Supporting Information

Synthesis of 3-arylamino-2-polyhydroxyalkyl-substituted indoles from unprotected saccharides and anilines

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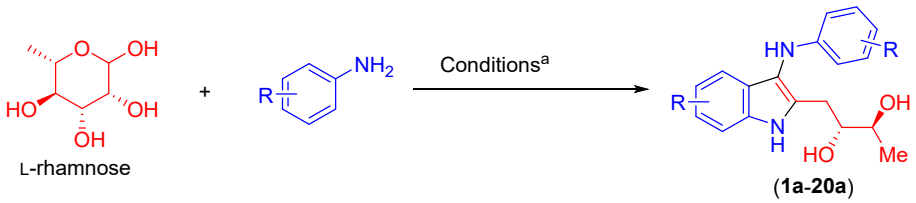
Contents

1. General Considerations：

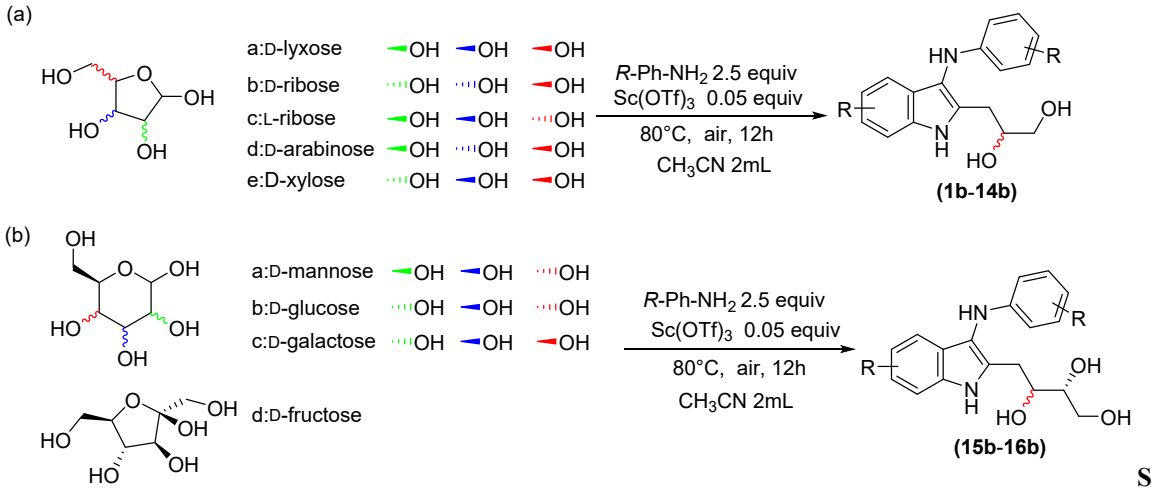
Solvents were all analytical grade and other reagents were purchased from energy chemical and Bide Pharmatech Ltd. All reactions need to be carried out under nitrogen atmosphere. ^{1}H NMR spectra were measured on Bruker AVANCE 600 MHz and 400 MHz spectrometers. ^{13}C NMR spectra were recorded on Bruker 100 MHz spectrometers with complete proton decoupling. Chemical shifts were reported in ppm from tetramethylsilane in the case of MeOH or DMSO as an internal standard. Melting points were measured on glass slides on an SGW X-4 Melting Point Apparatus. Optical rotations were determined on an SGW-1 automatic polarimeter. Mass Spectra (MS) and High resolution mass spectrometry (HRMS) is conducted on FTICR-MS (Ionspec 7.0T) mass spectrometer with electric spray ionization (ESI) manufactured by Ionspec Company in the United States.Thin-layer chromatography (TLC) was performed on precoated plates (Qingdao GF254) with detection by UV light, Puke (china) silica gel (200-300 mesh) was used for column chromatography.Structural assignments were made with additional information from gCOSY, gHSQC, and gHMBC experiments. X-Ray diffraction data were gathered on a Bruker D8 VENTURE diffractometer equipped with Mo-Kα radiation (λ = 0.71073 Å) at 273 K.

2. Experimental Section：



SchemeS1 Synthesis of the indoles using unprotected L-rhamnose.

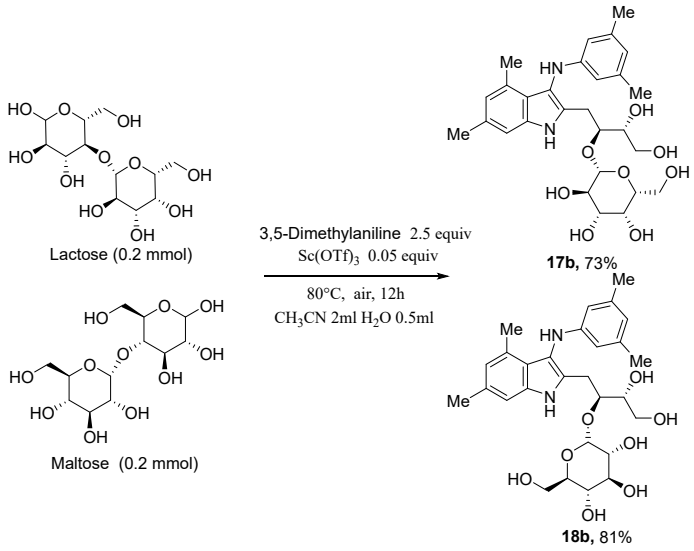
General experimental procedure: L-rhamnose (66 mg, 0.4 mmol), aniline (2.5 equiv.) and $Sc(OTf)_3$ (0.05 equiv.) were added into a 10 mL flask, 2.0 mL acetonitrile as the solvent. Then the solution was stirred at the temperature of 80 °C under air atmosphere for 12h. Upon completion, the mixture was cooled to room temperature. The solvent was evaporated in *vacuo*. The crude product was purified by column chromatography (petroleum ether : ethyl acetate *V*/*V* = 1 : 1) to give **1a** as a pale white solid with a yield of 78%. Under similar conditions, different aromatic amines were used as starting materials for the reaction, and the corresponding products **2a-20a** were obtained, respectively (Scheme S1).



Scheme S2 Synthesis of the indoles using unprotected five-carbons or six-carbons sugars.

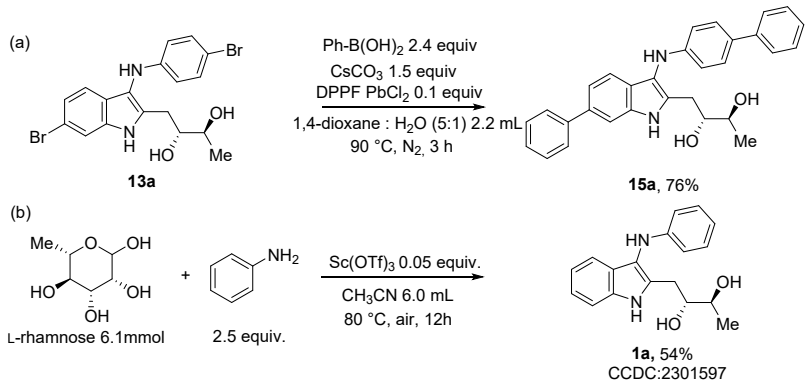
General experimental procedure: D-lyxose (60 mg, 0.4 mmol), aromatic amines (2.5 equiv.) and $Sc(OTf)_3$ (0.05 equiv.) were added into a 10 mL flask, 2.0 mL acetonitrile as the solvent. Then the solution was stirred at the temperature of 80 °C under air atmosphere for 12 h. Upon completion, the mixture was cooled to room temperature. The solvent was evaporated in *vacuo*. The crude product was purified by column chromatography (petroleum ether : ethyl acetate *V/V* = 1 : 1) to give **1b-8b** as pale yellow solids. Under similar conditions, D/L-ribose(60 mg, 0.4 mmol), D-arabinose(60 mg, 0.4 mmol), and D-xylose(60 mg, 0.4 mmol) with different aromatic amines were used as starting materials for the reaction, and the corresponding products **9b-14b** were obtained, respectively (Scheme S2-a).

D-mannose (72 mg, 0.4 mmol), aromatic amines (2.5 equiv.) and $Sc(OTf)_3$ (0.05 equiv.) were added into a 10 mL flask, 2.0 mL acetonitrile as the solvent. Then the solution was stirred at the temperature of 80 °C under air atmosphere for 12 h. Upon completion, the mixture was cooled to room temperature, and the solvent was evaporated in *vacuo*. The crude product was purified by column chromatography (petroleum ether : ethyl acetate *V/V* = 1 : 1) to give **15b** as a pale yellow solid. Under similar conditions, D-glucose(72 mg, 0.4 mmol), D-galactose(72 mg, 0.4 mmol) or D-fructose(72 mg, 0.4 mmol)with different aromatic amines were used as starting materials for the reaction, and the corresponding products **15b** and **16b** were obtained, respectively (Scheme S2-b).



Scheme S3 Synthesis of the indoles using unprotected disaccharides.

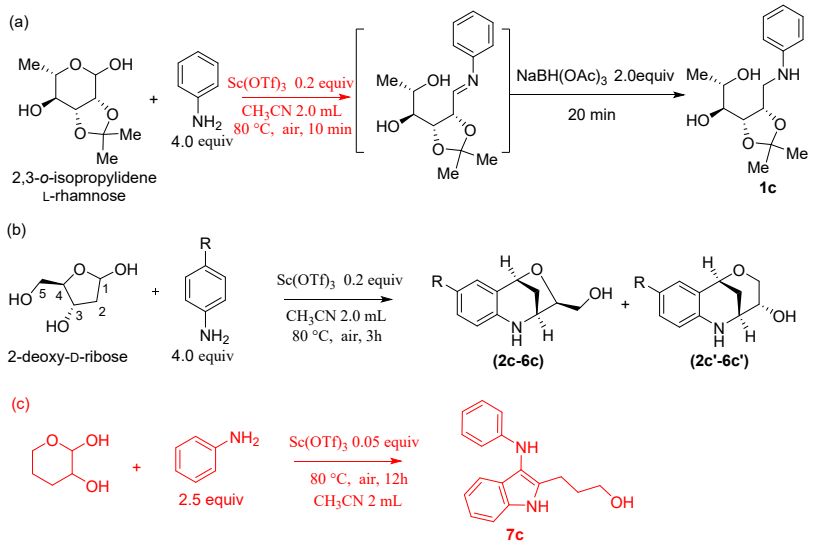
General experimental procedure: Lactose (68 mg, 0.2 mmol), 3,5-dimethylaniline (2.5 equiv.) and $Sc(OTf)_3$ (0.05 equiv.) were added into a 10 mL flask, 2.5 mL acetonitrile and water (*V:V*=4:1) as the mixed solvent. Then the solution was stirred at the temperature of 80 °C under air atmosphere for 12 h. Upon completion, the mixture was cooled to room temperature, and the solvent was evaporated in *vacuo*. The crude product was purified by column chromatography (dichloromethane : methanol *V/V* = 5 : 1) to give **17b** as a pale yellow solid. Under similar conditions, maltose (68mg, 0.2mmol) with 3,5-dimethylaniline were used as starting materials for the reaction, and the corresponding **18b** product was obtained(SchemeS3).



Scheme S4 Extension experiments.

General experimental procedure:Product **13a** (50 mg, 0.11 mmol), Ph-$B(OH)_2$ (2.4 equiv.), $CsCO_3$ (1.5 equiv.) and DPPF $PbCl_2$ (0.1 equiv.) were added into a 20 mL flask, 2.2 mL 1,4-dioxane : H_2O (V:V=5:1) as the mixed solvent. Then the solution was stirred at the temperature of 90 °C under N_2 atmosphere for 3 h. Upon completion, the mixture was cooled to room temperature, 20 mL methanol was added to dissolve the solid residue, and then the solvent was evaporated in *vacuo*. The crude product was purified by column

chromatography (petroleum ether : ethyl acetate *V/V* = 1 : 1) to give **15a** as a pale yellow solid (SchemeS4-a). General experimental procedure: L-rhamnose (1g, 6.1mmol), aniline (2.5 equiv.) and $Sc(OTf)_3$ (0.05 equiv.) were added into a 20 mL flask, 6.0 mL acetonitrile as the solvent. Then the solution was stirred at the temperature of 80 °C under air atmosphere for 12 h. Upon completion, the mixture was cooled to room temperature, and the solvent was evaporated in *vacuo*. The crude product was purified by column chromatography (petroleum ether : ethyl acetate *V/V* = 1 : 1) to give **1a** as a pale white solid with a yield of 54% (SchemeS4-b).

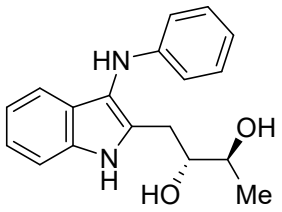


Scheme S5 Controlled experiment.

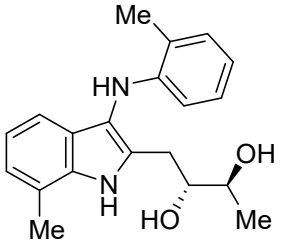
General experimental procedure: 2,3-*O*-Isopropylidene L-rhamnose(88 mg, 0.4mmol), aniline (4.0 equiv.) and $Sc(OTf)_3$ (0.2 equiv.) were added into a 10 mL flask, 2.0 mL acetonitrile as the solvent. Then the solution was stirred at the temperature of 80 °C under air atmosphere for 10 minutes, subsequently, 2.0 equiv $NaBH(OAc)_3$ was added into the reaction for another 20 minutes. Upon completion, the mixture was cooled to room temperature, and the solvent was evaporated in *vacuo*. The crude product was purified by silica gel column chromatography (petroleum ether : ethyl acetate *V/V* = 1 : 1) to give **1c** as a pale yellow solid (Scheme S5-a).

General experimental procedure:2-Deoxy-D-ribose(55 mg, 0.4 mmol), aniline (4.0 equiv.) and $Sc(OTf)_3$ (0.2 equiv.) were added into a 10 mL flask, 2.0 mL acetonitrile as the solvent. Then the solution was stirred at the temperature of 80 °C under air atmosphere for 3h. Upon completion, the mixture was cooled to room temperature, and the solvent was evaporated in *vacuo*. The crude product was purified by column chromatography (petroleum ether : ethyl acetate *V/V* = 3 : 1) to give **2c** and **2c'** as pale yellow solids. Under similar conditions, 2-deoxy-D-ribose and different aromatic amines were used as starting materials for the reaction, and the corresponding products **3c,3c'-6c,6c'** were obtained, respectively (Scheme S5-b).

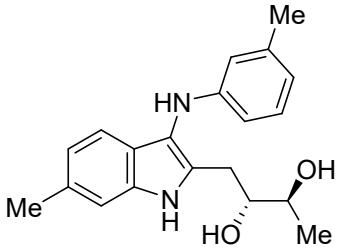
General experimental procedure: Tetrahydro-2*H*-pyran-2,3-diol (60 mg, 0.5mmol), aniline (2.5 equiv.) and $Sc(OTf)_3$ (0.05 equiv.) were added into a 10 mL flask, 2.0 mL acetonitrile as the solvent. Then the solution was stirred at the temperature of 80 °C under air atmosphere for 12 h. Upon completion, the mixture was cooled to room temperature, and the solvent was evaporated in *vacuo*. The crude product was purified by column chromatography (petroleum ether : ethyl acetate *V/V* = 1 : 1) to give **7c** (Scheme S5-c).



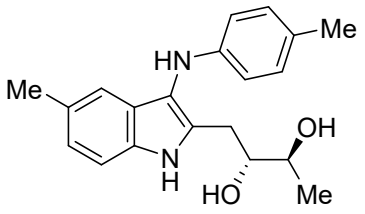
(2*S*,3*R*)-1-(3-(phenylamino)-1*H*-indol-2-yl)butane-2,3-diol (1a). Yellow solid, 90 mg, yield 78%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 102.5 - 103.3 °C. $[\alpha]_D^{25}$ +10.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 7.30 (d, *J* = 8.2 Hz, 1H), 7.21 (d, *J* = 7.8 Hz, 1H), 7.07 – 7.00 (m, 3H), 6.91 (d, *J* = 7.2 Hz, 1H), 6.63 – 6.53 (m, 3H), 3.76 (dt, *J* = 8.6, 4.8 Hz, 1H), 3.64 – 3.57 (m, 1H), 3.03 (dd, *J* = 14.8, 4.2 Hz, 1H), 2.80 (dd, *J* = 14.8, 8.4 Hz, 1H), 1.16 (d, *J* = 6.4 Hz, 3H). ^{13}C NMR (100 MHz, CD_3OD) δ 149.0, 134.8, 131.9, 128.5, 125.6, 120.5, 118.2, 117.5, 116.6, 114.8, 113.0, 110.5, 75.1, 70.0, 28.7, 17.1. MS (ESI): Calculated for $C_{18}H_{21}N_2O_2$ ($[M+H]^+$): 297.1598, found: 297.1597.



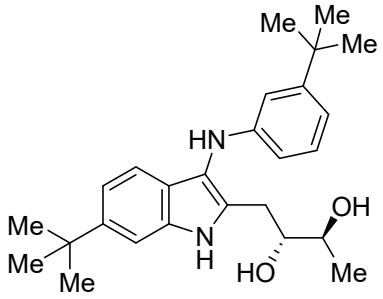
(2*R*,3*S*)-1-(7-methyl-3-(*o*-tolylamino)-1*H*-indol-2-yl)butane-2,3-diol(2a). Yellow solid, 91mg, yield 72%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 100.5 - 101.3 °C. $[\alpha]_D^{25}$ +9.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 7.06 (t, *J* = 6.2 Hz, 2H), 6.89 – 6.82 (m, 3H), 6.57 (t, *J* = 7.4 Hz, 1H), 6.36 (d, *J* = 8.2 Hz, 1H), 3.81 (dd, *J* = 8.6, 4.4 Hz, 1H), 3.64 (d, *J* = 7.2 Hz, 1H), 3.05 (dd, *J* = 14.6, 4.2 Hz, 1H), 2.87 (dd, *J* = 14.8, 8.2 Hz, 1H), 2.53 (s, 3H), 2.37 (s, 3H), 1.20 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 146.5, 134.0, 131.1, 129.5, 126.2, 125.3, 121.5, 121.1, 119.9, 118.4, 116.6, 115.8, 115.4, 111.7, 75.3, 70.0, 28.8, 17.3, 16.6, 15.3.MS (ESI): Calculated for $C_{20}H_{25}N_2O_2$ ($[M+H]^+$): 325.1911, found: 325.1918.



(2*R*,3*S*)-1-(6-methyl-3-(*m*-tolylamino)-1*H*-indol-2-yl)butane-2,3-diol(3a).Yellow solid, 95 mg, yield 62%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 90.5 - 92.3 °C. $[\alpha]_D^{25}$ +18.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 7.16 – 7.11 (m, 1H), 6.94 (dd, *J* = 7.8, 5.6 Hz, 2H), 6.67 (d, *J* = 7.2 Hz, 1H), 6.48 – 6.32 (m, 3H), 3.78 (dd, *J* = 8.8, 4.6 Hz, 1H), 3.66 – 3.62 (m, 1H), 3.08 – 2.95 (m, 1H), 2.78 (dd, *J* = 14.8, 8.4 Hz, 1H), 2.42 (d, *J* = 8.8 Hz, 3H), 2.19 (s, 3H), 1.18 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 150.5, 138.2, 134.9, 133.0, 128.9, 128.4, 120.5, 119.8, 117.3, 117.2, 113.6, 113.2, 109.9, 108.3, 75.1, 70.0, 47.6, 28.4, 20.4, 17.5, 17.0.MS (ESI): Calculated for $C_{20}H_{25}N_2O_2$ ($[M+H]^+$): 325.1911, found: 325.1907.

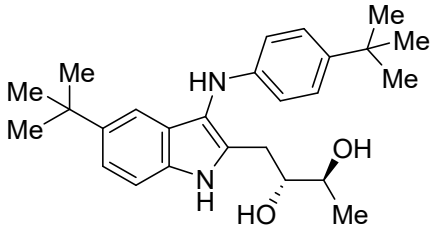


(2*R*,3*S*)-1-(5-methyl-3-(*p*-tolylamino)-1*H*-indol-2-yl)butane-2,3-diol(4a). Yellow solid, 84 mg, yield 71%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 97.4 - 98.6 °C. $[\alpha]_D^{25}$ +16.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 7.20 (d, *J* = 8.2 Hz, 1H), 7.03 (s, 1H), 6.89 (dd, *J* = 8.4, 2.4 Hz, 3H), 6.57 – 6.51 (m, 2H), 3.77 (ddd, *J* = 8.2, 5.4, 4.2 Hz, 1H), 3.68 – 3.60 (m, 1H), 3.03 (dd, *J* = 14.8, 4.2 Hz, 1H), 2.81 (dd, *J* = 14.8, 8.2 Hz, 1H), 2.34 (s, 3H), 2.21 (s, 3H), 1.18 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 146.7, 133.2, 131.9, 128.9, 127.2, 125.9, 125.7, 122.0, 117.2, 114.8, 113.2, 110.3, 75.1, 70.0, 48.3, 48.1, 47.9, 47.6, 47.4, 47.2, 47.0, 28.8, 20.3, 19.2, 17.1.MS (ESI): Calculated for $C_{20}H_{25}N_2O_2$ ($[M+H]^+$): 325.1911, found: 325.1913.

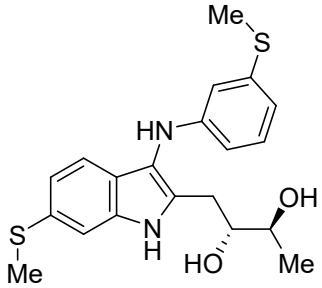


(2*R*,3*S*)-1-(6-(*tert*-butyl)-3-((3-(*tert*-butyl)phenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol(5a).Yellow solid, 124 mg, yield 72%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 93.7 - 94.3 °C. $[\alpha]_D^{25}$ +15.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.36 (d, *J* = 1.8 Hz, 1H), 7.18 (dd, *J* = 8.4, 1.8 Hz, 1H), 7.05 (d, *J* = 8.4Hz, 1H), 6.99 (t, *J* = 7.8 Hz, 1H), 6.80 (q, *J* = 2.0 Hz, 1H), 6.69 (d, *J* = 7.8 Hz, 1H), 6.41 (dd, *J* = 7.8,

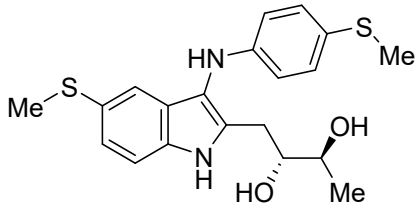
2.2 Hz, 1H), 3.79 (dt, *J* = 7.8, 4.8 Hz, 1H), 3.64 (dd, *J* = 6.6, 1.8 Hz, 1H), 3.04 (ddd, *J* = 14.8, 4.4, 1.8 Hz, 1H), 2.84 (ddd, *J* = 14.8, 8.2, 1.8 Hz, 1H), 1.39 (s, 9H), 1.25 (s, 9H), 1.18 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 151.5, 148.6, 143.8, 134.9, 130.9, 128.1, 123.2, 117.2, 116.3, 114.8, 113.8, 110.5, 110.3, 106.9, 75.2, 69.9, 34.1, 34.0, 31.0, 30.5, 28.8, 17.1.MS (ESI): Calculated for $C_{26}H_{37}N_2O_2$ ($[M+H]^+$): 409.2850, found: 409.2851.



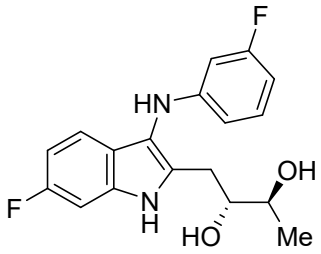
(2*R*,3*S*)-1-(5-(*tert*-butyl)-3-((4-(*tert*-butyl)phenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol (6a).Yellow solid, 96 mg, yield 58%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 93.1 - 94.8 °C. $[\alpha]_D^{25}$ +22.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.29 – 7.24 (m, 2H), 7.19 – 7.12 (m, 3H), 6.64 – 6.57 (m, 2H), 3.81 – 3.76 (m, 1H), 3.63 (d, *J* = 1.7 Hz, 1H), 3.03 (ddd, *J* = 14.7, 4.2, 1.6 Hz, 1H), 2.86 – 2.80 (m, 1H), 1.31 (s, 9H), 1.28 (s, 9H), 1.18 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 146.6, 141.0, 139.4, 132.9, 131.6, 125.4, 125.2, 118.6, 115.4, 113.4, 112.9, 110.0, 75.1, 70.0, 34.0, 33.3, 31.1, 30.7, 30.3, 28.8, 17.1.MS (ESI): Calculated for $C_{26}H_{37}N_2O_2$ ($[M+H]^+$): 409.2850, found: 409.2850.



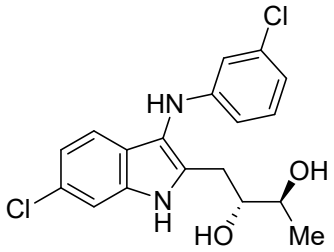
(2*R*,3*S*)-1-(6-(methylthio)-3-((3-(methylthio)phenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol (7a).Yellow solid, 107 mg, yield 63%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 107.7 - 109.1 °C. $[\alpha]_D^{25}$ +12.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.35 (d, *J* = 1.8 Hz, 1H), 7.18 (dd, *J* = 8.2, 1.6 Hz, 1H), 7.04 – 6.94 (m, 2H), 6.54 (dd, *J* = 4.4, 2.2 Hz, 2H), 6.41 (d, *J* = 8.2 Hz, 1H), 3.81 – 3.74 (m, 1H), 3.64 – 3.62 (m, 1H), 3.04 (ddd, *J* = 14.8, 4.2, 1.6 Hz, 1H), 2.86 – 2.75 (m, 1H), 2.51 (s, 3H), 2.36 (s, 3H), 1.19 (d, *J* = 6.4, 3H).^{13}C NMR (101 MHz, CD_3OD) δ150.1, 139.7, 130.0, 133.9, 130.4, 129.7, 124.9, 122.1, 120.7, 118.3, 117.2, 115.6, 111.8, 111.0, 75.8, 70.9, 29.4, 18.0, 17.6, 15.2.MS (ESI): Calculated for $C_{20}H_{25}N_2O_2S_2$ ($[M+H]^+$): 389.1352, found: 389.1355.



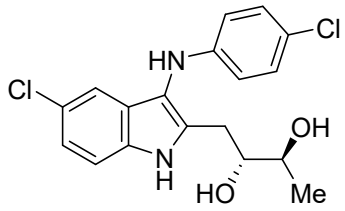
(2*R*,3*S*)-1-(5-(methylthio)-3-((4-(methylthio)phenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol (8a).Yellow solid, 93 mg, yield 64%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 106.6 - 107.9 °C. $[\alpha]_D^{25}$ +13.0 (*c* 0.1, CH_3OH); ^1H NMR (400 MHz, CD_3OD) δ 7.29 (d, *J* = 8.4 Hz, 1H), 7.23 (d, *J* = 1.8 Hz, 1H), 7.17 – 7.13 (m, 2H), 7.10 (dd, *J* = 8.4, 1.8 Hz, 1H), 6.59 (d, *J* = 8.6 Hz, 2H), 3.77 (ddd, *J* = 8.4, 5.4, 4.2 Hz, 1H), 3.63 (d, *J* = 5.6 Hz, 1H), 3.04 (dd, *J* = 14.8, 4.2 Hz, 1H), 2.83 – 2.78 (m, 1H), 2.40 (s, 3H), 2.38 (s, 3H), 1.19 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 148.0, 133.5, 133.1, 131.2, 126.7, 126.2, 126.1, 123.6, 122.6, 118.2, 114.3, 113.5, 111.2, 75.0, 70.0, 28.6, 18.0, 17.5, 17.2.MS (ESI): Calculated for $C_{20}H_{25}N_2O_2S_2$ ($[M+H]^+$): 389.1352, found: 389.1353.



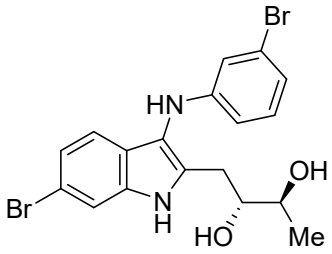
(2*R*,3*S*)-1-(6-fluoro-3-((3-fluorophenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol (9a).Yellow solid, 71 mg, yield 49%, petroleum ether/ethyl acetate (*V/V*)=1:1, $[\alpha]_D^{25}$ +17.0 (*c* 0.1, CH_3OH); m.p. 90.1 - 92.4 °C.^1H NMR (400 MHz, CD_3OD) δ 7.20 – 7.13 (m, 1H), 7.06 – 7.02 (m,, 2H), 6.78 – 6.71 (m, 1H), 6.44 (dd, *J* = 8.4, 2.2 Hz, 1H), 6.32 – 6.29 (m, 1H), 6.25 – 6.22 (m, 1H), 3.79 – 3.74 (m, 1H), 3.66 – 3.62 (m, 1H), 3.05 – 3.03 (m, 1H), 2.77 (ddd, *J* = 14.8, 8.6, 2.4 Hz, 1H), 1.20 (d, *J* = 6.4Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 165.0, 163.4, 160.4, 158.8, 151.2, 151.1, 134.7, 134.6, 132.8, 132.8, 129.7, 125.4, 122.0, 118.1, 118.0, 114.2, 108.9, 108.8, 106.7, 106.6, 102.7, 102.6, 99.4, 99.2, 96.9, 96.7, 75.0, 70.1, 28.6, 17.2.MS (ESI): Calculated for $C_{18}H_{19}N_2O_2F_2$ ($[M+H]^+$): 333.1409, found: 333.1410.



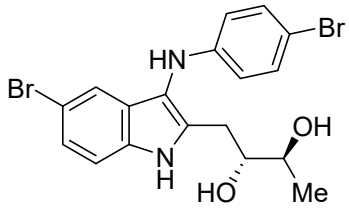
(2*R*,3*S*)-1-(6-chloro-3-((3-chlorophenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol (10a).Yellow solid, 95 mg, yield 66%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 94.2 – 96.3 °C. $[\alpha]_D^{25}$ +31.0 (*c* 0.1, CH_3OH); ^1H NMR (400 MHz, CD_3OD) δ 7.29 (d, *J* = 8.0 Hz, 1H), 7.06 – 6.98 (m, 2H), 6.93 (d, *J* = 7.6 Hz, 1H), 6.61 – 6.43 (m, 3H), 3.80 – 3.78 (m, 1H), 3.68 – 3.63 (m, 1H), 3.05 (dd, *J* = 14.8, 4.2 Hz, 1H), 2.76 (dd, *J* = 14.6, 8.8 Hz, 1H), 1.20 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 151.8, 136.2, 135.7, 134.3, 129.5, 123.7, 121.2, 119.5, 116.0, 112.4, 111.3, 109.5, 74.8, 70.1, 28.3, 17.2.MS (ESI): Calculated for $C_{18}H_{19}N_2O_2Cl_2$ ($[M+H]^+$): 365.0818, found: 365.0820.



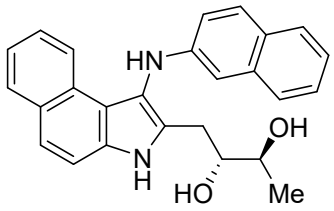
(2*R*,3*S*)-1-(5-chloro-3-((4-chlorophenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol (11a).Yellow solid, 75 mg, yield 58%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 97.5 - 98.5 °C. $[\alpha]_D^{25}$ +20.0 (*c* 0.1, CH_3OH); ^1H NMR (400 MHz, DMSO – *d*6) δ 10.98 (s, 1H), 7.36 (d, *J* = 8.6 Hz, 1H), 7.30 (s, 1H), 7.10 – 7.05 (m, 3H), 7.02 (dd, *J* = 8.6, 2.2 Hz, 1H), 6.57 – 6.51 (m, 2H), 4.65 (d, *J* = 5.8 Hz, 2H), 3.72 – 3.43 (m, 2H), 2.94 (dd, *J* = 14.6, 3.8 Hz, 1H), 2.60 (dd, *J* = 14.6, 8.8 Hz, 1H), 1.06 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, DMSO – *d*6) δ 148.3, 136.2, 133.2, 129.0, 126.5, 123.5, 120.6, 120.0, 116.5, 114.6, 113.7, 113.3, 74.8, 70.1, 29.7, 19.5.MS (ESI): Calculated for $C_{18}H_{19}N_2O_2Cl_2$ ($[M+H]^+$): 365.0818, found: 365.0815.



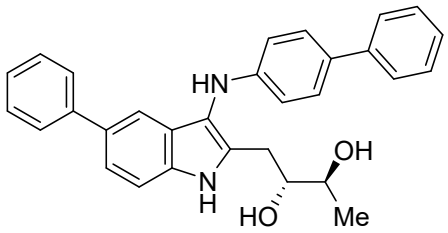
(2*R*,3*S*)-1-(6-bromo-3-((3-bromophenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol (12a).Yellow solid, 126 mg, yield 67%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 100.1 - 102.3 °C. $[\alpha]_D^{25}$ +19.0 (*c* 0.1, CH_3OH); ^1H NMR (400 MHz, CD_3OD) δ 7.35 (d, *J* = 8.0 Hz, 1H), 7.15 – 7.10 (m, 1H), 6.99 – 6.93 (m, 2H), 6.74 – 6.70 (m, 1H), 6.63 (d, *J* = 2.2 Hz, 1H), 6.48 (dd, *J* = 8.2, 2.2 Hz, 1H), 3.79 – 3.77 (m, 1H), 3.66 – 3.64 (m, 1H), 3.04 (ddd, *J* = 14.6, 4.0, 2.8 Hz, 1H), 2.80 – 2.71 (m, 1H), 1.19 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 151.9, 136.1, 129.9, 123.6, 122.9, 122.5, 121.6, 119.2, 118.9, 115.4, 113.6, 113.4, 111.7, 110.1, 74.8, 70.2, 28.3, 17.2.MS (ESI): Calculated for $C_{18}H_{19}N_2O_2Br_2$ ($[M+H]^+$): 452.9808, found: 452.9810.



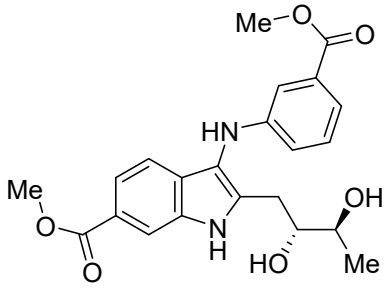
(2*R*,3*S*)-1-(5-bromo-3-((4-bromophenyl)amino)-1*H*-indol-2-yl)butane-2,3-diol (13a)..Yellow solid, 113 mg, yield 64%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 108.7 - 109.3 °C. $[\alpha]_D^{25}$ +15.0 (*c* 0.1, CH_3OH); ^1H NMR (400 MHz, CD_3OD) δ 7.32 (d, *J* = 1.8 Hz, 1H), 7.26 (d, *J* = 8.6 Hz, 1H), 7.19 – 7.16 (m, 2H), 7.16 – 7.12 (m, 1H), 6.56 – 6.47 (m, 2H), 3.76 (ddd, *J* = 8.8, 5.4, 4.0 Hz, 1H), 3.67 – 3.58 (m, 1H), 3.04 (dd, *J* = 14.8, 4.0 Hz, 1H), 2.79 (dd, *J* = 14.8, 8.8 Hz, 1H), 1.20 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 148.0, 134.3, 133.4, 131.3, 127.1, 123.2, 119.7, 114.5, 113.8, 112.4, 111.6, 107.9, 74.9, 70.1, 47.7, 28.6, 17.2.MS (ESI): Calculated for $C_{18}H_{19}N_2O_2Br_2$ ($[M+H]^+$): 452.9808, found: 452.9809.



(2*R*,3*S*)-1-(1-(naphthalen-2-ylamino)-3*H*-benzo[e]indol-2-yl)butane-2,3-diol (14a).Yellow solid, 107 mg, yield 60%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 99.5 - 100.3 °C. $[\alpha]_D^{25}$ +34.0 (*c* 0.1, CH_3OH); ^1H NMR (400 MHz, CD_3OD) δ 8.41 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.82 (dd, *J* = 7.6, 1.8 Hz, 1H), 7.62 (dd, *J* = 8.6, 4.6 Hz, 2H), 7.60 – 7.50 (m, 2H), 7.29 (d, *J* = 8.2 Hz, 1H), 7.22 (td, *J* = 7.6, 1.6 Hz, 2H), 7.19 – 7.11 (m, 2H), 7.08 (ddd, *J* = 8.0, 6.8, 1.4 Hz, 1H), 6.69 (d, *J* = 2.4 Hz, 1H), 3.83 (dt, *J* = 8.8, 4.6 Hz, 1H), 3.71 – 3.61 (m, 1H), 3.14 (dd, *J* = 14.8, 4.2 Hz, 1H), 2.89 (dd, *J* = 14.8, 8.6 Hz, 1H), 1.17 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 146.9, 135.5, 131.1, 131.0, 129.5, 128.5, 128.0, 127.7, 127.7, 127.2, 125.5, 125.4, 124.6, 123.4, 122.2, 121.5, 121.1, 118.9, 117.2, 116.8, 112.9, 105.4, 75.3, 70.1, 47.7, 28.4, 17.1.MS (ESI): Calculated for $C_{26}H_{25}N_2O_2$ ($[M+H]^+$): 397.1911, found: 397.1910.

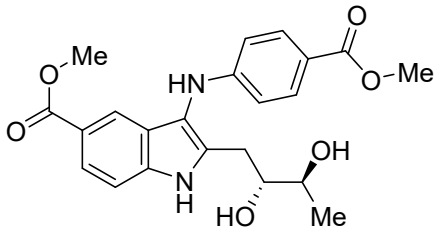


(2*R*,3*S*)-1-(3-([1,1'-biphenyl]-4-ylamino)-5-phenyl-1*H*-indol-2-yl)butane-2,3-diol (15a).Yellow solid, 106 mg, yield 63%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 112.7 - 113.1 °C. $[\alpha]_D^{25}$ +17.0 (*c* 0.1, CH_3OH);^1H NMR (400 MHz, $CDCl_3$) δ 7.57 – 7.52 (m, 3H), 7.48 (d, *J* = 7.8 Hz, 2H), 7.40 – 7.32 (m, 8H), 7.20 (q, *J* = 7.0 Hz, 2H), 6.71 (d, *J* = 8.2 Hz, 2H), 3.70 – 3.60 (m, 2H), 2.96 (dd, *J* = 14.8, 3.4 Hz, 1H), 2.82 (dd, *J* = 14.8, 8.6 Hz, 1H), 1.15 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, $CDCl_3$) δ 151.5, 146.2, 145.0, 137.7, 136.9, 136.4, 134.1, 132.3, 132.2, 131.5, 131.0, 129.9, 129.7, 124.8, 120.1, 118.5, 117.3, 115.0, 78.7, 73.8, 31.9, 21.3.MS (ESI): Calculated for $C_{30}H_{29}N_2O_2$ ($[M+H]^+$): 449.2224, found: 449.2228.

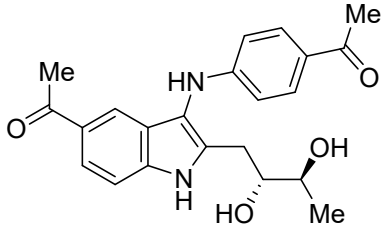


methyl2-((2*R*,3*S*)-2,3-dihydroxybutyl)-3-((3-(methoxycarbonyl)phenyl)amino)-1*H*-indole-6-carboxylate (16a).Yellow solid, 100 mg, yield 54%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 95.2 - 96.8 °C. $[\alpha]_D^{25}$ +27.0 (*c* 0.1, CH_3OH); ^1H NMR (400 MHz, DMSO – *d*6, D_2O) δ 7.61 (d, *J* = 8.0 Hz, 1H),

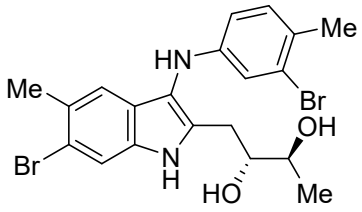
7.37 (d, *J* = 7.4 Hz, 1H), 7.17 – 7.08 (m, 3H), 7.01 (s, 1H), 6.70 – 6.68 (m, 1H), 3.75 (s, 3H), 3.62 (d, *J* = 4.4 Hz, 1H), 3.49 (s, 3H), 3.46 – 3.40 (m, 1H), 2.93 (dd, *J* = 14.6, 3.8 Hz, 1H), 2.61 (dd, *J* = 14.6, 9.0 Hz, 1H), 1.03 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, DMSO – *d*6) δ 168.8, 167.3, 150.3, 138.2, 135.9, 130.5, 129.4, 122.3, 121.9, 119.8, 117.7, 117.2, 116.0, 113.3, 79.7, 74.7, 70.2, 52.3, 29.7, 19.5.MS (ESI): Calculated for $C_{22}H_{25}N_2O_6$ ([M+H]$^+$): 413.1707, found: 413.1705.



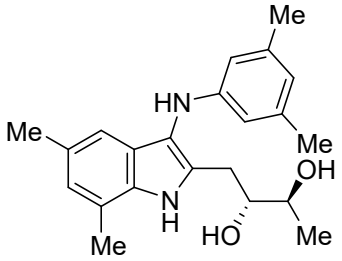
methyl2-((2*R*,3*S*)-2,3-dihydroxybutyl)-3-((4-(methoxycarbonyl)phenyl)amino)-1*H*-indole-5-carboxylate (17a). Yellow solid, 91 mg, yield 51%, petroleum ether/ethyl acetate (*V/V*)=1:2, m.p. 106.4 - 108.3 °C. $[\alpha]_D^{25}$ +17.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 8.00 (d, *J* = 1.6 Hz, 1H), 7.82 – 7.76 (m, 3H), 7.42 (d, *J* = 8.6 Hz, 1H), 6.64 (d, *J* = 8.6 Hz, 2H), 3.86 (s, 3H), 3.84 (s, 3H), 3.78 (ddd, *J* = 9.0, 5.4, 4.0 Hz, 1H), 3.68 – 3.63 (m, 1H), 3.07 (dd, *J* = 14.8, 3.8 Hz, 1H), 2.81 (dd, *J* = 14.8, 8.8 Hz, 1H), 1.20 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 168.7, 167.9, 153.4, 137.5, 134.7, 131.1, 124.8, 122.1, 120.4, 120.1, 117.4, 114.4, 111.8, 110.6, 74.8, 70.1, 50.9, 50.6, 28.6, 17.3.MS (ESI): Calculated for $C_{22}H_{25}N_2O_6$ ([M+H]$^+$): 413.1707, found: 413.1702.



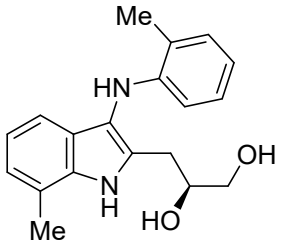
1-(4-((5-acetyl-2-((2*R*,3*S*)-2,3-dihydroxybutyl)-1*H*-indol-3-yl)amino)phenyl)ethan-1-one (18a).Yellow solid, 87 mg, yield 66%, petroleum ether/ethyl acetate (*V/V*)=1:2, m.p. 102.5 - 103.3 °C. $[\alpha]_D^{25}$ +23.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.98 (d, *J* = 1.8 Hz, 1H), 7.81 (dd, *J* = 8.8, 1.8 Hz, 3H), 7.44 (d, *J* = 8.6 Hz, 1H), 6.67 (d, *J* = 8.6 Hz, 2H), 3.78 (ddd, *J* = 9.0, 5.4, 3.8 Hz, 1H), 3.66 – 3.63 (m, 1H), 3.07 (dd, *J* = 14.8, 3.8 Hz, 1H), 2.81 (dd, *J* = 14.8, 8.8 Hz, 1H), 2.57 (s, 3H), 2.48 (s, 3H), 1.20 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 199.7, 197.9, 153.7, 137.7, 134.9, 130.7, 128.6, 126.0, 124.7, 121.4, 119.6, 114.6, 111.9, 110.9, 74.8, 70.1, 28.6, 25.3, 24.6, 17.3.MS (ESI): Calculated for $C_{22}H_{25}N_2O_4$ ([M+H]$^+$): 381.1809, found: 381.1809.



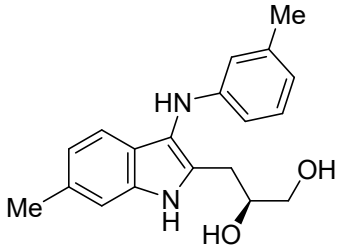
(2*R*,3*S*)-1-(6-bromo-3-((3-bromo-4-methylphenyl)amino)-5-methyl-1*H*-indol-2-yl)butane-2,3-diol (19a).Yellow solid, 147 mg, yield 78%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 98.9 - 101.5 °C. $[\alpha]_D^{25}$ +12.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 7.23 (d, *J* = 8.2 Hz, 1H), 6.98 (dd, *J* = 13.9, 8.2 Hz, 2H), 6.67 (d, *J* = 2.4 Hz, 1H), 6.42 (dd, *J* = 8.2, 2.4 Hz, 1H), 3.79 (dt, *J* = 8.9, 4.5 Hz, 1H), 3.68 – 3.63 (m, 1H), 3.03 (dd, *J* = 14.7, 4.1 Hz, 1H), 2.74 (dd, *J* = 14.7, 8.7 Hz, 1H), 2.41 (s, 3H), 2.24 (s, 3H), 1.19 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 149.8, 135.9, 134.5, 130.4, 127.7, 124.6, 124.4, 124.0, 123.4, 116.2, 113.7, 112.9, 112.4, 109.8, 74.8, 70.1, 28.4, 21.1, 20.4, 17.1.MS (ESI): Calculated for $C_{20}H_{23}N_2O_2Br_2$ ($[M+H]^+$): 481.0121, found: 481.0124.



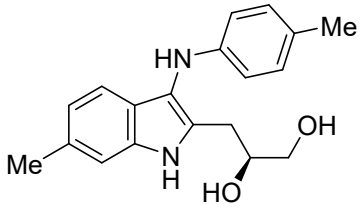
(2*R*,3*S*)-1-(3-((3,5-dimethylphenyl)amino)-5,7-dimethyl-1*H*-indol-2-yl)butane-2,3-diol (20a).Yellow solid, 115 mg, yield 85%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 106.5 - 108.2 °C. $[\alpha]_D^{25}$ +15.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, $CDCl_3$) δ 8.56 (s, 1H), 6.94 (s, 1H), 6.67 (s, 1H), 6.38 (s, 1H), 6.19 (s, 2H), 5.04 (s, 1H), 3.71 (ddd, *J* = 10.8, 7.4, 4.2 Hz, 2H), 2.84 (dd, *J* = 15.2, 2.8 Hz, 1H), 2.74 (dd, *J* = 15.2, 8.2 Hz, 1H), 2.42 (d, *J* = 3.0 Hz, 6H), 2.17 (s, 6H), 1.14 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, $CDCl_3$) δ 149.4, 139.0, 135.1, 132.5, 131.6, 129.4, 123.0, 122.6, 120.0, 115.2, 111.2, 108.7, 77.1, 75.0, 70.2, 27.4, 21.6, 21.5, 18.7, 17.7.MS (ESI): Calculated for $C_{22}H_{24}N_2O_2$ ($[M+H]^+$): 353.2224, found: 353.2227.



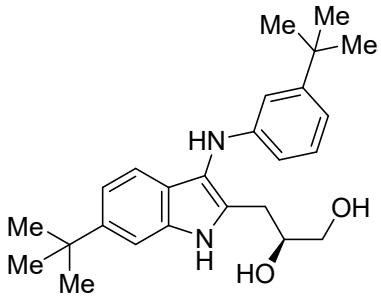
(*S*)-3-(7-methyl-3-(*o*-tolylamino)-1*H*-indol-2-yl)propane-1,2-diol (1b).Yellow solid, 84 mg, yield 67%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 105.2 - 106.7 °C. $[\alpha]_D^{25}$ -9.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 7.05 – 7.00 (m, 2H), 6.91 – 6.76 (m, 3H), 6.55 – 6.53 (m, 1H), 6.33 (dd, *J* = 8.0, 1.2 Hz, 1H), 4.03 – 3.94 (m, 1H), 3.52 (dd, *J* = 11.2, 4.4 Hz, 1H), 3.43 (dd, *J* = 11.4, 6.0 Hz, 1H), 2.96 (dd, *J* = 14.4, 5.8 Hz, 1H), 2.87 (dd, *J* = 14.6, 7.2 Hz, 1H), 2.50 (s, 3H), 2.33 (s, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 146.5, 134.0, 130.5, 129.6, 126.2, 125.3, 121.5, 121.2, 120.0, 118.5, 116.6, 115.8, 115.5, 111.7, 71.7, 65.3, 29.3, 16.7, 15.4.MS (ESI): Calculated for $C_{19}H_{23}N_2O_2$ ($[M+H]^+$): 311.1754, found: 311.1758.



(*S*)-3-(6-methyl-3-(*m*-tolylamino)-1*H*-indol-2-yl)propane-1,2-diol (2b).Yellow solid, 94 mg, yield 73%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 100.0 - 100.9 °C. $[\alpha]_D^{25}$ -14.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 7.15 (d, *J* = 8.2 Hz, 1H), 6.95 – 6.93 (m, 2H), 6.68 (d, *J* = 7.2 Hz, 1H), 6.43 (d, *J* = 7.6 Hz, 1H), 6.37 (d, *J* = 2.6 Hz, 1H), 6.35 – 6.29 (m, 1H), 3.98 – 3.96 (m, 1H), 3.53 (dd, *J* = 11.4, 4.2 Hz, 1H), 3.45 (dd, *J* = 11.4, 6.4 Hz, 1H), 2.92 (dd, *J* = 14.4, 6.0 Hz, 1H), 2.83 (dd, *J* = 14.6, 7.4 Hz, 1H), 2.40 (s, 3H), 2.19 (s, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 150.5, 138.2, 134.9, 132.4, 129.1, 128.9, 128.4, 124.9, 120.6, 119.9, 117.1, 113.1, 109.9, 108.3, 71.6, 65.5, 47.7, 29.4, 29.1, 20.4, 17.4.MS (ESI): Calculated for $C_{19}H_{23}N_2O_2$ ($[M+H]^+$): 311.1754, found: 311.1754.

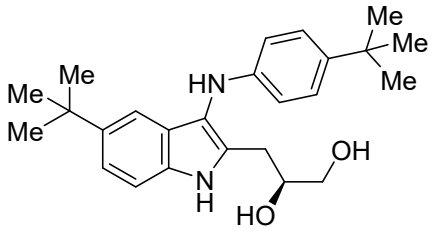


(*S*)-3-(6-methyl-3-(*p*-tolylamino)-1*H*-indol-2-yl)propane-1,2-diol (3b).Yellow solid, 78 mg, yield 59%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 97.6 - 98.8 °C. $[\alpha]_D^{25}$ -13.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.22 – 7.16 (m, 1H), 7.02 (s, 1H), 6.89 (d, *J* = 7.4 Hz, 3H), 6.61 – 6.46 (m, 2H), 3.96 (p, *J* = 6.2 Hz, 1H), 3.55 – 3.40 (m, 2H), 2.99 – 2.74 (m, 2H), 2.34 (s, 3H), 2.21 (s, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 146.7, 133.1, 131.3, 129.7, 128.9, 127.3, 125.8, 125.6, 122.1, 117.2, 114.9, 113.1, 110.3, 71.6, 65.4, 47.6, 29.4, 20.3, 19.2.MS (ESI): Calculated for $C_{19}H_{23}N_2O_2$ ($[M+H]^+$): 311.1754, found: 311.1752.

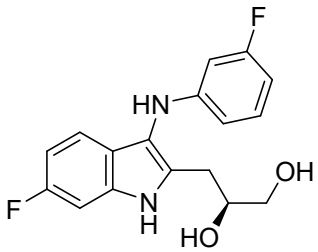


(*S*)-3-(6-(*tert*-butyl)-3-((3-(*tert*-butyl)phenyl)amino)-1*H*-indol-2-yl)propane-1,2-diol (4b).Yellow solid, 113 mg, yield 74%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 97.5 - 99.8 °C. $[\alpha]_D^{25}$ -11.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.35 (d, *J* = 1.6 Hz, 1H), 7.18 (d, *J* = 8.4 Hz, 1H), 7.05 (dt, *J* = 8.6, 1.4 Hz, 1H), 6.99 (t, *J* = 7.8 Hz, 1H), 6.81 – 6.79 (m, 1H), 6.68 (ddd, *J* = 7.8, 1.8, 1.0 Hz, 1H), 6.39 (ddd, *J* = 8.0, 2.2, 1.2 Hz, 1H), 3.99 – 3.97 (m, 1H), 3.54 (dd, *J* = 11.4, 4.4 Hz, 1H), 3.46 (dd, *J* = 11.4, 6.2 Hz, 1H), 2.96 (dd, *J* = 14.6, 5.8 Hz, 1H), 2.88 (dd, *J* = 14.6, 7.2 Hz, 1H), 1.39 (s, 9H), 1.26 (s, 9H).^{13}C NMR (101 MHz,

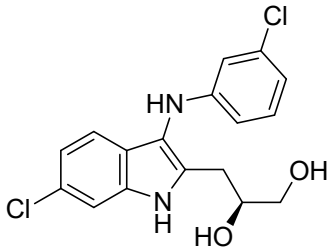
CD_3OD) δ 151.5, 148.6, 143.9, 135.0, 130.3, 128.1, 123.2, 117.3, 116.4, 114.8, 113.8, 110.5, 110.1, 106.9, 71.7, 65.4, 47.7, 34.1, 34.0, 31.0, 30.5, 29.4.MS (ESI): Calculated for $C_{25}H_{35}N_2O_2$ ([M+H]$^+$): 395.2693, found: 395.2689.



(*S*)-3-(5-(*tert*-butyl)-3-((4-(*tert*-butyl)phenyl)amino)-1*H*-indol-2-yl)propane-1,2-diol (5b).Yellow solid, 83mg, yield 57%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 97.5 - 98.5 °C. $[\alpha]_D^{25}$ -14.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.37 – 7.31 (m, 2H), 7.27 – 7.21 (m, 3H), 6.71 – 6.63 (m, 2H), 4.12 – 4.00 (m, 1H), 3.61 (dd, *J* = 11.4, 4.2 Hz, 1H), 3.53 (dd, *J* = 11.4, 6.2 Hz, 1H), 3.03 (dd, *J* = 14.6, 5.8 Hz, 1H), 2.97 – 2.87 (m, 1H), 1.39 (s, 9H), 1.36 (s, 9H).^{13}C NMR (101 MHz, CD_3OD) δ 146.6, 141.1, 139.4, 133.0, 131.1, 126.3, 125.5, 125.3, 118.8, 115.5, 113.5, 112.9, 110.1, 71.7, 65.5, 47.7, 34.0, 33.4, 31.2, 30.8, 29.5.MS (ESI): Calculated for $C_{19}H_{23}N_2O_2$ ([M+H]$^+$): 395.2693, found: 395.2694.

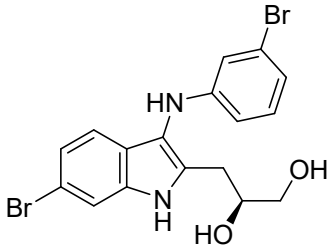


(*S*)-3-(6-fluoro-3-((3-fluorophenyl)amino)-1*H*-indol-2-yl)propane-1,2-diol (6b).Yellow solid, 76 mg, yield 52%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 95.5 - 96.7 °C. $[\alpha]_D^{25}$ -20.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.21 – 7.13 (m, 1H), 7.08 – 6.96 (m, 2H), 6.77 – 6.74 (m, 1H), 6.43 (dd, *J* = 8.2, 2.2 Hz, 1H), 6.32 – 6.30 (m, 1H), 6.26 – 6.18 (m, 1H), 4.01 – 3.92 (m, 1H), 3.57 – 3.42 (m, 2H), 3.00 – 2.78 (m, 2H).^{13}C NMR (101 MHz, CD_3OD) δ 165.4, 163.0, 160.8, 158.4, 151.2, 151.1, 132.1, 129.8, 129.7, 121.9, 118.1, 118.0, 114.2, 108.7, 107.0, 106.8, 106.6, 103.8, 103.6, 102.6, 102.4, 99.3, 99.0, 96.9, 96.7, 71.4, 65.5, 29.3.MS (ESI): Calculated for $C_{17}H_{17}N_2O_2F_2$ ([M+H]$^+$): 319.1253, found: 319.1255.

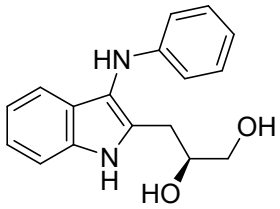


(*S*)-3-(6-chloro-3-((3-chlorophenyl)amino)-1*H*-indol-2-yl)propane-1,2-diol (7b).Yellow solid, 80 mg, yield 51%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 104.4 - 105.4 °C. $[\alpha]_D^{25}$ -19.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 7.39 – 7.25 (m, 1H), 7.02 (t, *J* = 8.2, 2H), 6.94 (t, *J* = 8.2 Hz, 1H), 6.61 – 6.43

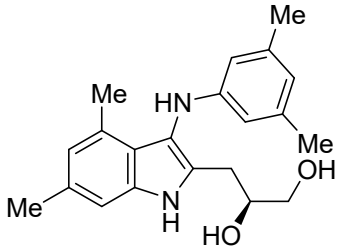
(m, 3H), 4.04 – 3.92 (m, 1H), 3.59 – 3.51 (m, 1H), 3.51 – 3.43 (m, 1H), 2.95 (dd, *J* = 14.6, 5.6 Hz, 1H), 2.83 (dd, *J* = 14.6, 7.6 Hz, 1H).^{13}C NMR (101 MHz, CD_3OD) δ 151.8, 136.2, 135.0, 134.4, 134.3, 129.6, 123.9, 123.8, 121.3, 119.6, 118.3, 116.0, 112.3, 111.2, 109.6, 71.3, 65.6, 29.1.MS (ESI): Calculated for $C_{17}H_{17}N_2O_2Cl_2$ ([M+H]$^+$): 351.0662, found: 351.0667.



(*S*)-3-(6-bromo-3-((3-bromophenyl)amino)-1*H*-indol-2-yl)propane-1,2-diol (8b).Yellow solid, 96 mg, yield 60%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 103.3 - 104.7 °C. $[\alpha]_D^{25}$ -23.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.35 (d, *J* = 8.0 Hz, 1H), 7.13 (d, *J* = 7.6 Hz, 1H), 6.97 – 6.95 (m, 2H), 6.71 (dd, *J* = 7.8, 1.8 Hz, 1H), 6.62 (t, *J* = 2.2 Hz, 1H), 6.47 (dd, *J* = 8.4, 2.2 Hz, 1H), 4.03 – 3.93 (m, 1H), 3.58 – 3.43 (m, 2H), 2.99 – 2.76 (m, 2H).^{13}C NMR (101 MHz, CD_3OD)δ 151.9, 135.5, 129.8, 123.6, 122.9, 122.5, 121.7, 119.1, 118.9, 115.3, 113.6, 111.6, 111.1, 110.1, 71.2, 65.5, 29.1.MS (ESI): Calculated for $C_{17}H_{17}N_2O_2Br_2$ ([M+H]$^+$): 438.9651, found: 438.9648.

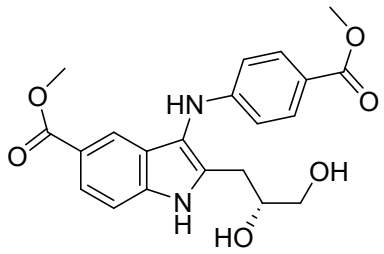


(S)-3-(3-(phenylamino)-1H-indol-2-yl)propane-1,2-diol (9b). Yellow solid, 81 mg, yield 72%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 107.5 - 108.5 °C. $[\alpha]_D^{25}$ -16.0 (*c* 0.1, CH_3OH); ^{1}H NMR (400 MHz, CD_3OD) δ 7.29 (d, *J* = 8.0 Hz, 1H), 7.06 – 6.98 (m, 2H), 6.93 (d, *J* = 7.6 Hz, 1H), 6.61 – 6.43 (m, 3H), 3.80 – 3.78 (m, 1H), 3.68 – 3.63 (m, 1H), 3.05 (dd, *J* = 14.8, 4.2 Hz, 1H), 2.76 (dd, *J* = 14.6, 8.8 Hz, 1H), 1.20 (d, *J* = 6.4 Hz, 3H).^{13}C NMR (101 MHz, CD_3OD) δ 151.8, 136.2, 135.7, 134.3, 129.5, 123.7, 121.2, 119.5, 116.0, 112.4, 111.3, 109.5, 74.8, 70.1, 47.6.MS (ESI): Calculated for $C_{17}H_{19}N_2O_2$ ([M+H]$^+$): 238.1441, found: 238.1444.

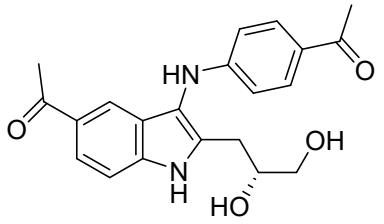


(*S*)-3-(3-((3,5-dimethylphenyl)amino)-4,6-dimethyl-1*H*-indol-2-yl)propane-1,2-diol (10b).Yellow solid, 108 mg, yield 83%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 92.7 - 94.3 °C. $[\alpha]_D^{25}$ -36.0 (*c* 0.1, CH_3OH); ^{1}H NMR (600 MHz, CD_3OD) δ 6.81 (s, 1H), 6.40 (s, 1H), 6.13 (s, 1H), 6.03 (s, 2H), 3.83 – 3.81 (m, 1H),

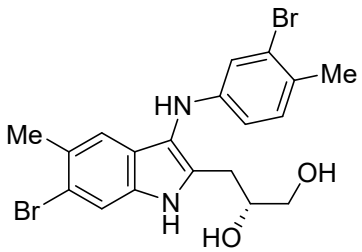
3.39 (dd, *J*= 11.4, 4.2 Hz, 1H), 3.31 (dd, *J* = 11.4, 6.4 Hz, 1H), 2.75 (dd, *J* = 14.6, 5.8 Hz, 1H), 2.66 (dd, *J* = 14.6, 7.4 Hz, 1H), 2.23 (d, *J* = 7.8 Hz, 6H), 2.01 (s, 6H).^{13}C NMR (151 MHz, CD_3OD) δ 150.4, 138.0, 135.3, 131.5, 130.1, 128.6, 122.8, 121.7, 118.1, 115.1, 110.5, 108.2, 71.6, 65.5, 47.6, 29.1, 20.3, 20.2, 17.3.MS (ESI): Calculated for $C_{21}H_{27}N_2O_2$ ([M+H]$^+$): 339.2067, found: 339.2065.



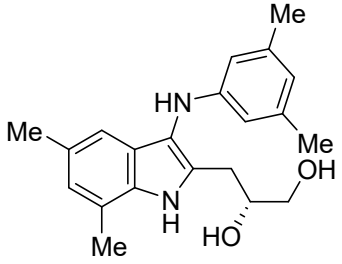
methyl(*R*)-2-(2,3-dihydroxypropyl)-3-((4-(methoxycarbonyl)phenyl)amino)-1*H*-indole-5-carboxylate (11b).Yellow solid, 92 mg, yield 60%, petroleum ether/ethyl acetate (*V/V*)=1:2, m.p. 90.6 - 92.4 °C. $[\alpha]_D^{25}$ -+31.0 (*c* 0.1, CH_3OH);^{1}H NMR (600 MHz, CD_3OD) δ 11.34 (s, 1H), 8.03 (s, 1H), 7.82 (d, *J* = 1.6 Hz, 1H), 7.68 (dd, *J* = 8.4, 1.4 Hz, 3H), 7.44 (d, *J* = 8.6 Hz, 1H), 6.59 (d, *J* = 8.4 Hz, 2H), 3.80 (dd, *J* = 8.2, 5.2 Hz, 1H), 3.77 (s, 3H), 3.74 (s, 3H), 3.29 (dd, *J* = 7.4, 5.6 Hz, 2H), 2.84 (dd, *J* = 14.6, 4.8 Hz, 1H), 2.65 (dd, *J* = 14.6, 8.2 Hz, 1H).^{13}C NMR (151 MHz, CD_3OD) δ 168.5, 167.6, 154.3, 138.2, 136.5, 132.3, 125.5, 122.9, 121.2, 120.7, 118.1, 114.9, 113.2, 112.6, 72.0, 66.9, 52.9, 52.5, 31.2.MS (ESI): Calculated for $C_{21}H_{23}N_2O_6$ ([M+H]$^+$): 399.1551, found: 399.1550.



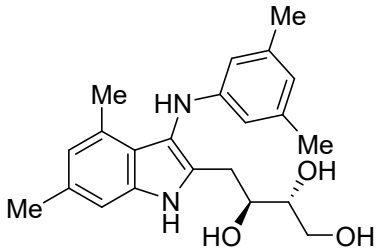
(*R*)-1-(4-((5-acetyl-2-(2,3-dihydroxypropyl)-1*H*-indol-3-yl)amino)phenyl)ethan-1-one(12b).Yellow solid, 91 mg, yield 55%, petroleum ether/ethyl acetate (*V/V*)=1:2, m.p. 93.6 - 94.8 °C. $[\alpha]_D^{25}$ +28.0 (*c* 0.1, CH_3OH);^{1}H NMR (600 MHz, CD_3OD) δ 7.85 (d, *J* = 1.7 Hz, 1H), 7.70 – 7.66 (m, 3H), 7.31 (d, *J* = 8.6 Hz, 1H), 6.54 (d, *J* = 8.5 Hz, 2H), 3.89 – 3.84 (m, 1H), 3.40 (dd, *J* = 11.2, 4.5 Hz, 1H), 3.35 (dd, *J* = 11.3, 6.2 Hz, 1H), 2.84 (dd, *J* = 14.7, 5.2 Hz, 1H), 2.73 (dd, *J* = 14.7, 7.8 Hz, 1H), 2.44 (s, 3H), 2.36 (s, 3H).^{13}C NMR (151 MHz, CD_3OD) δ 199.7, 197.8, 153.7, 137.7, 134.3, 130.7, 128.7, 126.0, 124.7, 121.4, 119.5, 114.7, 111.8, 110.8, 71.2, 65.5, 47.6, 29.3, 25.2, 24.6.MS (ESI): Calculated for $C_{21}H_{23}N_2O_4$ ([M+H]$^+$): 367.1652, found: 367.1651.



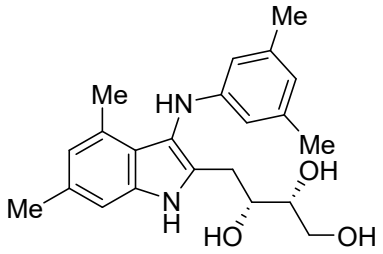
(*R*)-3-(6-bromo-3-((3-bromo-4-methylphenyl)amino)-5-methyl-1*H*-indol-2-yl)propane-1,2-diol (13b).Yellow solid, 140 mg, yield 72%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 97.5 - 99.7 °C. $[\alpha]_D^{25}$ +40.0 (*c* 0.1, CH_3OH);^{1}H NMR (600 MHz, CD_3OD) δ 7.10 (d, *J* = 8.2 Hz, 1H), 6.87 (d, *J* = 8.2 Hz, 1H), 6.83 (d, *J* = 8.4 Hz, 1H), 6.54 (d, *J* = 2.4 Hz, 1H), 6.27 (dd, *J* = 8.4, 2.4 Hz, 1H), 3.89 – 3.83 (m, 1H), 3.40 (dd, *J* = 11.4, 4.4 Hz, 1H), 3.33 (dd, *J* = 11.4, 6.4 Hz, 1H), 2.79 (dd, *J* = 14.6, 5.6 Hz, 1H), 2.68 (dd, *J* = 14.6, 7.6 Hz, 1H), 2.28 (s, 3H), 2.11 (s, 3H).^{13}C NMR (151 MHz, CD_3OD) δ 149.8, 135.3, 134.4, 130.4, 127.8, 124.5, 124.4, 124.0, 123.5, 116.1, 113.7, 112.9, 112.3, 109.8, 71.3, 65.5, 29.2, 21.0, 20.3.MS (ESI): Calculated for $C_{19}H_{21}N_2O_2Br_2$ ($[M+H]^+$): 466.9964, found: 466.9967.



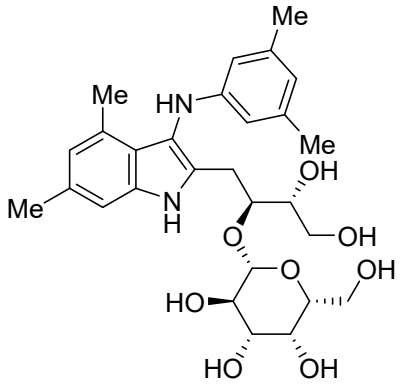
(*R*)-3-(3-((3,5-dimethylphenyl)amino)-5,7-dimethyl-1*H*-indol-2-yl)propane-1,2-diol (14b).Yellow solid, 95 mg, yield 74%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 108.5 - 109.3 °C. $[\alpha]_D^{25}$ +17.0 (*c* 0.1, CH_3OH);^{1}H NMR (400 MHz, CD_3OD) δ 6.95 (s, 1H), 6.53 (s, 1H), 6.26 (s, 1H), 6.16 (s, 2H), 3.96 (qd, *J* = 6.4, 4.1 Hz, 1H), 3.53 (dd, *J* = 11.3, 4.1 Hz, 1H), 3.44 (dd, *J* = 11.3, 6.3 Hz, 1H), 2.89 (dd, *J* = 14.5, 5.9 Hz, 1H), 2.80 (dd, *J* = 14.5, 7.2 Hz, 1H), 2.37 (d, *J* = 6.0 Hz, 6H), 2.14 (s, 6H).^{13}C NMR (101 MHz, CD_3OD) δ 150.5, 138.0, 135.4, 131.5, 130.1, 128.7, 122.8, 121.7, 118.2, 115.1, 110.5, 108.2, 71.6, 65.5, 29.1, 20.3, 17.4.MS (ESI): Calculated for $C_{21}H_{27}N_2O_2$ ($[M+H]^+$): 339.2067, found: 339.2066.



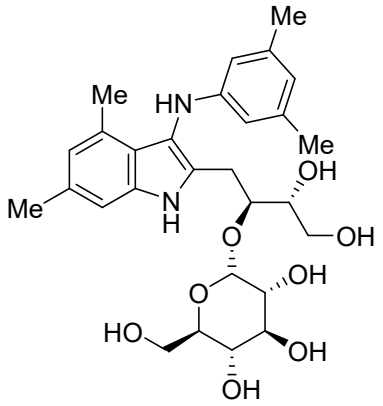
(2*R*,3*S*)-4-(3-((3,5-dimethylphenyl)amino)-4,6-dimethyl-1*H*-indol-2-yl)butane-1,2,3-triol(15b).Yellow solid, 117 mg, yield 82%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 122.6 - 123.4 °C. $[\alpha]_D^{25}$ -9.0 (*c* 0.1, CH_3OH); ^{1}H NMR (600 MHz, CD_3OD) δ 6.92 (s, 1H), 6.50 (s, 1H), 6.24 (s, 1H), 6.15 (s, 2H), 3.86 (dd, *J* = 9.8, 5.0 Hz, 1H), 3.73 – 3.66 (m, 1H), 3.60 – 3.52 (m, 1H), 3.50 – 3.41 (m, 1H), 3.01 (dd, *J* = 14.8, 4.0 Hz, 1H), 2.80 (dd, *J* = 14.8, 8.2 Hz, 1H), 2.34 (s, 6H), 2.11 (s, 6H).^{13}C NMR (151 MHz, CD_3OD) δ 151.8, 139.5, 139.4, 136.7, 133.2, 131.5, 130.0, 124.2, 123.1, 119.7, 119.7, 116.6, 112.1, 112.0, 109.6, 109.6, 75.9, 73.5, 64.6, 64.5, 30.2, 21.7, 21.6, 21.6, 18.8, 18.7.MS (ESI): Calculated for $C_{22}H_{29}N_2O_3$ ($[M+H]^+$): 369.2173, found: 369.2175.



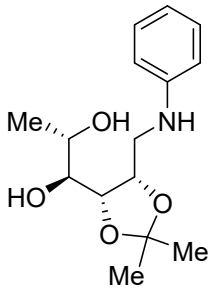
(2*R*,3*R*)-4-(3-((3,5-dimethylphenyl)amino)-4,6-dimethyl-1*H*-indol-2-yl)butane-1,2,3-triol (16b).Yellow solid, 119 mg, yield 76%, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 107.5 - 108.9 °C. $[\alpha]_D^{25}$ -2.0 (*c* 0.1, CH_3OH);^{1}H NMR (600 MHz, CD_3OD) δ 6.80 (s, 1H), 6.39 (s, 1H), 6.12 (s, 1H), 6.03 (s, 2H), 3.84 – 3.76 (m, 1H), 3.45 (t, *J* = 6.0 Hz, 2H), 3.35 (ddd, *J* = 6.4, 5.4, 3.0 Hz, 1H), 2.84 – 2.74 (m, 2H), 2.22 (s, 6H), 1.99 (s, 6H).^{13}C NMR (151 MHz, CD_3OD) δ 150.4, 138.1, 135.3, 131.6, 130.2, 128.6, 122.8, 121.7, 118.2, 115.1, 110.6, 108.2, 73.2, 70.8, 63.4, 29.3, 20.3, 20.3, 17.4.MS (ESI): Calculated for $C_{22}H_{29}N_2O_3$ ($[M+H]^+$): 369.2173, found: 369.2170.



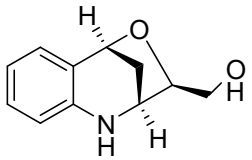
(2*R*,3*R*,4*S*,5*R*,6*R*)-2-(((2*S*,3*R*)-1-(3-((3,5-dimethylphenyl)amino)-4,6-dimethyl-1*H*-indol-2-yl)-3,4-dihydroxybutan-2-yl)oxy)-6-(hydroxymethyl)tetrahydro-2*H*-pyran-3,4,5-triol. (17b).Yellow solid, 82 mg, yield 73%, DCM/MeOH (*V/V*) = 5:1, m.p. 130.6 - 131.2 °C. $[\alpha]_D^{25}$ +10.0 (*c* 0.1, CH_3OH); ^{1}H NMR (600 MHz, CD_3OD) δ 6.97 (s, 1H), 6.52 (s, 1H), 6.27 (s, 1H), 6.19 (s, 2H), 4.44 (d, *J* = 7.8 Hz, 1H), 4.03 (d, *J* = 5.6 Hz, 1H), 3.89 (d, *J* = 3.4 Hz, 1H), 3.78 (dd, *J* = 6.2, 2.0 Hz, 2H), 3.69 – 3.64 (m, 2H), 3.64 – 3.57 (m, 2H), 3.55 (t, *J* = 6.2 Hz, 1H), 3.51 (dd, *J* = 9.8, 3.4 Hz, 1H), 3.08 (d, *J* = 4.8 Hz, 2H), 2.36 (s, 6H), 2.13 (s, 6H).^{13}C NMR (151 MHz, CD_3OD) δ 150.2, 138.1, 135.3, 130.8, 130.1, 128.5, 122.5, 121.6, 118.4, 115.4, 110.8, 108.3, 104.4, 81.0, 75.3, 73.4, 72.6, 71.6, 68.9, 62.7, 61.1, 26.7, 20.3, 20.3, 17.3.MS (ESI): Calculated for $C_{28}H_{39}N_2O_8$ ($[M+H]^+$): 531.2701, found: 531.2700.



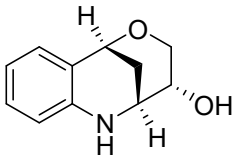
(2*S*,3*R*,4*S*,5*S*,6*R*)-2-(((2*S*,3*R*)-1-(3-((3,5-dimethylphenyl)amino)-4,6-dimethyl-1*H*-indol-2-yl)-3,4-dihydroxybutan-2-yl)oxy)-6-(hydroxymethyl)tetrahydro-2*H*-pyran-3,4,5-triol (18b).Yellow solid, 90 mg, yield 81%, DCM/MeOH (*V/V*) = 5:1, m.p. 139.5 - 140.1 °C. $[\alpha]_D^{25}$ +62.0 (*c* 0.1, CH_3OH); ^1H NMR (600 MHz, CD_3OD) δ 6.83 (s, 1H), 6.39 (s, 1H), 6.13 (s, 1H), 6.03 (s, 2H), 4.95 (d, *J* = 3.8 Hz, 1H), 3.87- 3.83 (m 1H), 3.73 (dd, *J* = 11.6, 2.4 Hz, 1H), 3.68 (ddd, *J* = 10.2, 5.6, 2.4 Hz, 1H), 3.63 (t, *J* = 9.4 Hz, 1H), 3.58 (dd, *J* = 11.6, 5.6 Hz, 1H), 3.53 (dt, *J* = 6.2, 3.2 Hz, 1H), 3.50 – 3.44 (m, 2H), 3.43 – 3.40 (m, 1H), 3.23 (d, *J* = 10.2 Hz, 1H), 2.92 – 2.81 (m, 2H), 2.24 (d, *J* = 9.8 Hz, 6H), 2.00 (s, 6H).^{13}C NMR (151 MHz, CD_3OD) δ 150.4, 138.1, 135.4, 131.1, 130.0, 128.6, 122.5, 121.6, 118.2, 115.3, 110.5, 108.3, 97.9, 78.3, 73.7, 72.9, 72.8, 72.1, 70.3, 63.0, 61.2, 23.7, 20.3, 20.3, 17.3.MS (ESI): Calculated for $C_{28}H_{39}N_2O_8$ ($[M+H]^+$): 531.2701, found: 531.2703.



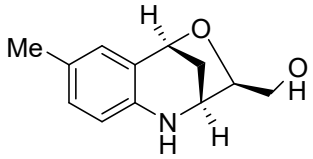
(1*S*)-1-((4*S*,5*S*)-2,2-dimethyl-5-((phenylamino)methyl)-1,3-dioxolan-4-yl)propane-1,2-diol (1c). Yellow solid, petroleum ether/ethyl acetate (*V/V*)=1:1, m.p. 112.6 - 113.4 °C.^1H NMR (600 MHz, CD_3OD) δ 7.01 (dd, *J* = 8.6, 7.2 Hz, 2H), 6.59 (d, *J* = 8.0 Hz, 2H), 6.55 (d, *J* = 7.4 Hz, 1H), 4.35 – 4.27 (m, 2H), 3.63 – 3.58 (m, 1H), 3.38 – 3.32 (m, 2H), 3.19 (dd, *J* = 12.4, 7.0 Hz, 1H), 1.39 (s, 3H), 1.27 (s, 3H), 1.17 (d, *J* = 6.2 Hz, 3H).^{13}C NMR (151 MHz, CD_3OD) δ 148.5, 128.7, 128.7, 117.2, 113.1, 107.7, 76.3, 75.8, 73.0, 68.2, 44.4, 24.0, 22.8, 19.0.MS (ESI): Calculated for $C_{15}H_{24}NO_4$ ($[M+H]^+$): 282.1700, found: 282.1702.MS (ESI): Calculated for $C_{15}H_{24}NO_4$ ($[M+H]^+$): 282.1700, found: 282.1701.



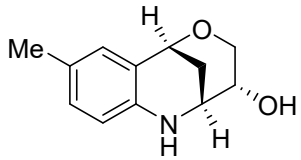
(3*R*)-1,3,4,6-tetrahydro-2*H*-2,6-methanobenzo[*c*][1,5]oxazocin-3-ol(2c). Yellow solid, yield 31%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 121.4 - 123.1°C.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.19 – 7.11 (m, 2H), 6.72 (t, *J* = 7.4 Hz, 1H), 6.64 (d, *J* = 8.0 Hz, 1H), 4.70 (p, *J* = 1.4 Hz, 1H), 3.82 – 3.75 (m, 1H), 3.72 (dd, *J* = 11.2, 5.8 Hz, 1H), 3.64 (d, *J* = 3.4 Hz, 1H), 2.92 (t, *J* = 10.6 Hz, 1H), 2.12 (ddd, *J* = 13.4, 3.4, 2.4 Hz, 1H), 1.89 (ddd, *J* = 13.2, 4.6, 1.8 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.4, 130.7, 129.7, 119.9, 117.7, 113.7, 68.9, 67.5, 62.8, 48.8, 27.8.MS (ESI): Calculated for $C_{11}H_{14}NO_2$ ($[M+H]^+$): 192.1019, found: 192.1019.



((3*R*)-1,2,3,5-tetrahydro-2,5-methanobenzo[*e*][1,4]oxazepin-3-yl)methanol(2c'). Yellow solid, yield 28%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 118.5 - 119.1°C.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.18 – 7.13 (m, 2H), 6.70 – 6.68 (m, 1H), 6.56 (dd, *J* = 8.4, 1.0 Hz, 1H), 4.75 (p, *J* = 1.6 Hz, 1H), 3.68 – 3.65 (m, 1H), 3.60 – 3.49 (m, 3H), 2.58 – 2.56 (m, 1H), 1.60 – 1.57 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.7, 130.8, 129.9, 118.4, 117.0, 113.0, 70.1, 69.0, 63.8, 47.8, 29.8, 23.9.MS (ESI): Calculated for $C_{11}H_{14}NO_2$ ($[M+H]^+$): 192.1019, found: 192.1018.

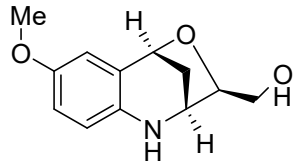


(3*R*)-8-methyl-1,3,4,6-tetrahydro-2*H*-2,6-methanobenzo[*c*][1,5]oxazocin-3-ol (3c). Yellow solid, yield 29%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 131.9 - 132.8°C.^{1}H NMR (400 MHz, $CDCl_3$) δ 6.98 (dd, *J* = 8.1, 2.0 Hz, 1H), 6.95 (d, *J* = 2.0 Hz, 1H), 6.57 (d, *J* = 8.2 Hz, 1H), 4.66 (t, *J* = 2.4 Hz, 1H), 3.79 – 3.68 (m, 2H), 3.62 (p, *J* = 2.6 Hz, 1H), 2.91 (t, *J*= 10.2 Hz, 1H), 2.24 (s, 3H), 2.11 (dt, *J* = 13.2, 2.8 Hz, 1H), 1.88 (ddd, *J* = 13.2, 4.6, 1.8 Hz, 1H).^{13}C NMR (101 MHz, $CDCl_3$) δ 143.0, 130.9, 130.5, 127.1, 120.0, 114.0, 68.8, 67.6, 67.5, 62.9, 48.8, 28.0, 20.4.MS (ESI): Calculated for $C_{12}H_{16}NO_2$ ($[M+H]^+$): 206.1176, found: 206.1175.

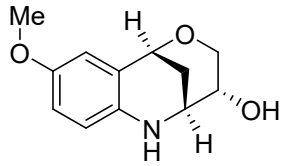


((3*R*)-7-methyl-1,2,3,5-tetrahydro-2,5-methanobenzo[*e*][1,4]oxazepin-3-yl)methanol (3c'). Yellow solid, yield 34%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 127.2 - 128.8°C.^{1}H NMR (400 MHz, $CDCl_3$) δ 6.97 (d, *J* = 6.6 Hz, 2H), 6.50 – 6.47 (m, 1H), 4.71 – 4.70 (m, 1H), 3.66 – 3.62 (m, 1H), 3.57 – 3.49 (m, 3H), 2.59 – 2.55 (m, 1H), 2.24 (s, 3H), 1.61 – 1.54 (m, 1H).^{13}C NMR (101 MHz, $CDCl_3$) δ 142.3, 131.0,

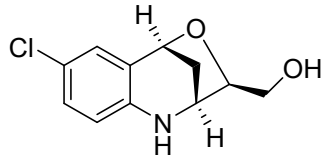
130.6, 126.2, 118.3, 113.0, 70.3, 69.1, 69.0, 63.8, 47.9, 24.1, 20.4.MS (ESI): Calculated for $C_{12}H_{16}NO_2$ ($[M+H]^+$): 206.1176, found: 206.1177.



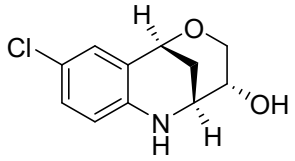
(3*R*)-8-methoxy-1,3,4,6-tetrahydro-2*H*-2,6-methanobenzo[*c*][1,5]oxazocin-3-ol(4c).Yellow solid, yield 34%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 115.4 - 116.7°C.^{1}H NMR (400 MHz, $CDCl_3$) δ 6.79 (dd, *J* = 8.8, 3.0 Hz, 1H), 6.71 (d, *J* = 2.8 Hz, 1H), 6.61 (d, *J* = 8.7 Hz, 1H), 4.65 (s, 1H), 3.74 (d, *J* = 6.3 Hz, 6H), 3.59 (s, 1H), 2.91 (q, *J* = 9.0, 7.4 Hz, 1H), 2.12 – 2.10 (m, 1H), 1.89 – 1.86 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 152.2, 139.2, 120.8, 116.9, 115.4, 114.7, 68.6, 67.7, 63.0, 55.8, 48.7, 28.0. MS (ESI): Calculated for $C_{12}H_{16}NO_3$ ($[M+H]^+$): 222.1125, found: 222.1126.



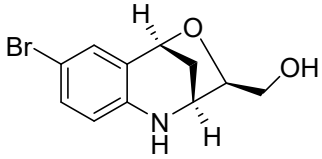
((3*R*)-7-methoxy-1,2,3,5-tetrahydro-2,5-methanobenzo[*e*][1,4]oxazepin-3-yl)methanol(4c').Yellow solid, yield 36%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 119.3 - 121.2°C.^{1}H NMR (400 MHz, $CDCl_3$) δ 6.79 (dd, *J* = 8.6, 2.6 Hz, 1H), 6.73 (d, *J* = 2.9 Hz, 1H), 6.51 (d, *J* = 8.6 Hz, 1H), 4.70 (s, 1H), 3.74 (d, *J* = 1.0 Hz, 3H), 3.60 (d, *J* = 8.2 Hz, 1H), 3.57 – 3.46 (m, 3H), 2.58 – 2.55 (m, 1H), 1.61 – 1.53 (m, 1H).^{13}C NMR (101 MHz, $CDCl_3$) δ 151.6, 138.8, 119.0, 117.1, 114.9, 114.3, 70.3, 69.2, 63.9, 55.9, 47.9, 24.0.MS (ESI): Calculated for $C_{12}H_{16}NO_3$ ($[M+H]^+$): 222.1125, found: 222.1128.



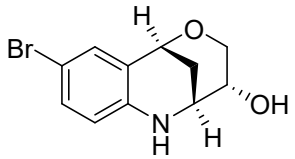
(3*R*)-8-chloro-1,3,4,6-tetrahydro-2*H*-2,6-methanobenzo[*c*][1,5]oxazocin-3-ol (5c).Yellow solid, yield 26%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 125.2 - 126.1°C.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.10 (d, *J* = 7.6 Hz, 2H), 6.60 – 6.56 (m, 1H), 4.64 (s, 1H), 4.48 (s, 1H), 3.80 – 3.38 (m, 1H), 3.73 (dd, *J* = 11.0, 6.0 Hz, 1H), 3.65 (s, 1H), 2.90 (t, *J* = 10.8 Hz, 1H), 2.14 – 2.10 (m, 1H), 1.85 (ddd, *J* = 13.1, 4.5, 1.8 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.0, 130.2, 129.6, 122.2, 121.2, 114.9, 68.9, 67.1, 67.1, 62.8, 48.8, 27.6.MS (ESI): Calculated for $C_{11}H_{13}NClO_2$ ($[M+H]^+$): 226.0629, found: 226.0629.



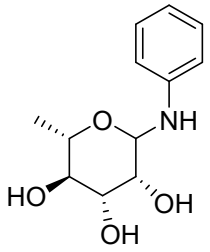
((3*R*)-7-chloro-1,2,3,5-tetrahydro-2,5-methanobenzo[*e*][1,4]oxazepin-3-yl)methanol(5c').Yellow solid, yield 26%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 132.7 - 133.5 °C.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.12 (d, *J* = 2.6 Hz, 1H), 7.09 (dd, *J* = 8.6, 2.6 Hz, 1H), 6.49 (d, *J* = 8.6 Hz, 1H), 4.68 (s, 1H), 4.42 (s, 1H), 3.74 – 3.63 (m, 2H), 3.58 (d, *J* = 13.0 Hz, 1H), 3.53 – 3.45 (m, 2H), 2.59 – 2.56 (m, 1H), 2.45 (s, 1H), 1.53 - 1.52 (m, 1H).^{13}C NMR (101 MHz, $CDCl_3$) δ 143.2, 130.3, 129.8, 128.0, 121.4, 119.7, 114.2, 69.9, 68.5, 63.8, 47.7, 23.6.MS (ESI): Calculated for $C_{11}H_{13}NClO_2$ ($[M+H]^+$): 226.0629, found: 226.0628.



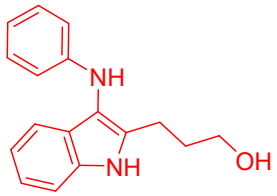
(3*R*)-8-bromo-1,3,4,6-tetrahydro-2*H*-2,6-methanobenzo[*c*][1,5]oxazocin-3-ol(6c).Yellow solid, yield 24%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 110.5 - 112.1°C.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 – 7.19 (m, 2H), 6.53 (d, *J* = 8.2 Hz, 1H), 4.64 (s, 1H), 4.51 (s, 1H), 3.79 – 3.76 (m, 2H), 3.65 (s, 1H), 2.90 (t, *J* = 10.6 Hz, 1H), 2.16 – 2.08 (m, 1H), 1.87 – 1.84 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.5, 133.0, 132.4, 121.7, 115.3, 109.1, 68.9, 67.0, 62.8, 48.7, 27.5. MS (ESI): Calculated for $C_{11}H_{13}NBrO_2$ ($[M+H]^+$): 270.0124, found: 270.0126.



((3*R*)-7-bromo-1,2,3,5-tetrahydro-2,5-methanobenzo[*e*][1,4]oxazepin-3-yl)methanol(6c').Yellow solid, yield 27%**.** petroleum ether/ethyl acetate (*V/V*) = 3:1, m.p. 120.3 - 121.5°C^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 – 7.19 (m, 2H), 6.44 (d, *J* = 8.6 Hz, 1H), 4.73 – 4.64 (m, 1H), 4.44 (d, *J* = 4.4 Hz, 1H), 3.66 (d, *J* = 5.8 Hz, 1H), 3.57 (d, *J* = 13.0 Hz, 1H), 3.53 – 3.45 (m, 2H), 3.39 – 3.36 (m, 1H), 2.59 – 2.55 (m, 1H), 1.54 – 1.51 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.6, 133.2, 132.6, 120.2, 114.6, 108.3, 69.8, 68.5, 63.8, 47.7, 23.5.MS (ESI): Calculated for $C_{11}H_{13}NBrO_2$ ($[M+H]^+$): 270.0124, found: 270.0125.



(2*S*,3*R*,4*R*,5*R*)-2-methyl-6-(phenylamino)tetrahydro-2*H*-pyran-3,4,5-triol (A).Yellow solid, petroleum ether/ethyl acetate (*V/V*)=1:3, m.p. 96.7 - 97.2 °C.^{1}H NMR (600 MHz, MeOD) δ 7.03 (dd, *J* = 8.6, 7.2 Hz, 2H), 6.63 (d, *J* = 8.0 Hz, 2H), 6.60 (t, *J* = 7.4 Hz, 1H), 4.73 (s, 1H), 3.81 (d, *J* = 3.4 Hz, 1H), 3.42 (dd, *J* = 5.4, 3.8 Hz, 1H), 3.25 (dd, *J* = 7.6, 4.8 Hz, 2H), 1.17 (d, *J* = 5.6 Hz, 3H).^{13}C NMR (151 MHz, MeOD) δ 145.7, 128.6, 118.1, 113.7, 82.0, 74.5, 72.8, 72.6, 71.7, 16.6.



3-(3-(phenylamino)-1*H*-indol-2-yl)propan-1-ol (7c):Yellow solid, petroleum ether/ethyl acetate (*V/V*)=1:1, ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.24 (s, 1H), 7.33 (dd, *J* = 20.6, 8.0 Hz, 2H), 7.14 (q, *J* = 8.2 Hz, 3H), 7.04 (t, *J* = 7.6 Hz, 1H), 6.72 (t, *J* = 7.4 Hz, 1H), 6.64 (d, *J* = 7.8 Hz, 2H), 5.22 (s, 1H), 3.67 (t, *J* = 6.0 Hz, 2H), 2.88 (t, *J* = 7.2 Hz, 2H), 1.89 (t, *J* = 6.6 Hz, 2H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 148.3, 134.6, 134.3, 129.1, 126.0, 121.6, 119.5, 118.1, 117.8, 114.4, 113.4, 110.8, 61.8, 31.2, 21.7.MS (ESI): Calculated for $C_{17}H_{19}N_2O$ ($[M+H]^+$): 267.1492, found: 267.1498.

3. NMR spectra of the compounds

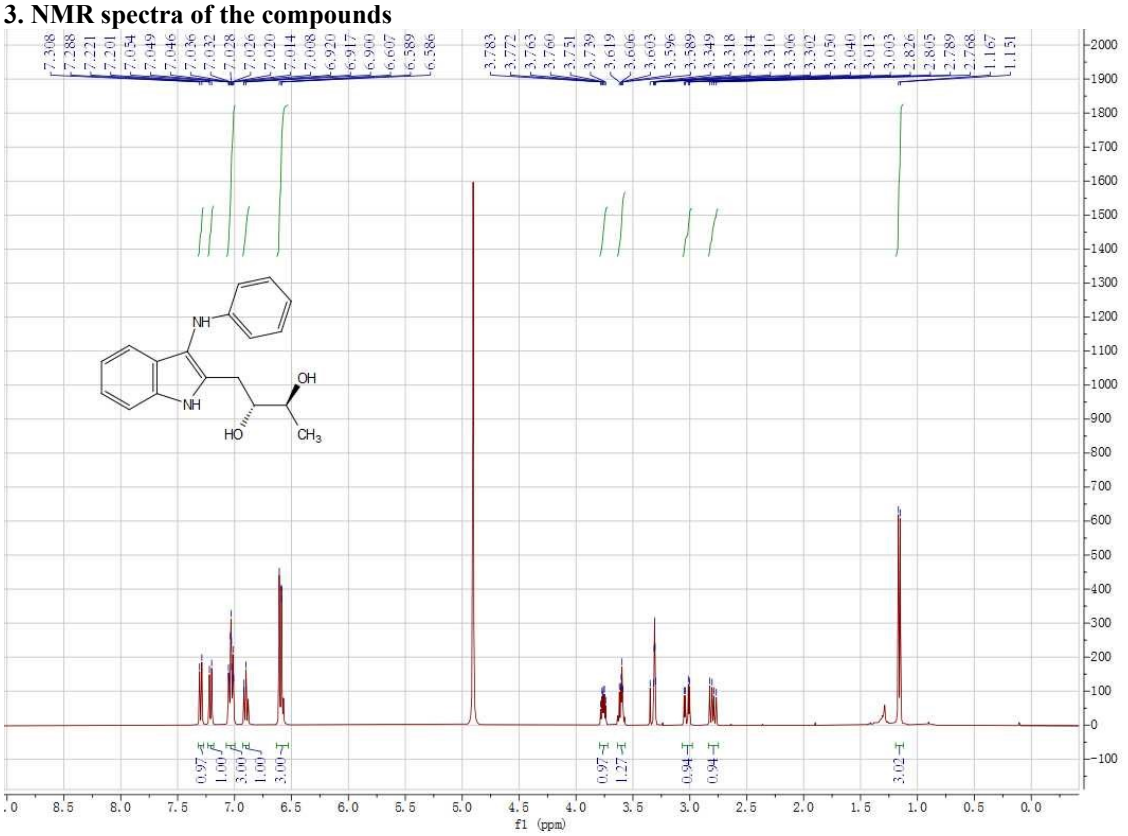


Figure. S1 ^{1}H NMR of compound**1a**

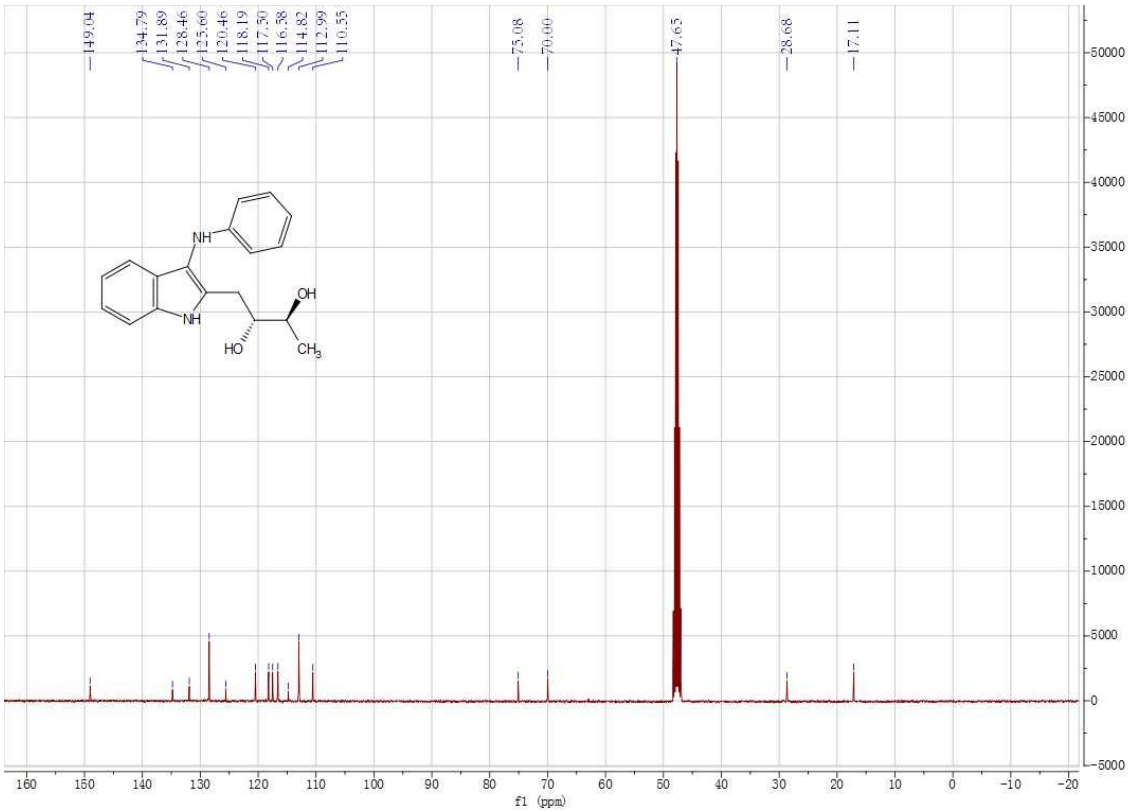


Figure. S2^{13}C{^{1}H} NMR of compound **1a**

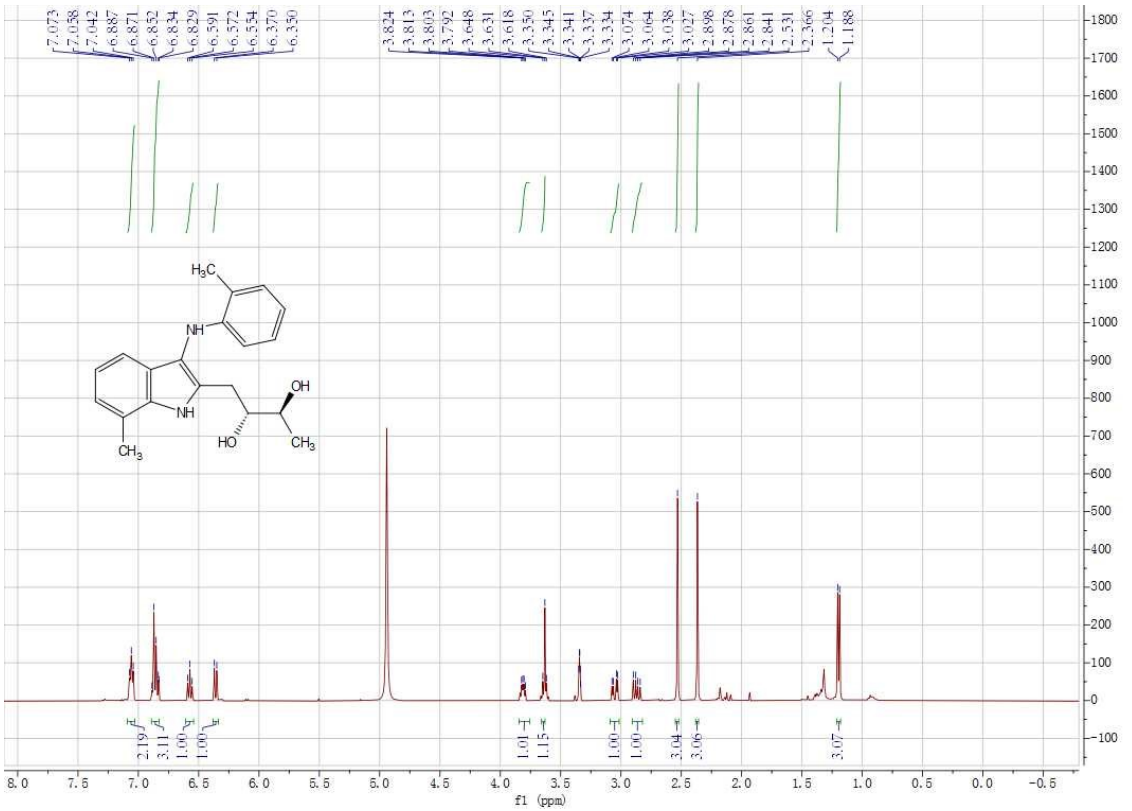


Figure.S3[1]H NMR of compound**2a**

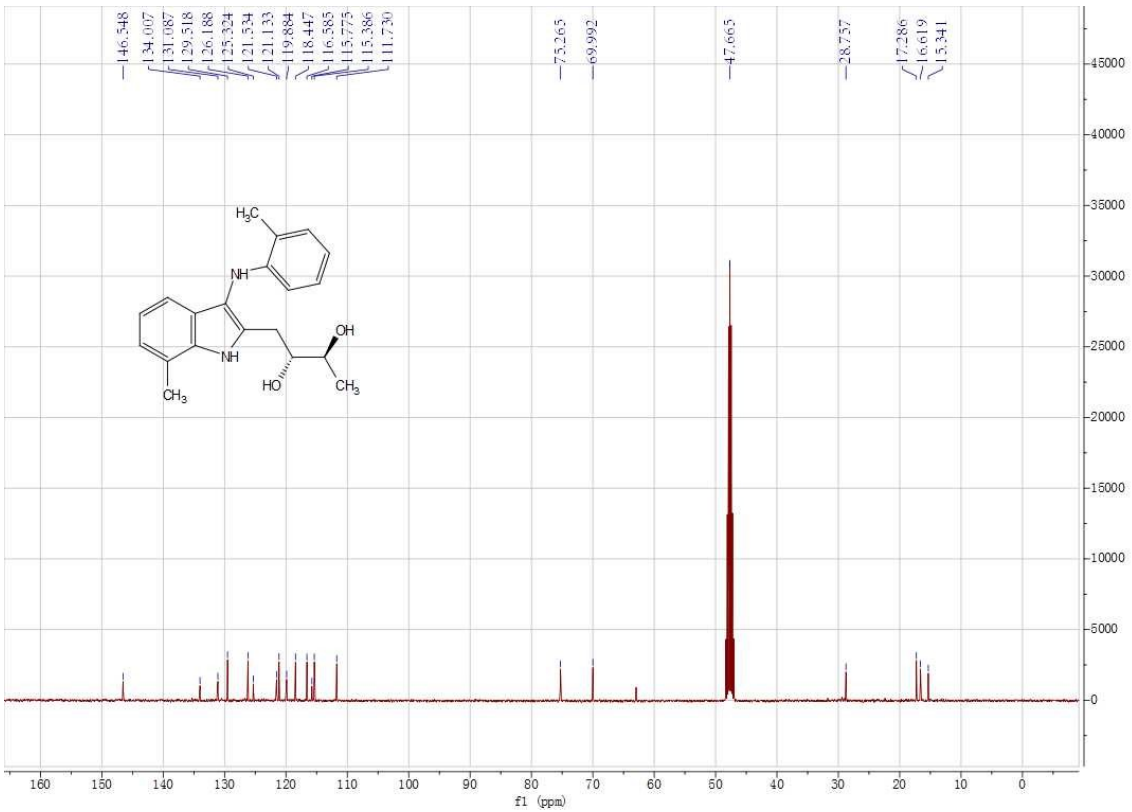


Figure. S4[13]C{[1]H} NMR of compound **2a**

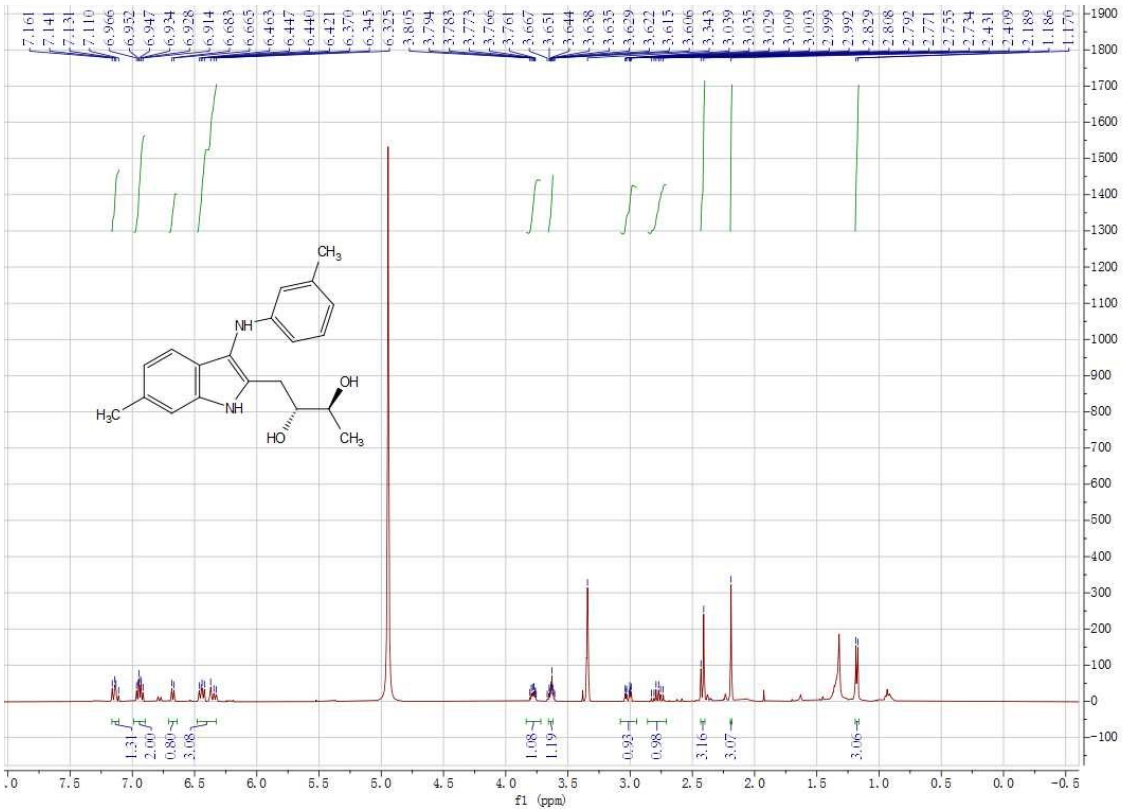


Figure. S5[1]H NMR of compound**3a**

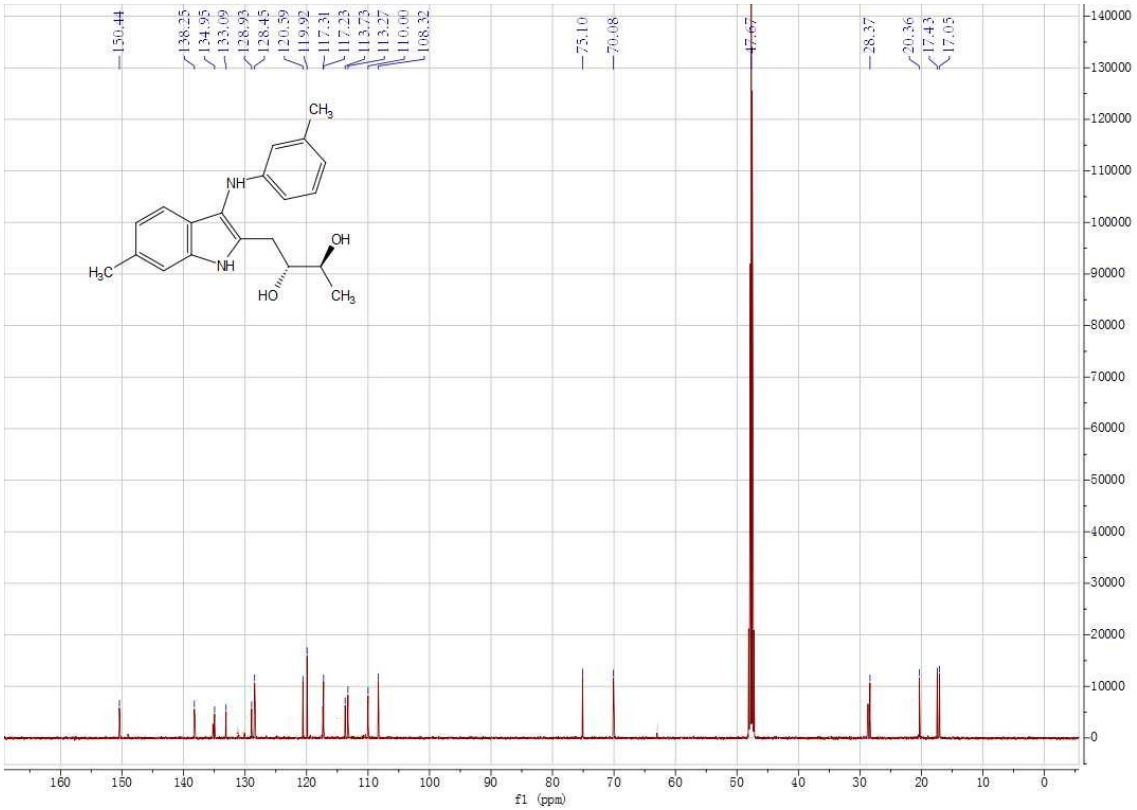


Figure.S6[13]C{[1]H} NMR of compound **3a**

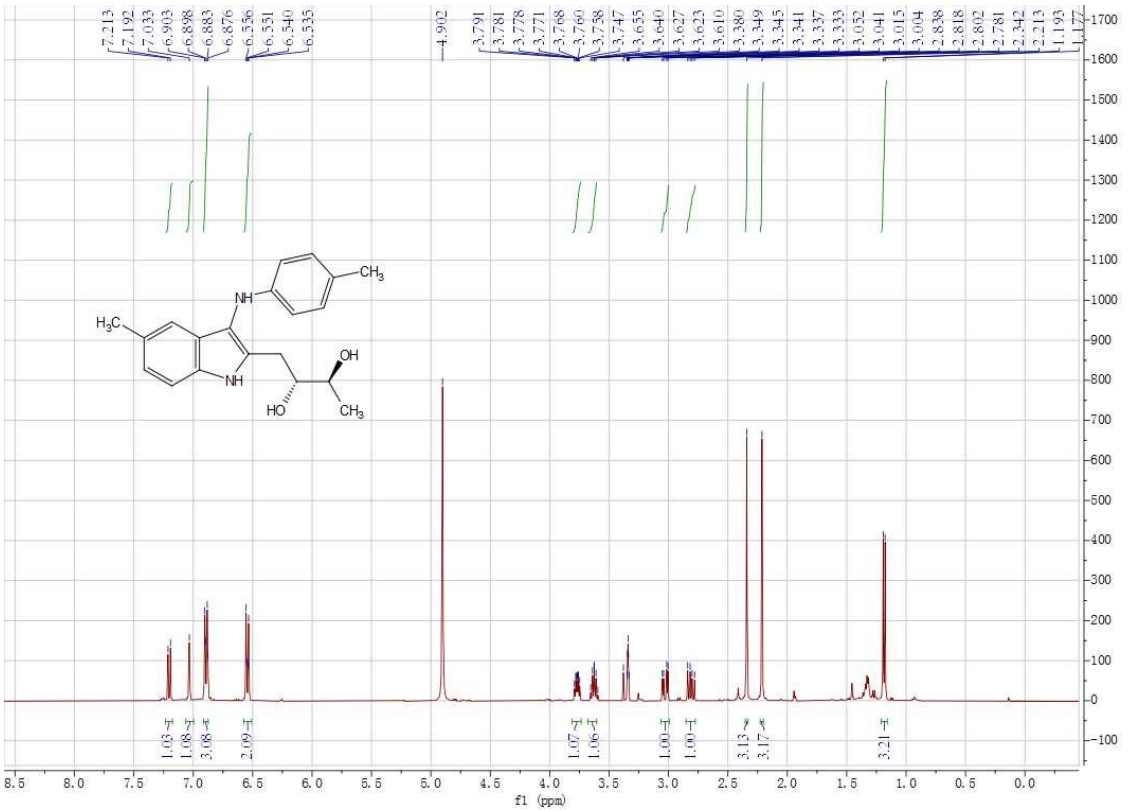


Figure.S7[1]H NMR of compound**4a**

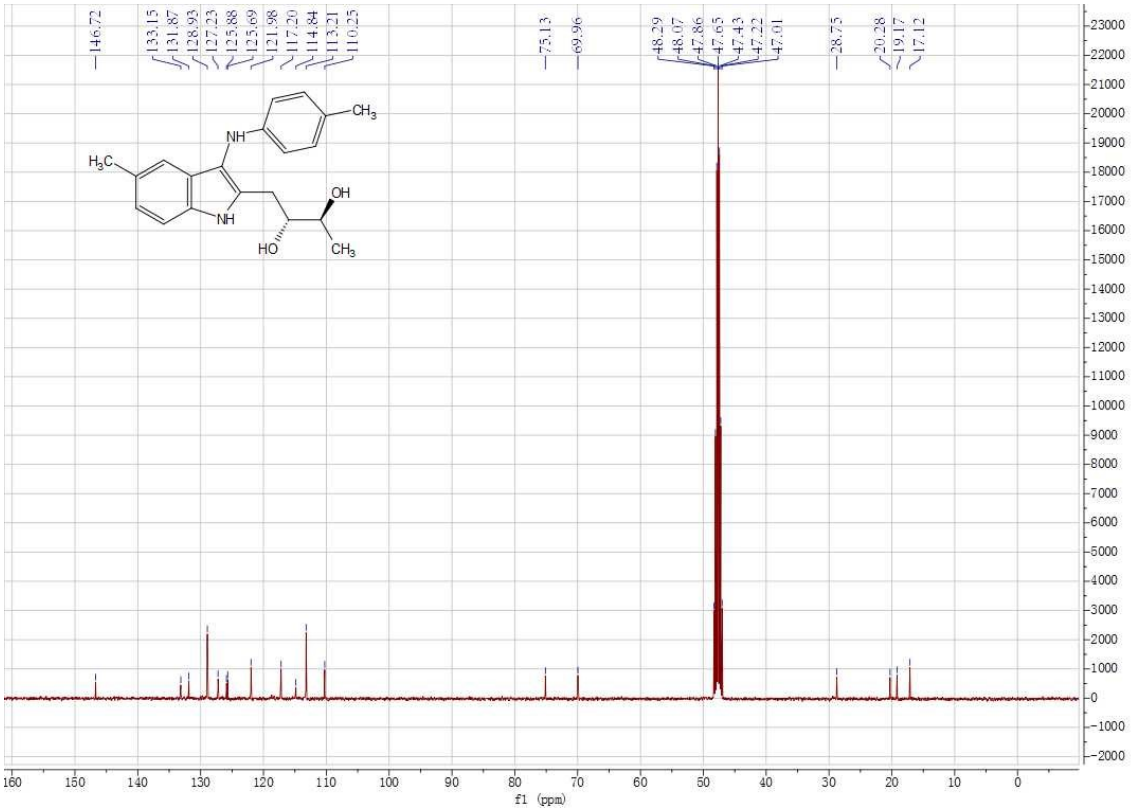


Figure.S8[13]C{[1]H} NMR of compound **4a**

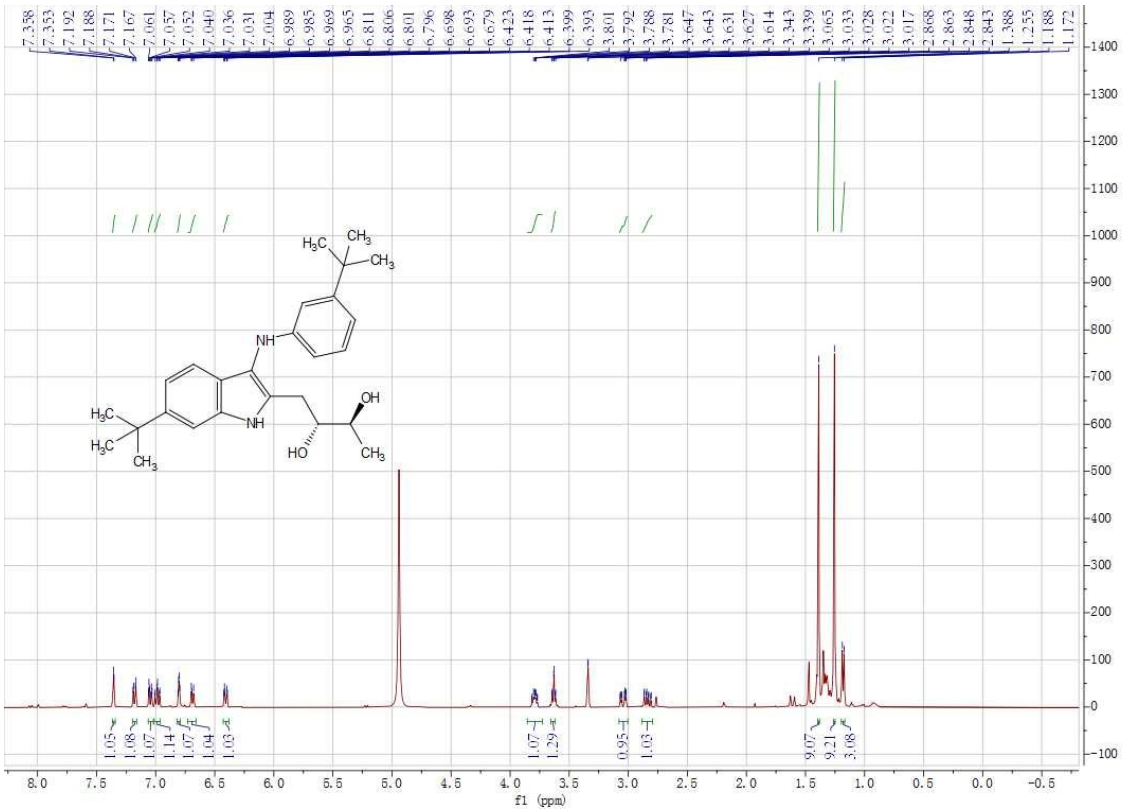


Figure.S9^{1}H NMR of compound**5a**

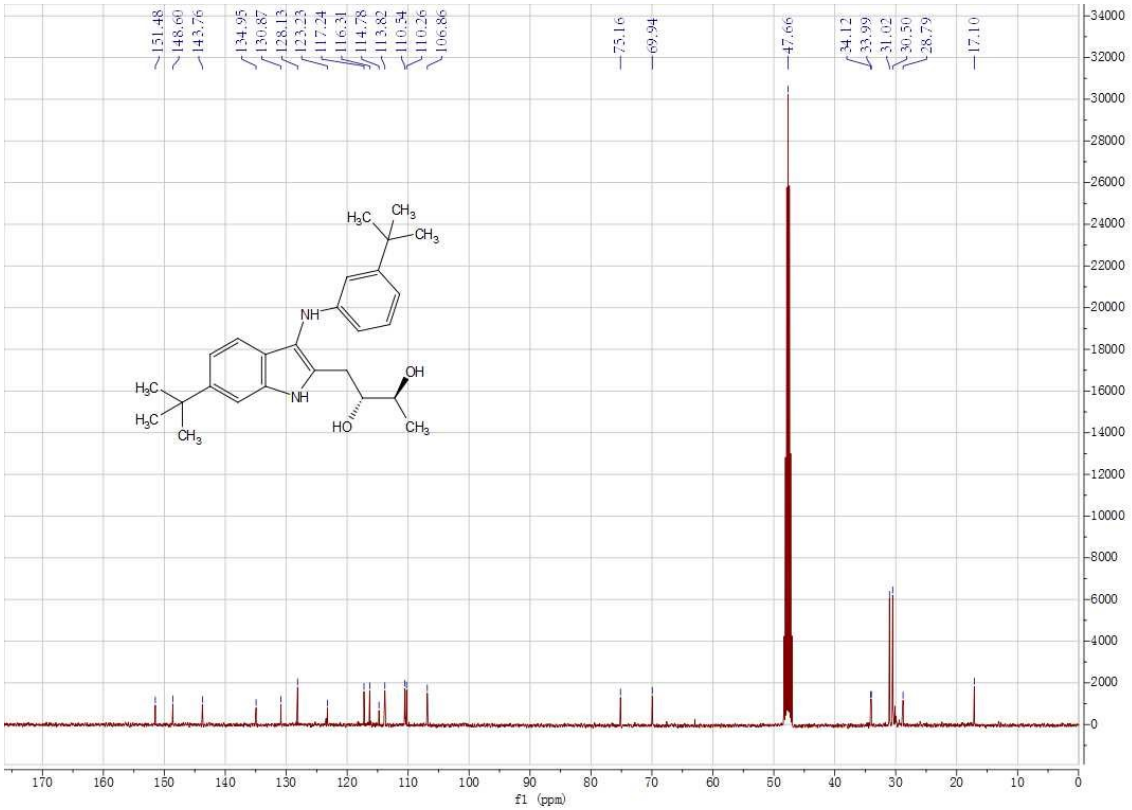


Figure. S10^{13}C{^{1}H} NMR of compound **5a**

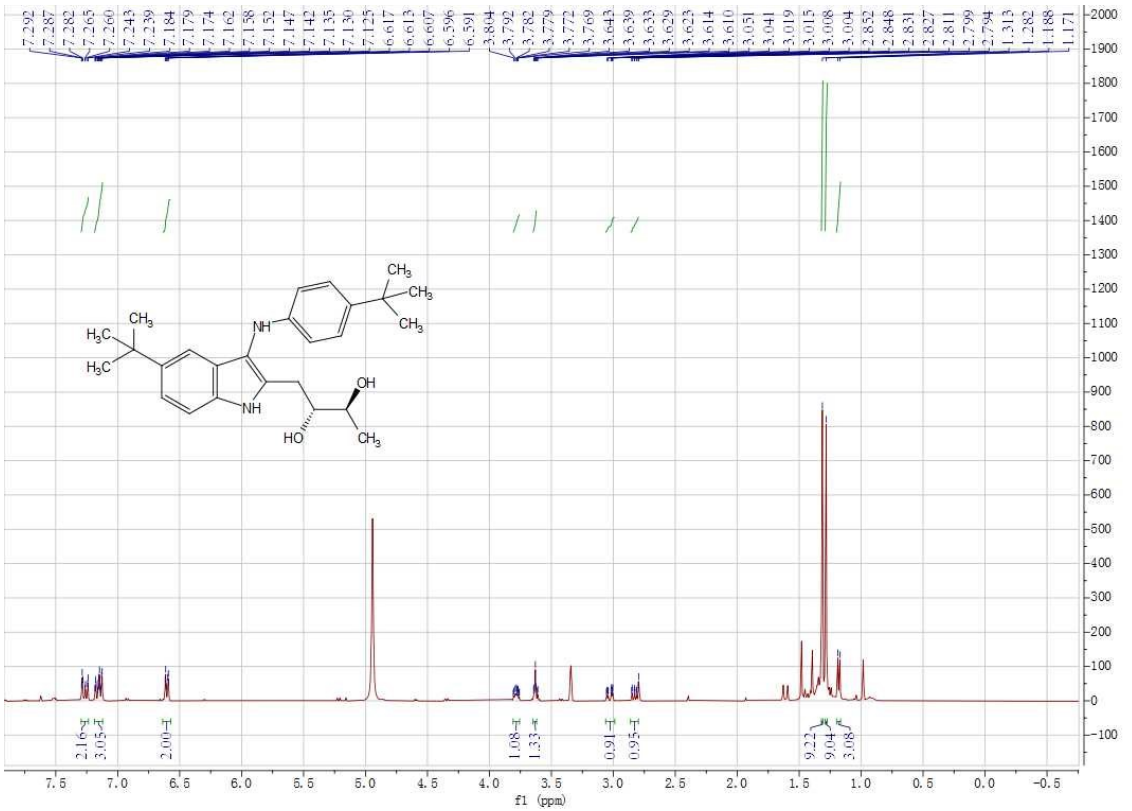


Figure. S11 ^{1}H NMR of compound**6a**

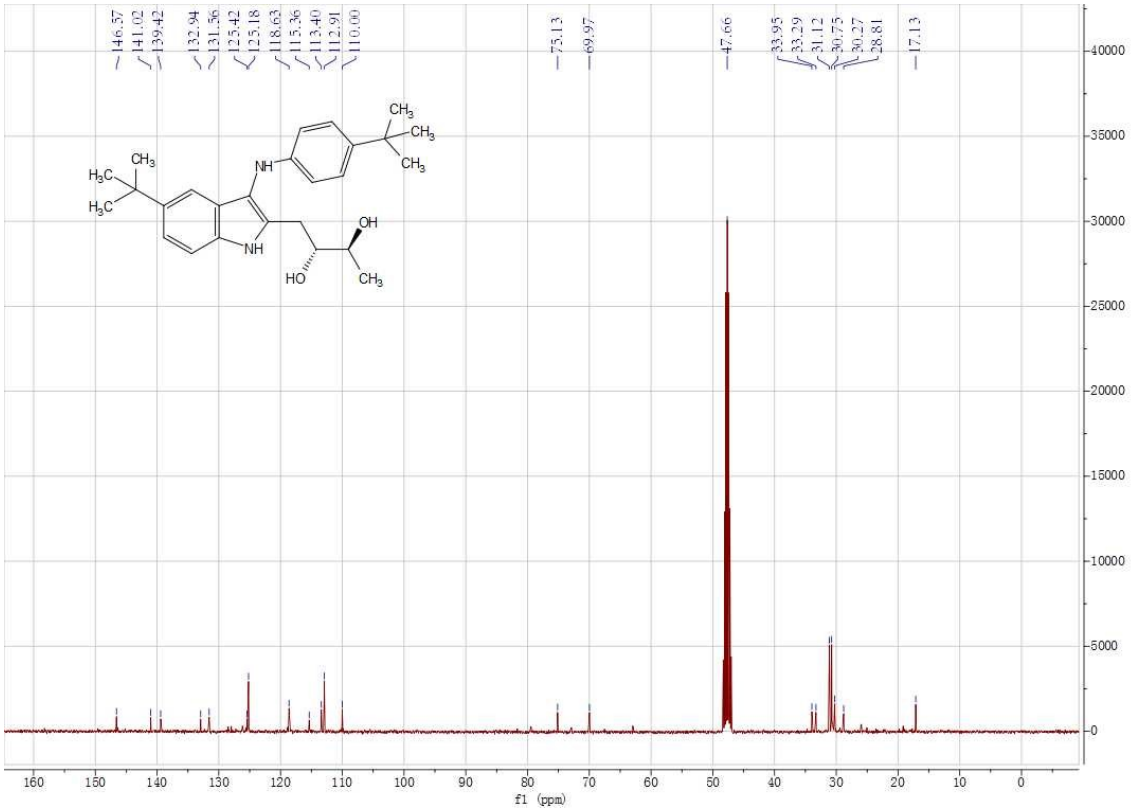


Figure. S12$^{13}C\{^{1}H\}$ NMR of compound **6a**

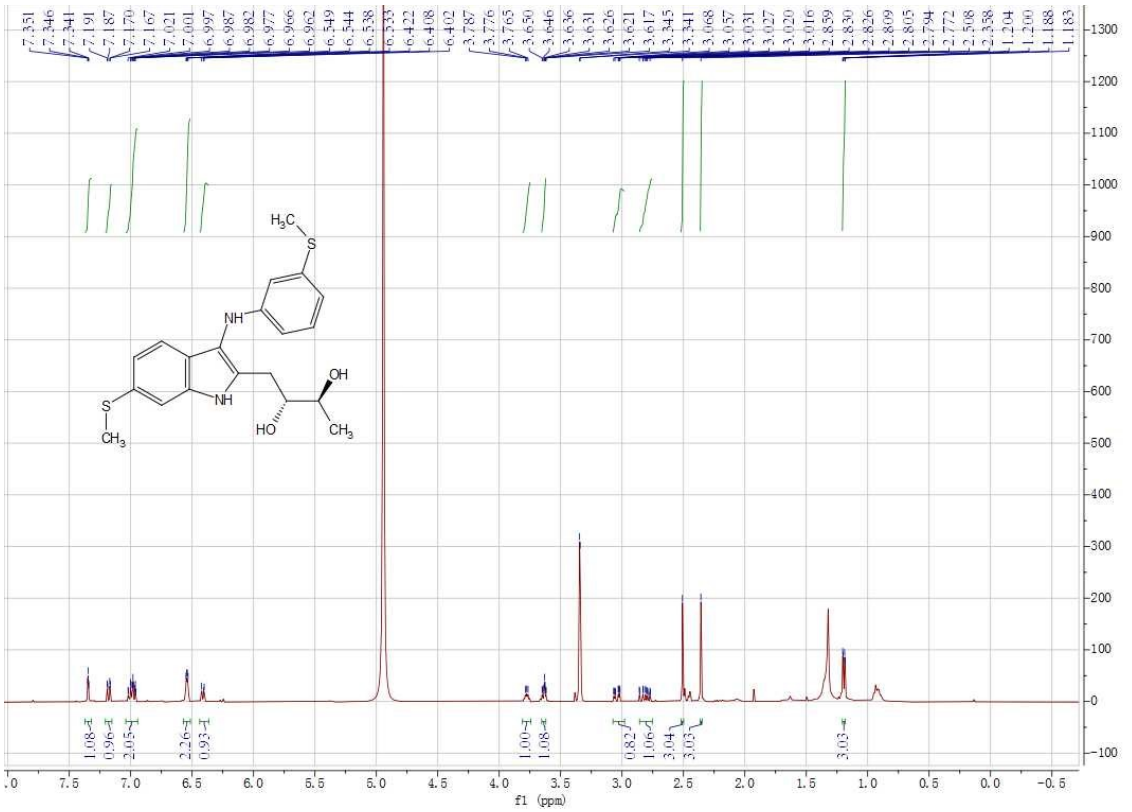


Figure. S13[1]H NMR of compound**7a**

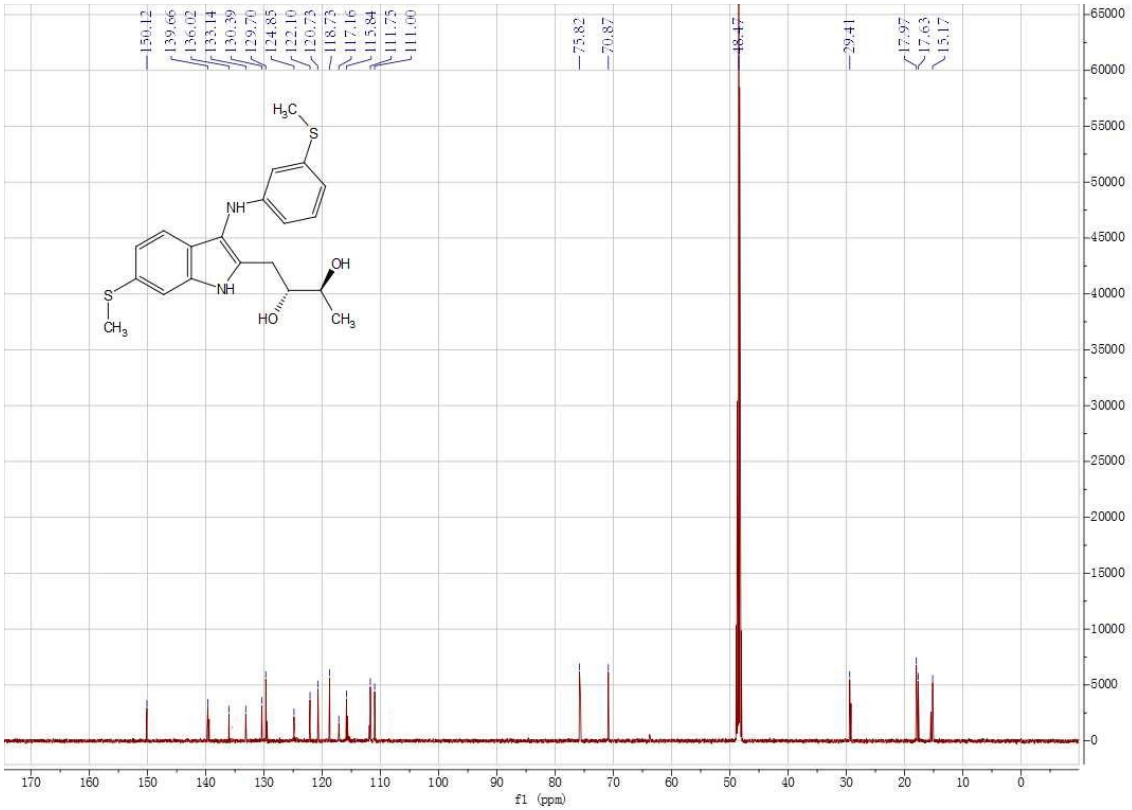


Figure. S14[13]C{[1]H} NMR of compound **7a**

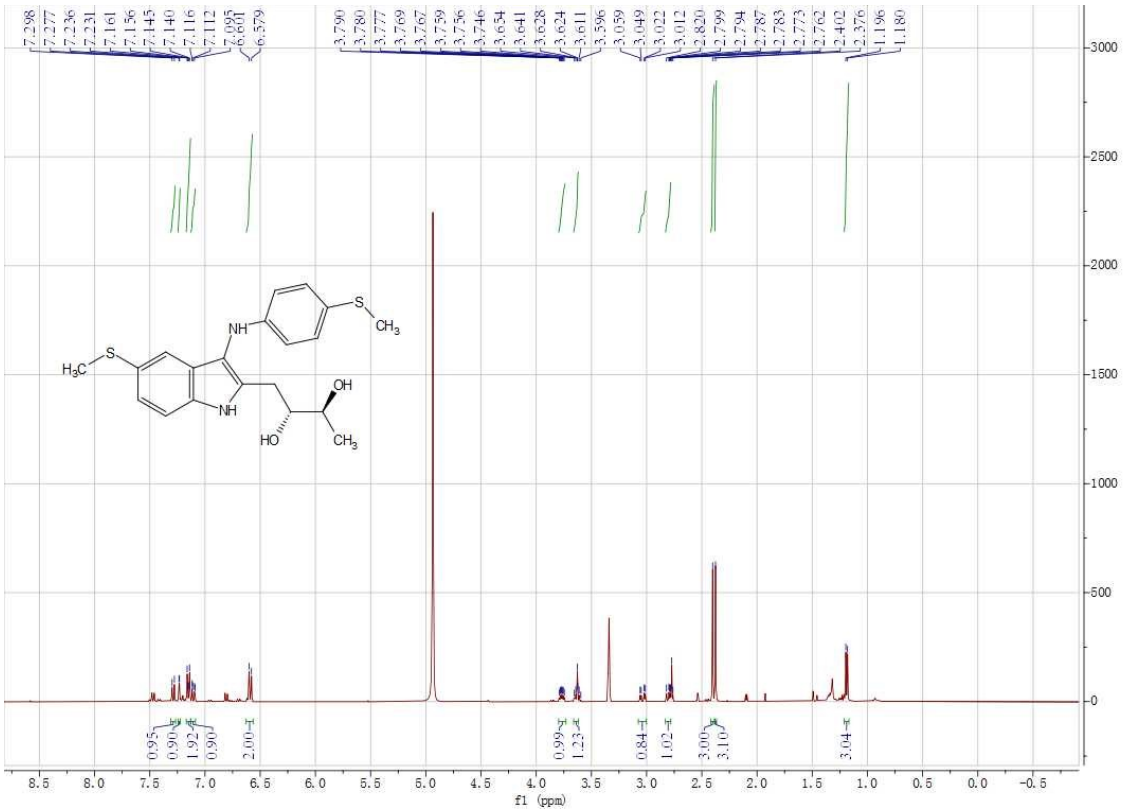


Figure. S15[1]H NMR of compound**8a**

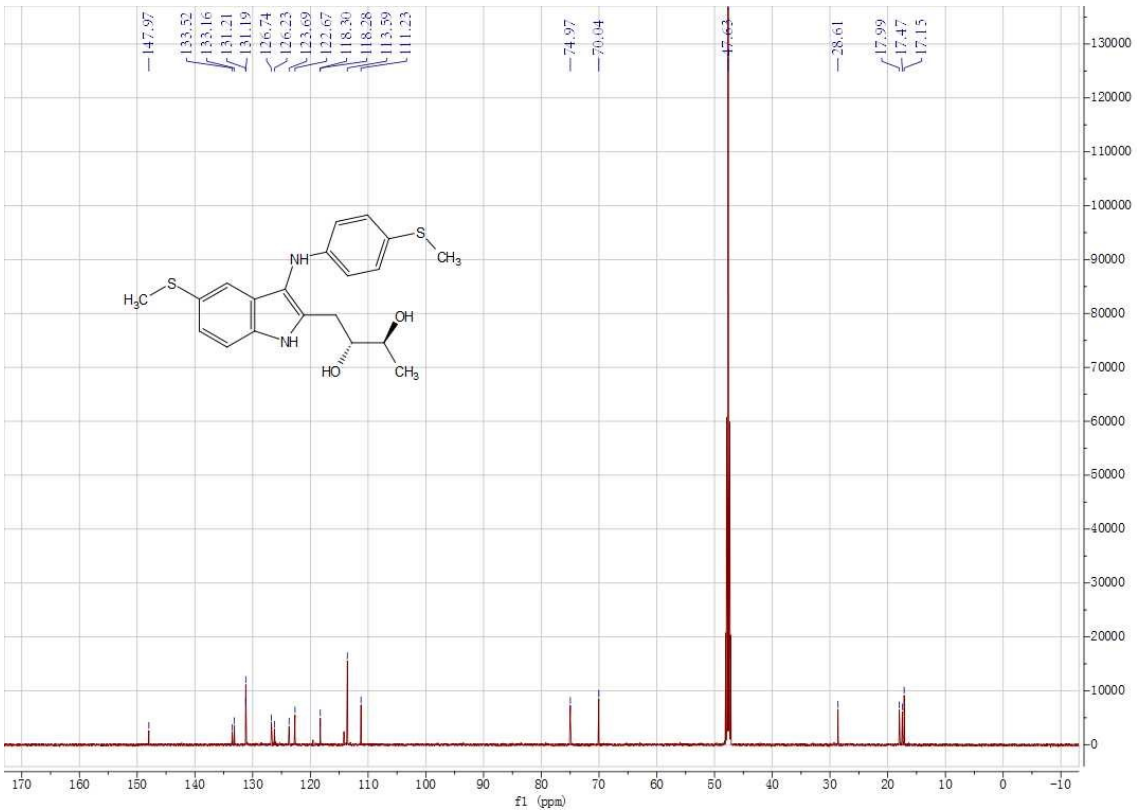


Figure. S16[13]C{[1]H} NMR of compound **8a**

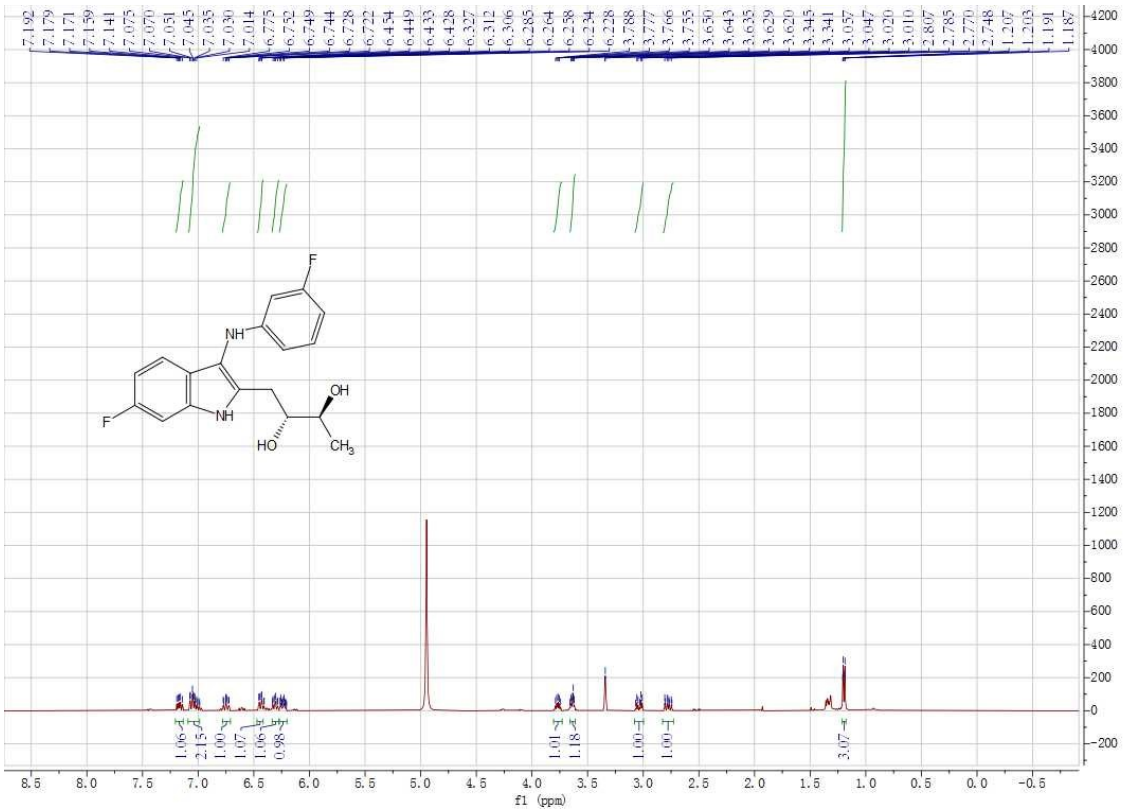


Figure. S17[1]H NMR of compound**9a**

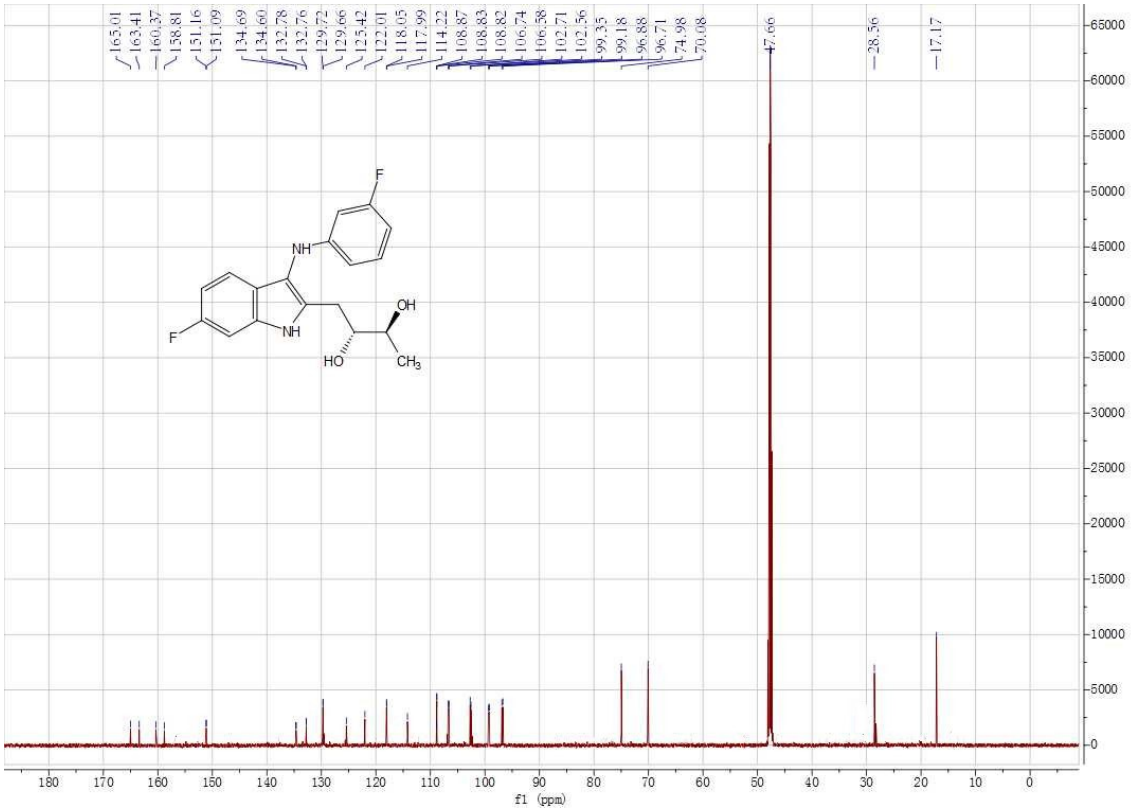


Figure. S18[13]C{[1]H} NMR of compound **9a**

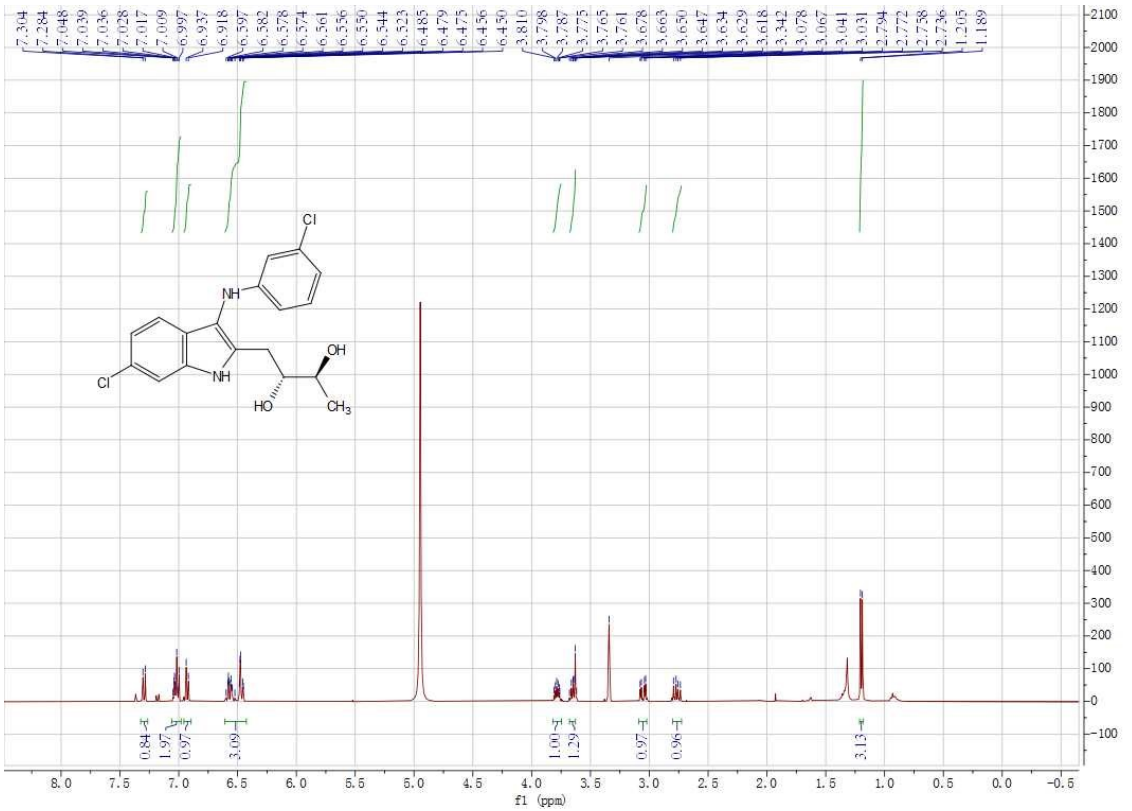


Figure. S19^{1}H NMR of compound**10a**

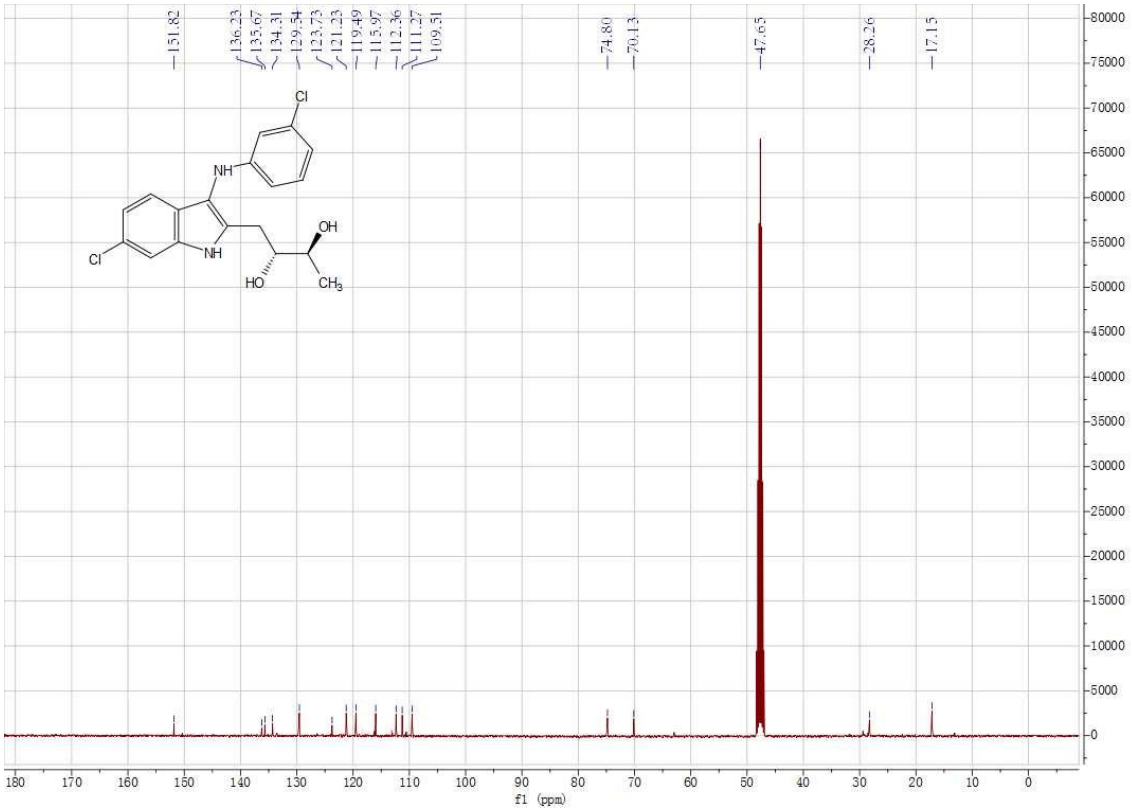


Figure. S20^{13}C{^{1}H} NMR of compound **10a**

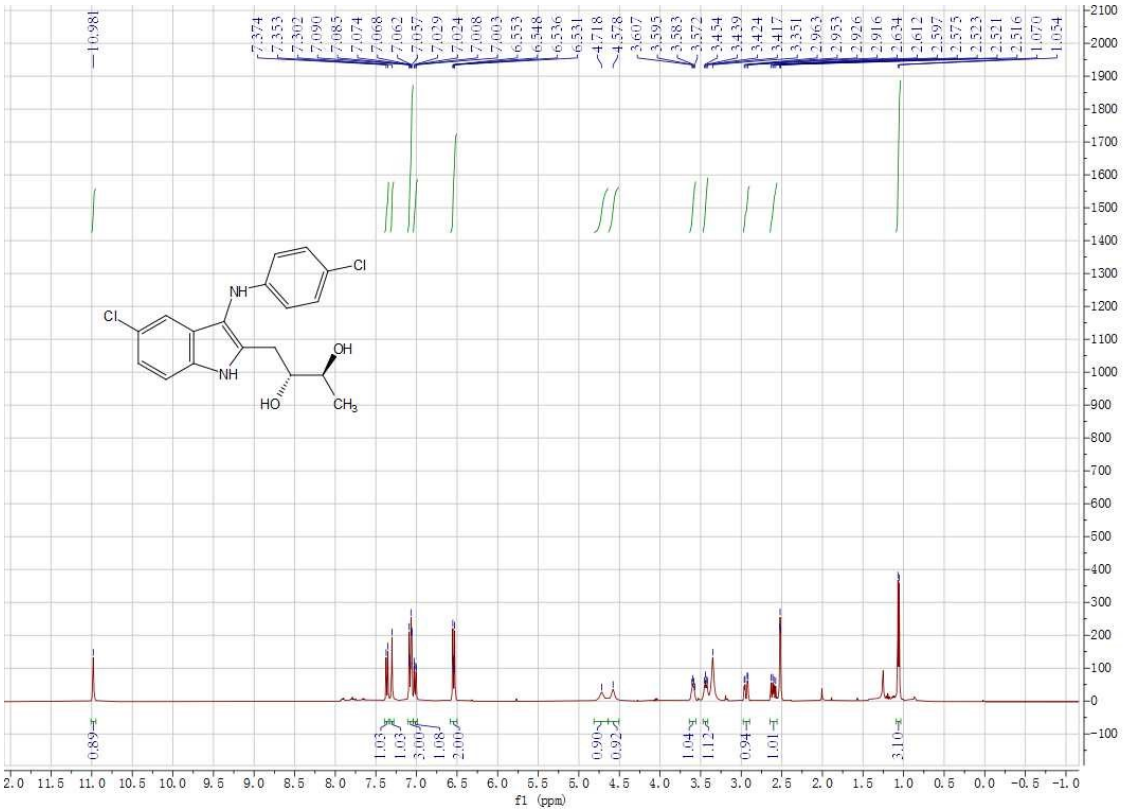


Figure. S21 ^{1}H NMR of compound**11a**

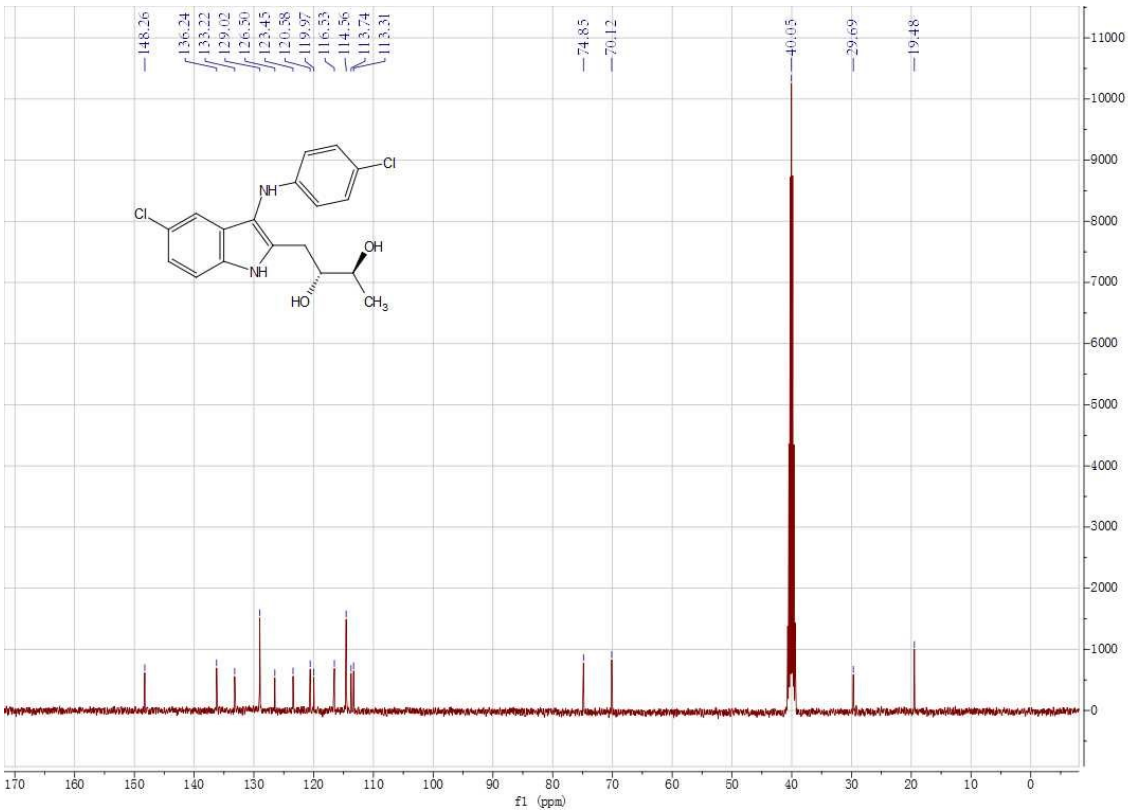


Figure. S22^{13}C{^{1}H} NMR of compound **11a**

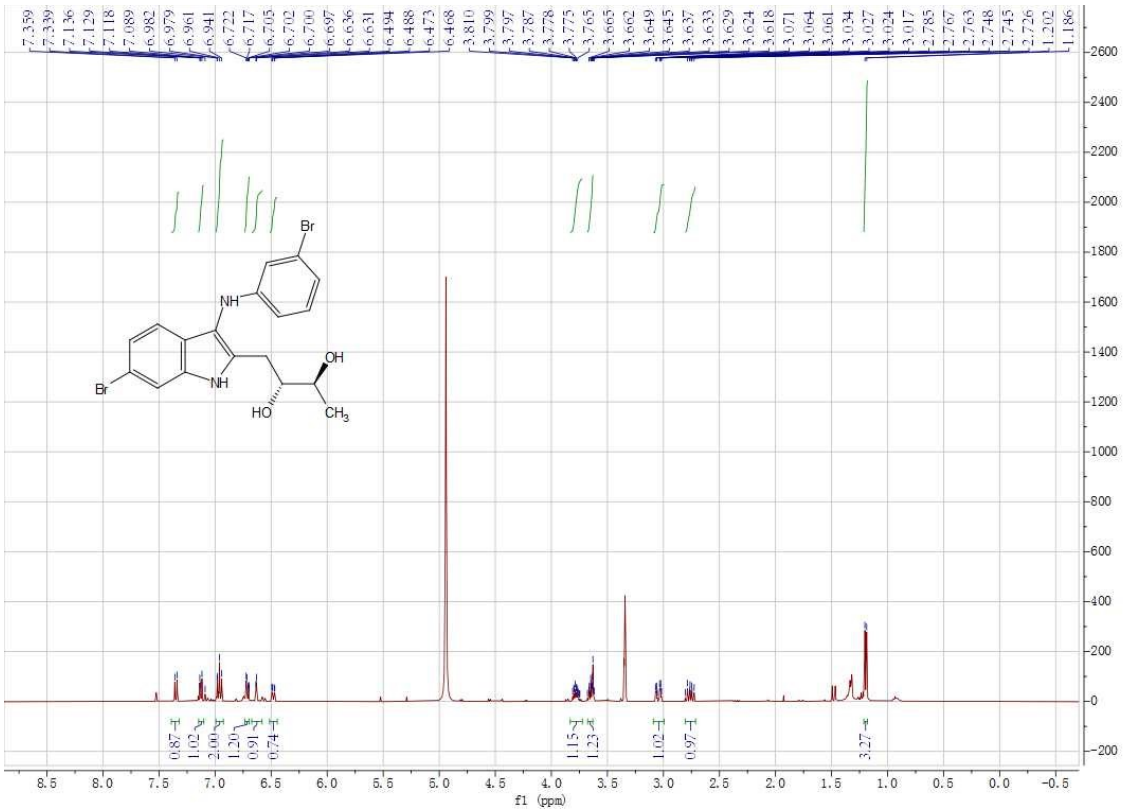


Figure. S23 ^{1}H NMR of compound**12a**

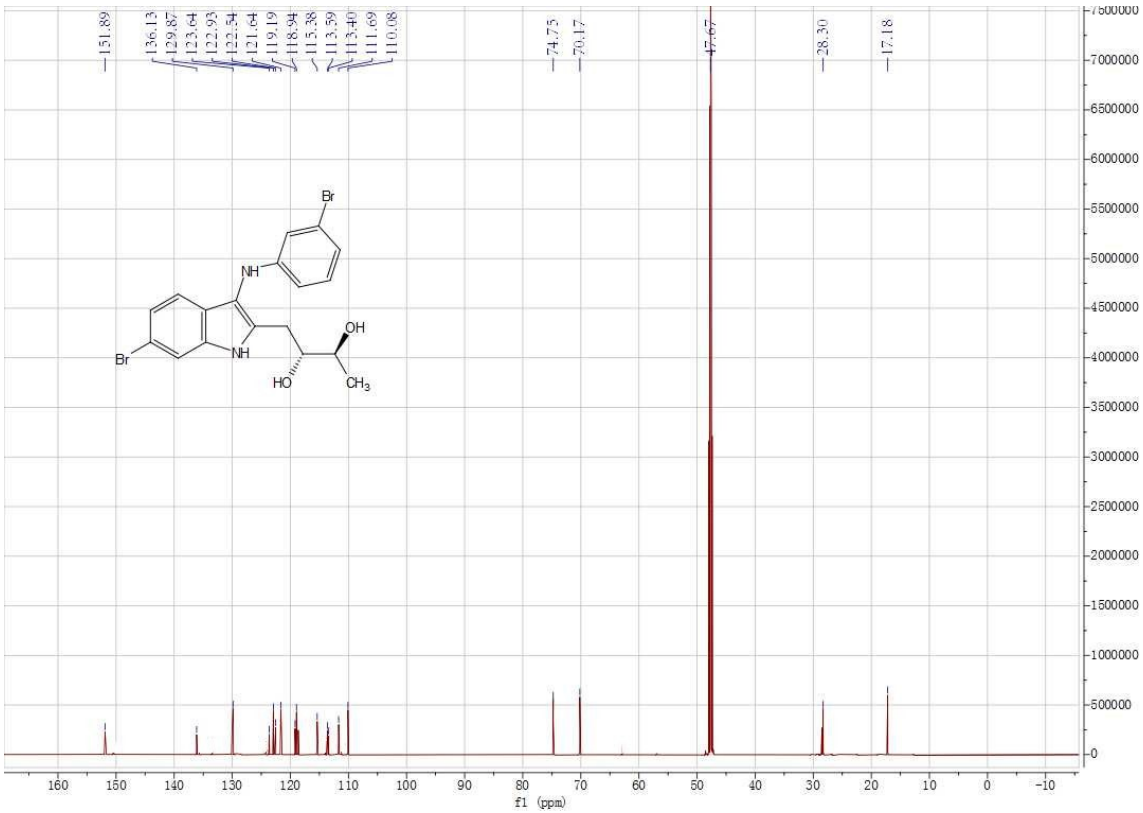


Figure. S24 ^{13}C{^{1}H} NMR of compound **12a**

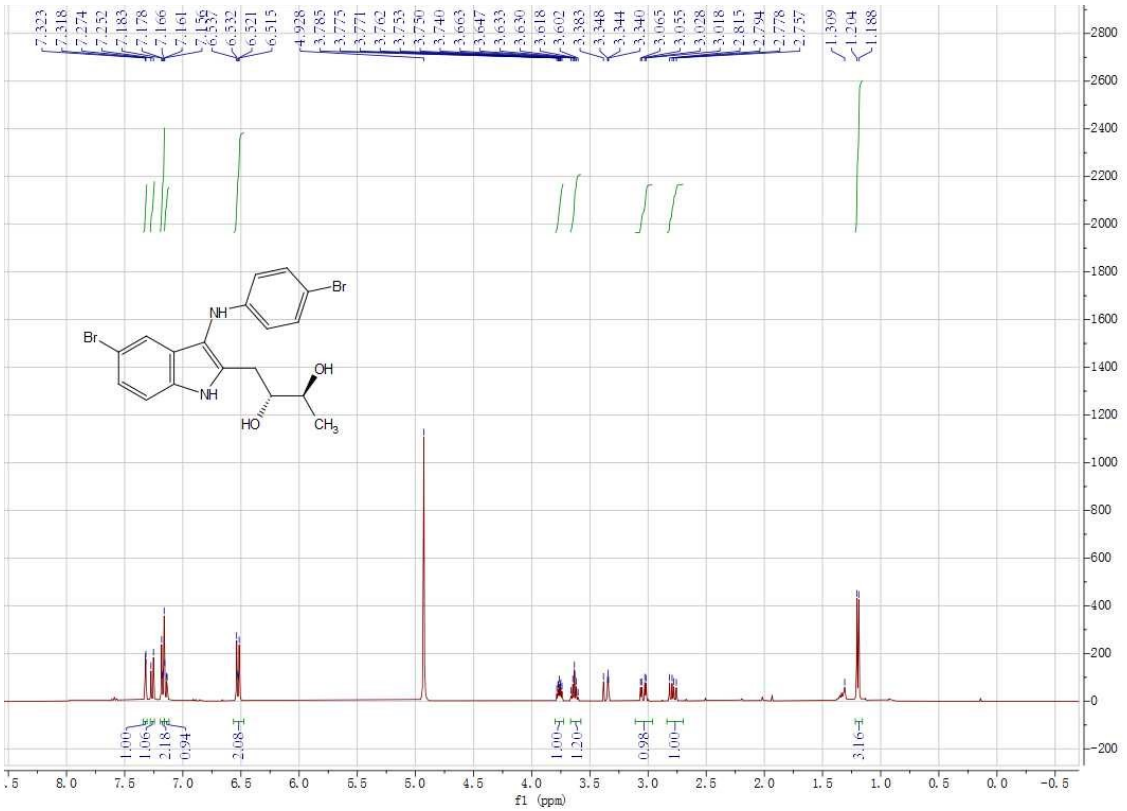


Figure. S25^{1}H NMR of compound**13a**

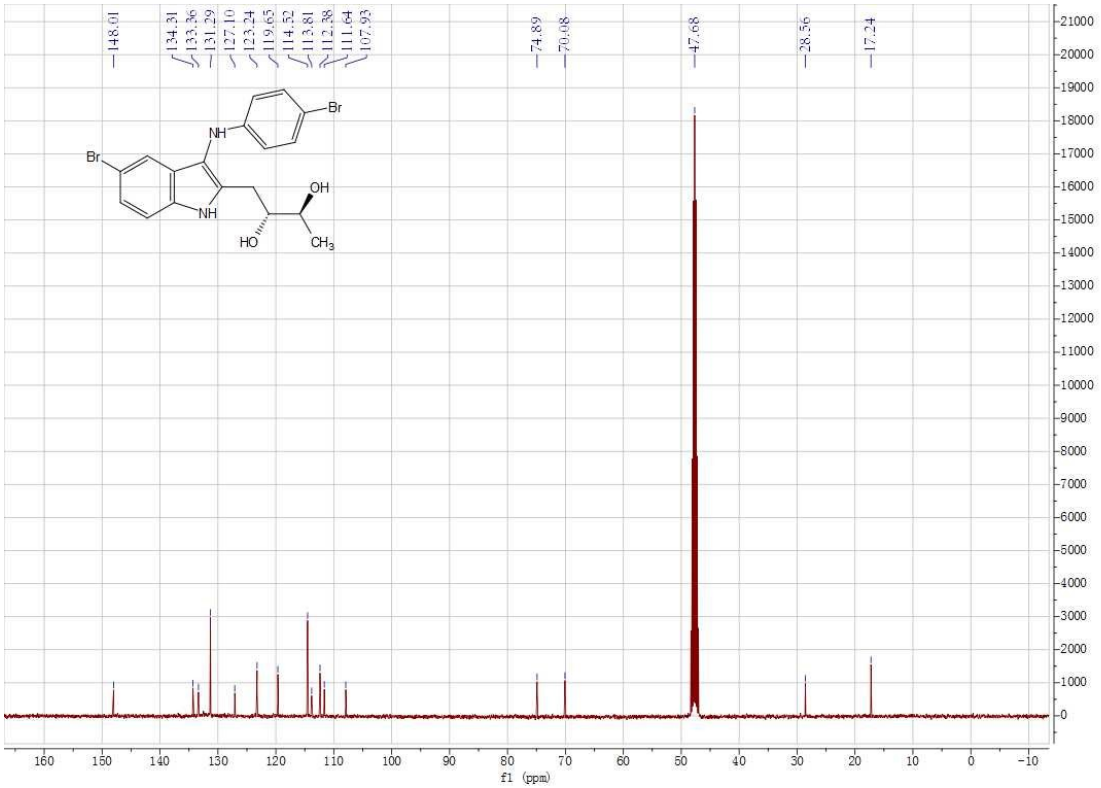


Figure. S26^{13}C{^{1}H} NMR of compound **13a**

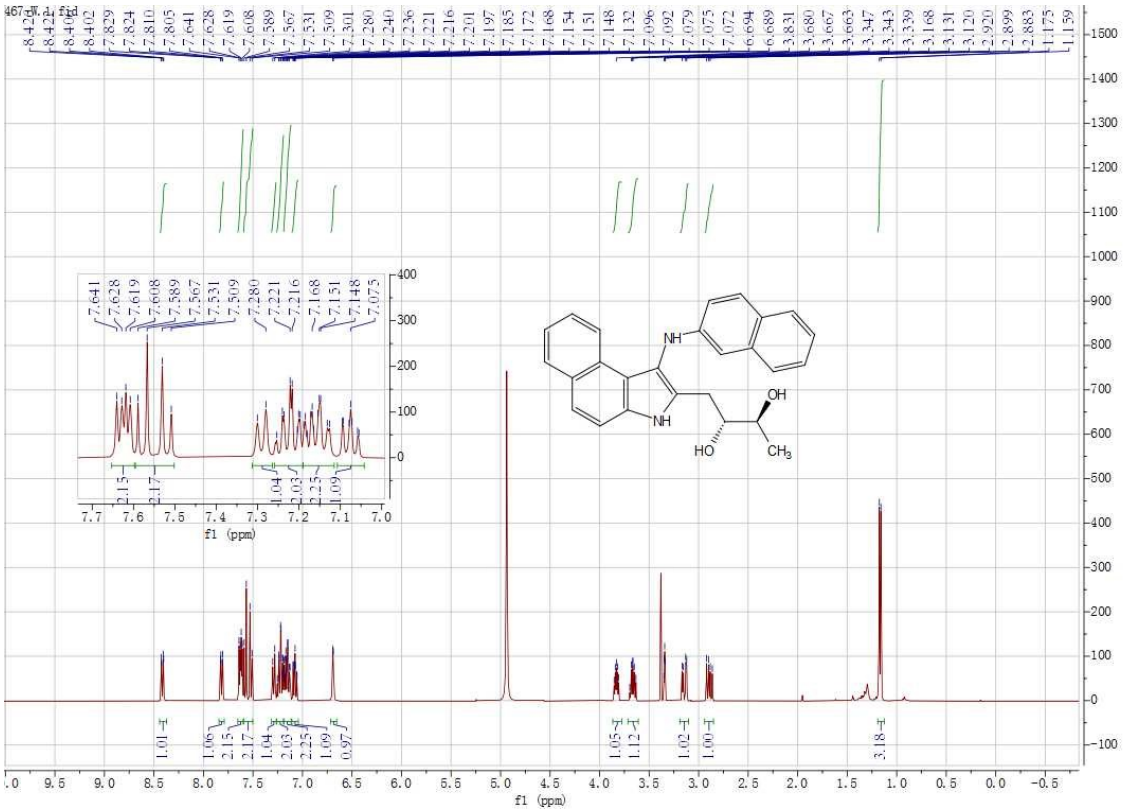


Figure. S27^{1}H NMR of compound**14a**

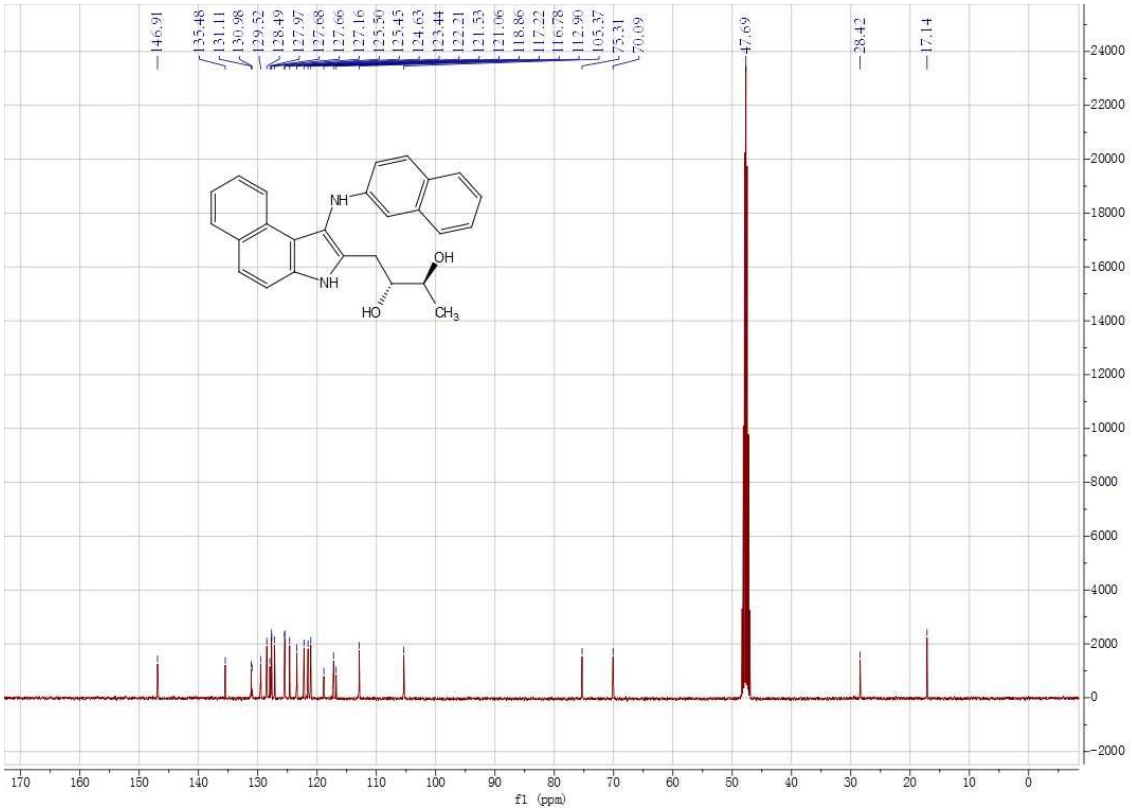


Figure. S28^{13}C{^{1}H} NMR of compound **14a**

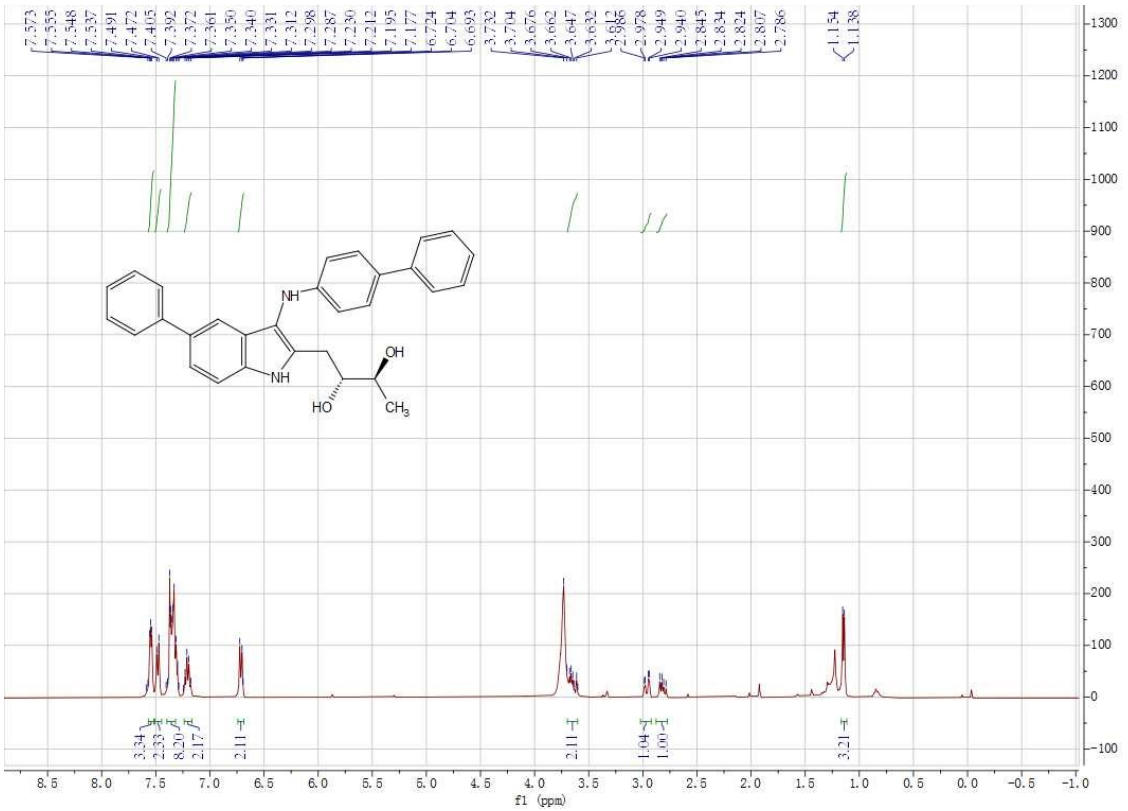


Figure. S29^{1}H NMR of compound**15a**

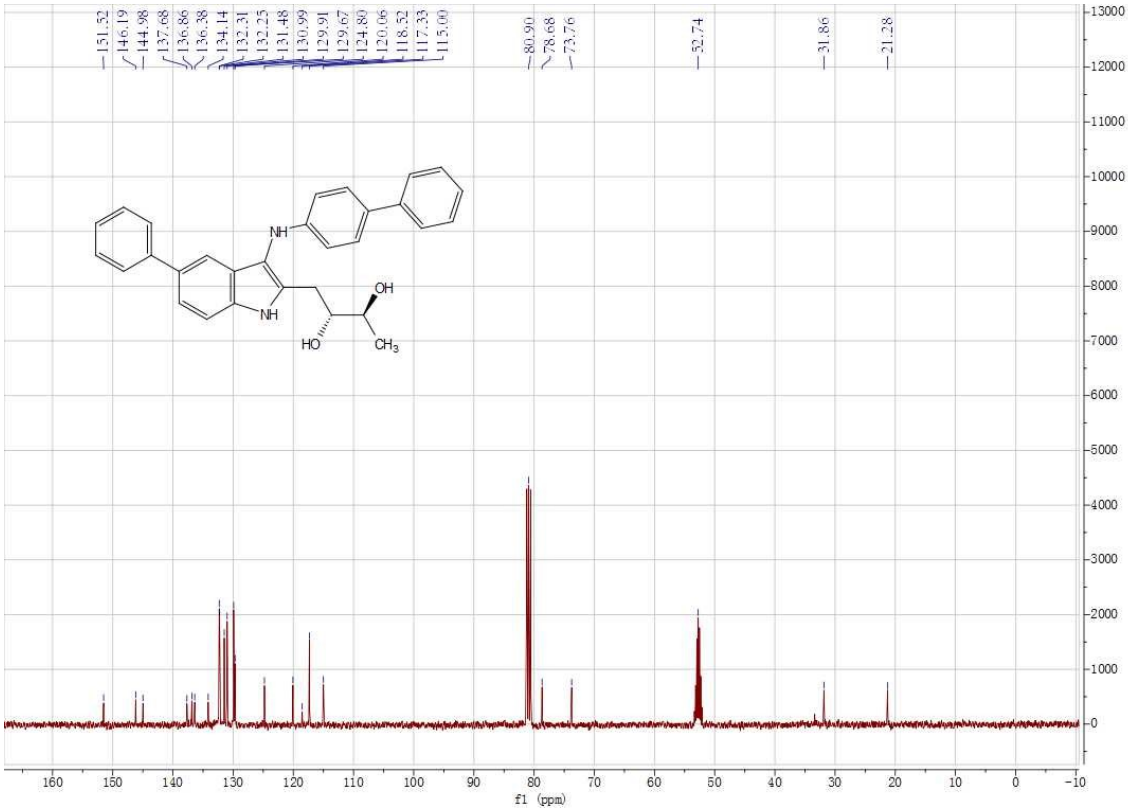


Figure. S30^{13}C{^{1}H} NMR of compound **15a**

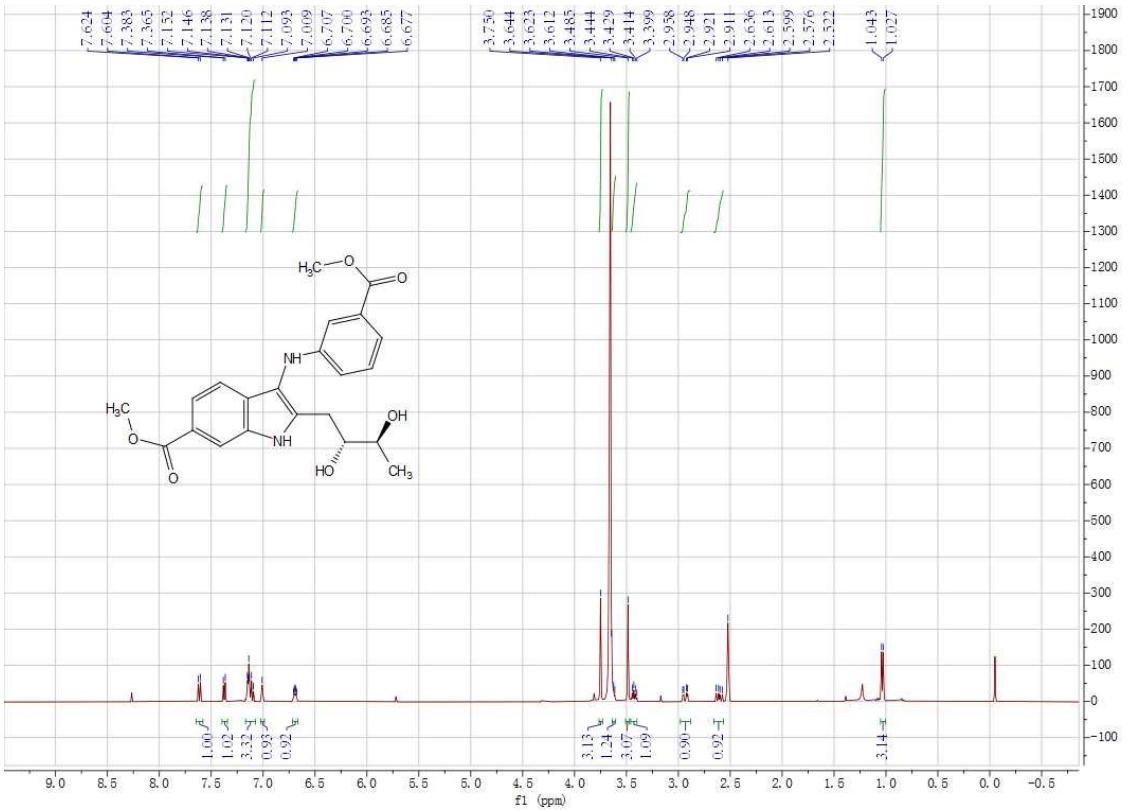


Figure. S31 ^{1}H NMR of compound**16a**

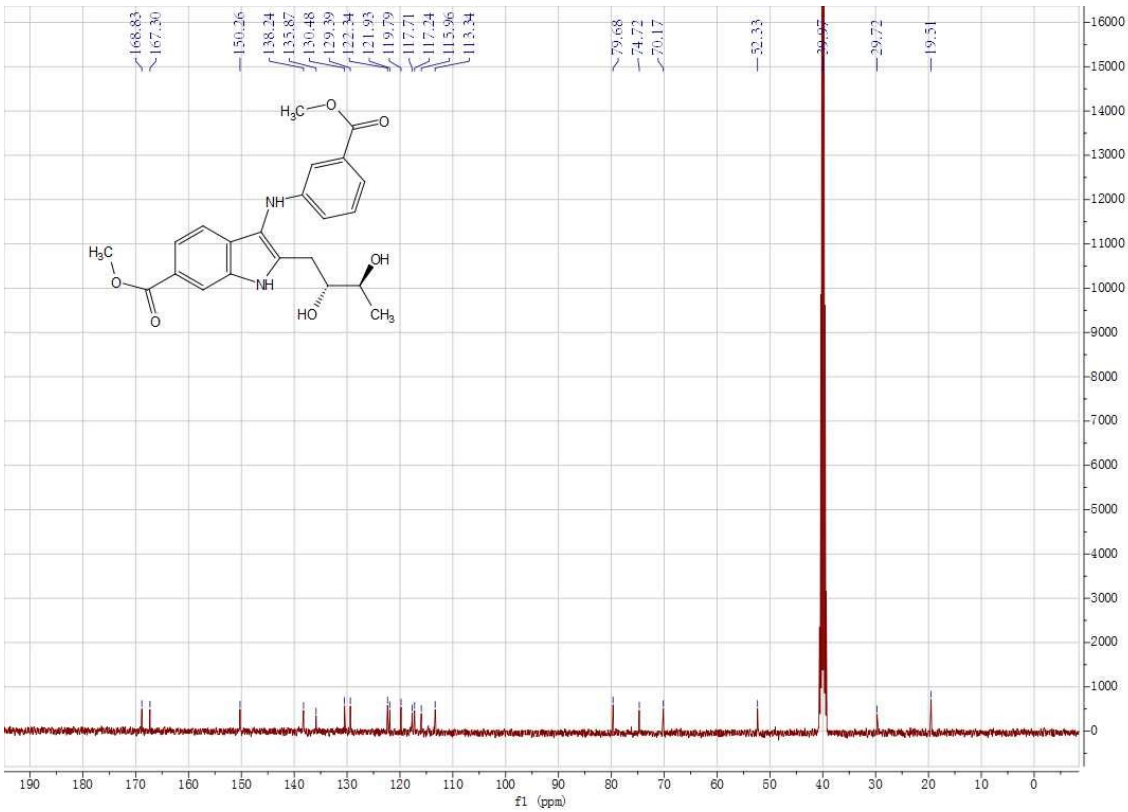


Figure. S32^{13}C{^{1}H} NMR of compound 1**6a**

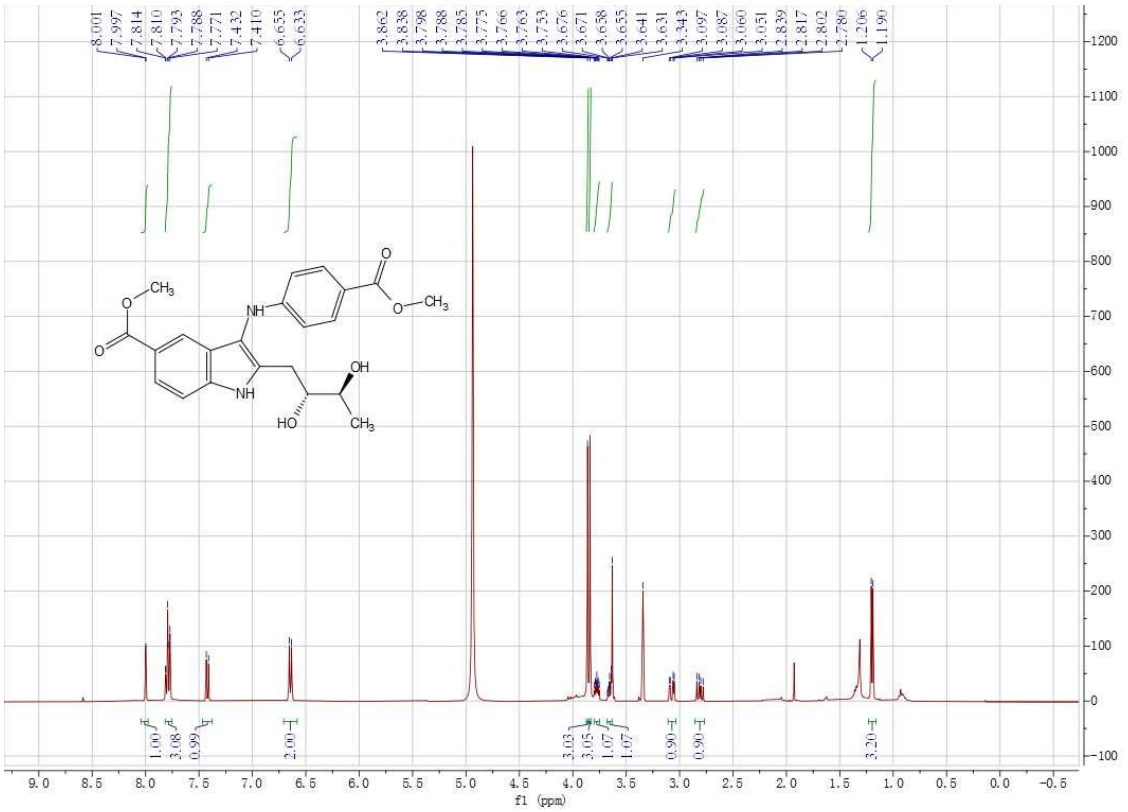


Figure. S33[1]H NMR of compound**17a**

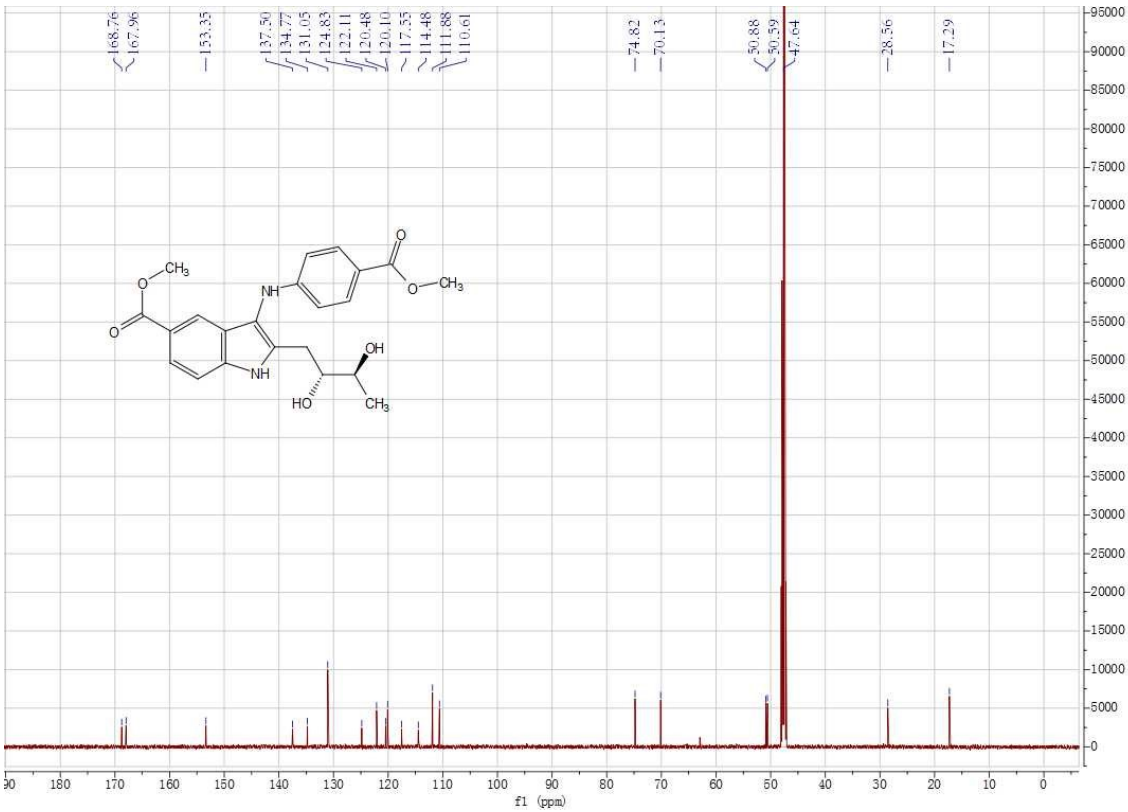


Figure. S34[13]C{[1]H} NMR of compound **17a**

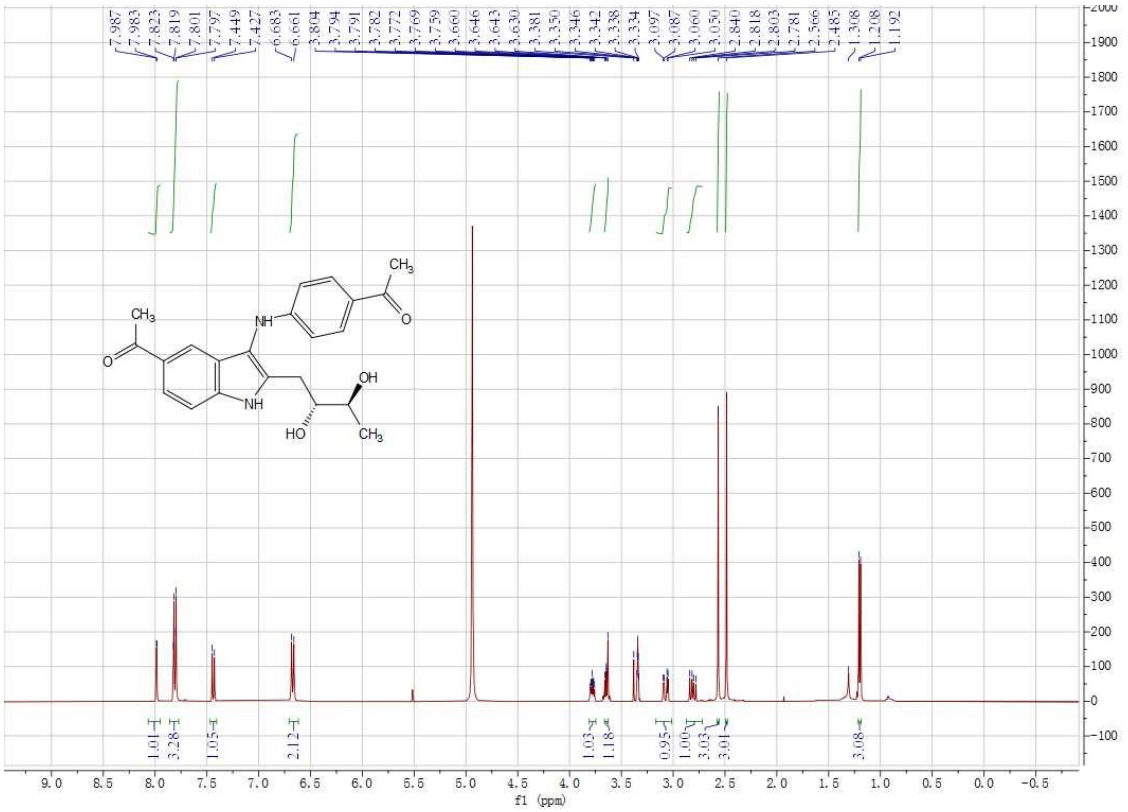


Figure. S35^{1}H NMR of compound**18a**

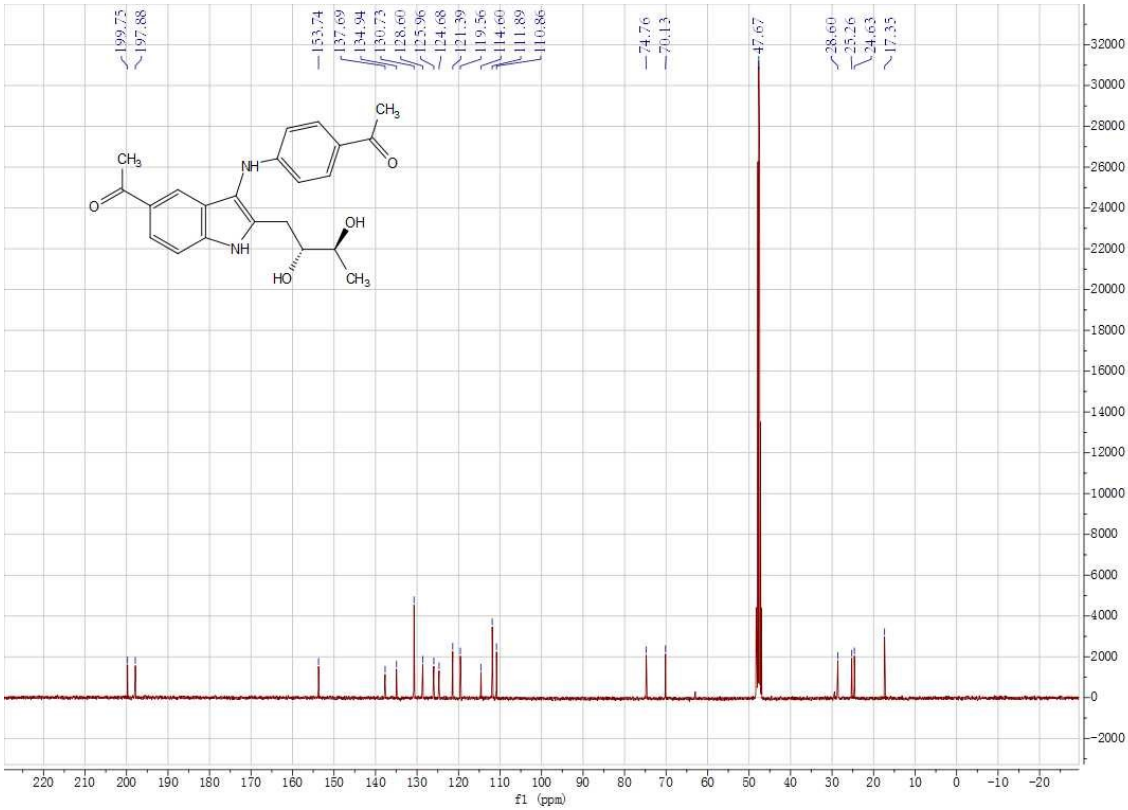


Figure. S36^{13}C{^{1}H} NMR of compound **18a**

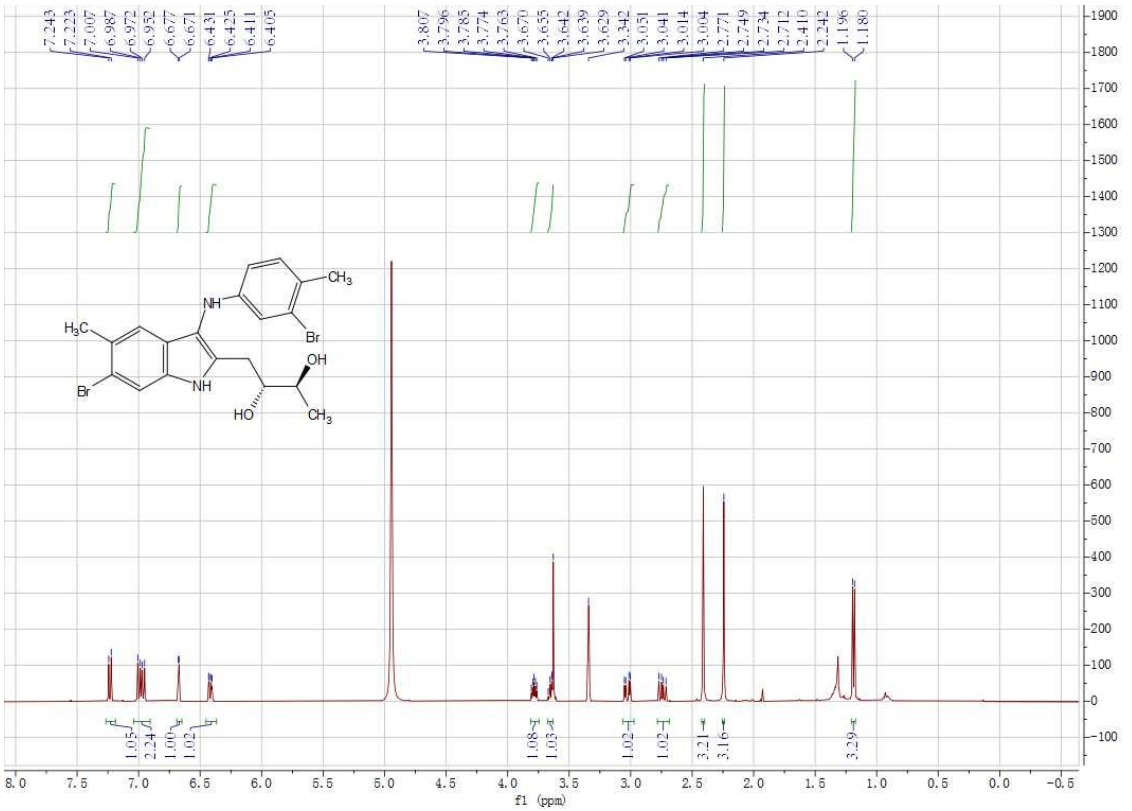


Figure. S37[1]H NMR of compound**19a**

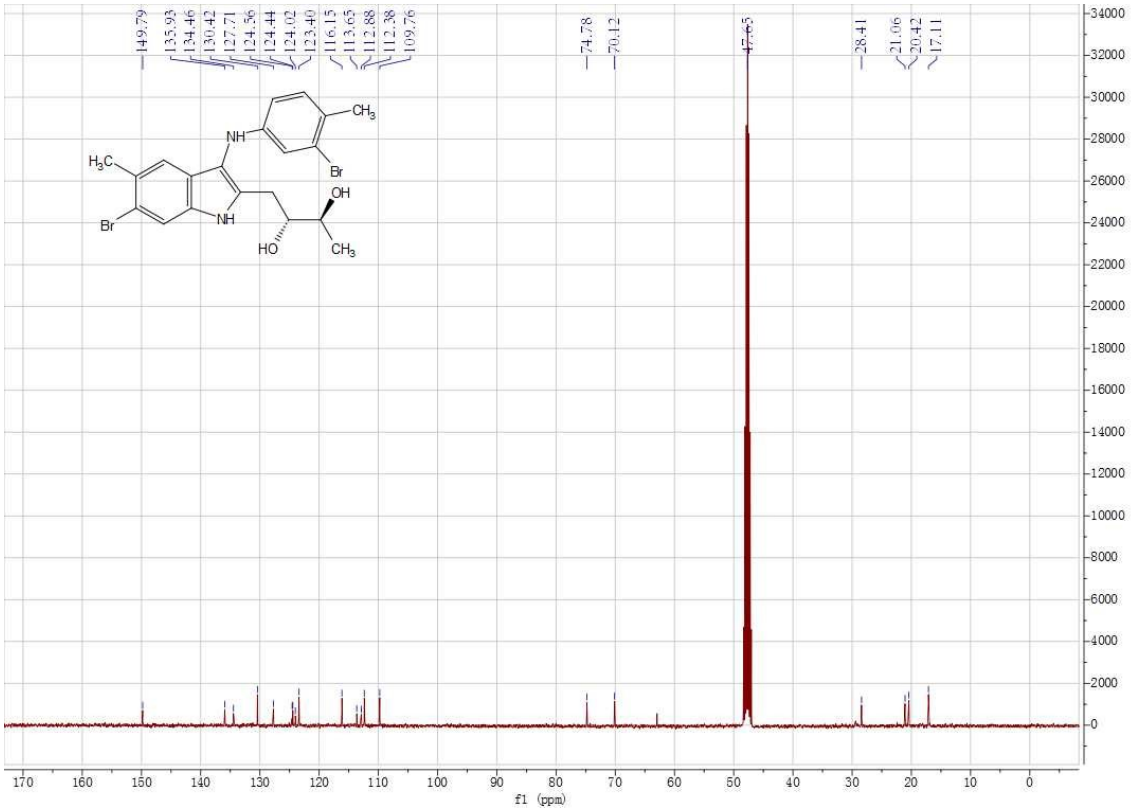


Figure. S38[13]C{[1]H} NMR of compound **19a**

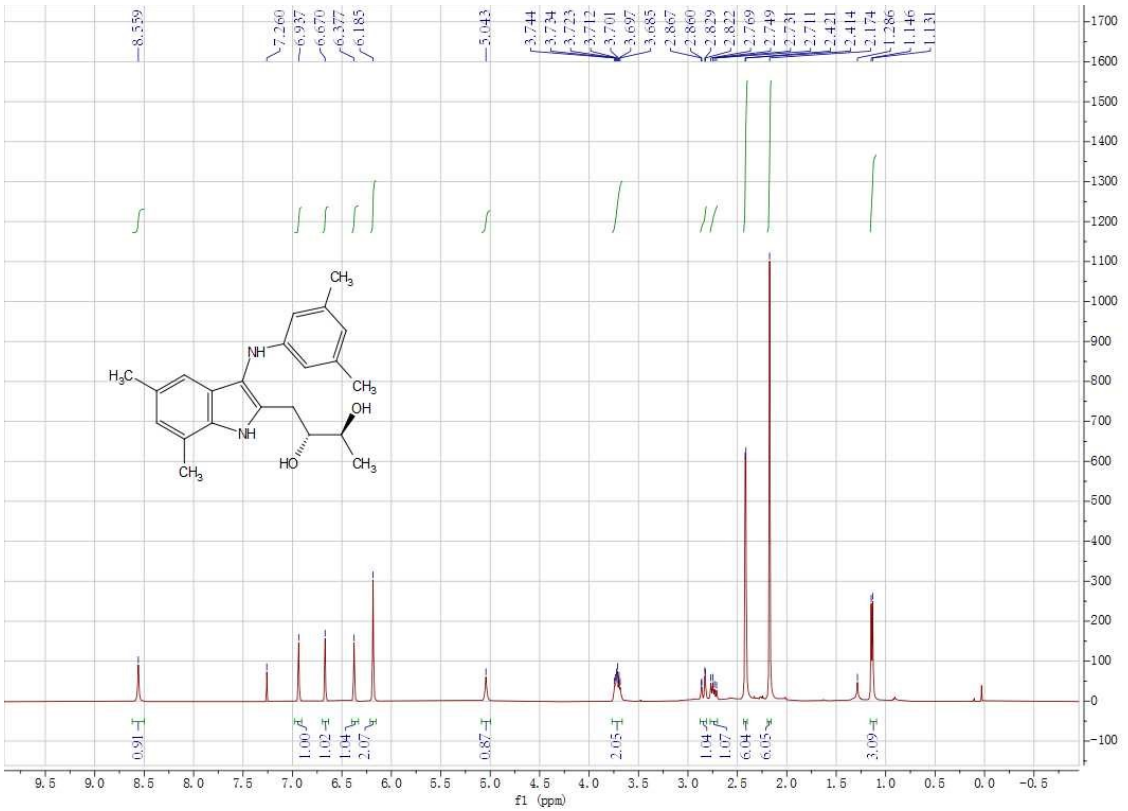


Figure. S39^{1}H NMR of compound**20a**

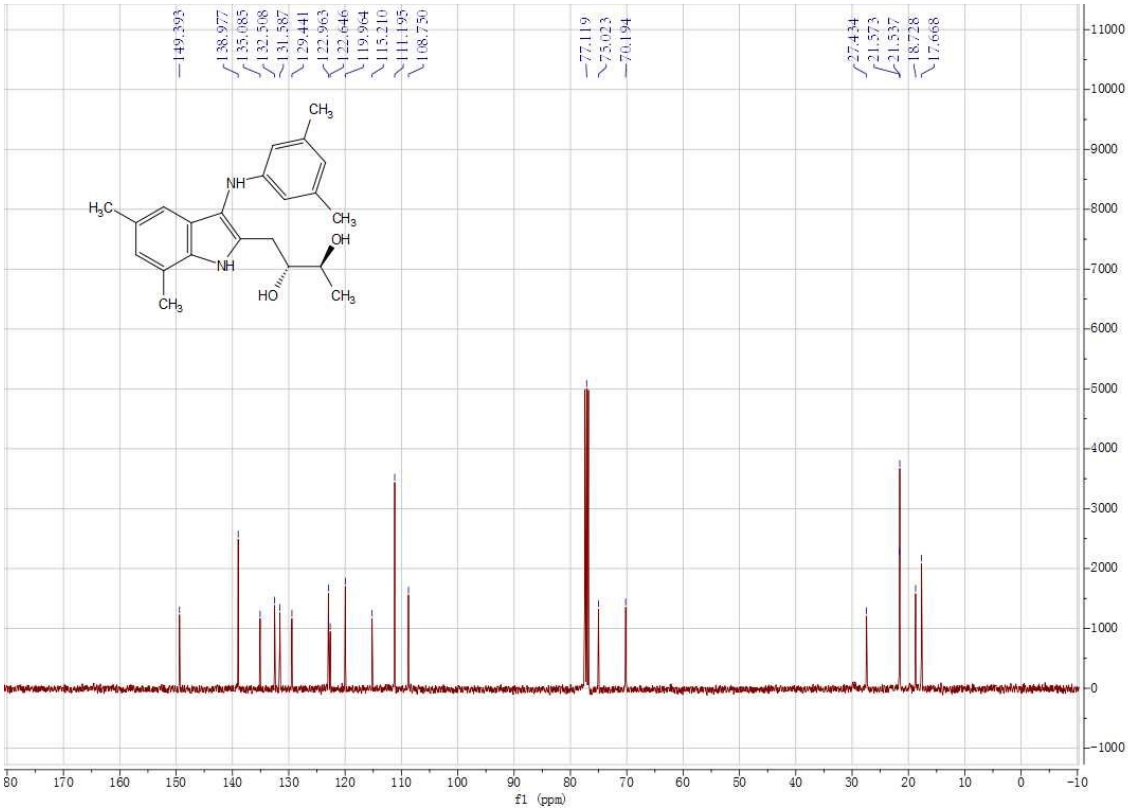


Figure. S40^{13}C{^{1}H} NMR of compound **20a**

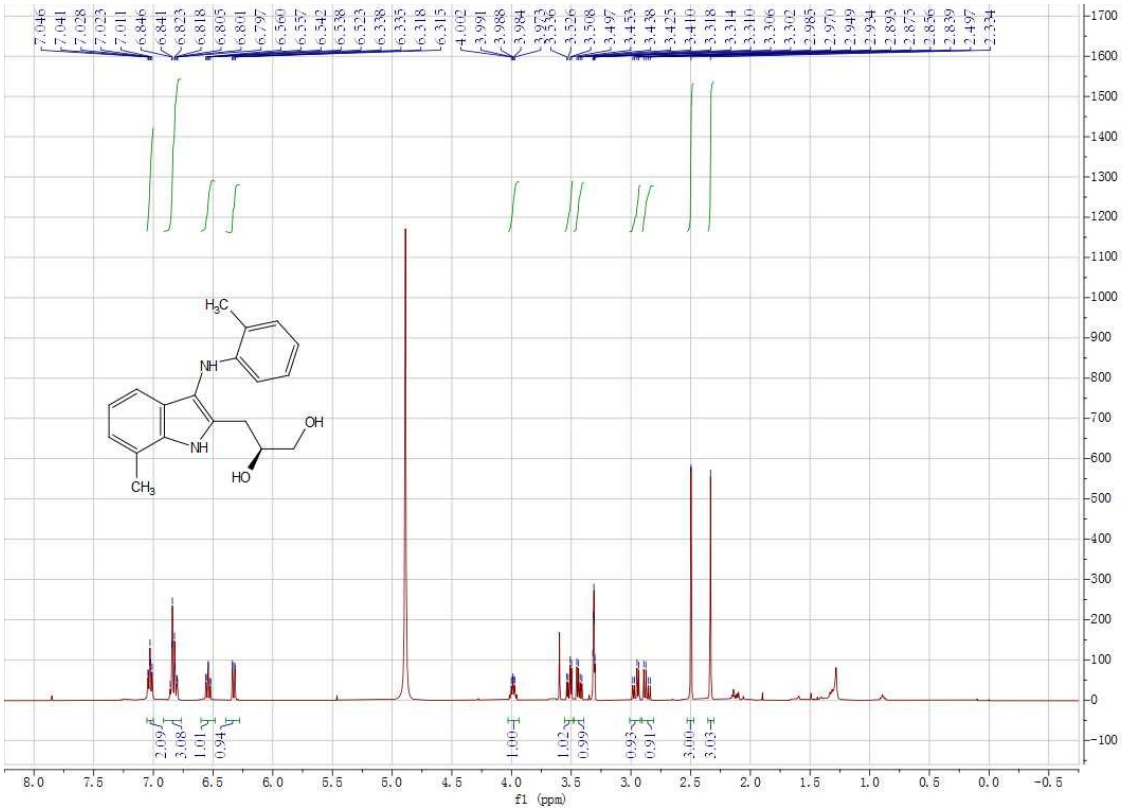


Figure. S41 ^{1}H NMR of compound**1b**

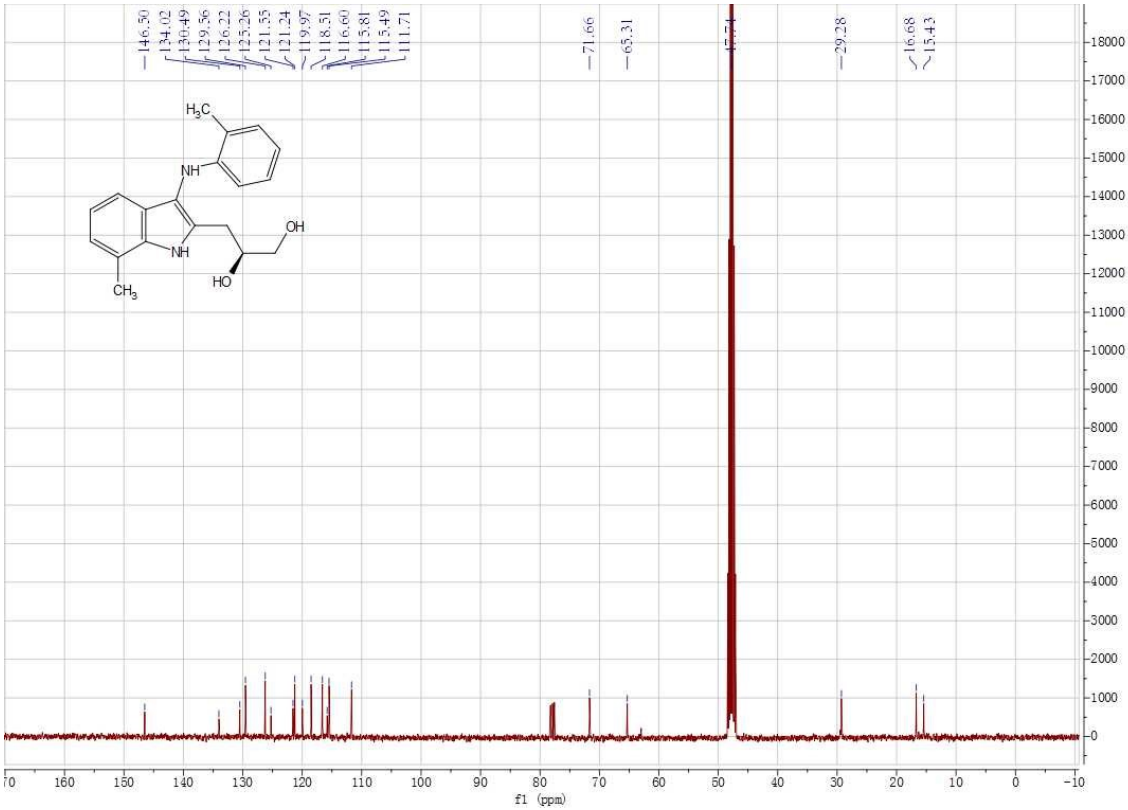


Figure. S42^{13}C{^{1}H} NMR of compound **1b**

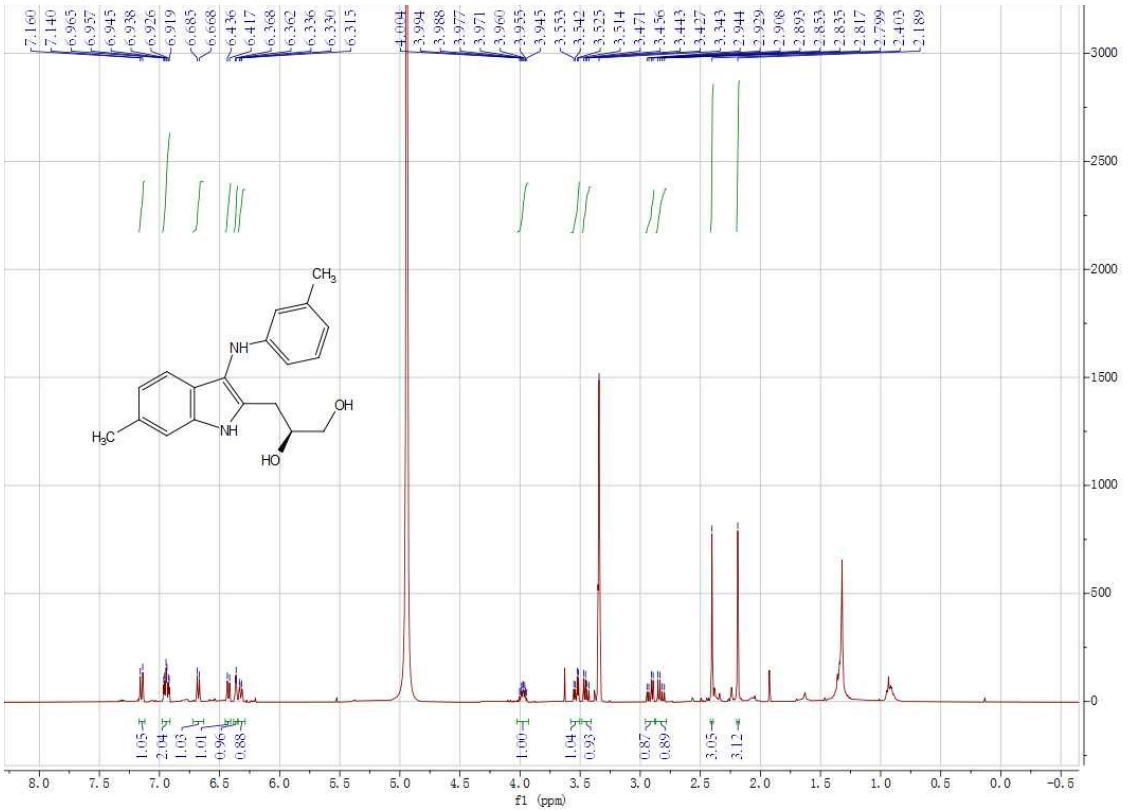


Figure. S43[1]H NMR of compound**2b**

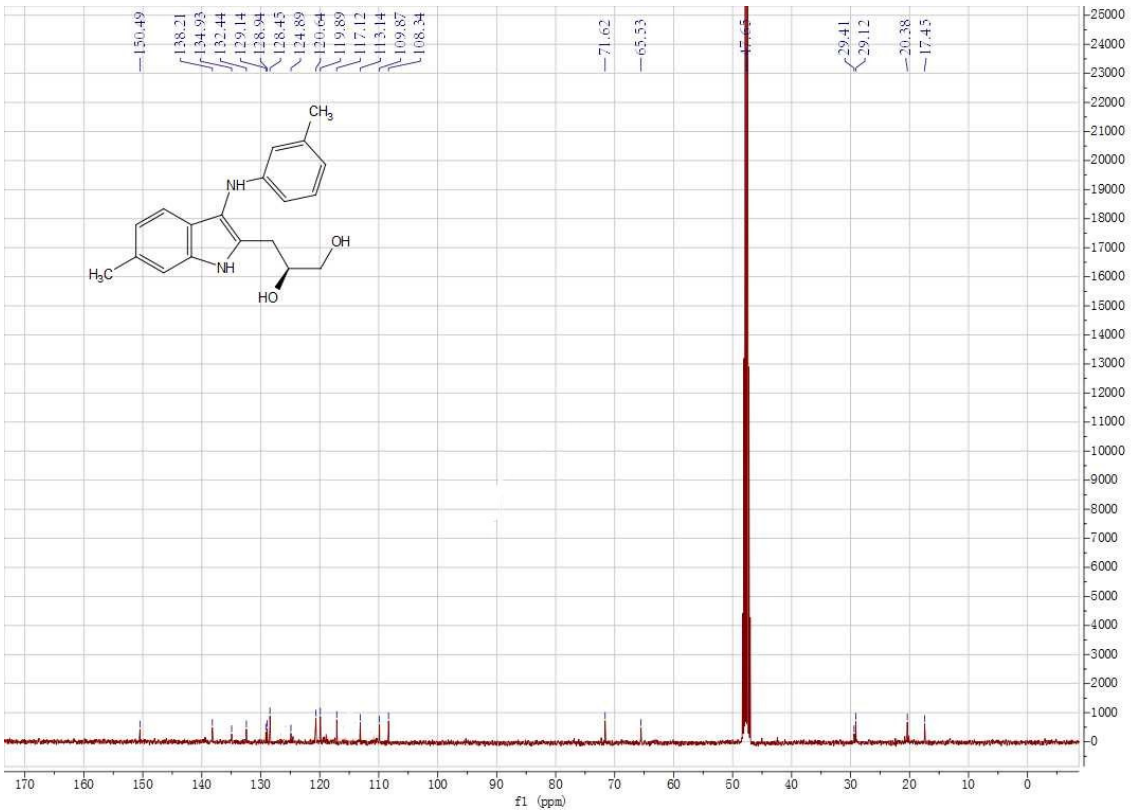


Figure. S44[13]C{[1]H} NMR of compound **2b**

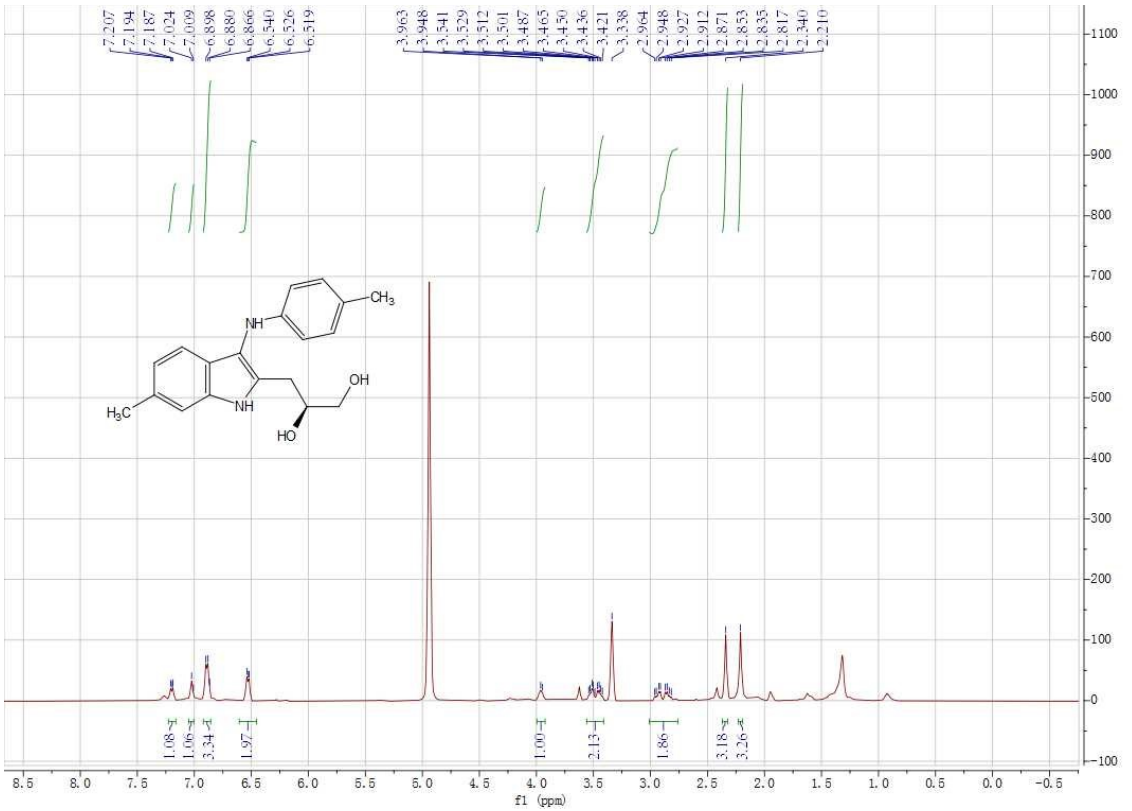


Figure. S45[1]H NMR of compound**3b**

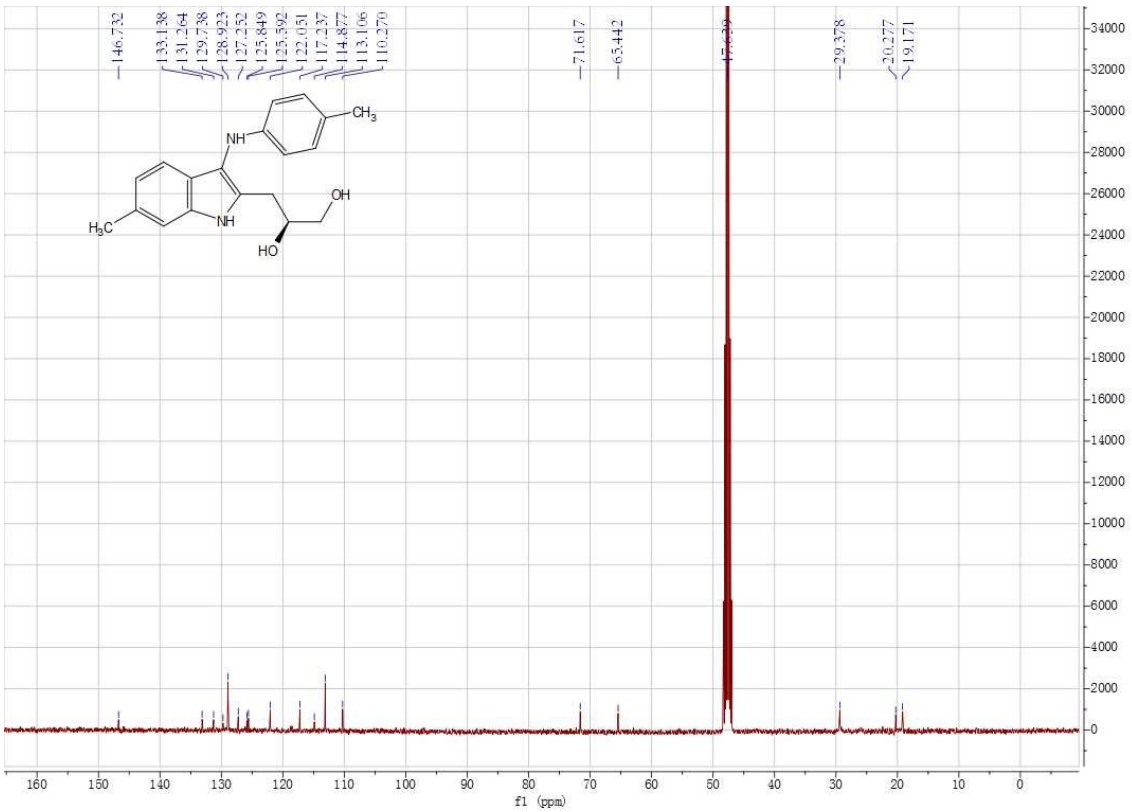


Figure. S46[13]C{[1]H} NMR of compound **3b**

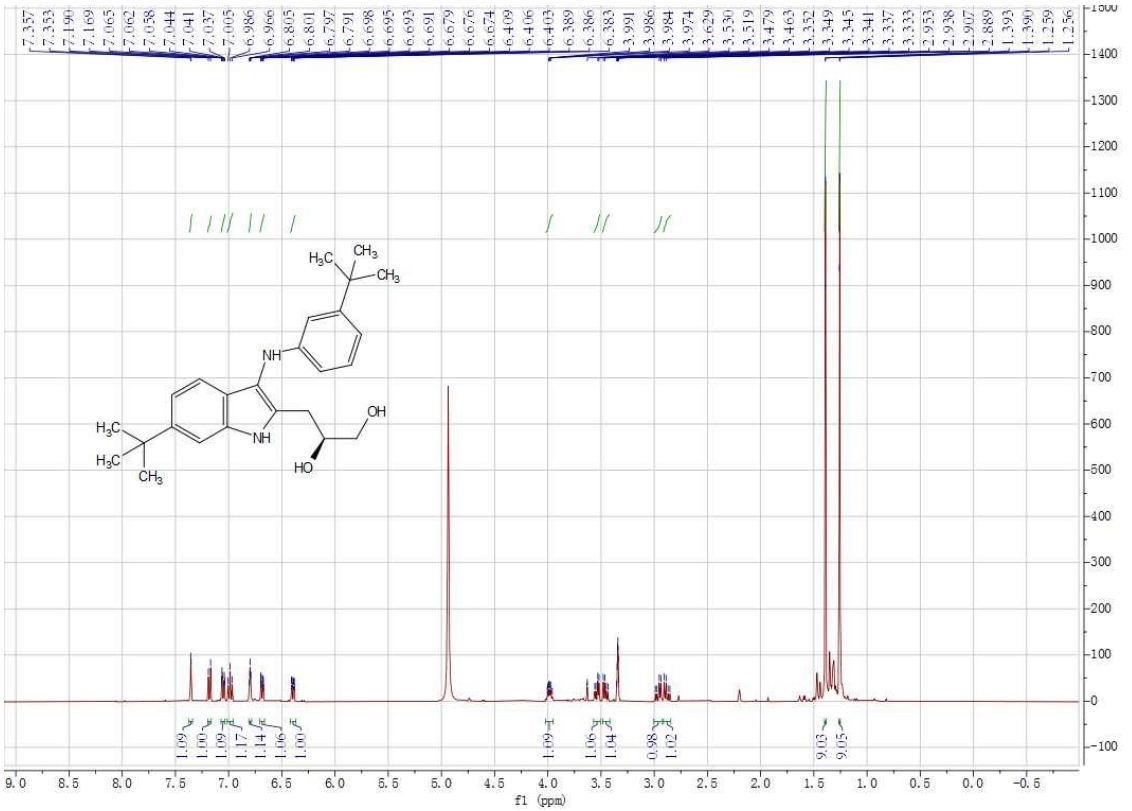


Figure. S47[1]H NMR of compound**4b**

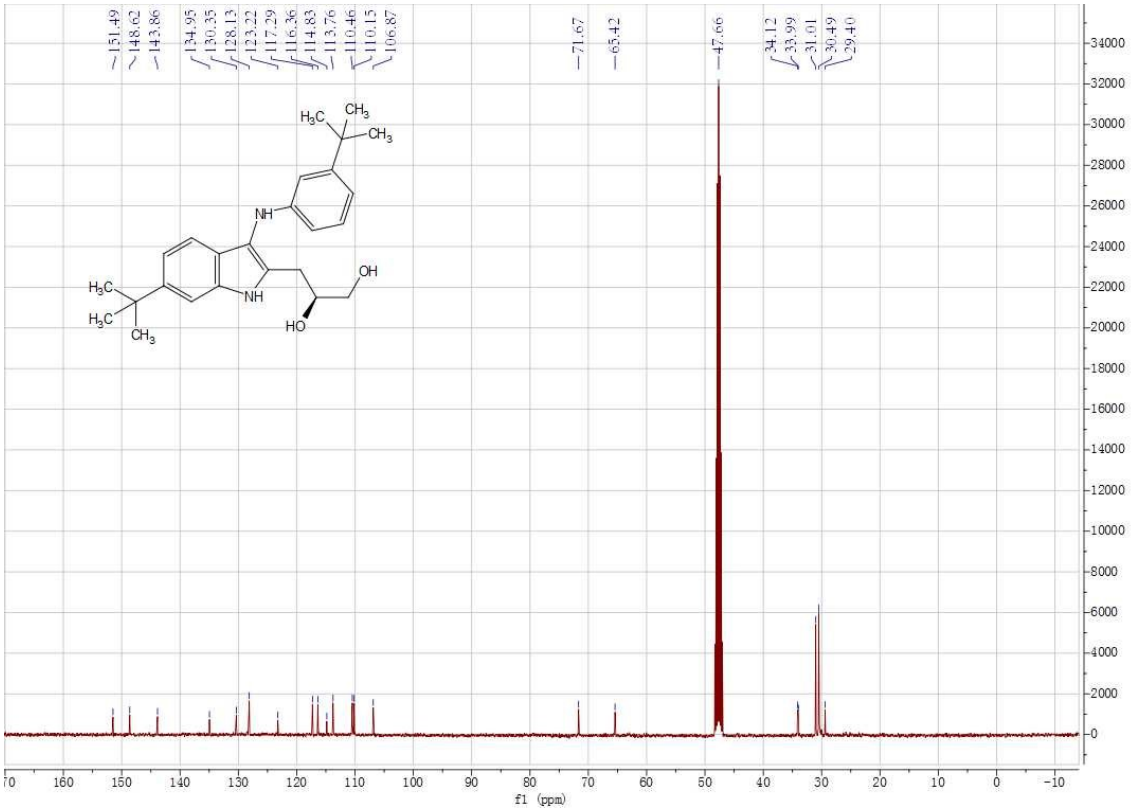


Figure. S48[13]C{[1]H} NMR of compound **4b**

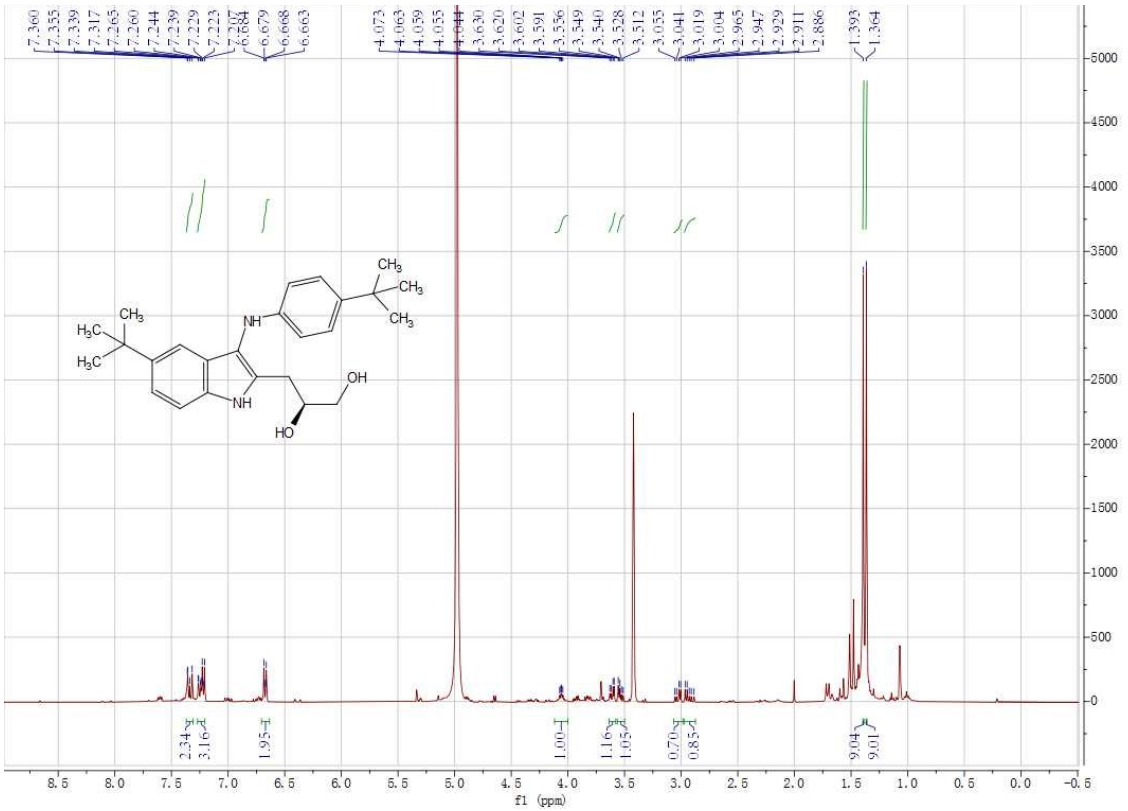


Figure. S49^{1}H NMR of compound**5b**

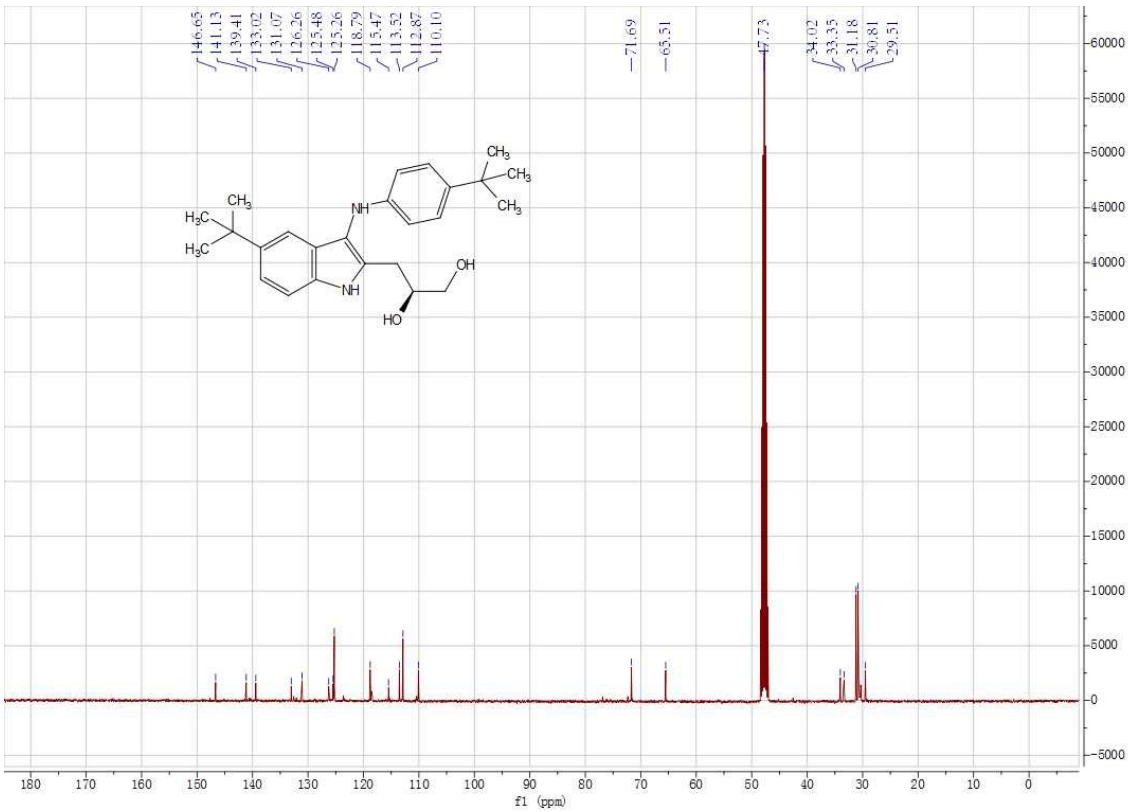


Figure. S50^{13}C{^{1}H} NMR of compound **5b**

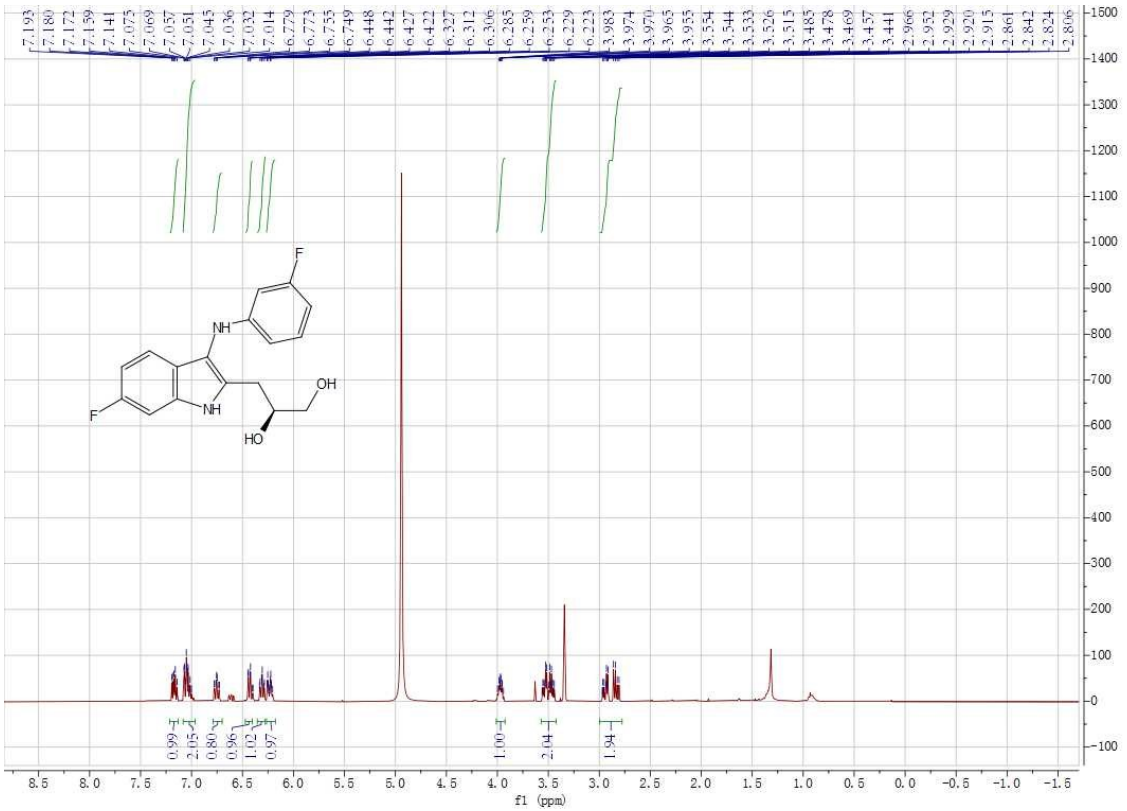


Figure. S51 ^{1}H NMR of compound**6b**

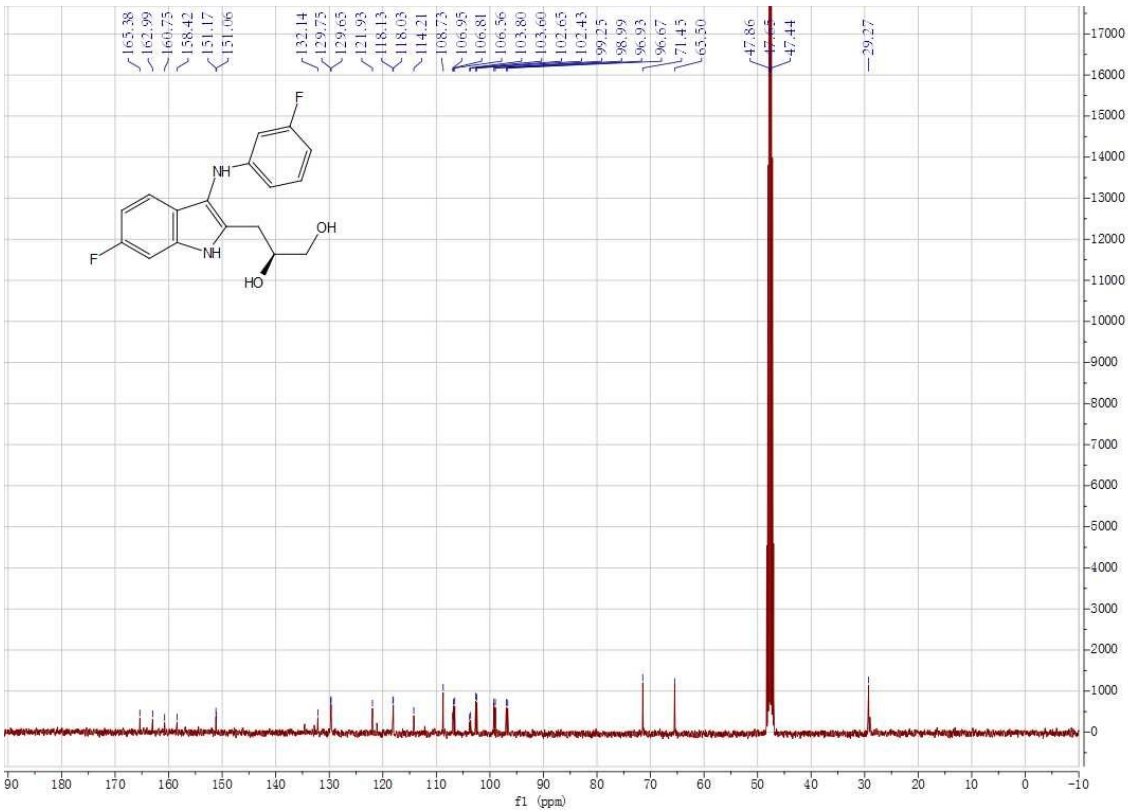


Figure. S52^{13}C{^{1}H} NMR of compound **6b**

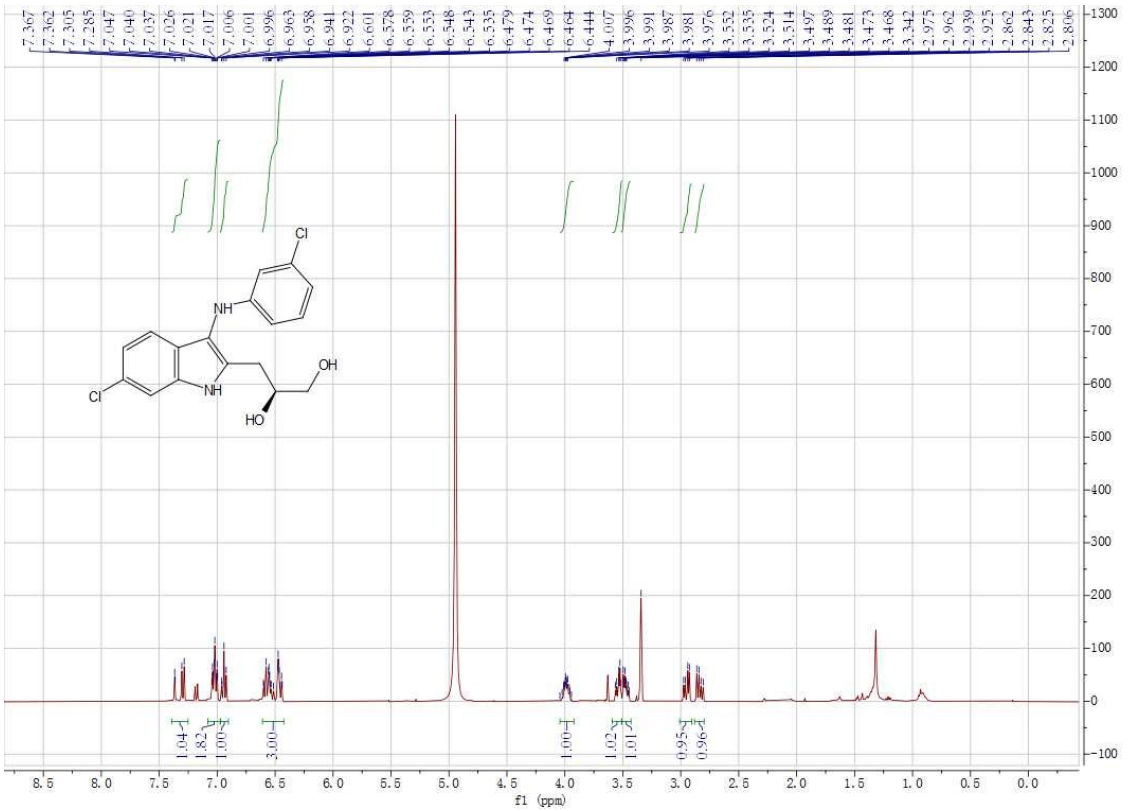


Figure. S53^{1}H NMR of compound**7b**

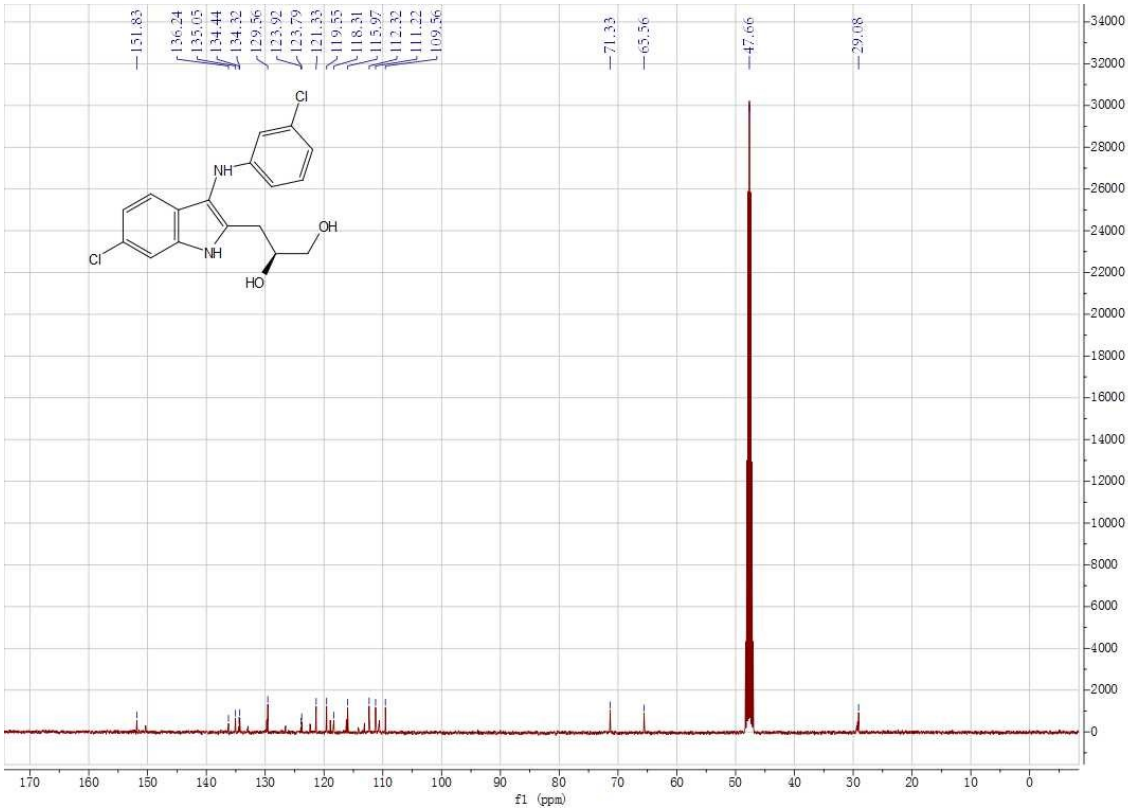


Figure. S54^{13}C{^{1}H} NMR of compound **7b**

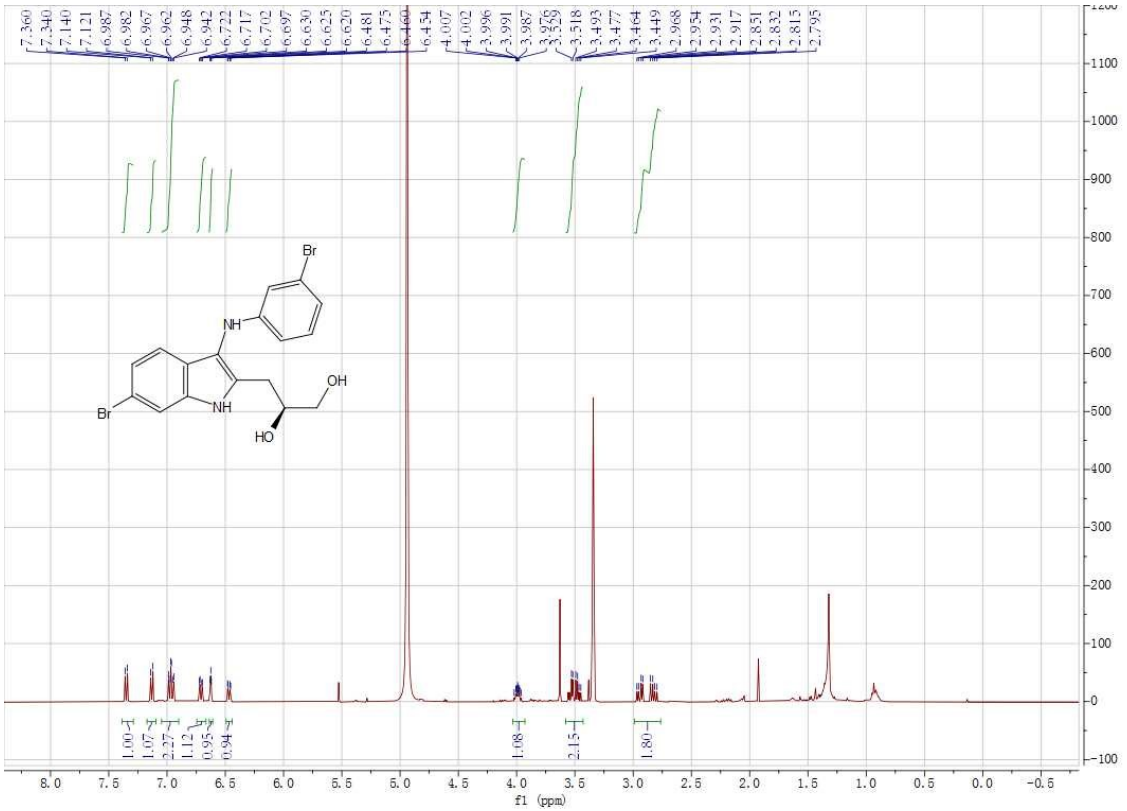


Figure. S55^{1}H NMR of compound**8b**

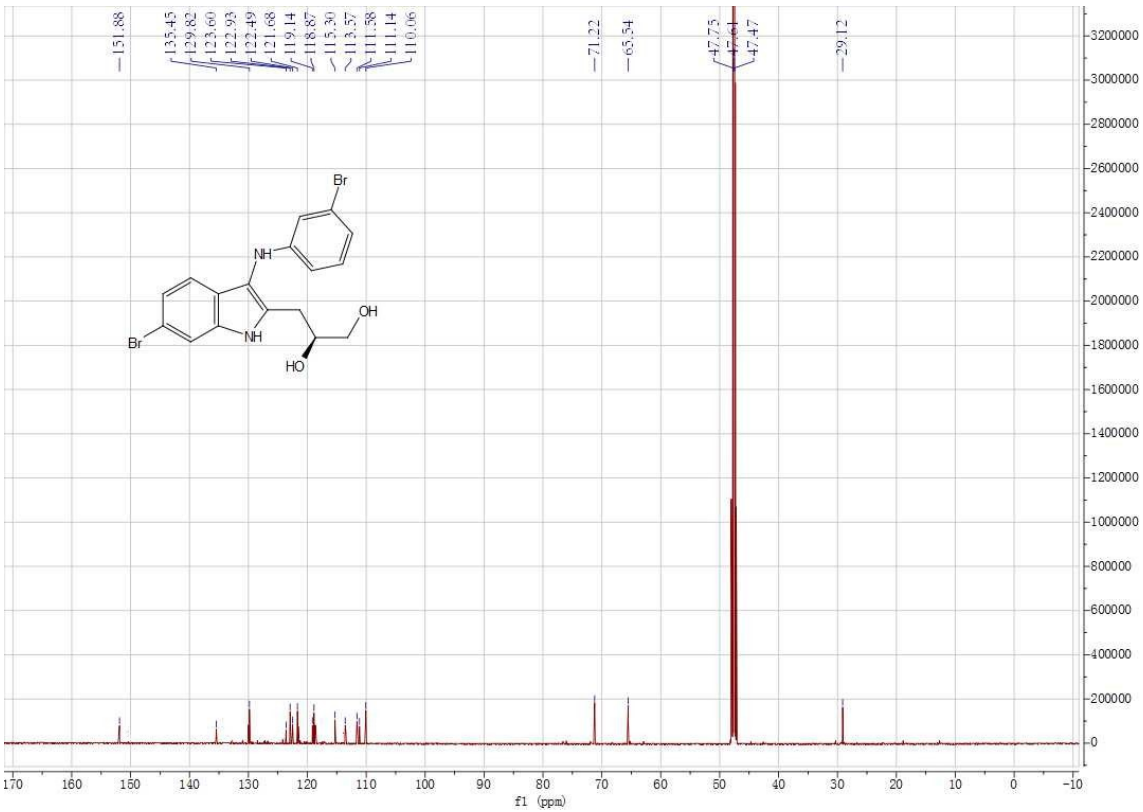


Figure. S56^{13}C{^{1}H} NMR of compound **8b**

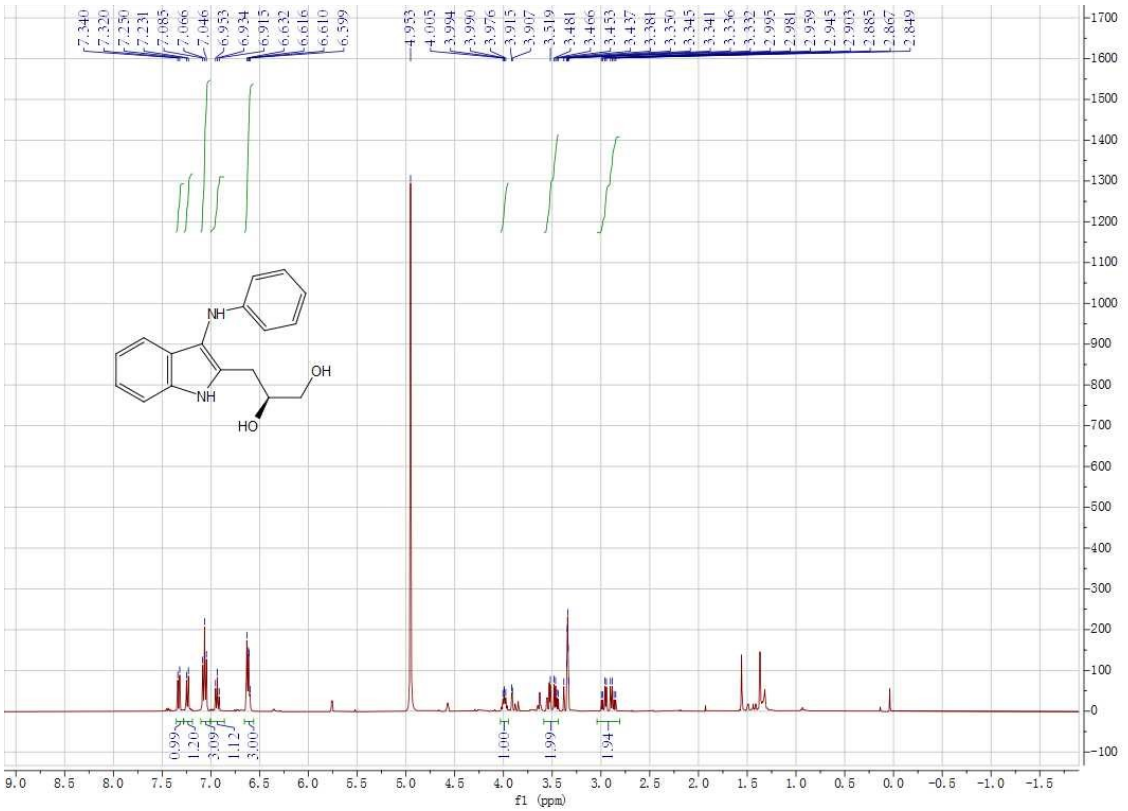


Figure. S57^{1}H NMR of compound**9b**

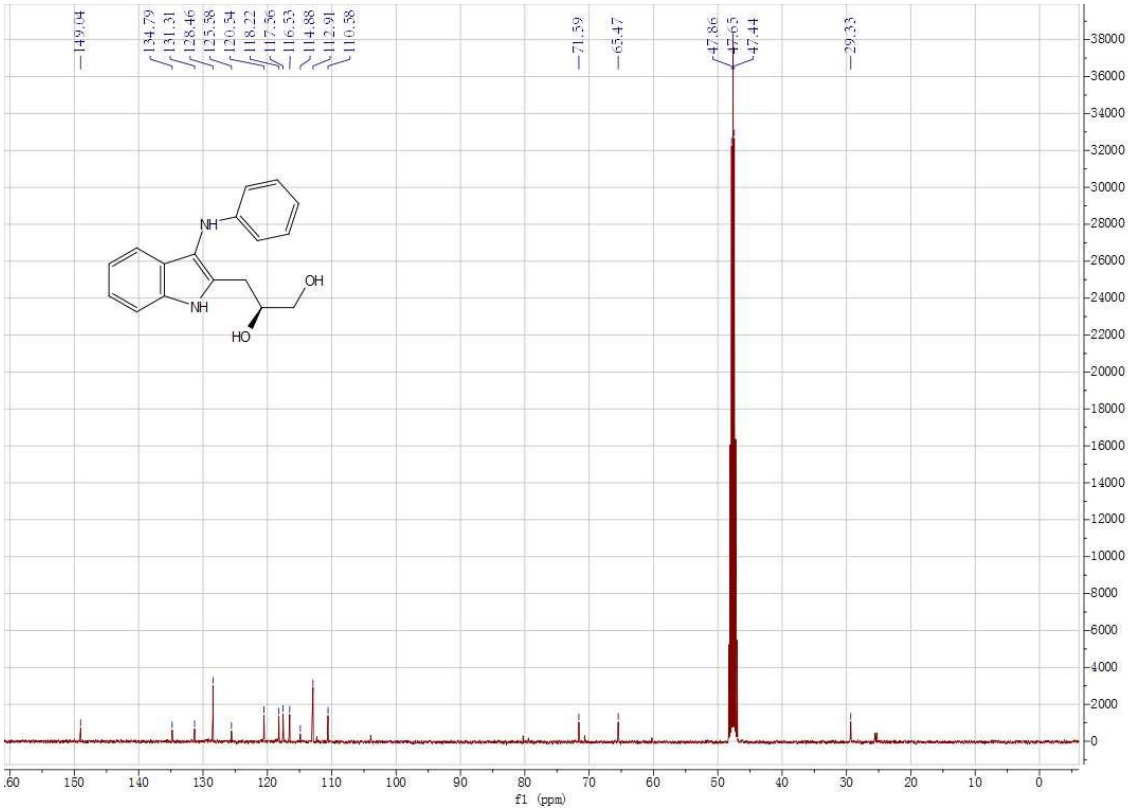


Figure. S58^{13}C{^{1}H} NMR of compound **9b**

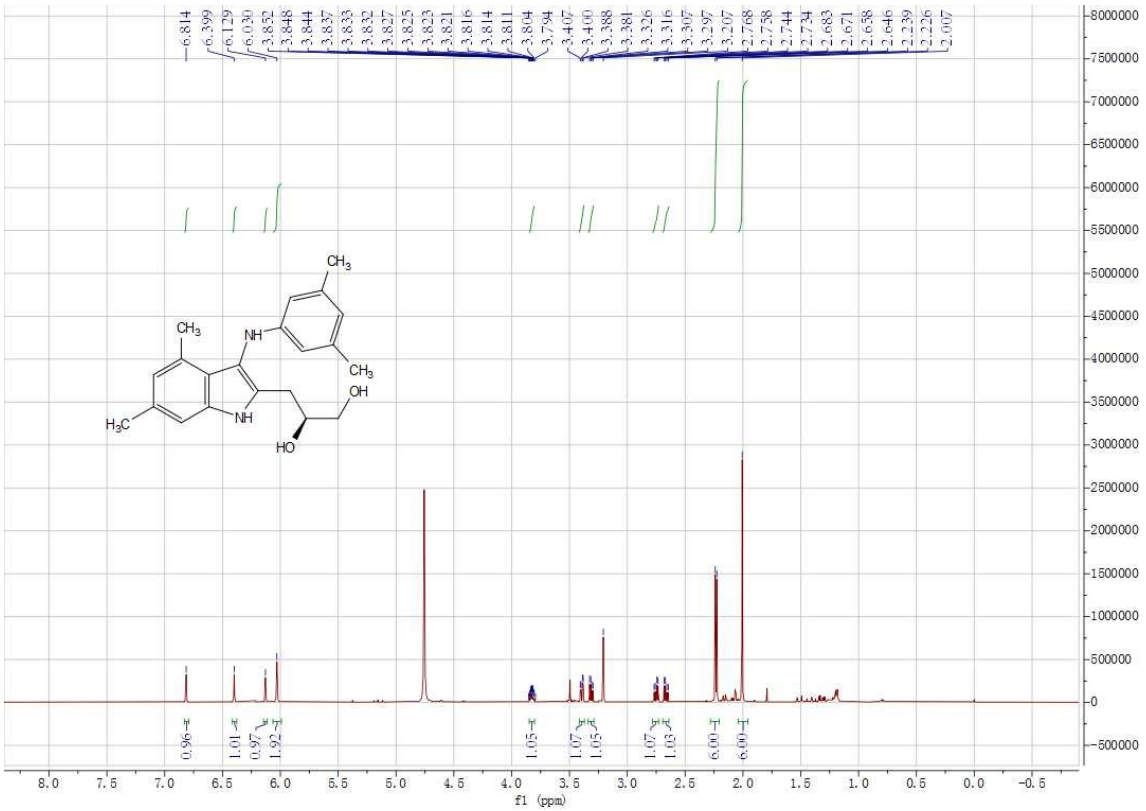


Figure. S59[1]H NMR of compound**10b**

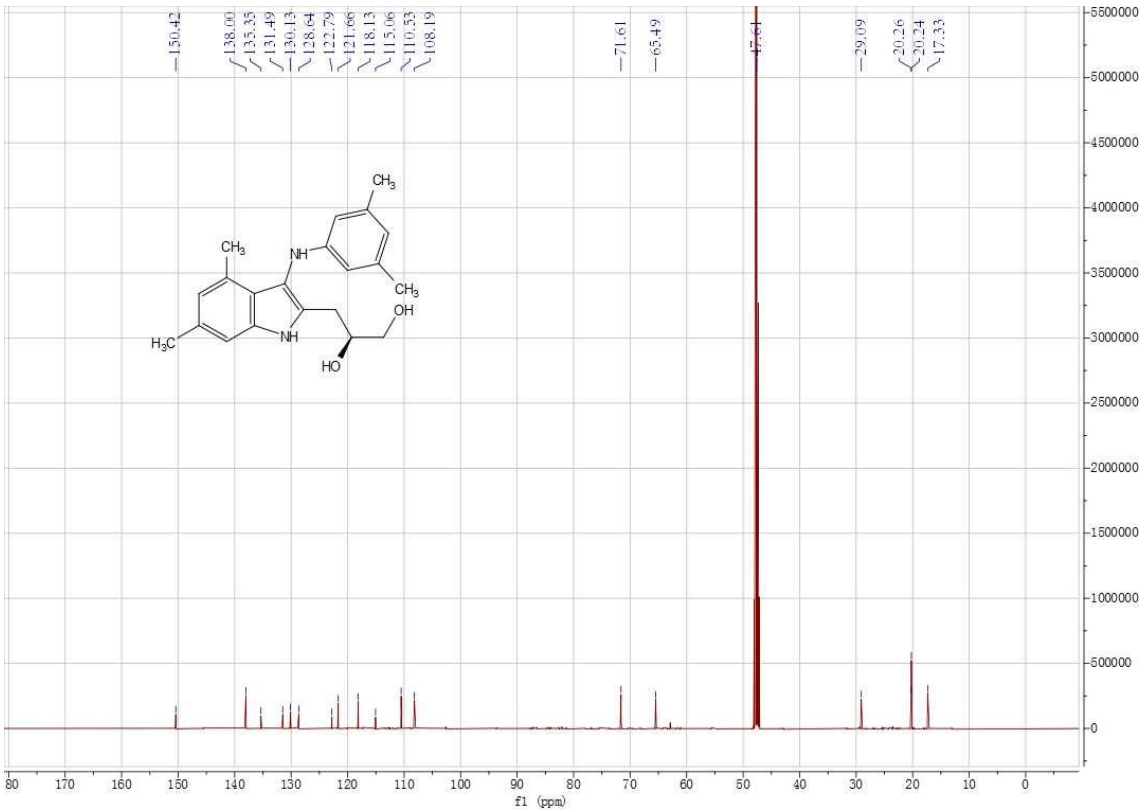


Figure. S60[13]C{[1]H} NMR of compound **10b**

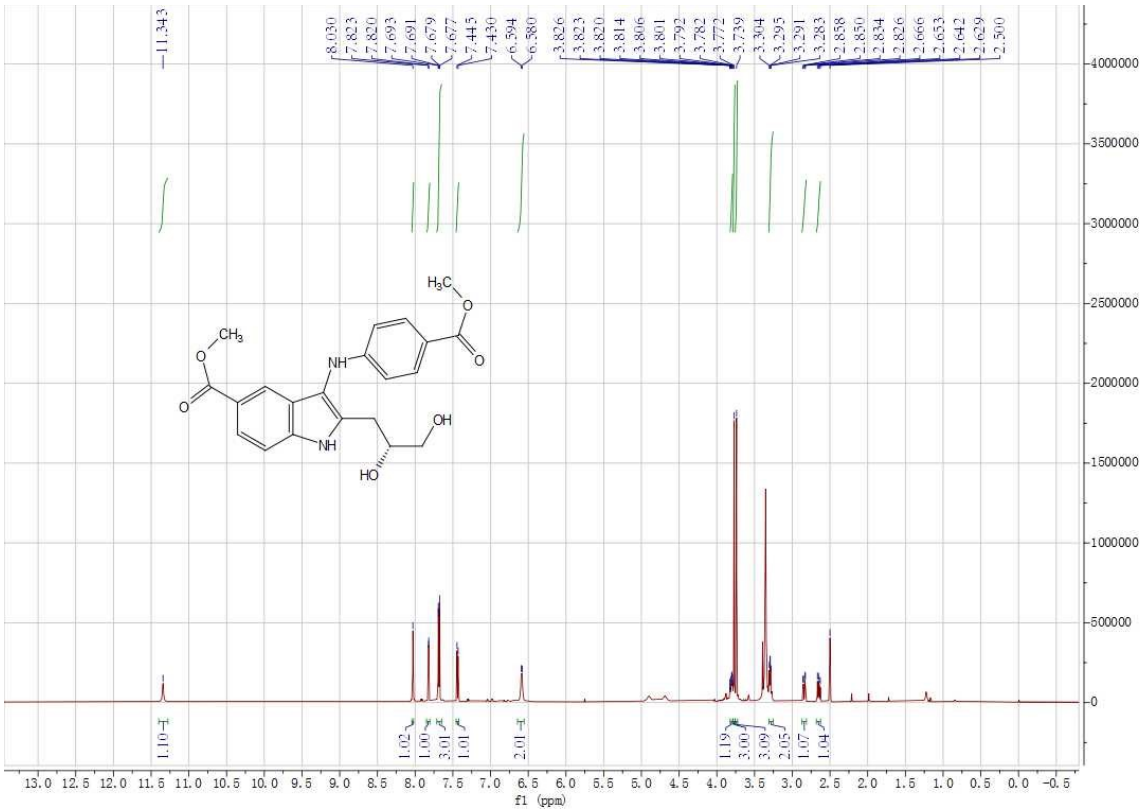


Figure. S61 ^{1}H NMR of compound**11b**

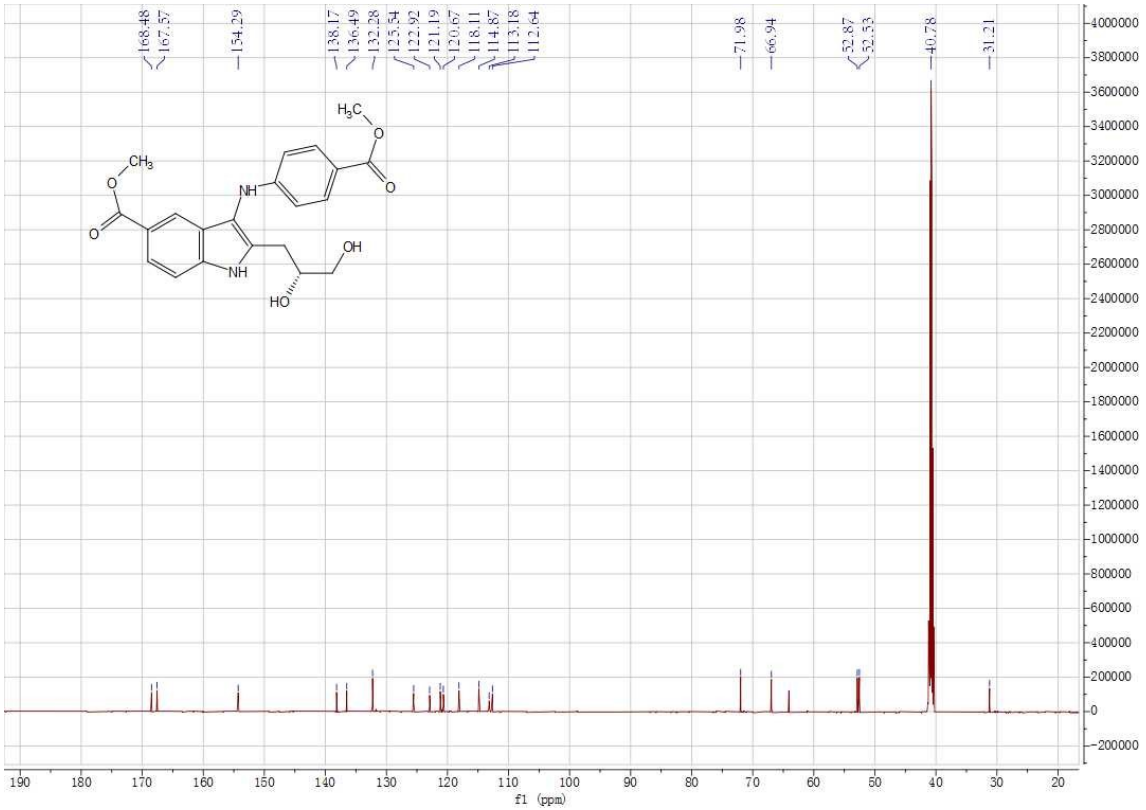


Figure. S62 ^{13}C{^{1}H} NMR of compound **11b**

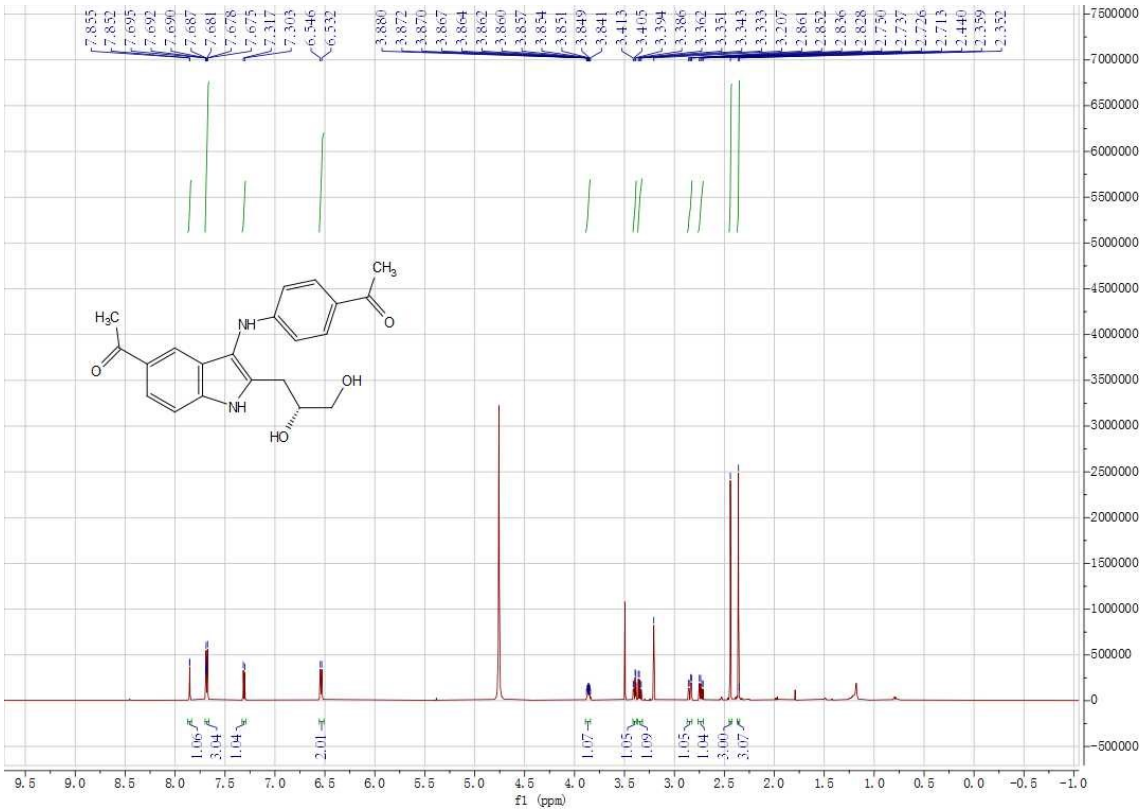


Figure. S63^{1}H NMR of compound**12b**

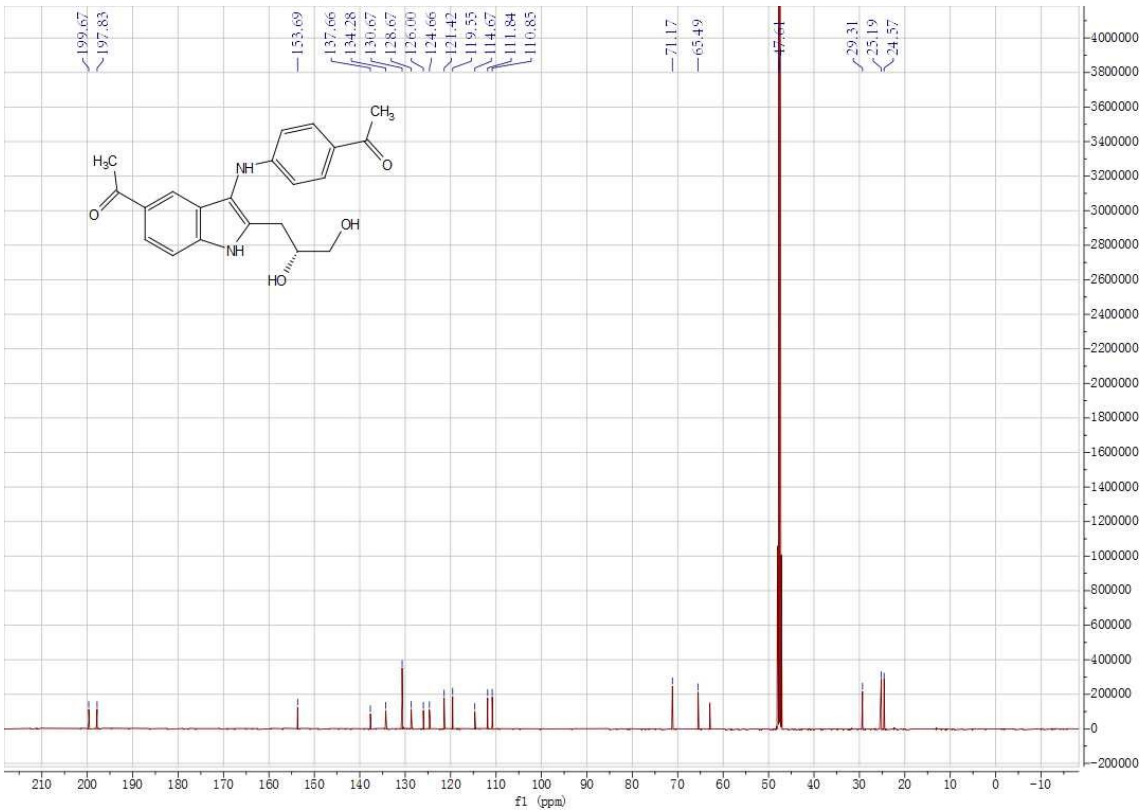


Figure. S64^{13}C{^{1}H} NMR of compound **12b**

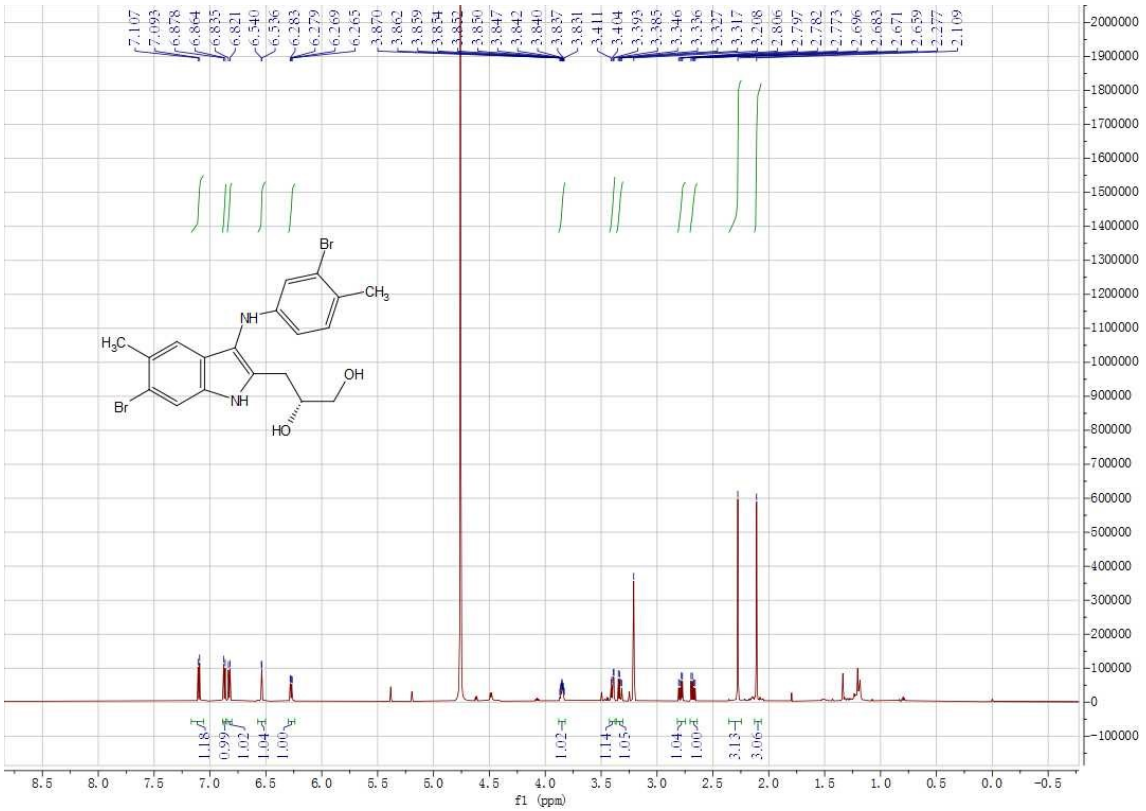


Figure. S65^{1}H NMR of compound**13b**

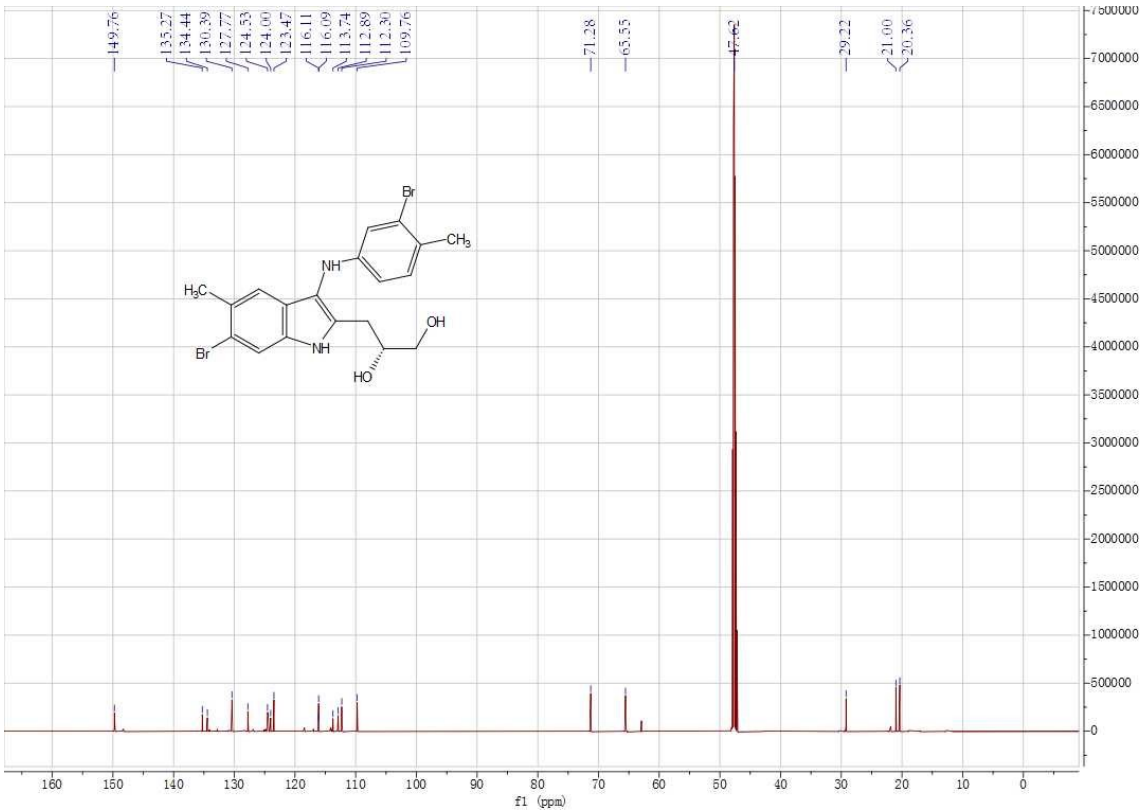


Figure. S66^{13}C{^{1}H} NMR of compound **13b**

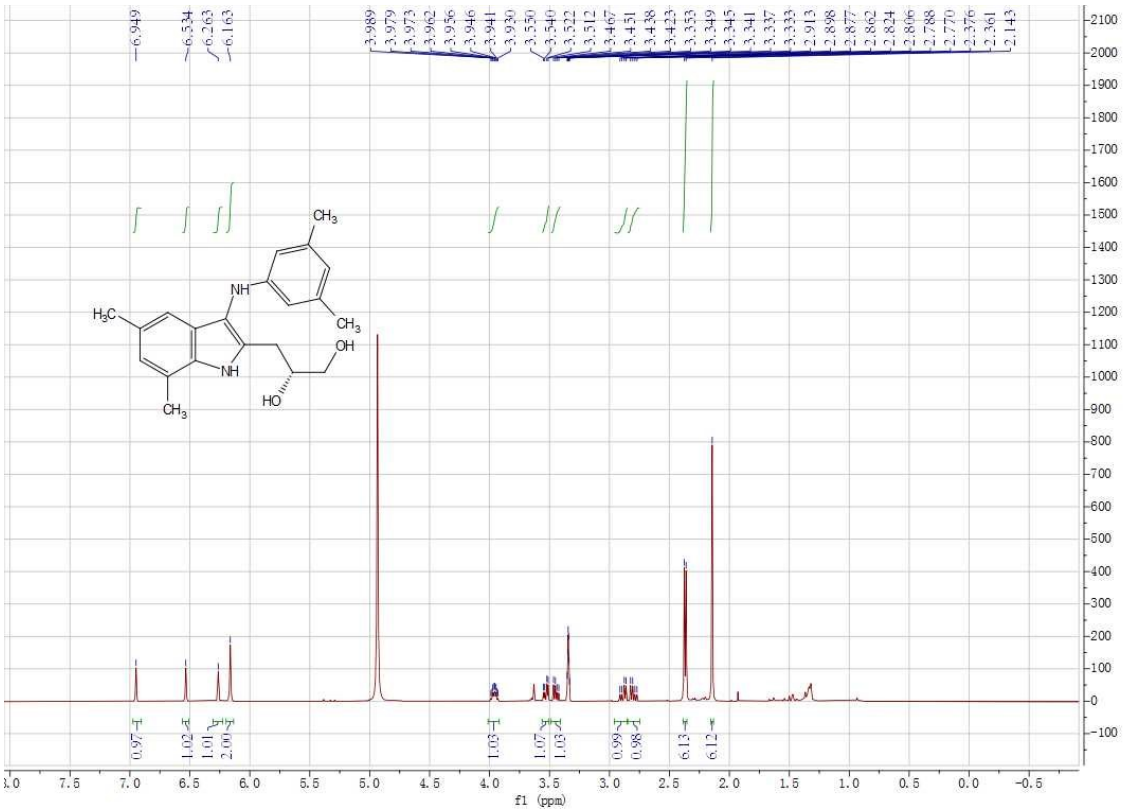


Figure. S67^{1}H NMR of compound**14b**

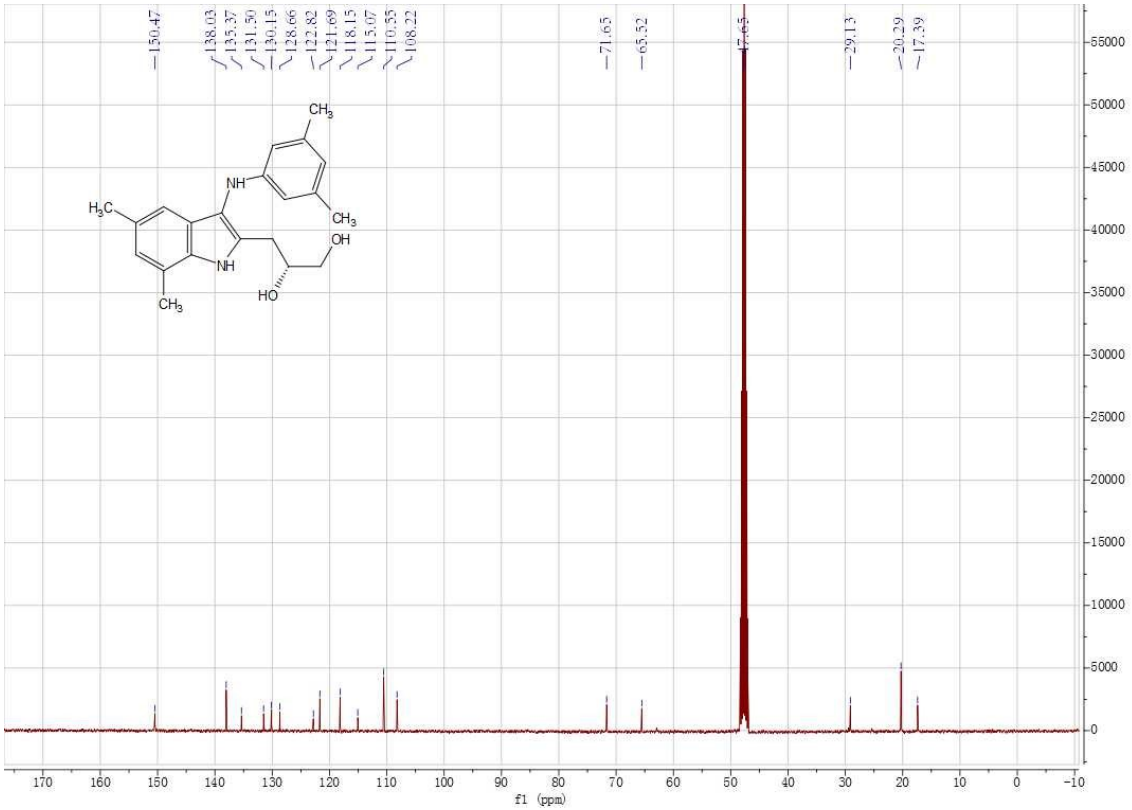


Figure. S68^{13}C{^{1}H} NMR of compound **14b**

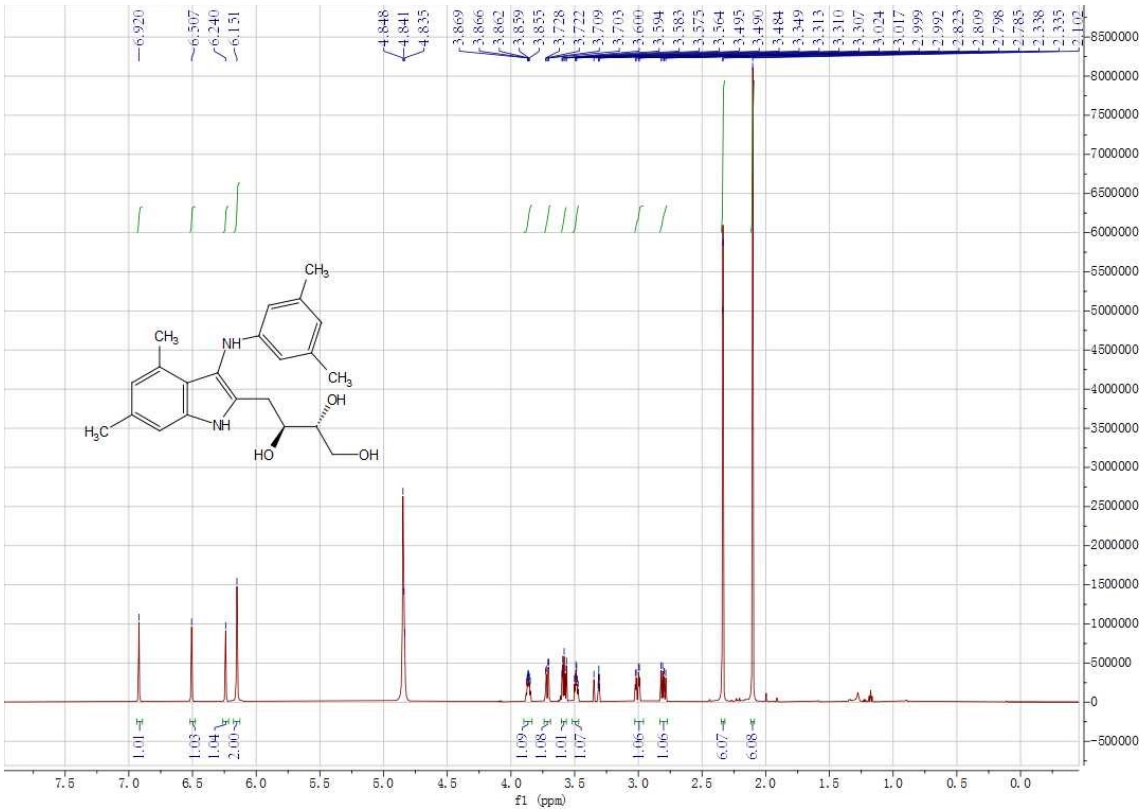


Figure. S69[1]H NMR of compound**15b**

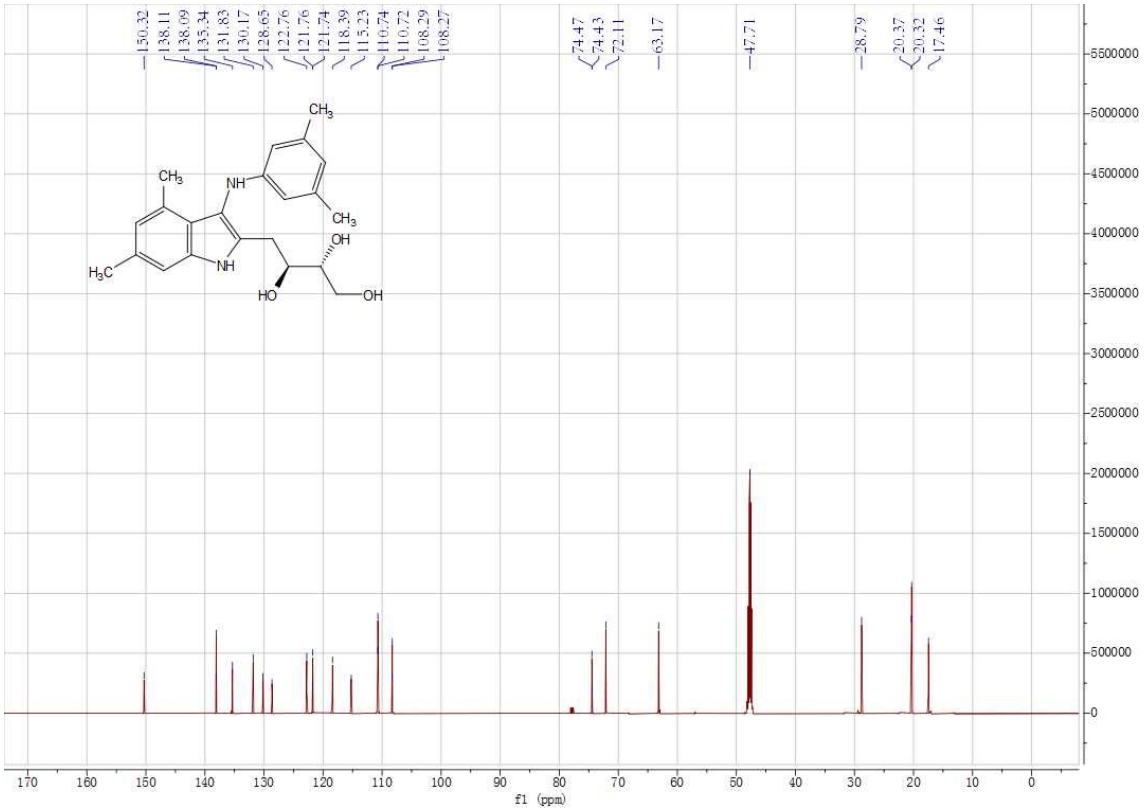


Figure. S70[13]C{[1]H} NMR of compound **15b**

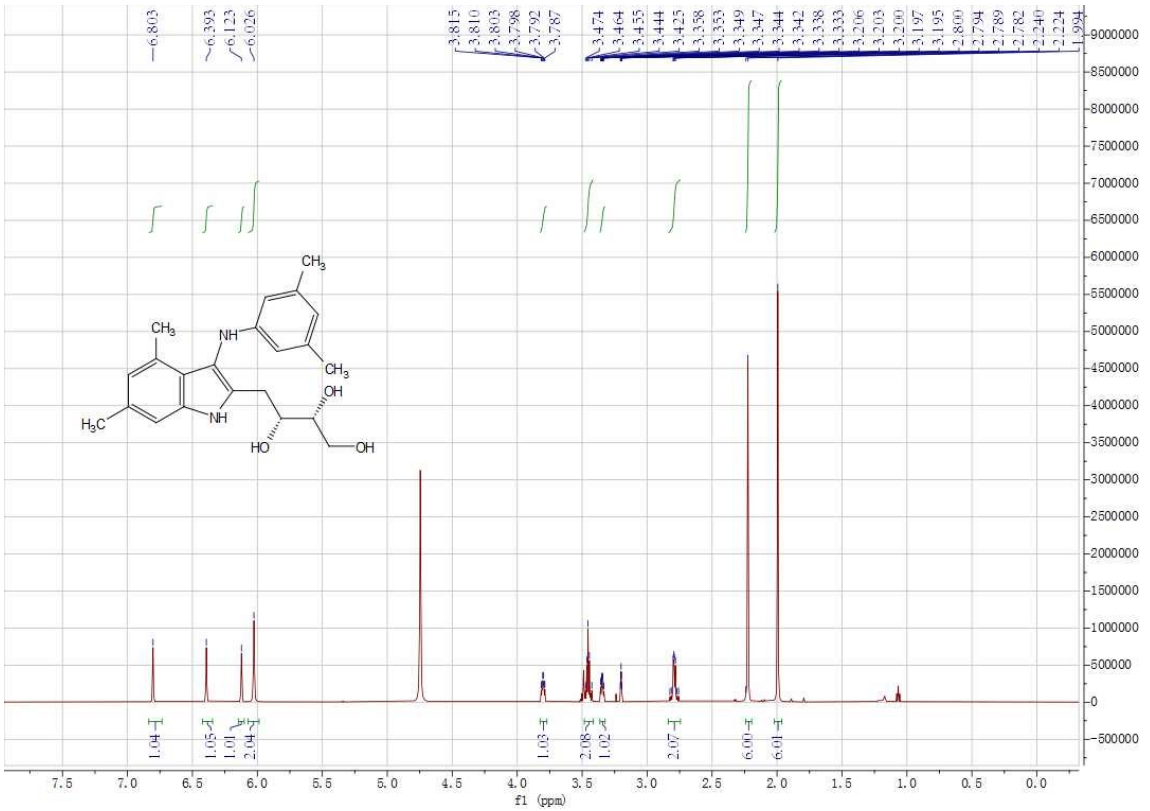


Figure. S71[1]H NMR of compound**16b**

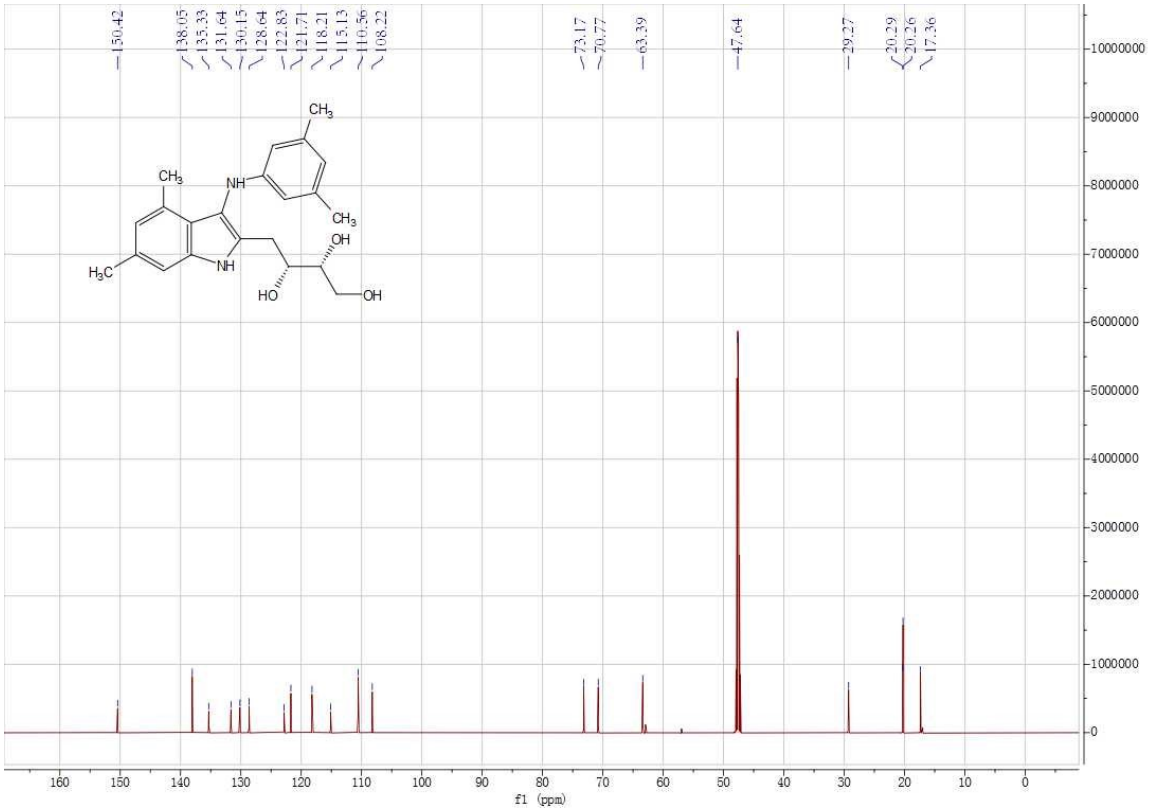


Figure. S72[13]C{[1]H} NMR of compound **16b**

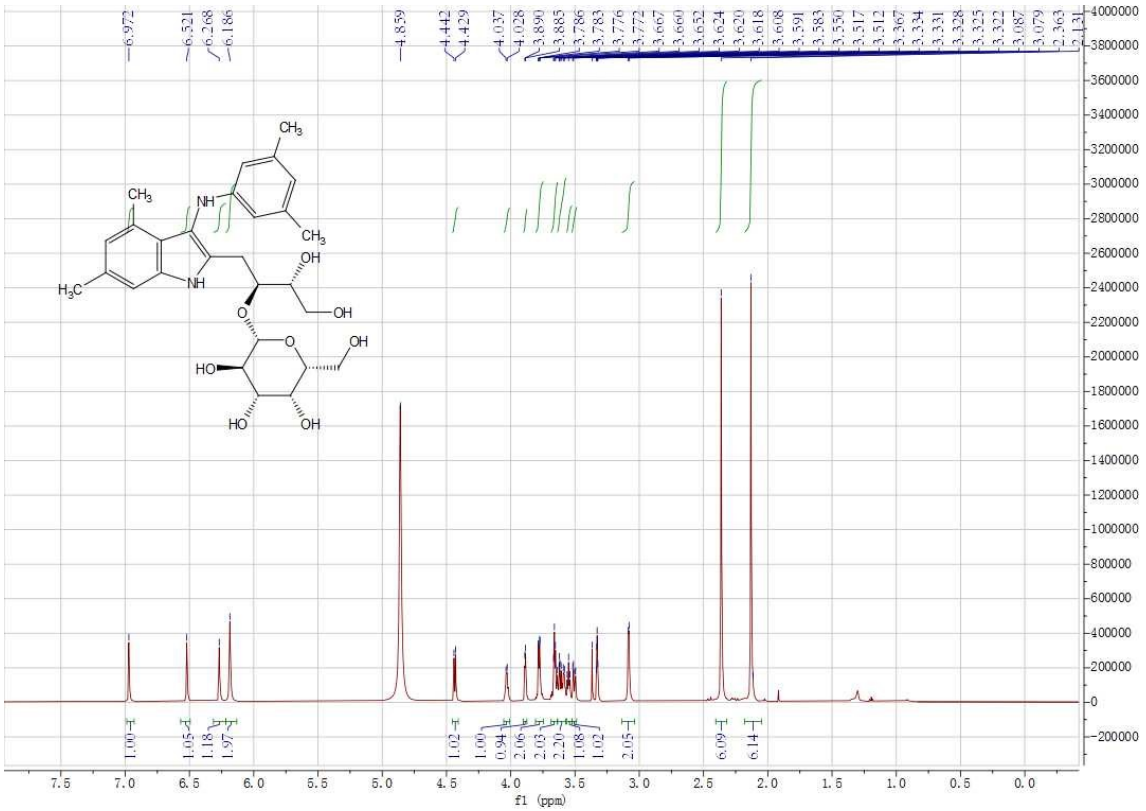


Figure. S73[1]H NMR of compound**17b**

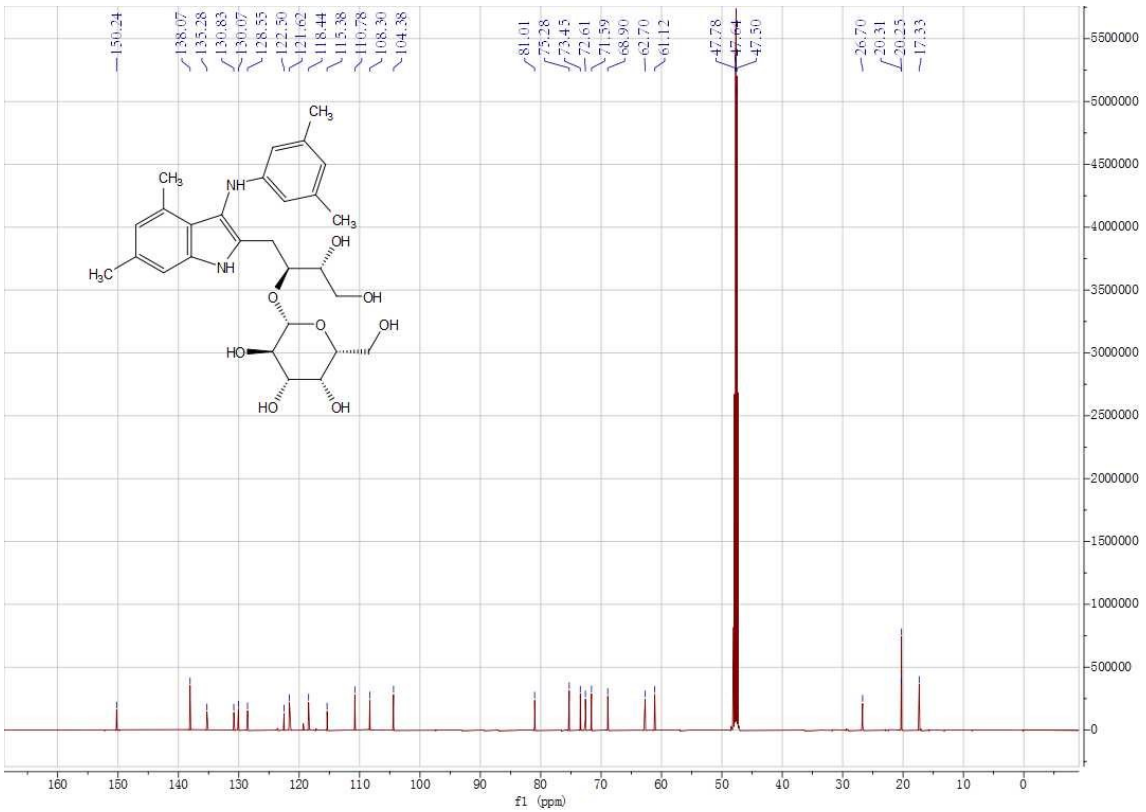


Figure. S74[13]C{[1]H} NMR of compound **17b**

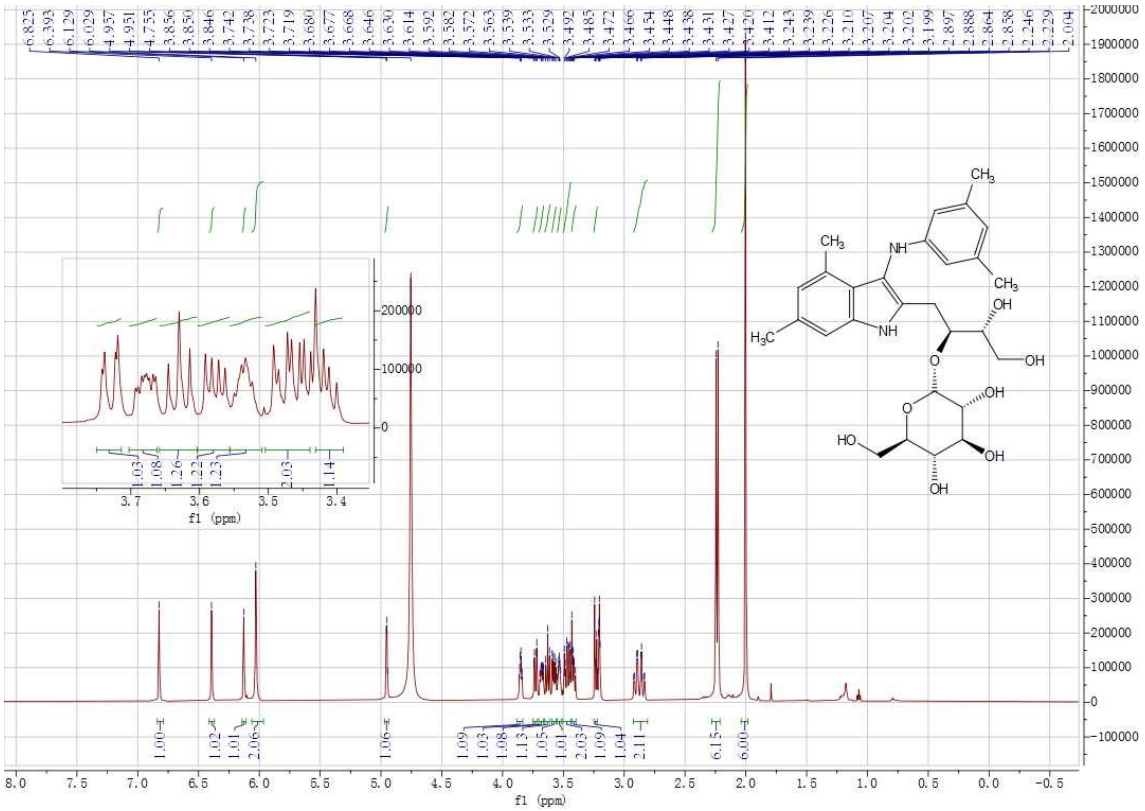


Figure. S75^{1}H NMR of compound**18b**

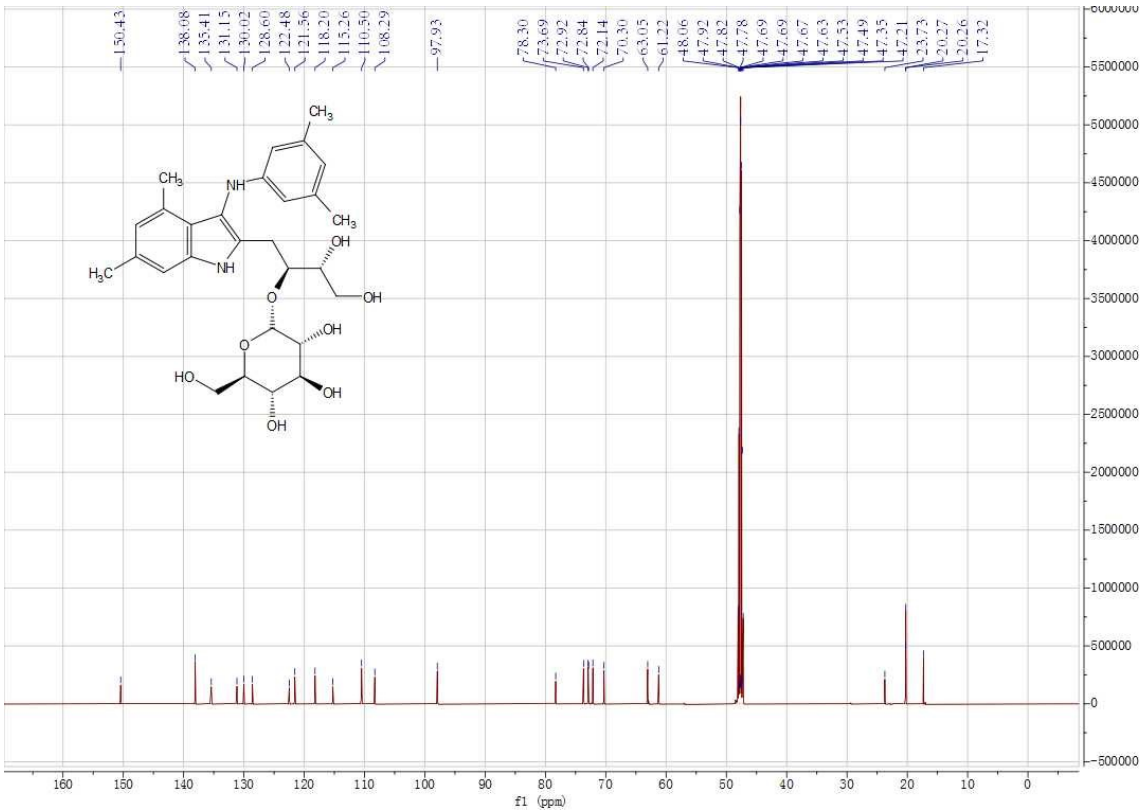


Figure. S76^{13}C{^{1}H} NMR of compound **18b**

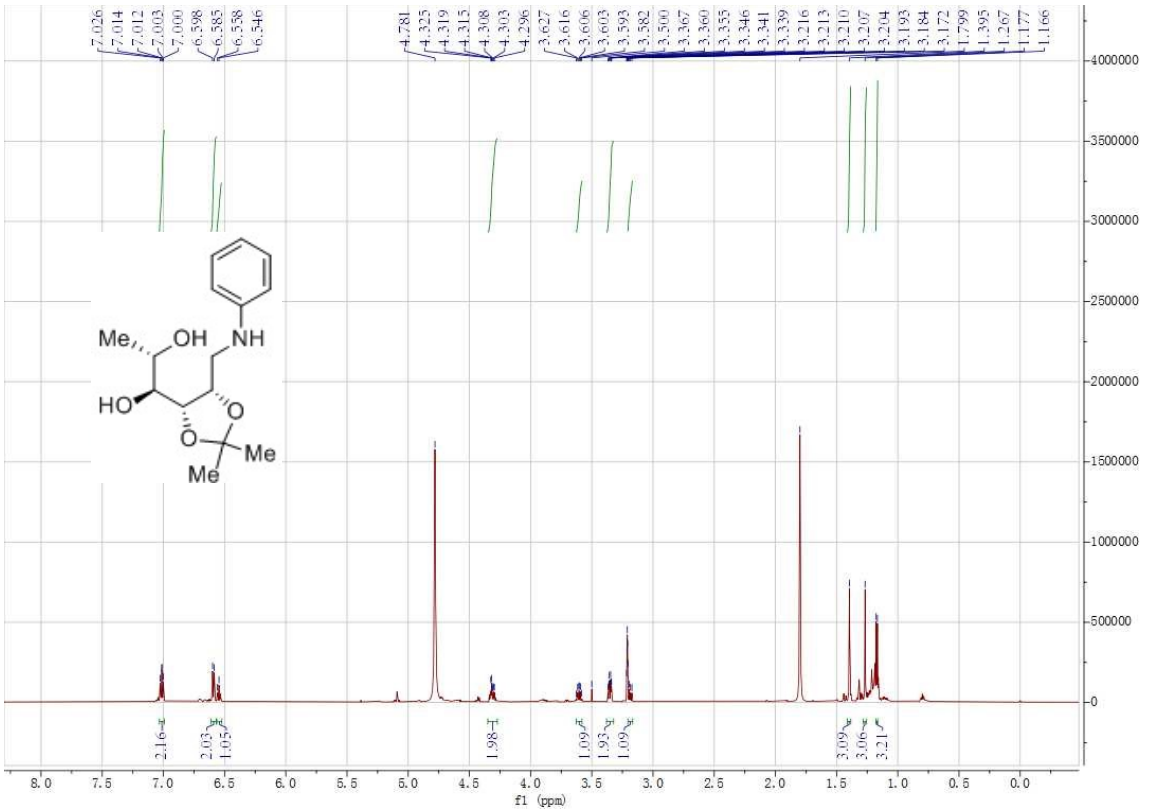


Figure. S77^{1}H NMR of compound**1c**

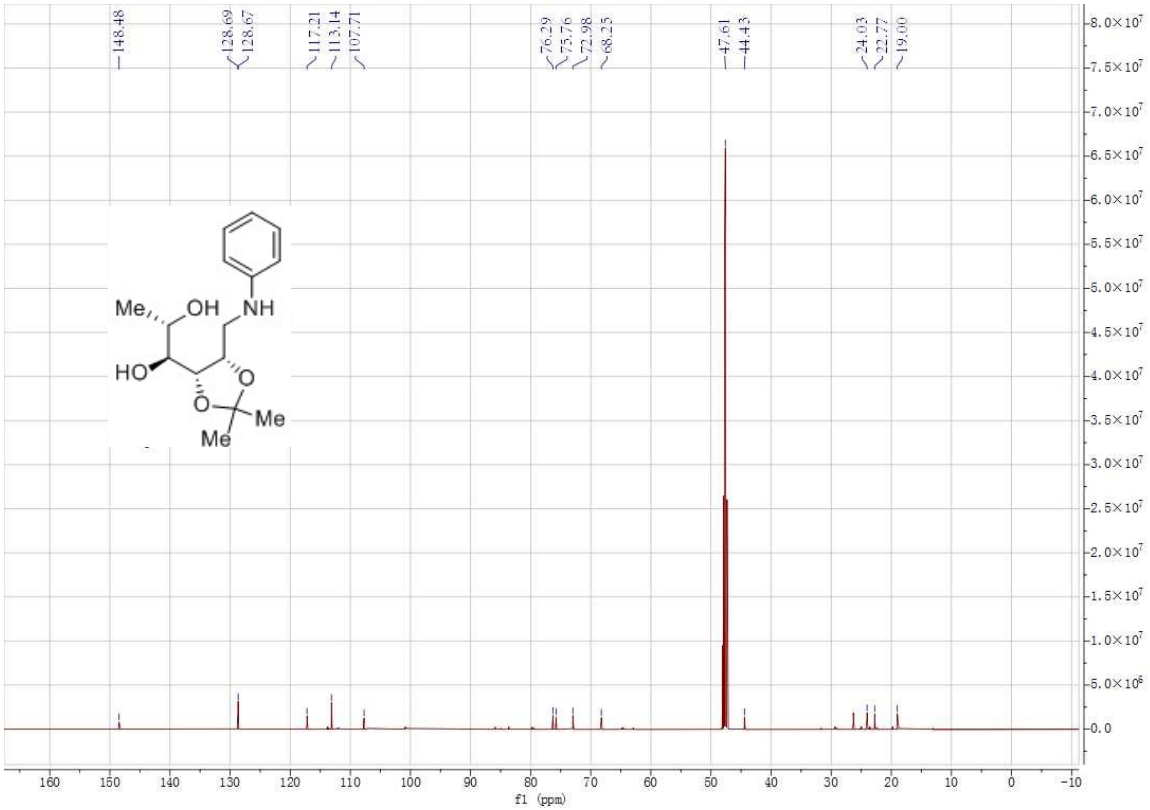


Figure. S78^{13}C{^{1}H} NMR of compound **1c**

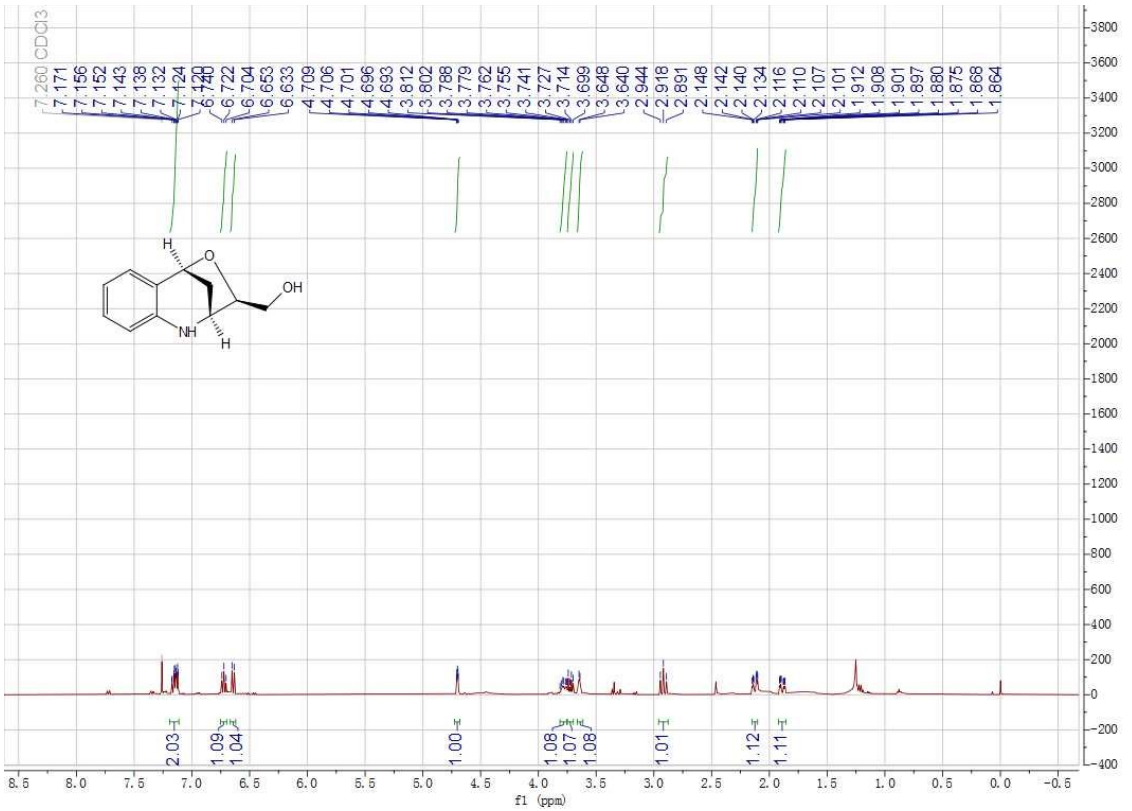


Figure. S79[1]H NMR of compound**2c**

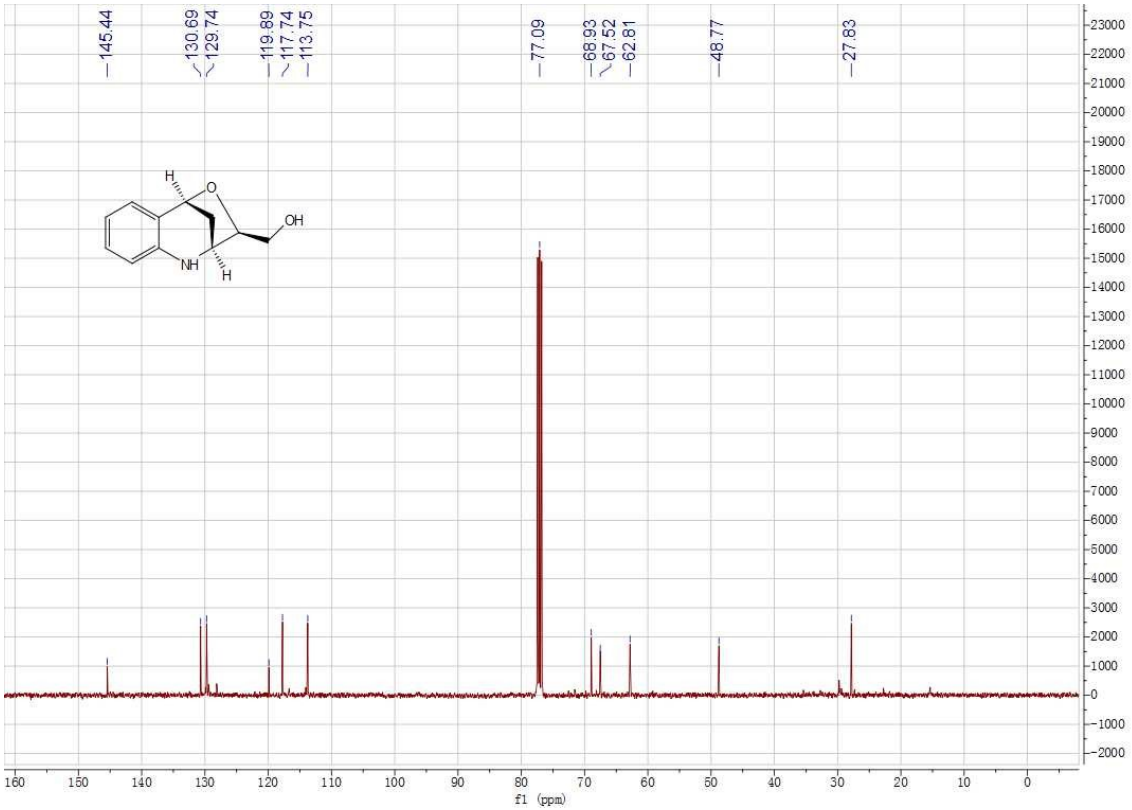


Figure. S80[13]C{[1]H} NMR of compound **2c**

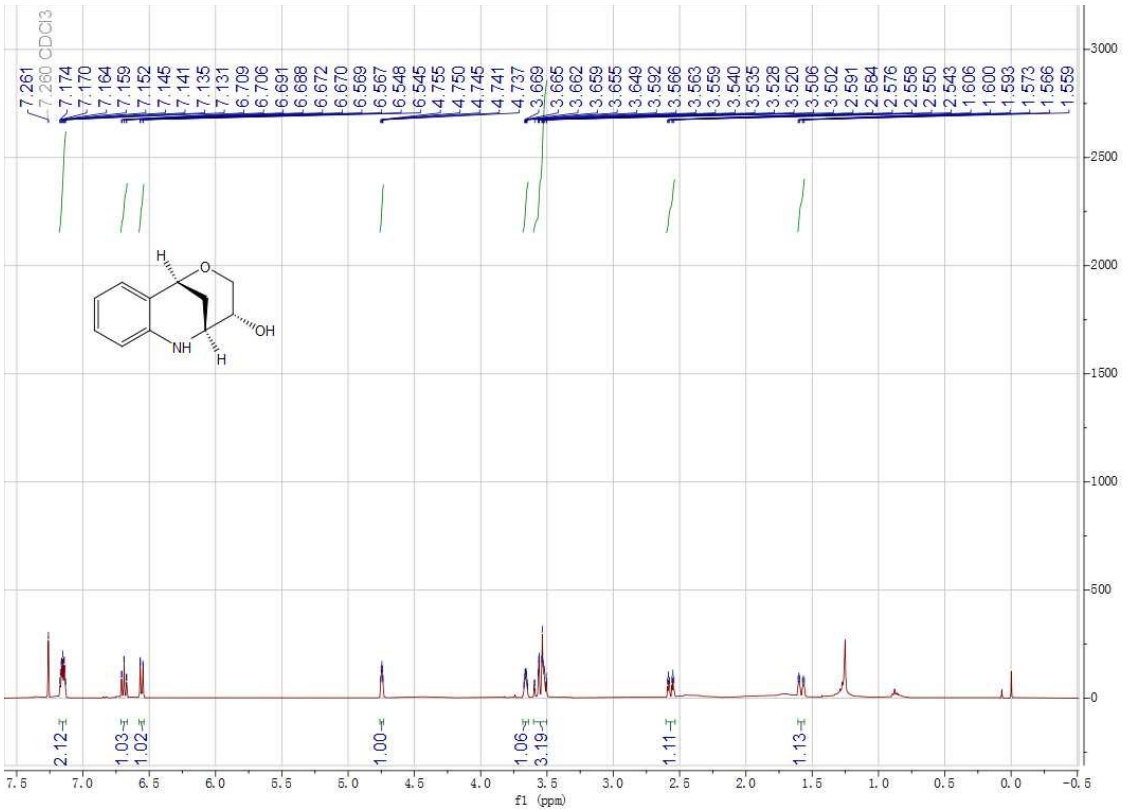


Figure. S81 ^{1}H NMR of compound**2c'**

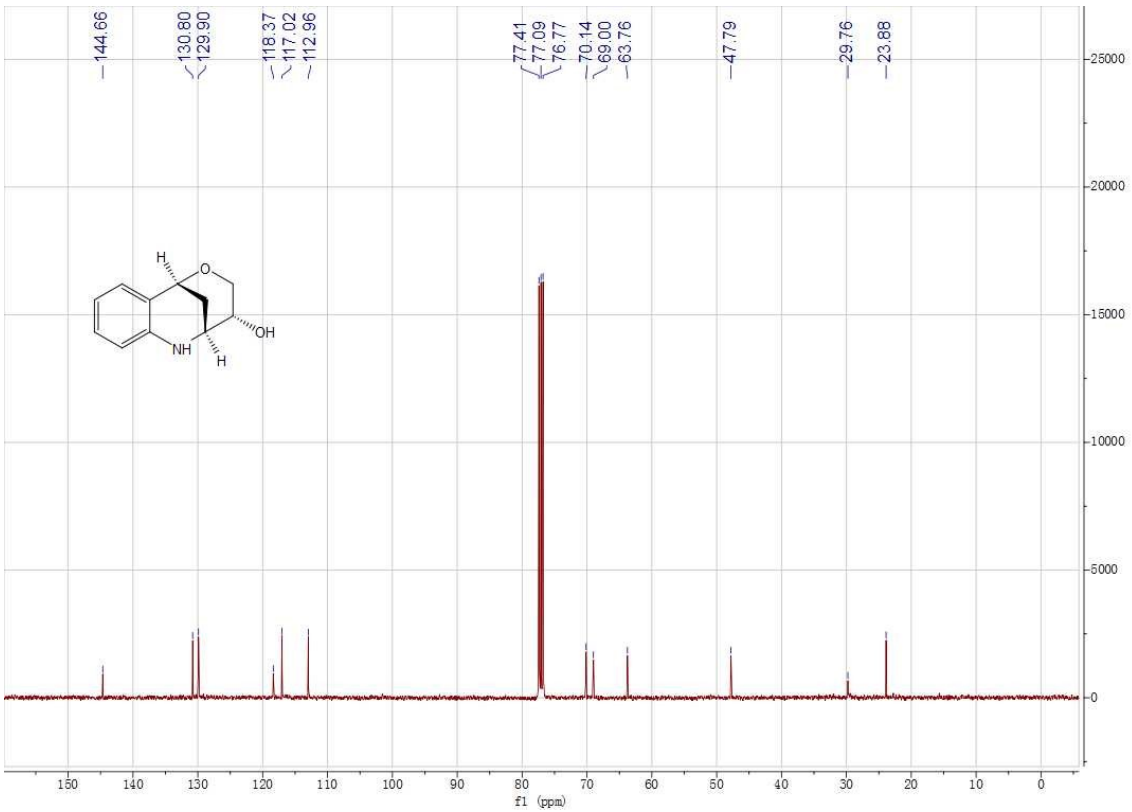


Figure. S82^{13}C{^{1}H} NMR of compound **2c'**

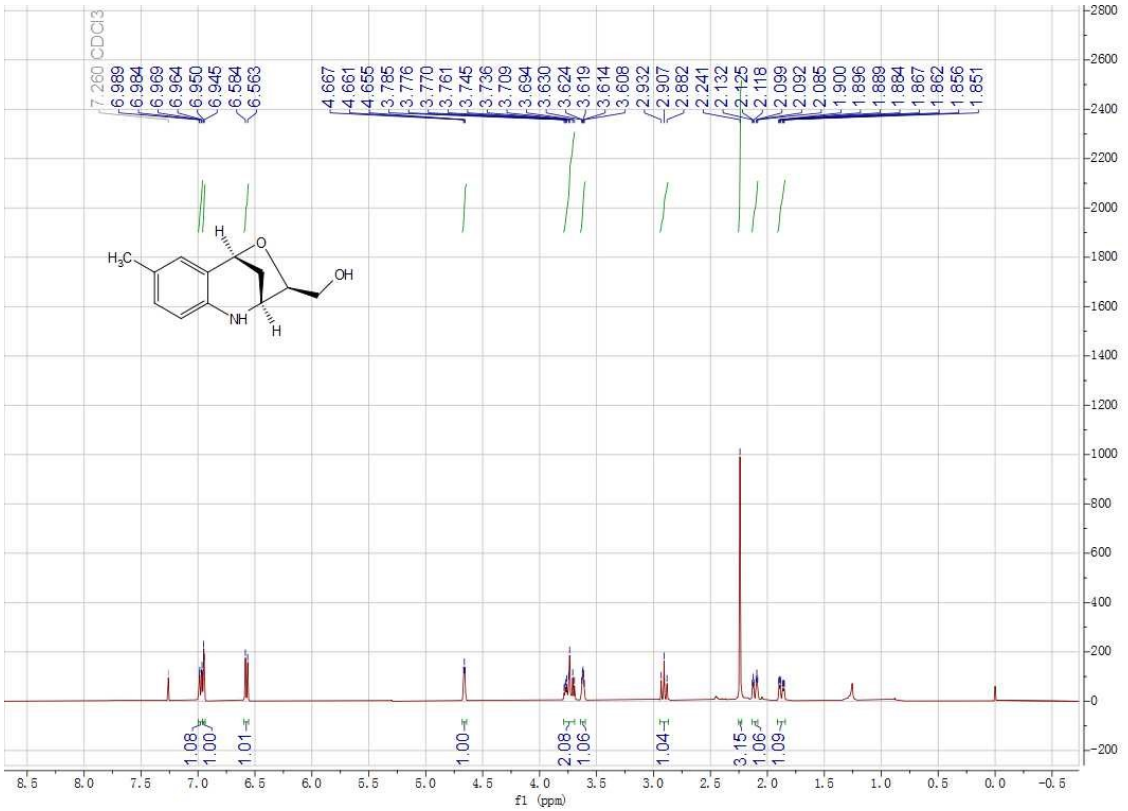


Figure. S83[1]H NMR of compound**3c**

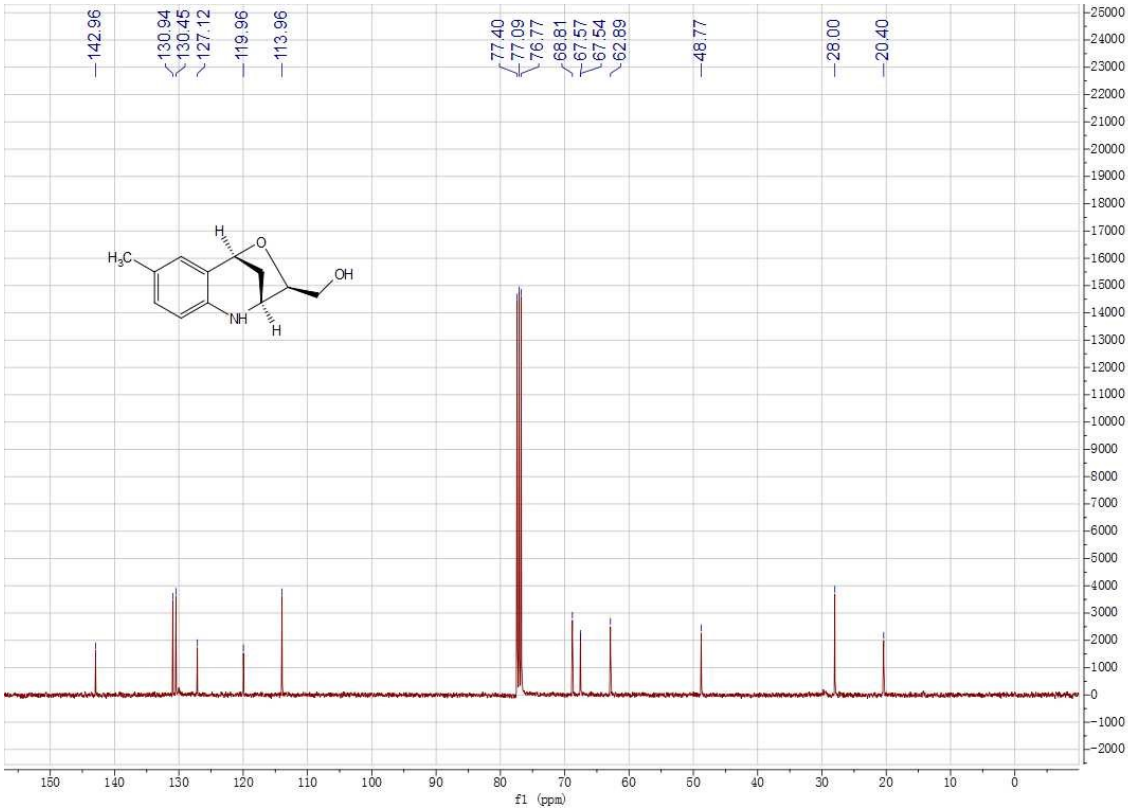


Figure. S84[13]C{[1]H} NMR of compound **3c**

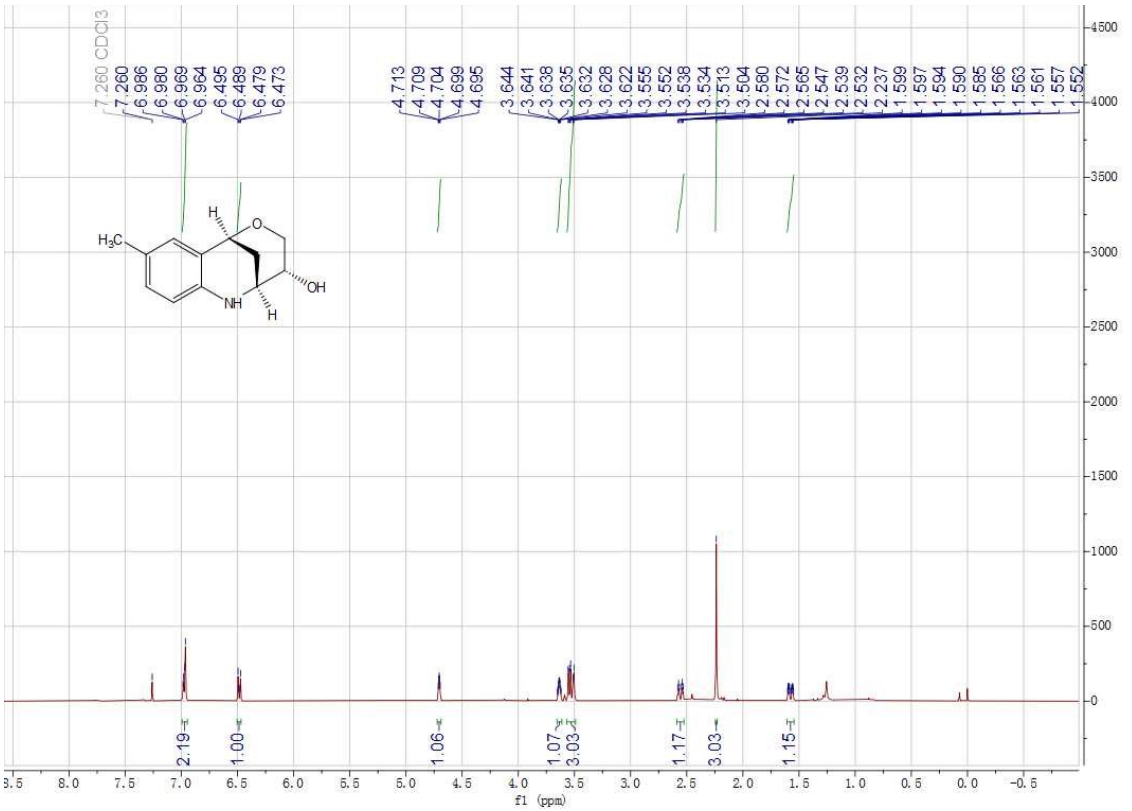


Figure. S85[1]H NMR of compound**3c'**

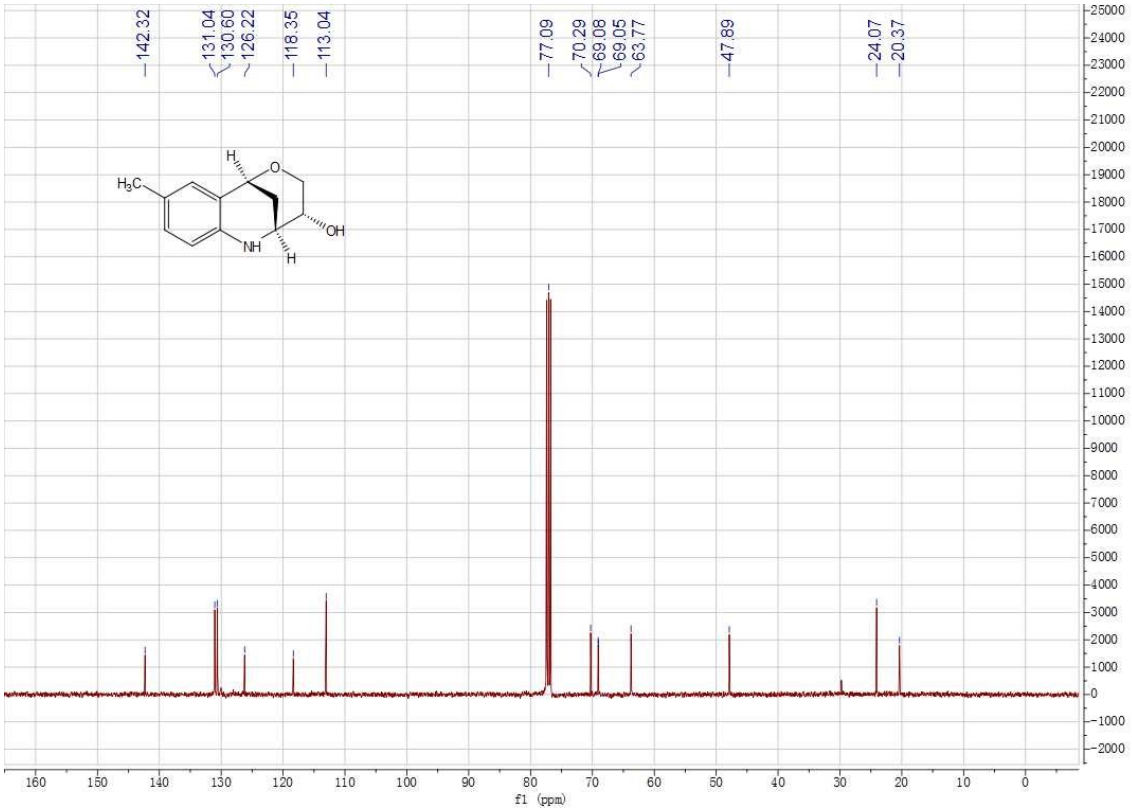


Figure. S86[13]C{[1]H} NMR of compound **3c'**

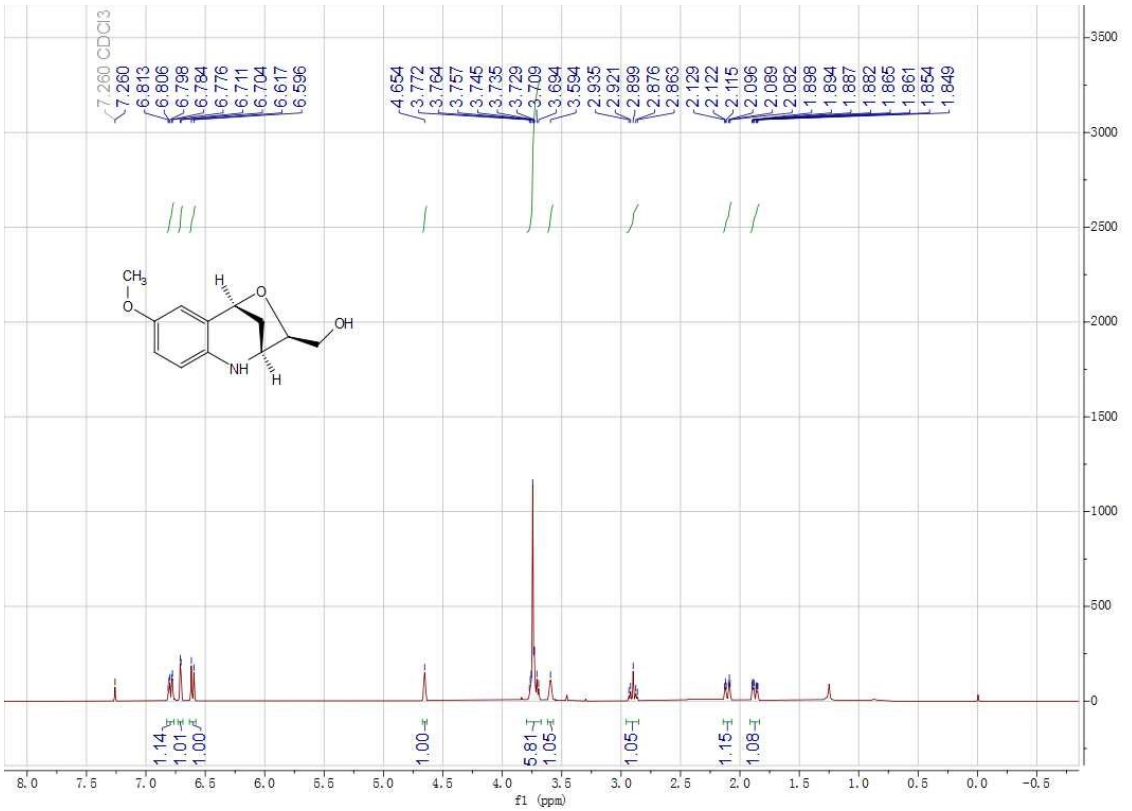


Figure. S87[1]H NMR of compound**4c**

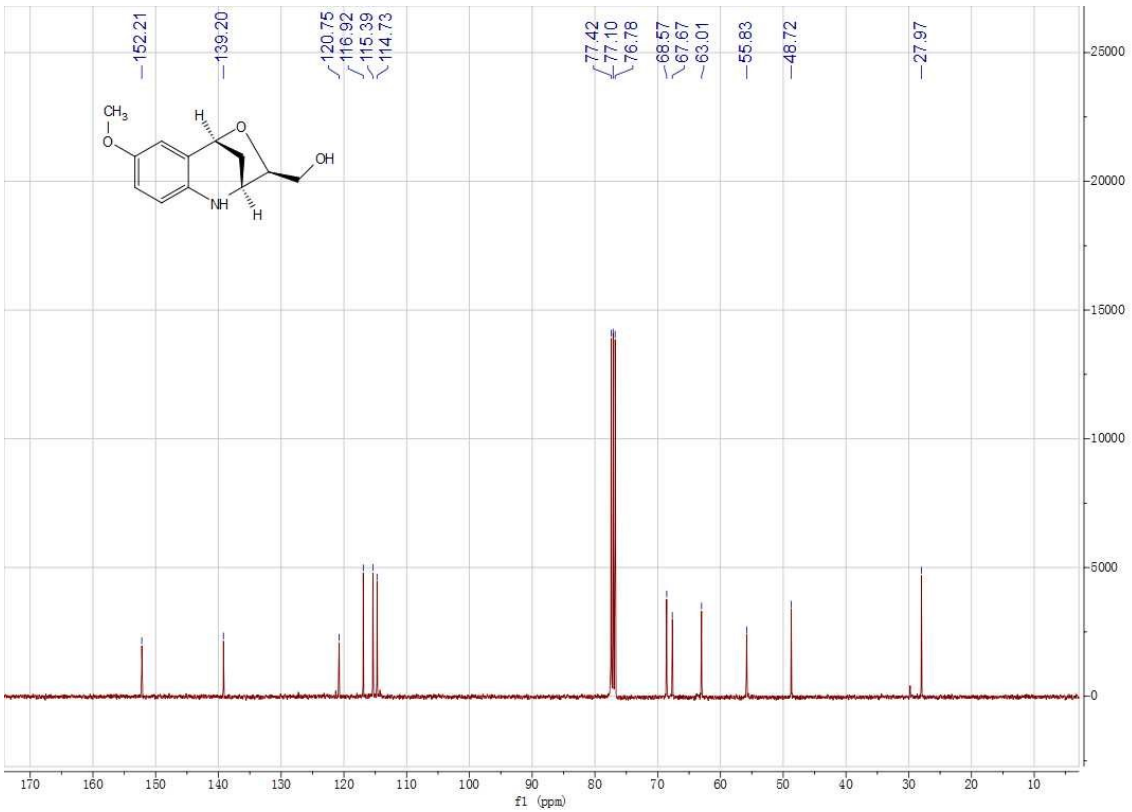


Figure. S88[13]C{[1]H} NMR of compound **4c**

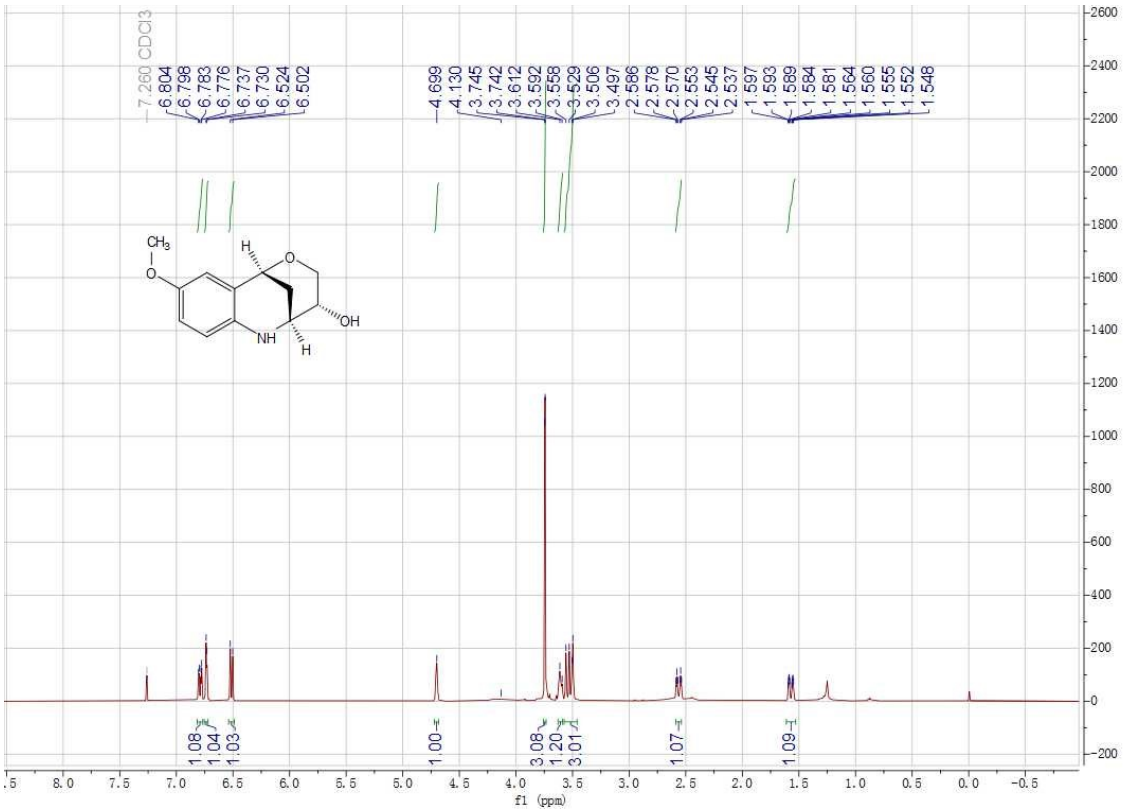


Figure. S89[1]H NMR of compound**4c'**

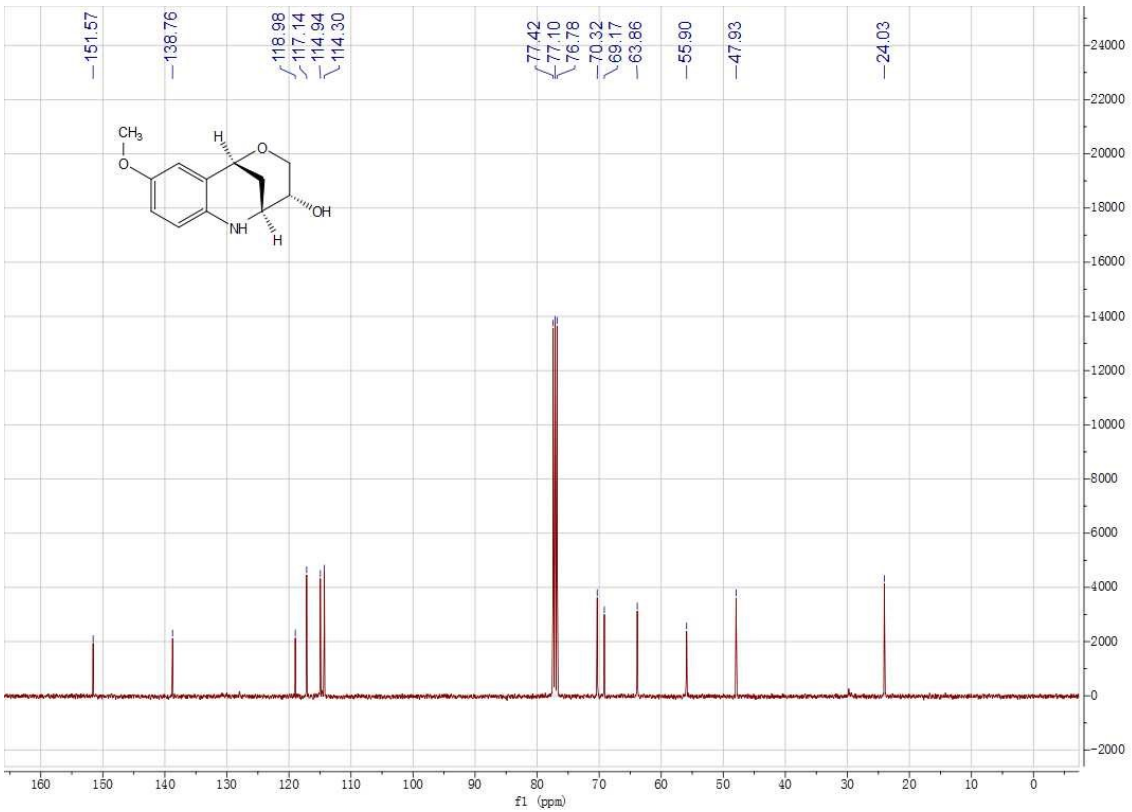


Figure. S90[13]C{[1]H} NMR of compound **4c'**

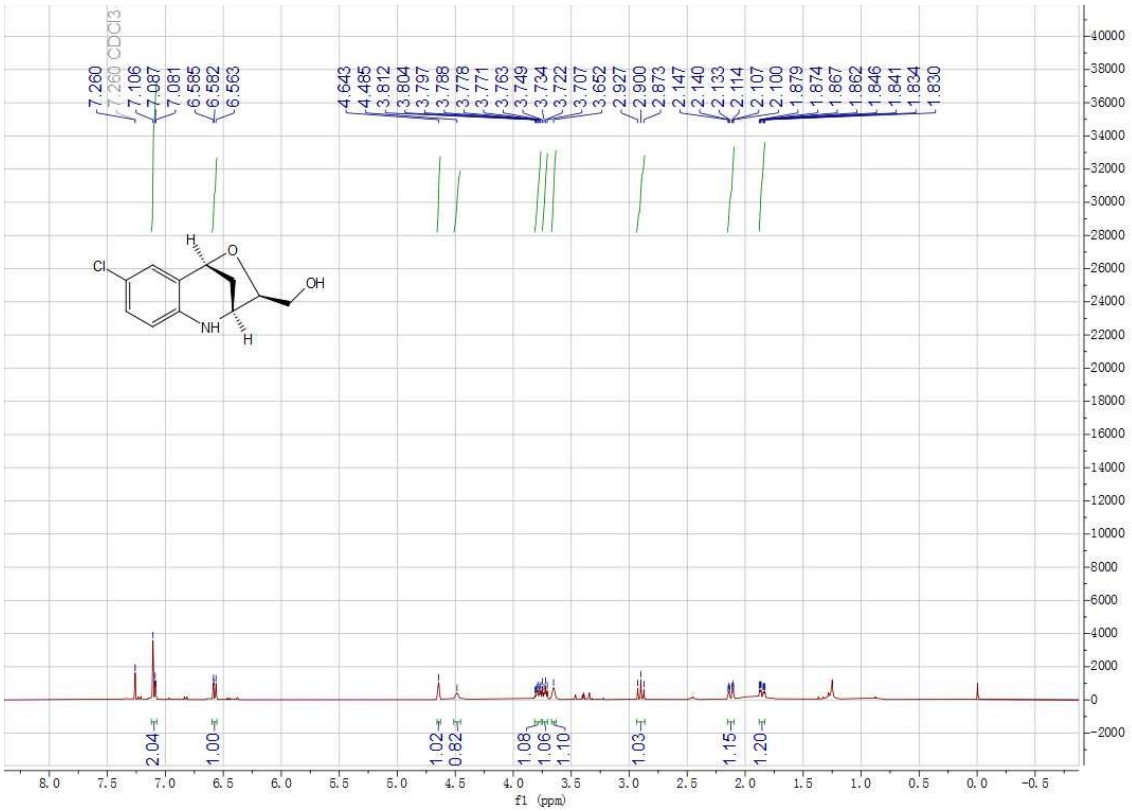


Figure. S91[1]H NMR of compound**5c**

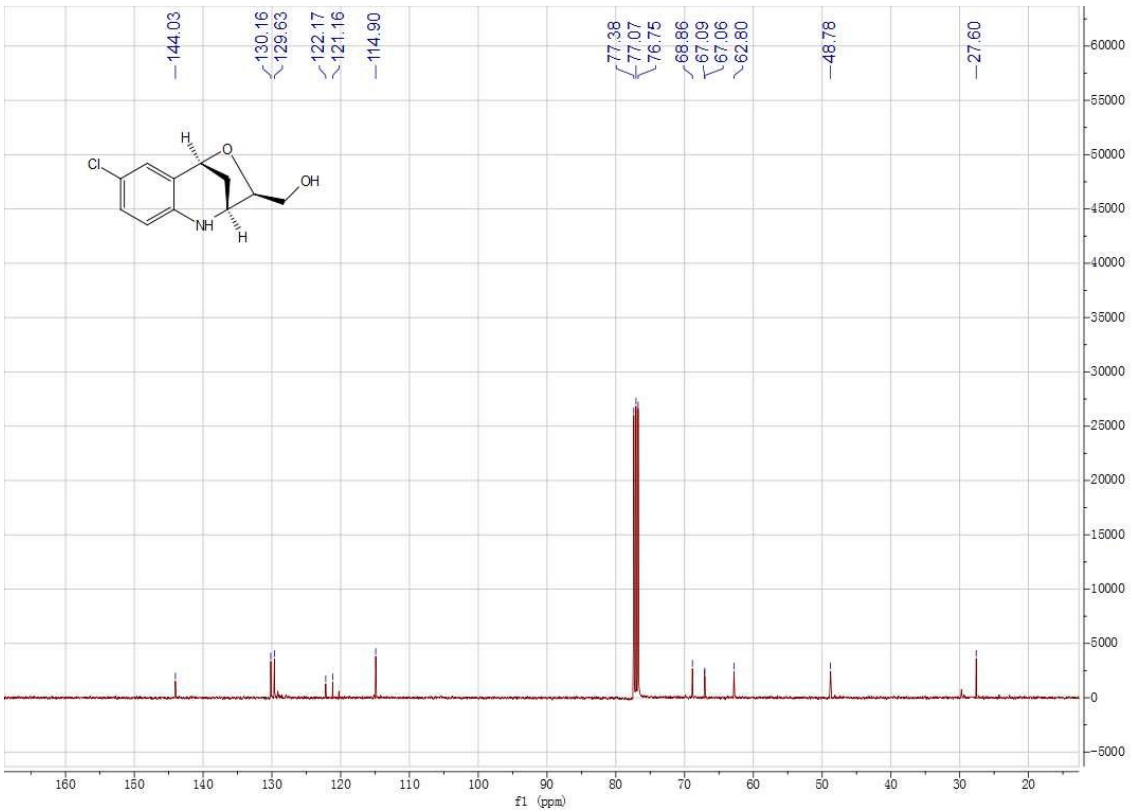


Figure. S92[13]C{[1]H} NMR of compound **5c**

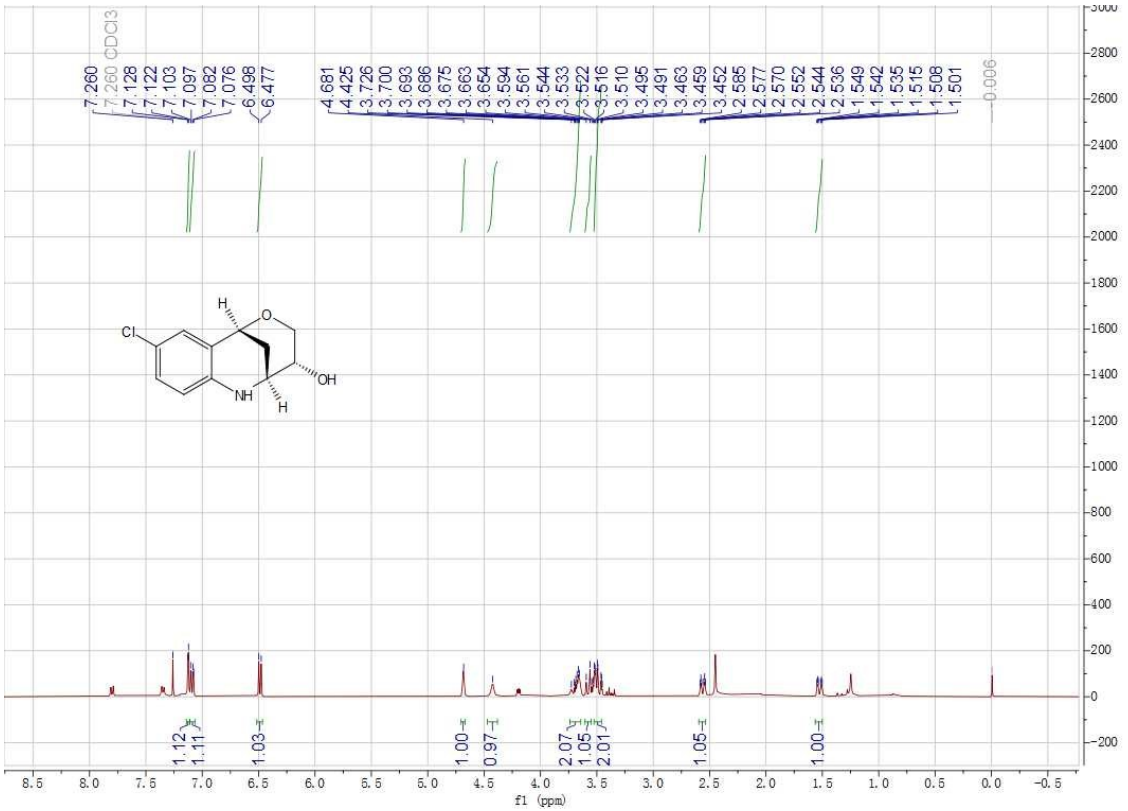


Figure. S93[1]H NMR of compound**5c'**

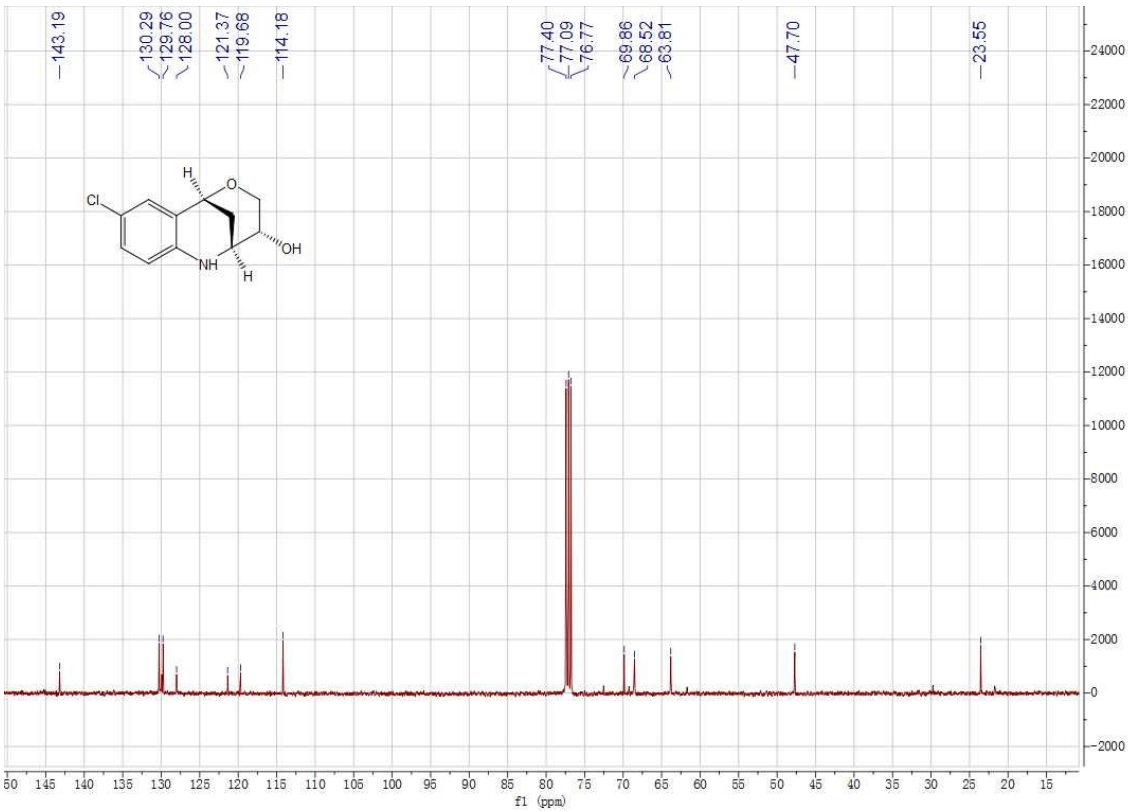


Figure. S94[13]C{[1]H} NMR of compound **5c'**

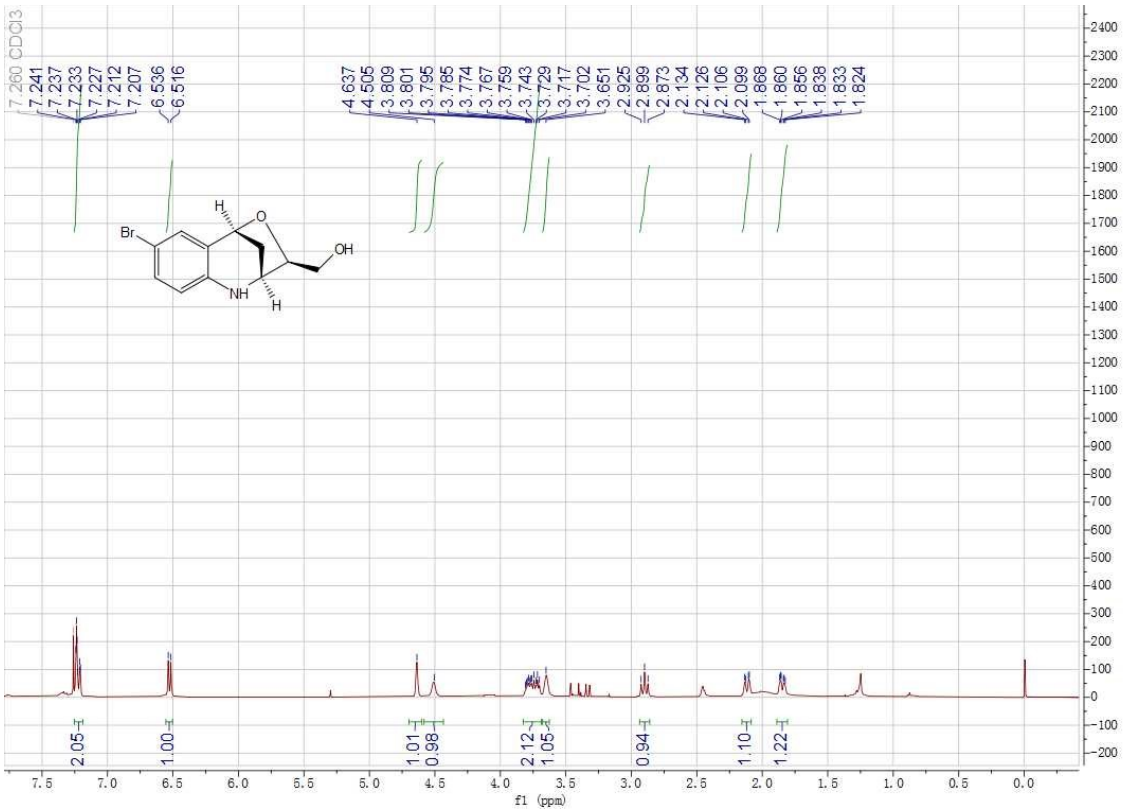


Figure. S95^{1}H NMR of compound**6c**

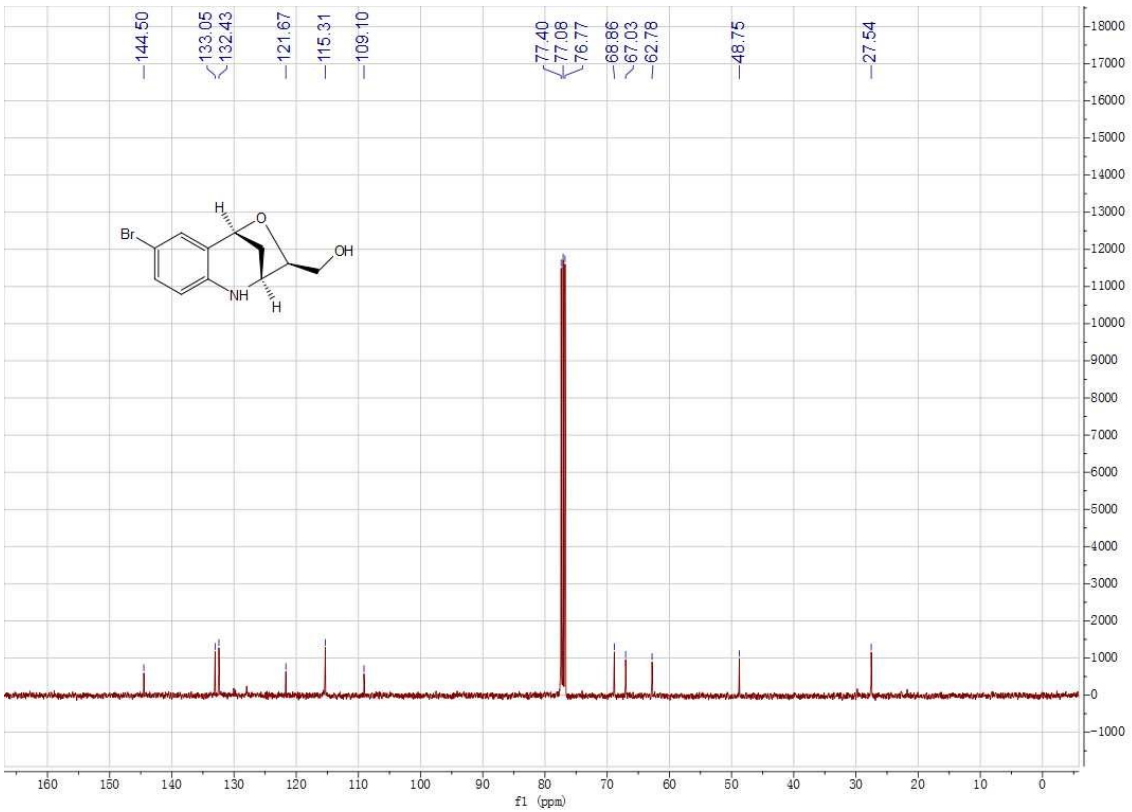


Figure. S96^{13}C{^{1}H} NMR of compound **6c**

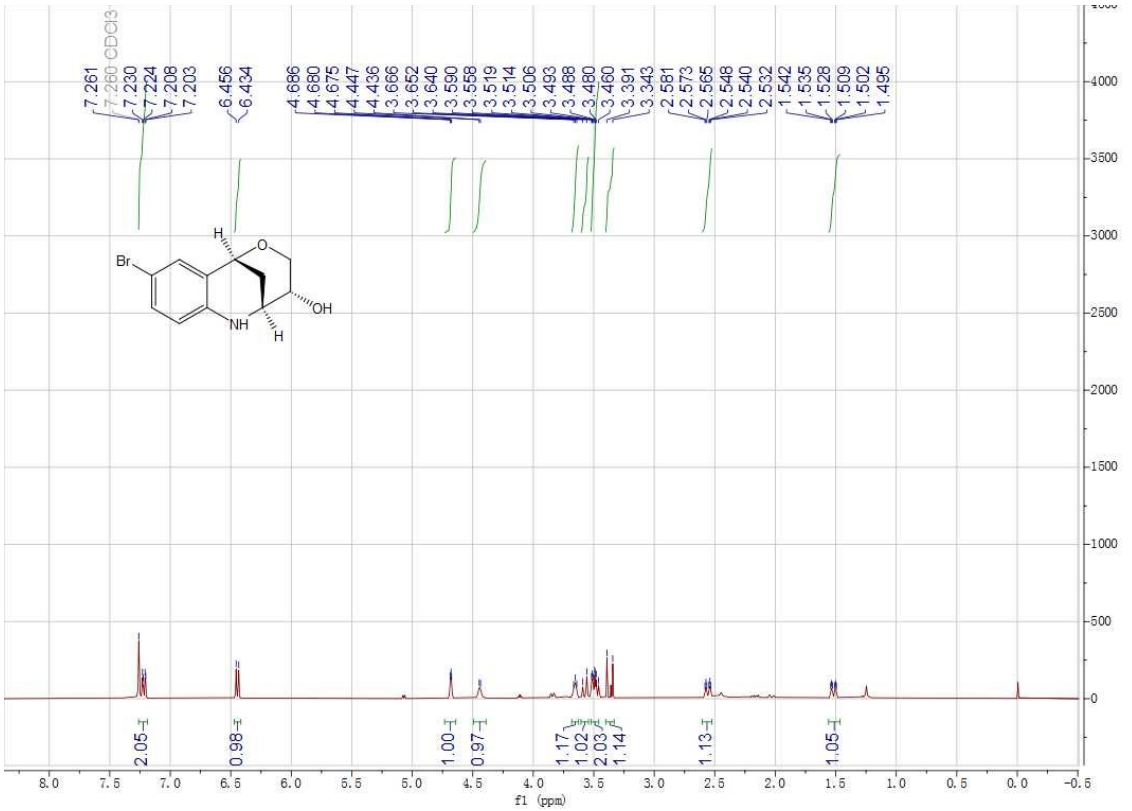


Figure. S97^{1}H NMR of compound**6c'**

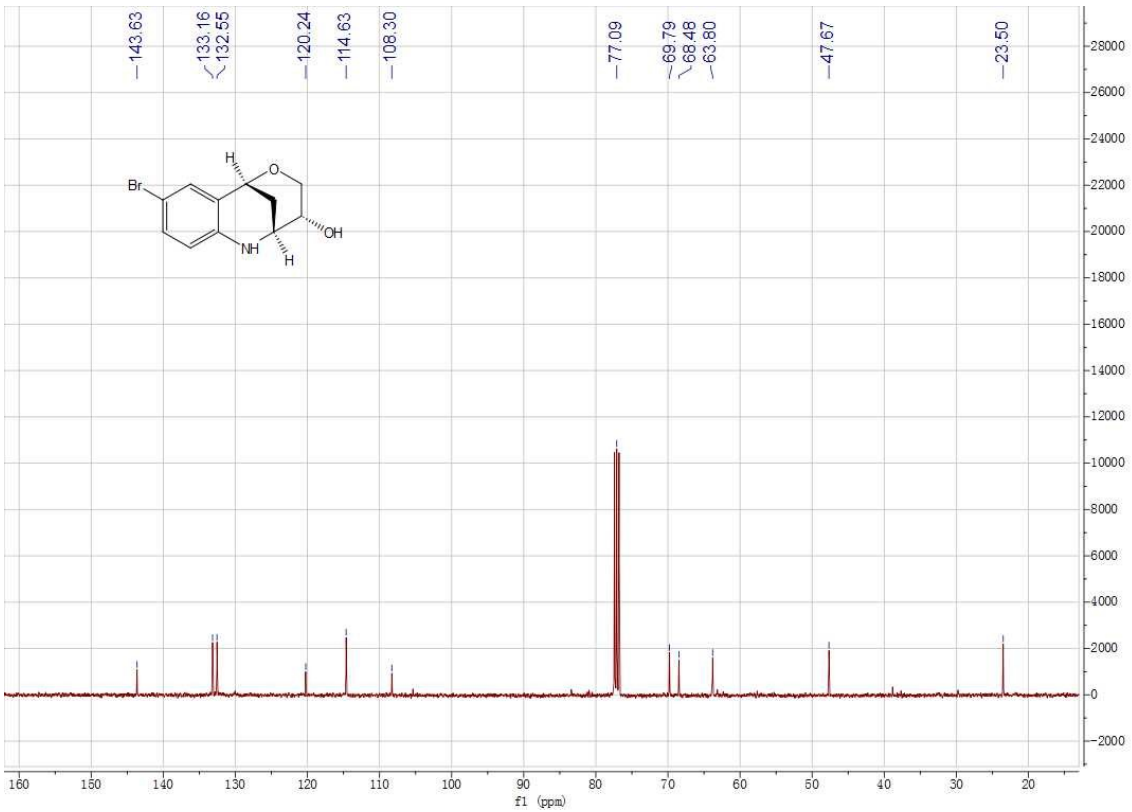


Figure. S98^{13}C{^{1}H} NMR of compound **6c'**

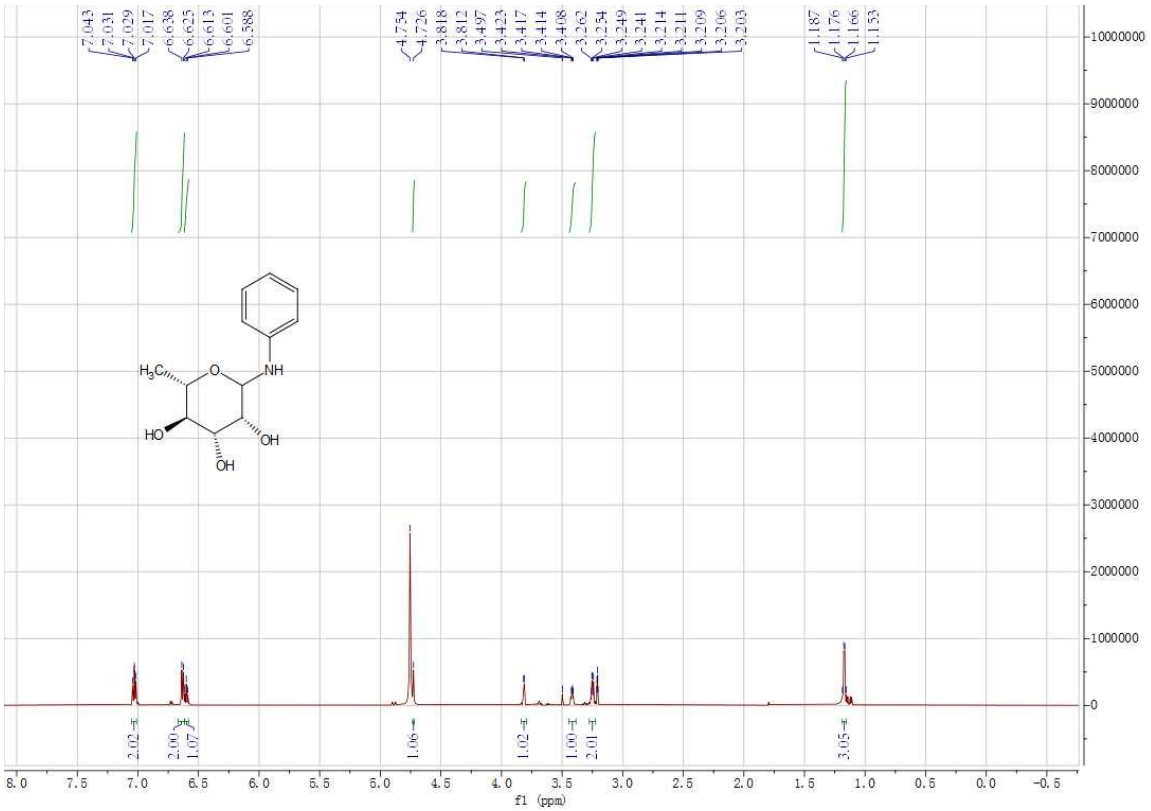


Figure. S99^{1}H NMR of compound**A**

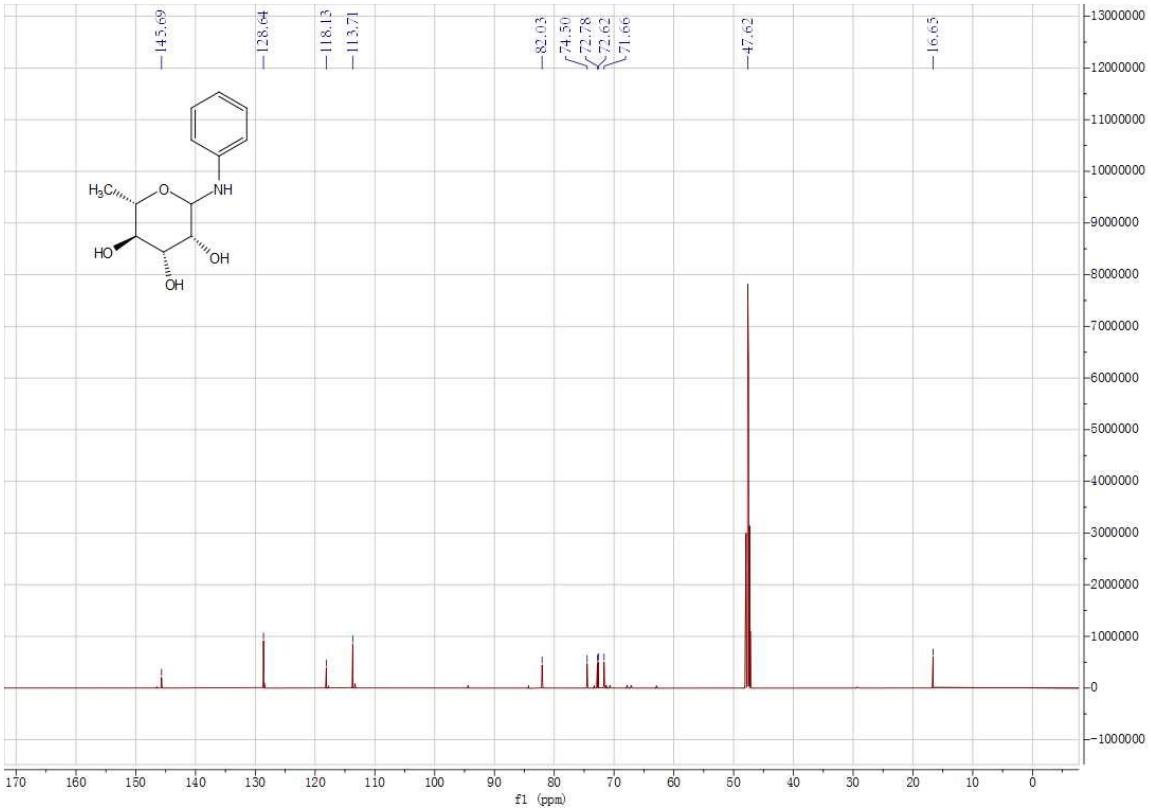


Figure. S100^{13}C{^{1}H} NMR of compound **A**

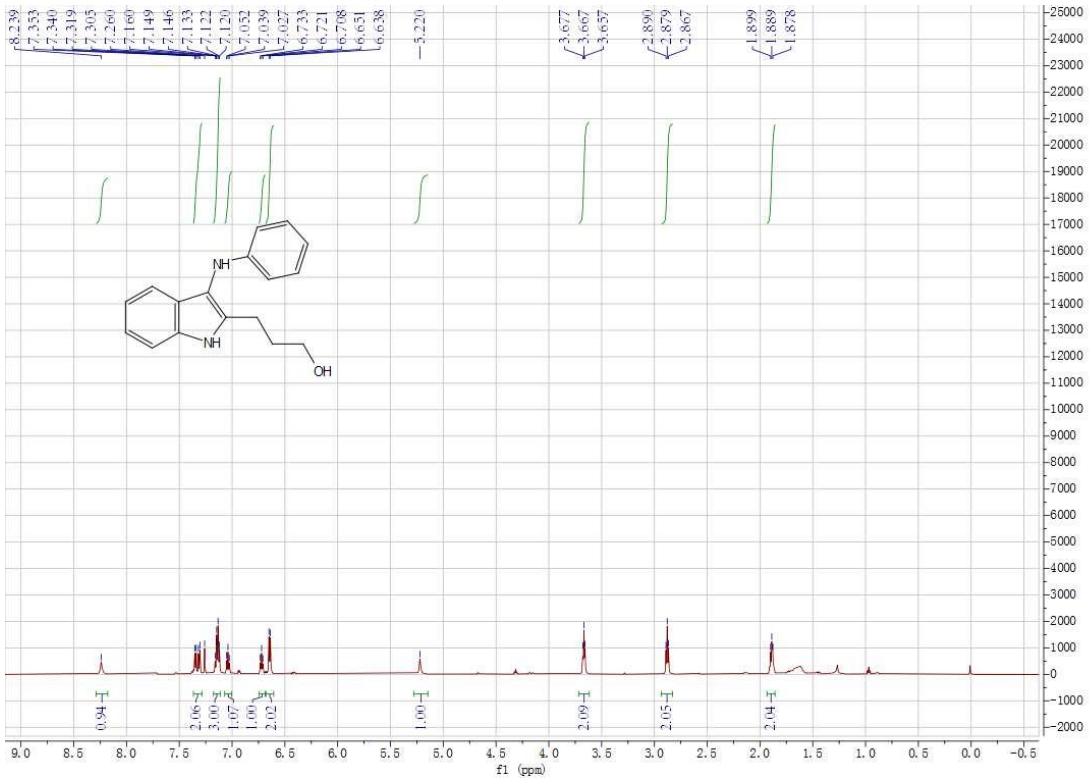


Figure. S101[1]H NMR of compound**7c**

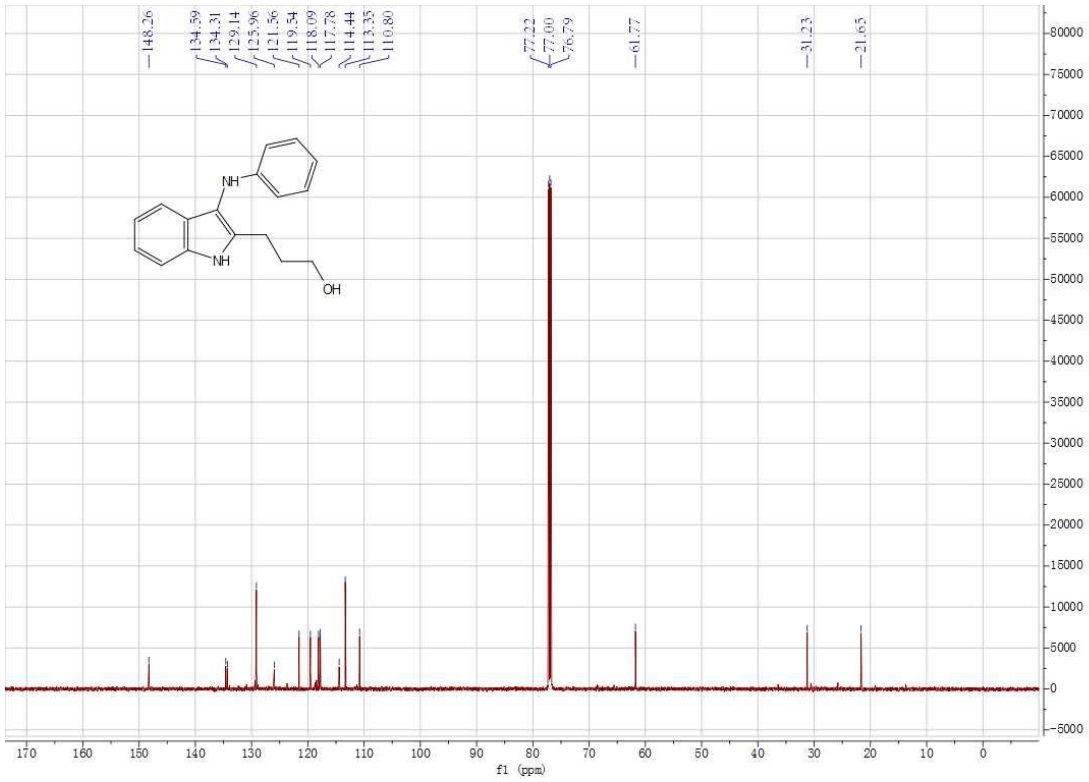


Figure. S102[13]C{[1]H} NMR of compound **7c**

4. 2D NMR analysis spectra

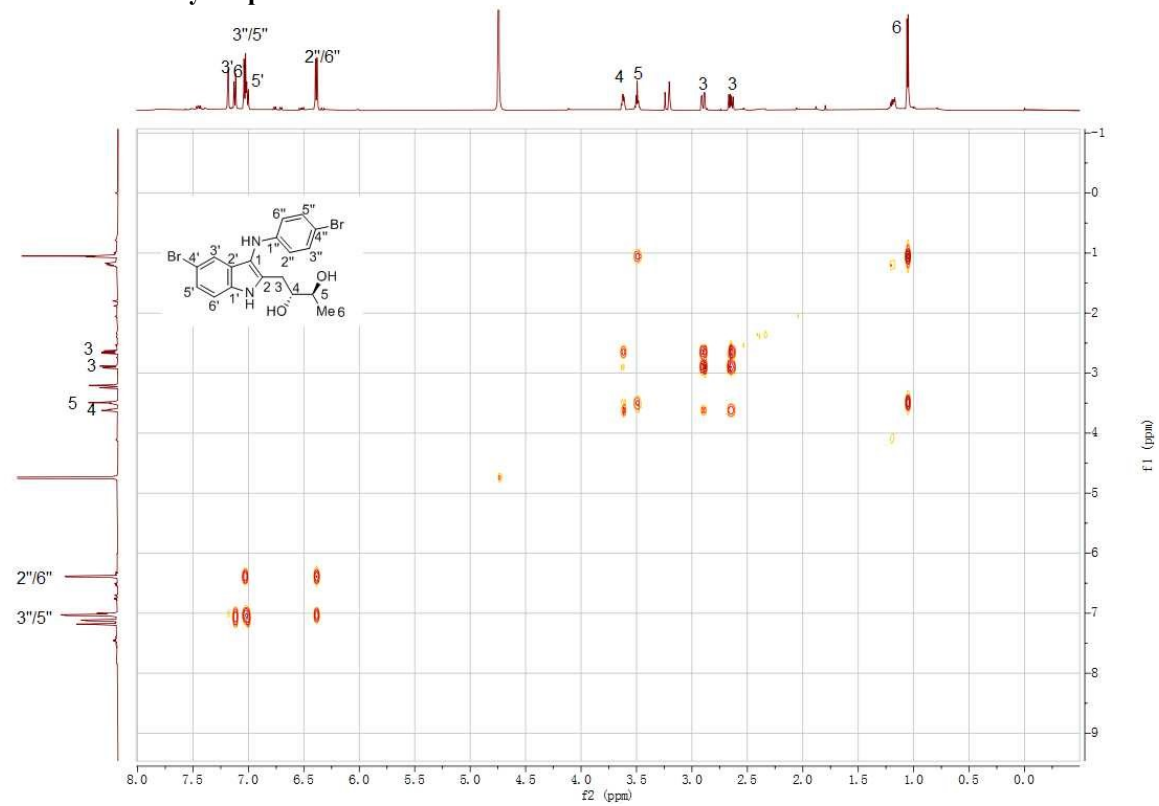


Figure. S103 ^{1}H-^{1}H COSY 2D-NMR of compound **13a**

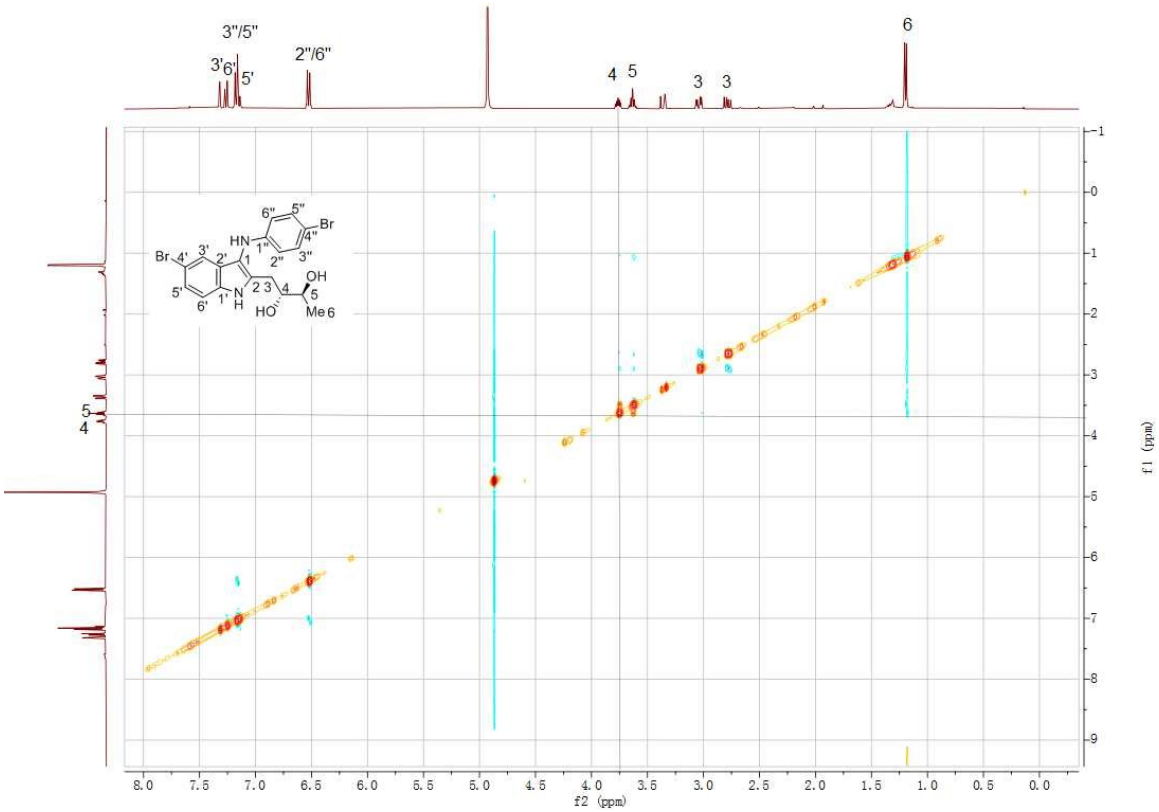


Figure. S104 ^{1}H-^{1}H ROESY 2D-NMR of compound **13a**

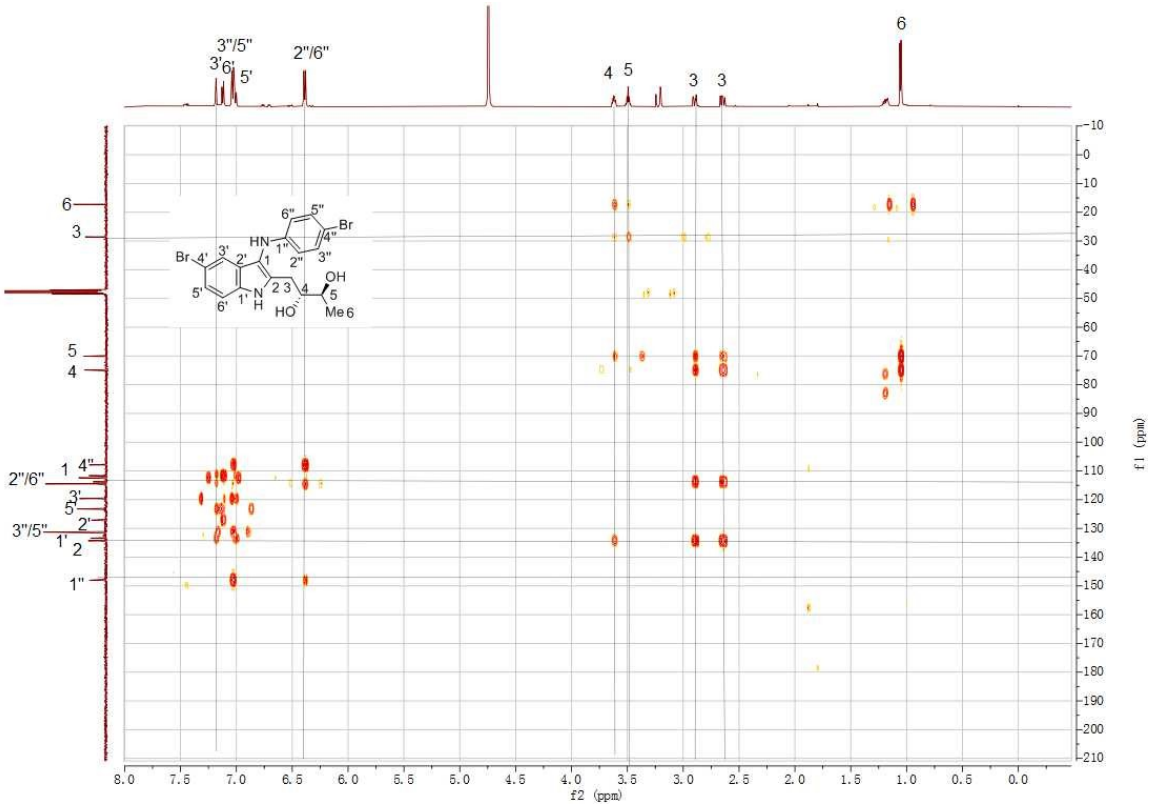


Figure. S105^{1}H-^{13}C HMBC 2D-NMR of compound **13a**

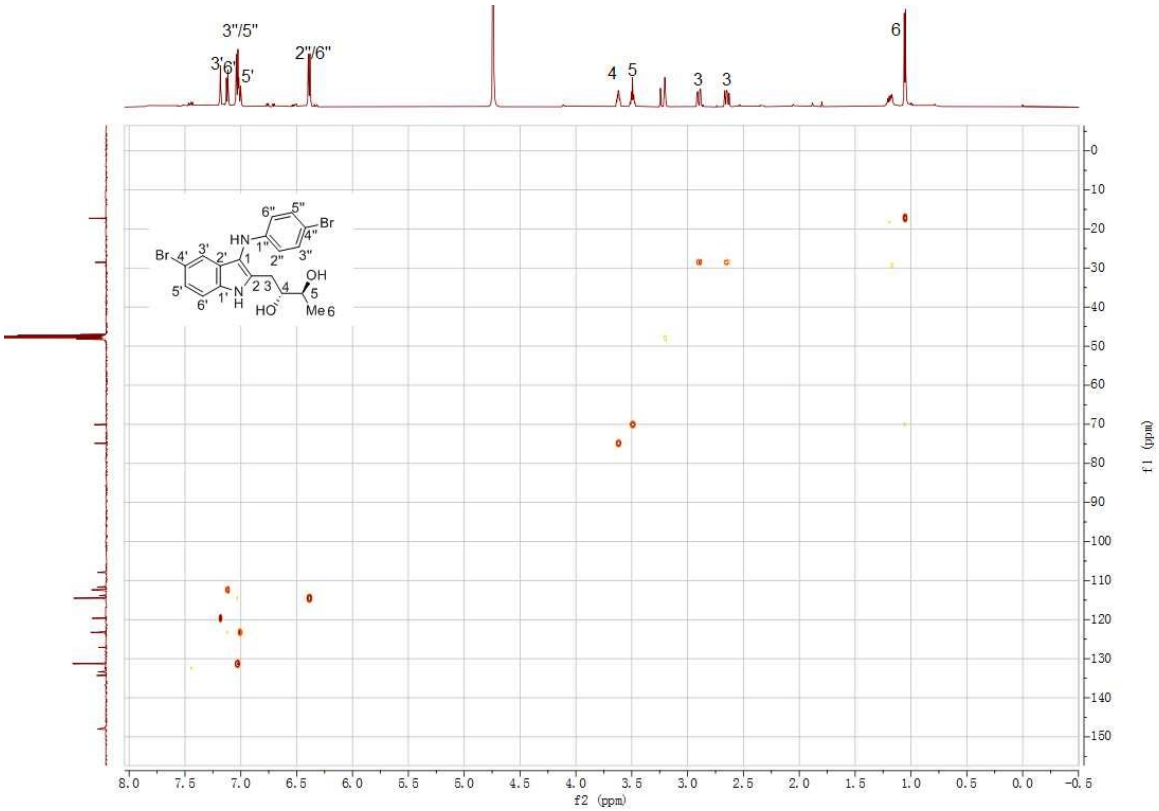


Figure. S106^{1}H-^{13}C HSQC 2D-NMR of compound **13a**

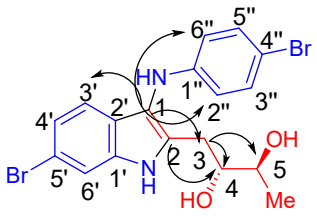
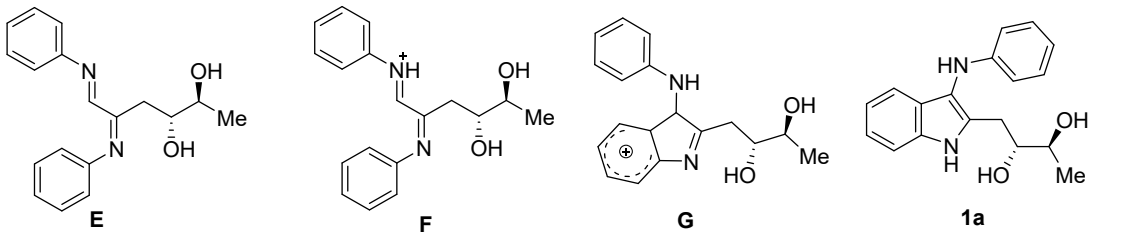
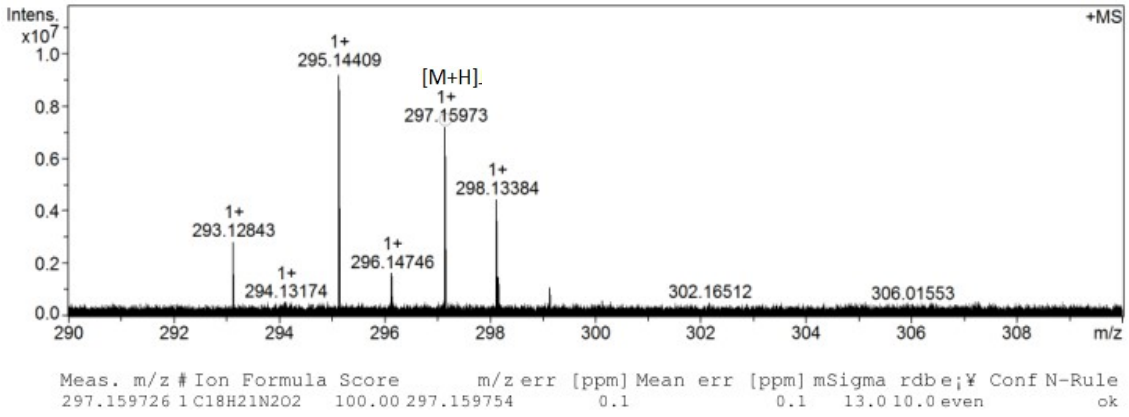


Figure S107 Key HMBC (C→H) correlations

5. High resolution mass spectra

E, F, G,or **1a:** MS(ESI): Calculated for $C_{18}H_{21}N_2O_2$([M+H]$^+$):297.1598, found:297.1597.





Meas. m/z	#	Ion Formula	Score	m/z	err [ppm]	Mean err [ppm]	mSigma	rdb	e¡¥ Conf	N-Rule
297.159726	1	C18H21N2O2	100.00	297.159754	0.1	0.1	13.0	10.0	even	ok

Figure S108 High resolution mass spectrum of compound**1a**orintermediate **I, J.**

6. Crystal Information：

1: To determine the absolute configureuration of **(2*S*,3*R*)-1-(3-(phenylamino)-1*H*-indol-2-yl)butane-2,3-diol (1a)**: Firstly, **1a** was recrystallized from dichloromethane/methabol. The solvents were slowly evaporated directly, and the single crystal was obtained after three days. The CCDC number is 2301597.

```
Bond precision:   C-C = 0.0071 A          Wavelength=0.71073

Cell:          a=5.4476(4)       b=9.3390(8)       c=15.3977(12)
               alpha=75.371(3)   beta=87.564(2)    gamma=85.468(3)
Temperature:   100 K

                Calculated                Reported
Volume          755.39(10)                755.39(10)
Space group     P 1                       P 1
Hall group      P 1                       P 1
Moiety formula  C18 H20 N2 O2             C18 H20 N2 O2
Sum formula     C18 H20 N2 O2             C18 H20 N2 O2
Mr              296.36                    296.36
Dx,g cm-3       1.303                     1.303
Z               2                         2
Mu (mm-1)       0.086                     0.086
F000            316.0                     316.0
F000'           316.13
h,k,lmax        6,11,19                   6,11,19
Nref            6188[ 3094]               4859
Tmin,Tmax       0.992,0.996               0.534,0.745
Tmin'           0.987

Correction method= # Reported T Limits: Tmin=0.534 Tmax=0.745
AbsCorr = MULTI-SCAN

Data completeness= 1.57/0.79        Theta(max)= 26.422

R(reflections)= 0.0546( 3848)                    wR2(reflections)=
                                                 0.1295( 4859)
S = 1.061                Npar= 417
```

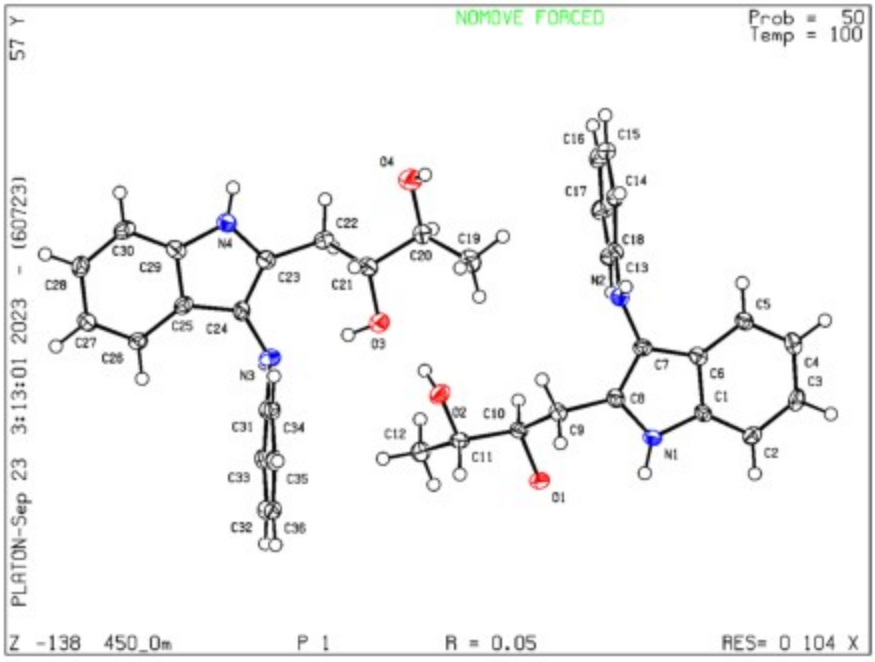


Figure S109Crystal information of **1a**

2: To determine the absolute configureuration of **((3*R*)-7-methyl-1,2,3,5-tetrahydro-2,5-methanobenzo[*e*][1,4]oxazepin-3-yl)methanol**: Firstly, **(3c')** was recrystallized from dichloromethane/methabol. The solvents were slowly evaporated directly, and the single crystal was obtained after three days. The CCDC number is 2303074.

Bond precision: C-C = 0.0066 A Wavelength=0.71073

Cell: a=6.163(2) b=10.528(4) c=32.488(12)
alpha=90 beta=90 gamma=90
Temperature: 273 K

	Calculated	Reported
Volume	2108.0(13)	2108.0(13)
Space group	P 21 21 21	P 21 21 21
Hall group	P 2ac 2ab	P 2ac 2ab
Moiety formula	C12 H13 N O2	C12 H13 N O2
Sum formula	C12 H13 N O2	C12 H13 N O2
Mr	203.23	203.23
Dx,g cm-3	1.281	1.281
Z	8	8
Mu (mm-1)	0.088	0.088
F000	864.0	864.0
F000'	864.40	
h,k,lmax	8,13,42	8,13,42
Nref	4933[2858]	4863
Tmin,Tmax	0.997,0.998	0.664,0.746
Tmin'	0.997	

Correction method= # Reported T Limits: Tmin=0.664 Tmax=0.746
AbsCorr = MULTI-SCAN

Data completeness= 1.70/0.99 Theta(max)= 27.717

R(reflections)= 0.0600(2936) wR2(reflections)= 0.1568(4863)

S = 1.091 Npar= 273

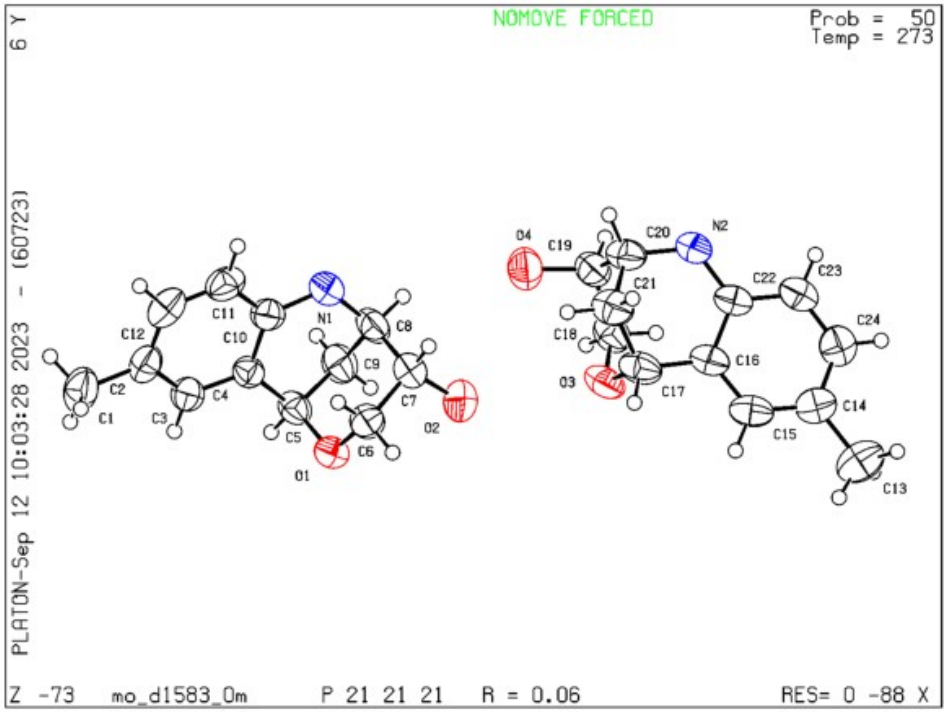


Figure S110Crystal information of **3c'**