Supporting Information

Organocatalytic Asymmetric Friedel-Crafts Reaction of 2-Substituted Indoles with Aldehydes: Enantioselective Synthesis of a-Hydroxyl Ketones by Low Loading of Chiral Phosphoric Acid

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Contents

1. General information

Unless otherwise stated, all reagents were purchased from commercial suppliers and used without further purification. All reactions were carried out in air and using undistilled solvents, without any precautions to exclude air and moisture unless otherwise noted. Reactions were monitored by thin-layer chromatography (TLC) on silica gel precoated glass plates. TLC plates were visualized with UV light (254 nm) or iodine treatment.

NMR spectra were recorded in $CDCl_3$, or DMSO-d_6 on a Varian Inova 400 (400 MHz for ^{1}H , 101 MHz for ^{13}C and 376 MHz for ^{19}F), using their residual solvent peaks as internal standard. Data were reported as follows: chemical shift (δ ppm), multiplicity (s = single, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constants (Hz), integration and assignment. High resolution mass spectra (HR-MS) were determined on a Bruker APEX III FT-MS (7 T magnet) with an ESI source. High-performance liquid chromatography (HPLC) was performed on Agilent 1200 Series or SHIMADZU LC6 A instrument equipped with a DAD detector on chiral columns (Chiralcel OD-H, CHIRALPAK IC, chiralpak AD-H or CHIRALPAK AS-H). Optical rotations were measured on an Autopol IV Polarimeter and reported as follows: $[\alpha]_D^{20}$ (*c* in g per 100 mL, solvent).

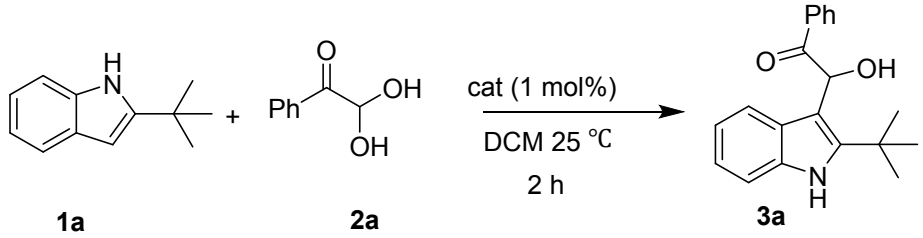
2. General procedure for reactions

a. Preparation of the substrates

The substrates **1a-e**[1] and **2b-j**[2], were prepared according to the reported procedures, respectively.

b. Typical experimental procedure for the racemic reaction

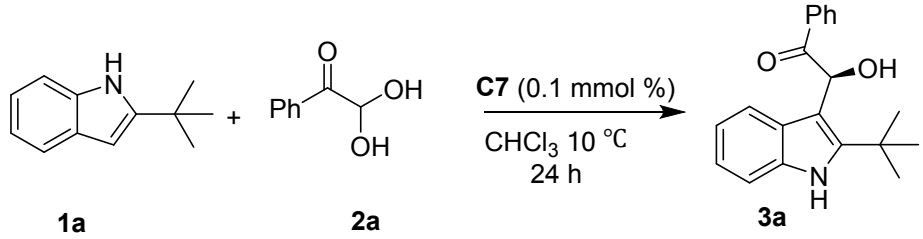
To a tube, we added substrates **1a** (0.2 mmol), **2a** (1.2 equiv), diphenyl phosphate (1 mol%), and dichloromethane (2 mL).the mixture was stirred at 25°C until complete consumption of starting material as monitored by TCL (about 4 h).After the reaction was finished, the reaction mixture was concentrated in vacuum, and the resulting residue was purified by silica gel column charomatograpgy to afford the desired product **3a**.



1a **2a** **3a**

c. Typical experimental procedure of the asymmetric reaction

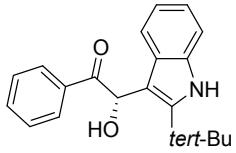
To a tube, we added substrates **1a** (0.1 mmol), **2a** (1.2 equiv), **C7** (0.1 mol%), and chloroform (1 mL). The mixture was stirred at 10 °C about 24 h. After the reaction was finished, the reaction mixture was concentrated in vacuum, and the resulting residue was purified by silica gel column charomatograpgy to afford the desired product **3a**.



1a **2a** **3a**

3. Analytical data

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3a**)



Yellow solid, 96% yield (29.5 mg), M.P = 124~125 °C

HPLC Analysis: 97%ee (t_{minor} = 17.0 min, t_{major} = 19.3 min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

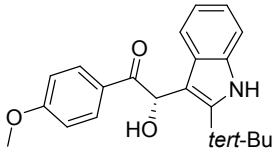
^{1}H NMR (400 MHz, DMSO-d_6) δ 10.67 (s, 1H), 7.75 (d, *J* = 7.3 Hz, 2H), 7.33 (t, *J* = 7.3 Hz, 1H), 7.23 (t, *J* = 7.6 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 1H), 7.14 (d, *J* = 8.0 Hz, 1H), 6.83 (t, *J* = 7.2 Hz, 1H), 6.71 (t, *J* = 7.4 Hz, 1H), 6.34 (d, *J* = 4.6 Hz, 1H), 5.25 (d, *J* = 4.7 Hz, 1H), 1.46 (s, 9H).

^{13}C NMR (101 MHz, DMSO-d_6) δ 201.87, 145.18, 136.40, 135.13, 133.11, 128.75, 128.45, 127.33, 120.77, 119.19, 119.09, 111.41, 107.93, 70.46, 55.39, 34.01, 31.43.

HRMS (ESI): m/z calcd for $C_{20}H_{21}NO_2Na$ $[M+Na]^+$ = 330.1465, found: 330.1471.

$[\alpha]_D^{20}$ = +169.0° (*c* 0.39, DCM).

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(4-methoxyphenyl)ethan-1-one (**3b**)



White solid, 92% yield (31.0 mg), M.P.= 121~123 °C.

HPLC Analysis: 93%ee (t_{minor}= 27.0 min, t_{major} = 32.3 min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

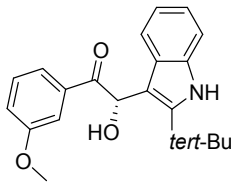
^{1}H NMR (400 MHz, DMSO-d_6) δ 10.36 (s, 1H), 7.48 (d, *J* = 8.8 Hz, 2H), 6.87 (d, *J* = 8.0 Hz, 1H), 6.77 (d, *J* = 8.0 Hz, 1H), 6.51 (dd, *J* = 17.1, 8.2 Hz, 3H), 6.38 (t, *J* = 7.5 Hz, 1H), 5.95 (s, 1H), 4.80 (s, 1H), 2.98 (s, 3H), 1.19 (s, 9H).

^{13}C NMR (101 MHz, DMSO-d_6) δ 199.9, 163.3, 145.0, 135.1, 130.9, 128.5, 127.2, 120.7, 119.1, 119.0, 114.1, 111.3, 108.5, 70.0, 55.9, 34.0, 31.4.

HRMS (ESI): m/z calcd for $C_{21}H_{23}NO_3Na$ $[M+Na]^+$ = 360.1570, found: 360.1579.

$[\alpha]_D^{20}$ = +60.0° (*c* 0.31, DCM).

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(3-methoxyphenyl)ethan-1-one (**3c**)



Yellow solid, 77% yield (26.0 mg), M.P.= 60~62 °C.

HPLC Analysis: 91%ee (t_{minor} = 27.0 min, t_{major} = 32.3 min); Daicel Chiralpak IC Column, n-Hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

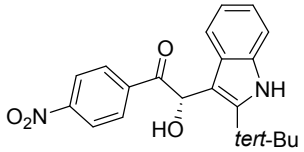
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (s, 1H), 7.49 (dd, *J* = 10.6, 5.1 Hz, 2H), 7.23 (d, *J* = 8.2 Hz, 2H), 7.15 (t, *J* = 8.0 Hz, 1H), 7.06 – 7.00 (m, 1H), 6.94 (dt, *J* = 15.1, 4.5 Hz, 2H), 6.32 (d, *J* = 4.2 Hz, 1H), 4.60 (d, *J* = 4.3 Hz, 1H), 3.69 (s, 3H), 1.64 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 201.43, 159.45, 144.65, 135.62, 134.17, 129.34, 126.91, 121.61, 121.32, 120.19, 119.85, 118.68, 113.37, 110.52, 108.46, 70.55, 55.33, 33.46, 31.09.

HRMS (ESI): m/z calcd for $C_{21}H_{23}NO_3Na$ $[M+Na]^+$ = 360.1570, found: 360.1573.

$[\alpha]_D^{20}$ = +92.4° (*c* 0.21, DCM)

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(4-nitrophenyl)ethan-1-one (**3d**)



Yellow solid, 68% yield (24.0 mg), M.P.= 58~60 °C.

HPLC Analysis: 95%ee (t_{minor} = 32.0 min, t_{major} = 37.8 min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

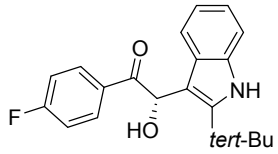
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H), 8.06 (dd, *J* = 27.8, 9.0 Hz, 4H), 7.25 (d, *J* = 8.1 Hz, 1H), 7.15 (d, *J* = 8.0 Hz, 1H), 7.05 (t, *J* = 7.6 Hz, 1H), 6.93 (t, *J* = 8.0 Hz, 1H), 6.35 (s, 1H), 4.36 (s, 1H), 1.64 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 200.61, 150.22, 145.24, 139.38, 134.13, 129.60, 126.61, 123.56, 121.98, 120.56, 118.15, 110.87, 107.07, 71.18, 33.45, 31.07.

HRMS (ESI): m/z calcd for $C_{20}H_{20}N_2O_4Na$ $[M+Na]^+$ = 375.1315, found: 375.1325.

$[\alpha]_D^{20}$ = +56.9° (*c* 0.13, DCM)

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-1-(4-fluorophenyl)-2-hydroxyethan-1-one (**3e**)



Yellow solid, 91% yield (29.6 mg), M.P. = 125~126 °C.

HPLC Analysis: 94%ee (t_{minor} = 12.4 min, t_{major} = 14.1 min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

^{1}H NMR (400 MHz, DMSO-d_6) δ 10.74 (s, 1H), 7.89 (dd, *J* = 8.7Hz, 2H), 7.24 (d, *J* = 8.0 Hz, 1H), 7.16 (dd, *J* = 8.7Hz, 3H), 6.90 (t, *J* = 7.2 Hz, 1H), 6.77 (t, *J* = 7.5 Hz, 1H), 6.37 (s, 1H), 5.34 (s, 1H), 1.52 (s, 9H).

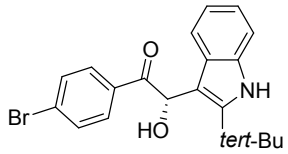
^{13}C NMR (101 MHz, DMSO-d_6) δ 200.4, 166.2, 163.7, 145.2, 135.1, 133.0, 131.4, 131.3, 127.3, 120.8, 119.1, 115.9, 115.7, 111.4, 107.8, 70.4, 34.0, 31.4.

^{19}F NMR (376 MHz, $CDCl_3$) δ 103.79.

HRMS (ESI): m/z calcd for $C_{20}H_{20}FNO_2Na$ $[M+Na]^+$ = 348.1370, found: 348.1368.

$[\alpha]_D^{20}$ = +60.0° (*c* 0.33, DCM).

(S)-1-(4-bromophenyl)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxyethan-1-one (**3f**)



Yellow solid, 90% yield (34.7 mg), M.P. = 124~125 °C.

HPLC Analysis: 95%ee (t_{minor} = 9.9 min, t_{major} = 11.6 min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

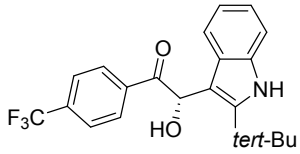
^{1}H NMR (400 MHz, DMSO-d_6) δ 10.75 (s, 1H), 7.73 (d, *J* = 8.5 Hz, 2H), 7.56 (d, *J* = 8.4 Hz, 2H), 7.25 (d, *J* = 8.0 Hz, 1H), 7.15 (d, *J* = 8.0 Hz, 1H), 6.91 (t, *J* = 7.4 Hz, 1H), 6.78 (d, *J* = 15.0 Hz, 1H), 6.37 (s, 1H), 5.38 (s, 1H), 1.53 (s, 9H).

^{13}C NMR (101 MHz, DMSO-d_6) δ 201.2, 145.3, 135.5, 135.1, 131.8, 130.4, 127.2, 127.0, 120.8, 119.1, 119.0, 111.4, 107.6, 70.5, 34.0, 31.4.

HRMS (ESI): m/z calcd for $C_{20}H_{20}BrNO_2Na$ $[M+Na]^+$ = 408.0570, found:408.0563.

$[\alpha]_D^{20}$ = +40.8° (*c* 0.39, DCM)

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(4-(trifluoromethyl)phenyl)ethan-1-one (**3g**)



Yellow solid, 90% yield (33.8 mg), M.P.= 71~72 °C.

HPLC Analysis: 95%ee (t_{minor} = 8.2 min, t_{major} = 9.4 min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T= 30°C, λ = 254 nm.

^{1}H NMR (400 MHz, DMSO-d_6) δ 10.76 (s, 1H), 7.95 (d, *J* = 8.1 Hz, 2H), 7.72 (d, *J* = 8.3 Hz, 2H), 7.25 (d, *J* = 8.0 Hz, 1H), 7.19 (d, *J* = 8.0 Hz, 1H), 6.92 (t, *J* = 7.4 Hz, 1H), 6.80 (t, *J* = 7.5 Hz, 1H), 6.45 (d, *J* = 4.6 Hz, 1H), 5.48 (d, *J* = 4.8 Hz, 1H), 1.51 (s, 9H).

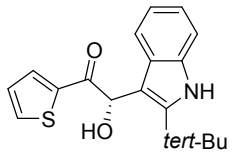
^{13}C NMR (101 MHz, DMSO-d_6) δ 201.6, 145.5, 140.3, 135.1, 129.1, 127.3, 125.8, 125.8, 120.8, 119.2, 119.0, 111.5, 107.2, 70.9, 33.9, 31.4.

^{19}F NMR (376 MHz, $CDCl_3$) δ 63.33.

HRMS (ESI): m/z calcd for $C_{21}H_{20}F_3NO_2Na$ $[M+Na]^+$ = 398.1338, foun-d:398.1333.

$[\alpha]_D^{20}$ = +58.8° (*c* 0.33, DCM)

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(thiophen-2-yl)ethan-1-one (**3h**)



Yellow solid, 97% yield (30.4 mg), M.P.= 70~72 °C.

HPLC Analysis: 95%ee (t_{minor} = 24.2 min, t_{major} = 27.2 min); Daicel Chiralpak ID Column, n-Hexane/ i-PrOH = 90/10, flow rate 1.0 mL/min, T= 30 °C, λ = 254 nm.

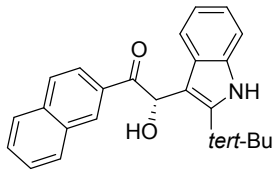
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H), 7.62 (dd, *J* = 3.8, 1.1 Hz, 1H), 7.47 (dd, *J* = 4.9, 1.0 Hz, 1H), 7.26 (t, *J* = 7.2 Hz, 2H), 7.05 (t, *J* = 7.6 Hz, 1H), 6.93 (t, *J* = 8.0 Hz, 1H), 6.91 – 6.86 (m, 1H), 6.17 (d, *J* = 3.3 Hz, 1H), 4.54 (d, *J* = 3.3 Hz, 1H), 1.64 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 193.95, 145.55, 139.33, 134.41, 134.12, 134.00, 127.84, 127.23, 121.72, 120.34, 118.69, 110.55, 108.30, 70.80, 33.44, 31.16.

HRMS (ESI): m/z calcd for $C_{18}H_{19}NO_2SNa$ $[M+Na]^+$ = 336.1053, foun-d:336.1036.

$[\alpha]_D^{20}$ = +88.2° (*c* 0.25, DCM)

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(naphthalen-2-yl)ethan-1-one (**3i**)



Yellow solid, 85% yield(30.4 mg), M.P.= 56~58 °C.

HPLC Analysis: 89%ee (t_{minor} = 20.2 min, t_{major} = 26.8 min); Daicel Chiralpak IC Column, n-Hexane/ i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

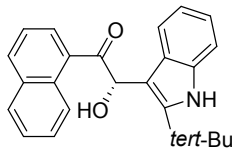
^{1}H NMR (400 MHz, DMSO-d_6) δ 10.73 (s, 1H), 8.46 (s, 1H), 7.86 (qd, *J* = 8.6, 3.2 Hz, 4H), 7.59 – 7.53 (m, 1H), 7.53 – 7.48 (m, 1H), 7.23 (dd, *J* = 12.1, 8.0 Hz, 2H), 6.94 – 6.83 (m, 1H), 6.82 – 6.72 (m, 1H), 6.57 (d, *J* = 4.9 Hz, 1H), 5.37 (d, *J* = 4.9 Hz, 1H), 1.59 (s, 9H).

^{13}C NMR (101 MHz, DMSO) δ 201.77, 145.17, 135.12, 133.61, 132.11, 129.62, 129.58, 128.90, 128.35, 128.08, 127.41, 127.30, 124.56, 120.73, 119.16, 119.04, 111.36, 108.11, 70.49, 34.05, 31.46.

HRMS (ESI): m/z calcd for $C_{24}H_{23}NO_2Na$ $[M+Na]^+$ = 380.1621, foun-d:380.1627.

$[\alpha]_D^{20}$ = +49.7° (*c* 0.31, DCM)

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(naphthalen-1-yl)ethan-1-one (**3j**)



Yellow solid, 95% yield (33.9 mg), M.P.= 71~74 °C.

HPLC Analysis: 90%ee (t_{minor} = 27.8 min, t_{major} = 39.3 min); Daicel Chiralpak IC Column, n-Hexane/ i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

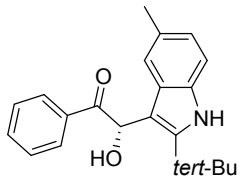
^{1}H NMR (400 MHz, DMSO-d_6) δ 10.52 (s, 1H), 7.91 (d, *J* = 8.2 Hz, 1H), 7.86 (dd, *J* = 8.0, 4.2 Hz, 2H), 7.67 (d, *J* = 7.8 Hz, 1H), 7.50 (d, *J* = 6.9 Hz, 1H), 7.46 – 7.41 (m, 1H), 7.39 (d, *J* = 7.8 Hz, 1H), 7.36 – 7.30 (m, 1H), 7.22 (d, *J* = 7.9 Hz, 1H), 6.96 (t, *J* = 7.1 Hz, 1H), 6.90 (t, *J* = 7.3 Hz, 1H), 6.45 (d, *J* = 3.9 Hz, 1H), 5.58 (d, *J* = 3.9 Hz, 1H), 1.19 (s, 9H).

^{13}C NMR (101 MHz, DMSO) δ 204.94, 145.33, 136.81, 135.10, 133.49, 131.15, 130.11, 128.73, 127.74, 127.34, 126.65, 126.03, 125.29, 124.82, 120.94, 120.61, 118.93, 111.26, 106.31, 72.76, 33.57, 31.16.

HRMS (ESI): m/z calcd for $C_{24}H_{23}NO_2Na$ $[M+Na]^+$ = 380.1621, foun-d:380.1627.

$[\alpha]_D^{20}$ = +86.6° (*c* 0.31, DCM)

(S)-2-(2-(tert-butyl)-5-methyl-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3k**)



Yellow solid, 97% yield (31.2 mg), M.P.= 59~61 °C.

HPLC Analysis: 94%ee (t_{minor} = 11.3 min, t_{major} = 12.8 min); Daicel Chiralpak AD-H Column, n-Hexane/i-PrOH = 80/20, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

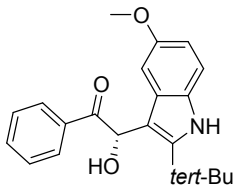
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07 (s, 1H), 7.97 – 7.89 (m, 2H), 7.42 (t, *J* = 7.4 Hz, 1H), 7.31 – 7.23 (m, 2H), 7.12 (d, *J* = 8.2 Hz, 1H), 6.99 (d, *J* = 16.6 Hz, 1H), 6.85 (dd, *J* = 8.2, 1.0 Hz, 1H), 6.29 (s, 1H), 2.28 (s, 3H), 1.63 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 201.68, 144.66, 134.54, 133.44, 132.47, 129.42, 128.78, 128.35, 127.15, 123.20, 118.34, 110.15, 107.84, 70.66, 33.43, 31.08, 21.58.

HRMS (ESI): m/z calcd for $C_{21}H_{23}NO_2Na$ $[M+Na]^+$ = 344.17288, found:344.16129.

$[\alpha]_D^{20}$ = +104.5° (*c* 0.55, DCM)

(S)-2-(2-(tert-butyl)-5-methoxy-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3l**)



Yellow solid, 99% yield (33.4 mg), M.P.= 64~66 °C.

HPLC Analysis: 90%ee (t_{minor} = 16.7 min, t_{major} = 19.1 min); Daicel Chiralcel OD-H Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

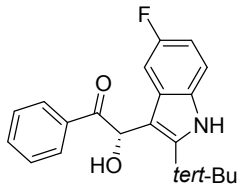
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (s, 1H), 7.93 (d, *J* = 7.2 Hz, 2H), 7.43 (t, *J* = 7.4 Hz, 1H), 7.31 – 7.24 (m, 2H), 7.14 – 7.05 (m, 1H), 6.67 (dq, *J* = 4.9, 2.4 Hz, 2H), 6.31 (d, *J* = 4.1 Hz, 1H), 4.60 (d, *J* = 4.2 Hz, 1H), 3.69 (s, 3H), 1.63 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 201.78, 154.35, 145.41, 134.48, 133.54, 129.18, 128.67, 128.39, 127.32, 111.78, 111.28, 108.24, 100.58, 70.57, 55.72, 33.46, 31.04.

HRMS (ESI): m/z calcd for $C_{21}H_{23}NO_3Na$ $[M+Na]^+$ = 360.1570, found:360.1574.

$[\alpha]_D^{20}$ = +62.1° (*c* 0.29, DCM)

(S)-2-(2-(tert-butyl)-5-fluoro-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3m**)



Yellow solid, 95% yield (30.9 mg), M.P.= 115~117 °C.

HPLC Analysis: 95%ee (t_{minor} = 14.1 min, t_{major} = 16.0 min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (s, 1H), 8.01 – 7.87 (m, 2H), 7.47 (t, *J* = 7.4 Hz, 1H), 7.31 (dd, *J* = 14.3, 6.7 Hz, 2H), 7.15 (dd, *J* = 8.8, 4.4 Hz, 1H), 6.90 (dd, *J* = 10.2, 2.3 Hz, 1H), 6.78 (td, *J* = 9.0, 2.4 Hz, 1H), 6.33 (s, 1H), 4.67 (s, 1H), 1.67 (s, 9H).

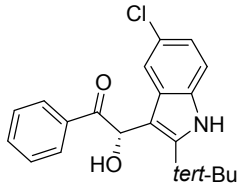
^{13}C NMR (101 MHz, $CDCl_3$) δ 201.24, 159.17, 156.84, 146.60, 134.22, 133.69, 130.63, 128.76, 128.45, 127.27, 111.27, 111.17, 110.07, 109.81, 108.69, 108.65, 103.95, 103.71, 70.25, 33.54, 30.98.

^{19}F NMR (376 MHz, $CDCl_3$) δ -123.37.

HRMS (ESI): m/z calcd for $C_{20}H_{20}FNO_2Na$ $[M+Na]^+$ = 348.1478, found:348.1370.

$[\alpha]_D^{20}$ = +132.1° (*c* 0.576, DCM)

(S)-2-(2-(tert-butyl)-5-chloro-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3n**)



Yellow solid, 98% yield (33.4 mg), M.P.= 58~60 °C.

HPLC Analysis: 95%ee (t_{major} = 10.8 min, t_{minor} = 14.9 min); Daicel Chiralpak AD-H Column, n-Hexane/i-PrOH = 80/20, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

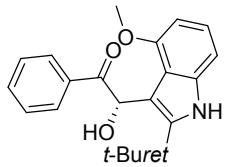
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (s, 1H), 7.98 – 7.86 (m, 2H), 7.45 (t, *J* = 7.4 Hz, 1H), 7.29 (t, *J* = 7.8 Hz, 2H), 7.19 (d, *J* = 1.7 Hz, 1H), 7.13 (d, *J* = 8.6 Hz, 1H), 6.97 (dd, *J* = 8.6, 1.9 Hz, 1H), 6.29 (s, 1H), 4.64 (s, 1H), 1.64 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 201.16, 146.17, 134.23, 133.68, 132.51, 128.76, 128.45, 127.91, 125.90, 122.02, 118.13, 111.57, 108.27, 70.19, 33.53, 30.97.

HRMS (ESI): m/z calcd for $C_{20}H_{20}ClNO_2Na$ $[M+Na]^+$ = 364.1183, found:364.1061.

$[\alpha]_D^{20}$ = +62.0° (*c* 0.84, DCM)

(S)-2-(2-(tert-butyl)-4-methoxy-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3o**)



Yellow solid, 93% yield (31.4 mg), M.P.= 163~165 °C.

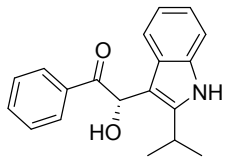
HPLC Analysis: 96%ee (t_{minor} = 10.8 min, t_{major} = 16.7 min); Daicel Chiralpak AD-H Column, n-Hexane/i-PrOH = 80/20, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (d, *J* = 32.5 Hz, 1H), 8.02 – 7.89 (m, 2H), 7.47 – 7.39 (m, 1H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.00 (dd, *J* = 14.9, 7.0 Hz, 1H), 6.94 – 6.86 (m, 1H), 6.37 (d, *J* = 7.6 Hz, 1H), 6.19 (s, 1H), 4.84 (d, *J* = 4.5 Hz, 1H), 3.64 (s, 3H), 1.55 (s, 9H).
^{13}C NMR (101 MHz, $CDCl_3$) δ 199.93, 152.21, 143.21, 135.64, 135.63, 132.43, 129.19, 128.12, 122.43, 117.49, 109.00, 104.30, 100.17, 71.42, 54.21, 31.10, 1.06.

HRMS (ESI): m/z calcd for $C_{20}H_{20}ClNO_2Na$ $[M+Na]^+$ = 360.1678, found:360.1571.

$[\alpha]_D^{20}$ = +82.7° (*c* 0.45, DCM)

(S)-2-hydroxy-2-(2-isopropyl-1H-indol-3-yl)-1-phenylethan-1-one (**3p**)



Yellow solid, 95% yield (27.8 mg), M.P.= 47~50 °C.

HPLC Analysis: 90%ee (t_{minor} = 8.1 min, t_{major} = 10.9min); Daicel Chiralpak IC Column, n-Hexane/ i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

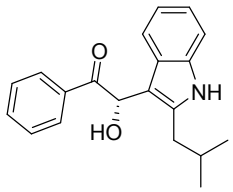
^{1}H NMR (400 MHz, $CDCl_3$-d1) δ 8.03 (s, 1H), 7.91 (d, *J* = 7.2 Hz, 2H), 7.49 (d, *J* = 7.3 Hz, 1H), 7.44 (t, *J* = 7.4 Hz, 1H), 7.30 (t, *J* = 7.8 Hz, 2H), 7.24 (d, *J* = 7.2 Hz, 1H), 7.08 (pd, *J* = 7.1, 1.2 Hz, 2H), 6.23 (d, *J* = 4.8 Hz, 1H), 4.51 (d, *J* = 4.9 Hz, 1H), 3.51 – 3.32 (m, 1H), 1.38 (d, *J* = 7.0 Hz, 3H), 1.26 (d, *J* = 6.9 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 200.26, 143.26, 135.25, 134.01, 133.58, 128.63, 128.47, 126.38, 121.67, 120.25, 118.37, 110.63, 107.88, 69.12, 29.73, 25.64, 23.06, 22.33.

HRMS (ESI): m/z calcd for $C_{19}H_{19}NO_2Na$ $[M+Na]^+$ = 316.1306, found:316.1317.

$[\alpha]_D^{20°C}$ =+94.3° (*c* 0.23, DCM)

(S)-2-hydroxy-2-(2-isobutyl-1H-indol-3-yl)-1-phenylethan-1-one (**3q**)



Yellow solid, 99% yield (30.4 mg), M.P.= 114~118 °C.

HPLC Analysis: 84%ee (t_{minor} = 14.7 min, t_{major} = 18.3min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

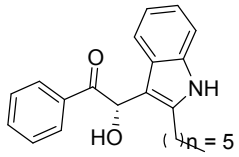
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (s, 1H), 7.96 – 7.79 (m, 2H), 7.52 – 7.38 (m, 2H), 7.29 (t, *J* = 7.8 Hz, 2H), 7.22 (d, *J* = 7.4 Hz, 1H), 7.15 – 6.97 (m, 2H), 6.16 (d, *J* = 4.2 Hz, 1H), 4.50 (d, *J* = 4.7 Hz, 1H), 2.82 – 2.60 (m, 2H), 2.13 – 1.95 (m, 1H), 0.99 (dd, *J* = 24.6, 6.6 Hz, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 200.13, 137.46, 135.29, 133.99, 133.58, 128.67, 128.47, 126.47, 121.67, 120.21, 118.31, 110.49, 110.12, 69.26, 35.56, 29.25, 22.88, 22.48.

HRMS (ESI): m/z calcd for $C_{20}H_{21}NO_2Na$ $[M+Na]^+$ = 330.1465, found:330.1472.

$[\alpha]_D^{20}$ = +97.2° (*c* 0.29, DCM)

(S)-2-(2-hexyl-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3r**)



Yellow solid, 98% yield (32.8 mg), M.P.= 95~98 °C.

HPLC Analysis: 80%ee (t_{minor} = 18.8 min, t_{major} = 20.4min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

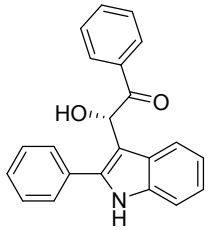
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (s, 1H), 7.90 (d, *J* = 7.2 Hz, 2H), 7.49 (d, *J* = 7.1 Hz, 1H), 7.44 (t, *J* = 7.4 Hz, 1H), 7.30 (t, *J* = 7.8 Hz, 2H), 7.22 (d, *J* = 7.8 Hz, 1H), 7.07 (pd, *J* = 7.1, 1.3 Hz, 2H), 6.19 (s, 1H), 4.51 (s, 1H), 2.91 – 2.71 (m, 2H), 1.65 (ddd, *J* = 21.0, 14.0, 7.0 Hz, 3H), 1.44 – 1.28 (m, 5H), 0.90 (t, *J* = 7.0 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 200.04, 138.24, 135.28, 133.95, 133.59, 128.65, 128.47, 126.56, 121.64, 120.23, 118.24, 110.49, 109.30, 69.16, 31.74, 29.20, 26.32, 22.50, 13.99.

HRMS (ESI): m/z calcd for $C_{22}H_{26}NO_2$ $[M+H]^+$ = 336.1019, found:336.1036.

$[\alpha]_D^{20}$ = +75.6° (*c* 0.27, DCM)

(S)-2-hydroxy-1-phenyl-2-(2-phenyl-1H-indol-3-yl)ethan-1-one (**3s**)



Yellow solid, 90% yield (29.4 mg), M.P.= 80~83 °C.

HPLC Analysis: 77%ee (t_{minor}= 15.5 min, t_{major} = 30.3min); Daicel Chiralpak AS-H Column, n-Hexane/i-PrOH =80/20, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

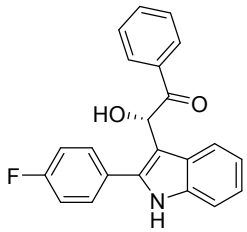
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40 (s, 1H), 7.65 (d, *J* = 7.3 Hz, 2H), 7.60 – 7.54 (m, 2H), 7.53 – 7.39 (m, 4H), 7.31 (t, *J* = 7.4 Hz, 1H), 7.24 (t, *J* = 3.9 Hz, 1H), 7.10 (td, *J* = 7.9, 4.0 Hz, 3H), 7.06 – 6.99 (m, 1H), 6.16 (d, *J* = 3.9 Hz, 1H), 4.70 (d, *J* = 3.6 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.67, 137.83, 136.02, 133.50, 131.79, 129.27, 128.86, 128.75, 128.63, 128.26, 126.50, 122.67, 120.67, 119.44, 111.08, 110.09, 69.87.

HRMS (ESI): m/z calcd for $C_{22}H_{17}NO_2Na$ $[M+Na]^+$ = 350.1151, found:350.1160.

$[\alpha]_D^{20}$ = +132.6° (*c* 0.35, DCM)

(S)-2-(2-(4-fluorophenyl)-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3t**)



Yellow solid, 95% yield (32.8 mg), M.P.= 121~124 °C.

HPLC Analysis: 92%ee (t_{minor} = 9.4 min, t_{major} = 11.2min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (s, 1H), 7.55 (t, *J* = 6.7 Hz, 4H), 7.46 (d, *J* = 7.9 Hz, 1H), 7.32 (t, *J* = 7.4 Hz, 1H), 7.23 (d, *J* = 8.0 Hz, 1H), 7.17 – 7.07 (m, 5H), 7.04 (t, *J* = 7.5 Hz, 1H), 6.09 (d, *J* = 4.3 Hz, 1H), 4.72 (d, *J* = 4.6 Hz, 1H).

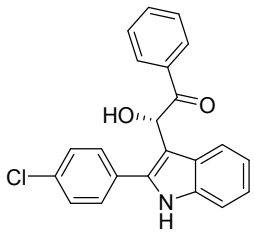
^{13}C NMR (101 MHz, $CDCl_3$) δ 199.50, 136.69, 135.92, 133.56, 130.65, 130.57, 128.56, 128.30, 127.90, 126.48, 122.86, 120.85, 119.42, 116.50, 116.28, 110.99, 110.46, 69.66.

^{19}F NMR (376 MHz, $CDCl_3$) δ 111.94.

HRMS (ESI): m/z calcd for $C_{22}H_{16}FNO_2Na$ $[M+Na]^+$ = 368.1057, found:368.1069.

$[\alpha]_D^{20}$ = +113.7° (*c* 0.29, DCM)

(S)-2-(2-(4-chlorophenyl)-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3u**)



White solid, 95%yield (34.3 mg), M.P.= 145~146 °C.

HPLC Analysis: 88%ee (t_{minor} = 6.9 min, t_{major} = 7.9min); Daicel Chiralpak IC Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

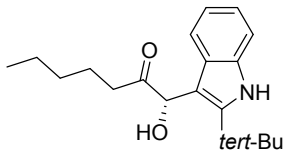
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (s, 1H), 7.58 – 7.53 (m, 2H), 7.52 (d, *J* = 8.4 Hz, 2H), 7.45 (d, *J* = 7.9 Hz, 1H), 7.39 (d, *J* = 8.4 Hz, 2H), 7.32 (t, *J* = 7.4 Hz, 1H), 7.23 (d, *J* = 8.1 Hz, 1H), 7.16 – 7.08 (m, 3H), 7.07 – 6.99 (m, 1H), 6.09 (d, *J* = 4.1 Hz, 1H), 4.74 (d, *J* = 4.5 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.46, 136.49, 136.06, 134.94, 133.61, 133.45, 130.12, 129.89, 129.47, 128.55, 128.32, 126.42, 122.97, 120.86, 119.42, 111.16, 110.50, 69.66.

HRMS (ESI): m/z calcd for $C_{22}H_{16}ClNO_2Na$ $[M+Na]^+$ = 384.0762, found:384.0773.

$[\alpha]_D^{20}$ = +100° (*c* 0.24, DCM)

(S)-1-(2-(tert-butyl)-1H-indol-3-yl)-1-hydroxyheptan-2-one (**3v**)



Yellow oil, 30%yield (9.0 mg).

HPLC Analysis: 52%ee (t_{minor}= 14.7 min, t_{major} = 23.5 min); Daicel Chiralcel OD-H Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

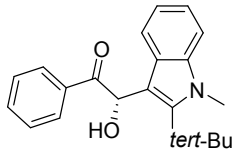
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (s, 1H), 7.32 (d, *J* = 8.1 Hz, 1H), 7.24 (d, *J* = 7.9 Hz, 1H), 7.17 – 7.10 (m, 1H), 7.07 – 6.99 (m, 1H), 5.68 (s, 1H), 4.35 (s, 1H), 2.39 (ddd, *J* = 10.5, 8.3, 6.7 Hz, 2H), 1.60 (s, 9H), 1.58 (s, 2H), 1.22 – 1.12 (m, 4H), 0.82 (t, *J* = 7.0 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 211.98, 145.81, 134.07, 127.15, 121.75, 120.30, 118.69, 110.68, 106.90, 73.05, 37.86, 33.04, 31.20, 31.16, 23.47, 22.33, 13.83.

HRMS (ESI): m/z calcd for $C_{21}H_{23}NO_2Na$ $[M+Na]^+$ = 324.2042, found:324.1931.

$[\alpha]_D^{20}$ = +13.3° (*c* 1.31, DCM)

(S)-2-(2-(tert-butyl)-1-methyl-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3w**)



Yellow solid, 70%yield (22.5 mg), M.P.= 115~118 °C.

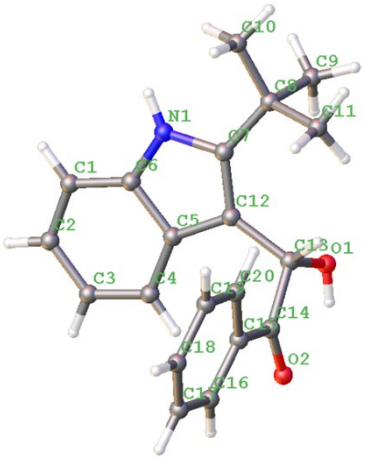
HPLC Analysis: 10%ee (t_{minor}= 21.5 min, t_{major} = 27.0 min); Daicel Chiralpak ID Column, n-Hexane/i-PrOH = 90/10, flow rate 1.0 mL/min, T = 30 °C, λ = 254 nm.

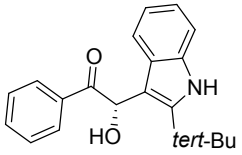
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93 (d, *J* = 7.4 Hz, 2H), 7.37 (t, *J* = 7.4 Hz, 1H), 7.26 (dt, *J* = 15.4, 7.8 Hz, 3H), 7.15 (d, *J* = 8.2 Hz, 1H), 7.06 (t, *J* = 7.6 Hz, 1H), 6.92 (t, *J* = 7.5 Hz, 1H), 6.57 (s, 1H), 4.60 (s, 1H), 3.87 (s, 3H), 1.75 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 201.63, 144.65, 138.24, 134.38, 133.39, 128.69, 128.34, 125.99, 121.72, 119.95, 119.16, 108.88, 108.77, 71.10, 34.93, 33.77, 31.66.

HRMS (ESI): m/z calcd for $C_{21}H_{23}NO_2Na$ $[M+Na]^+$ = 344.1621, found:344.1630.

$[\alpha]_D^{20}$ = +11.5° (*c* 0.13, DCM)





3a

CCDC: 1969228

4. X-ray crystallography

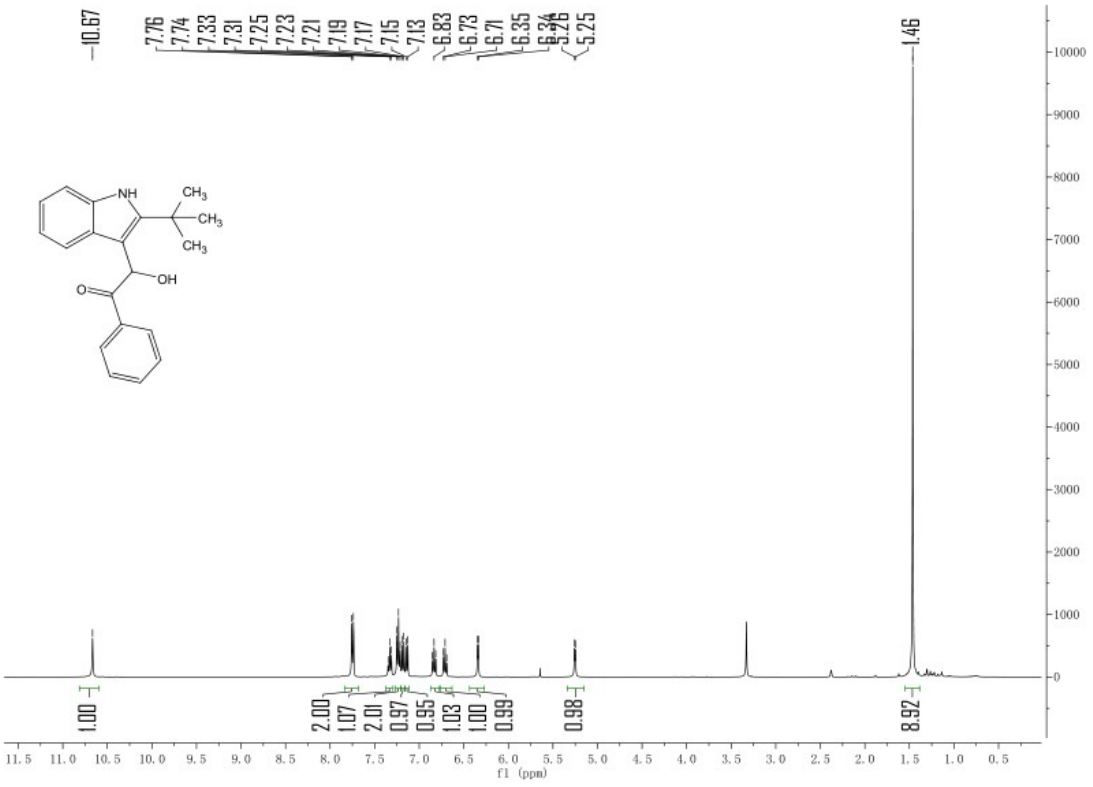
Empirical formula	$C_{20}H_{21}NO_2$
Formula weight	307.38
Z	4
Space group	C2
a/Å	14.3043(11)
b/Å	9.7587(7)
c/Å	12.3878(7)
α/°	90
β/°	105.846(7)
γ/°	90
Volume/Å3	1663.5(2)
ρ_{calc}g/cm3	1.227
μ/mm^{-1}	0.623
F(000)	656.0
Temperature/K	296

Reference

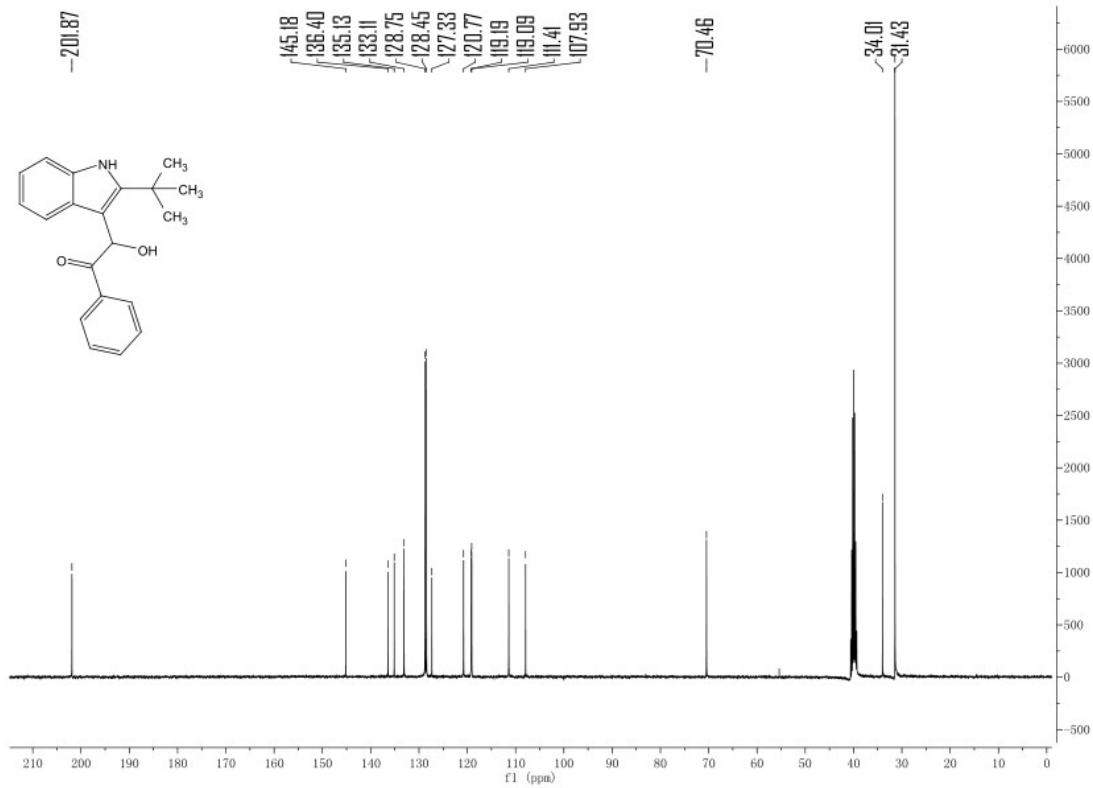
1. W. Wu, S. Zou, L. Lin, J. Ji, Y. Zhang, B. Ma, X. Liu and X. Feng, *Chem. Commun.*, 2017, **53**, 3232-3235.
2. D. Gritzalis, J. Park, W. Chiu, H. Cho, Y. S. Lin, J. W. De Schutter, C. M. Lacbay, M. Zielinski, A. M. Berghuis and Y. S. Tsantrizos, *Bioorg. Med. Chem. Lett.*, 2015, **25**, 1117-1123.

NMR spectra of compounds

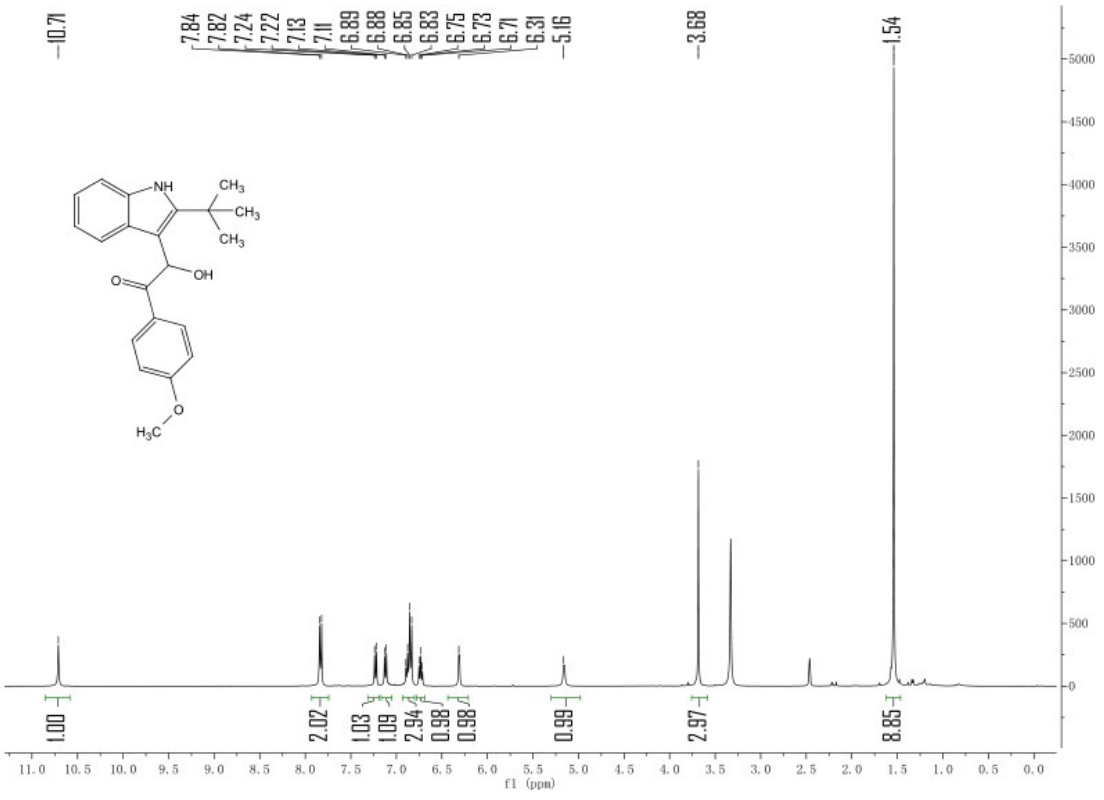
^{1}H NMR (400 MHz, DMSO-d_6) and **^{13}C NMR** (101 MHz, DMSO-d_6) of **3a**

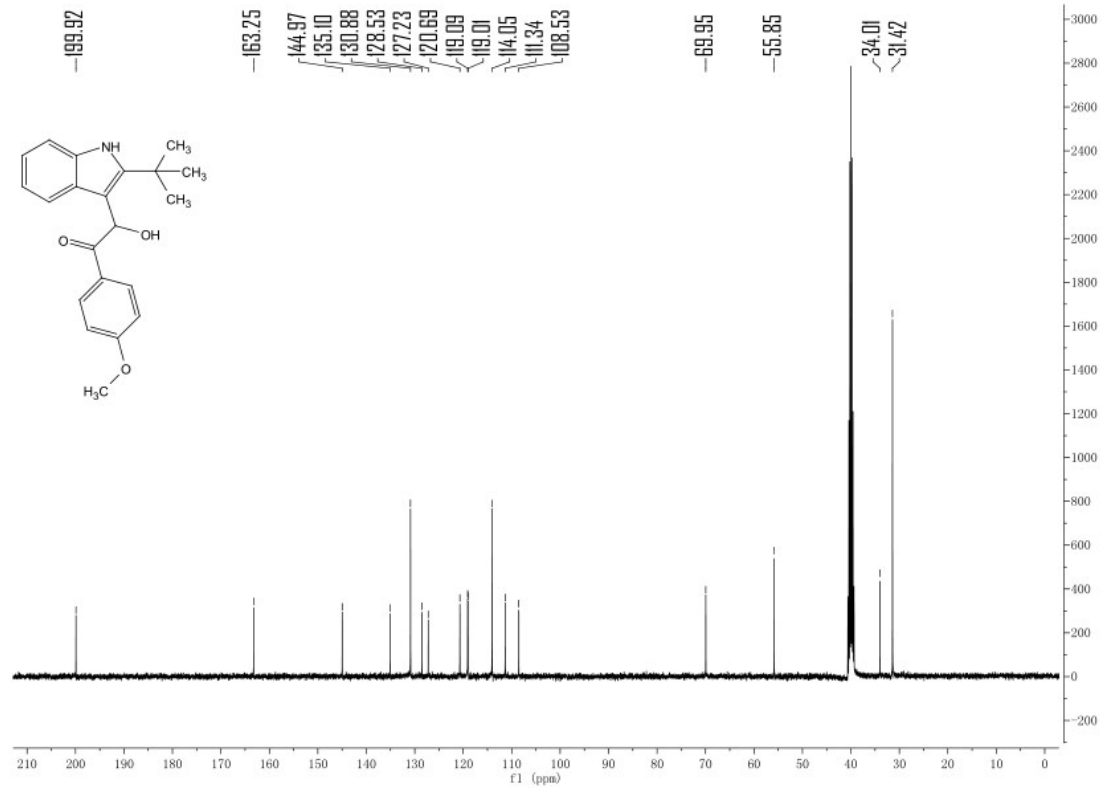


^{1}H NMR (400 MHz, DMSO-d_6) and **^{13}C NMR** (101 MHz, DMSO-d_6) of **3a**

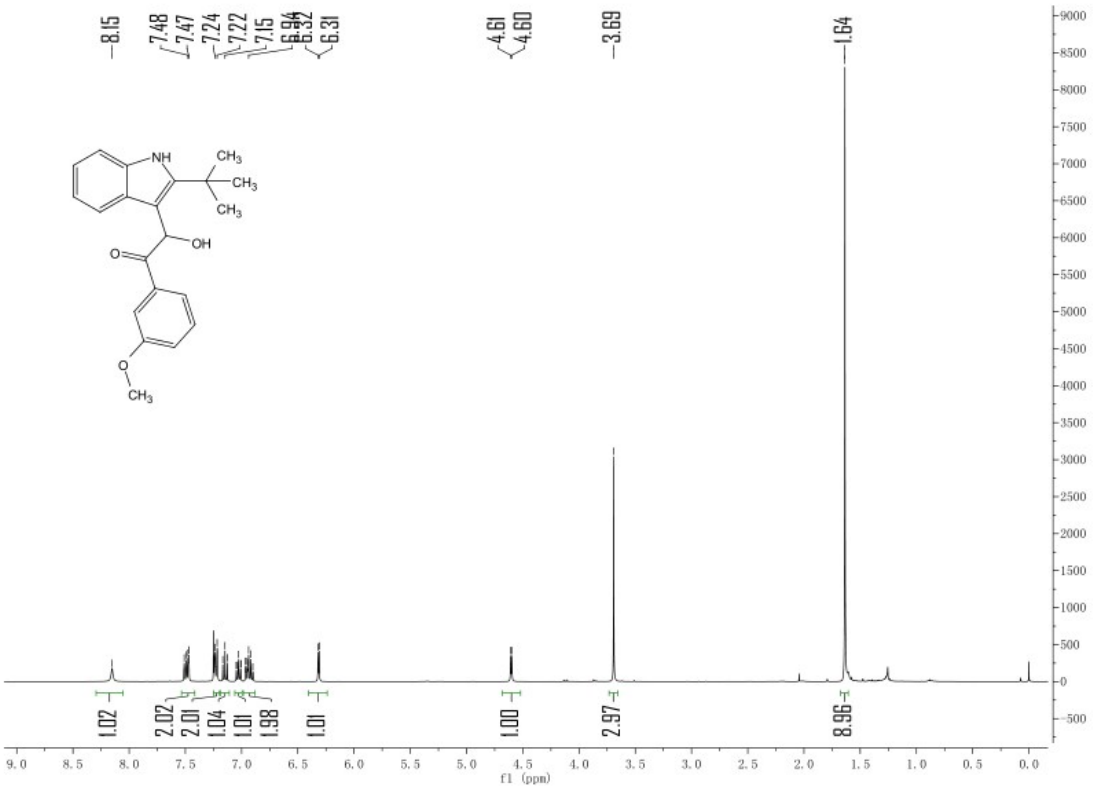


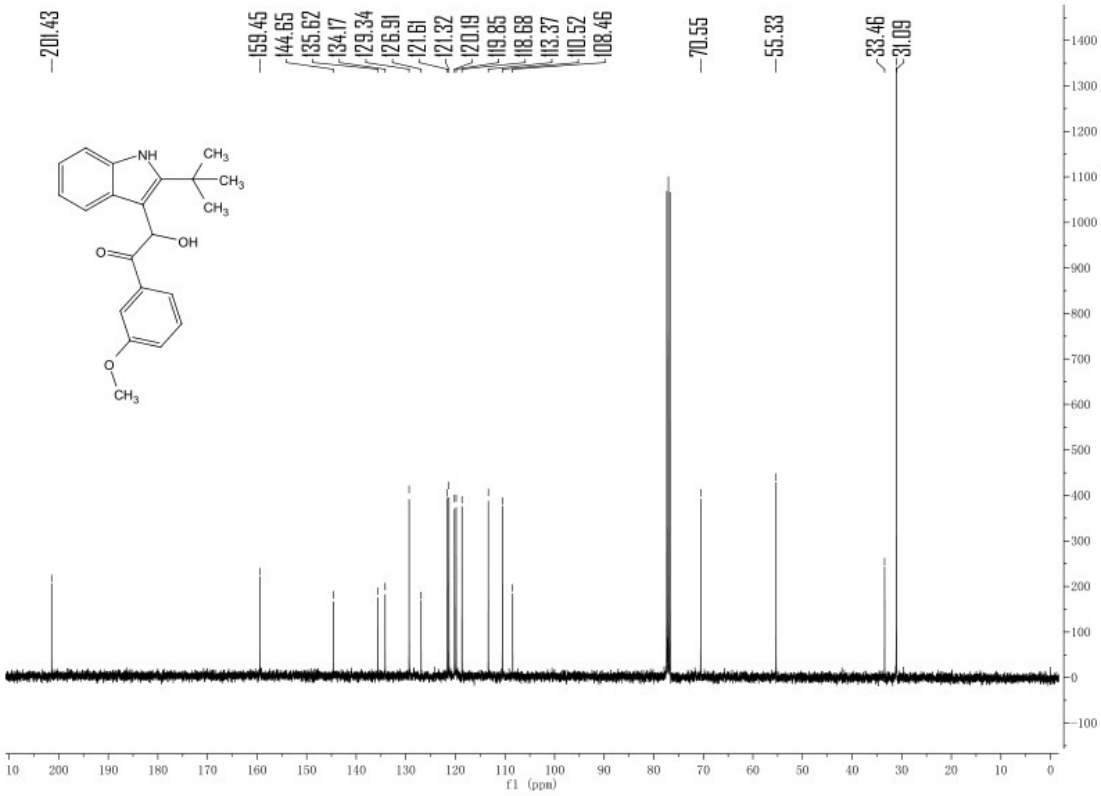
^{1}H NMR (400 MHz, DMSO-d_6) and **^{13}C NMR** (101 MHz, DMSO-d_6) of **3b**



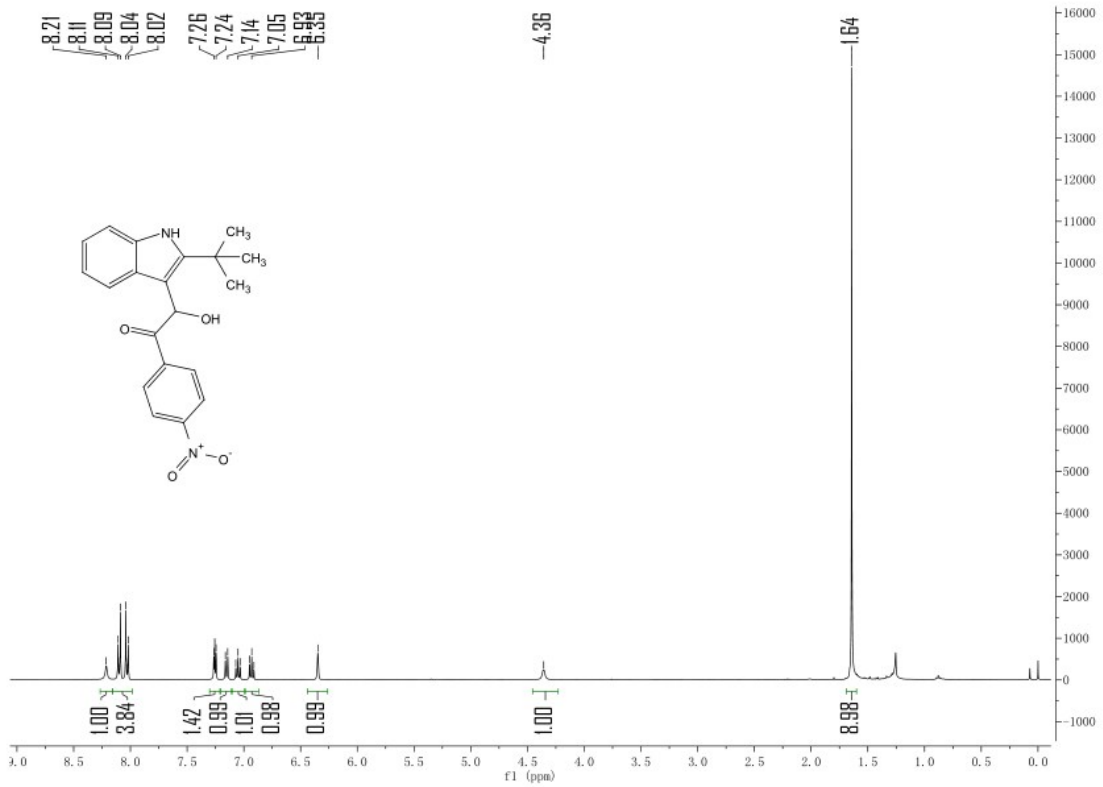


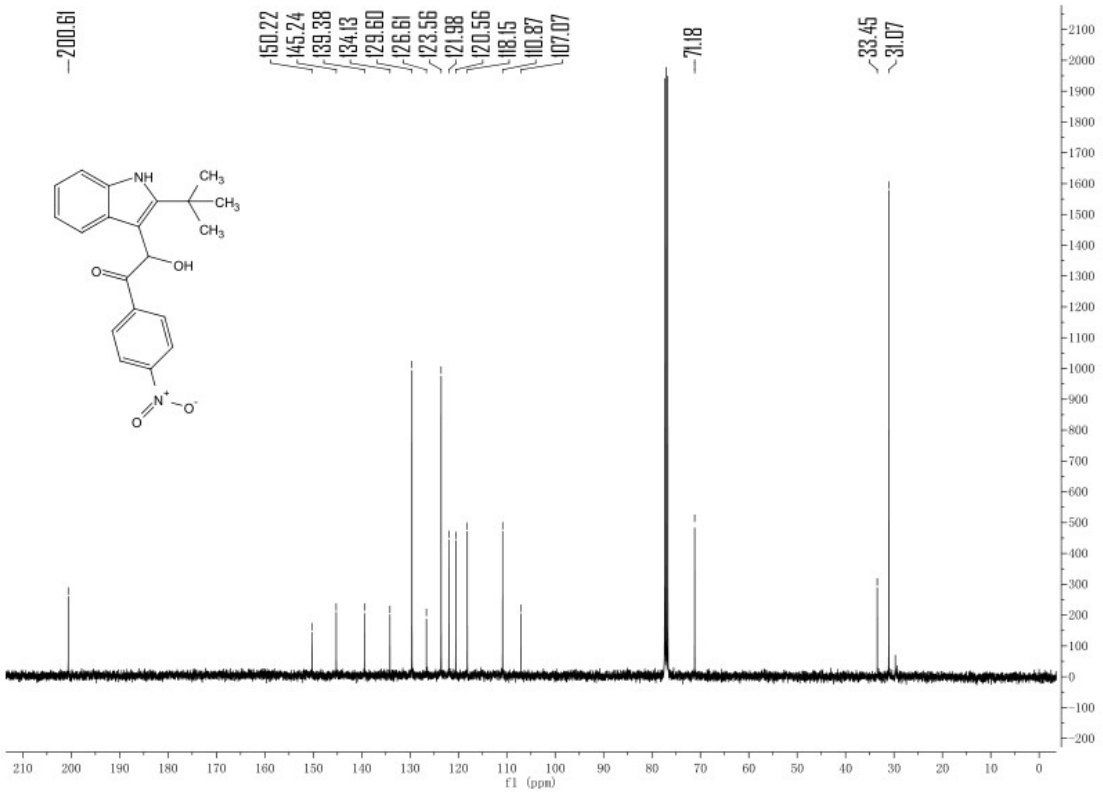
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3c**



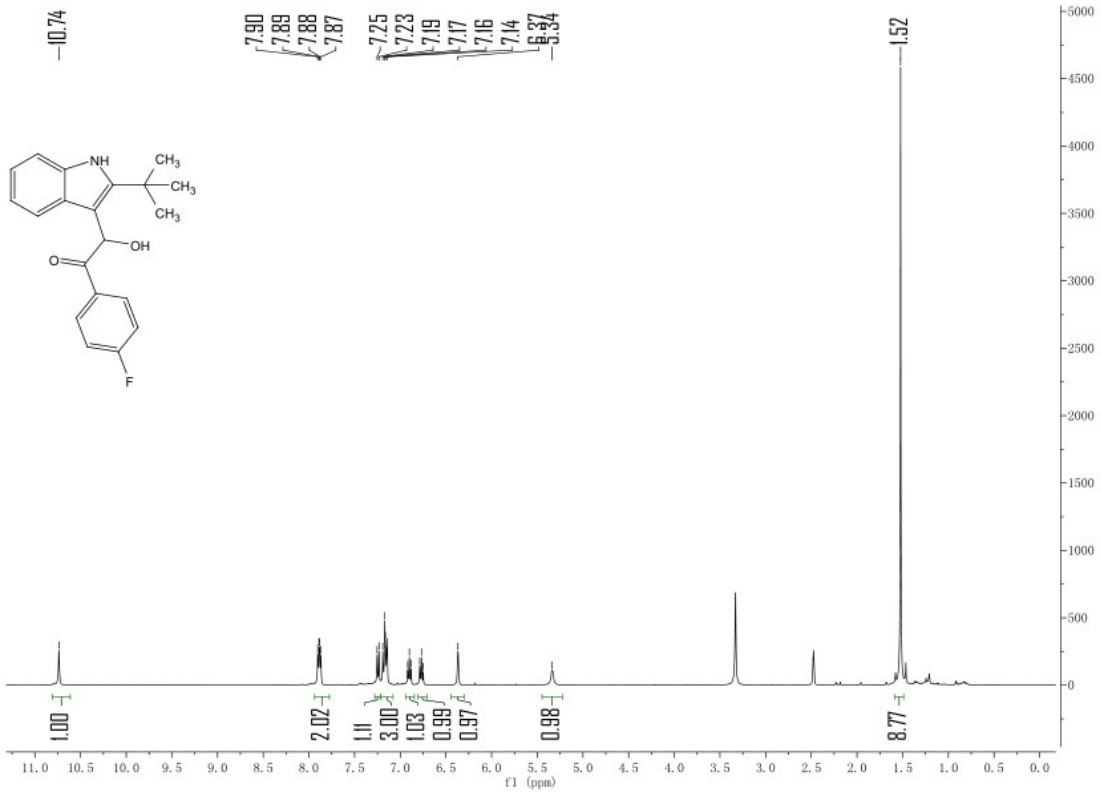


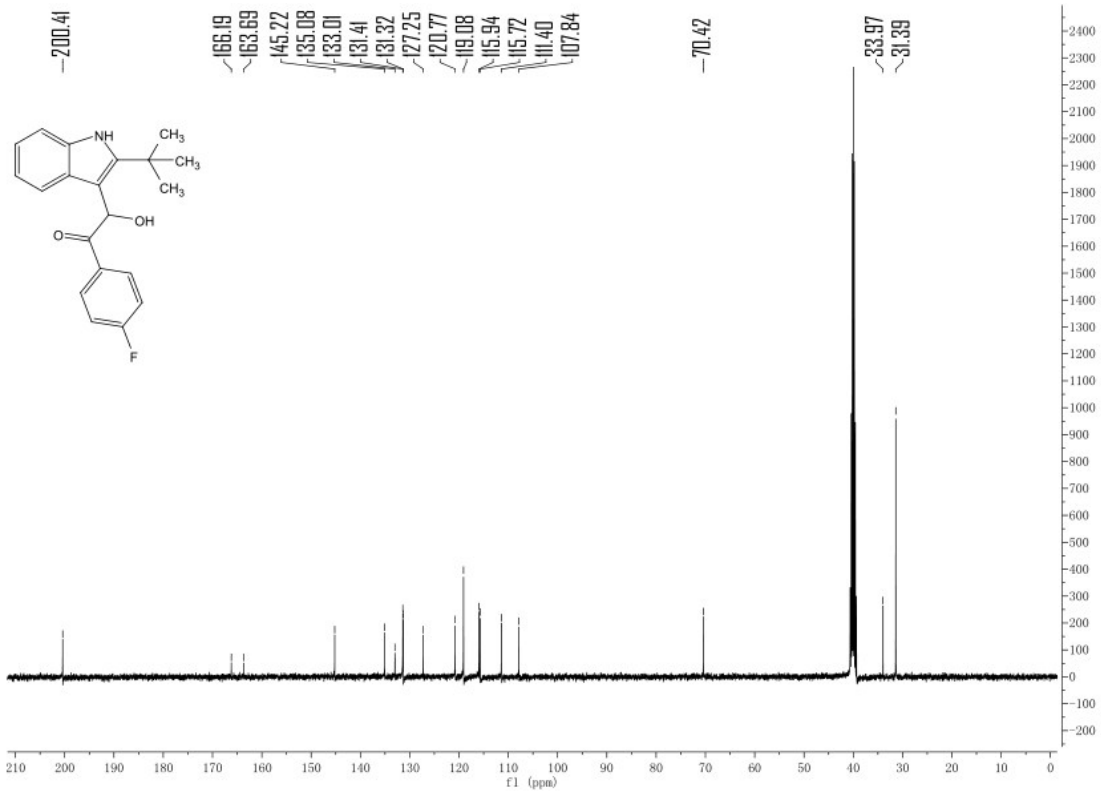
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3d**





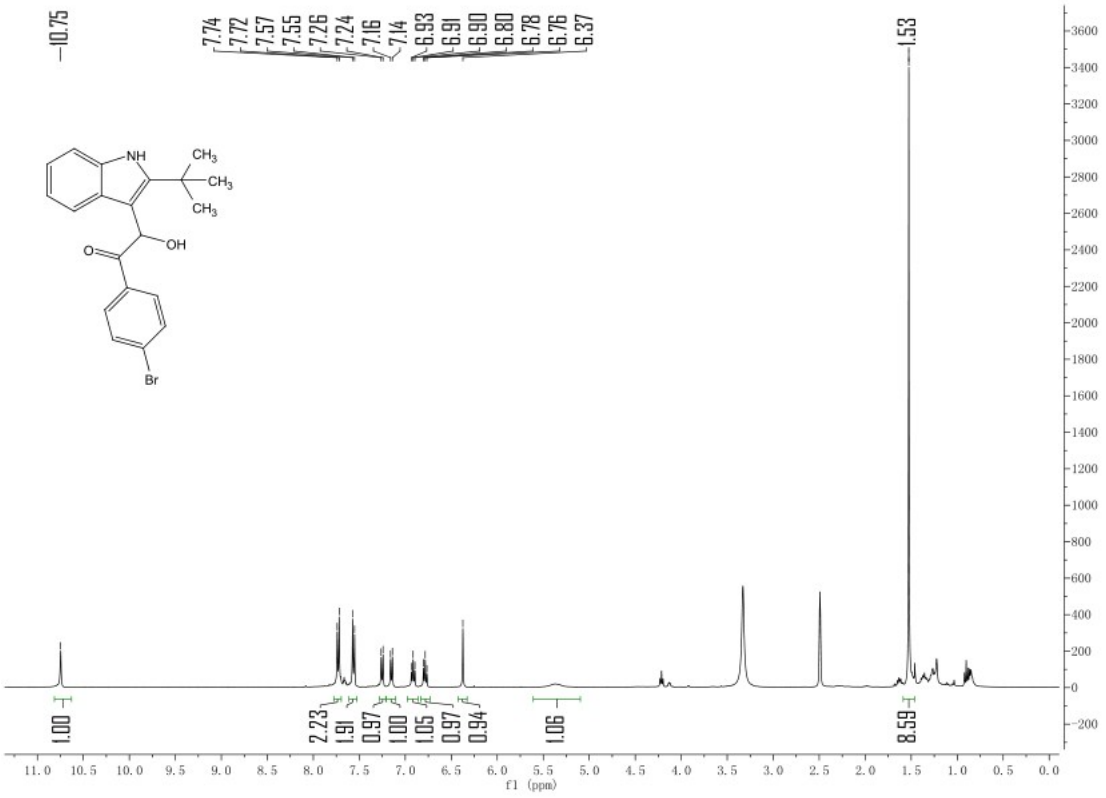
^{1}H NMR (400 MHz, DMSO-d_6) and **^{13}C NMR** (101 MHz, DMSO-d_6) of **3e**

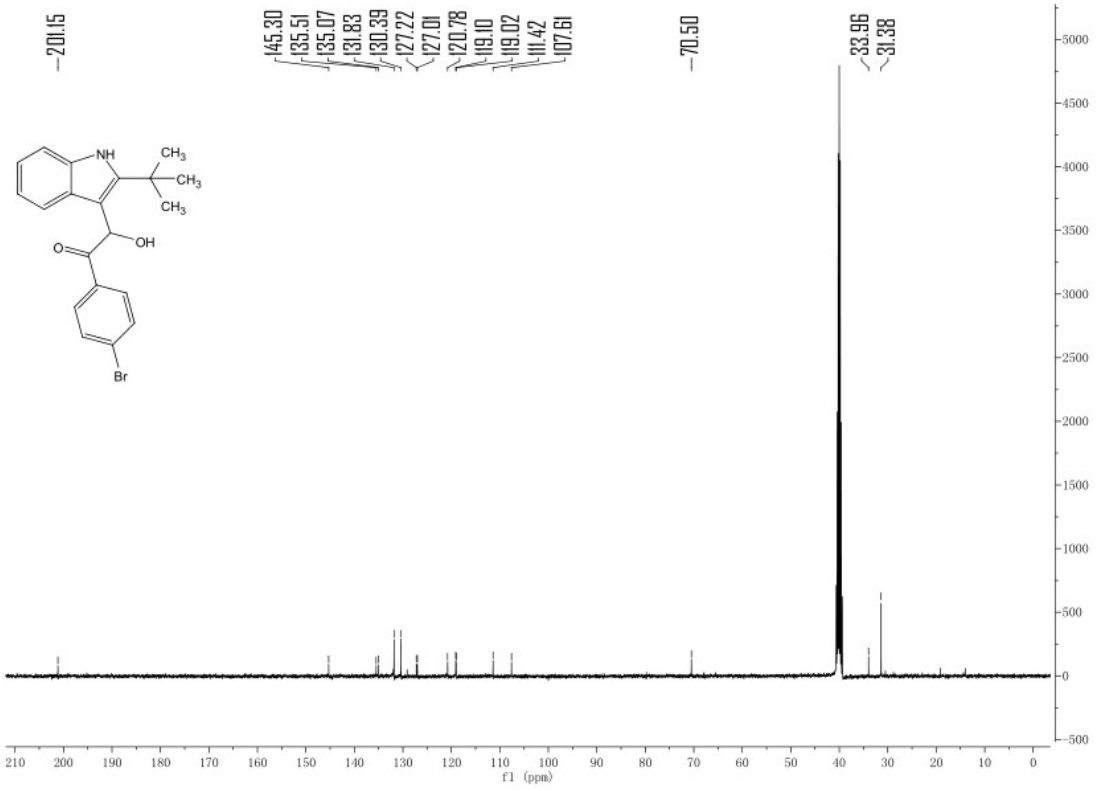




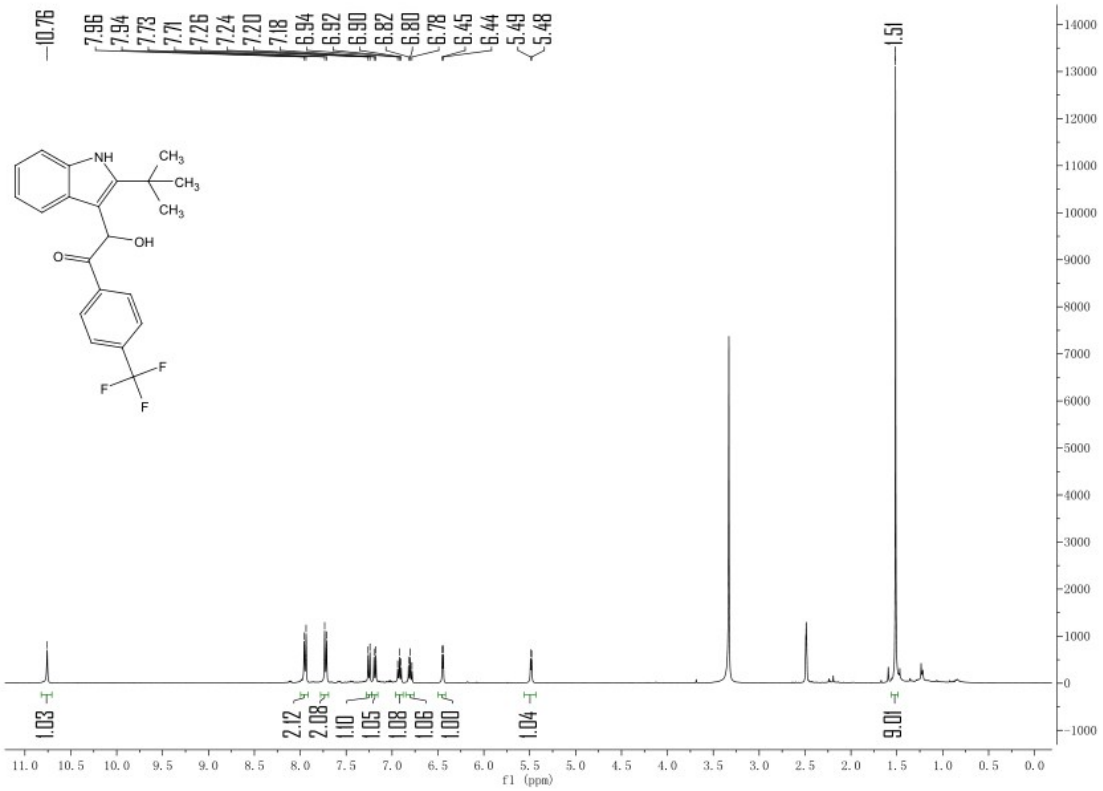
^{19}F NMR (376 MHz, $CDCl_3$) of **3e**

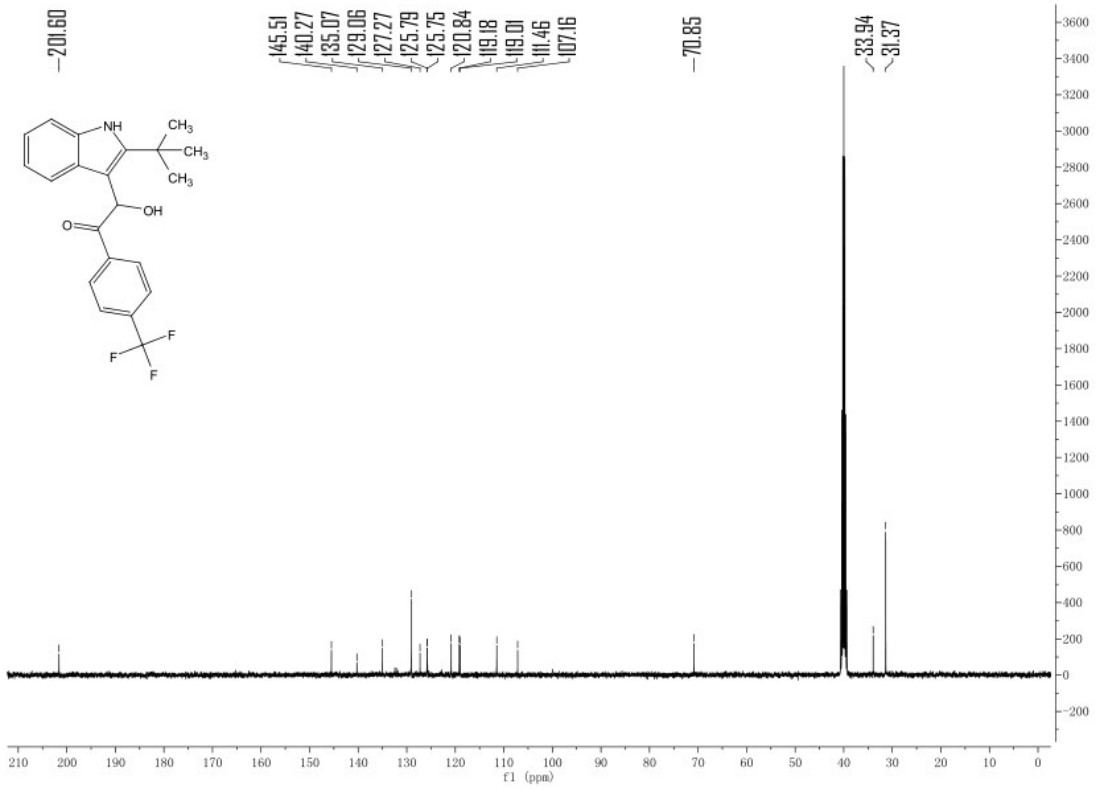
^{1}H NMR (400 MHz, DMSO-d_6) and **^{13}C NMR** (101 MHz, DMSO-d_6) of **3f**



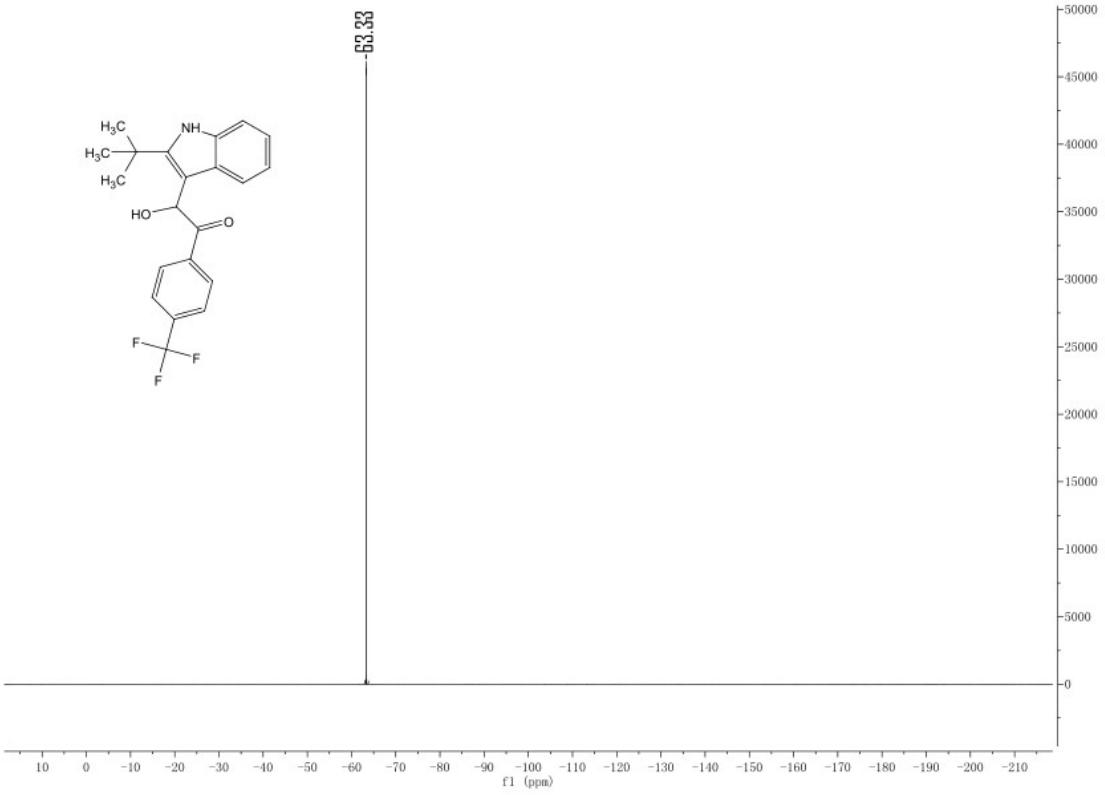


^{1}H NMR (400 MHz, DMSO-d_6) and **^{13}C NMR** (101 MHz, DMSO-d_6) of **3g**

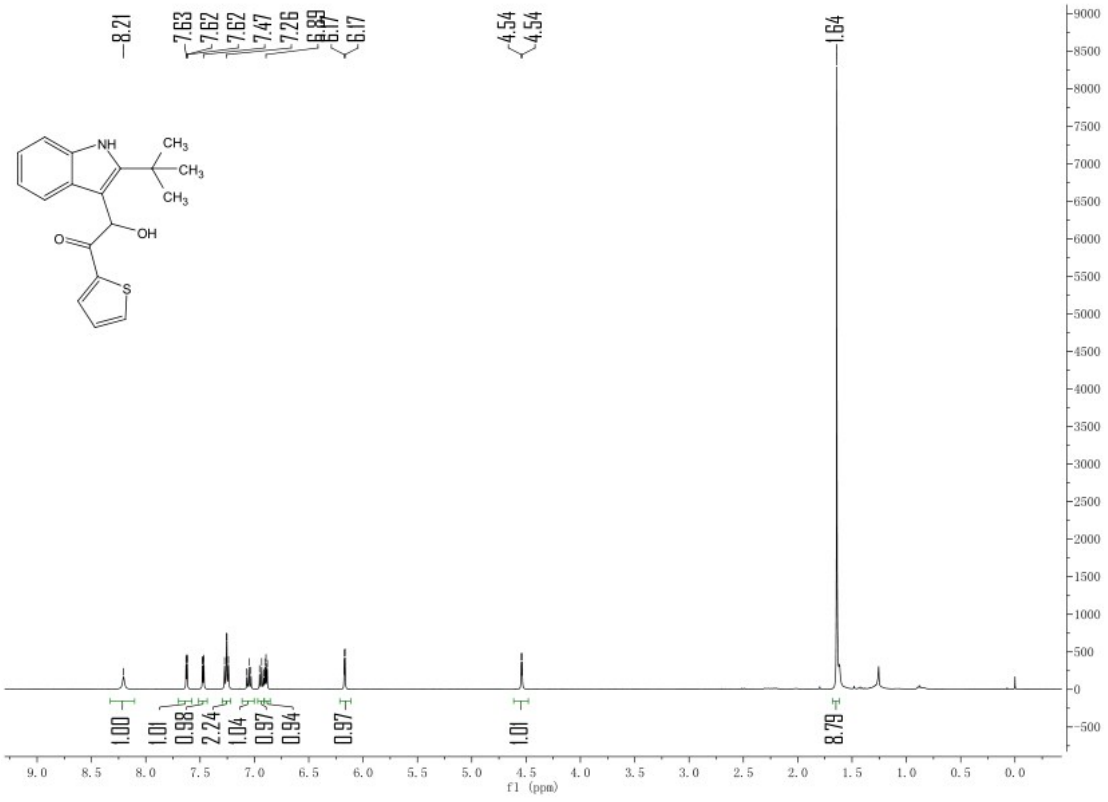


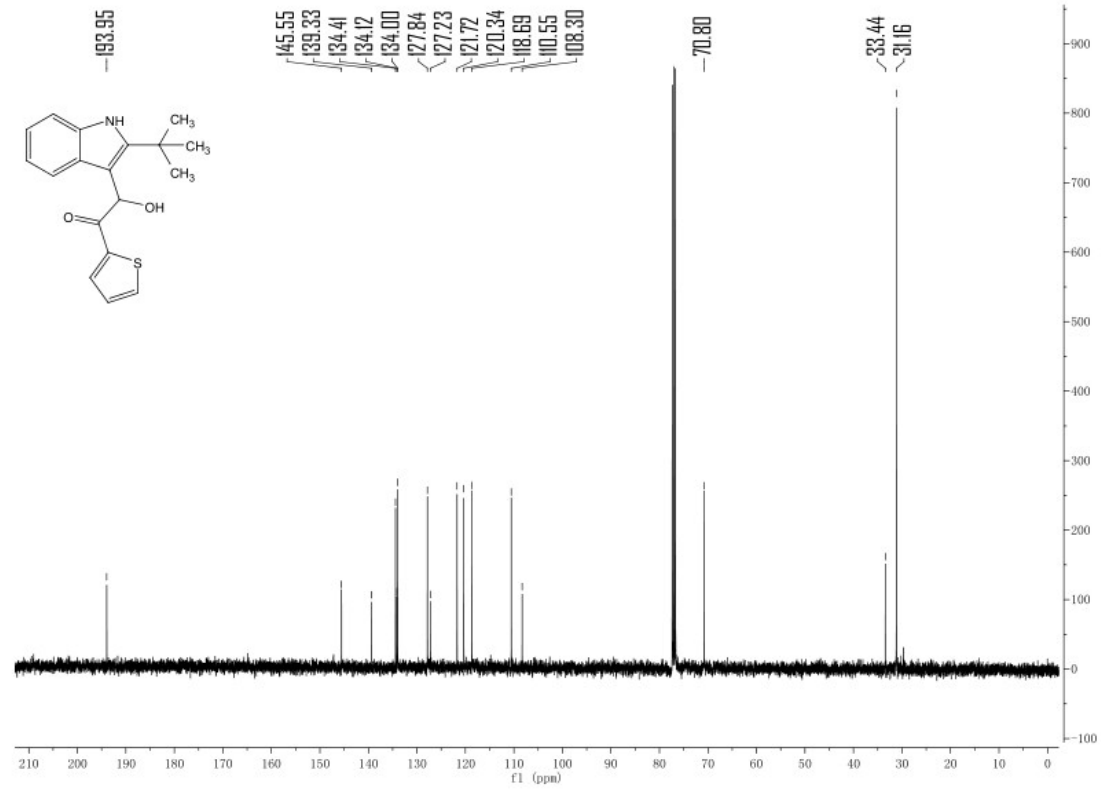


^{19}F NMR (376 MHz, $CDCl_3$) of **3g**

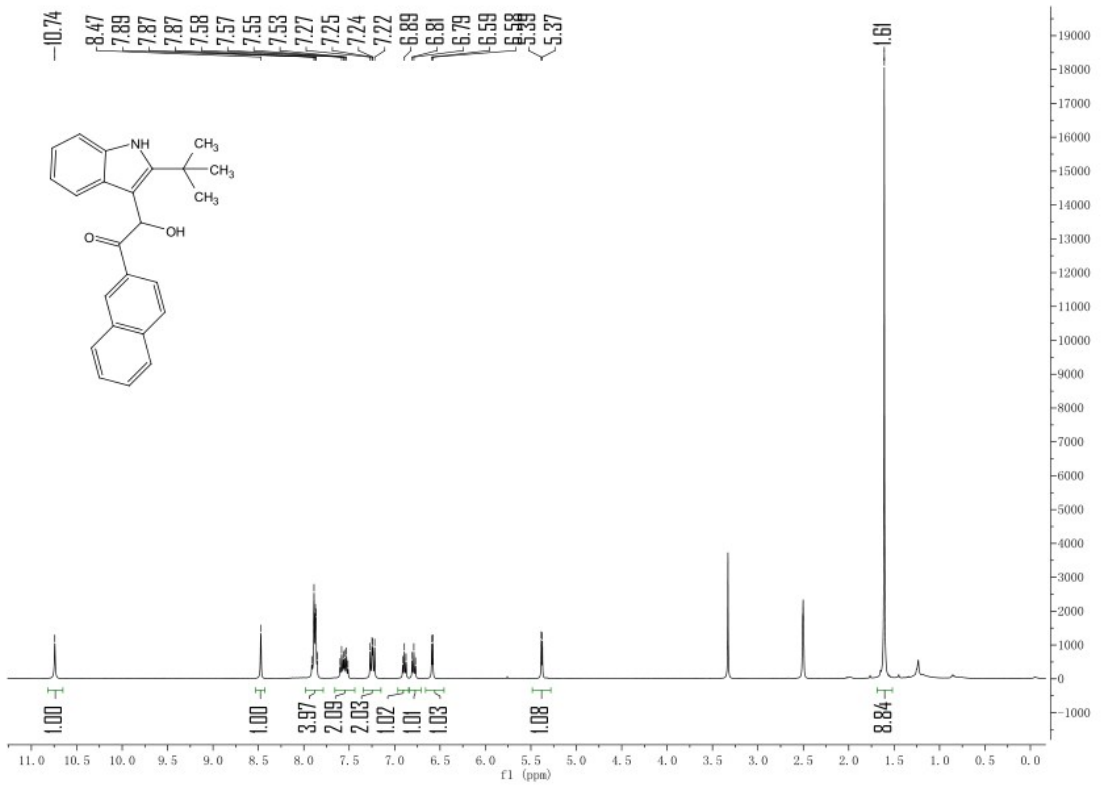


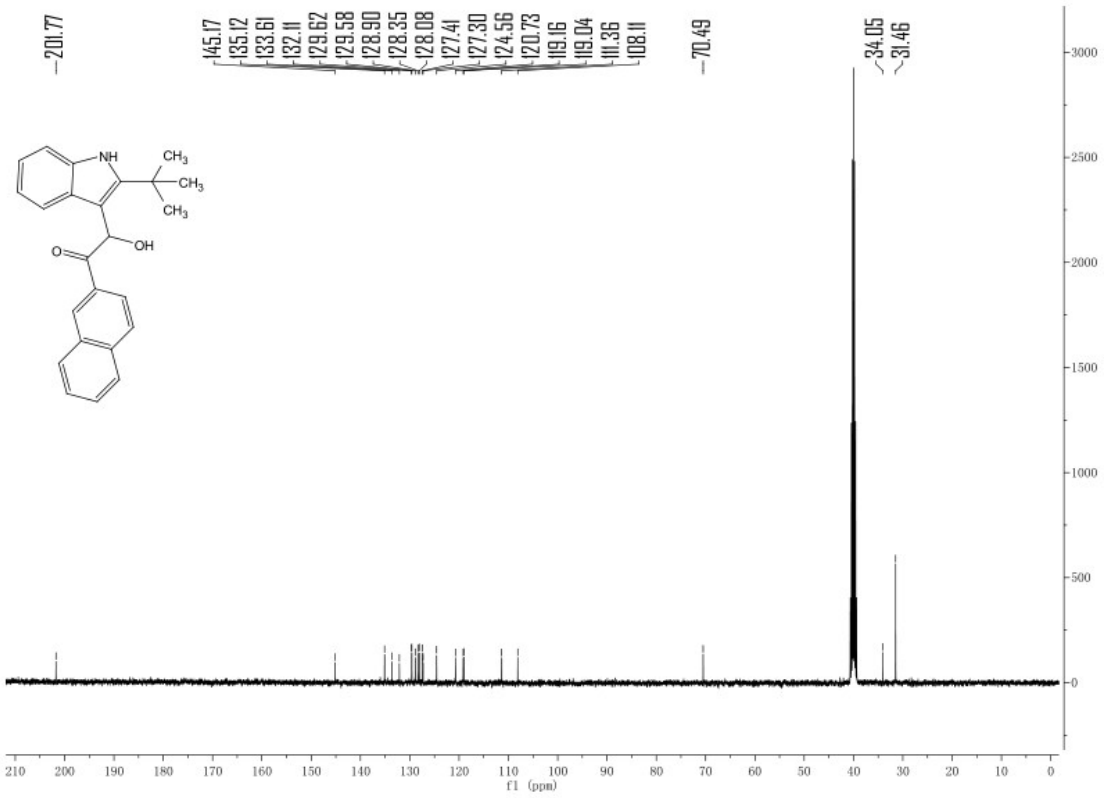
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3h**



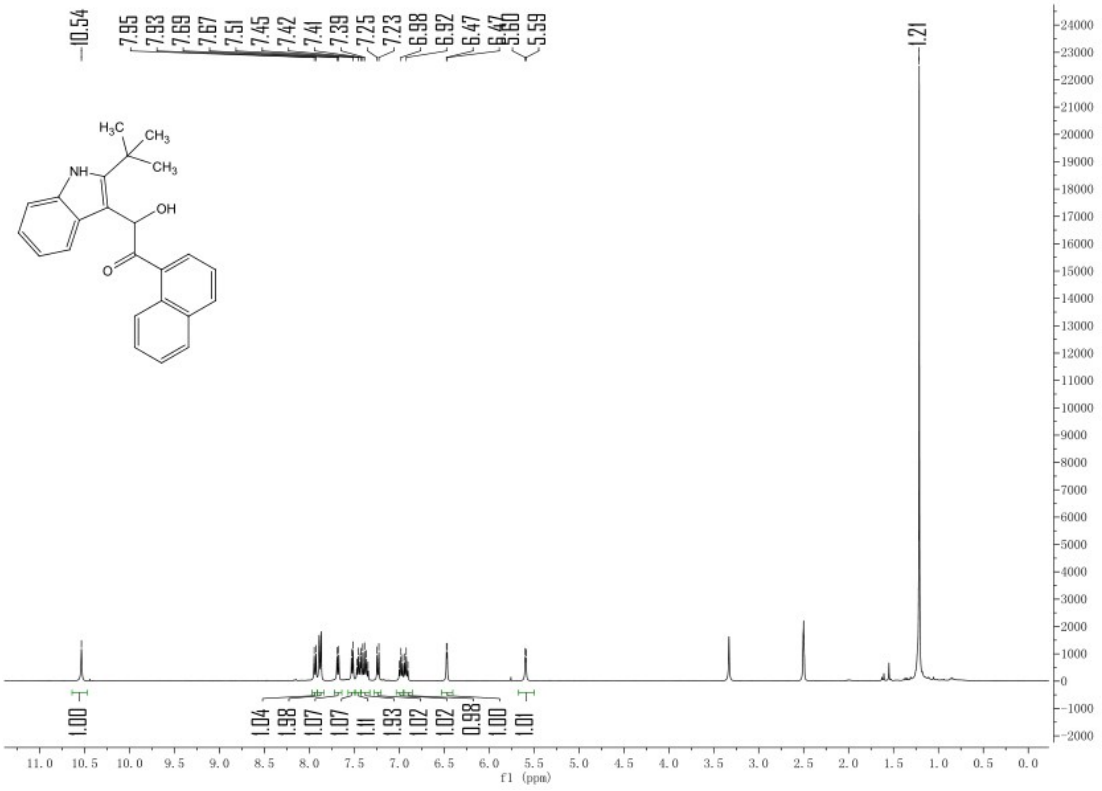


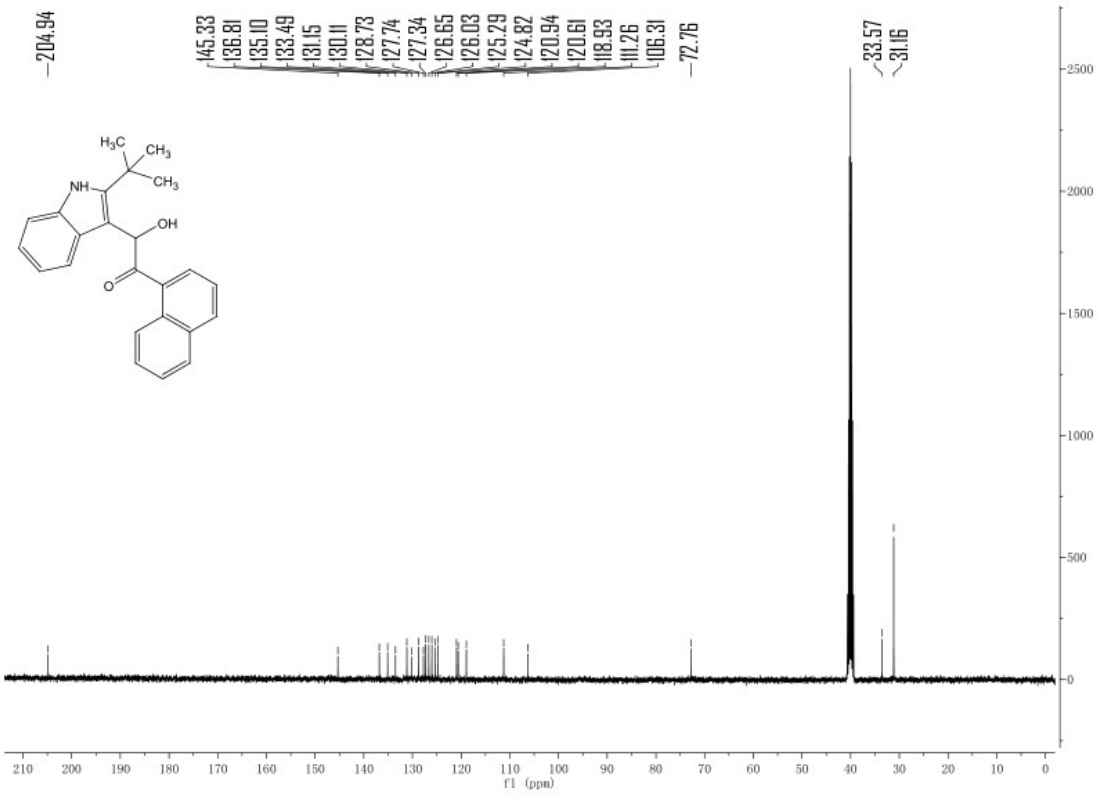
^{1}H NMR (400 MHz, DMSO-d_6) and **^{13}C NMR** (101 MHz, DMSO) of **3i**



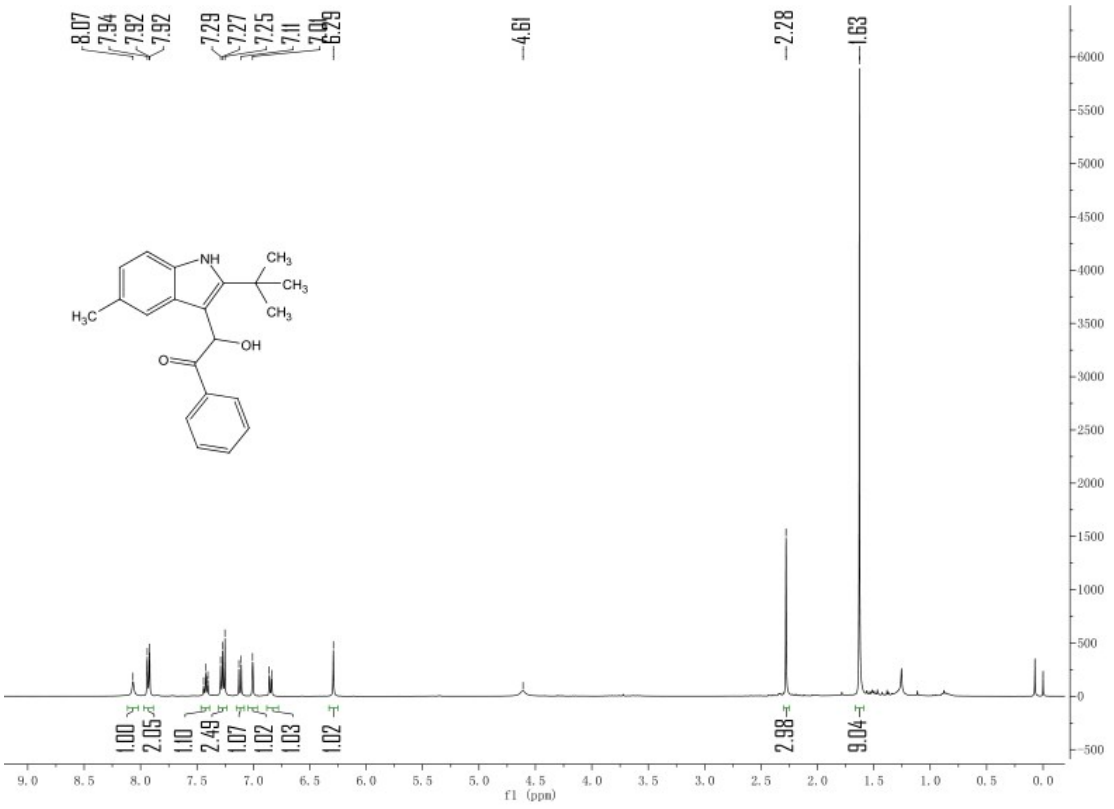


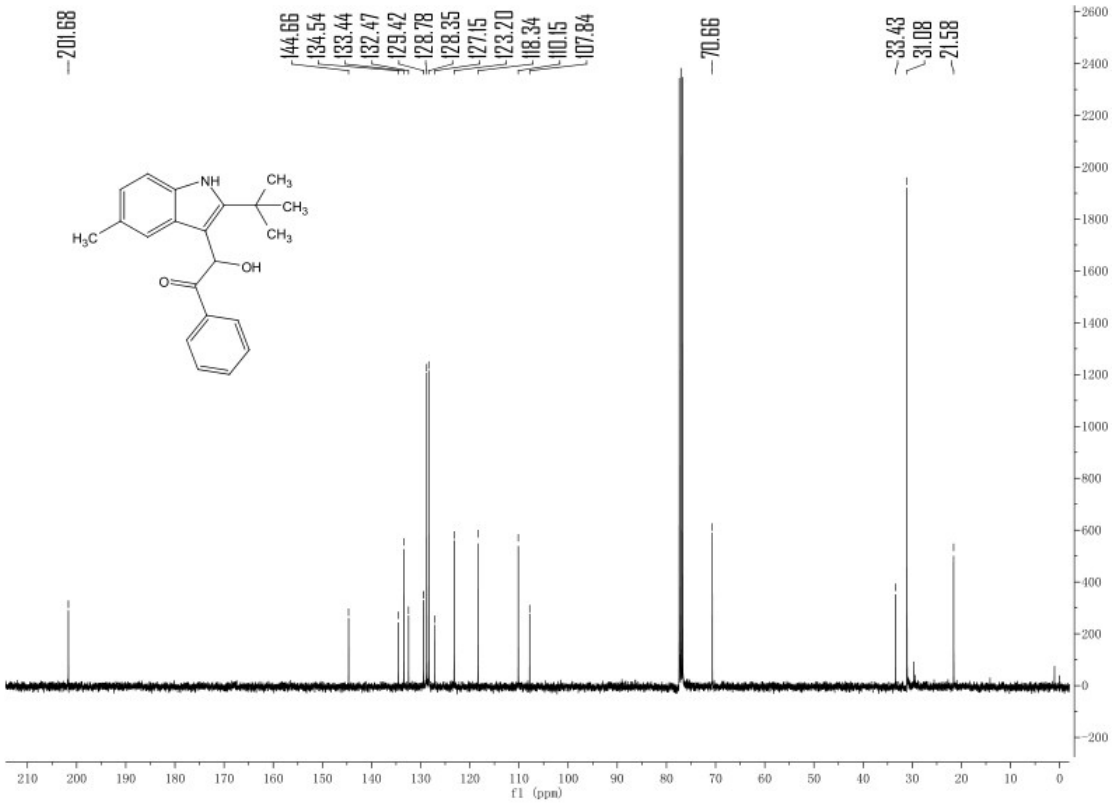
^{1}H NMR (400 MHz, DMSO-d_6) and **^{13}C NMR** (101 MHz, DMSO) of **3j**



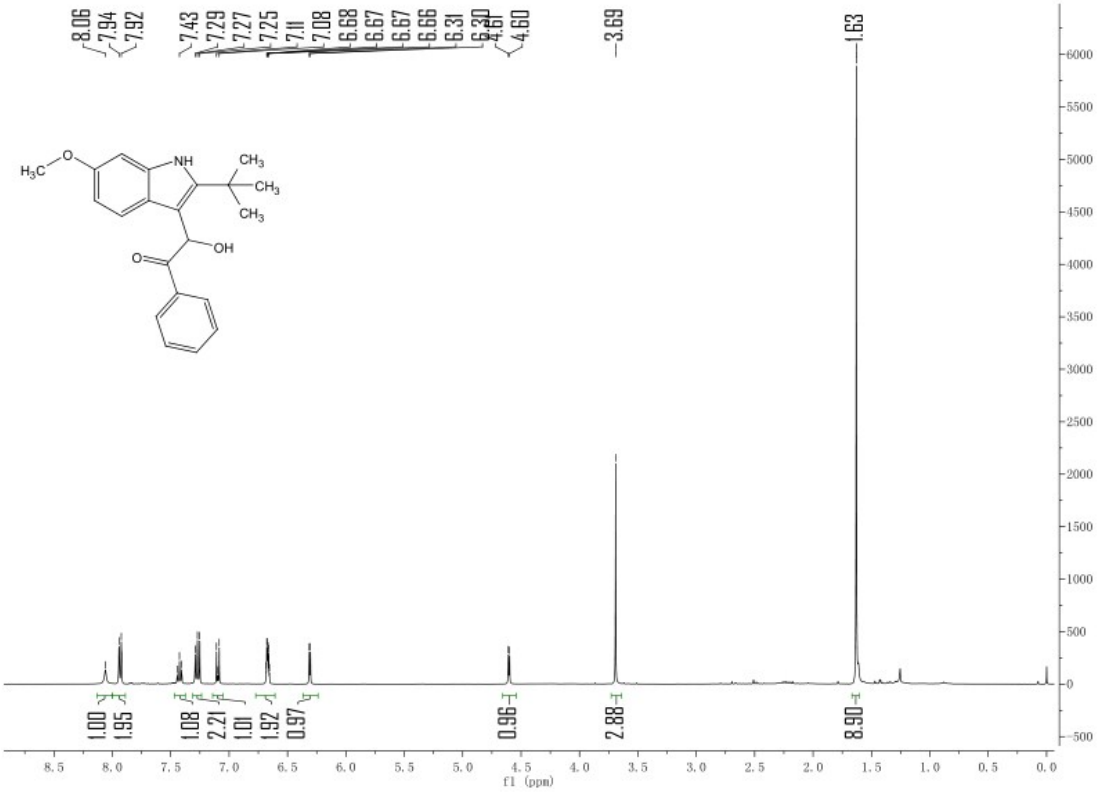


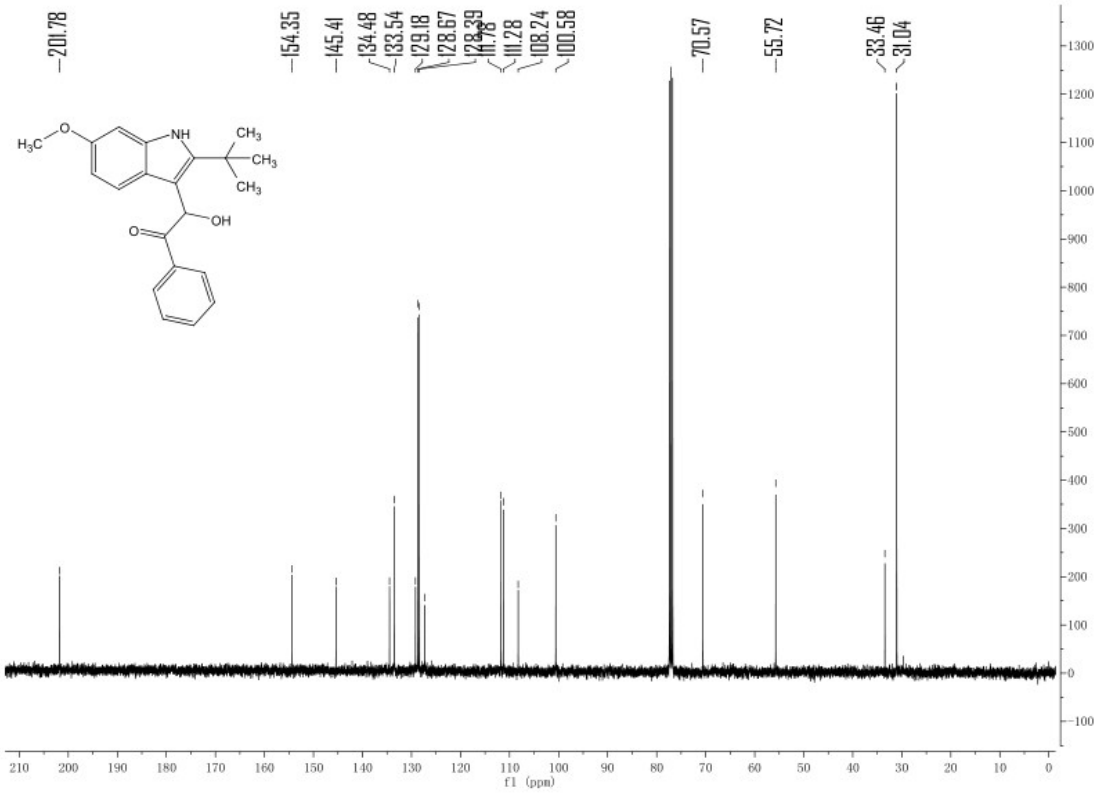
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3k**



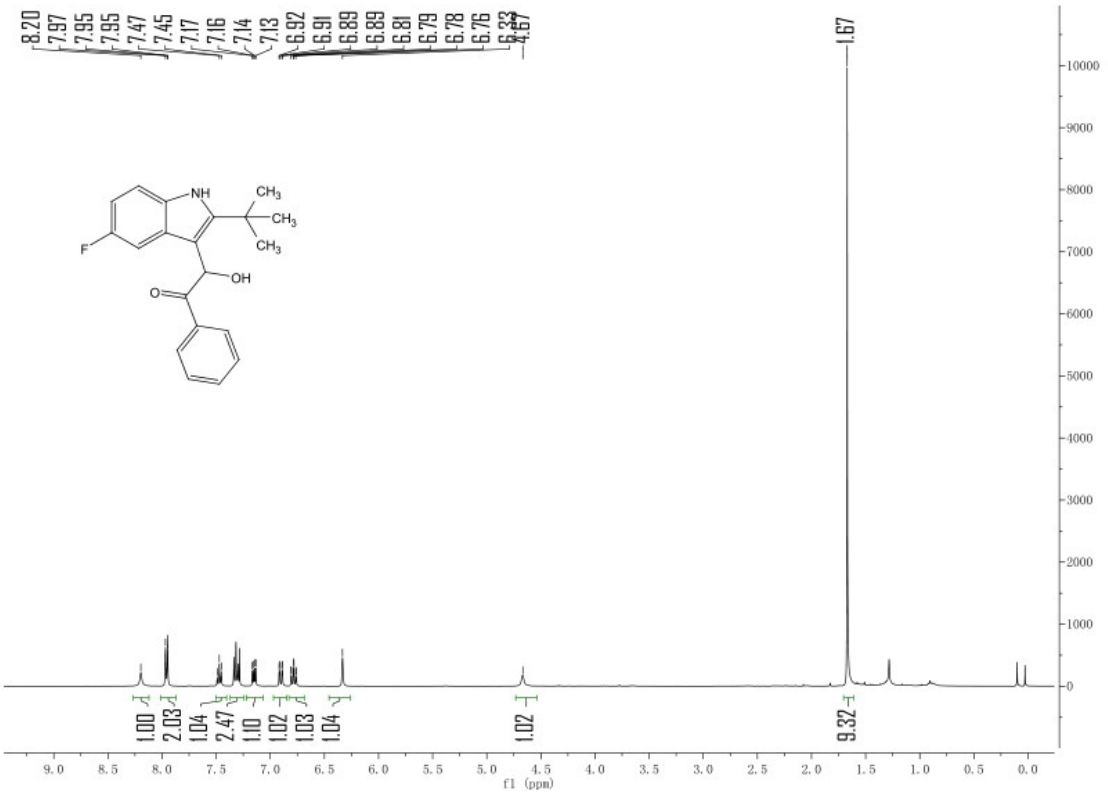


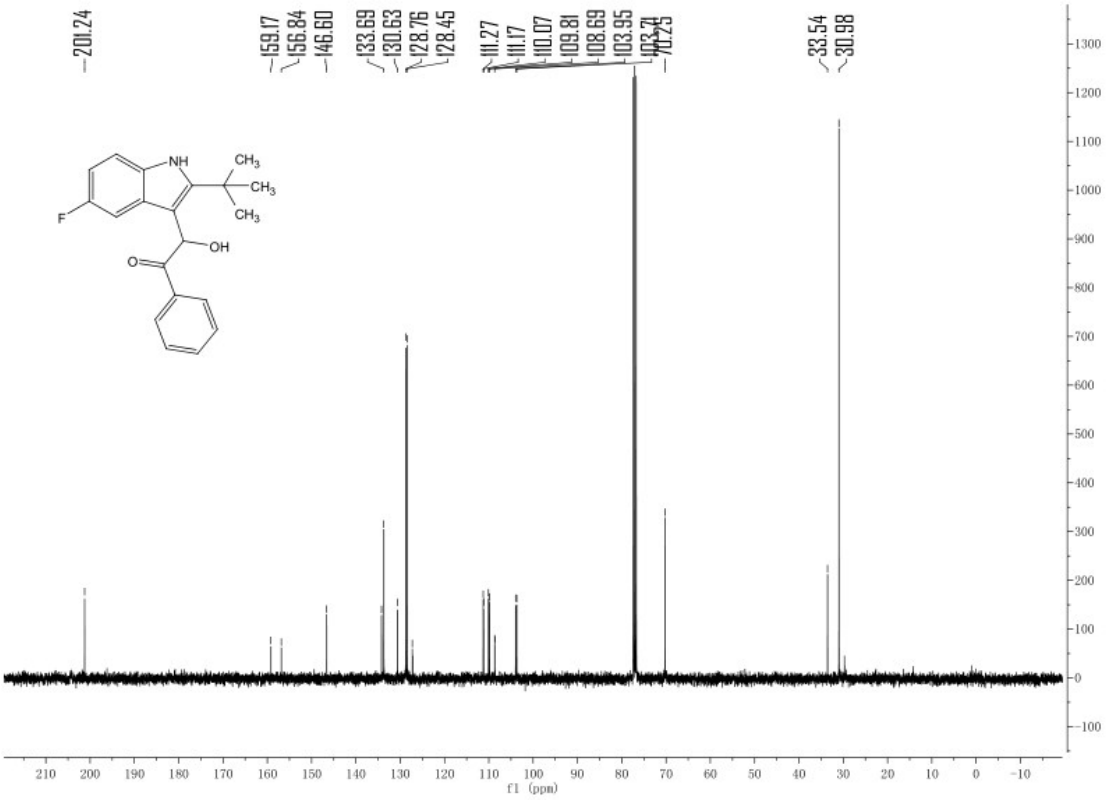
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3l**



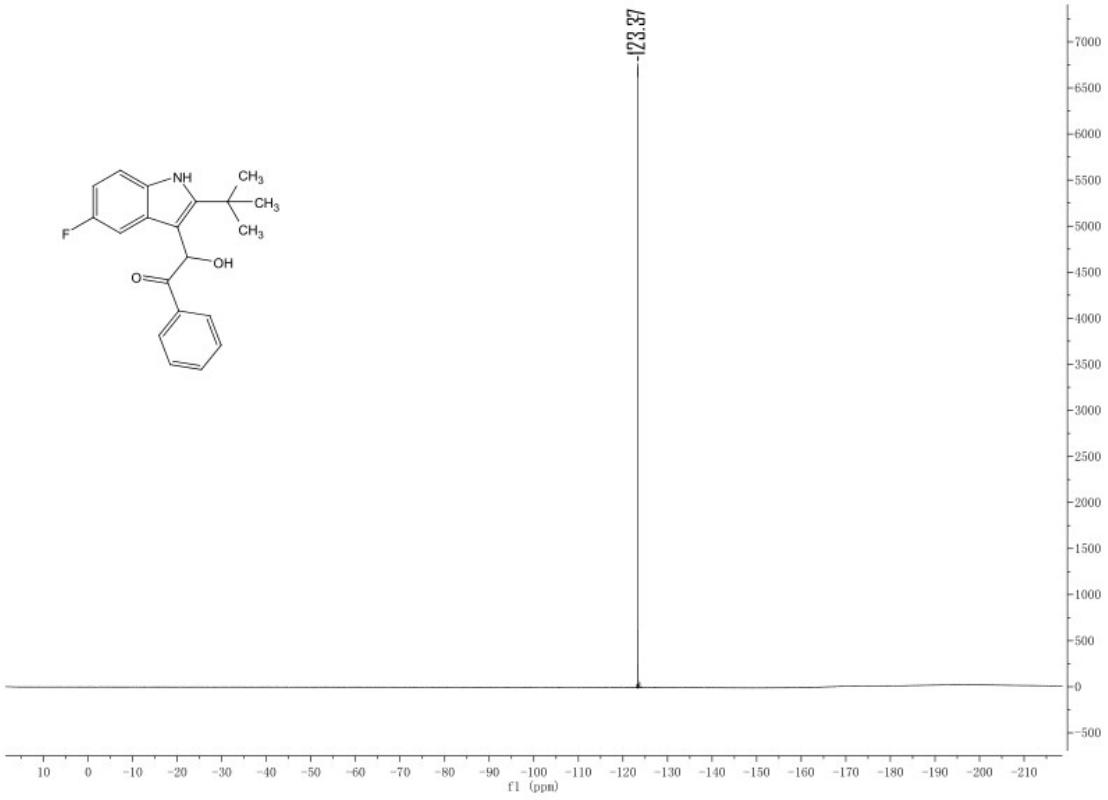


^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3m**

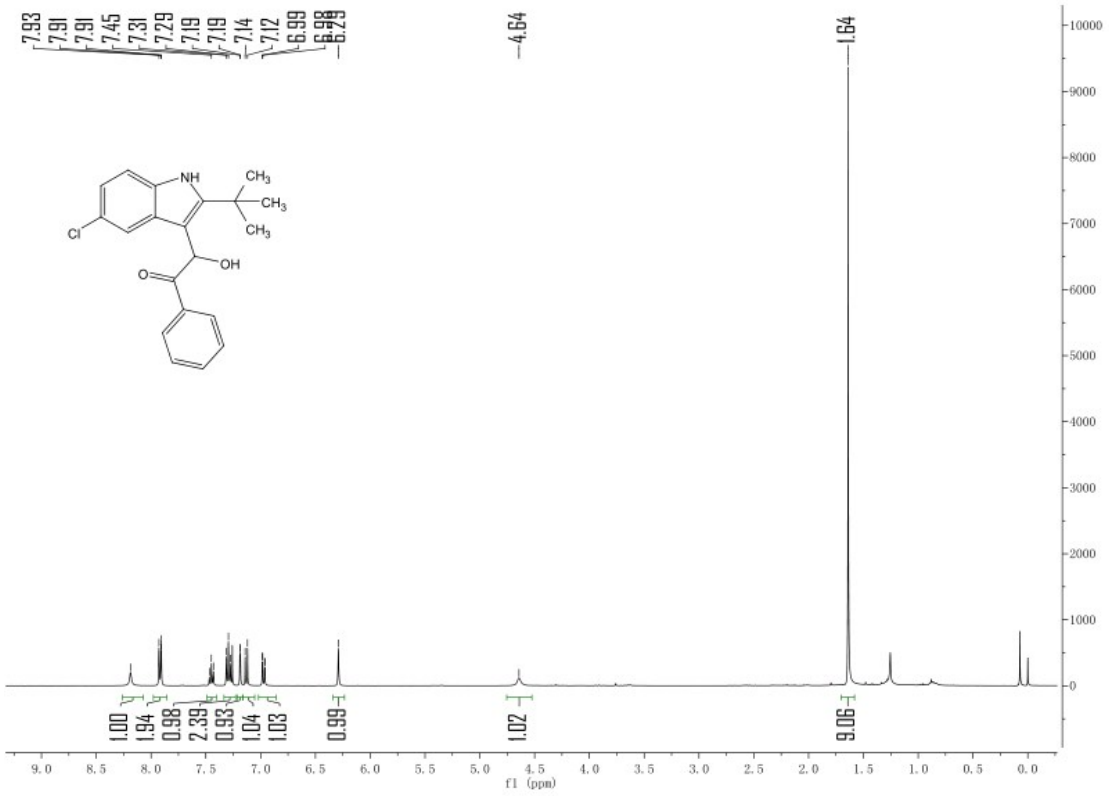


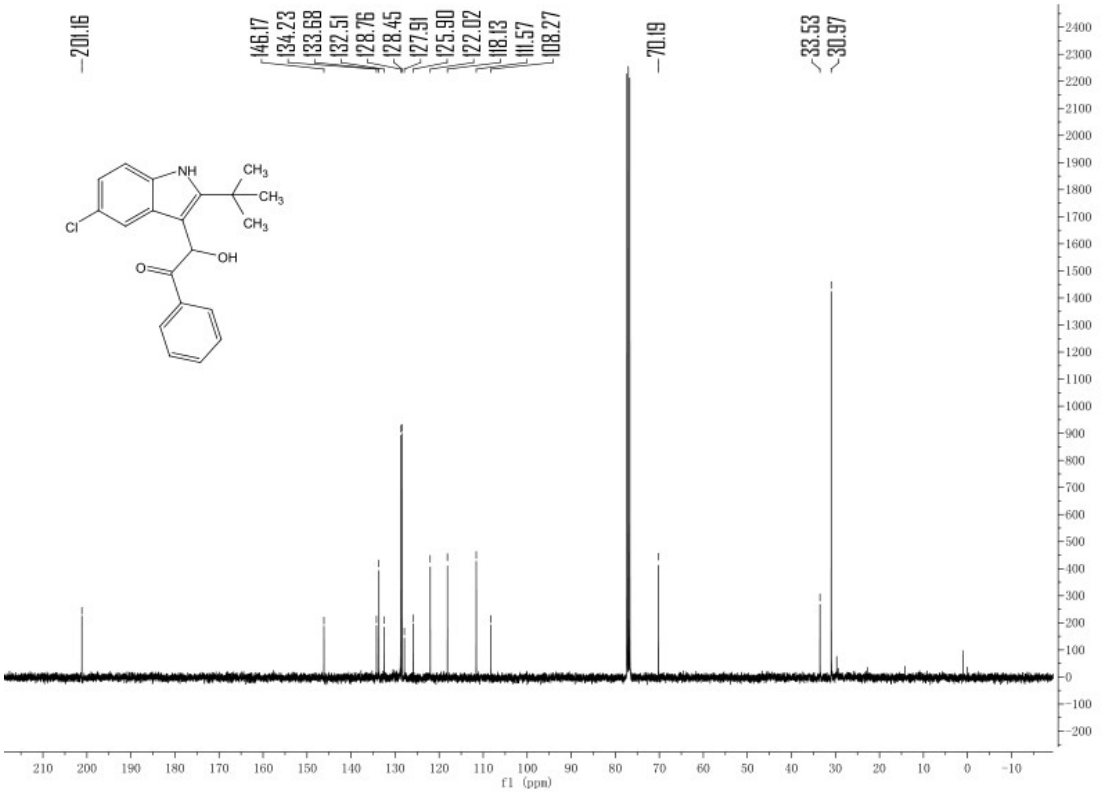


^{19}F NMR (376 MHz, $CDCl_3$) of **3m**

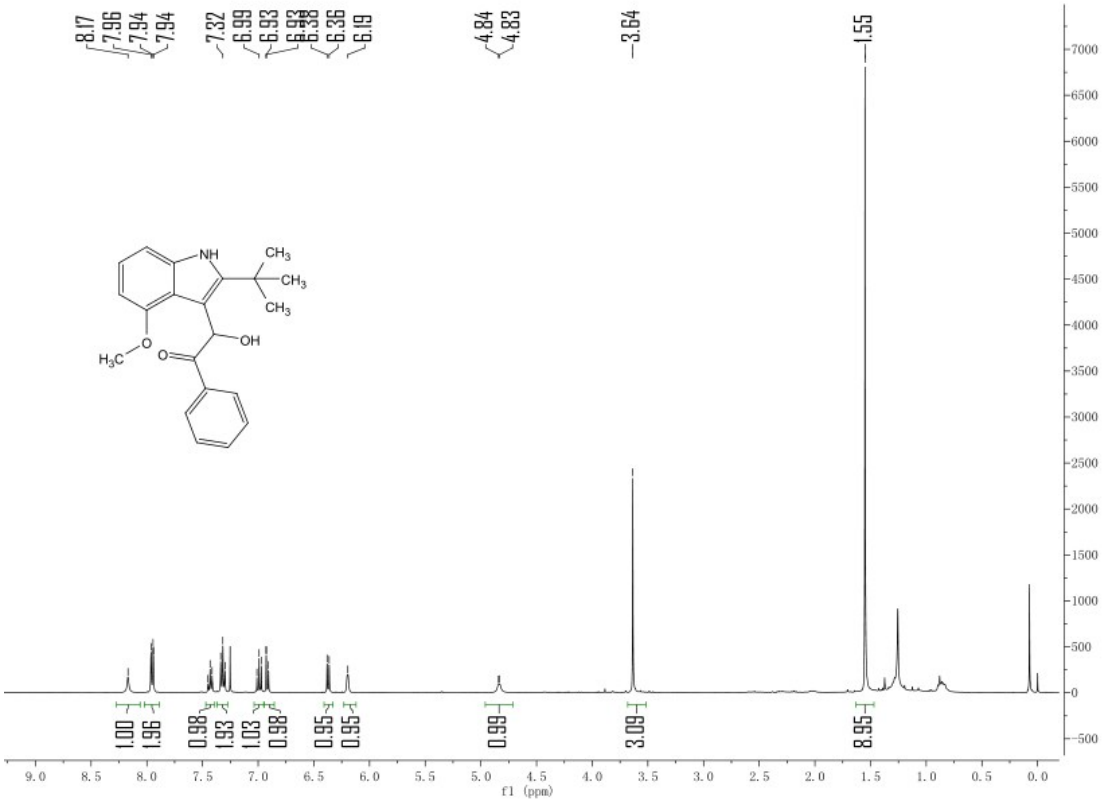


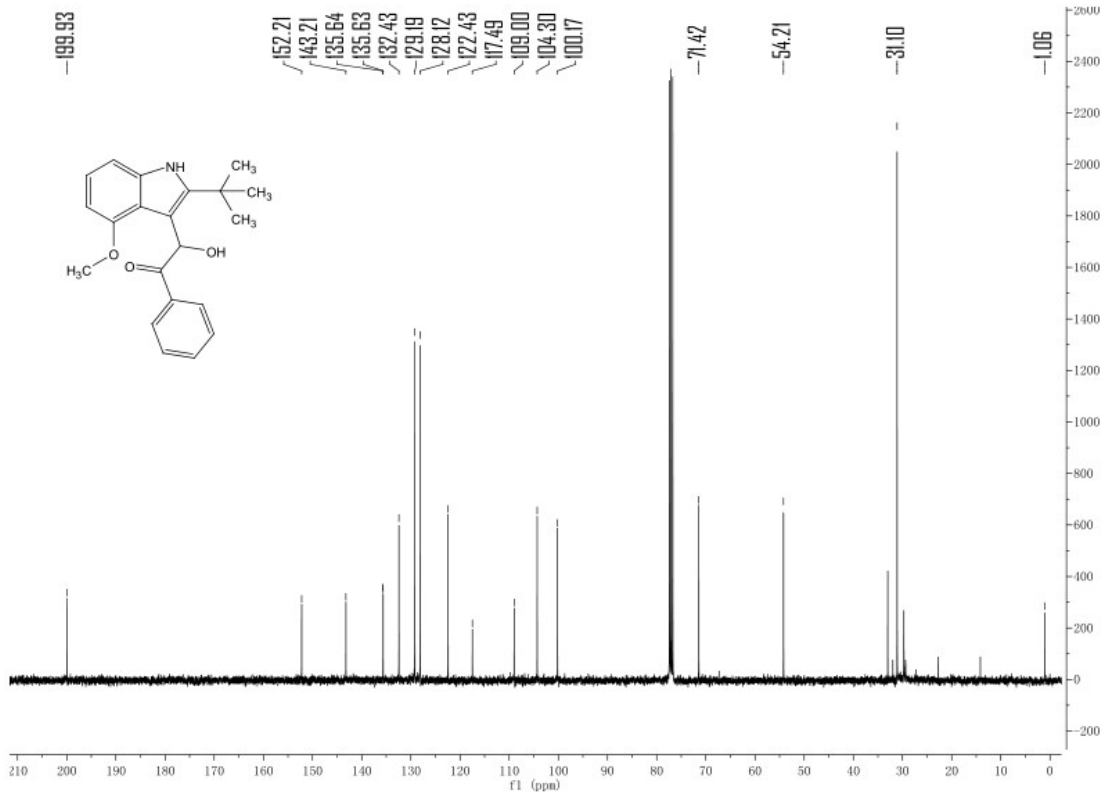
^{1}H NMR (400 MHz, $CDCl_3$-d1) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3n**



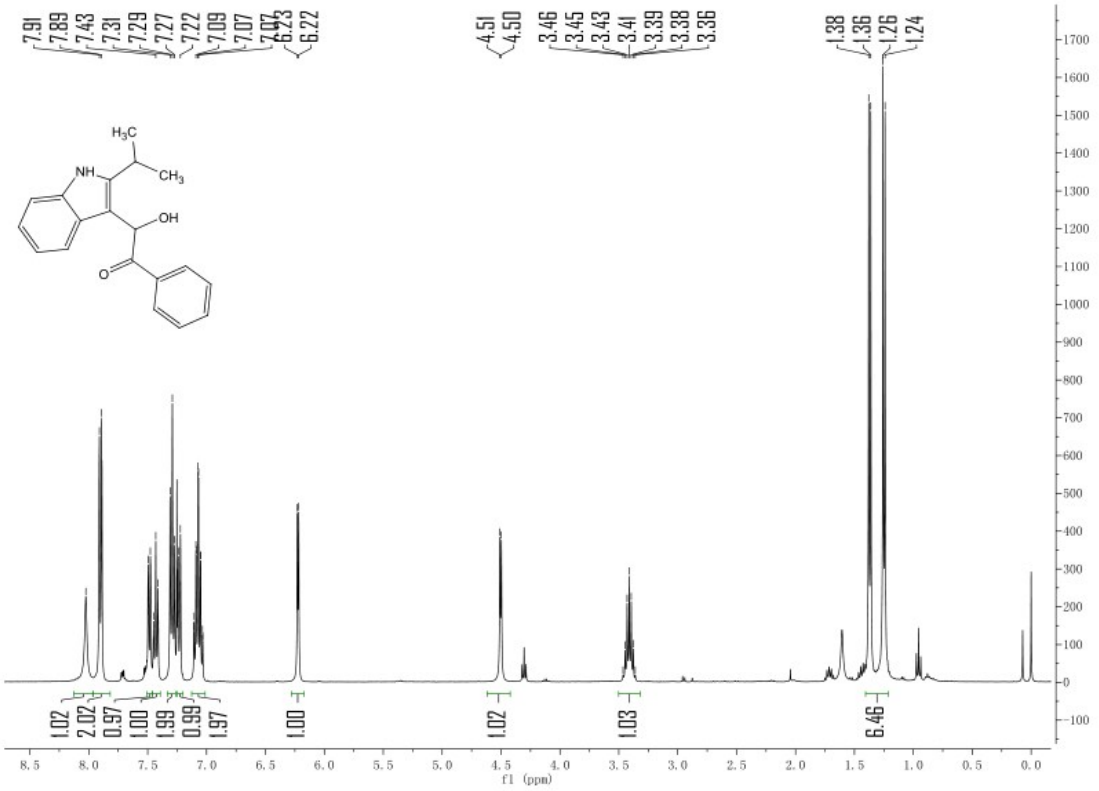


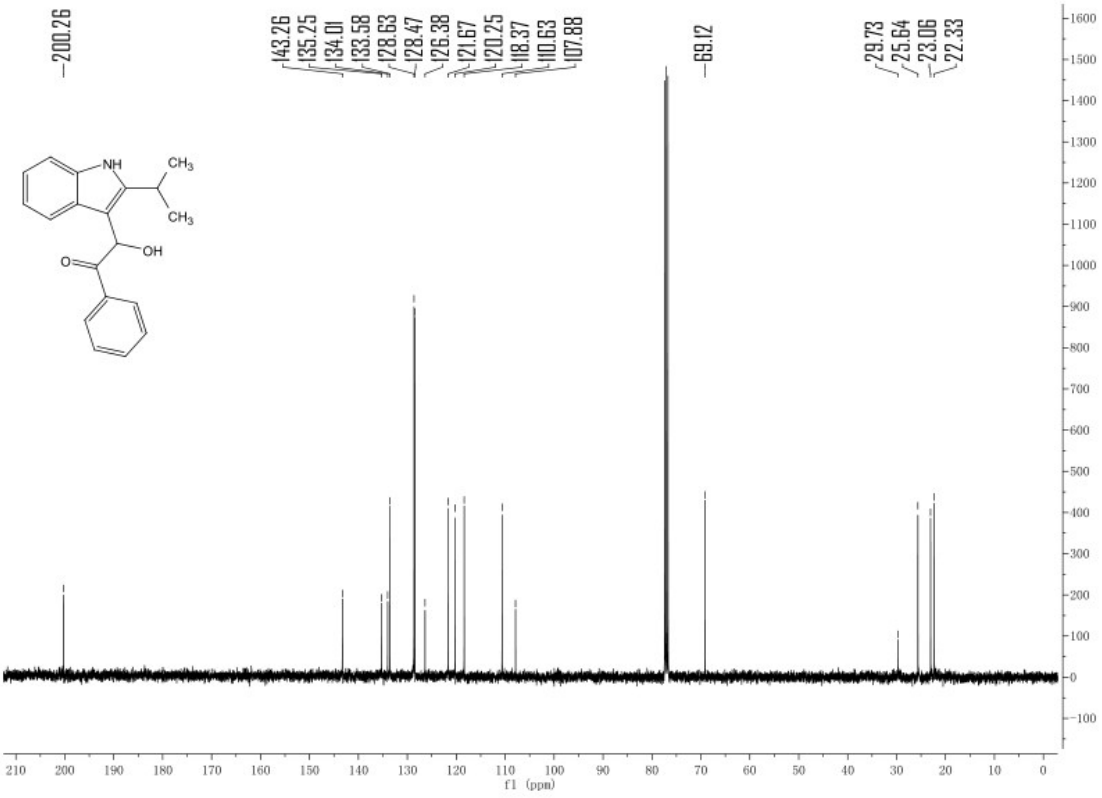
^{1}H NMR (400 MHz, $CDCl_3$-d1) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3o**



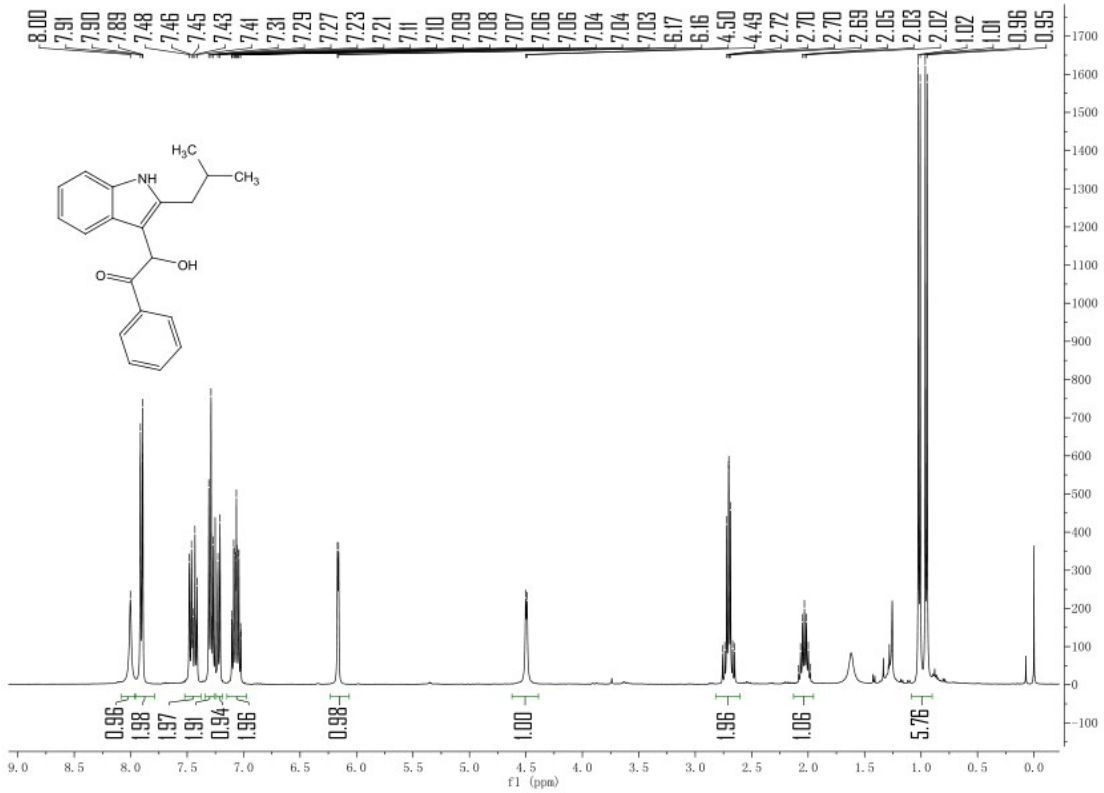


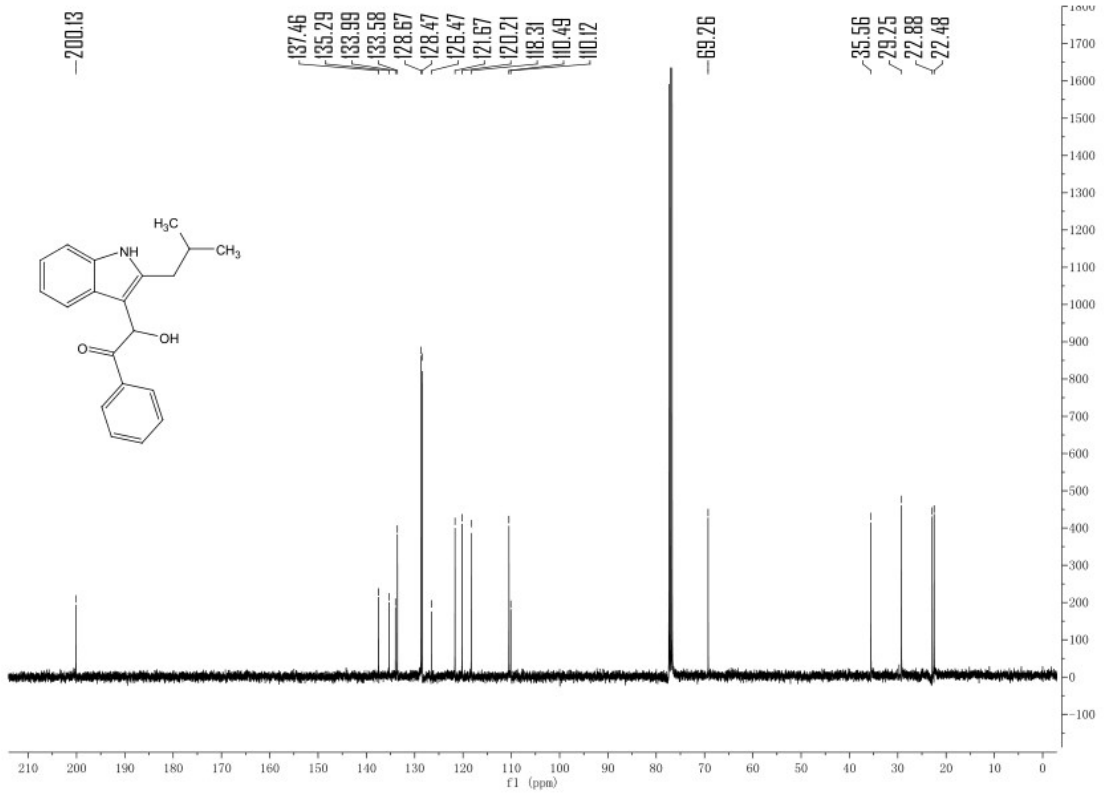
^{1}H NMR (400 MHz, $CDCl_3$-d1) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3p**



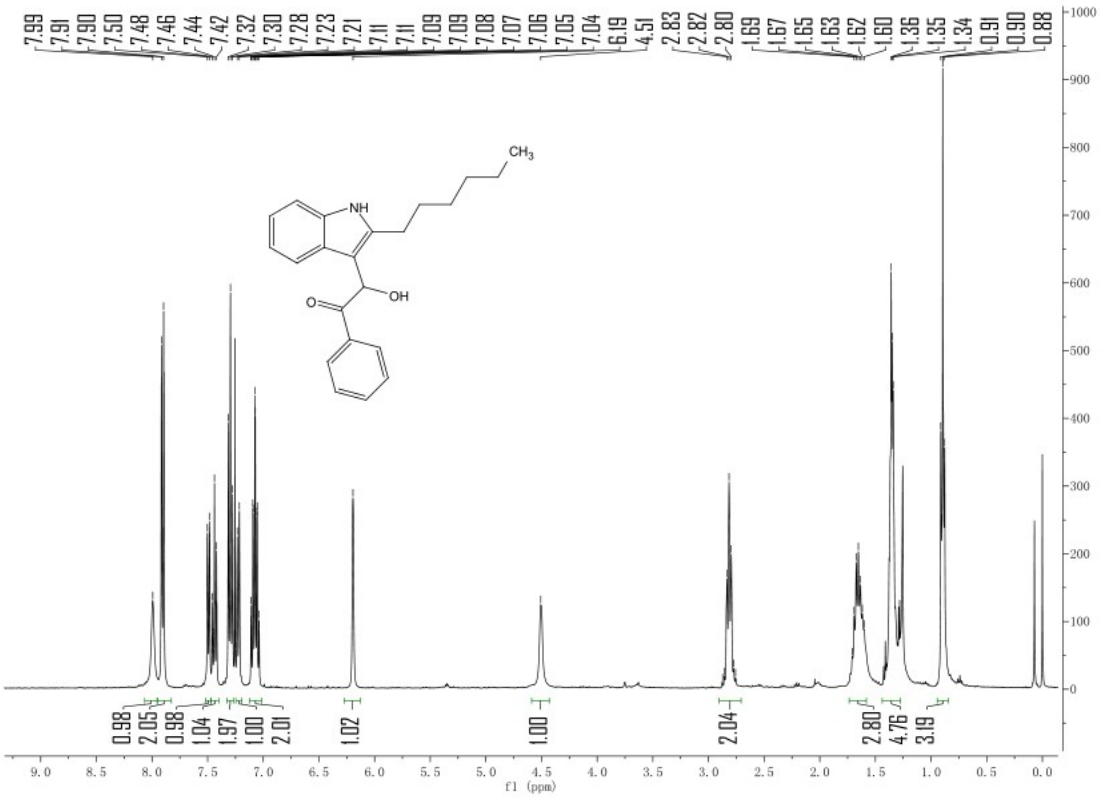


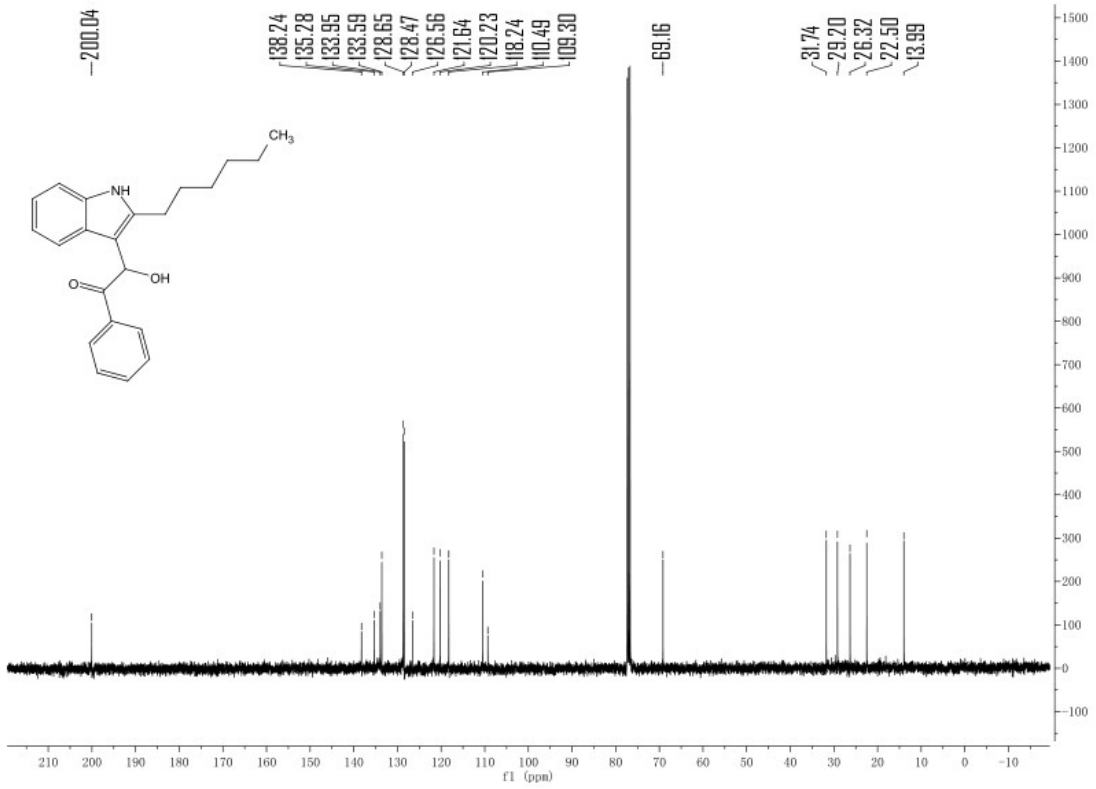
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3q**



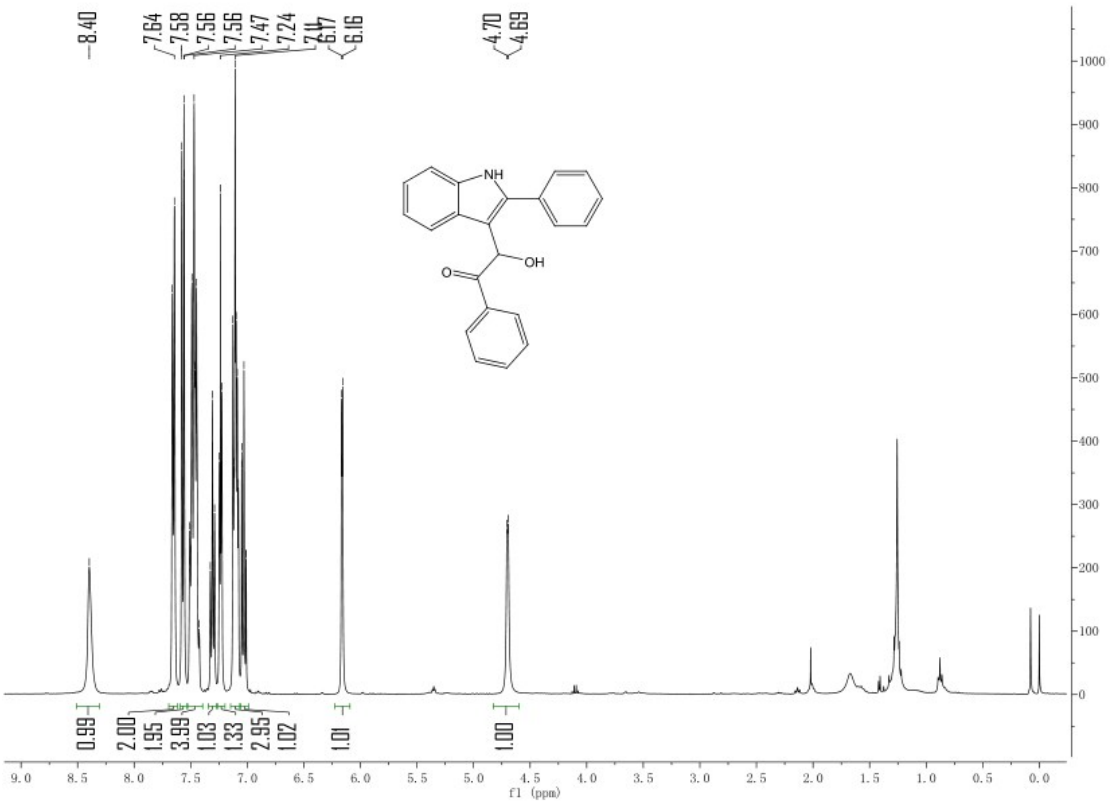


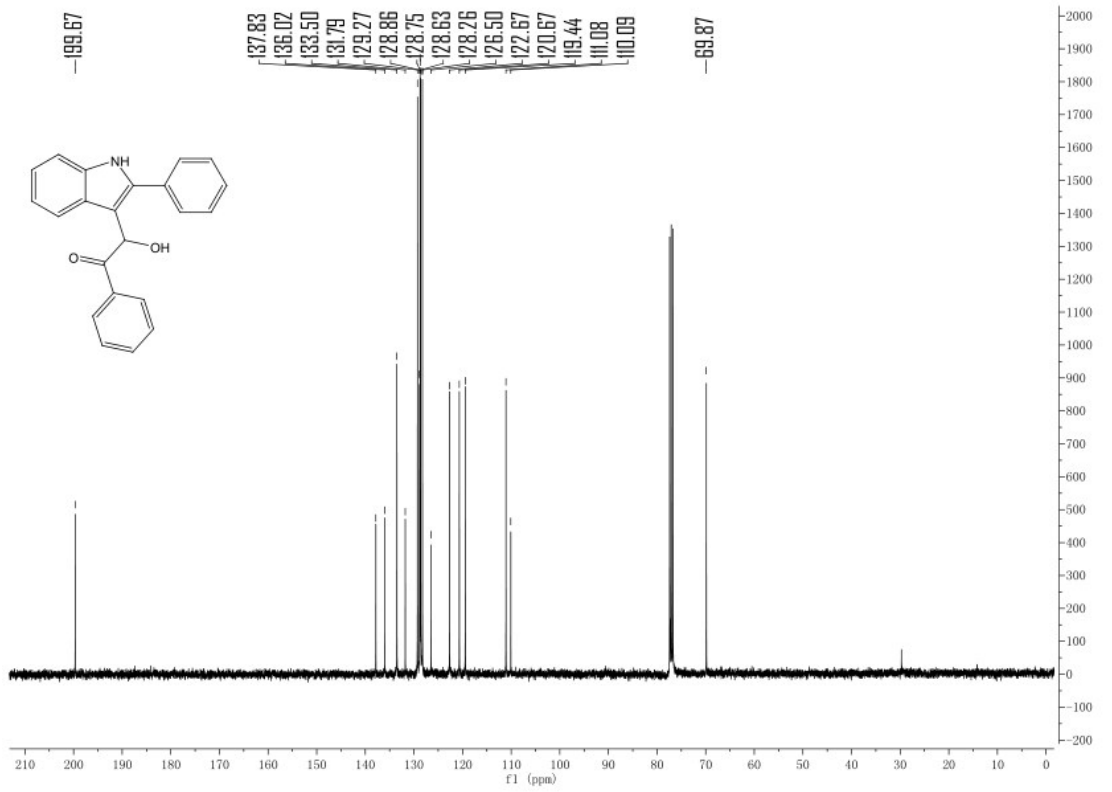
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3r**



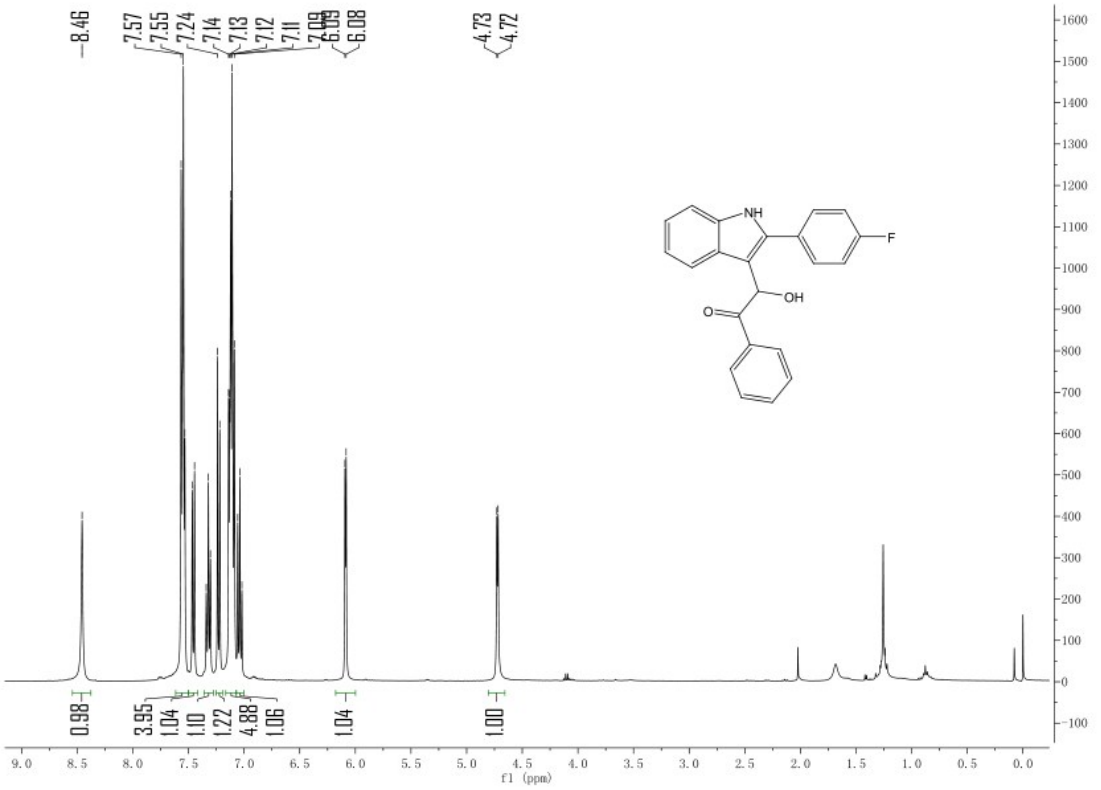


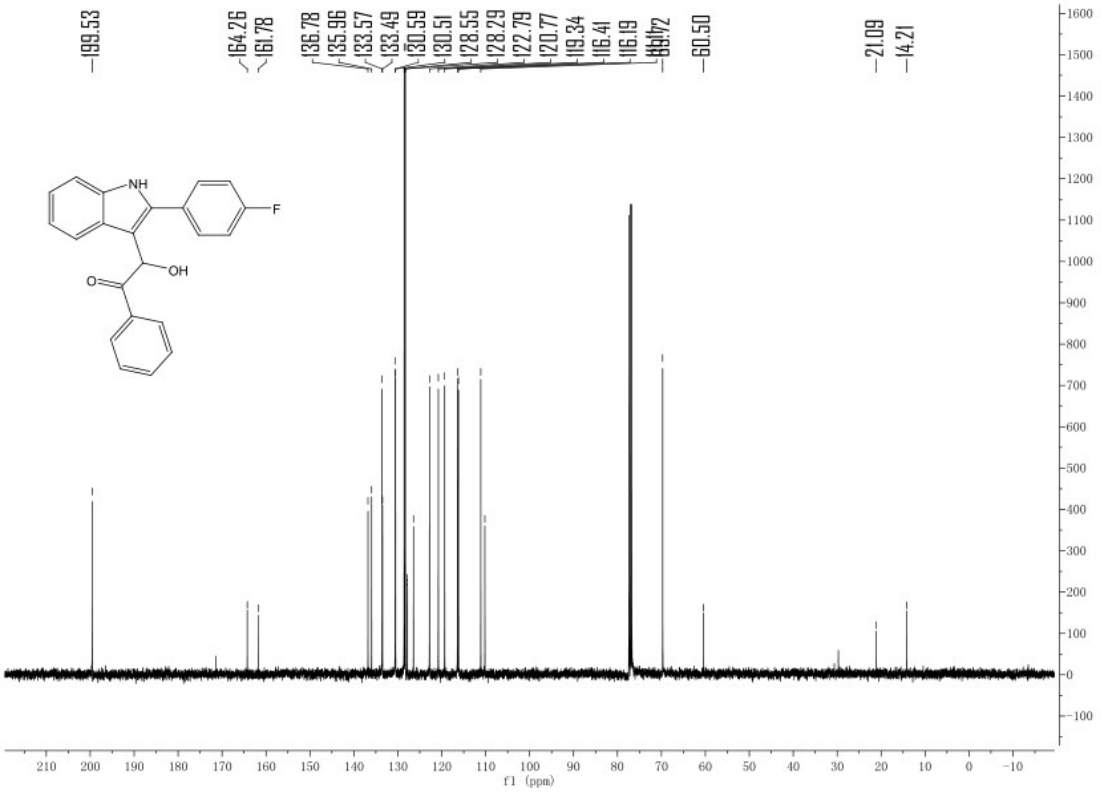
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3s**





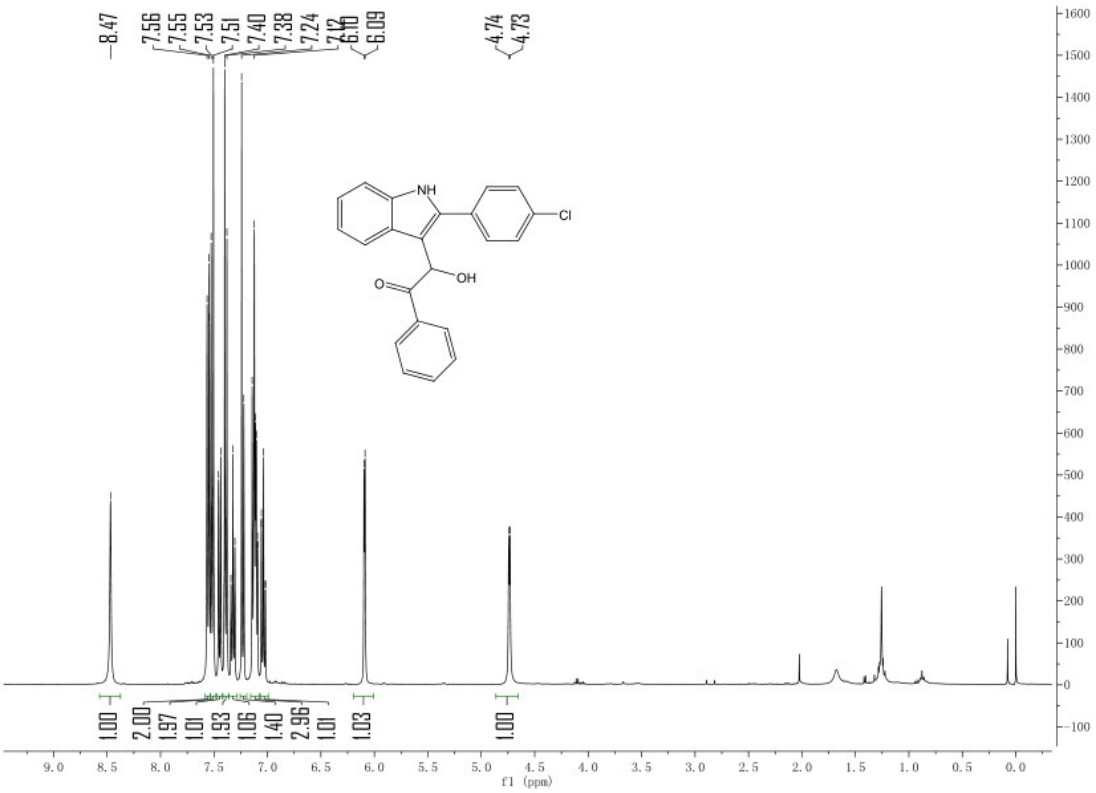
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3t**

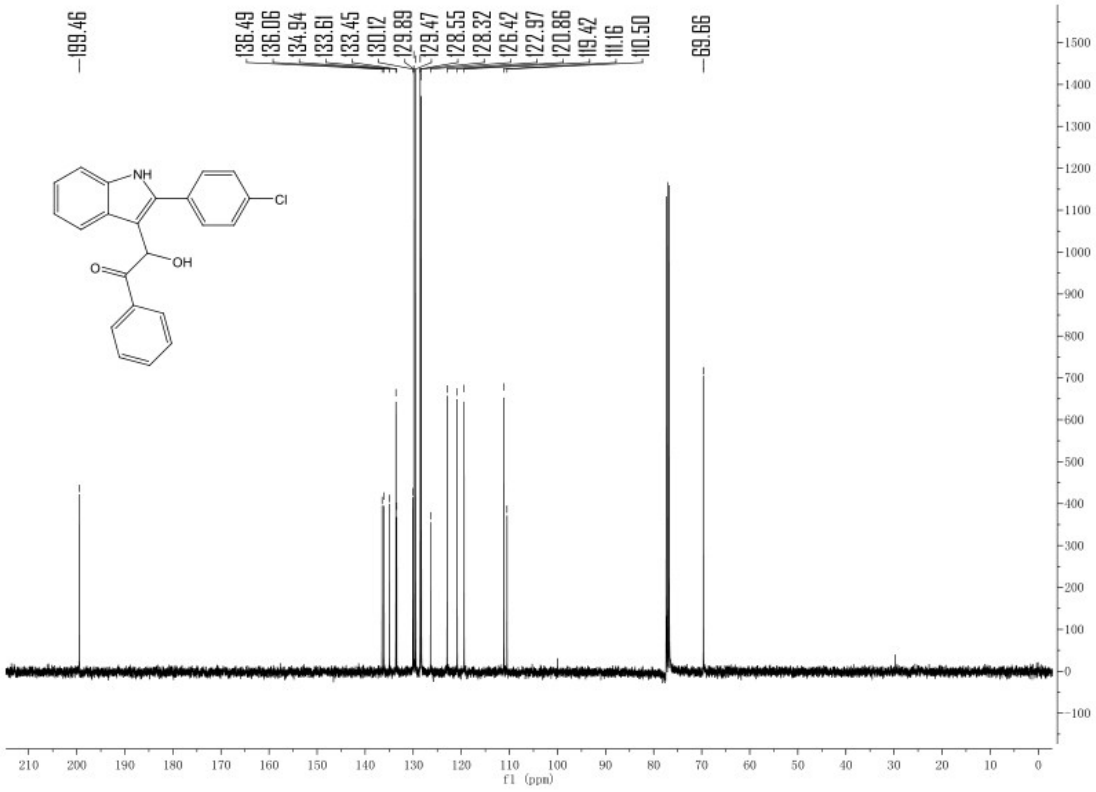




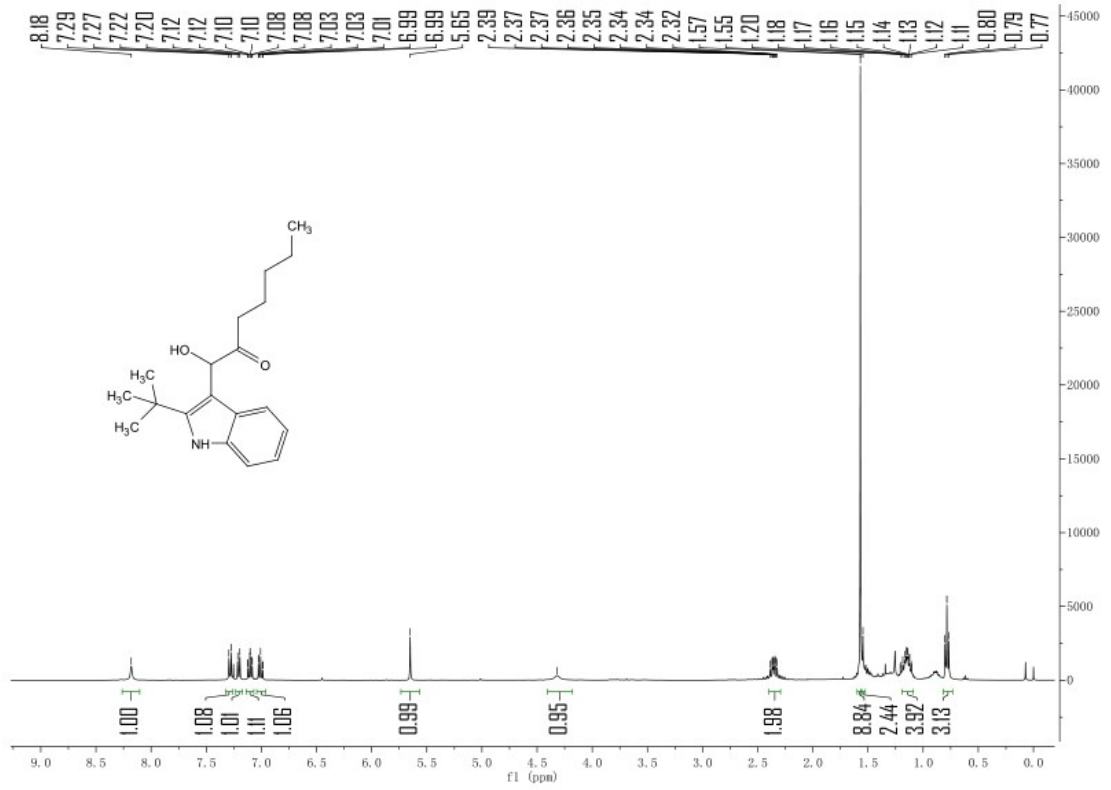
^{19}F NMR (376 MHz, $CDCl_3$) OF **3t**

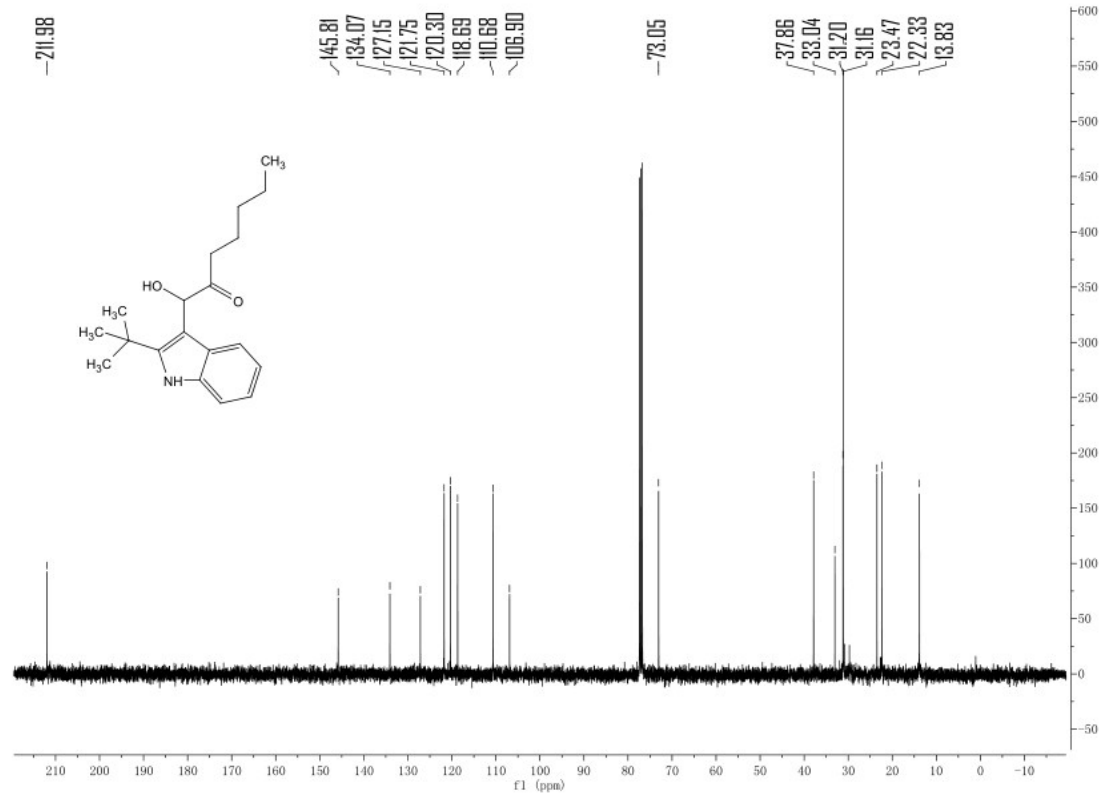
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3u**



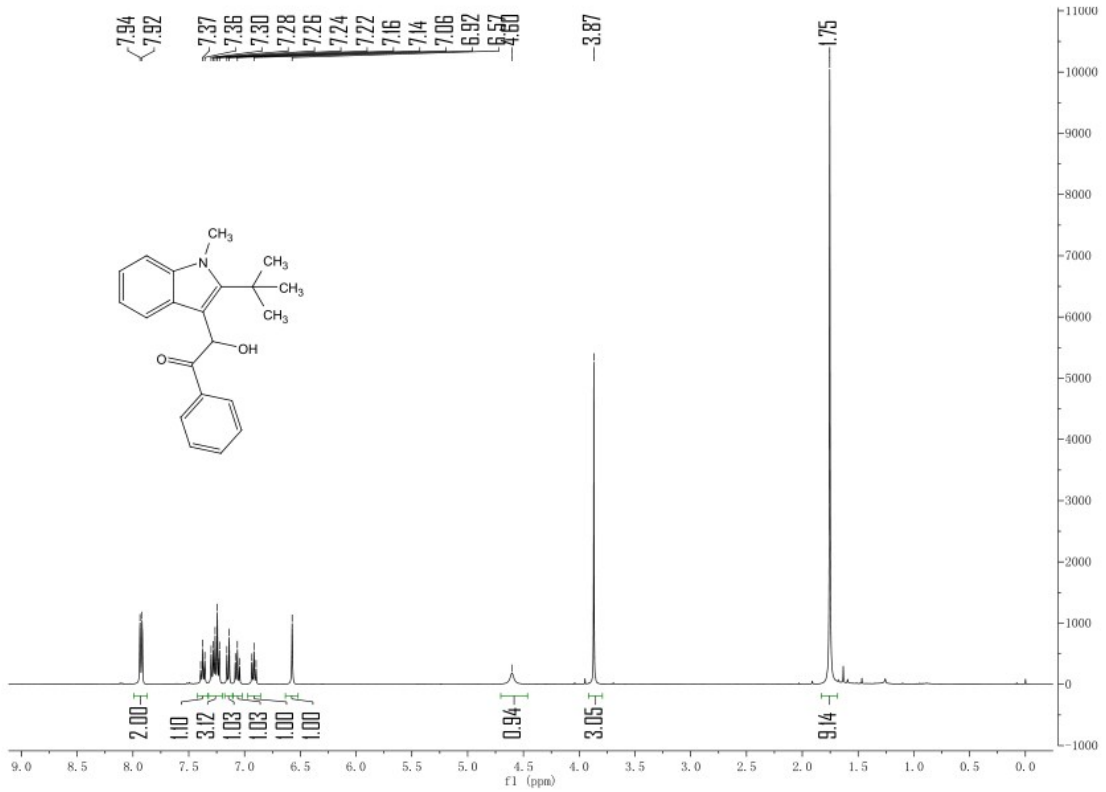


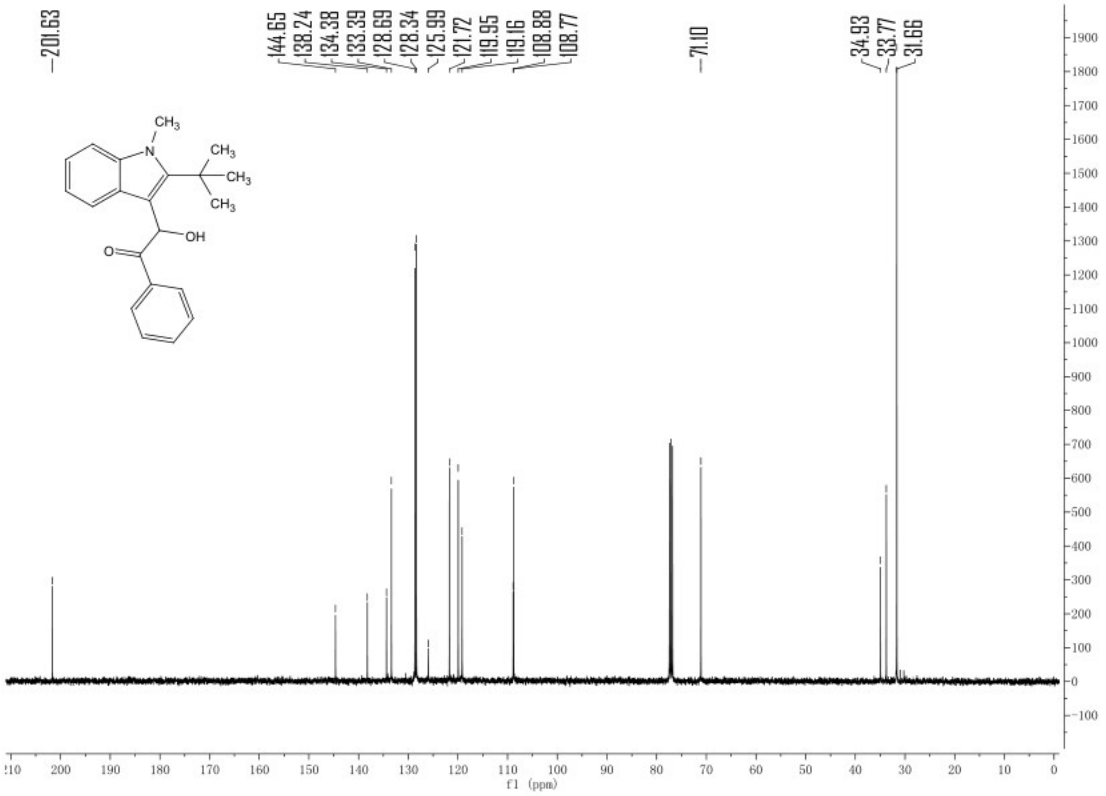
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3v**





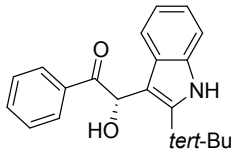
^{1}H NMR (400 MHz, $CDCl_3$) and **^{13}C NMR** (101 MHz, $CDCl_3$) of **3w**

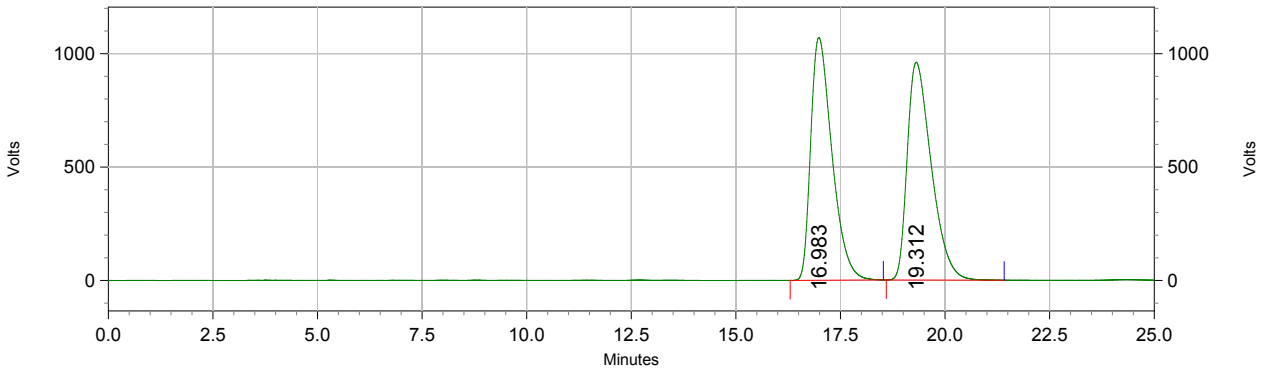




HPLC analysis of compounds

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3a**)

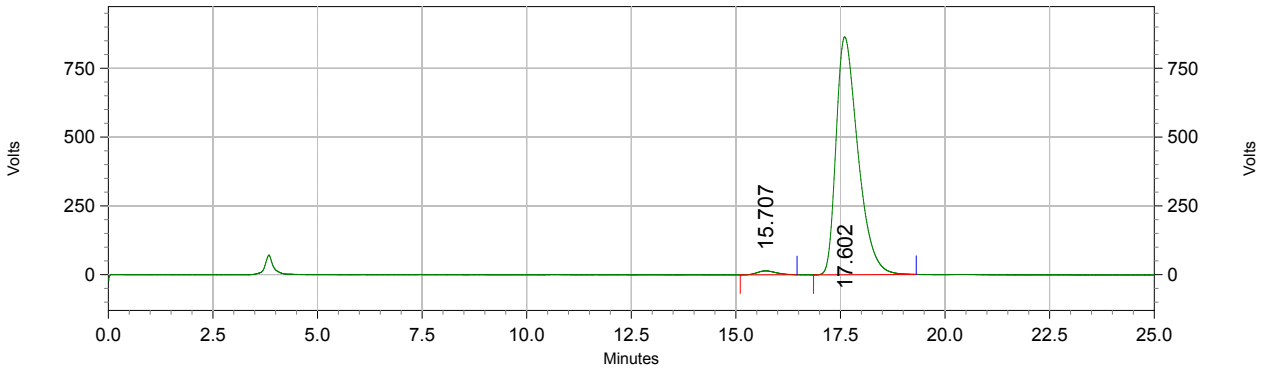




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	16.983	37802128	49.591	1070714
2	19.312	38425308	50.409	960087
Totals		76227436	100.000	2030801

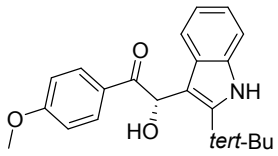


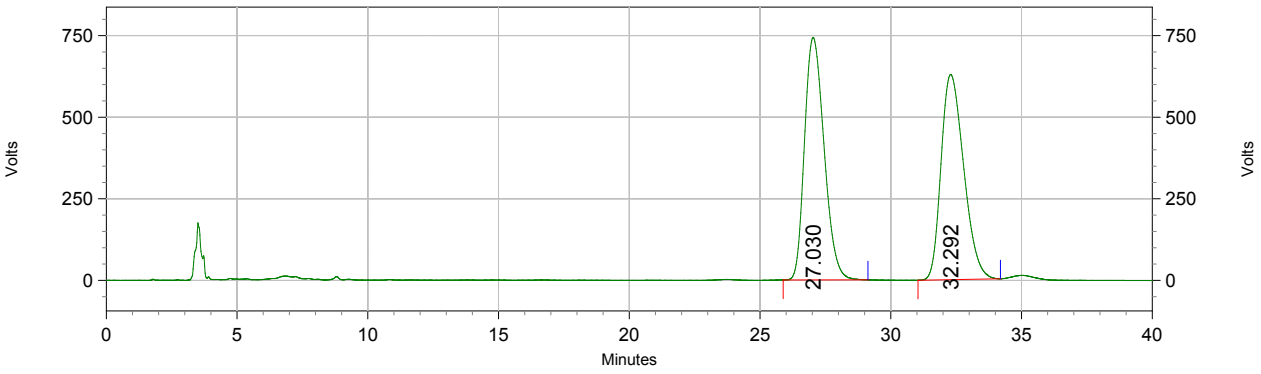
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	15.707	438550	1.379	14176
2	17.602	31354560	98.621	864000
Totals		31793110	100.000	878176

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(4-methoxyphenyl)ethan-1-one (**3b**)

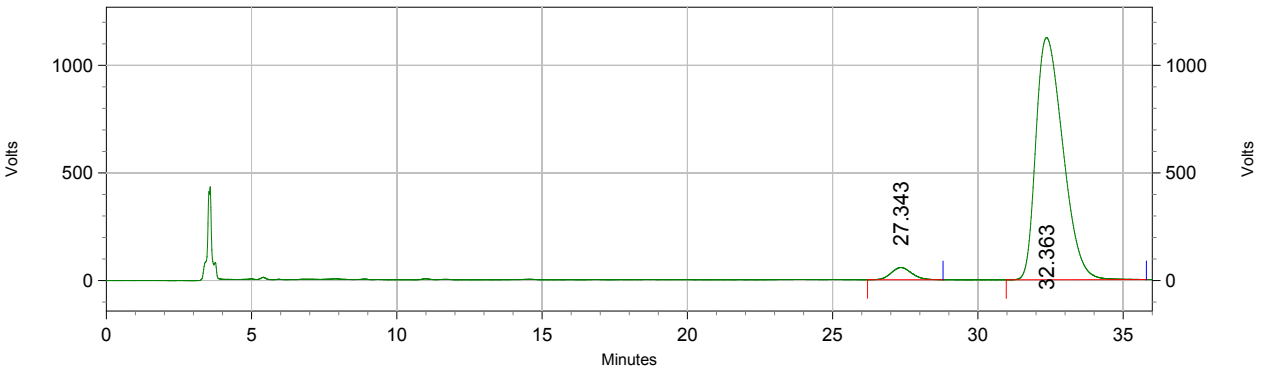




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	27.030	38657351	50.537	743107
2	32.292	37836034	49.463	628897
Totals		76493385	100.000	1372004

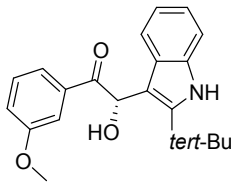


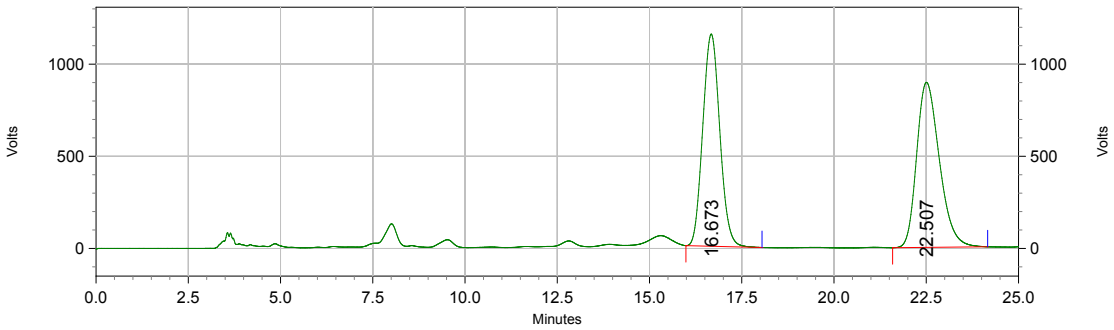
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	27.343	2758738	3.655	56510
2	32.363	72723747	96.345	1125308
Totals		75482485	100.000	1181818

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(3-methoxyphenyl)ethan-1-one (**3c**)

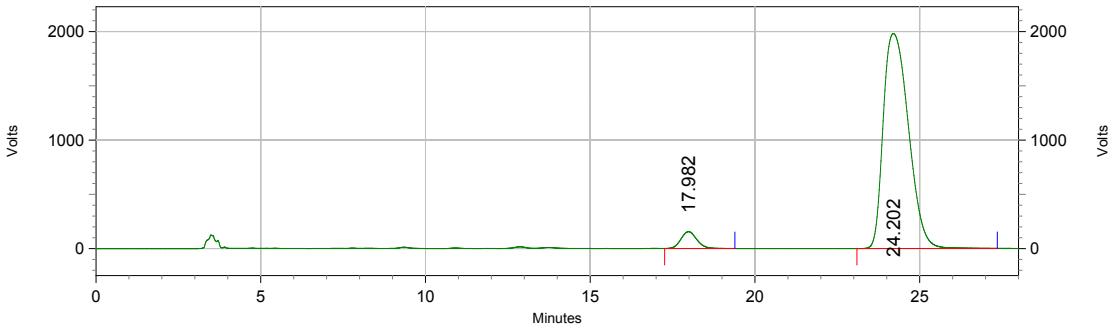




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	16.673	36926925	49.081	1151390
2	22.507	38310202	50.919	895311
Totals		75237127	100.000	2046701

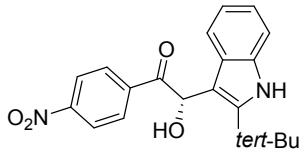


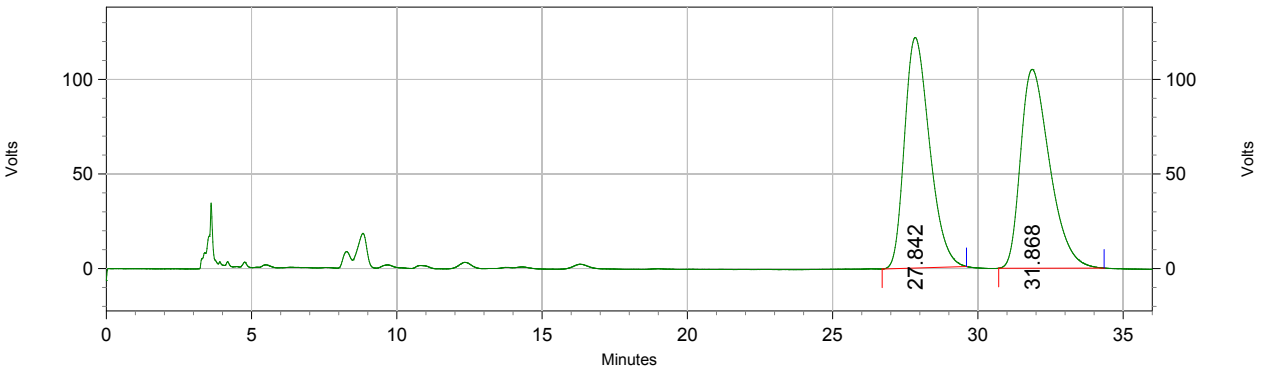
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	17.982	5182384	4.685	155135
2	24.202	105438389	95.315	1980688
Totals		110620773	100.000	2135823

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(4-nitrophenyl)ethan-1-one (**3d**)

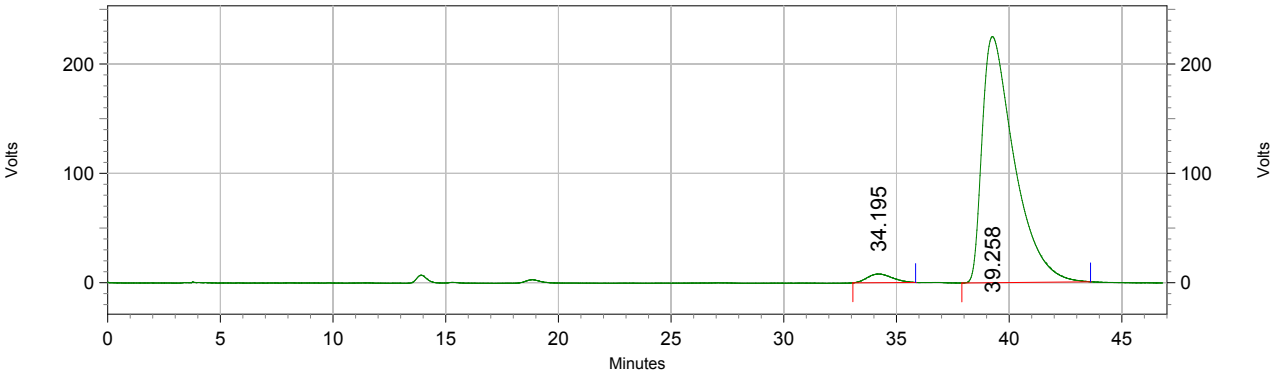




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	27.842	7308063	49.967	121888
2	31.868	7317844	50.033	105107
Totals		14625907	100.000	226995

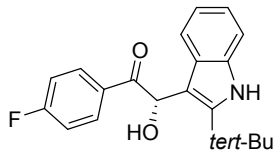


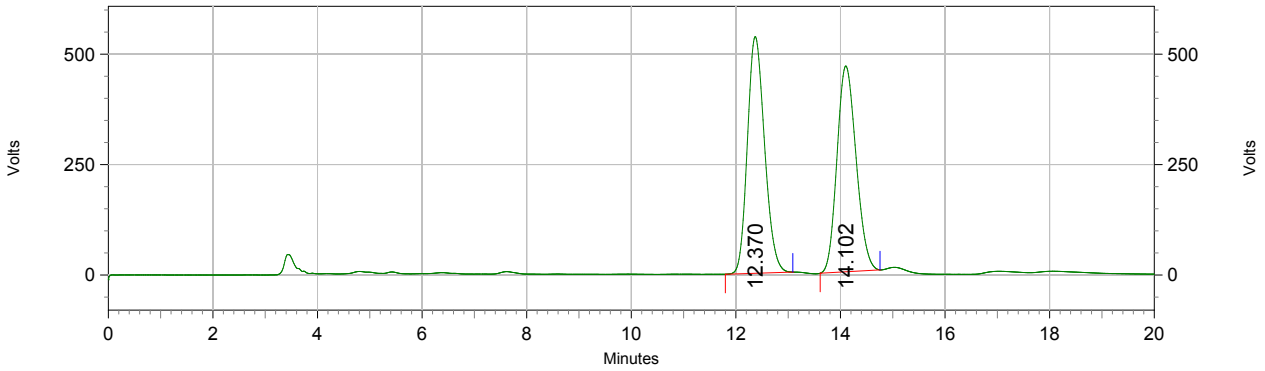
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	34.195	609564	2.665	7923
2	39.258	22265958	97.335	225091
Totals	Totals	22875522	100.000	233014

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-1-(4-fluorophenyl)-2-hydroxyethan-1-one (**3e**)

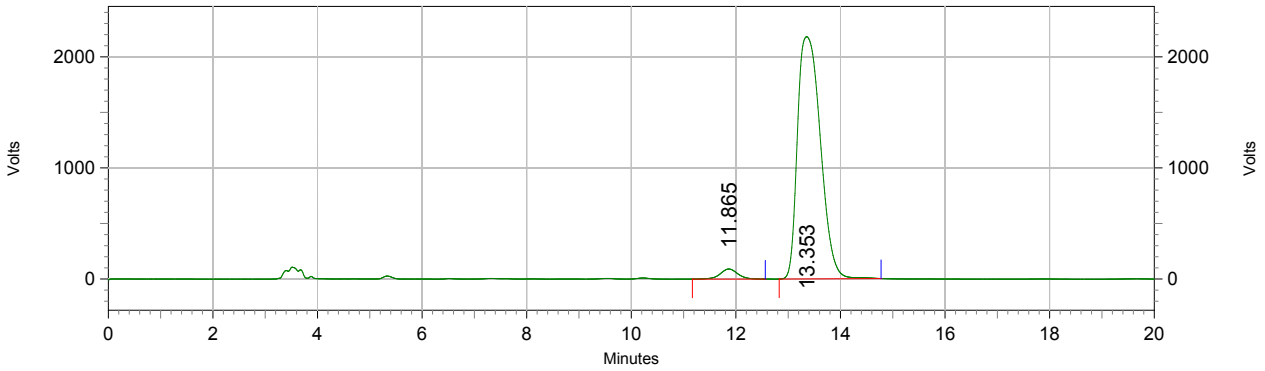




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	12.370	12218951	50.841	535843
2	14.102	11814477	49.159	465940
Totals		24033428	100.000	1001783

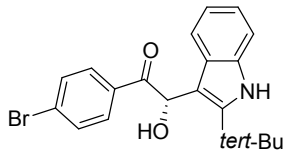


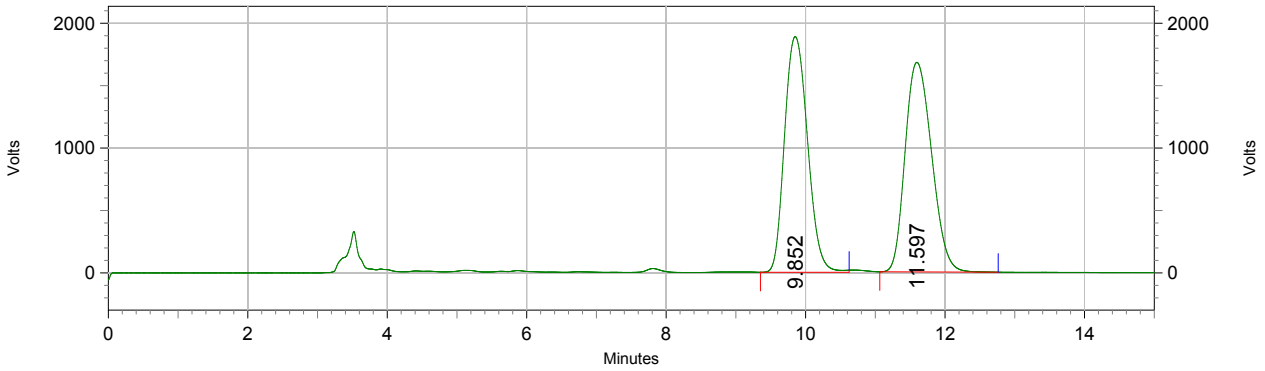
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	11.865	2117343	3.088	90856
2	13.353	66444149	96.912	2180178
Totals		68561492	100.000	2271034

(S)-1-(4-bromophenyl)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxyethan-1-one (**3f**)

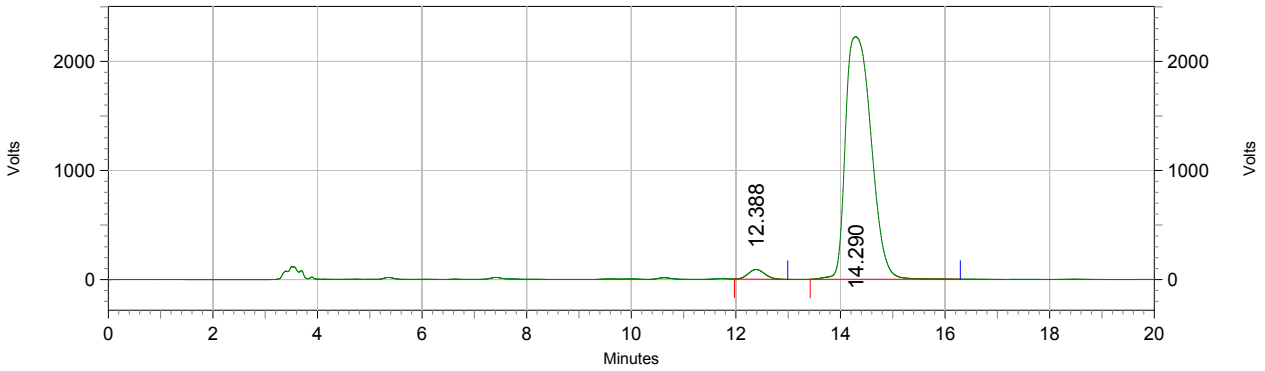




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	9.852	43368900	49.372	1887998
2	11.597	44471951	50.628	1679014
Totals		87840851	100.000	3567012

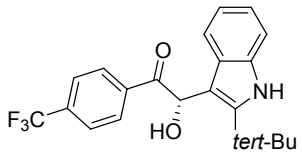


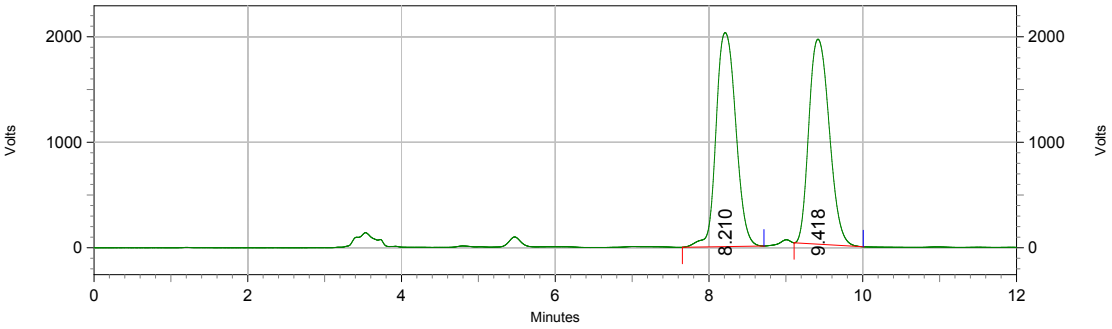
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	12.388	1955045	2.508	89084
2	14.290	75998982	97.492	2223286
Totals		77954027	100.000	2312370

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(4-(trifluoromethyl)phenyl)ethan-1-one (**3g**)

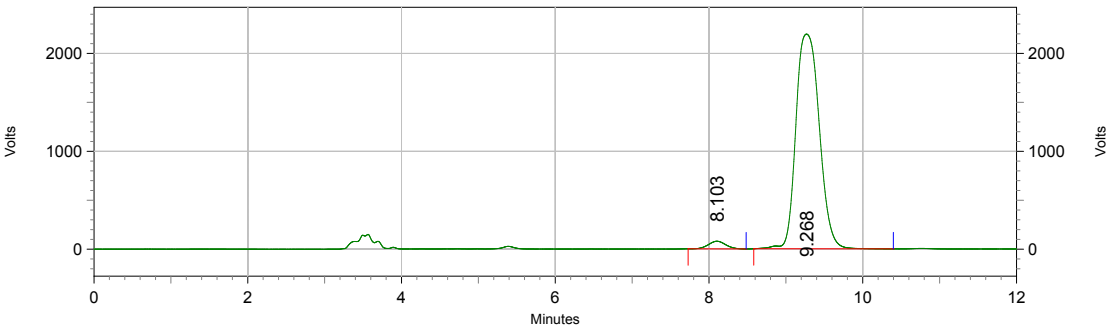




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	8.210	36307952	50.326	2028372
2	9.418	35837839	49.674	1942853
Totals		72145791	100.000	3971225

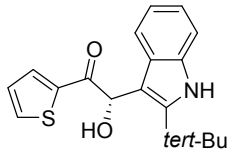


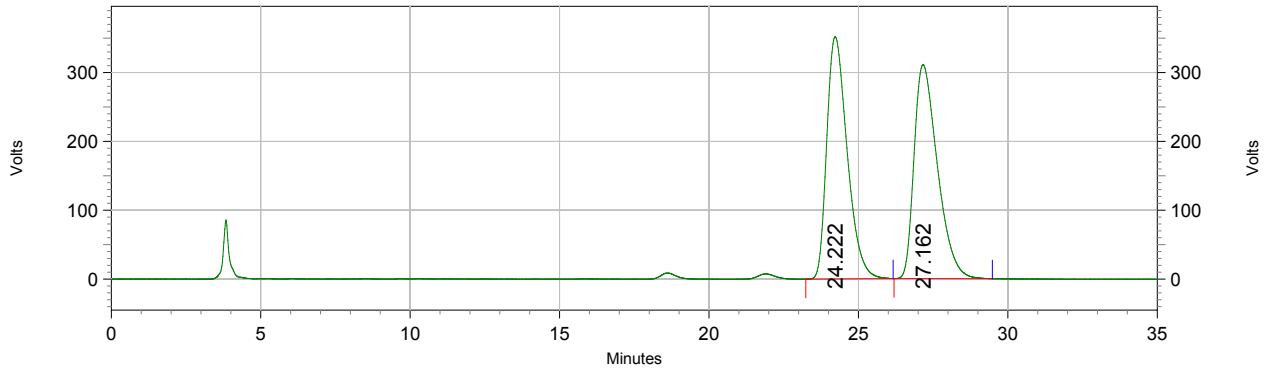
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	8.103	1209759	2.542	77800
2	9.268	46383886	97.458	2192818
Totals		47593645	100.000	2270618

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(thiophen-2-yl)ethan-1-one (**3h**)

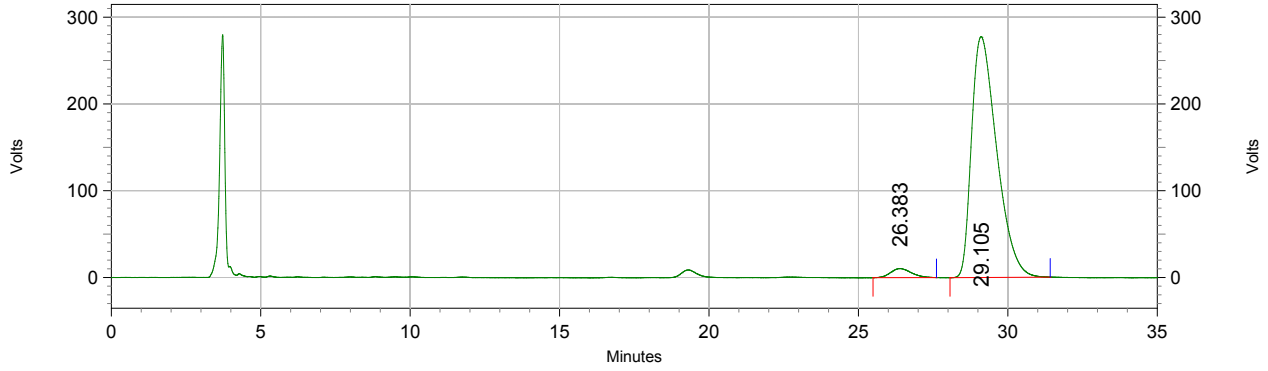




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	24.222	16706941	49.775	352016
2	27.162	16858257	50.225	310764
Totals		33565198	100.000	662780

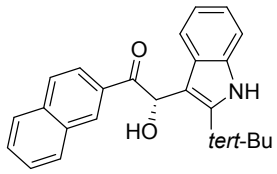


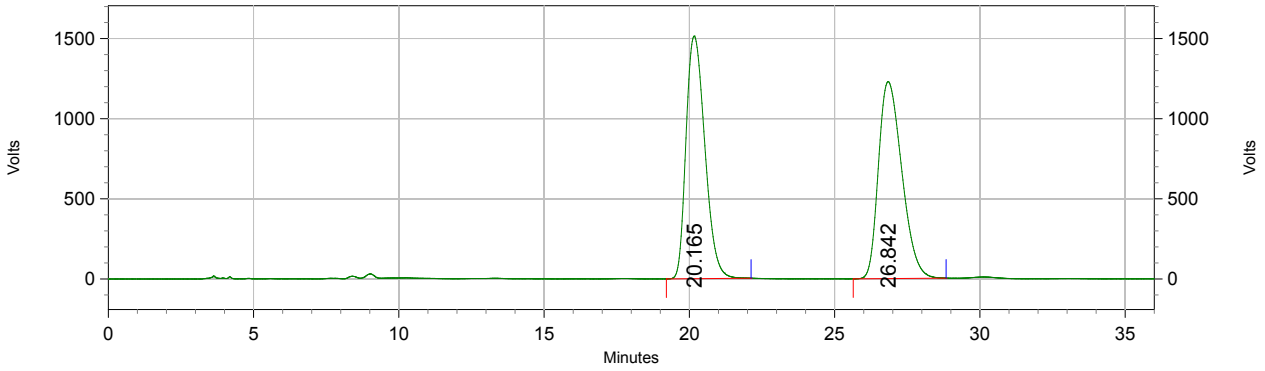
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	26.383	503297	3.005	10450
2	29.105	16242776	96.995	277594
Totals		16746073	100.000	288044

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(naphthalen-2-yl)ethan-1-one (**3i**)

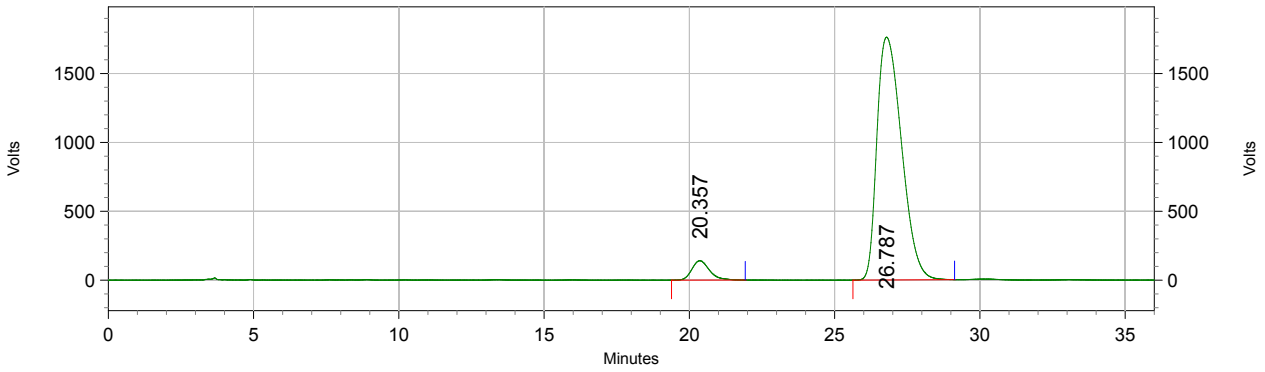




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	20.165	68197590	49.804	1513863
2	26.842	68733529	50.196	1229057
Totals		136931119	100.000	2742920

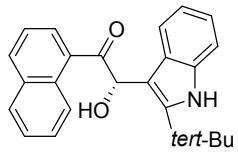


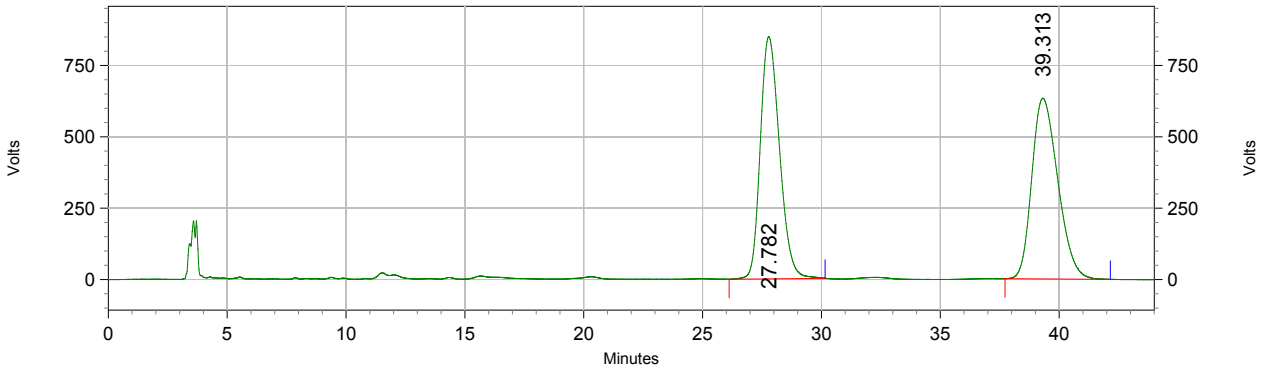
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	20.357	5910051	5.380	140634
2	26.787	103935601	94.620	1762465
Totals		109845652	100.000	1903099

(S)-2-(2-(tert-butyl)-1H-indol-3-yl)-2-hydroxy-1-(naphthalen-1-yl)ethan-1-one (**3j**)

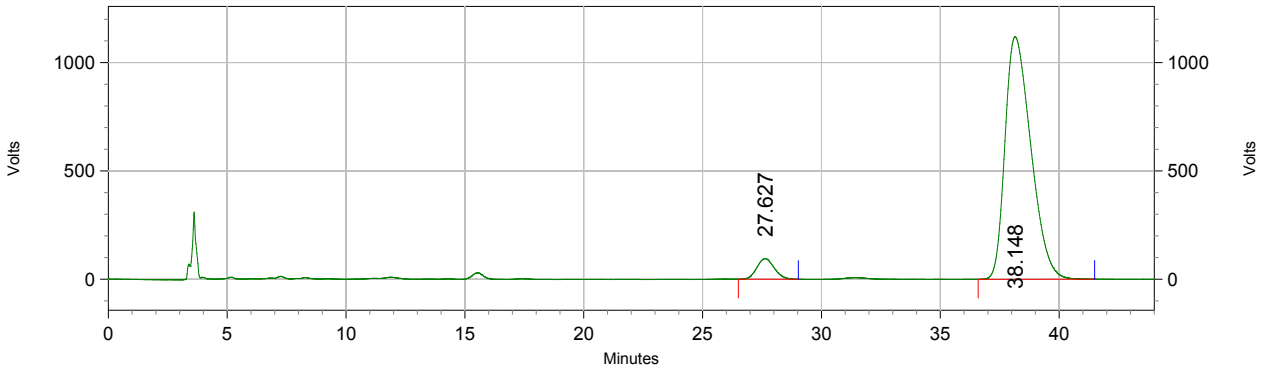




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	27.782	47669996	49.737	848609
2	39.313	48174670	50.263	632858
Totals		95844666	100.000	1481467

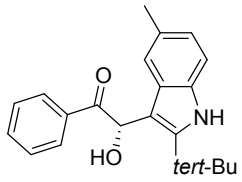


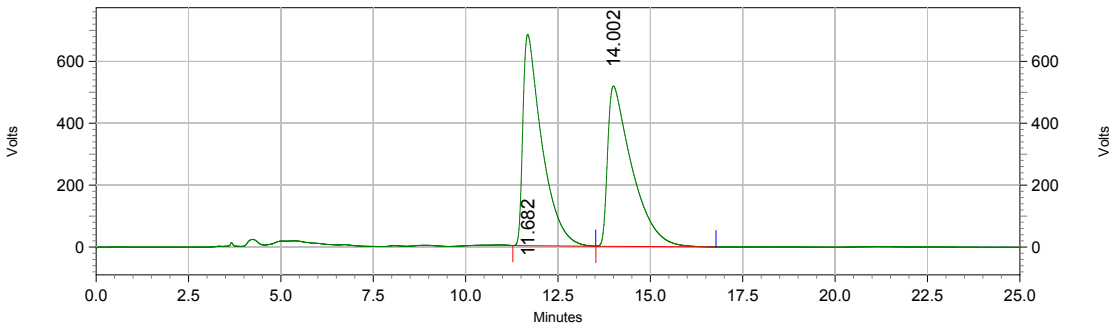
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	27.627	4855714	5.417	95260
2	38.148	84776257	94.583	1119702
Totals		89631971	100.000	1214962

(S)-2-(2-(tert-butyl)-5-methyl-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3k**)

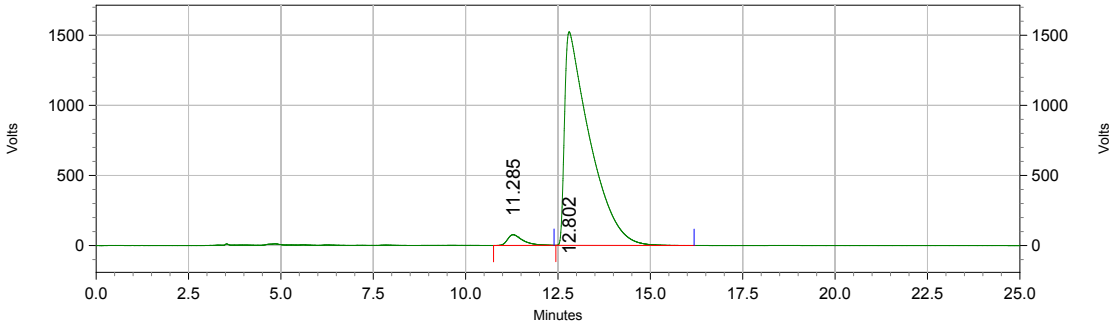




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	11.682	24378370	50.764	682450
2	14.002	23644238	49.236	517396
Totals		48022608	100.000	1199846

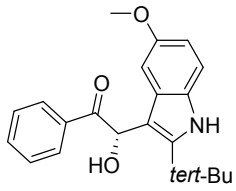


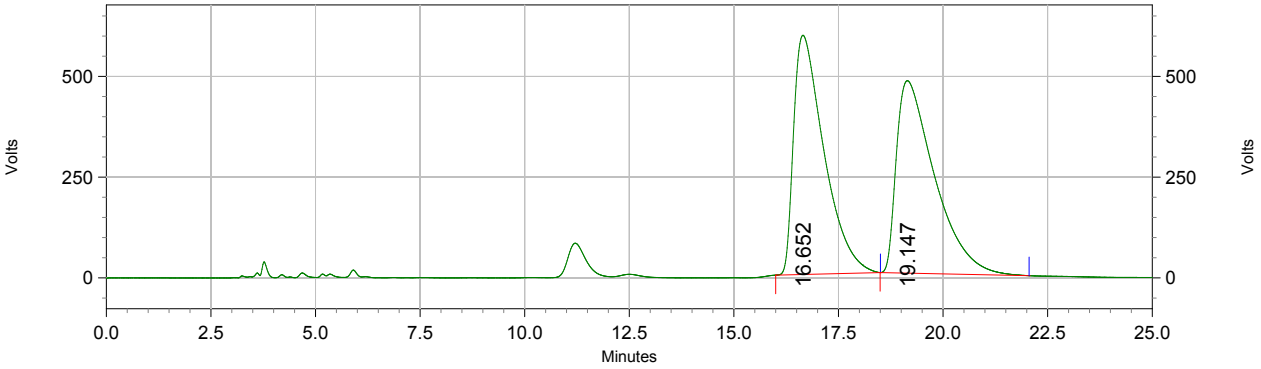
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	11.285	2192754	2.952	76455
2	12.802	72081945	97.048	1522871
Totals		74274699	100.000	1599326

(S)-2-(2-(tert-butyl)-5-methoxy-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3l**)

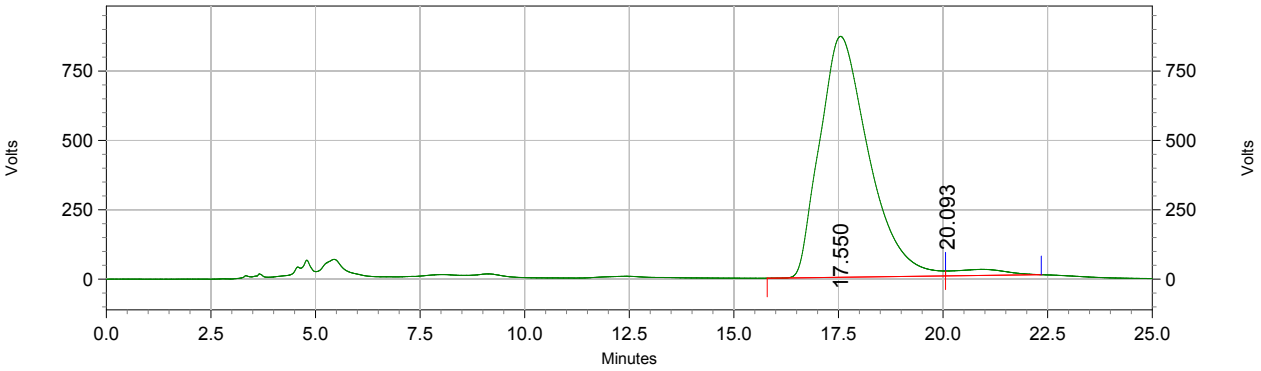




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	16.652	29908283	49.674	593560
2	19.147	30300511	50.326	477474
Totals		60208794	100.000	1071034

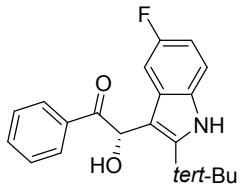


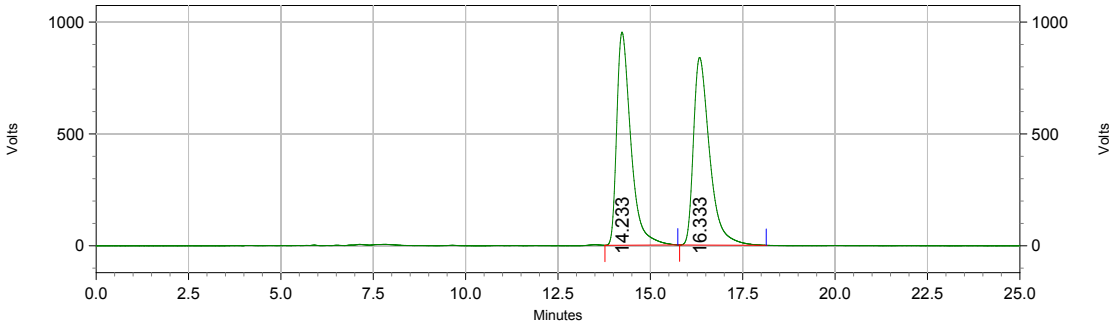
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	17.550	70512201	97.369	868199
2	20.093	1905658	2.631	17730
Totals		72417859	100.000	885929

(S)-2-(2-(tert-butyl)-5-fluoro-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3m**)

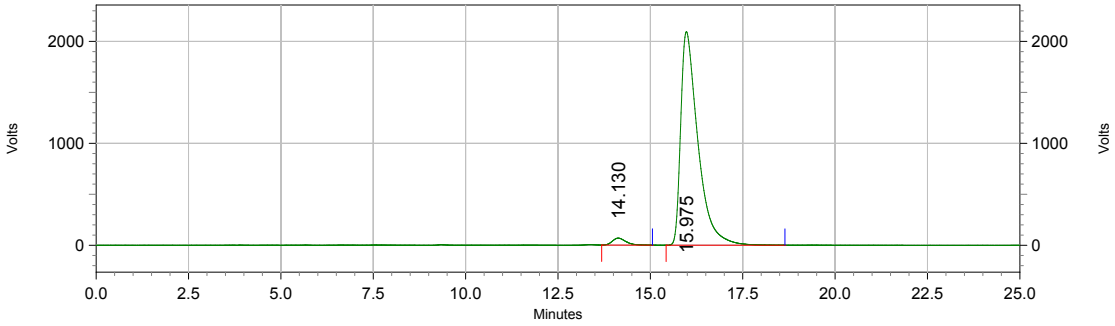




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	14.233	25244597	49.773	952463
2	16.333	25474738	50.227	838780
Totals		50719335	100.000	1791243

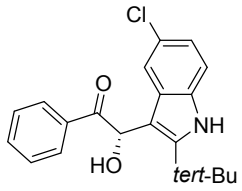


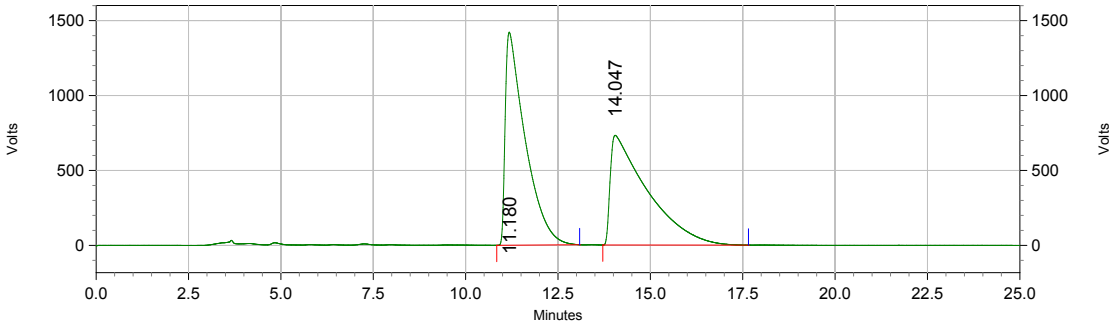
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	14.130	1736565	2.501	68476
2	15.975	67698194	97.499	2094898
Totals		100.000	2163374	69434759

(S)-2-(2-(tert-butyl)-5-chloro-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3n**)

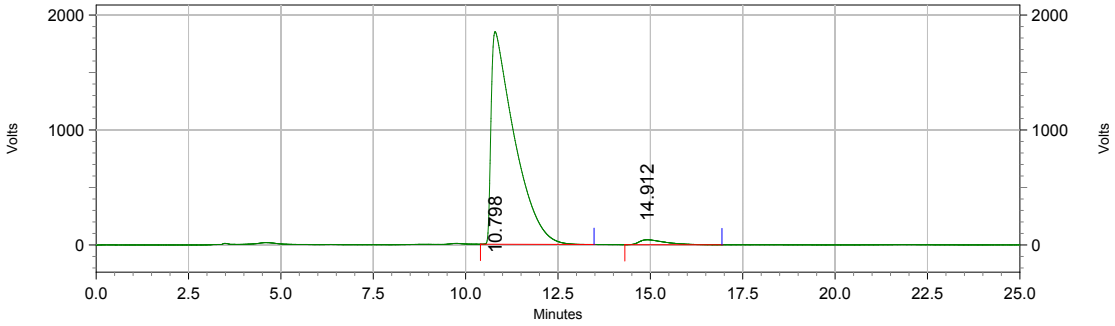




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	11.180	53330874	51.065	1421664
2	14.047	51105808	48.935	731827
Totals		104436682	100.000	2153491

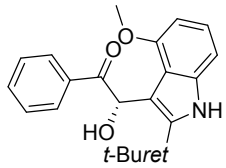


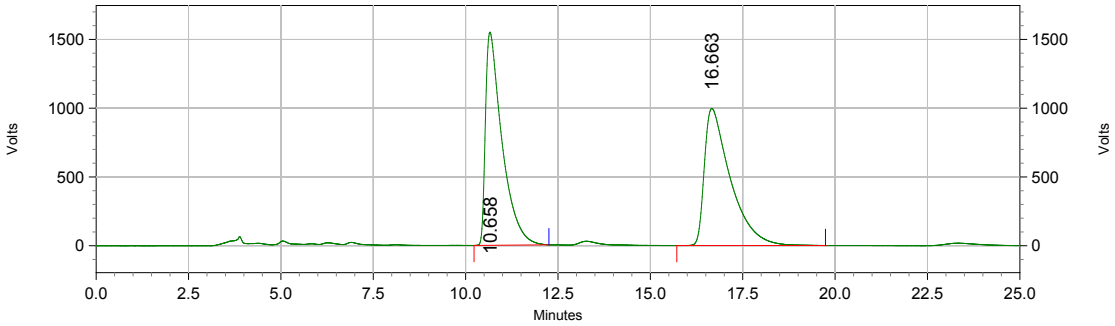
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	10.798	80745597	97.474	1848941
2	14.912	2092101	2.526	43055
Totals		82837698	100.000	1891996

(S)-2-(2-(tert-butyl)-4-methoxy-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3o**)

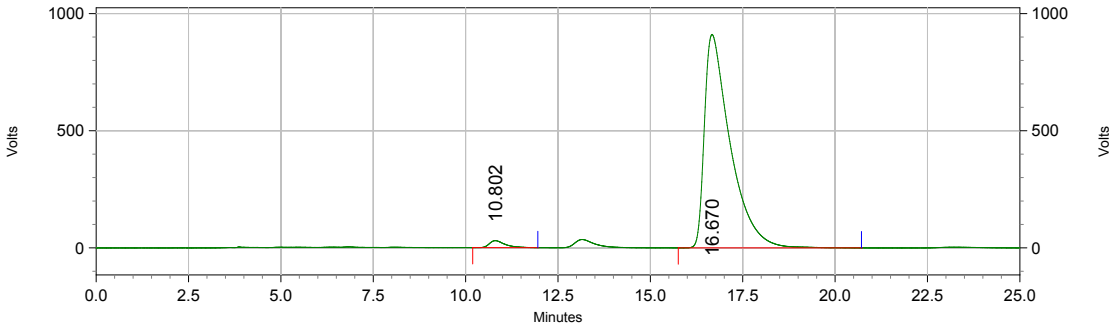




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	10.658	48233422	49.769	1549494
2	16.663	48681744	50.231	996908
Totals		96915166	100.000	2546402

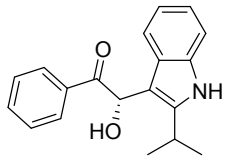


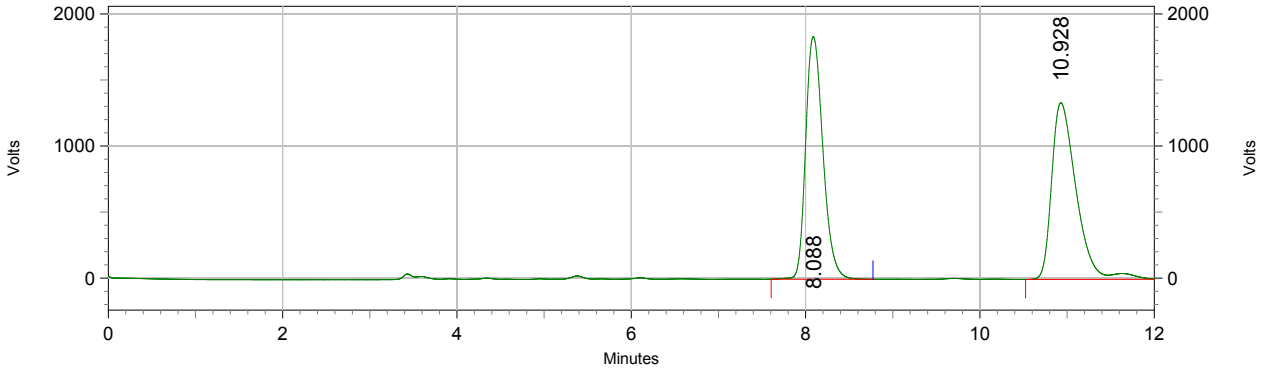
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	10.802	866889	1.926	29847
2	16.670	44135669	98.074	910927
Totals		45002558	100.000	940774

(S)-2-hydroxy-2-(2-isopropyl-1H-indol-3-yl)-1-phenylethan-1-one (**3p**)

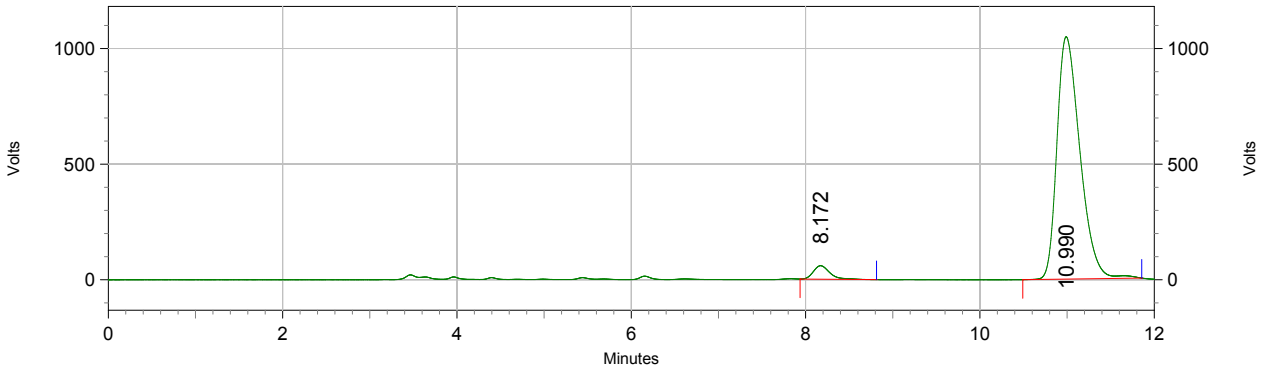




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	8.088	25362024	49.135	1836540
2	10.928	26254490	50.865	1337449
Totals		51616514	100.000	3173989

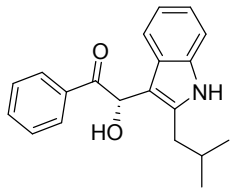


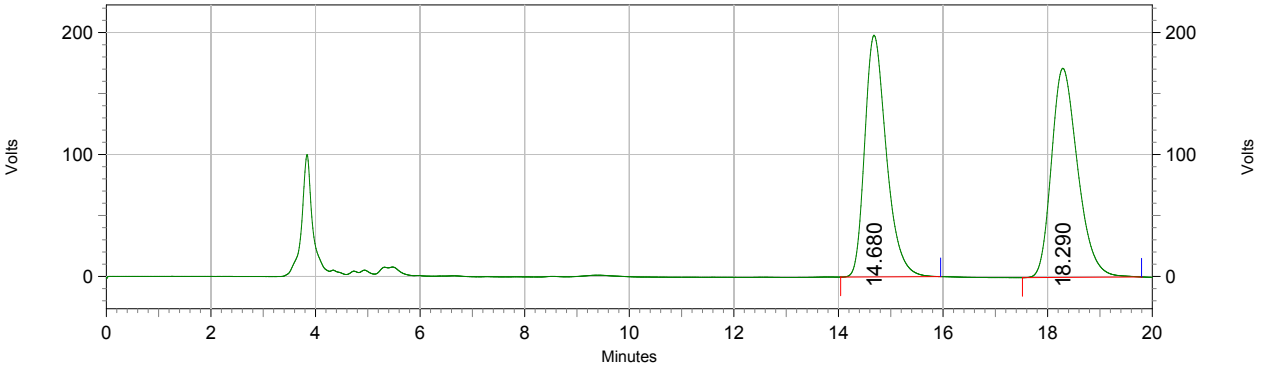
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	8.172	765660	3.835	58391
2	10.990	19197762	96.165	1048037
Totals		19963422	100.000	1106428

(S)-2-hydroxy-2-(2-isobutyl-1H-indol-3-yl)-1-phenylethan-1-one (**3q**)

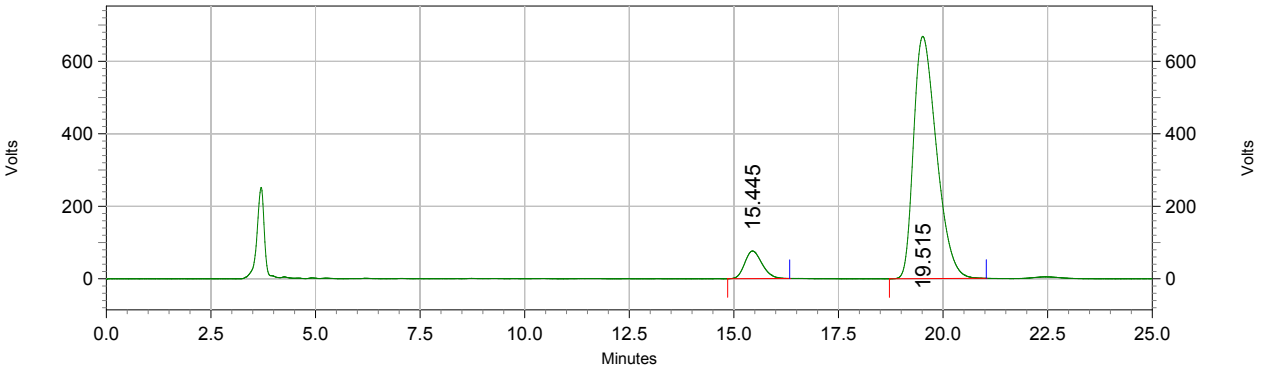




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	14.680	5705720	48.858	198228
2	18.290	5972561	51.142	171502
Totals		11678281	100.000	369730

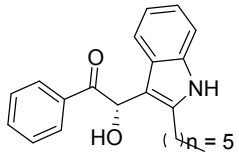


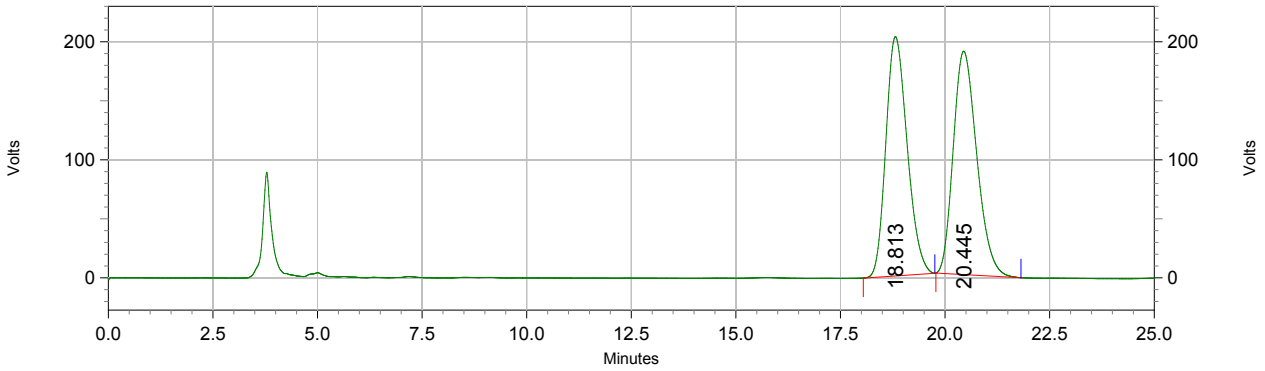
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	15.445	2188172	7.919	76100
2	19.515	25443688	92.081	668340
Totals		27631860	100.000	744440

(S)-2-(2-hexyl-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3r**)

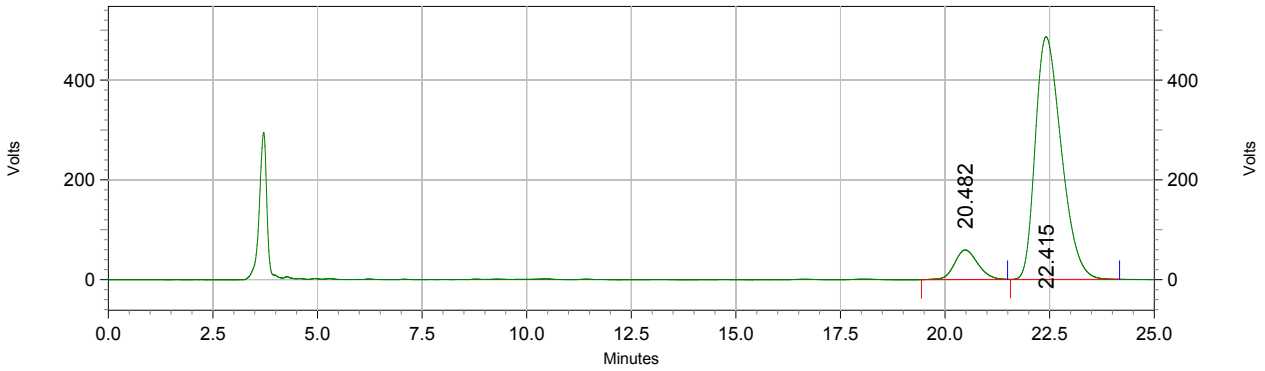




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	18.813	7181925	49.292	202697
2	20.445	7388342	50.708	189202
Totals		14570267	100.000	391899

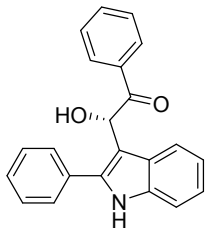


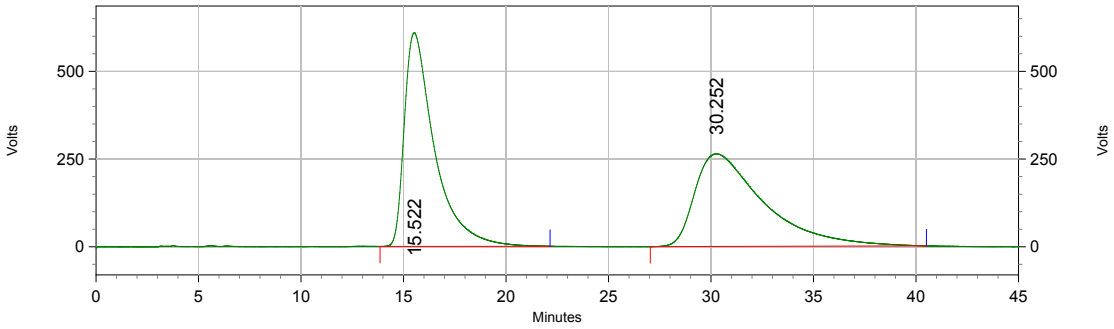
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	20.482	2274098	9.751	59046
2	22.415	21046810	90.249	486118
Totals		23320908	100.000	545164

(S)-2-hydroxy-1-phenyl-2-(2-phenyl-1H-indol-3-yl)ethan-1-one (**3s**)

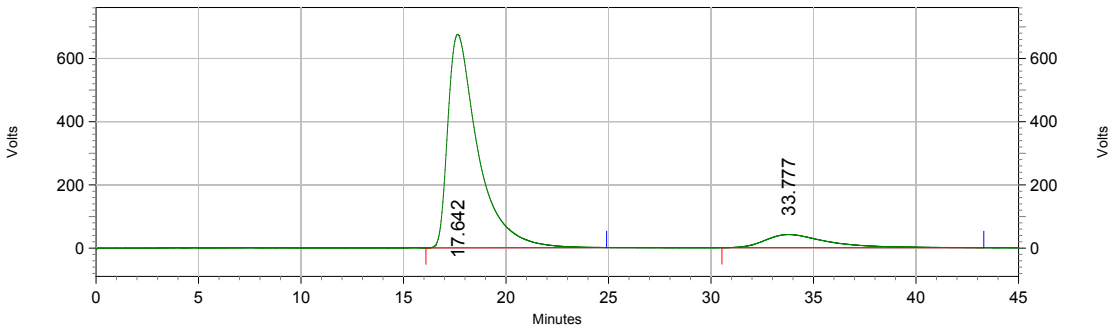




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	15.522	62133306	50.335	608607
2	30.252	61306546	49.665	263989
Totals		123439852	100.000	872596

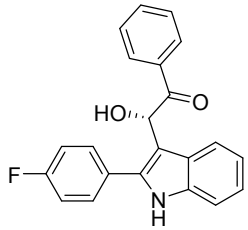


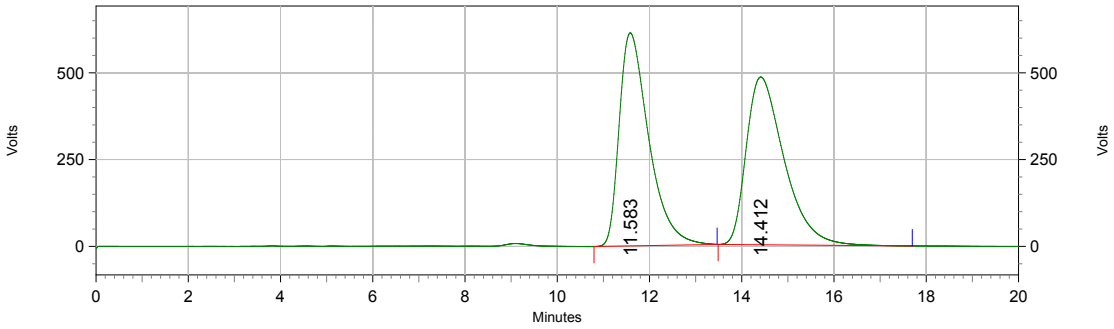
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	17.642	68690851	88.647	675142
2	33.777	8797434	11.353	41571
Totals		77488285	100.000	716713

(S)-2-(2-(4-fluorophenyl)-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3t**)

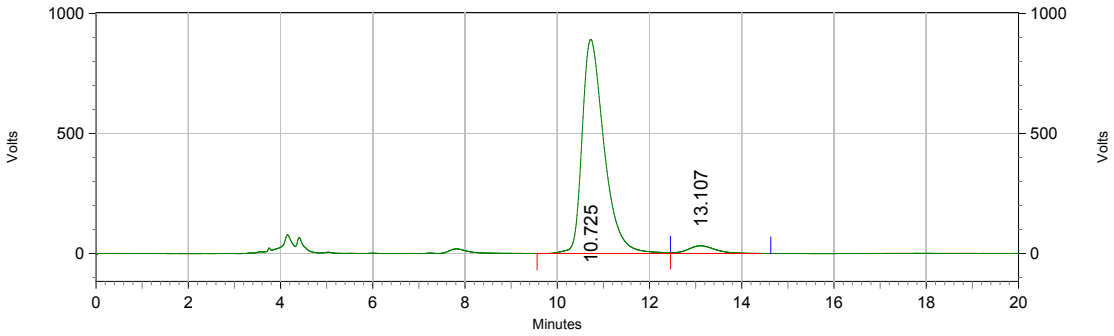




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	11.583	27236675	49.706	613594
2	14.412	27558387	50.294	483050
Totals		54795062	100.000	1096644

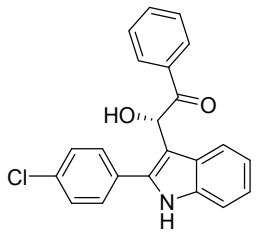


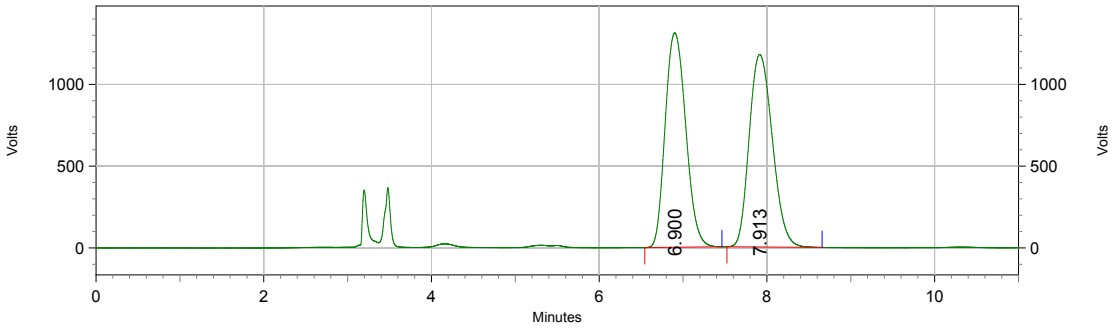
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	10.725	29531103	95.653	892061
2	13.107	1341986	4.347	32196
Totals		30873089	100.000	924257

(S)-2-(2-(4-chlorophenyl)-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3u**)

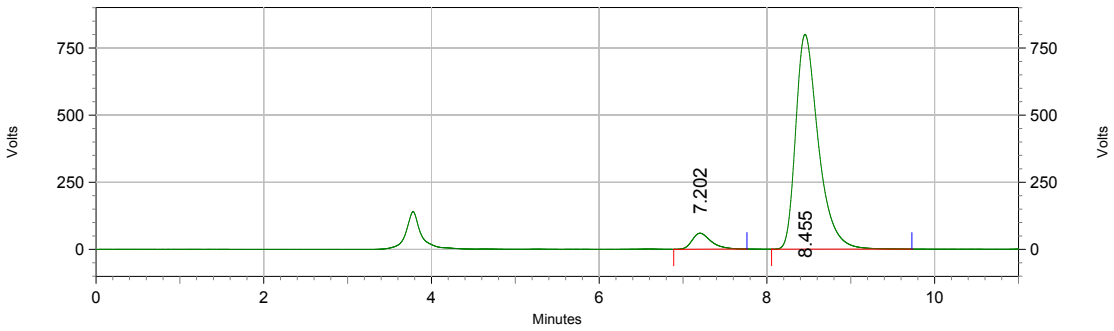




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	6.900	22363612	49.719	1310814
2	7.913	22616727	50.281	1176782
Totals		44980339	100.000	2487596

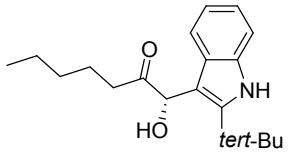


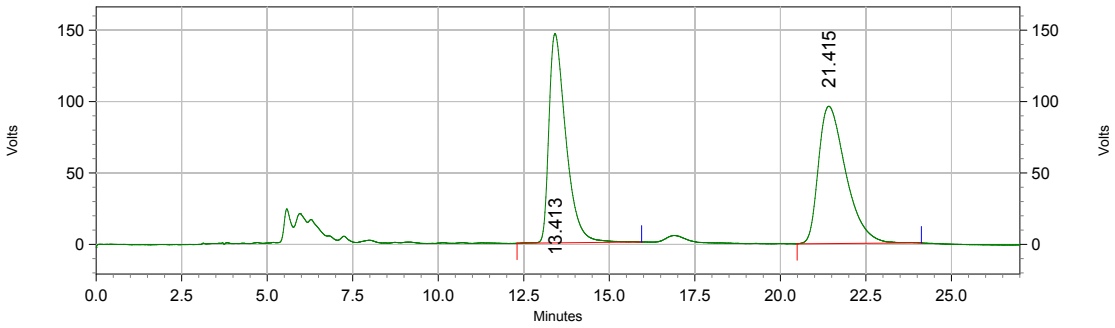
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	7.202	937449	5.882	59650
2	8.455	15000444	94.118	800166
Totals		15937893	100.000	859816

(S)-1-(2-(tert-butyl)-1H-indol-3-yl)-1-hydroxyheptan-2-one (**3v**)

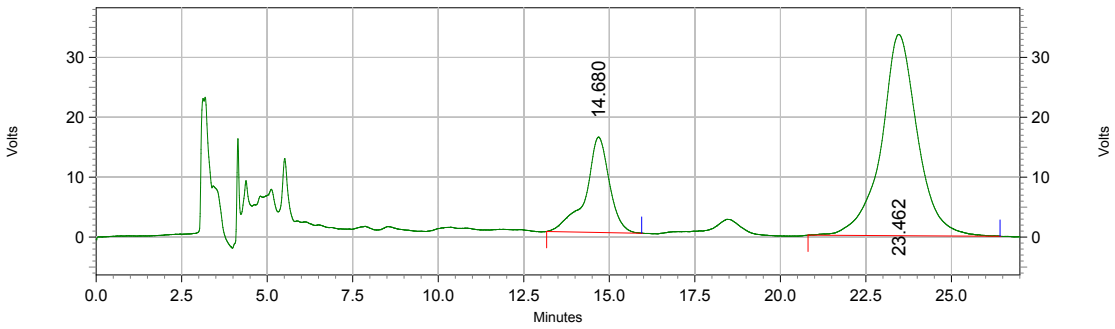




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	13.413	5058556	48.604	146594
2	21.415	5349175	51.396	96163
Totals		10407731	100.000	242757

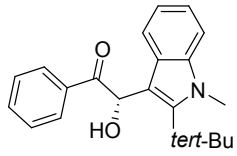


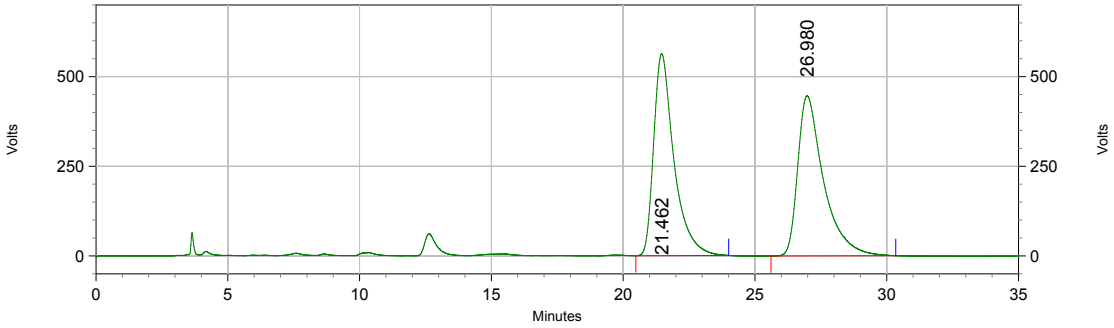
UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	14.680	768141	23.728	15910
2	23.462	2469197	76.272	33588
Totals		3237338	100.000	49498

(S)-2-(2-(tert-butyl)-1-methyl-1H-indol-3-yl)-2-hydroxy-1-phenylethan-1-one (**3w**)

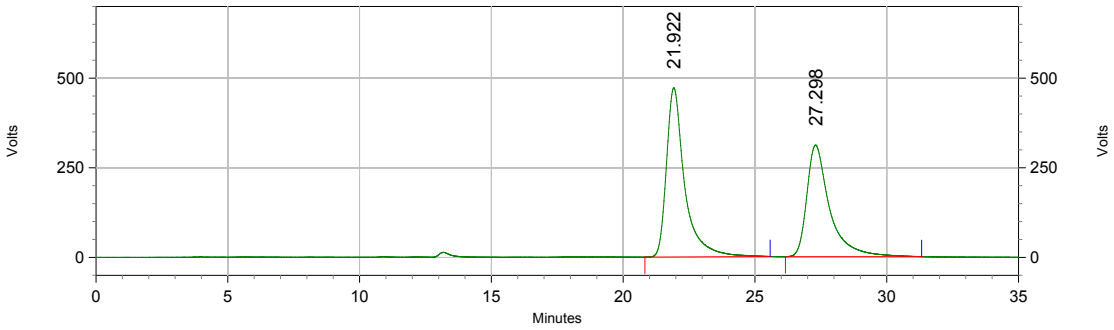




UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	21.462	30069520	49.805	562724
2	26.980	30304930	50.195	446731
Totals		60374450	100.000	1009455



UV1000-254nm

Results

peak	Ret.time	area	Conc.	height
1	21.922	22707661	54.788	472082
2	27.298	18739072	45.212	311329
Totals		41446733	100.000	783411