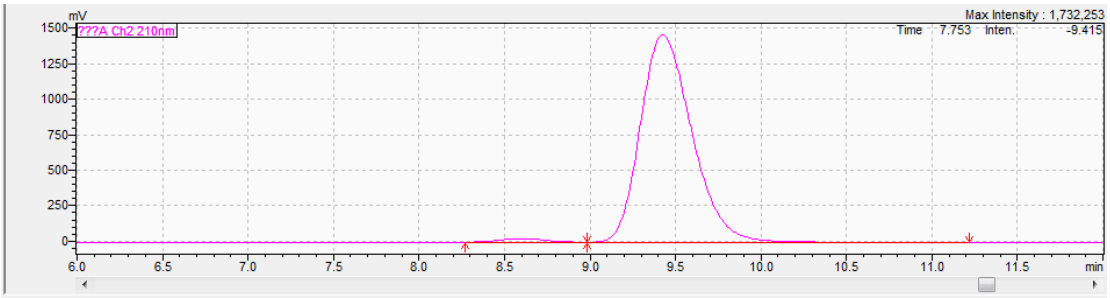


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

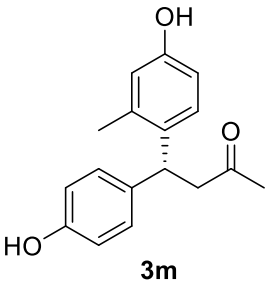
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.558	15036878	814956	49.088	49.088
2	9.430	15595610	740730	50.912	50.912
Total		30632488	1555686	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.595	454787	25803	1.464	1.464
2	9.426	30618099	1463013	98.536	98.536
Total		31072886	1488816	100.000	100.000



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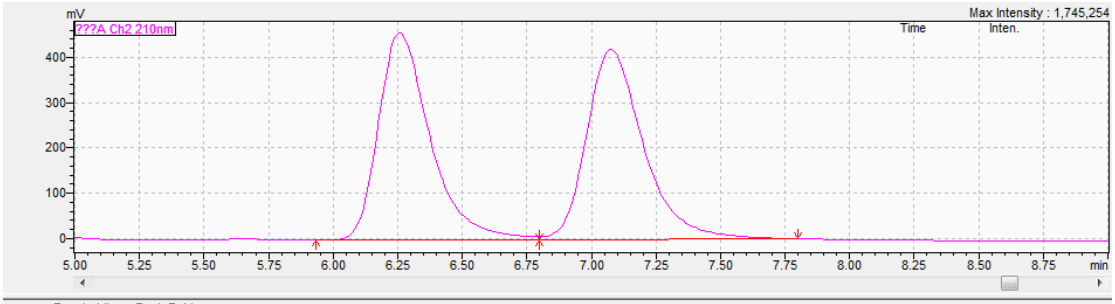
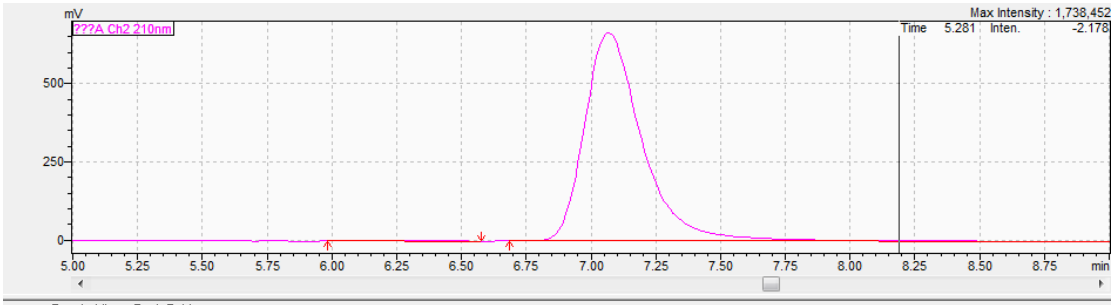


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

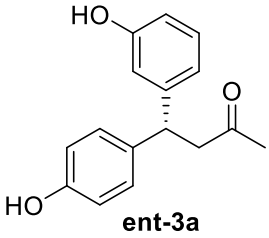
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.258	6374668	456833	49.879	49.879
2	7.076	6405486	418662	50.121	50.121
Total		12780154	875495	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.282	35496	2699	0.342	0.342
2	7.067	10332721	665292	99.658	99.658
Total		10368218	667990	100.000	100.000



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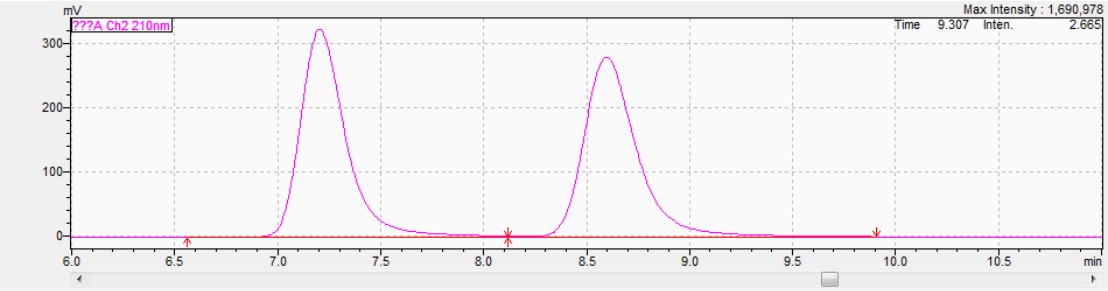
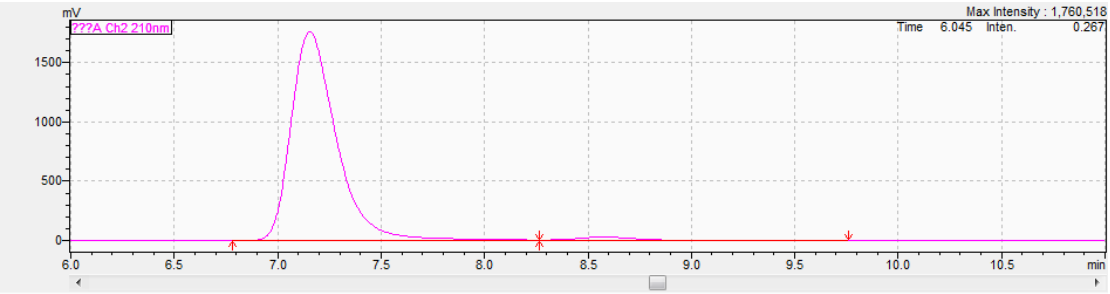


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

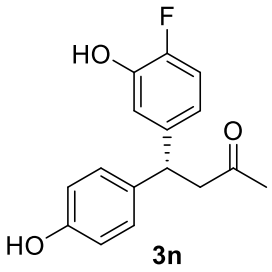
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.204	4903617	321717	49.796	49.796
2	8.596	4943706	278212	50.204	50.204
Total		9847323	599929	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.154	26649016	1758811	97.856	97.856
2	8.576	583866	28905	2.144	2.144
Total		27232882	1787716	100.000	100.000



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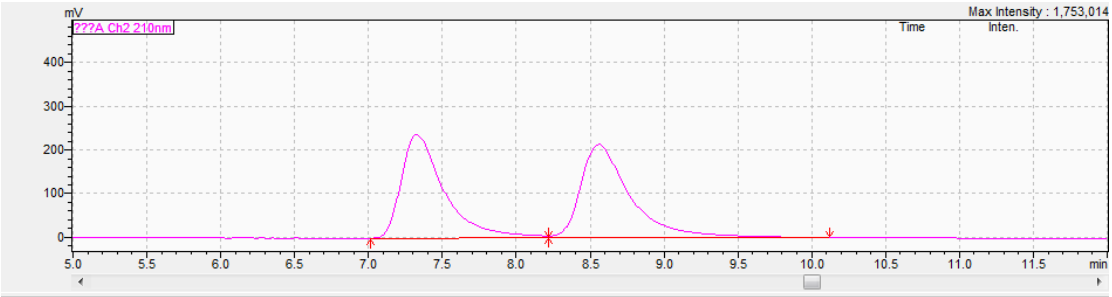
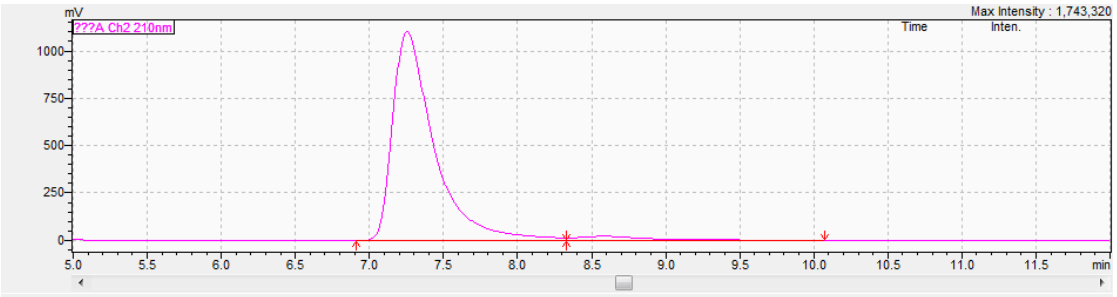


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

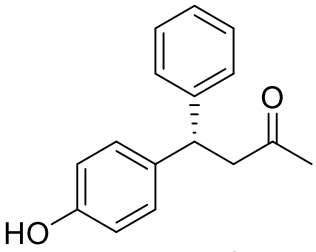
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.327	4815040	236966	49.096	49.096
2	8.559	4992391	213799	50.904	50.904
Total		9807431	450765	100.000	100.000



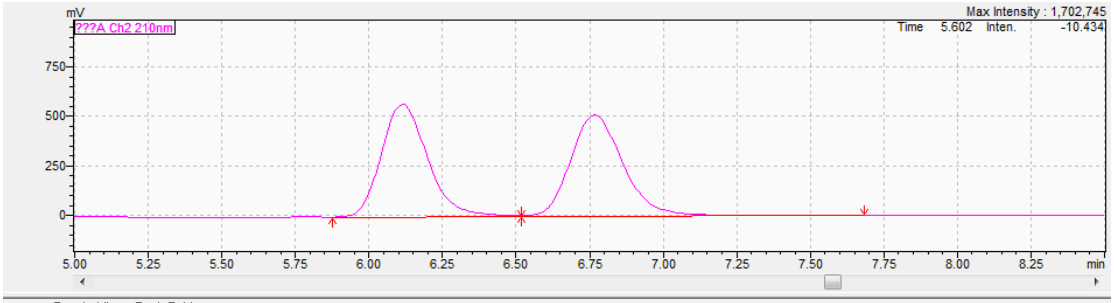
Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.254	21499425	1103734	96.772	96.772
2	8.585	717050	21881	3.228	3.228
Total		22216475	1125615	100.000	100.000



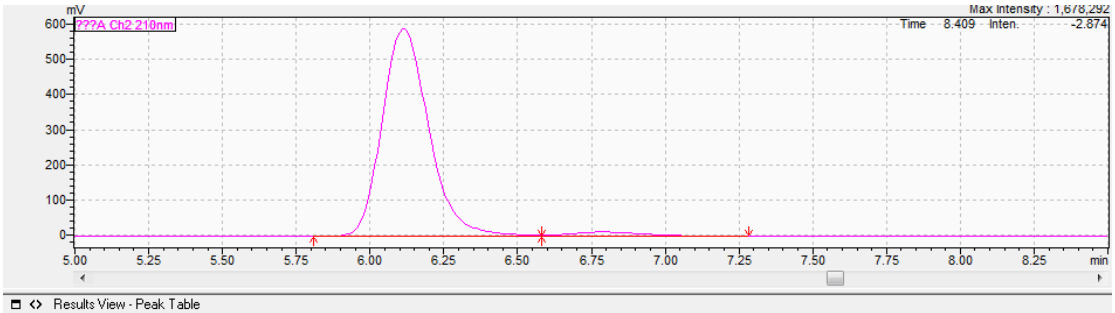
ent-3f



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

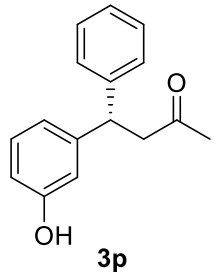
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.114	6232970	566692	49.453	49.453
2	6.767	6370763	510233	50.547	50.547
Total		12603733	1076925	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.114	6470655	588930	97.188	97.188
2	6.786	187219	11501	2.812	2.812
Total		6657874	600431	100.000	100.000



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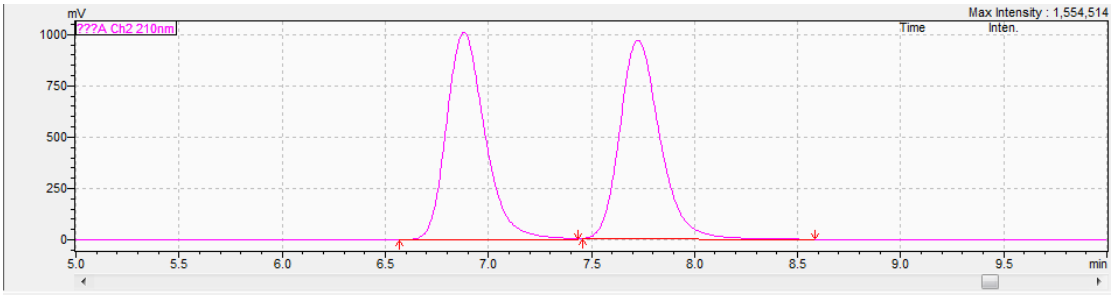
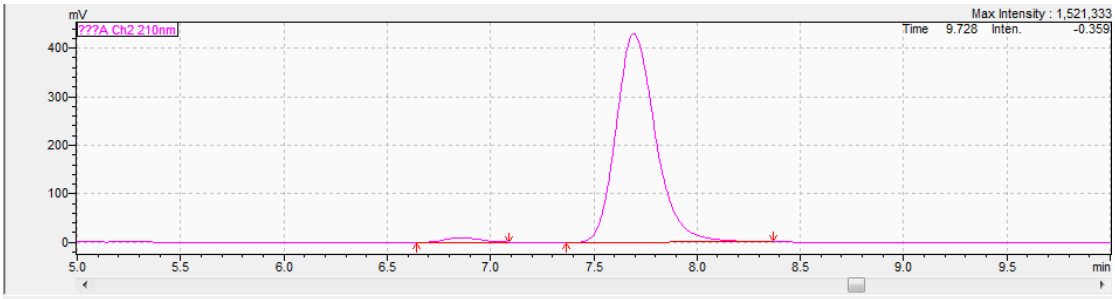


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

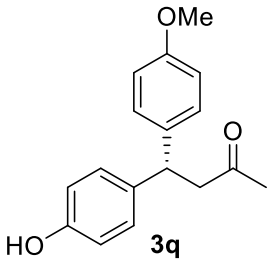
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.882	13146332	1011462	50.293	50.293
2	7.725	12993246	967311	49.707	49.707
Total		26139578	1978773	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.861	112091	9816	1.931	1.931
2	7.695	5693093	429451	98.069	98.069
Total		5805184	439267	100.000	100.000



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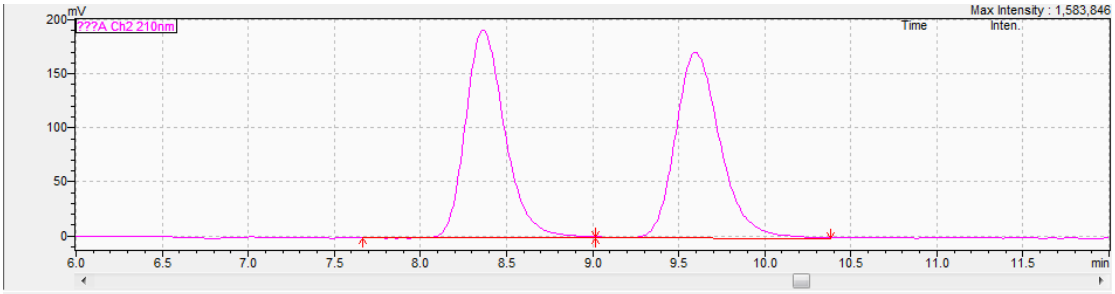
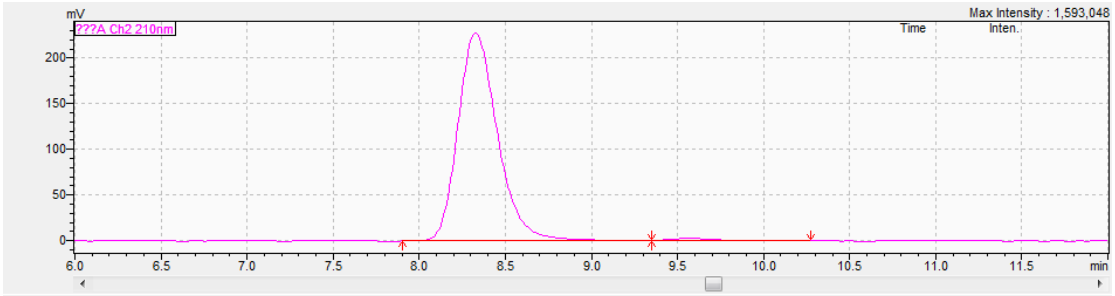


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

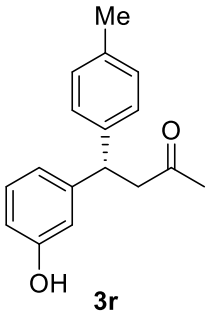
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.365	3054954	192247	49.568	49.568
2	9.599	3108154	171980	50.432	50.432
Total		6163108	364228	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.328	3646175	227793	98.599	98.599
2	9.548	51792	2686	1.401	1.401
Total		3697967	230479	100.000	100.000



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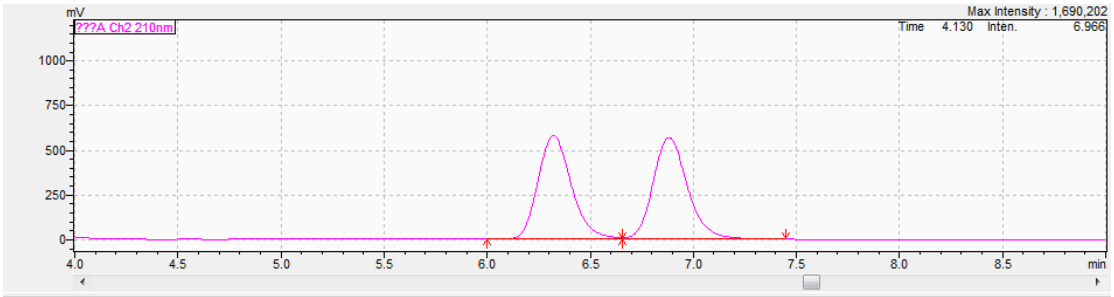
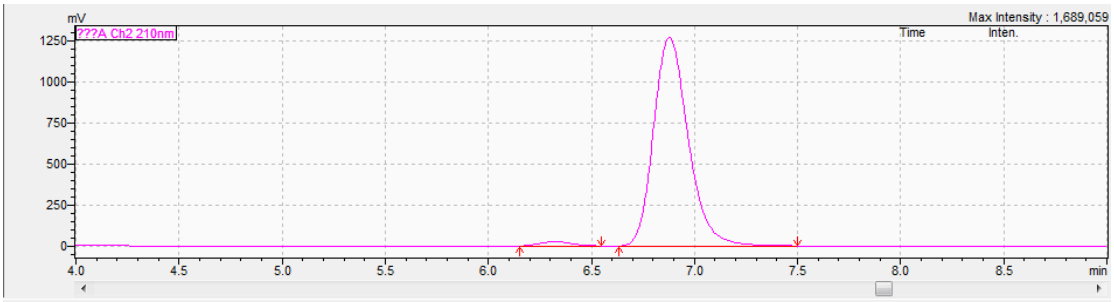


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

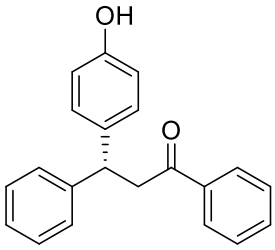
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.322	6544555	579239	49.751	49.751
2	6.882	6610062	567843	50.249	50.249
Total		13154617	1147082	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.324	263195	25093	1.744	1.744
2	6.878	14830151	1269613	98.256	98.256
Total		15093346	1294706	100.000	100.000



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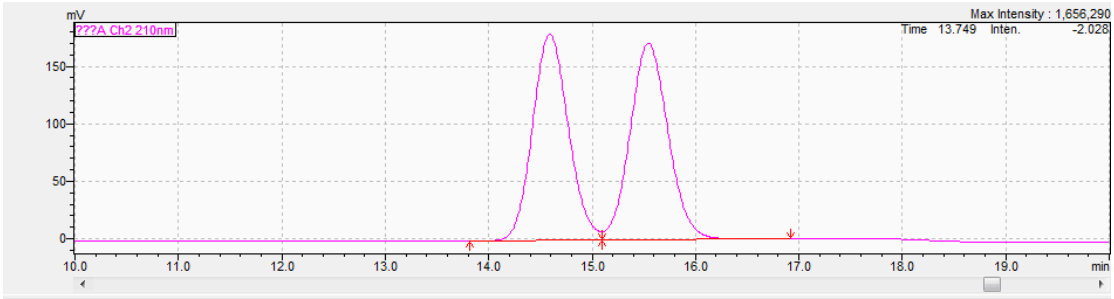
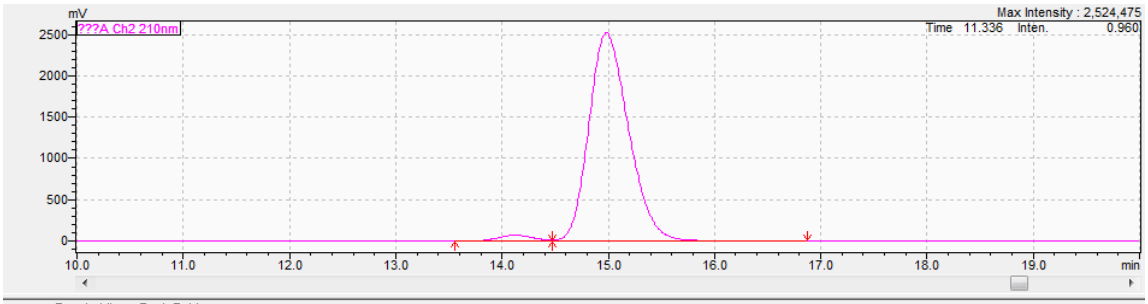


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

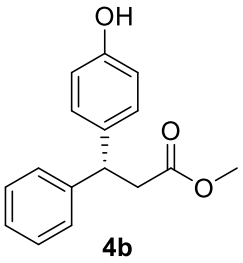
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	14.590	4335294	179892	49.633	49.633
2	15.545	4399398	171115	50.367	50.367
Total		8734692	351006	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	14.124	1626424	70511	2.422	2.422
2	14.982	65524242	2524146	97.578	97.578
Total		67150667	2594656	100.000	100.000



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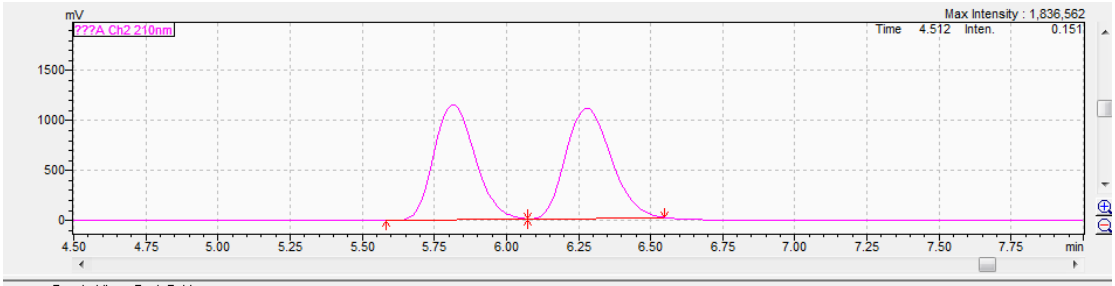
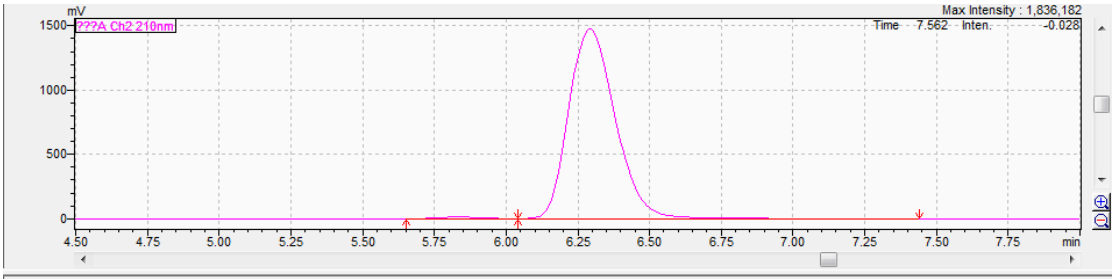


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

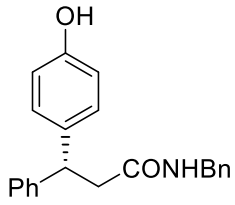
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.815	11375698	1151292	48.556	48.556
2	6.278	12052355	1101761	51.444	51.444
Total		23428053	2253052	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.834	125200	13319	0.746	0.746
2	6.291	16660609	1474530	99.254	99.254
Total		16785809	1487849	100.000	100.000



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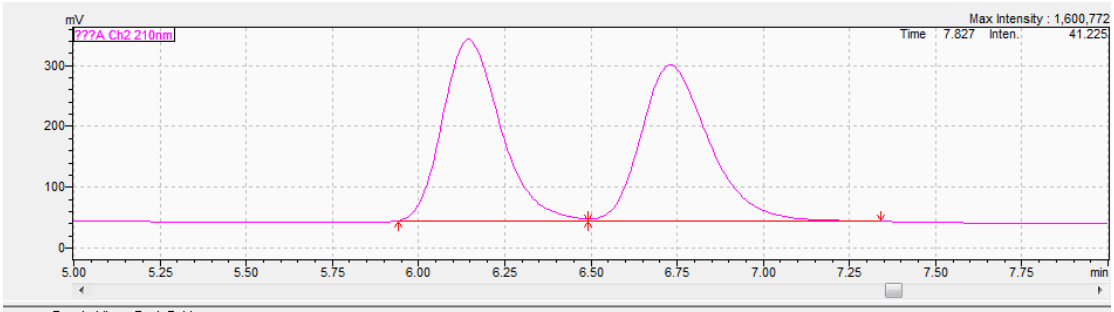
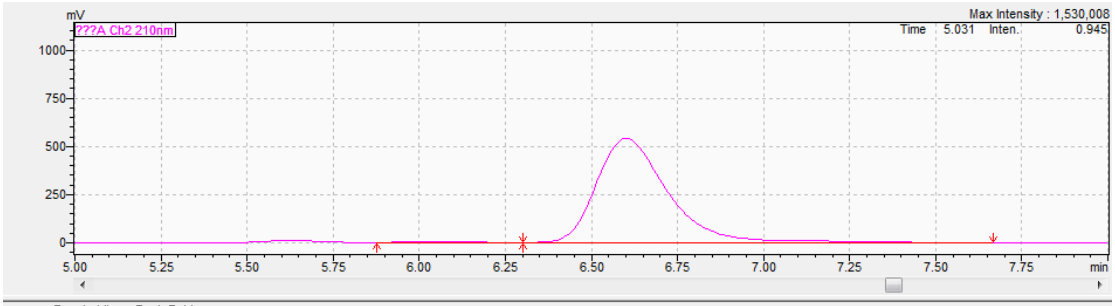


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

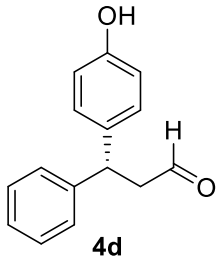
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.144	3491196	299074	49.898	49.898
2	6.731	3505479	256328	50.102	50.102
Total		6996675	555402	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.042	72386	6498	0.927	0.927
2	6.600	7732203	539002	99.073	99.073
Total		7804589	545500	100.000	100.000



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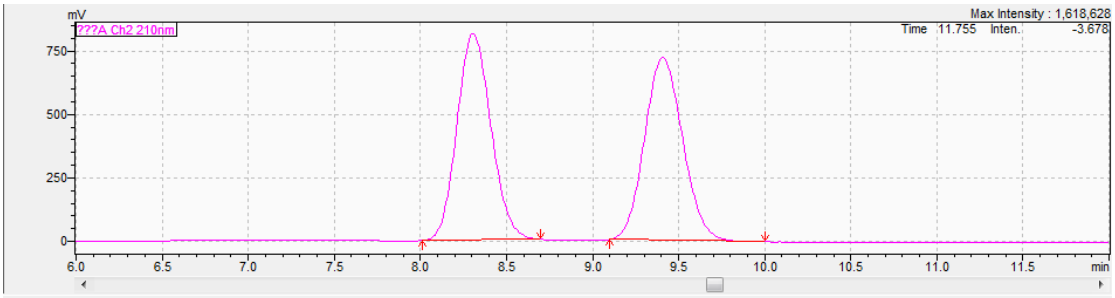
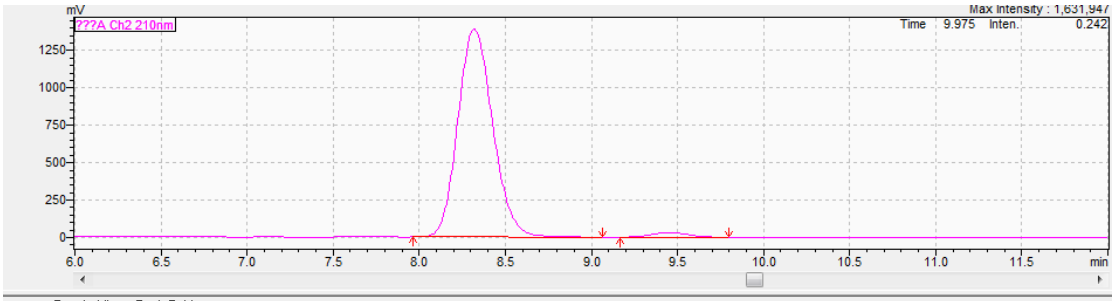


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

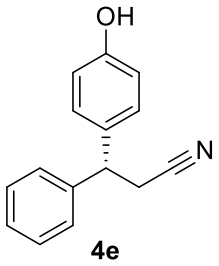
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.306	11192076	812131	50.208	50.208
2	9.408	11099530	719044	49.792	49.792
Total		22291606	1531175	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	8.319	19608930	1391462	97.625	97.625
2	9.449	476982	31465	2.375	2.375
Total		20085912	1422927	100.000	100.000



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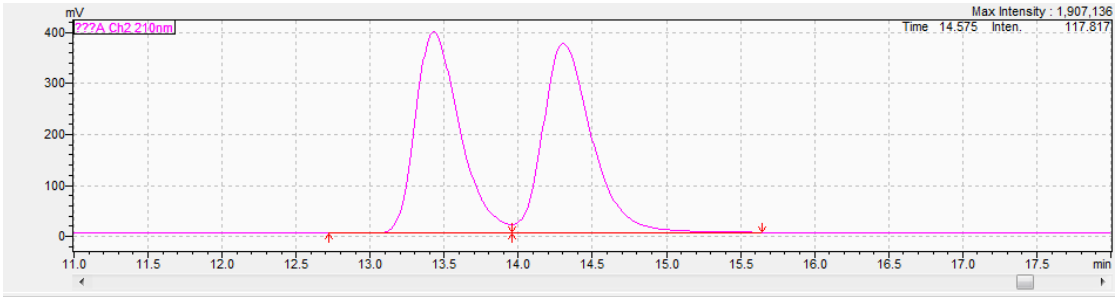
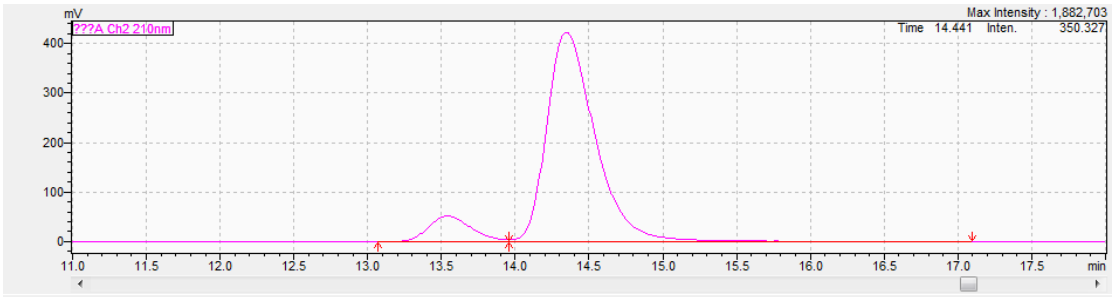


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

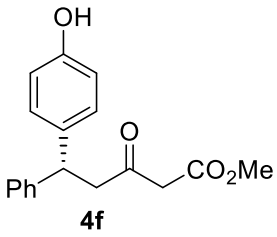
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	13.428	8213347	395300	49.109	49.109
2	14.303	8511446	371403	50.891	50.891
Total		16724793	766703	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	13.542	1054321	52018	9.856	9.856
2	14.347	9643367	422906	90.144	90.144
Total		10697688	474924	100.000	100.000



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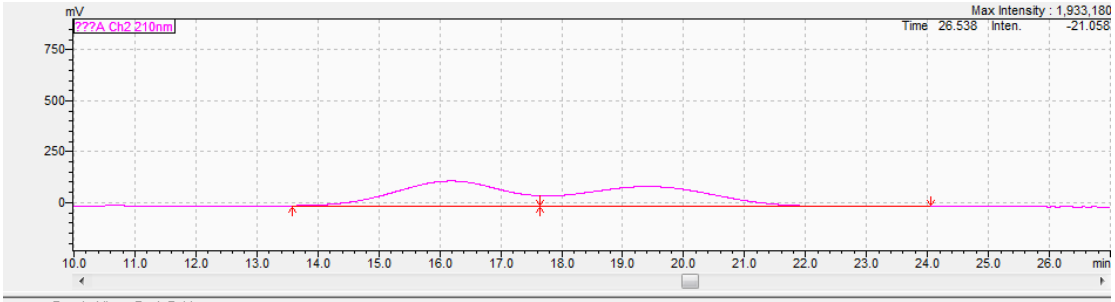
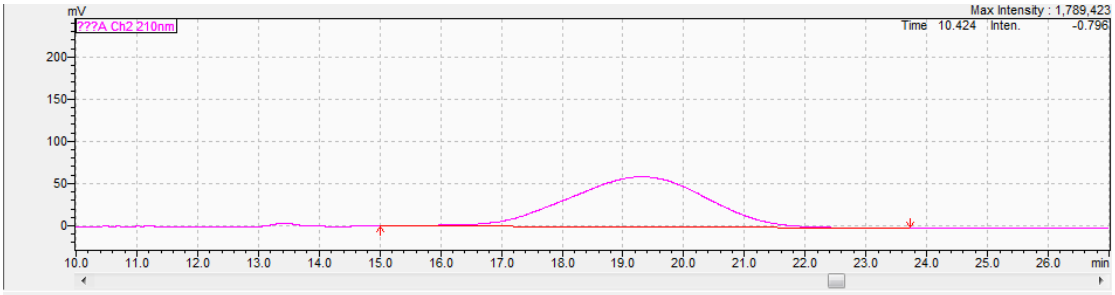


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

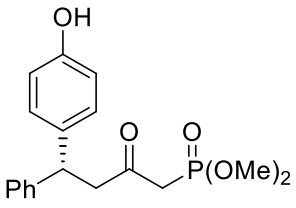
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	16.160	15415761	122513	50.417	50.417
2	19.408	15160612	96998	49.583	49.583
Total		30576373	219511	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	19.344	9501035	59522	100.000	100.000
Total		9501035	59522	100.000	100.000



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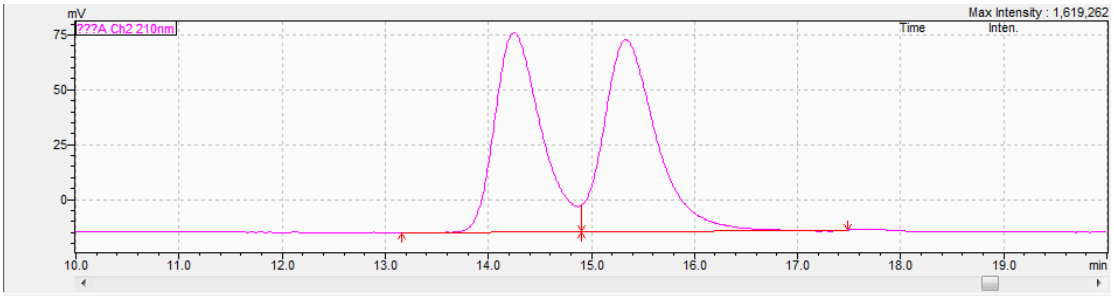
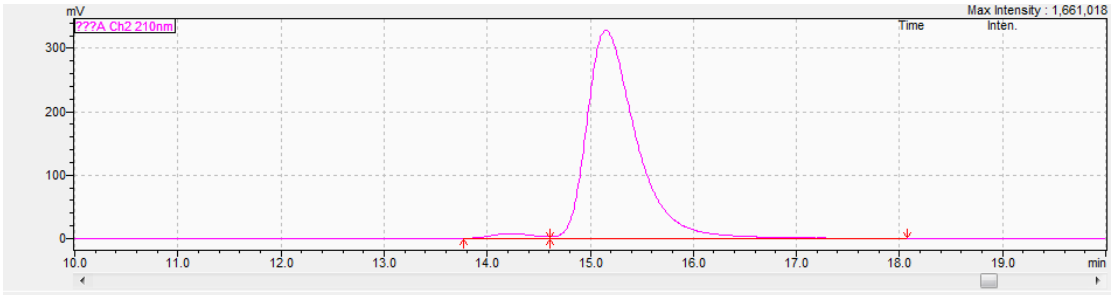


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

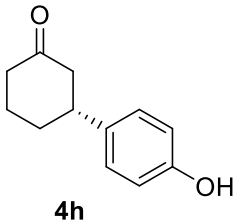
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	14.251	2835278	90849	48.222	48.222
2	15.335	3044378	87225	51.778	51.778
Total		5879657	178074	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	14.229	205264	7448	1.863	1.863
2	15.152	10815247	328268	98.137	98.137
Total		11020511	335716	100.000	100.000



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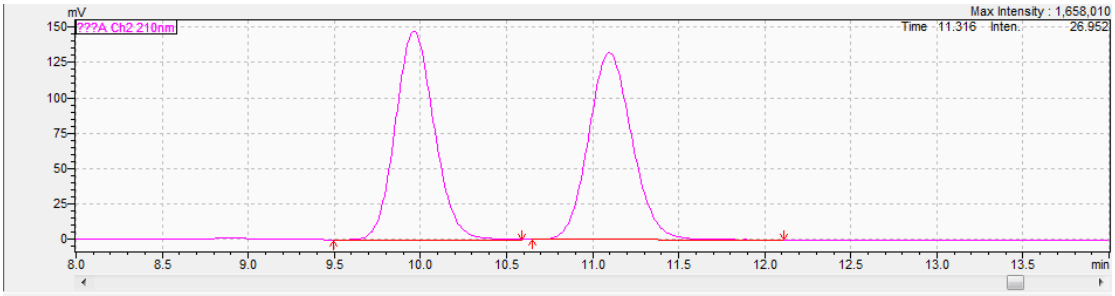
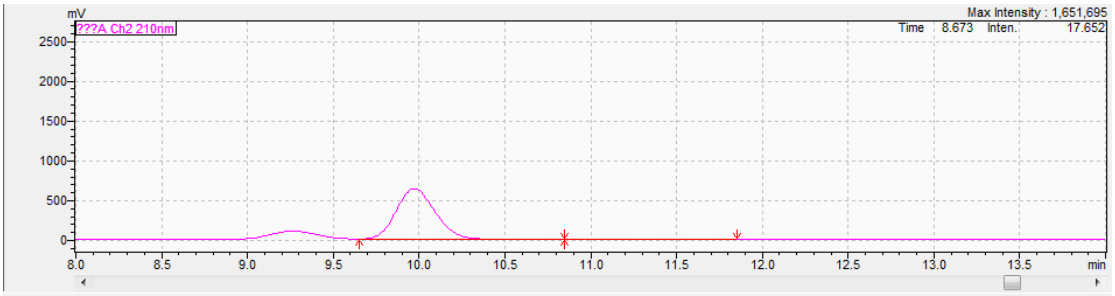


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

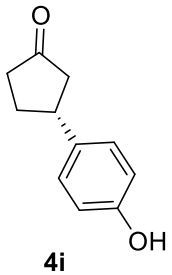
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	9.962	2315738	147352	50.045	50.045
2	11.097	2311554	132051	49.955	49.955
Total		4627292	279403	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	9.972	10089368	636596	98.924	98.924
2	11.132	109703	5837	1.076	1.076
Total		10199071	642433	100.000	100.000



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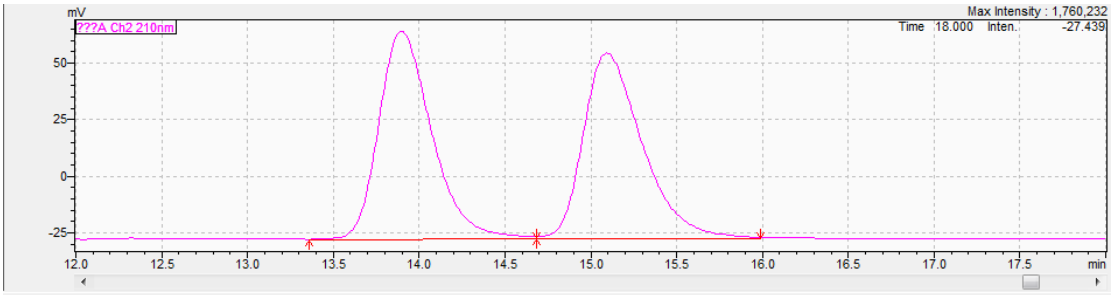
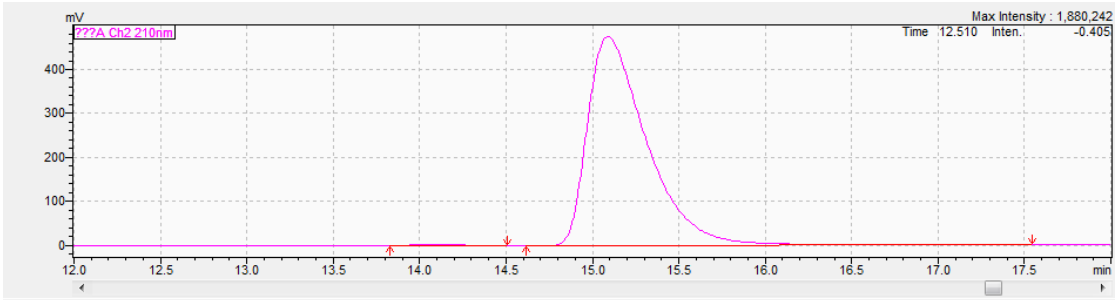


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

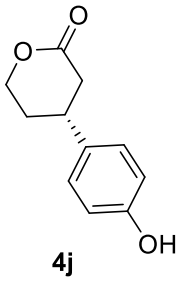
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	13.897	1979496	91876	49.976	49.976
2	15.093	1981396	82271	50.024	50.024
Total		3960892	174147	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	14.083	50234	2885	0.441	0.441
2	15.090	11341728	475244	99.559	99.559
Total		11391962	478130	100.000	100.000



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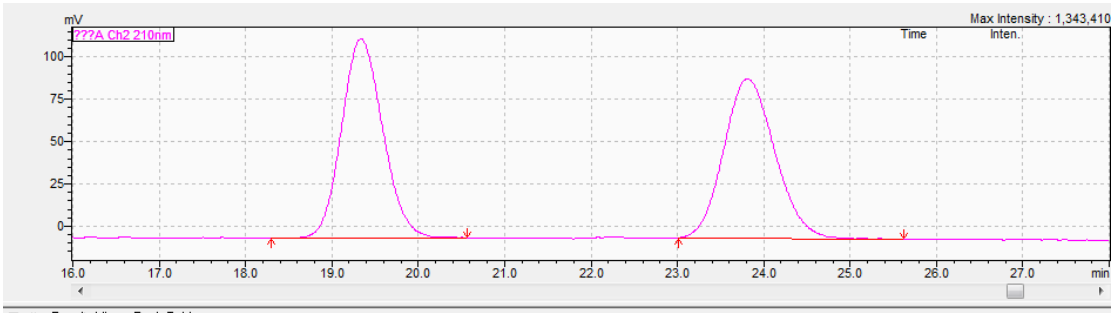
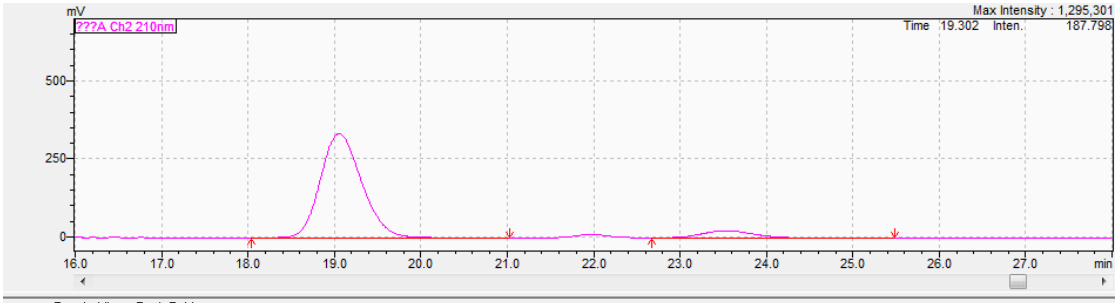


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

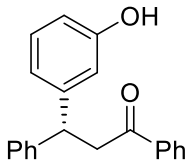
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	19.335	3885830	117661	49.960	49.960
2	23.813	3892012	94240	50.040	50.040
Total		7777842	211901	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	19.054	11035474	334198	92.045	92.045
2	23.544	953740	23303	7.955	7.955
Total		11989214	357501	100.000	100.000



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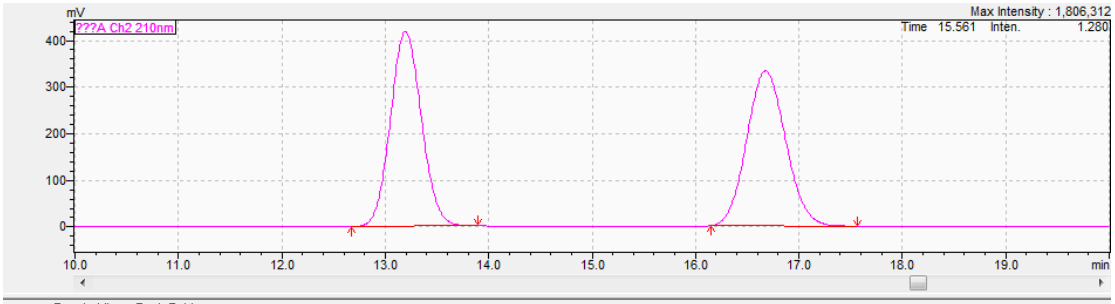
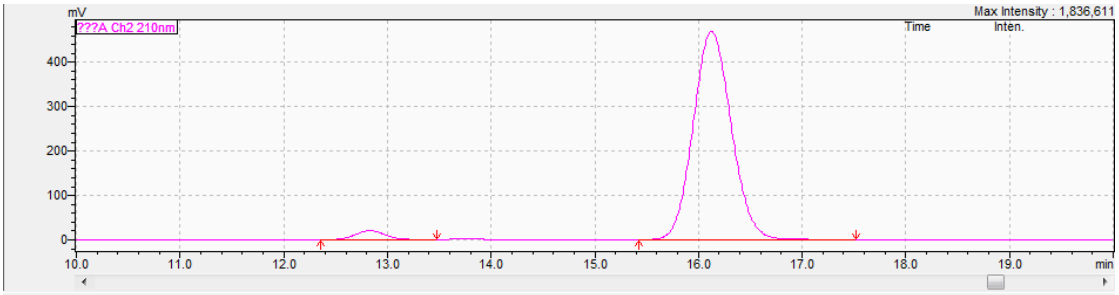


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

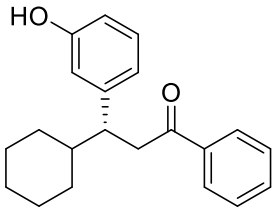
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	13.196	8719787	417402	50.057	50.057
2	16.677	8699981	332181	49.943	49.943
Total		17419769	749583	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	12.828	388761	19893	3.155	3.155
2	16.126	11934562	468676	96.845	96.845
Total		12323322	488569	100.000	100.000



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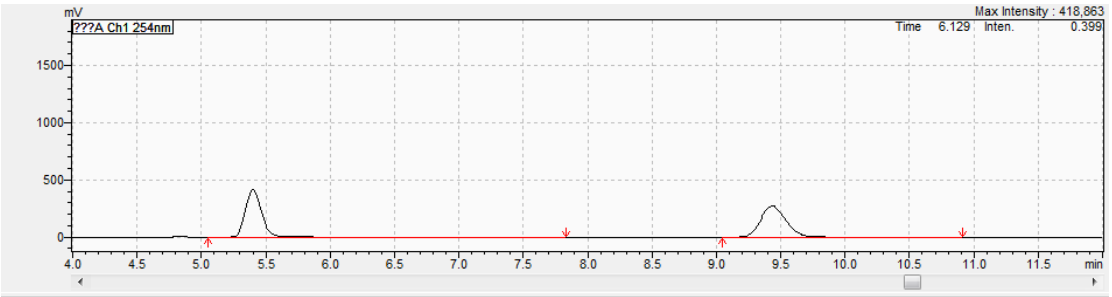
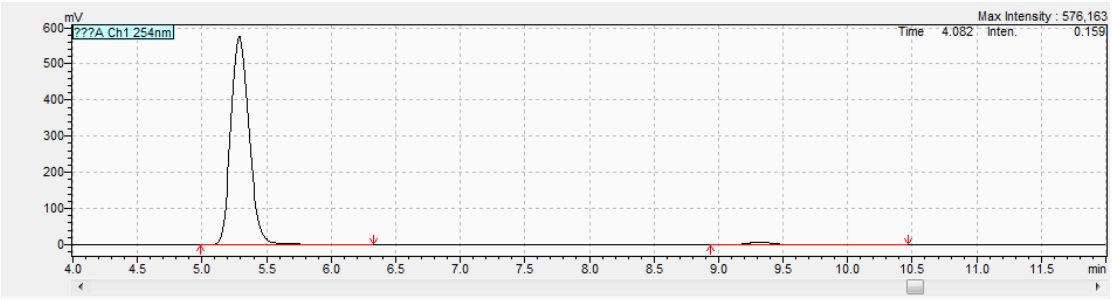


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

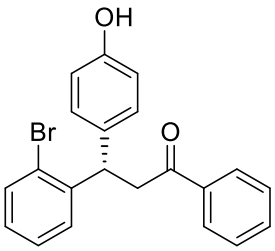
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.400	3734400	419776	50.415	50.415
2	9.434	3672851	271263	49.585	49.585
Total		7407251	691039	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.289	5693977	576286	98.271	98.271
2	9.322	100202	7277	1.729	1.729
Total		5794179	583563	100.000	100.000



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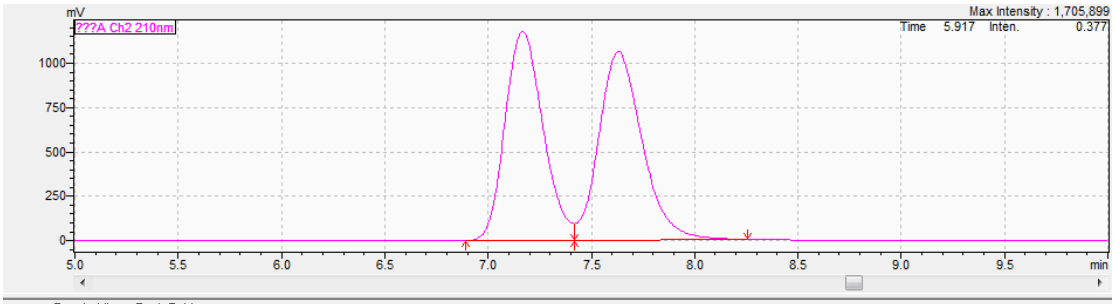
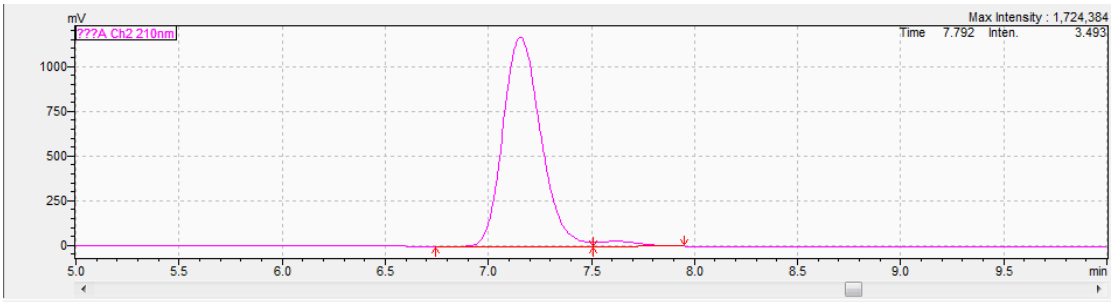


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

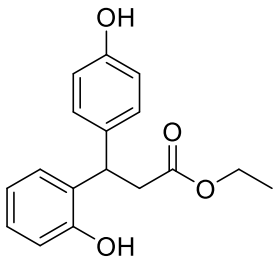
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.167	15065686	1177517	49.354	49.354
2	7.630	15459968	1060328	50.646	50.646
Total		30525653	2237844	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.155	14905483	1167571	97.506	97.506
2	7.621	381304	27543	2.494	2.494
Total		15286787	1195115	100.000	100.000



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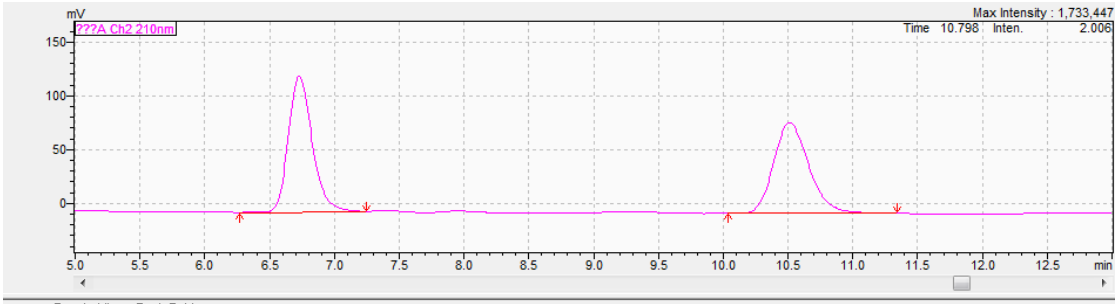
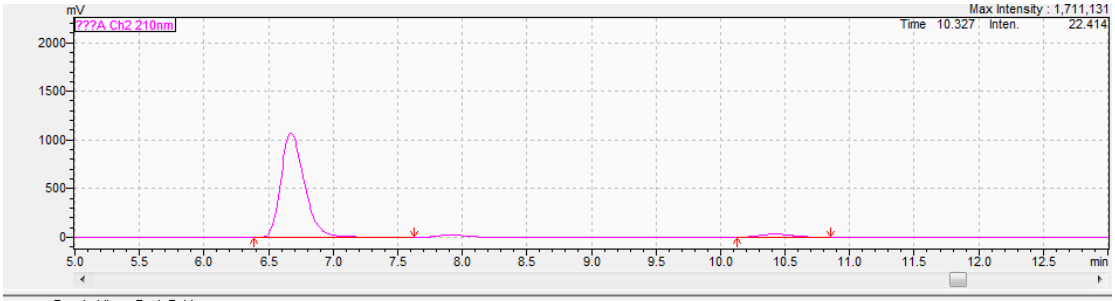


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

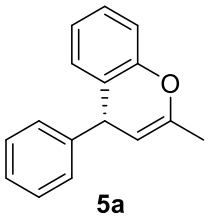
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.728	1643388	126858	50.697	50.697
2	10.513	1598169	84385	49.303	49.303
Total		3241558	211243	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	6.674	13586468	1070234	95.937	95.937
2	10.423	575436	31945	4.063	4.063
Total		14161903	1102179	100.000	100.000



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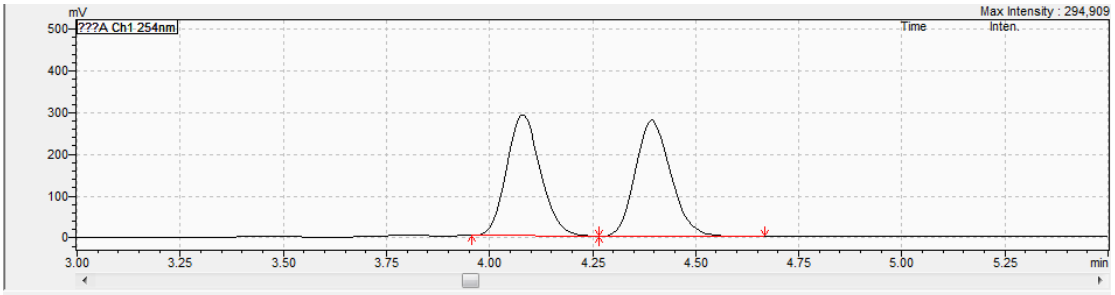
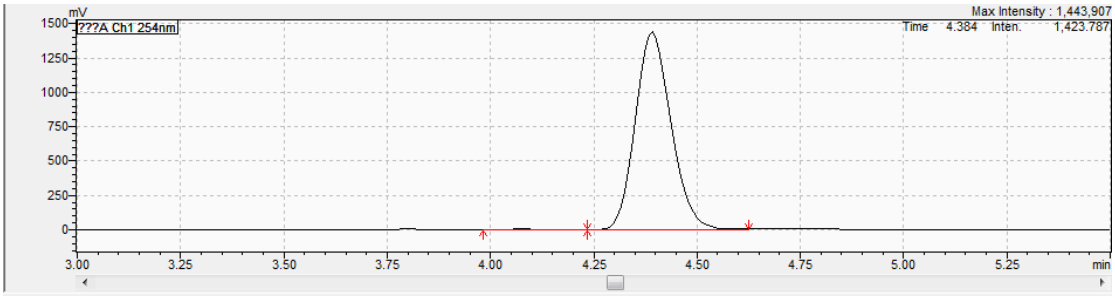


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

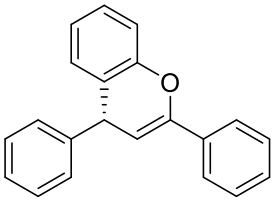
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	4.080	1660253	289773	49.778	49.778
2	4.394	1675042	279302	50.222	50.222
Total		3335295	569074	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	4.076	27255	4754	0.311	0.311
2	4.391	8748772	1443315	99.689	99.689
Total		8776026	1448070	100.000	100.000



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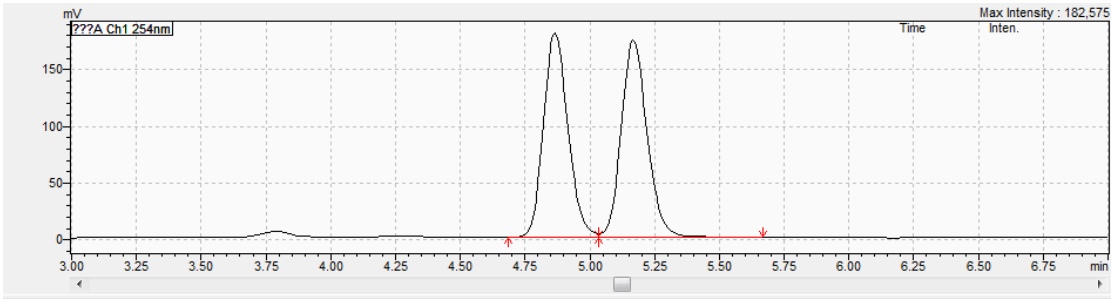
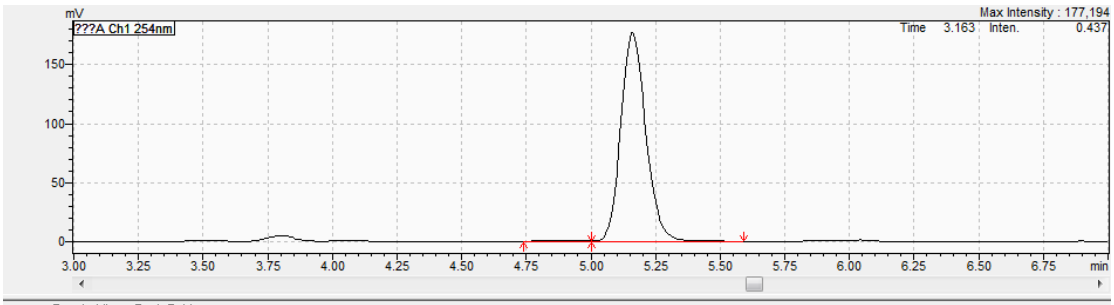


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

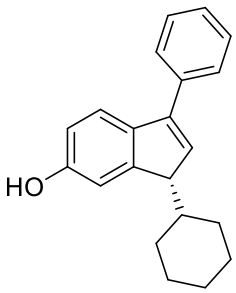
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	4.865	1184867	179695	49.775	49.775
2	5.168	1195595	173671	50.225	50.225
Total		2380462	353366	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	4.864	7117	873	0.597	0.597
2	5.161	1184944	176667	99.403	99.403
Total		1192061	177540	100.000	100.000



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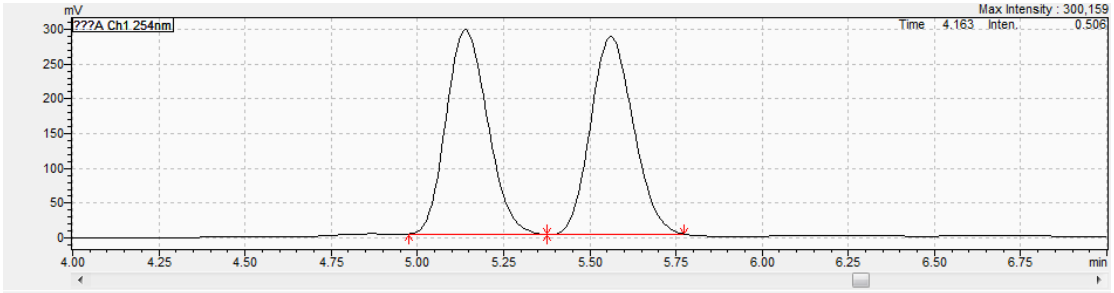
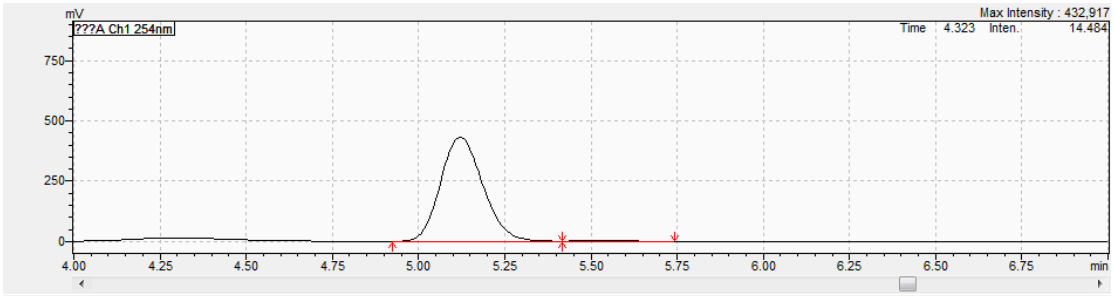


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

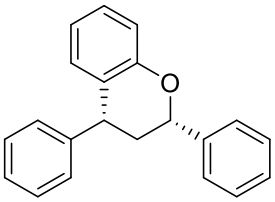
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.140	2466703	294778	50.026	50.026
2	5.561	2464169	284166	49.974	49.974
Total		4930871	578945	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.121	3695829	432045	98.678	98.678
2	5.538	49529	5516	1.322	1.322
Total		3745358	437561	100.000	100.000



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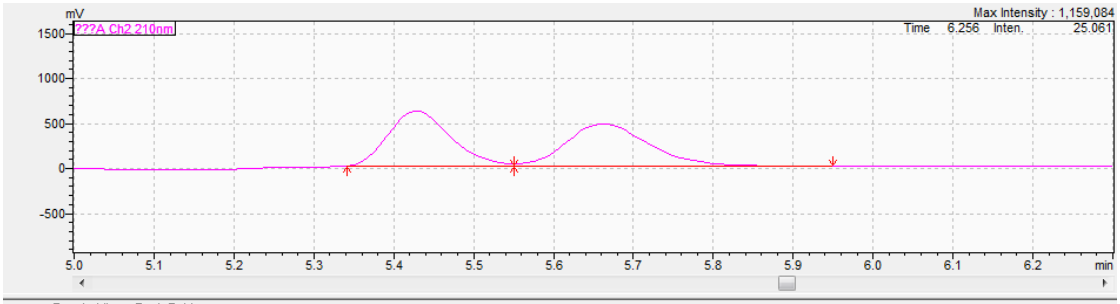
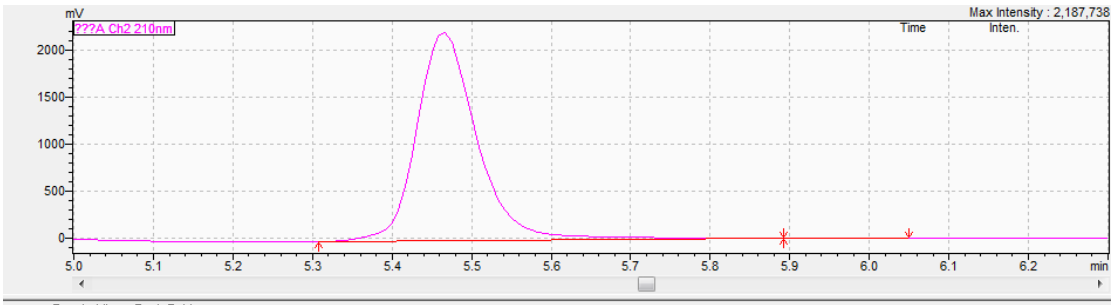


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

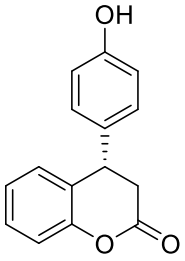
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.428	3287672	609386	49.599	49.599
2	5.661	3340897	471496	50.401	50.401
Total		6628569	1080882	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	5.465	11708679	2217827	99.981	99.981
2	5.910	2188	450	0.019	0.019
Total		11710867	2218277	100.000	100.000



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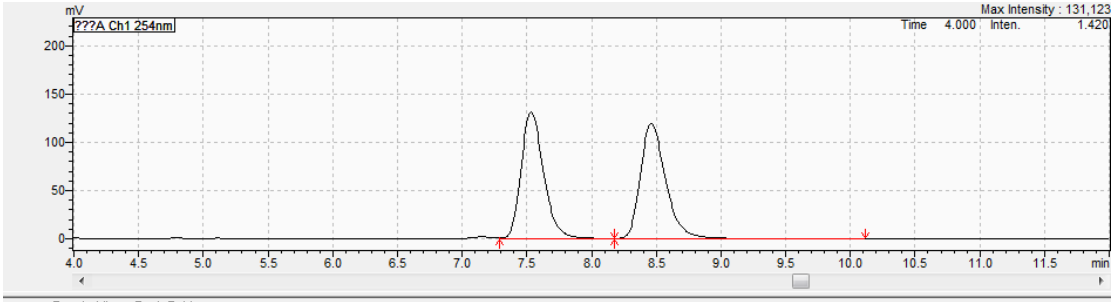
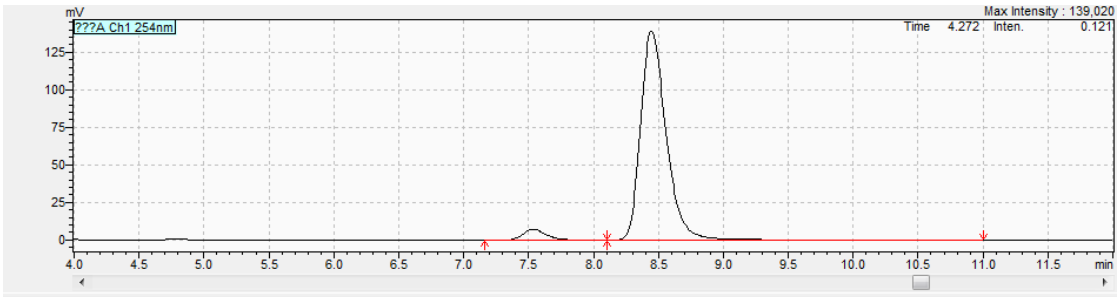


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

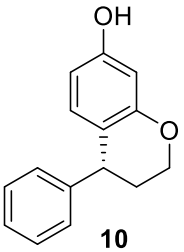
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.533	1606883	131159	49.497	49.497
2	8.462	1639557	119010	50.503	50.503
Total		3246440	250168	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.538	90408	7191	4.508	4.508
2	8.447	1915271	139064	95.492	95.492
Total		2005679	146255	100.000	100.000



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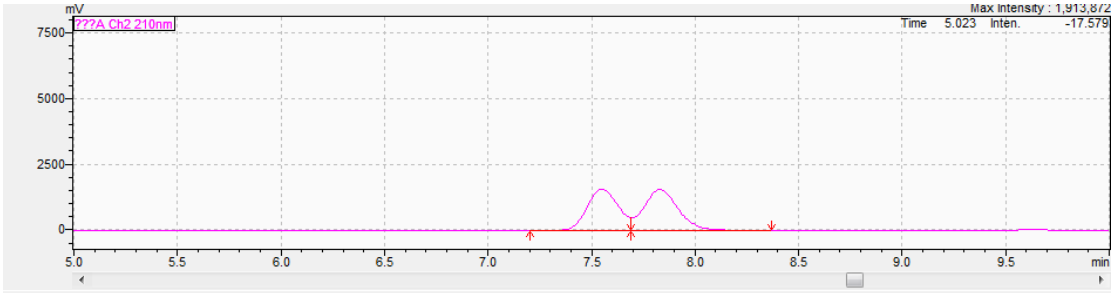
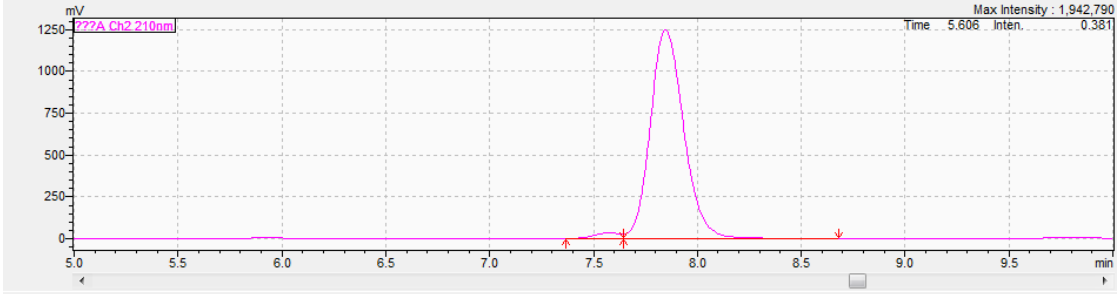


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

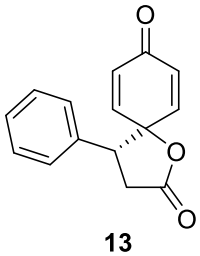
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.549	16477759	1565283	48.088	48.088
2	7.830	17787981	1544398	51.912	51.912
Total		34265740	3109681	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.574	287918	32644	2.031	2.031
2	7.848	13885675	1247455	97.969	97.969
Total		14173593	1280099	100.000	100.000



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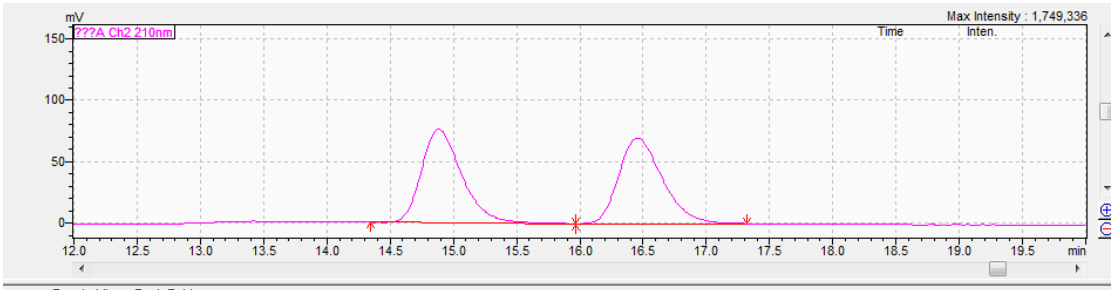
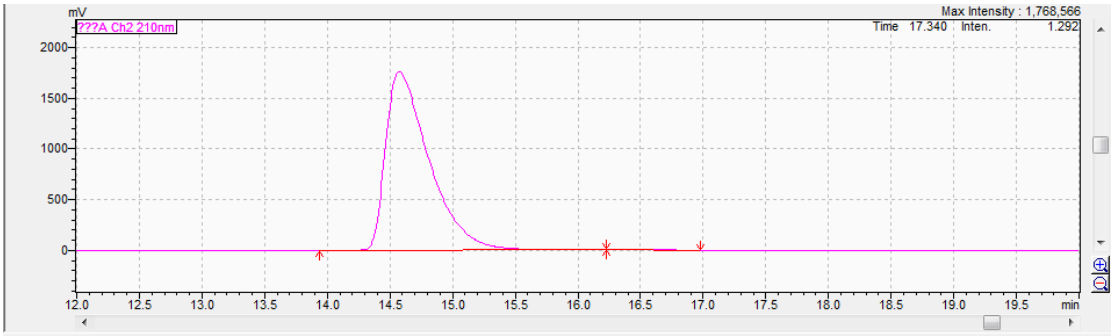


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

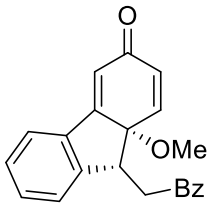
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	14.883	1683508	75837	50.127	50.127
2	16.456	1674944	69592	49.873	49.873
Total		3358452	145429	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	14.578	42377783	1760612	99.538	99.538
2	16.464	196903	9545	0.462	0.462
Total		42574686	1770157	100.000	100.000



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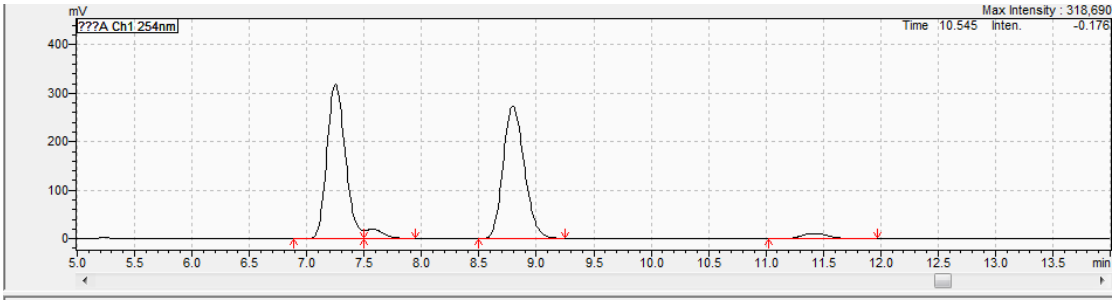
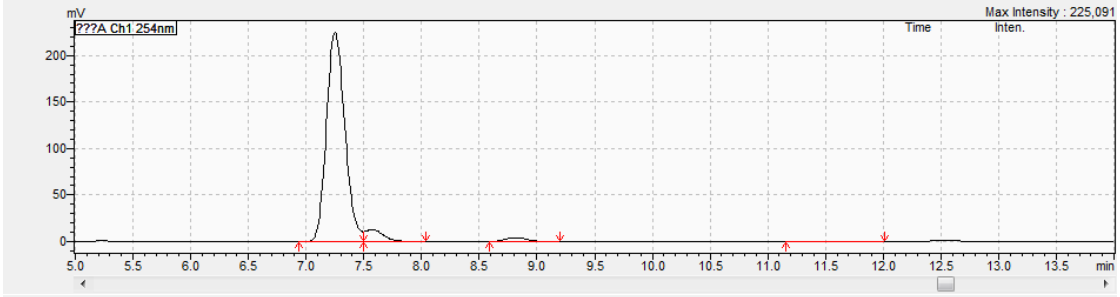


Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

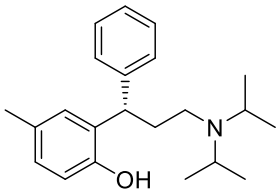
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.251	3560847	318582	47.670	47.670
2	7.572	204982	19223	2.744	2.744
3	8.795	3523329	272862	47.168	47.168
4	11.419	180598	11269	2.418	2.418
Total		7469756	621936	100.000	100.000



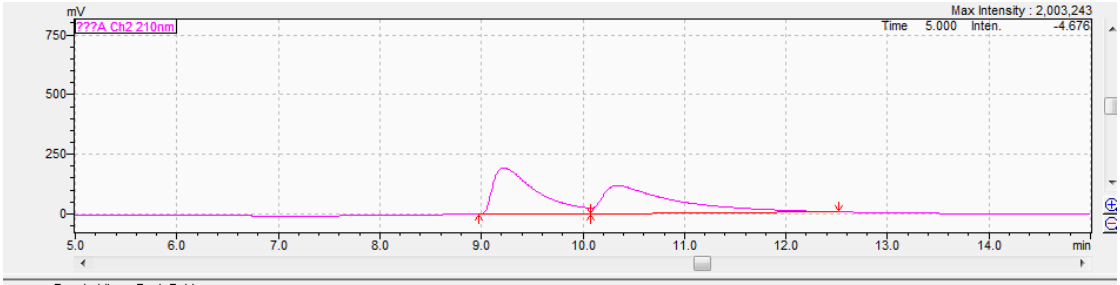
Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	7.251	2498875	225044	92.836	92.836
2	7.574	135531	12825	5.035	5.035
3	8.813	53307	4239	1.980	1.980
4	11.399	3994	192	0.148	0.148
Total		2691707	242300	100.000	100.000



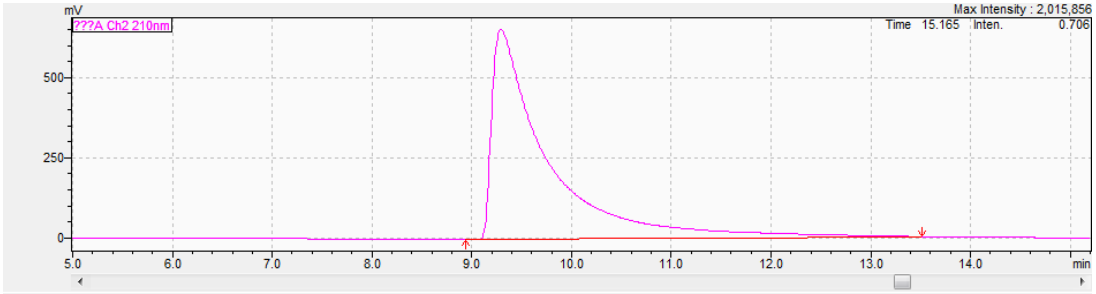
(*S*)-Tolterodine



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

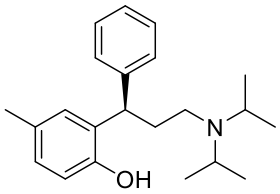
Peak#	Ret. Time	Area	Height	Conc.	Area%
1	9.220	5815873	193375	50.361	50.361
2	10.339	5732603	117351	49.639	49.639
Total		11548476	310726	100.000	100.000



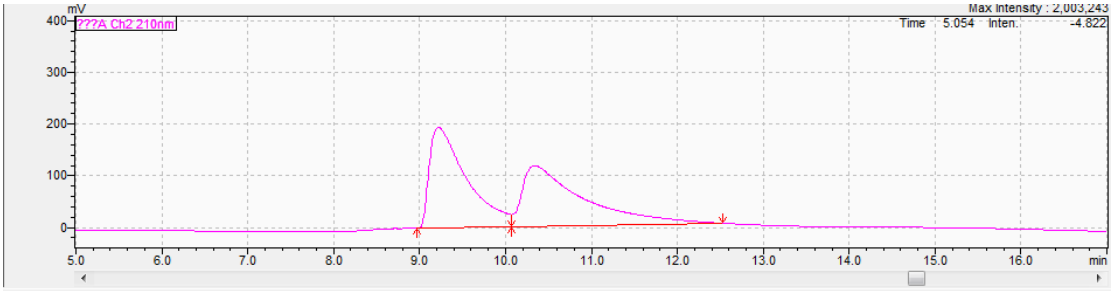
Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	9.295	25170914	654605	100.000	100.000
Total		25170914	654605	100.000	100.000



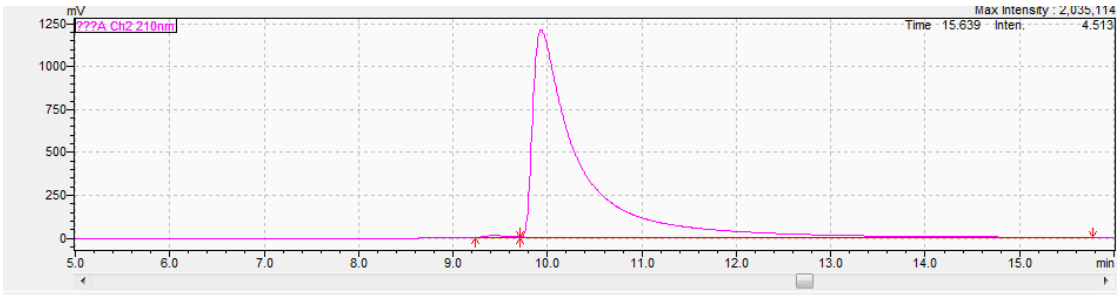
(*R*)-Tolterodine



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	9.220	5815873	193375	50.361	50.361
2	10.339	5732603	117351	49.639	49.639
Total		11548476	310726	100.000	100.000



Results View - Peak Table

Peak Table | Compound | Group | Calibration Curve

Peak#	Ret. Time	Area	Height	Conc.	Area%
1	9.433	236830	12202	0.560	0.560
2	9.934	42047324	1209723	99.440	99.440
Total		42284154	1221925	100.000	100.000