Supplementary Information

Visible-light-mediated Green Synthesis of Tertiary Alcohols from Dicarbonyl Compounds and Arylamines in Water

Xin Hui, Dan Zhang, Chunying Wu, Yifan Ma, Huihui Zhou and Yunbo Zhu*

School of Pharmacy, Health Science Center, Xi'an Jiaotong University, 76 Yanta West Road, Xi'an, Shaanxi 710061, P.R. China

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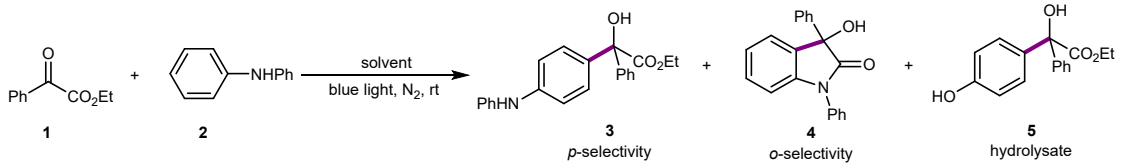
1. General Information

All solvents were purified according to the reported method (W. L. F. Armarego and C. L. L. Chai, Purification of Laboratory Chemicals, Bulterworth-Heinemann, Oxford, UK, 7th edition, 2013). If no special indicated, commercial reagents were used without further purification. Column chromatographic purification of all products was conducted using 200-300 dry mesh silica gel. ^{1}H and ^{13}C NMR spectra were measured on a JEOL JNM-ECZ400S/L1 spectrometers, NMR (400 MHz for ^{1}H NMR, 101 MHz for ^{13}C NMR). Multiplicity (s = singlet, D = doublet, t = triplet, m = multiplet, Q = quartet, Coupling Constant (J) in Hz). Tetramethylsilane (TMS) served as the internal standard for ^{1}H NMR, and $CDCl_3$ served as the internal standard for ^{13}C NMR. Infrared spectra were collected on a Bruker VERTEX70 as a thin film, and selected maximum absorbance were reported in wavenumbers. High-resolution mass spectra (HRSM) were obtained on a Waters I-Class VION IMS QTof and are reported as m/z (relative intensity). UV-vis spectra experiments were measured on an Ultraviolet-visible Spectrophotometer (YOKE L6).

2. Experimental Procedure

2.1 Optimization Studies[a]



entry	solvent	total yield	yield of **3**	yield of **4**	yield of **5**
1	CH_3OH	43%	30%	9%	4%
2	CH_3CN	24%	21%	3%	trace
3	THF	48%	40%	2%	6%
4	DCM	37%	30%	5%	2%
5	$PhCH_3$	44%	34%	3%	7%
6	PhH	38%	31%	7%	trace
7	H_2O	80%	56%	11%	13%
8[b]	H_2O	0%	0%	0%	0%

[a]Experiments were run with 0.2 mmol ethyl benzylformate **1**, 0.4 mmol diphenylamine **2** in solvent (1.0 mL) under N_2 using 40 W blue LEDs for 48 h. Isolated yields were indicated. [b]Without light irradiation.

2.2 General Procedure

A 10 mL of Schlenk tube equipped with magnetic bar was added subsequently the carbonyl compounds (0.2 mmol, 1 equiv.), the arylamines (0.4 mmol, 2 equiv.), water as a solvent (1 mL). The Schlenk tube was degassed by three freeze-pump-thaw cycles. Then, under the irradiation of blue light (5 cm away from the light source) for 48 h or 72 h at room temperature, the reaction mixture was extracted three times with EtOAc. The combined organic layer was dried over with anhydrous sodium sulfate and concentrated under reduced pressure. The residue was purified rapidly by flash column chromatography (about 10% EtOAc in petroleum ether) on silica gel to furnish the desired products.

3. Mechanistic Investigations

3.1 Free Radical Capture Experiment

A 10 mL of Schlenk tube equipped with magnetic bar was added subsequently the ethyl benzylformate **1** (0.2 mmol, 1 equiv.), diphenylamine **2** (0.4 mmol, 2 equiv.), the radical trapping agent TEMPO (10 equiv.), water as a solvent (1 mL). The Schlenk tube was degassed by three freeze-pump-thaw cycles. Then, under the irradiation of blue light for 48 h at room temperature, the reaction mixture was extracted three times with EtOAc. The combined organic layer was dried over with anhydrous sodium sulfate and concentrated under reduced pressure. The residue was purified rapidly by flash column chromatography (10% EtOAc in petroleum ether) on silica gel to furnish the desired products.

3.2 Uv-vis Absorption Spectrum

The absorption spectrum of ethyl benzylformate **1** (0.2 mmol) was measured at room temperature at a concentration of 0.2 M in THF (1 mL).

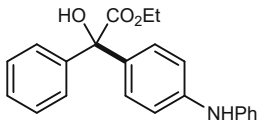
The absorption spectrum of diphenylamine **2** (0.2 mmol) was measured at room temperature at a concentration of 0.2 M in THF (1 mL).

The absorption spectrum of the EDA complex (0.2 mmol ethyl benzylformate and 0.2 mmol diphenylamine **2**) was measured in THF (1 mL) at room temperature.

The absorption spectrum of the EDA complex (0.2 mmol ethyl benzylformate, 0.2 mmol diphenylamine **2** and 72 μL water) was measured in THF (1 mL) at room temperature.

The absorption spectrum of the EDA complex (0.2 mmol ethyl benzylformate, 0.2 mmol diphenylamine **2** and 108 μL water) was measured in THF (1 mL) at room temperature.

4. Characterization of Products



3

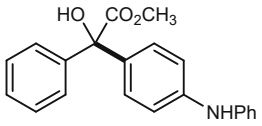
The title compound was prepared according to the general procedure using ethyl benzoylformate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 5/1), providing the product as a light yellow oil (60% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 – 7.45 (m, 2H), 7.37 – 7.20 (m, 7H), 7.08 – 7.03 (m, 2H), 7.00 – 6.95 (m, 2H), 6.95 – 6.90 (m, 1H), 5.78 (s, 1H), 4.29 (q, *J* = 7.1 Hz, 2H), 4.22 (s, 1H), 1.25 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.7, 143.1, 142.6, 142.2, 134.2, 129.4, 128.6, 128.1, 128.0, 127.5, 121.4, 118.4, 116.6, 80.8, 63.0, 14.1.

HRMS (LCMS-ESI) m/z Calcd. for $C_{22}H_{21}NO_3$ $[M+H]^+$ 348.1594, found: 348.1595.

IR (film) ν_{max} (cm^{-1}) 3466, 3351, 2981, 1707, 1593, 1523, 1495, 1447, 1323, 1301, 1255, 1189, 1167, 1090, 1053, 1008, 916, 847, 746, 734, 695, 597, 496.



4

The title compound was prepared according to the general procedure using methyl benzoylformate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.), in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a white solid (67% yield).

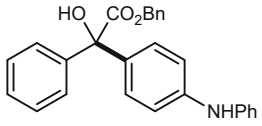
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 – 7.44 (m, 2H), 7.37 – 7.32 (m, 3H), 7.28 – 7.24 (m, 4H), 7.10 – 7.07 (m, 2H), 7.02 – 6.99 (m, 2H), 6.97 – 6.92 (m, 1H), 5.76 (s, 1H), 4.14 (s, 1H), 3.85 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.3, 143.2, 142.6, 142.1, 134.0, 129.5, 128.6, 128.2,

128.1, 127.5, 127.2, 121.5, 118.5, 116.6, 81.0, 53.7.

HRMS (LCMS-ESI) m/z Calcd. for $C_{21}H_{19}NO_3$ $[M+H]^+$ 334.1438, found: 334.1439.

IR (film) ν_{max} (cm^{-1}) 3452, 3340, 2921, 1715, 1594, 1516, 1449, 1430, 1307, 1256, 1170, 1089, 745, 733, 697, 591, 479.



5

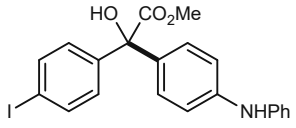
The title compound was prepared according to the general procedure using benzyl 2-oxo-2-phenylacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 5/1), providing the product as a light yellow oil (58% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 – 7.42 (m, 2H), 7.33 – 7.26 (m, 9H), 7.24 – 7.20 (m, 3H), 7.09 – 7.06 (m, 2H), 6.99 – 6.92 (m, 3H), 5.75 (s, 1H), 5.28 (s, 2H), 4.15 (s, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.6, 143.1, 142.7, 142.1, 135.0, 134.1, 129.5, 128.7, 128.7, 128.6, 128.2, 128.2, 128.1, 127.6, 121.5, 118.3, 116.7, 81.0, 68.4.

HRMS (LCMS-ESI) m/z Calcd. for $C_{27}H_{23}NO_3$ $[M+H]^+$ 410.1751, found: 410.1750.

IR (film) ν_{max} (cm^{-1}) 3492, 3392, 3030, 1720, 1595, 1514, 1495, 1447, 1314, 1224, 1163, 1058, 906, 826, 783, 746, 496.



6

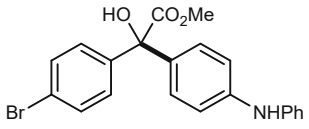
The title compound was prepared according to the general procedure using methyl 2-(4-iodophenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a light yellow oil (68% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 – 7.63 (m, 2H), 7.28 – 7.23 (m, 2H), 7.23 – 7.18 (m, 4H), 7.08 – 7.05 (m, 2H), 6.99 – 6.92 (m, 3H), 5.78 (s, 1H), 4.15 (s, 1H), 3.83 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.8, 143.5, 142.4, 141.8, 137.2, 133.6, 129.6, 129.5 128.4, 121.7, 118.6, 116.6, 94.2, 80.7, 53.8.

HRMS (LCMS-ESI) m/z Calcd. for $C_{21}H_{18}INO_3$ $[M+H]^+$ 460.0404, found: 460.0405.

IR (film) ν_{max} (cm^{-1}) 3485, 3390, 3028, 2951, 1723, 1594, 1513, 1495, 1314, 1244, 1163, 1064, 1005, 987, 906, 821,784, 730, 695, 491.



7

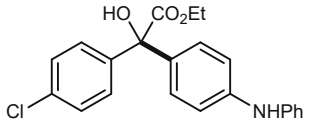
The title compound was prepared according to the general procedure using methyl 2-(4-bromophenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 48 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a light yellow oil (67% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 – 7.44 (m, 2H), 7.37 – 7.32 (m, 2H), 7.30 – 7.23 (m, 2H), 7.23 – 7.19 (m, 2H), 7.09– 7.06 (m, 2H), 7.02 – 6.98 (m, 2H), 6.97– 6.93 (m, 1H), 5.78 (s, 1H), 4.15 (s, 1H), 3.85 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.9, 143.5, 142.4, 141.1, 133.6, 131.3, 129.5, 129.4, 128.4, 122.3, 121.7, 118.6, 116.6, 80.6, 53.8.

HRMS (LCMS-ESI) m/z Calcd. for $C_{21}H_{18}BrNO_3$ $[M+H]^+$ 412.0543, found: 412.0542.

IR (film) ν_{max} (cm^{-1}) 3484, 3392, 3029, 2952, 1724, 1595, 1514, 1495, 1314, 1245, 1163, 1071, 1009, 987, 907, 824, 785, 730, 695, 492.



8

The title compound was prepared according to the general procedure using ethyl 2-(4-

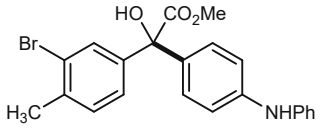
chlorophenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a white solid (57% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 – 7.40 (m, 2H), 7.31 – 7.22 (m, 6H), 7.10-7.05 (m, 2H), 7.01 – 6.97 (m, 2H), 6.97 – 6.92 (m, 1H), 5.79 (s, 1H), 4.31 (q, *J* = 7.1 Hz, 2H), 4.22 (s, 1H), 1.27 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.4, 143.4, 142.5, 140.7, 134.0, 133.9, 129.5, 129.1, 128.4, 128.2, 121.7, 118.6, 116.6, 80.3, 63.2, 14.2.

HRMS (LCMS-ESI) m/z Calcd. for $C_{22}H_{20}ClNO_3$ $[M+H]^+$ 382.1205, found: 382.1207.

IR (film) ν_{max} (cm^{-1}) 3452, 3396, 2919, 2849, 1712, 1594, 1517, 1490, 1317, 1300, 1252, 1205, 1171, 1091, 1066, 1009, 922, 813, 771, 752, 743, 732, 691, 573, 505, 491.



9

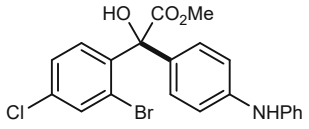
The title compound was prepared according to the general procedure using methyl 2-(3-bromo-4-methylphenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (67.6 mg, 0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the title compound as a white solid (84% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 (d, *J* = 1.9 Hz, 1H), 7.29 – 7.27 (m, 2H), 7.25 – 7.23 (m, 2H), 7.22 – 7.18 (m, 2H), 7.10 – 7.08 (m, 2H), 7.01 – 6.99 (m, 2H), 6.95 (dd, *J* = 6.7, 5.8 Hz, 1H), 5.78 (s, 1H), 4.14 (s, 1H), 3.85 (s, 3H), 2.39 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.9, 143.4, 142.4, 141.4, 137.8, 133.7, 131.3, 130.5, 129.5, 128.4, 126.6, 124.8, 121.7, 118.6, 116.6, 80.3, 53.8, 22.7.

HRMS (LCMS-ESI) m/z Calcd. for $C_{22}H_{20}BrNO_3$ $[M+H]^+$ 426.0699, found: 426.0689.

IR (film) ν_{max} (cm^{-1}) 3481, 3371, 1717, 1596, 1519, 1492, 1336, 1313, 1172, 830, 778, 749, 733, 695, 682, 461.



10

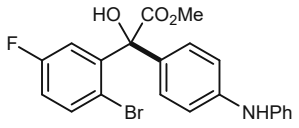
The title compound was prepared according to the general procedure using methyl 2-(2-bromo-4-chlorophenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a white solid (74% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 2.2 Hz, 1H), 7.50 – 7.48 (m, 2H), 7.33 – 7.29 (m, 2H), 7.15 – 7.12 (m, 3H), 7.10 – 7.07 (m, 2H), 7.01 – 6.97 (m, 1H), 6.85 (d, *J* = 8.5 Hz, 1H), 5.84 (s, 1H), 4.18 (s, 1H), 3.87 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.7, 143.9, 142.3, 140.3, 134.9, 133.9, 132.2, 130.7, 129.5, 128.1, 127.1, 124.4, 121.9, 118.9, 116.6, 80.9, 53.9.

HRMS (LCMS-ESI) m/z Calcd. for $C_{21}H_{17}BrClNO_3$ $[M+H]^+$ 446.0153, found: 446.0157.

IR (film) ν_{max} (cm^{-1}) 3489, 3389, 2951, 2925, 1731, 1595, 1554, 1514, 1496, 1318, 1246, 1167,1142,1107, 1082, 1041, 826, 795, 751, 736, 695, 491.



11

The title compound was prepared according to the general procedure using methyl 2-(2-bromo-5-fluorophenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (67.6 mg, 0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a light yellow oil (75% yield).

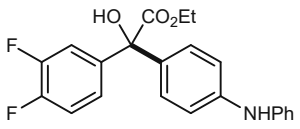
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 (dd, *J* = 8.7, 5.4 Hz, 1H), 7.52 – 7.49 (m, 2H), 7.33 – 7.28 (m, 2H), 7.16 – 7.12 (m, 2H), 7.11 – 7.07 (m, 2H), 6.99 (t, *J* = 7.4 Hz, 1H),

6.89 (ddd, *J* = 8.7, 7.4, 3.1 Hz, 1H), 6.66 (dd, *J* = 10.2, 3.1 Hz, 1H), 5.90 (s, 1H), 4.23 (s, 1H), 3.87 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.44, 162.65, 160.20, 144.04, 143.87, 143.80, 142.25, 135.54, 135.47, 130.33, 129.55, 128.09, 121.96, 119.17, 118.97, 118.92, 118.02, 116.94, 116.72, 116.61, 81.03, 53.89.

HRMS (LCMS-ESI) m/z Calcd. for $C_{21}H_{17}BrFNO_3$ $[M+H]^+$ 430.0449, found: 430.0451.

IR (film) ν_{max} (cm^{-1}) 3474, 3386, 2950, 2922, 1729, 1595, 1514, 1496, 1459, 1317, 1246, 1128, 1174, 1148, 1081, 1034, 815, 777, 750, 731, 694, 602, 585, 492.



12

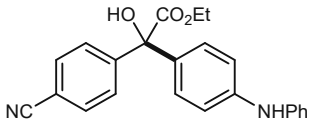
The title compound was prepared according to the general procedure using ethyl 2-(3,4-difluorophenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 48 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a white solid (57% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (dd, *J* = 4.1, 2.3 Hz, 1H), 7.28 – 7.23 (m, 5H), 7.14 – 7.06 (dd, *J* = 7.0, 1.5 Hz, 3H), 7.01 – 6.96 (m, 3H), 5.81 (s, 1H), 4.33 (dd, *J* = 7.1, 1.0 Hz, 2H), 4.24 (s, 1H), 1.29 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.08, 151.34, 151.21, 151.18, 151.06, 148.86, 148.73, 148.59, 143.57, 142.36, 139.13, 139.09, 139.05, 133.56, 129.52, 128.31, 123.82, 123.78, 123.75, 123.72, 121.81, 118.72, 117.18, 116.99, 116.80, 116.62, 116.57, 79.98, 63.34, 14.16.

HRMS (LCMS-ESI) m/z Calcd. for $C_{22}H_{19}F_2NO_3$ $[M+H]^+$ 384.1406, found: 384.1403.

IR (film) ν_{max} (cm^{-1}) 3458, 3361, 1714, 1594, 1511, 1495, 1446, 1319, 1300, 1106, 1065, 823, 772, 752, 727, 693, 605, 579, 462.



13

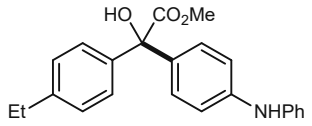
The title compound was prepared according to the general procedure using ethyl 2-(4-cyanophenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow oil (62% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 – 7.60 (m, 4H), 7.30 – 7.25 (m, 2H), 7.22 – 7.18 (m, 2H), 7.12 – 7.07 (m, 2H), 7.03 – 6.99 (m, 2H), 6.99 – 6.94 (m, 1H), 5.85 (s, 1H), 4.33 (dd, *J* = 7.1, 3.7 Hz, 2H), 4.29 (s, 1H), 1.28 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 173.7, 147.2, 143.7, 142.3, 133.2, 131.9, 129.5, 128.5, 128.3, 121.9, 118.8, 116.5, 111.8, 80.5, 63.46, 14.15.

HRMS (LCMS-ESI) m/z Calcd. for $C_{23}H_{20}N_2O_3$ $[M+H]^+$ 373.1547, found: 373.1548.

IR (film) ν_{max} (cm^{-1}) 3475, 3382, 3053, 2983, 2229, 1724, 1595, 1515, 1496, 1317, 1241, 1181, 1160, 1072, 1018, 820, 750, 735, 695, 656, 556, 532, 493.



14

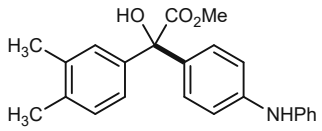
The title compound was prepared according to the general procedure using methyl 2-(4-ethylphenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a colourless oil (74% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 – 7.33 (m), 7.30 – 7.23 (m), 7.20 – 7.15 (m), 7.11 – 7.06 (m), 7.03 – 6.98 (m), 6.97 – 6.91 (m), 5.76 (s), 4.11 (s), 3.84 (s), 2.65 (q, *J* = 7.6 Hz), 1.24 (t, *J* = 7.6 Hz).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.5, 144.2, 143.1, 142.7, 139.5, 134.2, 129.5, 128.6, 127.7, 127.4, 121.5, 118.4, 116.6, 80.9, 53.6, 28.6, 15.5.

HRMS (LCMS-ESI) m/z Calcd. for $C_{23}H_{23}NO_3$ $[M+H]^+$ 362.1751, found: 362.1748.

IR (film) ν_{max} (cm^{-1}) 3493, 3390, 2963, 1722, 1595, 1512, 1496, 1314, 1244, 1163, 1070, 831, 795, 749, 694, 613, 585, 495.



15

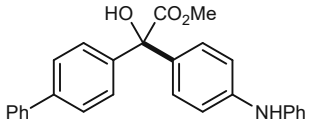
The title compound was prepared according to the general procedure using methyl 2-(3,4-dimethylphenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a light yellow oil (76% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 – 7.24 (m, 3H), 7.24 – 7.20 (m, 2H), 7.15 – 7.10 (m, 2H), 7.07 (dd, *J* = 8.5, 1.0 Hz, 2H), 7.02 – 6.97 (m, 2H), 6.92 (dd, *J* = 10.5, 4.1 Hz, 1H), 5.79 (s, 1H), 4.10 (s, 1H), 3.83 (s, 3H), 2.24 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.5, 143.1, 142.6, 139.6, 136.6, 134.1, 129.4, 128.6, 124.9, 121.5, 118.4, 116.6, 80.9, 53.6, 20.1, 19.6.

HRMS (LCMS-ESI) m/z Calcd. for $C_{23}H_{23}NO_3$ $[M+H]^+$ 362.1751, found: 362.1746.

IR (film) ν_{max} (cm^{-1}) 3395, 3388, 3026, 2950, 1722, 1595, 1513, 1496, 1446, 1315, 1244, 1177, 1154, 1120, 1071, 908, 821, 781, 749, 728, 694, 495.



16

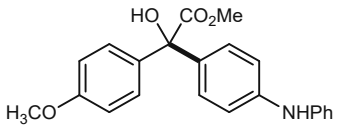
The title compound was prepared according to the general procedure using methyl 4-phenylbenzoylformate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a white solid (70% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 – 7.55 (m, 4H), 7.54 – 7.50 (m, 2H), 7.46 – 7.41 (m, 2H), 7.37 – 7.29 (m, 3H), 7.28 – 7.25 (m, 2H), 7.12 – 7.07 (m, 2H), 7.05 – 7.01 (m, 2H), 6.98 – 6.92 (m, 1H), 5.77 (s, 1H), 4.17 (s, 1H), 3.88 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.3, 143.2, 142.5, 141.1, 140.9, 140.6, 134.0, 129.5, 128.9, 128.6, 127.9, 127.5, 127.2, 126.9, 121.6, 118.5, 116.6, 80.8, 53.7.

HRMS (LCMS-ESI) m/z Calcd. for $C_{27}H_{23}NO_3$ $[M+H]^+$ 410.1751, found: 410.1752.

IR (film) ν_{max} (cm^{-1}) 3489, 3391, 3029, 2952, 1723, 1595, 1514, 1495, 1314, 1244, 1164, 1069, 1007, 987, 907, 838, 792, 750, 731, 694, 590, 493.



17

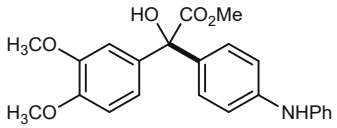
The title compound was prepared according to the general procedure using methyl 4-methoxybenzoate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 48 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a white solid (50% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.33 (m, 2H), 7.29 – 7.23 (m, 4H), 7.10 – 7.05 (m, 2H), 7.03 – 6.98 (m, 2H), 6.97 – 6.91 (m, 1H), 6.90 – 6.84 (m, 2H), 5.77 (s, 1H), 4.10 (s, 1H), 3.84 (s, 3H), 3.80 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.5, 159.3, 143.1, 142.6, 134.3, 134.2, 129.4, 128.7, 128.5, 121.4, 118.4, 116.6, 113.5, 80.6, 55.4, 53.6.

HRMS (LCMS-ESI) m/z Calcd. for $C_{22}H_{21}NO_4$ $[M+H]^+$ 364.1543, found: 364.1540.

IR (film) ν_{max} (cm^{-1}) 3486, 3387, 3028, 2952, 2837, 1722, 1595, 1509, 1496, 1311, 1244, 1176, 1067, 1030, 987, 908, 830, 802, 780, 750, 730, 695, 568, 495.



18

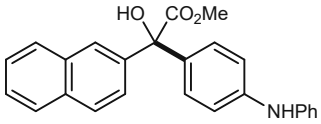
The title compound was prepared according to the general procedure using methyl 2-(3,4-dimethoxyphenyl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a colourless oil (50% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 – 7.23 (m, 4H), 7.09 (dt, *J* = 8.8, 1.7 Hz, 2H), 7.05 – 7.00 (m, 3H), 6.98 – 6.93 (m, 2H), 6.83 (d, *J* = 8.4 Hz, 1H), 5.78 (s, 1H), 4.12 (s, 1H), 3.89 (s, 3H), 3.86 (s, 3H), 3.83 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.4, 148.8, 148.6, 143.2, 142.5, 134.4, 134.0, 129.4, 128.5, 121.5, 119.8, 118.4, 116.5, 110.7, 110.3, 80.7, 77.4, 55.9, 53.6.

HRMS (LCMS-ESI) m/z Calcd. for $C_{23}H_{23}NO_5$ $[M+H]^+$ 394.1649, found: 394.1642.

IR (film) ν_{max} (cm^{-1}) 3490, 3364, 2923, 2851, 1726, 1595, 1511, 1496, 1463, 1412, 1318, 1254, 1176, 1139, 1072, 1024, 751, 734, 696, 496.



19

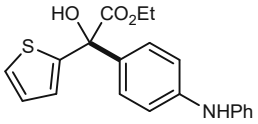
The title compound was prepared according to the general procedure using methyl 2-(naphthalen-2-yl)-2-oxoacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 48 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a light yellow oil (52% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.95 (d, *J* = 1.8 Hz, 1H), 7.85 – 7.78 (m, 3H), 7.54 (dd, *J* = 8.6, 1.9 Hz, 1H), 7.50 – 7.46 (m, 2H), 7.31 – 7.26 (m, 3H), 7.25 – 7.23 (m, 1H), 7.11 – 7.06 (m, 2H), 7.04 – 6.99 (m, 2H), 6.97 – 6.91 (m, 1H), 5.77 (s, 1H), 4.24 (s, 1H), 3.87 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.3, 143.3, 142.5, 139.4, 133.9, 133.0, 132.8, 129.5, 128.7, 128.6, 127.9, 127.6, 126.5, 126.3, 126.2, 125.8, 121.6, 118.5, 116.6, 81.2, 53.7.

HRMS (LCMS-ESI) m/z Calcd. for $C_{25}H_{21}NO_3$ $[M+H]^+$ 384.1594, found: 384.1594.

IR (film) ν_{max} (cm^{-1}) 3500, 3360, 2919, 2850, 1713, 1594, 1518, 1313, 1263, 1244, 1158, 1120, 1061, 817, 782, 754, 722, 696, 479.



20

The title compound was prepared according to the general procedure using ethyl 2-oxo-2-(thiophen-2-yl)acetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.)

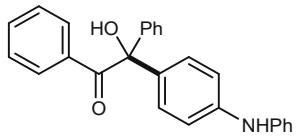
in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a white solid (53% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.35 (m, 2H), 7.31 – 7.24 (m, 3H), 7.16 – 7.13 (m, 1H), 7.11 – 7.06 (m, 2H), 7.03 – 6.98 (m, 3H), 6.98 – 6.93 (m, 1H), 5.79 (s, 1H), 4.49 (s, 1H), 4.43 – 4.25 (m, 2H), 1.31 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 173.7, 146.4, 143.5, 142.5, 133.8, 129.4, 127.8, 126.8, 126.3, 125.8, 121.6, 118.5, 116.6, 78.5, 63.4, 14.1.

HRMS (LCMS-ESI) m/z Calcd. for $C_{20}H_{19}NO_3S$ $[M+H]^+$ 354.1158, found: 354.1155.

IR (film) ν_{max} (cm^{-1}) 3469, 3351, 2983, 1712, 1593, 1520, 1496, 1322, 1248, 1228, 1185, 1142, 1067, 1041, 1005, 962, 906, 877, 748, 733, 700, 596, 504.



21

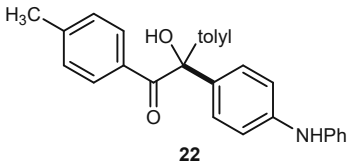
The title compound was prepared according to the general procedure using dibenzoyl (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1.5 mL of H_2O/CH_3OH (v:v = 1:1) under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a light yellow solid (57% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 – 7.73 (m, 2H), 7.47 – 7.43 (m, 3H), 7.37 – 7.30 (m, 4H), 7.30-7.24 (m, 5H), 7.11 – 7.08 (m, 2H), 7.02 – 6.99 (m, 2H), 6.98 – 6.93 (m, 1H), 5.77 (s, 1H), 5.02 (s, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 201.06, 143.27, 142.40, 142.15, 135.25, 133.75, 133.01, 130.98, 129.61, 129.47, 128.47, 128.41, 128.22, 128.17, 121.68, 118.61, 116.66, 84.86.

HRMS (LCMS-ESI) m/z Calcd. for $C_{26}H_{21}NO_2$ $[M+H]^+$ 380.1645, found: 380.1639.

IR (film) ν_{max} (cm^{-1}) 3382, 2922, 2852, 1668, 1595, 1515, 1495, 1446, 1316, 1233, 1178, 1053, 982, 881, 820, 749, 698, 495.



22

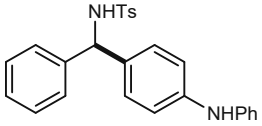
The title compound was prepared according to the general procedure using 1,2-di-*p*-tolylethane-1,2-dione (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1.5 mL of H_2O:CH_3OH (v:v = 1:1) under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 6/1), providing the product as a yellow oil (65% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 – 7.66 (m, 2H), 7.33 – 7.31 (m, 2H), 7.28 – 7.23 (m, 4H), 7.15 – 7.11 (m, 2H), 7.10 – 7.06 (m, 4H), 7.00 – 6.98 (m, 2H), 6.96 – 6.92 (m, 1H), 5.76 (s, 1H), 5.14 (s, 1H), 2.33 (s, 3H), 2.33 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 200.5, 144.0, 143.1, 142.5, 139.4, 137.9, 134.3, 132.4, 131.3, 129.7, 129.5, 129.1, 129.0, 128.4, 121.6, 118.5, 116.7, 84.4, 21.8, 21.3.

HRMS (LCMS-ESI) m/z Calcd. for $C_{28}H_{25}NO_2$ $[M+H]^+$ 408.1958, found: 408.1954.

IR (film) ν_{max} (cm^{-1}) 3381, 3028, 2921, 1661, 1595, 1513, 1495, 1446, 1312, 1240, 1180, 1159, 1019, 979, 908, 815, 770, 749, 729, 696, 616, 601, 494.



23

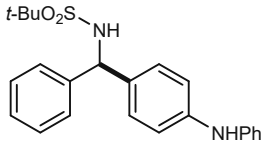
The title compound was prepared according to the general procedure using N-benzylidene-4-methylbenzenesulfonamide (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 5/1), providing the product as a light yellow oil (45% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 – 7.54 (m, 2H), 7.27 – 7.22 (m, 2H), 7.21 – 7.17 (m, 3H), 7.15 – 7.11 (m, 4H), 7.04 – 6.99 (m, 2H), 6.97 – 6.90 (m, 3H), 6.89 – 6.85 (m, 2H), 5.70 (s, 1H), 5.51 (d, *J* = 7.1 Hz, 1H), 5.23 (d, *J* = 7.0 Hz, 1H), 2.36 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 143.21, 142.73, 140.81, 137.53, 132.85, 129.44, 128.59, 128.58, 127.53, 127.39, 127.33, 121.38, 118.13, 117.34, 61.05, 21.61.

HRMS (LCMS-ESI) m/z Calcd. for $C_{26}H_{24}N_2O_2S$ $[M+H]^+$ 429.1631, found: 429.1630.

IR (film) ν_{max} (cm^{-1}) 3378, 3272, 3028, 1596, 1516, 1495, 1449, 1313, 1153, 1092, 1045, 1027, 810, 743, 695, 667, 565, 543, 495.



24

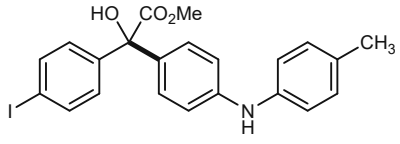
The title compound was prepared according to the general procedure using *N*-benzylidene-2-methylpropane-2-sulfonamide (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 5/1), providing the product as a white solid (33% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.29 (m, 4H), 7.28 – 7.23 (m, 3H), 7.14 (d, *J* = 8.5 Hz, 2H), 7.07 – 7.04 (m, 2H), 7.00 (d, *J* = 8.5 Hz, 2H), 6.93 (dd, J = 10.8, 3.9 Hz, 1H), 5.76 (s, 1H), 5.72 (d, J = 9.1 Hz, 1H), 4.92 (d, J = 9.2 Hz, 1H), 1.27 (s, 9H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 142.75, 142.69, 142.22, 134.36, 129.46, 128.79, 128.69, 127.56, 127.49, 121.38, 118.19, 117.46, 61.36, 60.08, 24.25.

HRMS (LCMS-ESI) m/z Calcd. for $C_{23}H_{26}N_2O_2S$ $[M+H]^+$ 395.1788, found: 395.1783.

IR (film) ν_{max} (cm^{-1}) 3393, 3259, 1597, 1524, 1495, 1446, 1306, 1288, 1275, 1119, 1085, 1057, 951, 929, 753, 739, 698, 667, 636, 562, 502.



25

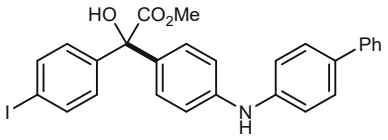
The title compound was prepared according to the general procedure using methyl 4-iodobenzoylformate (0.2 mmol, 1 equiv.), 4-methyldiphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow oil (41% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.70 – 7.60 (m, 2H), 7.23 – 7.15 (m, 4H), 7.09 (d, *J* = 8.3 Hz, 2H), 7.04 – 6.98 (m, 2H), 6.96 – 6.91 (m, 2H), 5.68 (s, 1H), 4.10 (s, 1H), 3.84 (s, 3H), 2.30 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.9, 144.2, 141.8, 139.5, 137.2, 132.9, 131.6, 130.0, 129.6, 128.4, 119.6, 115.7, 94.2, 80.7, 53.8, 20.8.

HRMS (LCMS-ESI) m/z Calcd. for $C_{22}H_{20}INO_3$ $[M+H]^+$ 474.0561, found: 474.0558.

IR (film) ν_{max} (cm^{-1}) 3491, 3391, 3027, 2922, 2853, 1727, 1606, 1514, 1484, 1435, 1315, 1250, 1164, 1068, 1006, 819, 786, 742, 498.



26

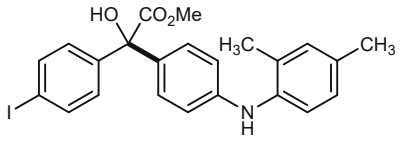
The title compound was prepared according to the general procedure using methyl 4-iodobenzoylformate (0.2 mmol, 1 equiv.), *N*-phenyl-[1,1'-biphenyl]-4-amine (0.4 mmol, 2 equiv.) in 1.5 mL of H_2O:CH_3OH (v:v = 1:1) under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow oil (48% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 – 7.65 (m, 2H), 7.56 (dd, *J* = 8.2, 1.1 Hz, 2H), 7.52 – 7.49 (m, 2H), 7.41 (t, *J* = 7.7 Hz, 2H), 7.30 (d, *J* = 7.4 Hz, 1H), 7.24 – 7.21 (m, 4H), 7.15 – 7.12 (m, 2H), 7.05 – 7.01 (m, 2H), 5.84 (s, 1H), 4.15 (s, 1H), 3.84 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.8, 141.8, 137.3, 129.6, 128.9, 128.5, 128.1, 126.9, 126.7, 118.7, 117.0, 94.3, 80.7, 53.8.

HRMS (LCMS-ESI) m/z Calcd. for $C_{27}H_{22}INO_3$ $[M+H]^+$ 536.0717, found: 536.0722.

IR (film) ν_{max} (cm^{-1}) 3491, 3389, 3028, 2951, 1723, 1600, 1511, 1483, 1310, 1241, 1162, 1064, 1005, 986, 821, 784, 761, 736, 696, 491.



27

The title compound was prepared according to the general procedure using methyl 4-iodobenzoylformate (0.2 mmol, 1 equiv.), 2,4-dimethyl-*N*-phenylaniline (0.4 mmol, 2

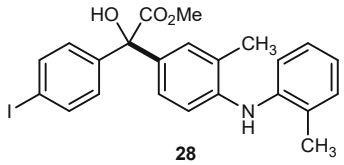
equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow oil (60% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 – 7.63 (m, 2H), 7.23 – 7.20 (m, 2H), 7.16 – 7.11 (m, 3H), 7.03 (s, 1H), 6.95 (dd, *J* = 8.0, 1.4 Hz, 1H), 6.78 – 6.74 (m, 2H), 5.35 (s, 1H), 4.10 (s, 1H), 3.83 (s, 3H), 2.29 (s, 3H), 2.19 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.9, 145.2, 141.9, 137.5, 137.2, 133.2, 132.4, 131.9, 130.6, 129.6, 128.3, 127.4, 121.8, 115.3, 94.1, 80.7, 53.7, 20.9, 18.0.

HRMS (LCMS-ESI) m/z Calcd. for $C_{23}H_{22}INO_3$ $[M+H]^+$ 488.0717, found: 488.0724.

IR (film) ν_{max} (cm^{-1}) 3392, 3389, 2951, 1725, 1607, 1510, 1483, 1307, 1248, 1183, 1163, 1065, 1005, 987, 907, 818, 783, 729, 485, 443.



28

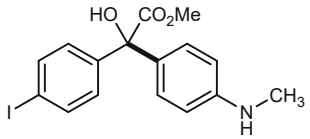
The title compound was prepared according to the general procedure using methyl 4-methoxybenzoylformate (0.2 mmol, 1 equiv.), di-*o*-tolylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow oil (70% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 – 7.65 (m, 2H), 7.28 – 7.20 (m, 3H), 7.17 – 7.08 (m, 3H), 7.03 (dd, *J* = 8.4, 2.3 Hz, 1H), 6.96 (td, *J* = 7.3, 1.4 Hz, 1H), 6.89 (d, *J* = 8.5 Hz, 1H), 5.20 (s, 1H), 4.14 (s, 1H), 3.86 (s, 3H), 2.26 (s, 3H), 2.25 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.9, 142.5, 141.8, 141.0, 137.2, 133.5, 131.1, 129.6, 128.9, 126.9, 125.9, 125.8, 122.5, 119.9, 115.9, 94.2, 80.7, 53.8, 18.0.

HRMS (LCMS-ESI) m/z Calcd. for $C_{23}H_{22}INO_3$ $[M+H]^+$ 488.0717, found: 488.0724.

IR (film) ν_{max} (cm^{-1}) 3491, 3027, 2951, 1725, 1586, 1506, 1482, 1435, 1248, 1156, 1120, 1070, 1006, 907, 820, 782, 729, 647, 498, 439.



29

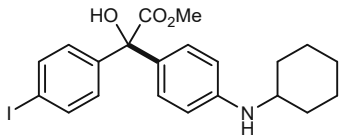
The title compound was prepared according to the general procedure using methyl 4-iodobenzoylformate (0.2 mmol, 1 equiv.), *N*-methylaniline (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow oil (59% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 – 7.62 (m, 2H), 7.24 – 7.18 (m, 2H), 7.17 – 7.10 (m, 2H), 6.58 – 6.52 (m, 2H), 4.06 (s, 1H), 3.82 (s, 3H), 2.82 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.1, 149.2, 142.1, 137.1, 130.3, 129.7, 128.3, 112.0, 94.0, 80.8, 53.7, 30.7.

HRMS (LCMS-ESI) m/z Calcd. for $C_{16}H_{16}INO_3$ $[M+H]^+$ 398.0248, found: 398.0248.

IR (film) ν_{max} (cm^{-1}) 3486, 3417, 2950, 1723, 1612, 1520, 1482, 1434, 1391, 1324, 1245, 1183, 1163, 1063, 1005, 987, 908, 820, 781, 731, 592, 530.



30

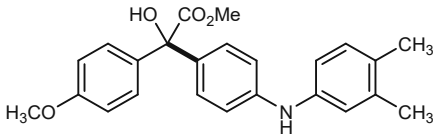
The title compound was prepared according to the general procedure using methyl 4-iodobenzoylformate (0.2 mmol, 1 equiv.), *N*-cyclohexylaniline (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 5/1), providing the product as a colourless oil (76% yield).

^{1}H-NMR (400 MHz, $CDCl_3$) δ 7.66 – 7.61 (m, 2H), 7.23 – 7.18 (m, 2H), 7.10 – 7.05 (m, 2H), 6.54 – 6.48 (m, 2H), 4.02 (s, 1H), 3.82 (s, 3H), 3.67 (s, 1H), 3.23 (tt, *J* = 10.1, 3.7 Hz, 1H), 2.03 (dd, *J* = 12.8, 3.1 Hz, 2H), 1.78 – 1.69 (m, 2H), 1.69 – 1.57 (m, 1H), 1.41 – 1.29 (m, 2H), 1.27 – 1.21 (m, 1H), 1.20 – 1.09 (m, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.1, 147.4, 142.1, 137.1, 129.7, 128.4, 112.5, 94.0, 80.7, 53.6, 51.7, 33.5, 26.0, 25.1.

HRMS (LCMS-ESI) m/z Calcd. for $C_{21}H_{24}INO_3$ $[M+H]^+$ 466.0874, found: 466.0881.

IR (film) ν_{max} (cm^{-1}) 3492, 3400, 2926, 2851, 1724, 1611, 1515, 1483, 1449, 1391, 1325, 1248, 1183, 1163, 1064, 1005, 987, 908, 819, 784, 730, 646, 605, 495.



31

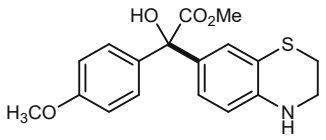
The title compound was prepared according to the general procedure using methyl 4-iodobenzoylformate (0.2 mmol, 1 equiv.), 2,4-dimethyl-*N*-phenylaniline (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 5/1), providing the product as a light yellow oil (63% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.33 (m, 2H), 7.25 – 7.21 (m, 2H), 7.02 (d, *J* = 8.0 Hz, 1H), 6.93 (d, *J* = 8.7 Hz, 2H), 6.89 (s, 1H), 6.88 – 6.82 (m, 3H), 5.66 (s, 1H), 4.09 (s, 1H), 3.82 (s, 3H), 3.79 (s, 3H), 2.21 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.6, 159.3, 144.0, 140.1, 137.7, 134.4, 133.5, 130.4, 130.2, 128.8, 128.5, 120.9, 116.8, 115.8, 113.5, 80.7, 55.4, 53.5, 20.0, 19.1.

HRMS (LCMS-ESI) m/z Calcd. for $C_{24}H_{25}NO_4$ $[M+H]^+$ 392.1856, found: 392.1854.

IR (film) ν_{max} (cm^{-1}) 3492, 3387, 2952, 2837, 1723, 1605, 1506, 1442, 1321, 1244, 1177, 1067, 1031, 987, 908, 828, 802, 781, 729, 567.



32

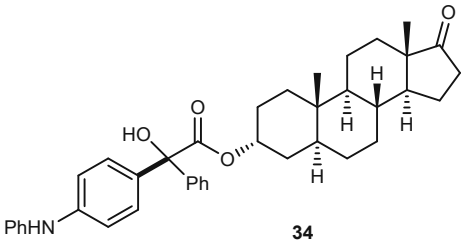
The title compound was prepared according to the general procedure using methyl 4-methoxybenzoylformate (0.2 mmol, 1 equiv.), 3,4-dihydro-2*H*-1,4-benzothiazine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 3/1), providing the product as a light yellow oil (67% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 – 7.30 (m, 2H), 7.02 (d, *J* = 2.2 Hz, 1H), 6.88 (dd, *J* = 8.5, 2.2 Hz, 1H), 6.86 – 6.82 (m, 2H), 6.40 (dd, *J* = 8.4, 1.6 Hz, 1H), 3.81 (s, 3H), 3.79 (s, 4H), 3.62 – 3.57 (m, 2H), 3.04 – 2.99 (m, 2H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.5, 159.3, 141.4, 134.2, 131.8, 129.4, 128.8, 126.7, 124.9, 115.0, 113.4, 80.5, 55.4, 53.6, 42.4, 25.9.

HRMS (LCMS-ESI) m/z Calcd. for $C_{18}H_{19}NO_4S$ $[M+H]^+$ 346.1108, found: 346.1113.

IR (film) ν_{max} (cm^{-1}) 3047, 2955, 2927, 1728, 1605, 1509, 1460, 1312, 1249, 1178, 1071, 1031, 833, 781.



34

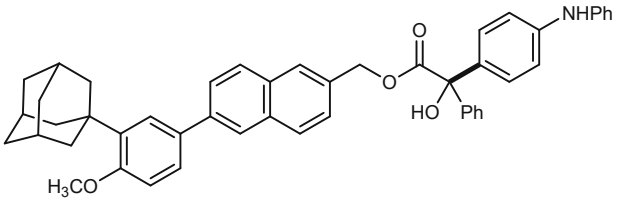
The title compound was prepared according to the general procedure using (3*R*,5*S*,8*R*,9*S*,10*S*,13*S*,14*S*)-10,13-dimethyl-17-oxohexadecahydro-1*H*-cyclopenta[*a*]phenanthren-3-yl 2-oxo-2-phenylacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 5/1), providing the product as a white solid (61% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 – 7.49 (m, 1H), 7.49 – 7.44 (m, 1H), 7.38 – 7.29 (m, 4H), 7.29 – 7.25 (m, 2H), 7.24 – 7.21 (m, 1H), 7.09 – 7.05 (m, 2H), 7.04 – 6.99 (m, 2H), 6.92 (dt, *J* = 13.0, 6.6 Hz, 1H), 5.84 (s, 1H), 5.18 – 5.13 (m, 1H), 4.32 (d, *J* = 8.4 Hz, 1H), 2.38 (ddd, *J* = 21.8, 19.4, 8.5 Hz, 1H), 2.07 – 1.85 (m, 1H), 1.81 – 1.59 (m, 5H), 1.56 – 1.49 (m, 1H), 1.48 – 1.35 (m, 5H), 1.19 – 1.03 (m, 5H), 0.96 – 0.83 (m, 3H), 0.80 (d, *J* = 7.1 Hz, 3H), 0.73 (d, *J* = 1.4 Hz, 3H), 0.53 – 0.41 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 221.48, 174.13, 143.00, 142.76, 142.56, 142.49, 142.33, 134.65, 134.23, 129.43, 128.72, 128.68, 128.16, 128.05, 127.97, 127.63, 127.58, 121.45, 121.34, 118.25, 117.87, 116.52, 116.33, 80.78, 73.51, 73.47, 54.22, 54.16, 51.50, 51.40, 47.84, 47.80, 39.54, 35.91, 35.85, 35.78, 34.89, 32.73, 32.59, 32.53, 31.64, 30.70, 30.64, 27.92, 26.04, 21.76, 20.03, 13.87, 11.37.

HRMS (LCMS-ESI) m/z Calcd. for $C_{39}H_{45}NO_4$ $[M+Na]^+$ 614.3241, found: 614.3244.

IR (film) ν_{max} (cm^{-1}) 3492, 3363, 2922, 2853, 1724, 1597, 1517, 1497, 1448, 1322, 1247, 1161, 1059, 974, 879, 832, 748, 584, 497.



35

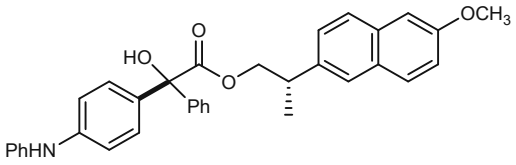
The title compound was prepared according to the general procedure using (6-(3-((3*r*,5*r*,7*r*)-adamantan-1-yl)-4-methoxyphenyl)naphthalen-2-yl)methyl 2-oxo-2-phenylacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a white solid (44% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (s, 1H), 7.87– 7.73 (m, 3H), 7.66 – 7.60 (m, 2H), 7.56 – 7.49 (m, 3H), 7.38 – 7.24 (m, 8H), 7.09 (dd, J = 8.5, 1.0 Hz, 2H), 7.04 – 6.94 (m, 4H), 5.81 (s, 1H), 5.56 – 5.41 (m, 2H), 4.25 (s, 1H), 3.91 (s, 3H), 2.22 (d, *J* = 2.2 Hz, 6H), 2.14 (s, 3H), 1.84 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.68, 158.76, 143.13, 142.61, 142.07, 139.63, 139.00, 134.04, 133.59, 132.96, 132.03, 131.92, 129.48, 128.74, 128.58, 128.47, 128.20, 128.15, 127.63, 127.11, 126.32, 125.99, 125.91, 125.72, 124.87, 121.50, 118.37, 116.68, 112.17, 81.03, 68.48, 55.28, 40.70, 37.24, 29.22.

HRMS (LCMS-ESI) m/z Calcd. for $C_{48}H_{45}NO_4$ $[M+H]^+$ 700.3421, found: 700.3425.

IR (film) ν_{max} (cm^{-1}) 3394, 2901, 2847, 1596, 1513, 1495, 1445, 1314, 1235, 1182, 1138, 1102, 1060, 1027, 904, 881, 808, 747, 730, 696, 648, 477.



36

The title compound was prepared according to the general procedure using (*S*)-2-(6-

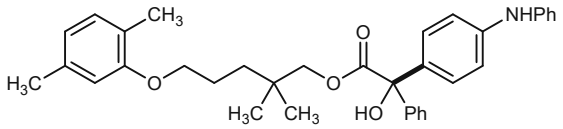
methoxynaphthalen-2-yl)propyl 2-oxo-2-phenylacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow oil (42% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 (t, *J* = 9.0 Hz, 2H), 7.44 (s, 1H), 7.36 – 7.31 (m, 1H), 7.28 – 7.18 (m, 6H), 7.15 – 7.00 (m, 7H), 6.93 (tdd, *J* = 7.4, 1.7, 0.9 Hz, 1H), 6.87 – 6.81 (m, 1H), 6.76 – 6.71 (m, 1H), 5.66 (s, 1H), 4.46 (ddd, *J* = 10.7, 7.5, 5.7 Hz, 1H), 4.35 (td, *J* = 10.6, 6.3 Hz, 1H), 4.14 (s, 1H), 3.87 (d, *J* = 7.2 Hz, 3H), 3.20 (dd, *J* = 6.8, 3.6 Hz, 1H), 1.26 (d, *J* = 7.0 Hz, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 174.81, 157.55, 142.85, 142.75, 142.70, 142.09, 142.05, 137.81, 137.77, 134.11, 134.06, 133.67, 129.44, 129.30, 129.06, 128.53, 128.40, 128.02, 127.94, 127.90, 127.46, 127.33, 127.17, 126.17, 126.11, 125.84, 121.37, 121.32, 118.94, 118.20, 118.11, 116.64, 105.64, 80.81, 71.63, 55.40, 38.82, 38.78, 18.00.

HRMS (LCMS-ESI) m/z Calcd. for $C_{34}H_{31}NO_4$ $[M+H]^+$ 518.2326, found: 518.2329.

IR (film) ν_{max} (cm^{-1}) 3492, 3393, 3056, 2962, 1720, 1596, 1514, 1496, 1317, 1263, 1232, 1215, 1162, 1060, 1030, 852, 810, 734, 696, 674, 623, 584, 475.



37

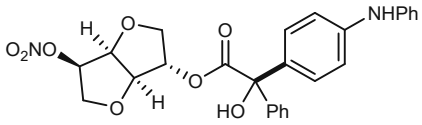
The title compound was prepared according to the general procedure using 5-(2,5-dimethylphenoxy)-2,2-dimethylpentyl 2-oxo-2-phenylacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a yellow oil (45% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 – 7.44 (m, 2H), 7.34 – 7.22 (m, 7H), 7.04 – 6.90 (m, 6H), 6.66 (d, *J* = 7.4 Hz, 1H), 6.56 (s, 1H), 5.65 (s, 1H), 4.24 (s, 1H), 3.98 (s, 2H), 3.76 (t, *J* = 6.4 Hz, 2H), 2.29 (s, 3H), 2.13 (s, 3H), 1.63 – 1.55 (m, 2H), 1.27 – 1.22 (m, 2H), 0.83 (s, 6H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 175.04, 157.07, 143.04, 142.69, 142.27, 136.59, 134.30, 130.43, 129.44, 128.68, 128.09, 127.61, 123.64, 121.39, 120.81, 118.21, 116.76, 112.03, 81.03, 74.45, 68.25, 35.21, 33.80, 24.33, 24.26, 24.07, 21.55, 15.93.

HRMS (LCMS-ESI) m/z Calcd. for $C_{35}H_{39}NO_4$ $[M+H]^+$ 538.2952, found: 538.2953.

IR (film) ν_{max} (cm^{-1}) 3492, 3391, 3027, 2954, 1721, 1596, 1511, 1496, 1313, 1249, 1157, 1129, 1089, 1057, 994, 908, 805, 746, 732, 696, 586, 495, 447.



38

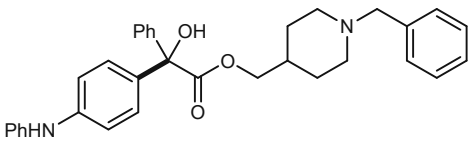
The title compound was prepared according to the general procedure using (3*S*,3a*R*,6*R*,6a*S*)-6-(nitrooxy)hexahydrofuro[3,2-b]furan-3-yl 2-oxo-2-phenylacetate (0.2 mmol, 1 equiv.), diphenylamine (0.4 mmol, 2 equiv.) in 1 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow solid (32% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 – 7.41 (m, 2H), 7.37 – 7.32 (m, 3H), 7.32 – 7.26 (m, 3H), 7.25 – 7.23 (m, 1H), 7.11 – 7.08 (m, 2H), 7.03 – 6.99 (m, 2H), 6.99 – 6.94 (m, 1H), 5.78 (s, 1H), 5.36 (s, 1H), 5.31 (td, *J* = 5.5, 2.7 Hz, 1H), 4.85 – 4.79 (m, 1H), 4.33 (dd, *J* = 19.4, 4.9 Hz, 1H), 4.05 – 3.98 (m, 4H), 3.85 (ddd, *J* = 11.3, 5.5, 4.2 Hz, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 173.9, 142.4, 133.4, 129.5, 128.6, 128.5, 128.4, 128.3, 127.4, 127.3, 121.8, 118.7, 118.6, 116.6, 116.5, 86.2, 81.7, 81.2, 80.9, 79.3, 73.1, 69.5.

HRMS (LCMS-ESI) m/z Calcd. for $C_{26}H_{24}N_2O_8$ $[M+H]^+$ 493.1605, found: 493.1601.

IR (film) ν_{max} (cm^{-1}) 3392, 2923, 1732, 1639, 1595, 1515, 1496, 1317, 1280, 1234, 1166, 1094, 1061, 1002, 966, 848, 749, 697, 494.



40

The title compound was prepared according to the general procedure using (1-benzylpiperidin-4-yl)methyl 2-oxo-2-phenylacetate (1 g, 1 equiv.), diphenylamine (2 equiv.) in 10 mL of H_2O under blue light for 72 hours. The resulting crude residue was purified by flash chromatography (petroleum ether/ethyl acetate = 10/1), providing the product as a light yellow oil (73% yield).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 – 7.43 (m, 2H), 7.36 – 7.23 (m, 12H), 7.09 – 7.05 (m, 2H), 7.02 – 6.98 (m, 2H), 6.94 (t, J = 7.3 Hz, 1H), 5.77 (s, 1H), 4.09 (d, J = 6.7 Hz, 2H), 3.47 (s, 2H), 2.83 (d, J = 11.6 Hz, 2H), 1.90 (td, J = 11.8, 2.0 Hz, 2H), 1.71 – 1.57 (m, 1H), 1.51 (d, J = 12.2 Hz, 2H), 1.30 – 1.17 (m, 2H).

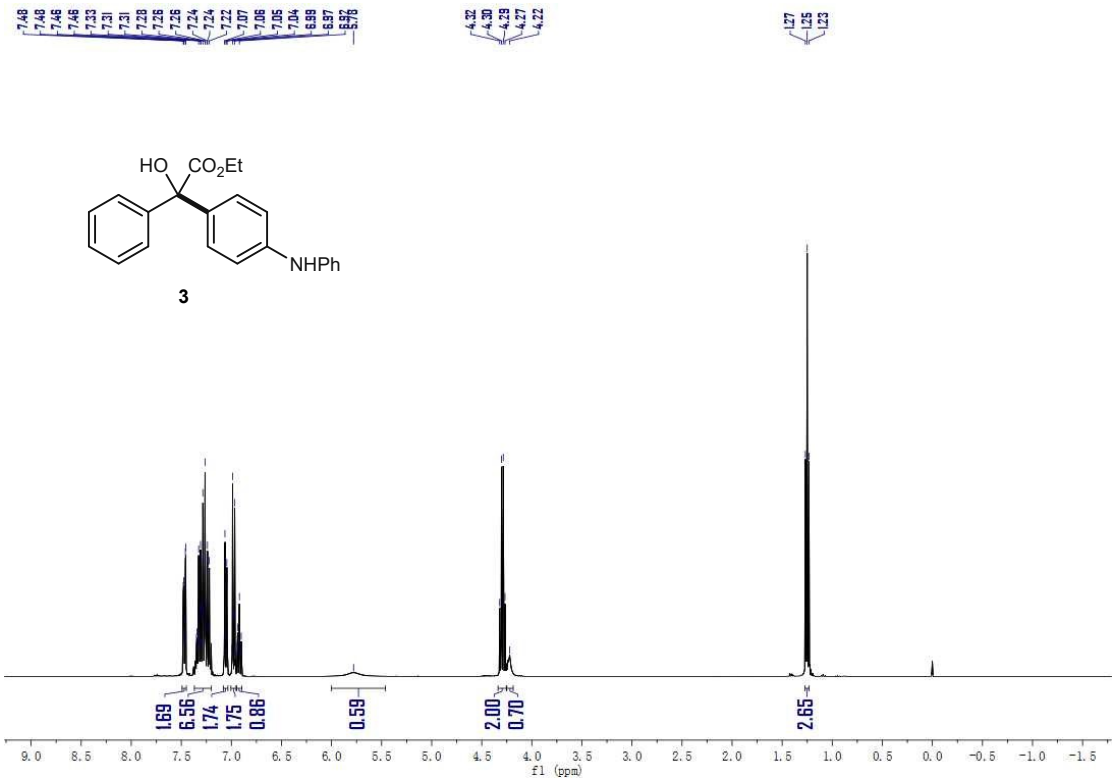
^{13}C NMR (101 MHz, $CDCl_3$) δ 174.89, 143.08, 142.69, 142.22, 138.25, 134.24, 129.46, 129.28, 128.64, 128.29, 128.12, 128.06, 127.52, 127.13, 121.46, 118.31, 116.73, 80.94, 71.15, 63.32, 53.05, 35.23, 28.69.

HRMS (LCMS-ESI) m/z Calcd. for $C_{33}H_{34}N_2O_3$ $[M+H]^+$ 507.2642, found: 507.2649.

IR (film) ν_{max} (cm^{-1}) 3495, 3392, 3028, 2924, 1721, 1595, 1514, 1495, 1448, 1316, 1248, 1165, 1062, 1029, 976, 833, 739, 607, 497.

HRMS (LCMS-ESI) m/z Calcd. for $C_{33}H_{34}N_2O_3$ $[M+H]^+$ 507.2642, found: 507.2649.

5. NMR Spectra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CO2Et
NHPh
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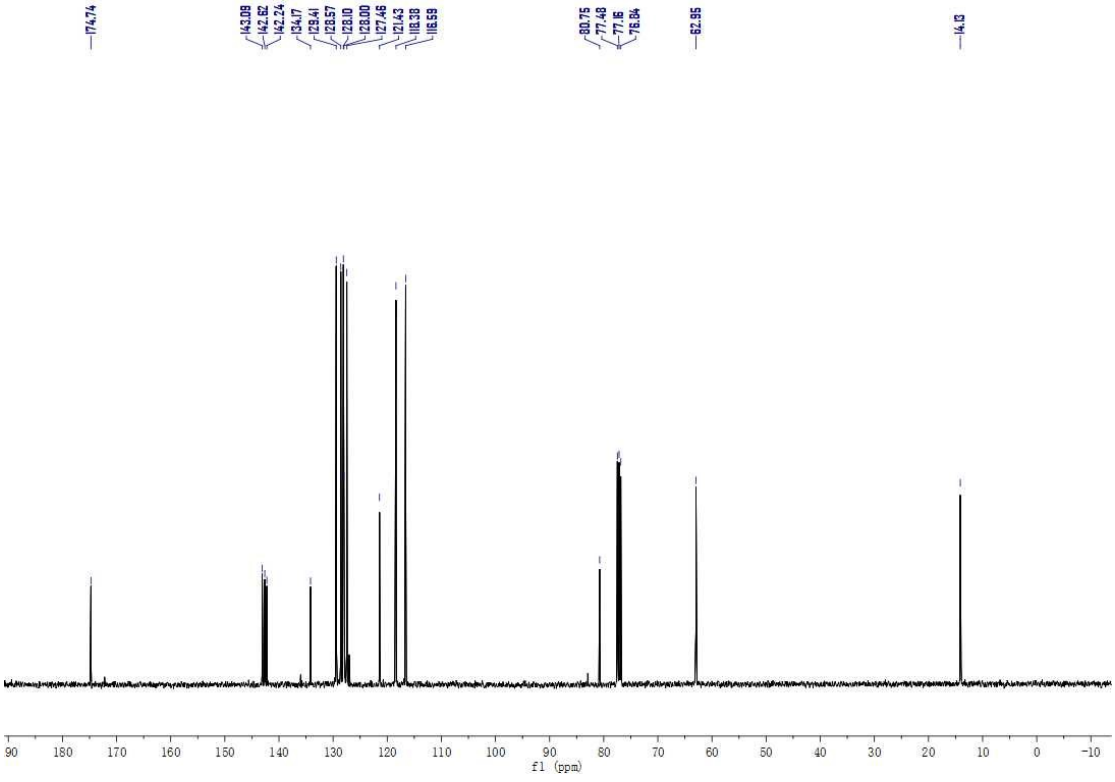
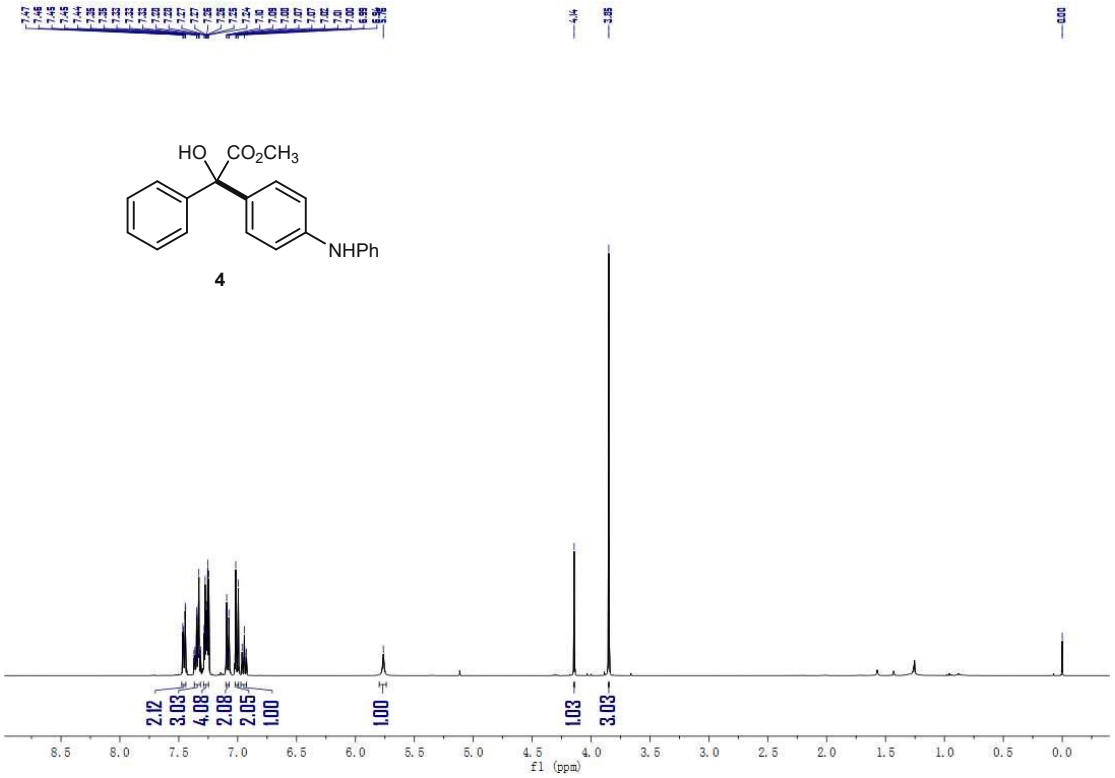
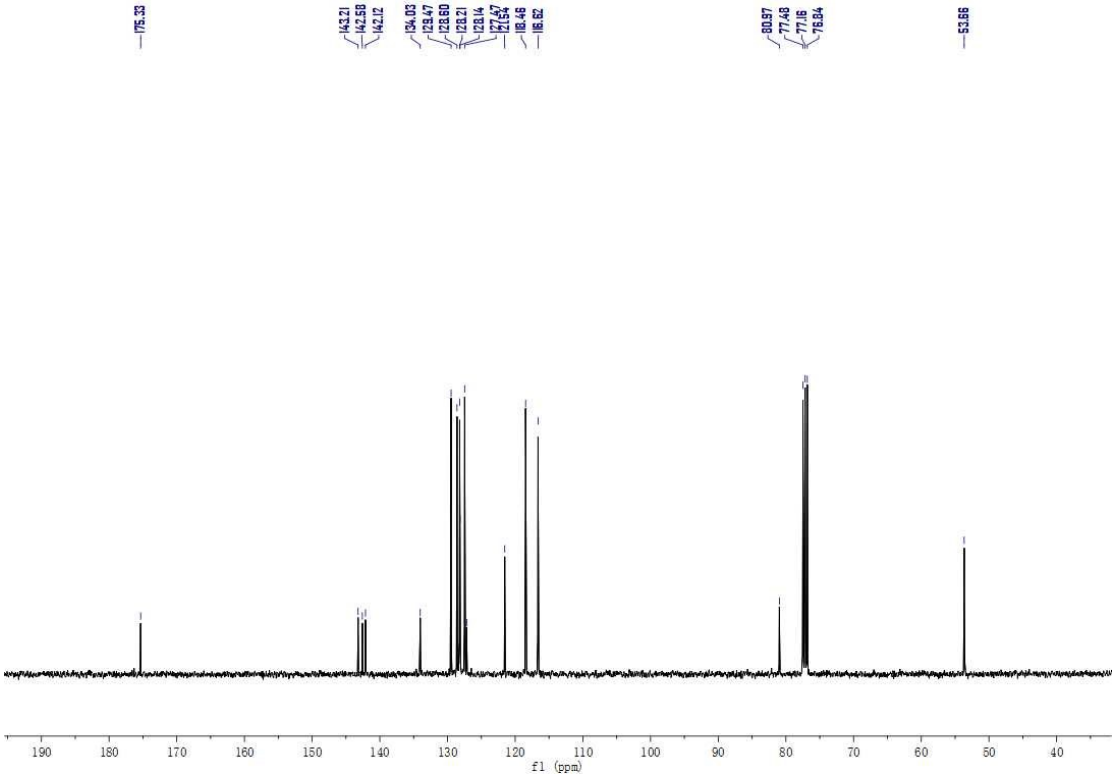
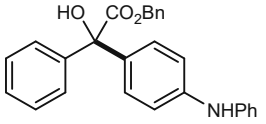
1.74
1.75
0.86
0.59
2.00
0.70
2.65
f1 (ppm)

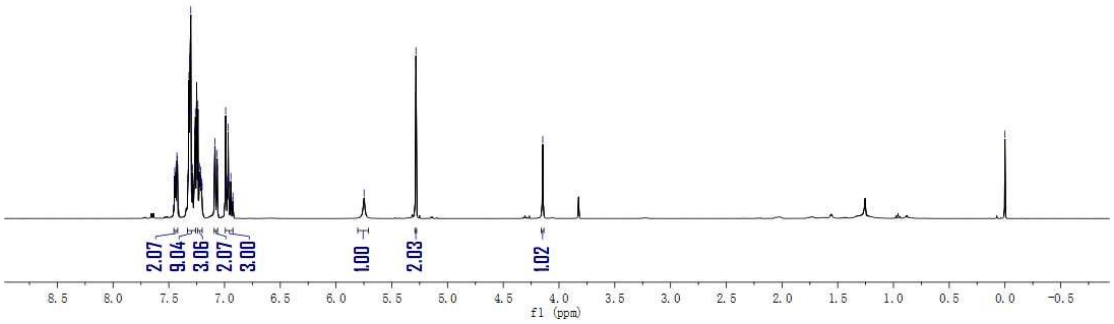

174.74
143.09
142.82
142.24
134.17
129.41
128.57
128.10
128.00
127.48
121.43
118.38
116.59
80.75
77.48
77.16
76.84
62.95
14.13
f1 (ppm)

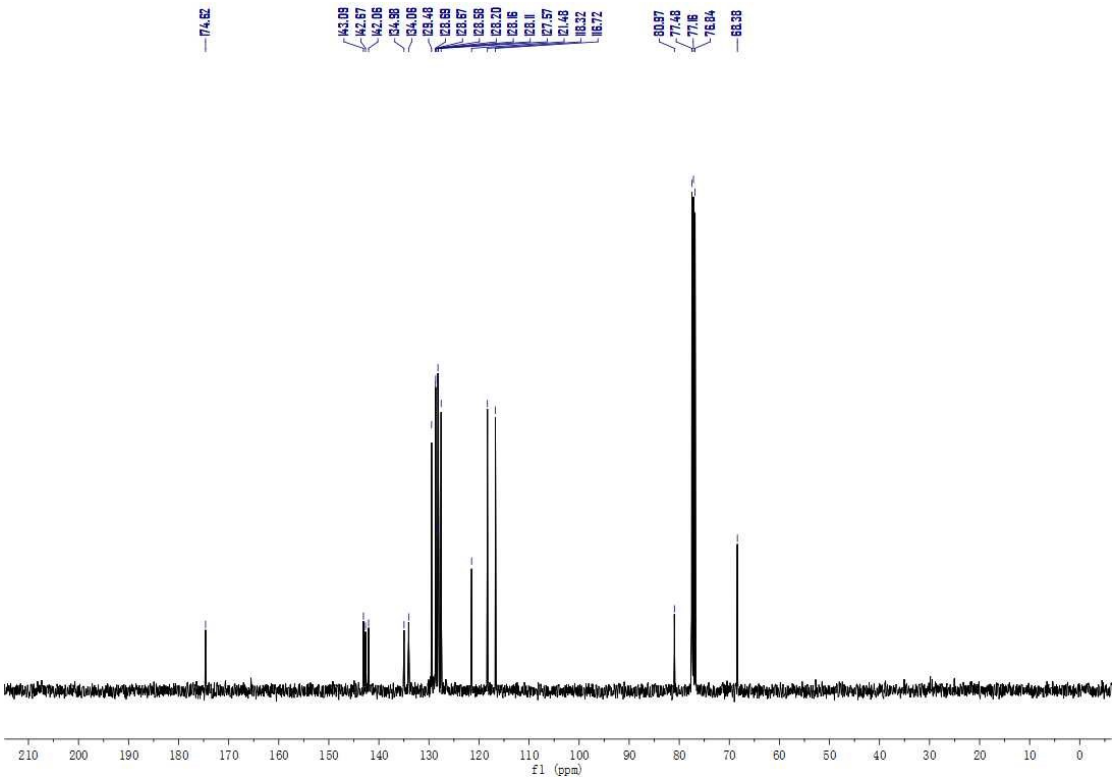

HO
CO2CH3
NHPh
4
2.12
3.03
4.08
2.08
2.05
1.00
1.00
1.03
3.03
f1 (ppm)

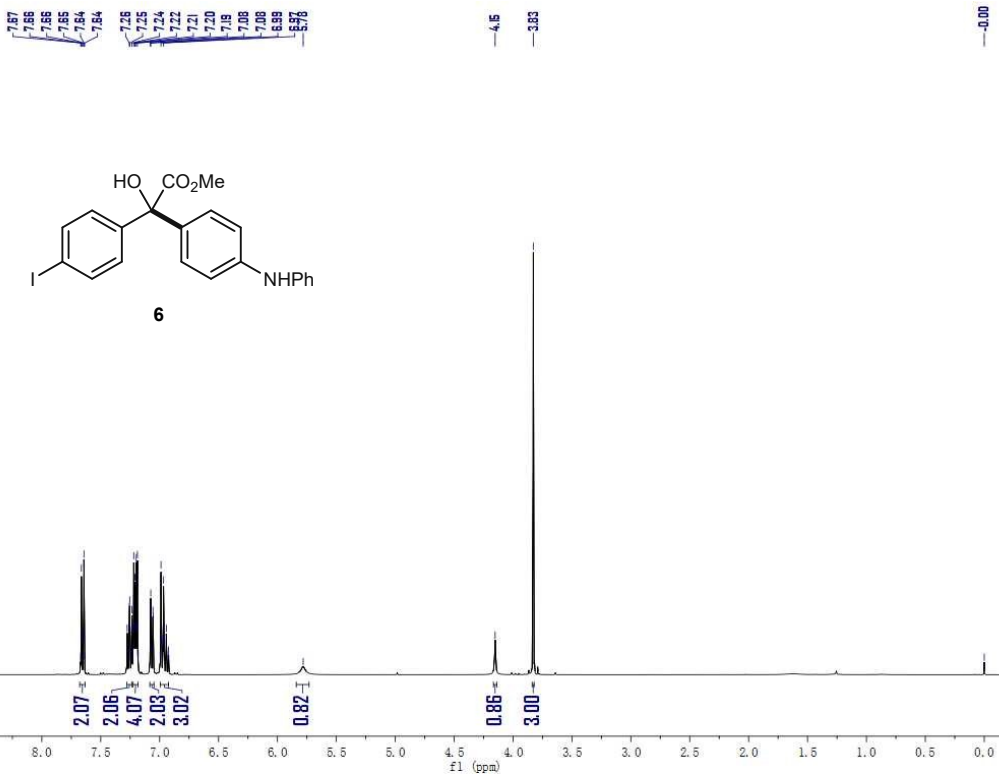

f1 (ppm)

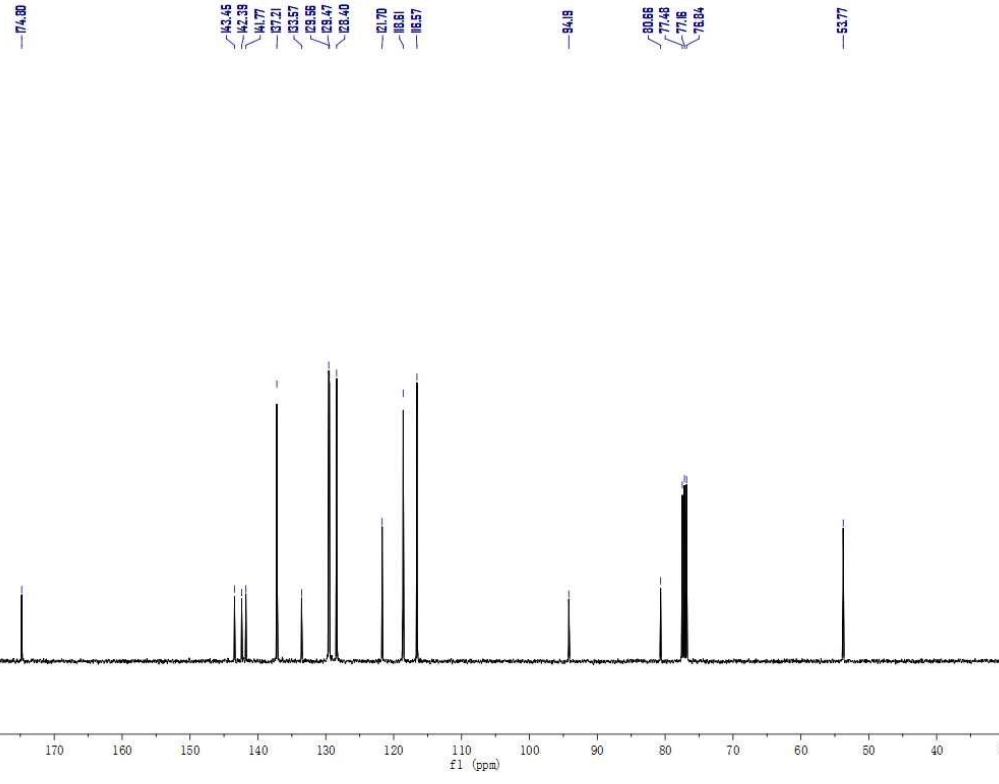

HO
CO2Bn
NHPh

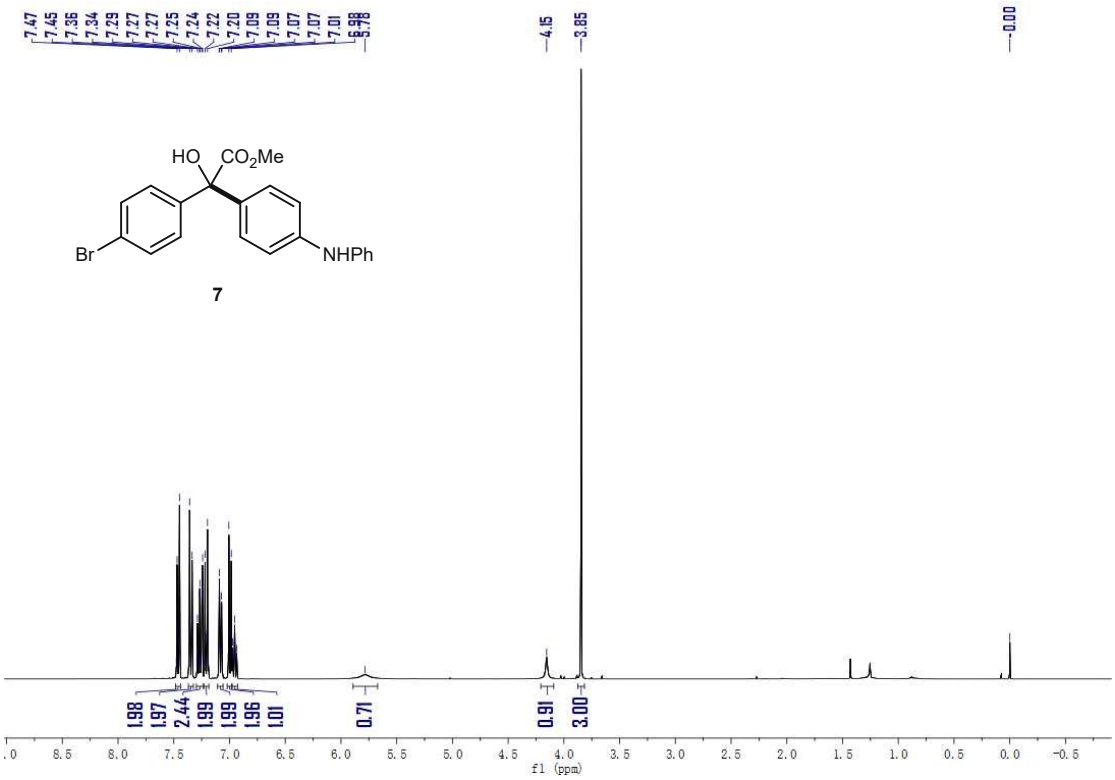
5


2.07
9.04
3.06
2.07
3.00
1.00
2.03
1.02
f1 (ppm)

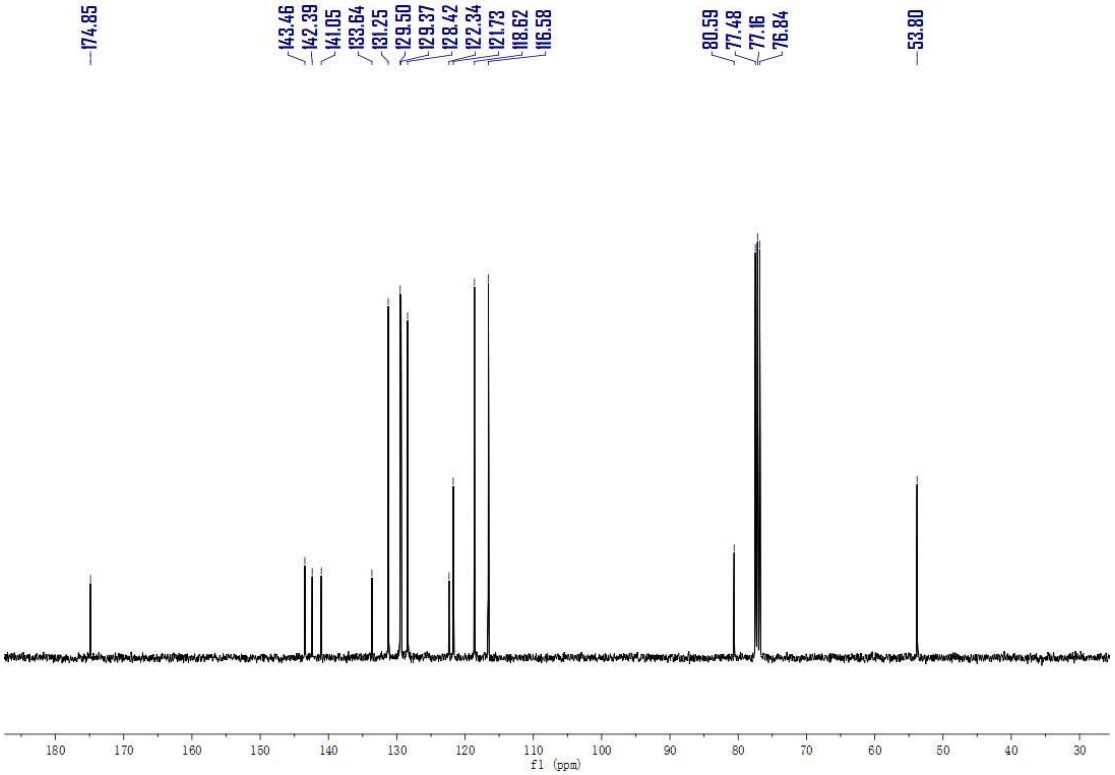

174.62
143.09
142.67
142.06
134.98
134.06
129.48
128.89
128.67
128.58
128.20
128.16
128.11
127.57
121.43
118.32
116.72
80.97
77.48
77.16
76.84
68.38
f1 (ppm)

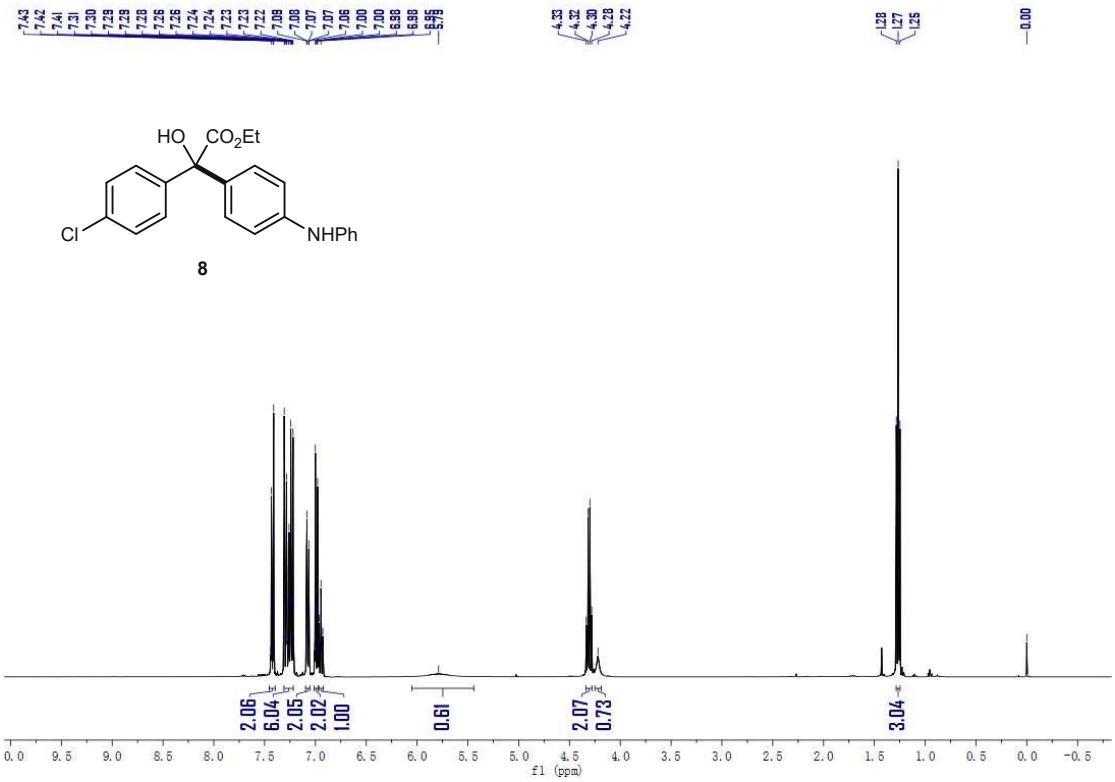

7.87
7.86
7.86
7.85
7.84
7.84
7.26
7.25
7.24
7.22
7.21
7.20
7.19
7.08
7.08
6.99
6.97
5.78
4.15
3.83
0.00
HO
CO2Me
I
NHPh
6
2.07
2.06
4.07
2.03
3.02
0.82
0.86
3.00
f1 (ppm)

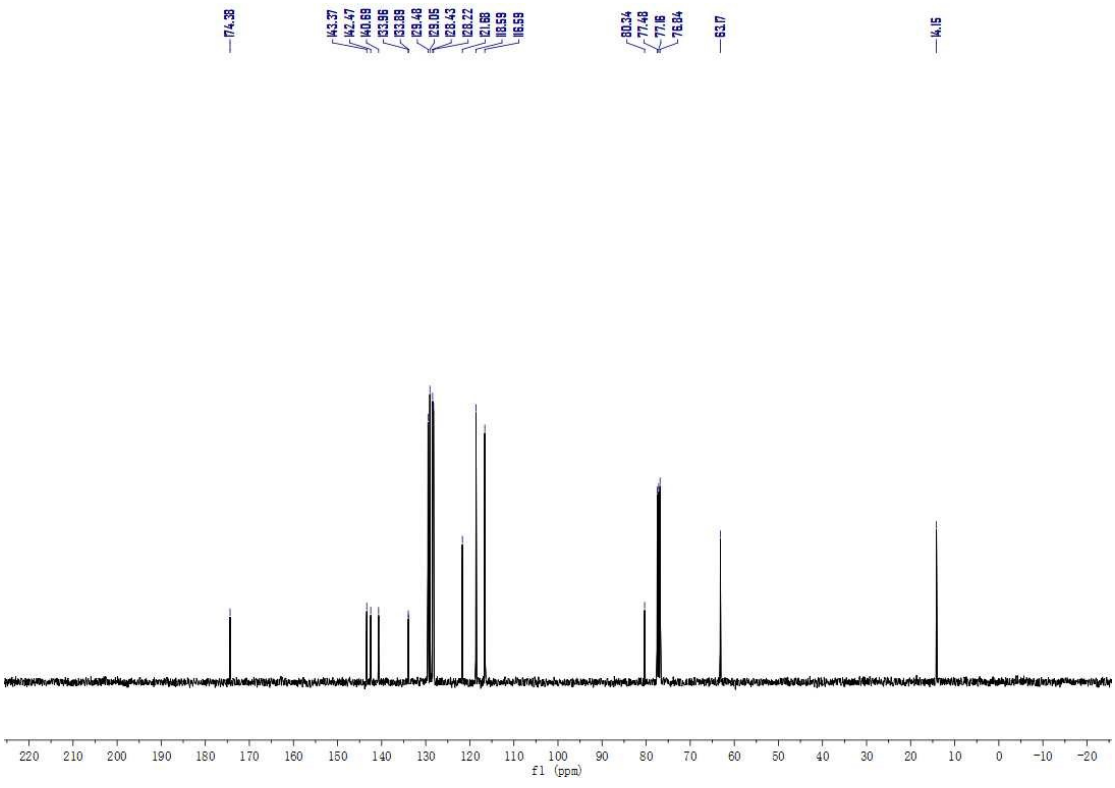

174.80
143.45
142.38
141.77
137.21
133.57
129.56
129.47
128.40
121.70
118.61
116.57
94.19
80.66
77.43
77.16
76.84
53.77
f1 (ppm)


7.47
7.45
7.36
7.34
7.29
7.27
7.27
7.25
7.24
7.22
7.20
7.09
7.07
7.07
7.01
6.98
6.78
4.15
3.85
0.00
HO
CO2Me
Br
NHPh
1.98
1.97
2.44
1.99
1.99
1.96
1.01
0.71
0.91
3.00
f1 (ppm)

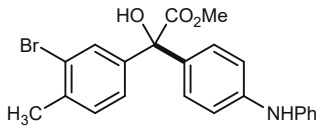
7


174.85
143.46
142.39
141.05
133.64
131.25
129.50
129.37
128.42
122.34
121.73
118.62
116.58
80.59
77.48
77.16
76.84
53.80
f1 (ppm)

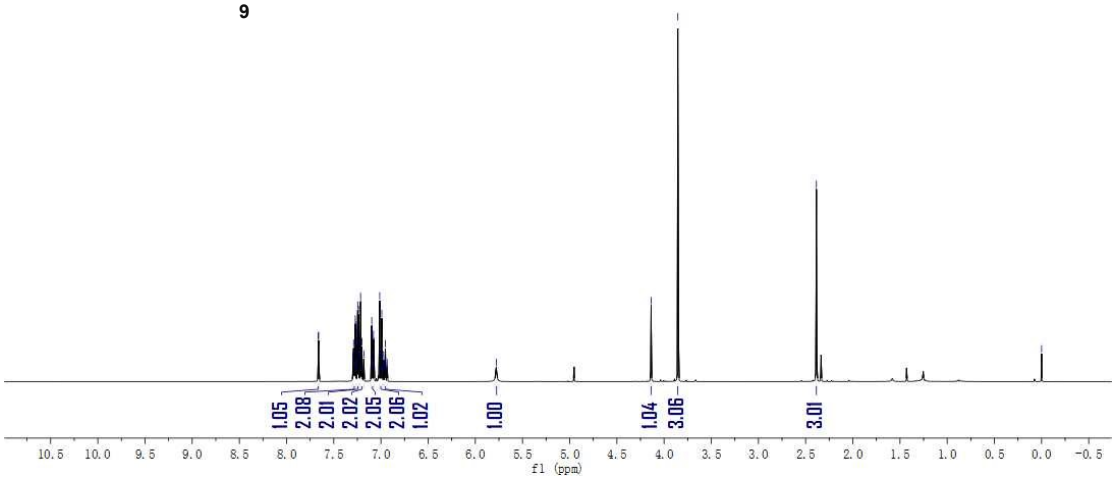

HO
CO2Et
Cl
NHPh
8
2.06
6.04
2.05
2.02
1.00
0.61
2.07
0.73
3.04
f1 (ppm)


f1 (ppm)

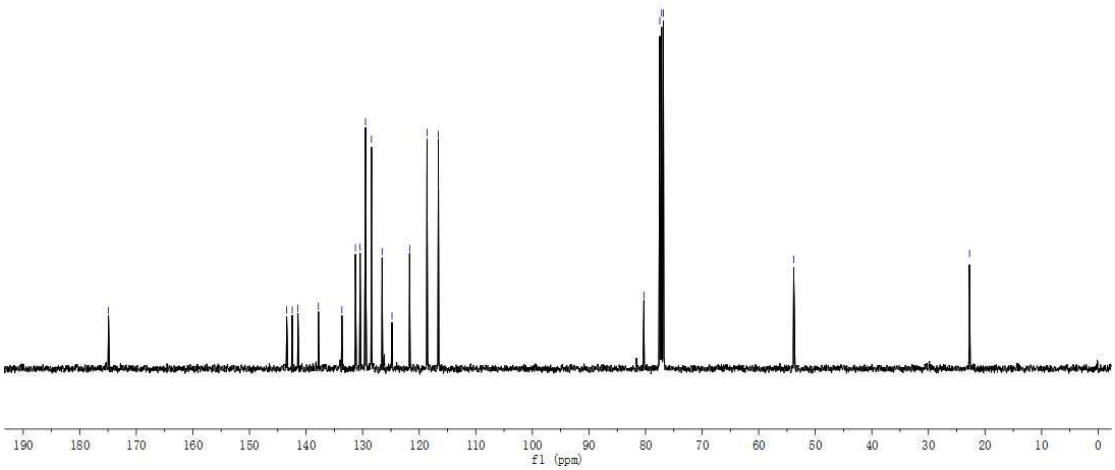

7.67
7.66
7.29
7.28
7.27
7.27
7.25
7.25
7.24
7.23
7.22
7.22
7.20
7.18
7.10
7.10
7.08
7.08
7.08
7.01
7.01
6.99
6.95
5.78
4.14
3.85
2.39
0.00

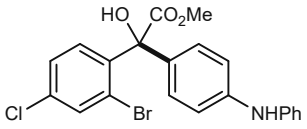

HO
CO2Me
Br
H3C
NHPh

9

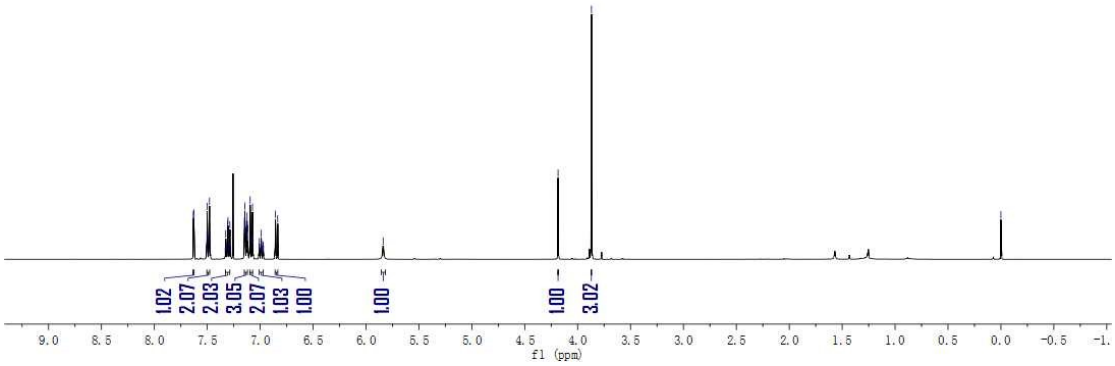

1.05
2.08
2.01
2.02
2.05
2.06
1.02
1.00
1.04
3.06
3.01
10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


174.91
143.42
142.44
141.44
137.81
133.66
131.27
130.45
129.49
128.44
126.55
124.81
121.69
118.62
116.62
80.29
77.48
77.16
76.84
53.81
22.73

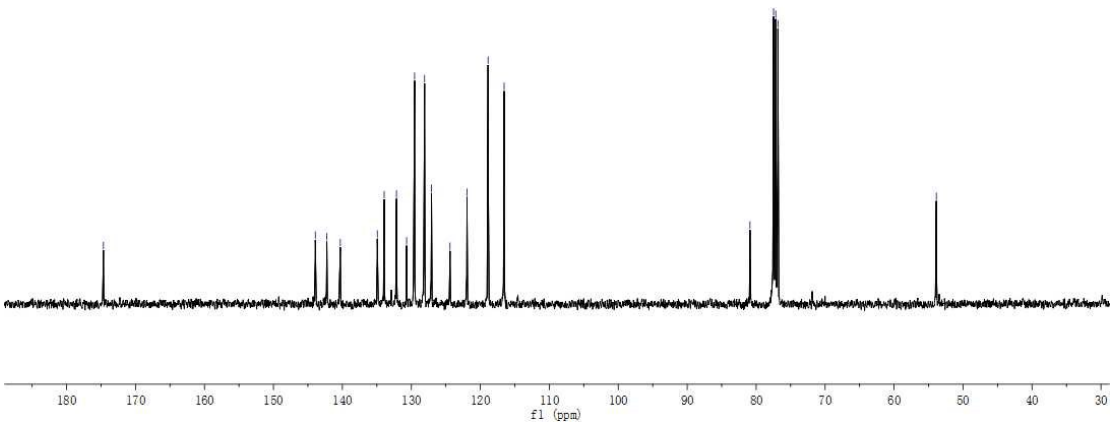

190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

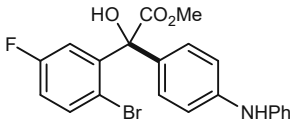

HO
CO2Me
Cl
Br
NHPh

10

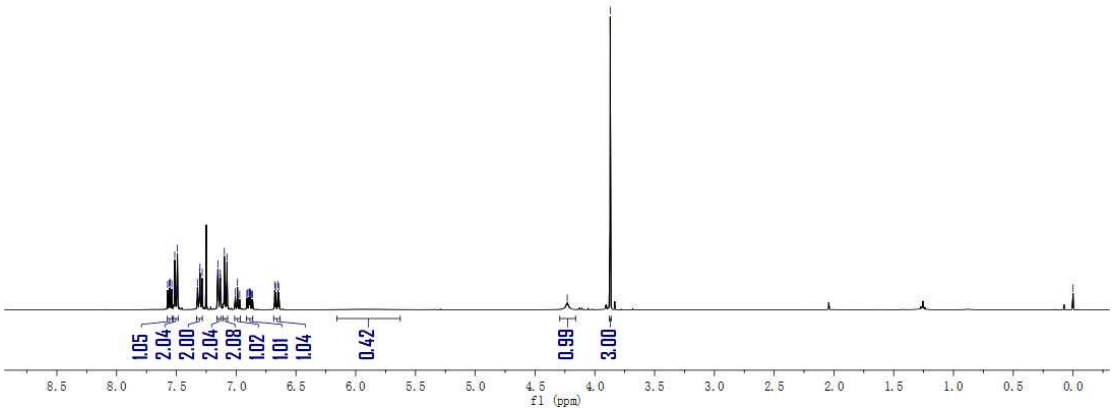

1.02
2.07
2.03
3.05
2.07
1.03
1.00
1.00
1.00
3.02
f1 (ppm)

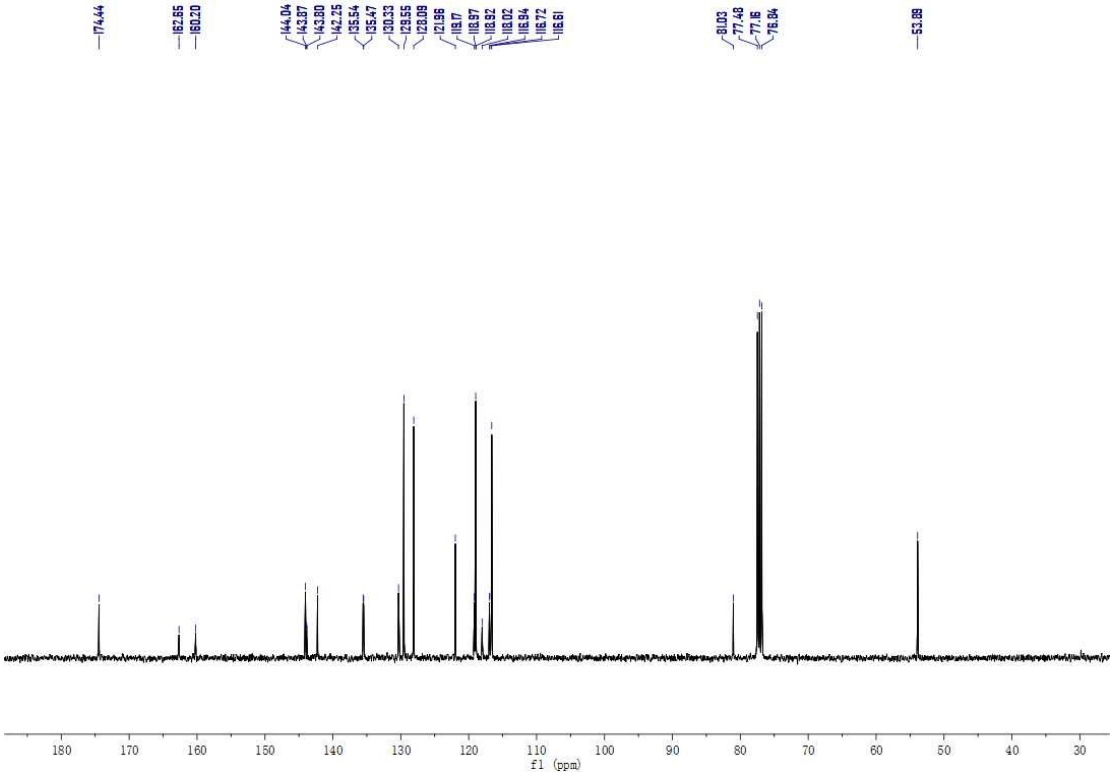

174.65
143.92
142.25
140.30
134.93
133.94
132.16
130.69
129.53
128.08
127.08
124.40
121.93
118.87
116.55
80.90
77.48
77.16
76.84
53.87

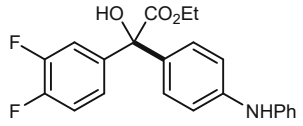

f1 (ppm)


HO
CO2Me
F
Br
NHPh

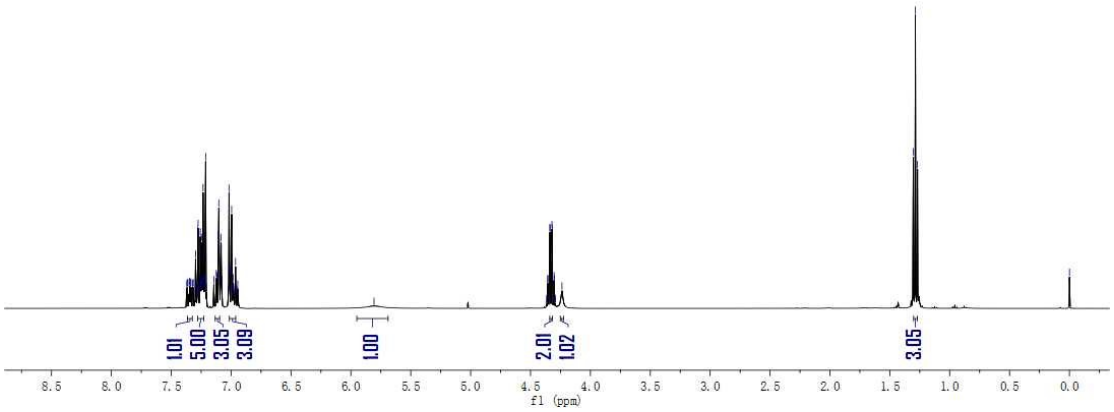
11

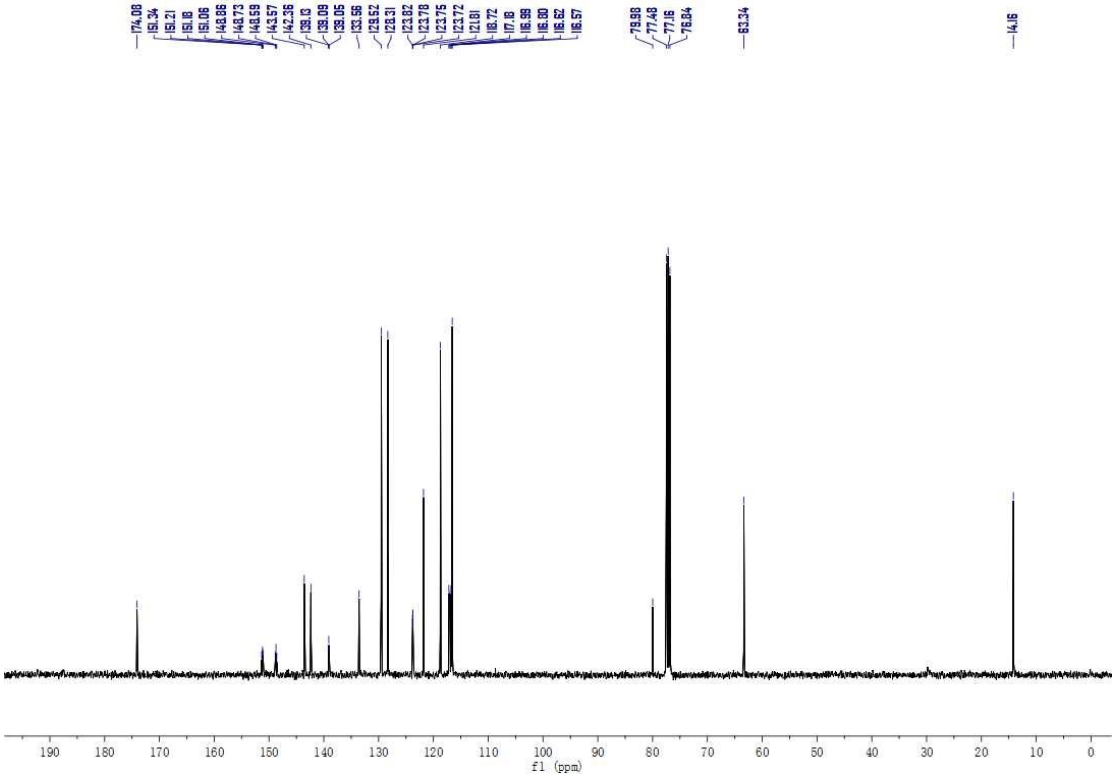

1.05
2.04
2.00
2.04
2.08
1.02
1.01
1.04
0.42
0.99
3.00
f1 (ppm)

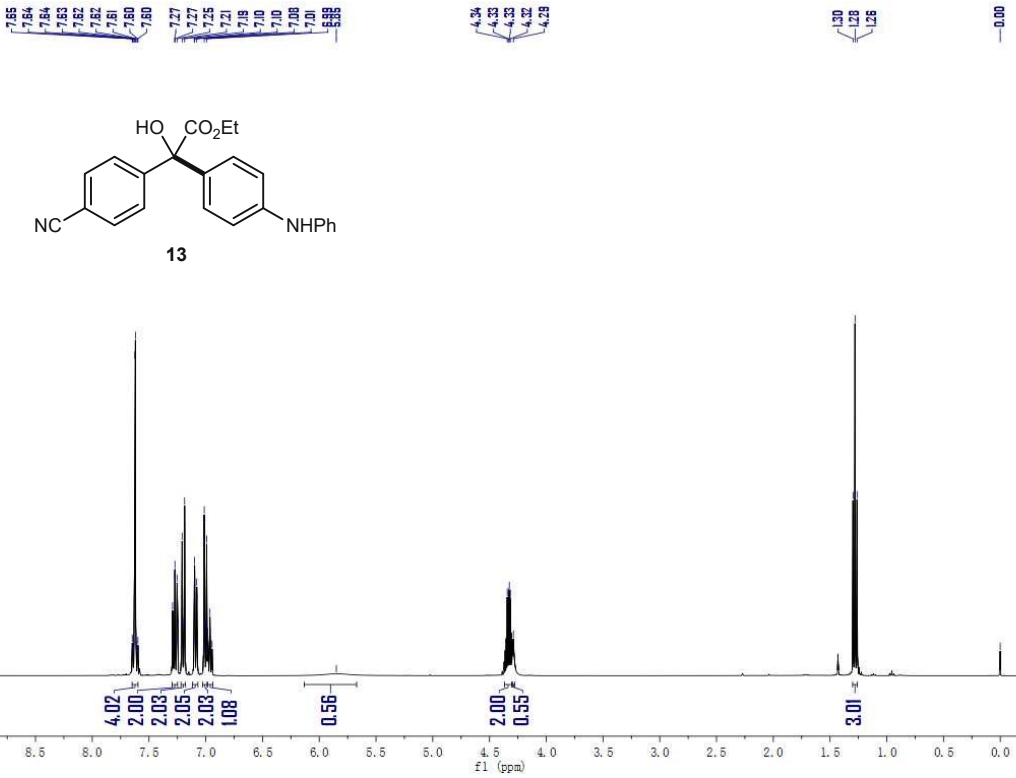

f1 (ppm)

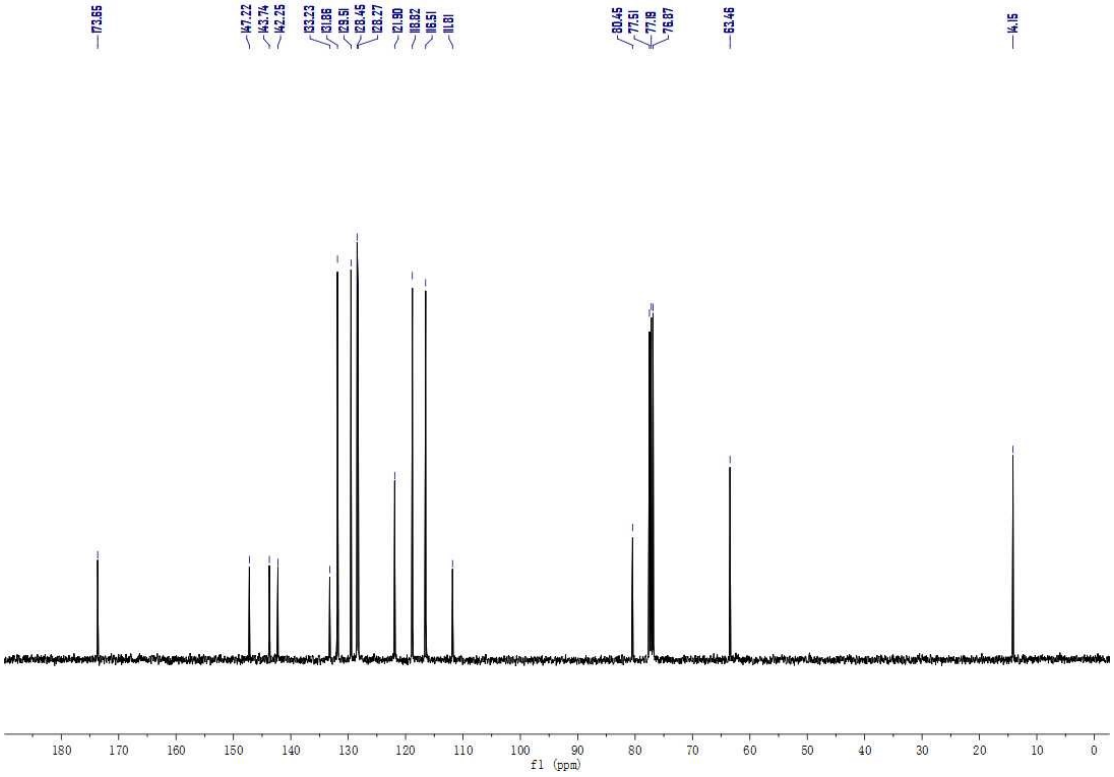


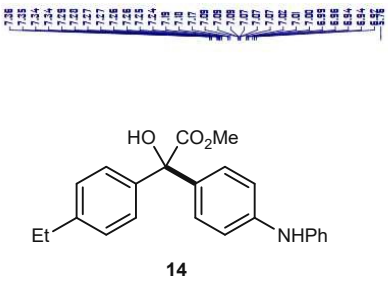
12



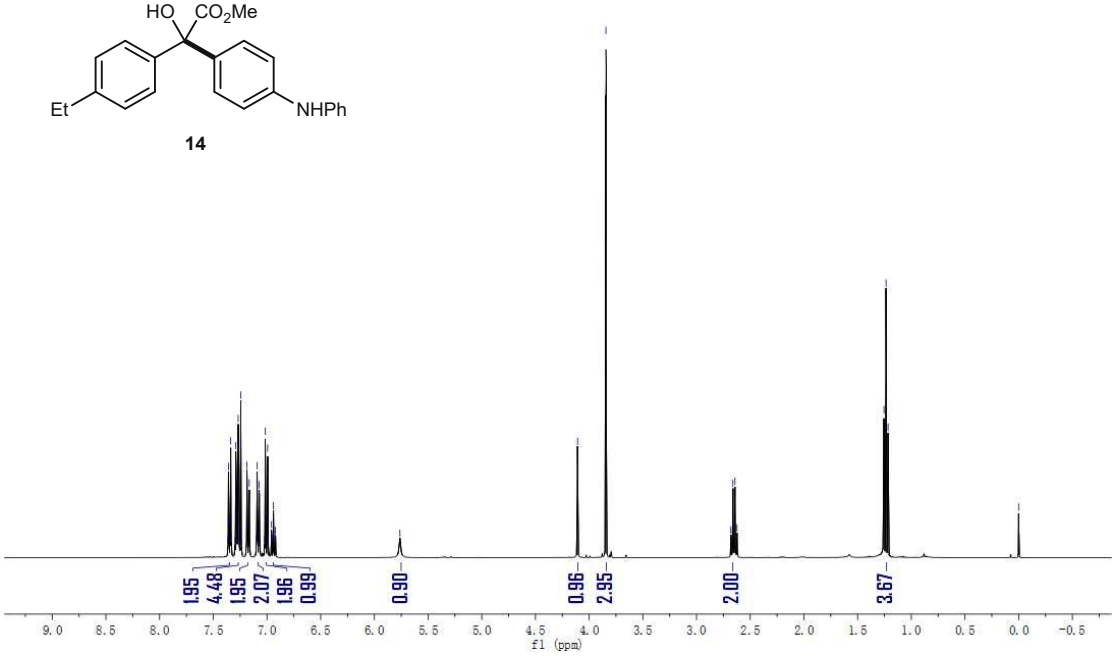


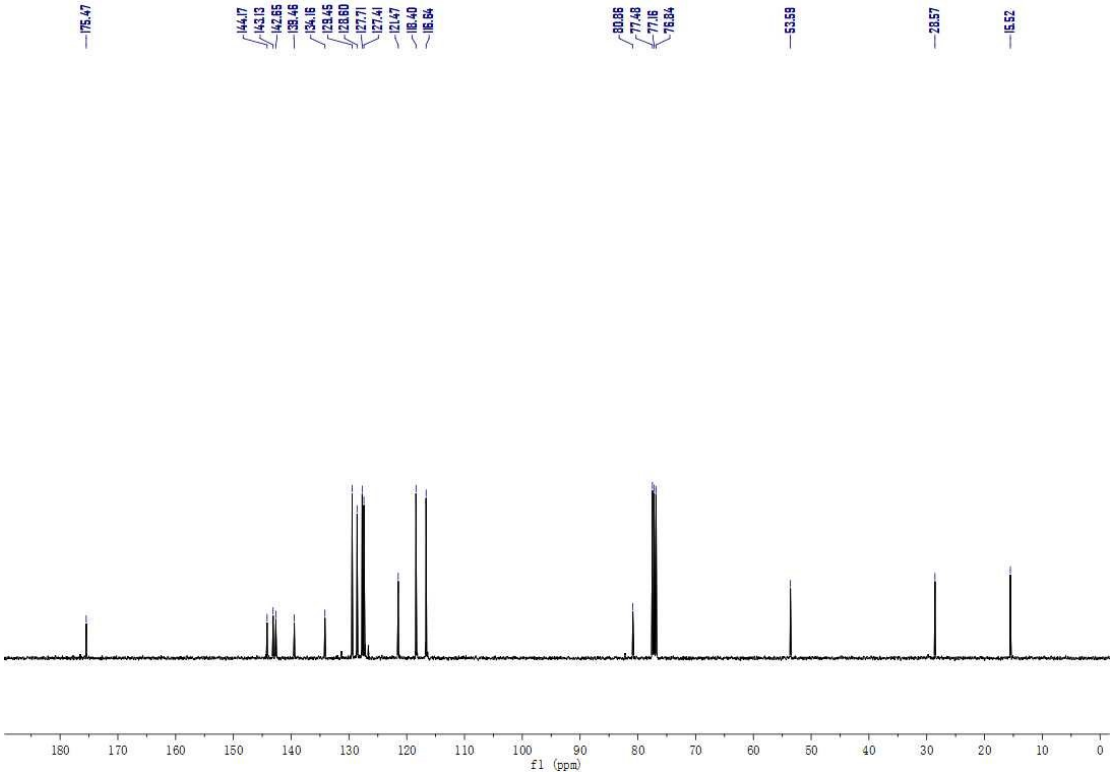

HO
CO2Et
NC
NHPh
13
4.02
2.00
2.03
2.05
2.03
1.08
0.56
2.00
0.55
3.01
f1 (ppm)

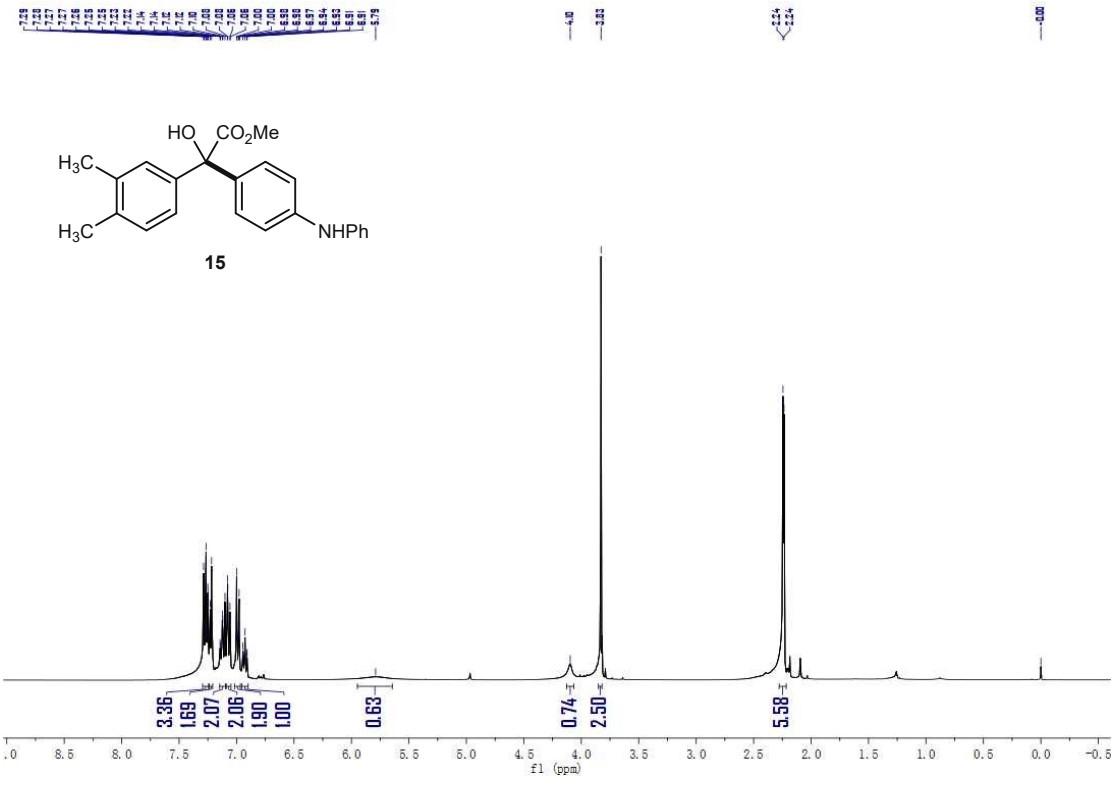

f1 (ppm)

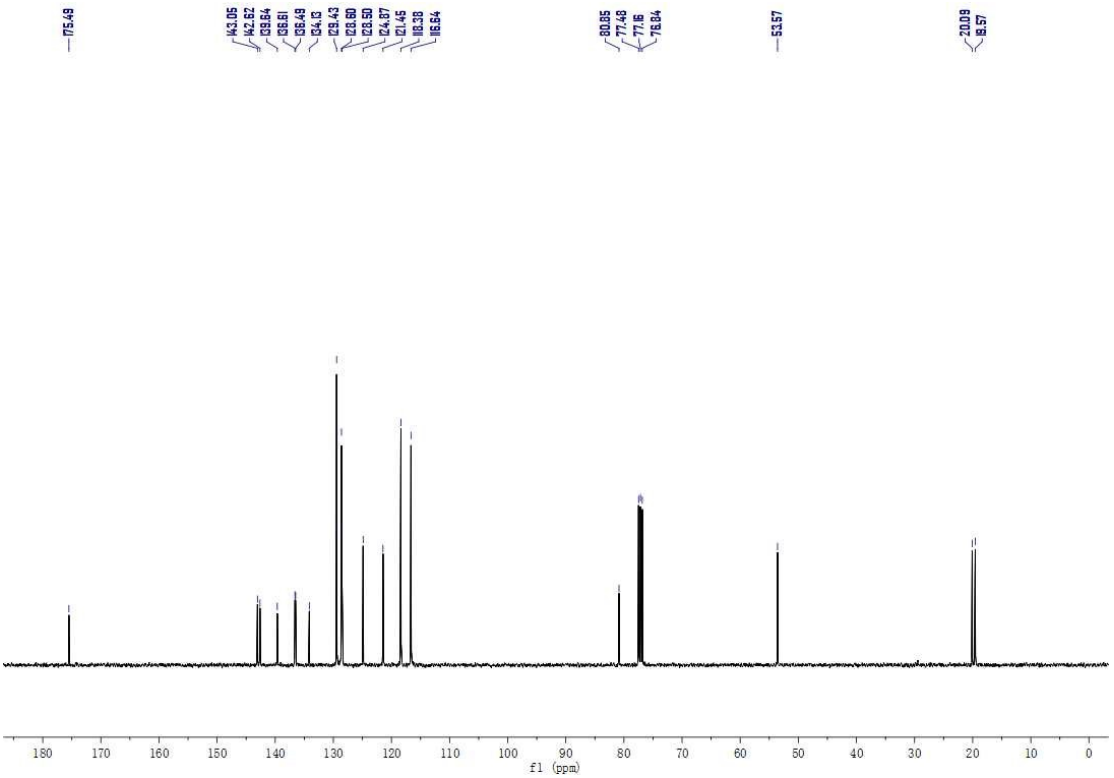

HO
CO2Me
Et
NHPh

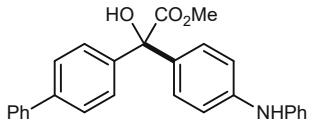
14


1.95
4.48
1.95
2.07
1.96
0.99
0.90
0.96
2.95
2.00
3.67
f1 (ppm)

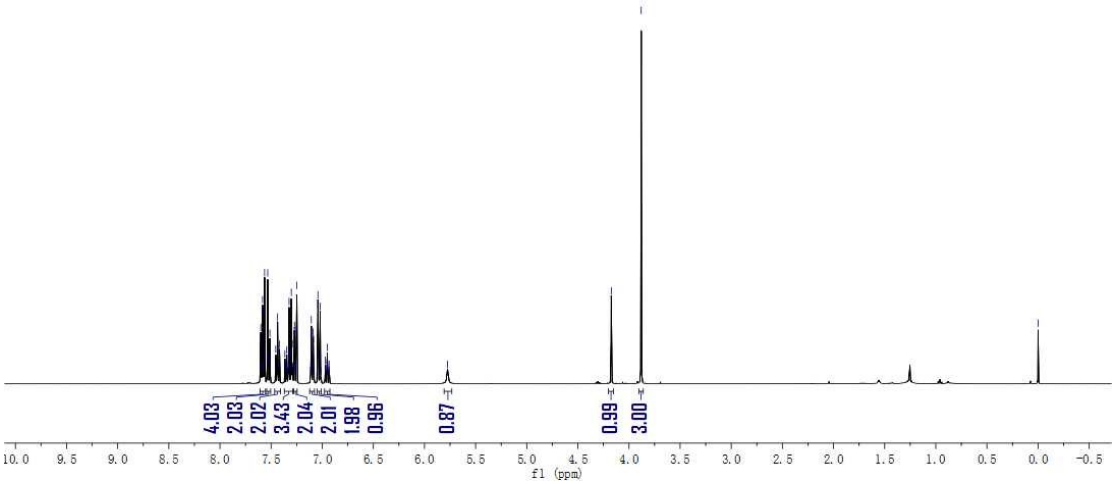

175.47
144.17
143.13
142.65
139.46
134.16
129.45
128.60
127.71
127.41
121.47
118.40
116.64
80.86
77.48
77.16
76.84
53.59
28.57
15.52
f1 (ppm)

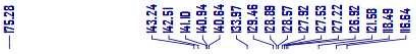

HO
CO2Me
H3C
H3C
NHPh
15
3.36
1.69
2.07
2.06
1.90
1.00
0.63
0.74
2.50
5.58
f1 (ppm)

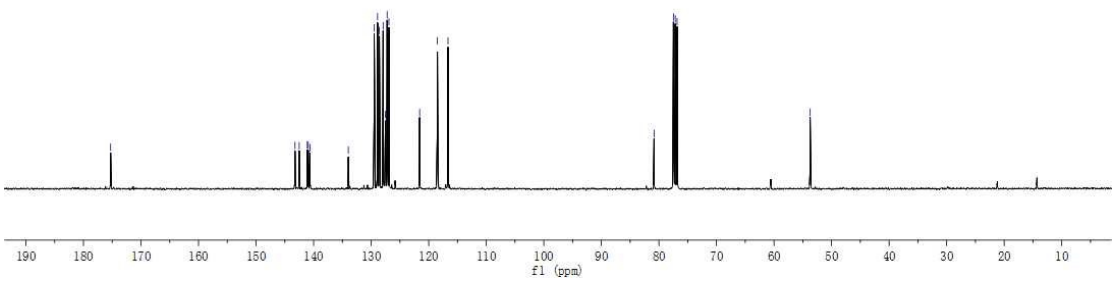

175.49
143.05
142.62
139.64
136.61
136.48
134.13
129.43
128.80
128.50
124.87
121.45
118.38
116.54
80.05
77.48
77.16
76.84
53.57
20.09
16.57
f1 (ppm)

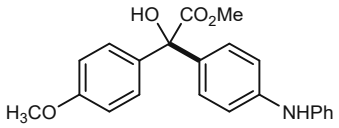

HO
CO2Me
Ph
NHPh

16

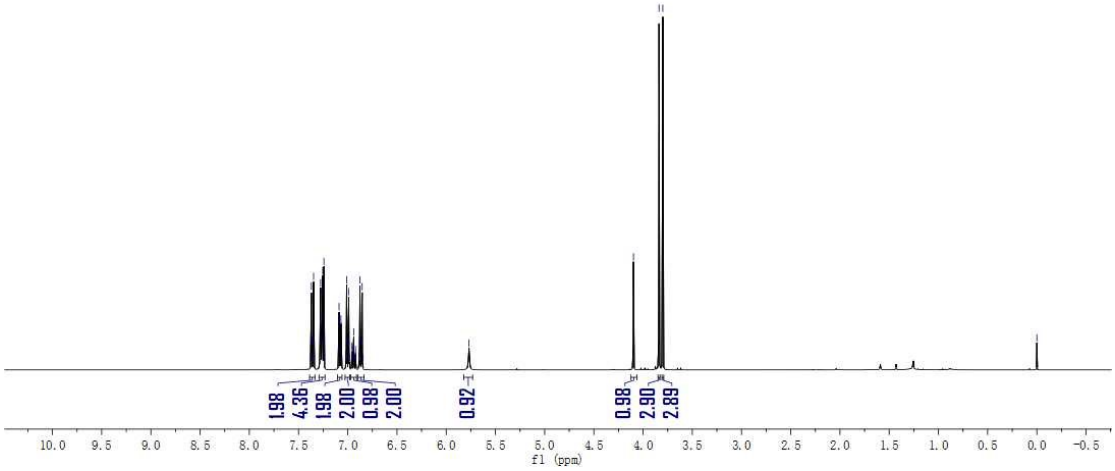

4.03
2.03
2.02
3.43
2.04
2.01
1.98
0.96
0.87
0.99
3.00
f1 (ppm)



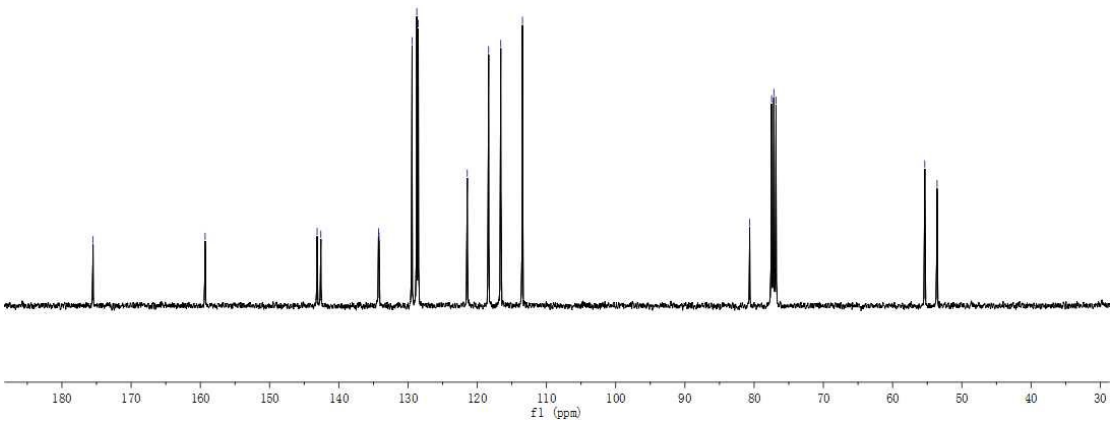

f1 (ppm)

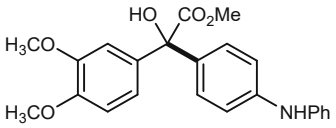

HO
CO2Me
H3CO
NHPh

17

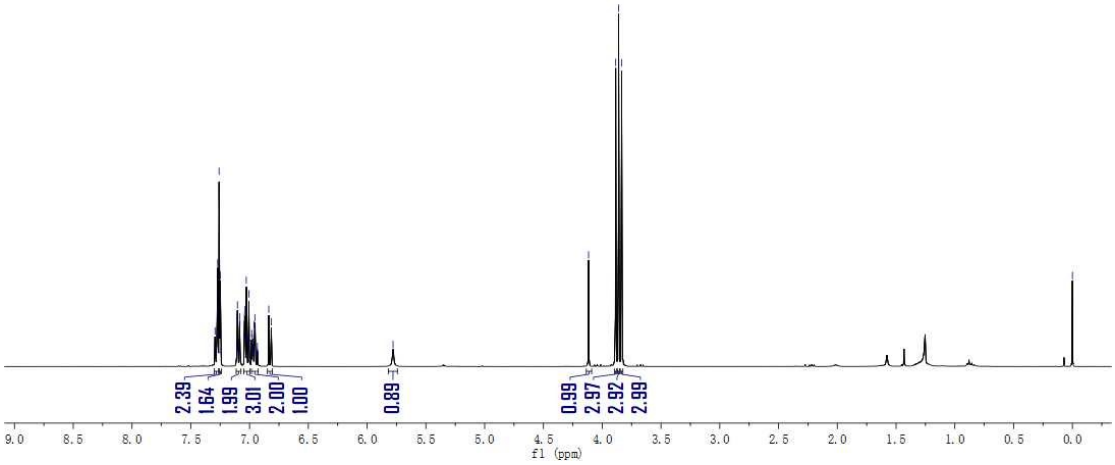

1.98
4.36
1.98
2.00
0.98
2.00
0.92
0.98
2.90
2.89
f1 (ppm)

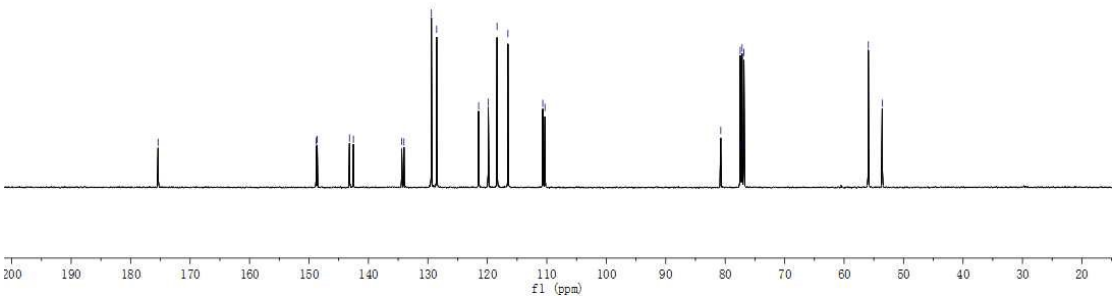

175.50
159.31
143.13
142.59
134.27
134.18
129.42
128.73
128.51
121.44
118.36
116.60
113.47
80.63
77.48
77.16
76.84
55.35
53.57

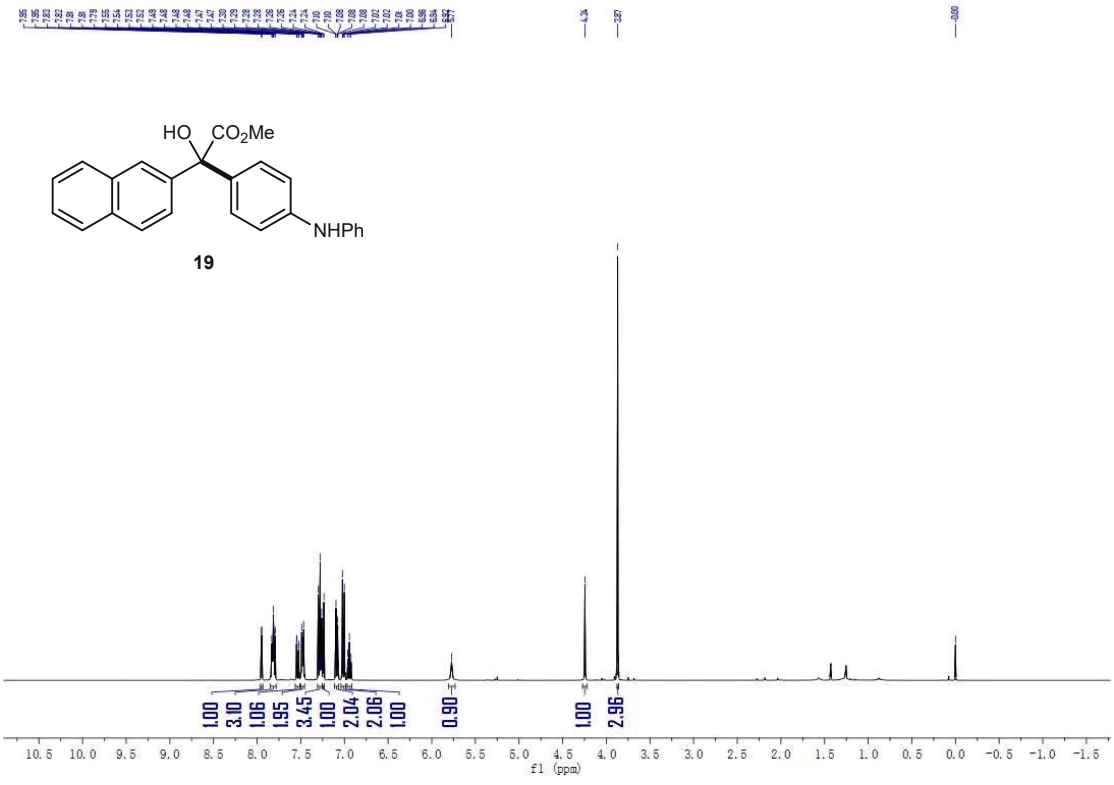

f1 (ppm)

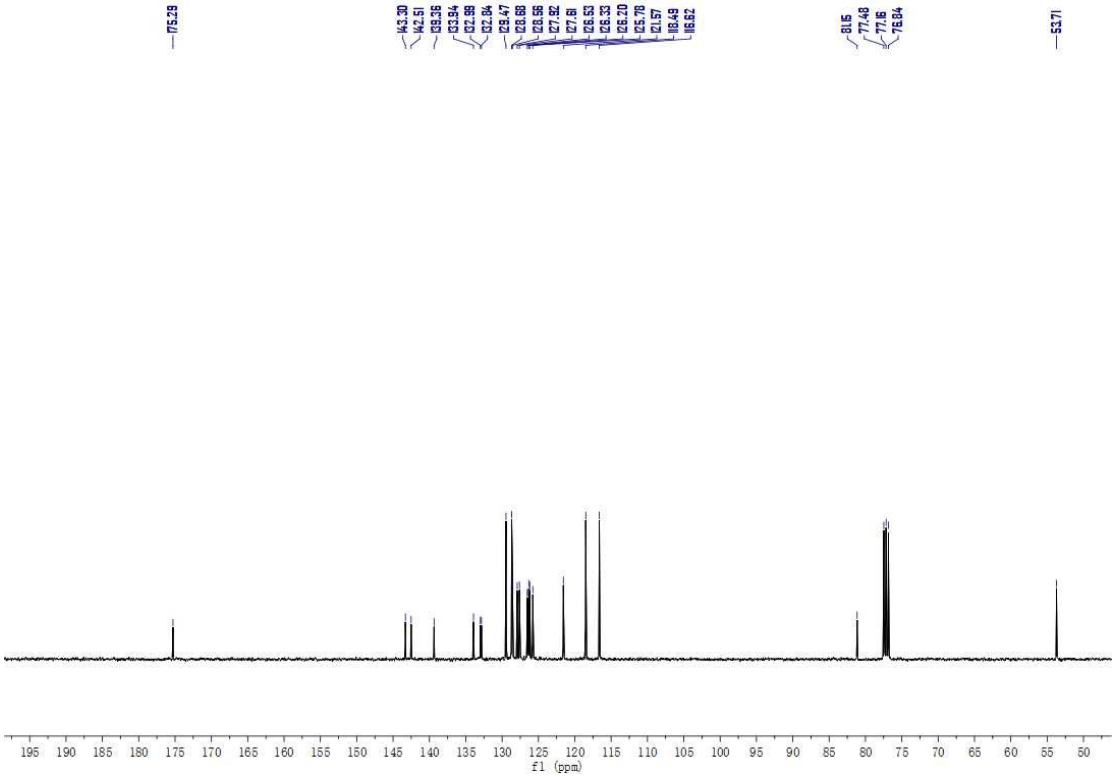

HO
CO2Me
H3CO
H3CO
NHPh

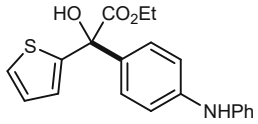
18


2.39
1.64
1.99
3.01
2.00
1.00
0.89
0.99
2.97
2.92
2.99
f1 (ppm)

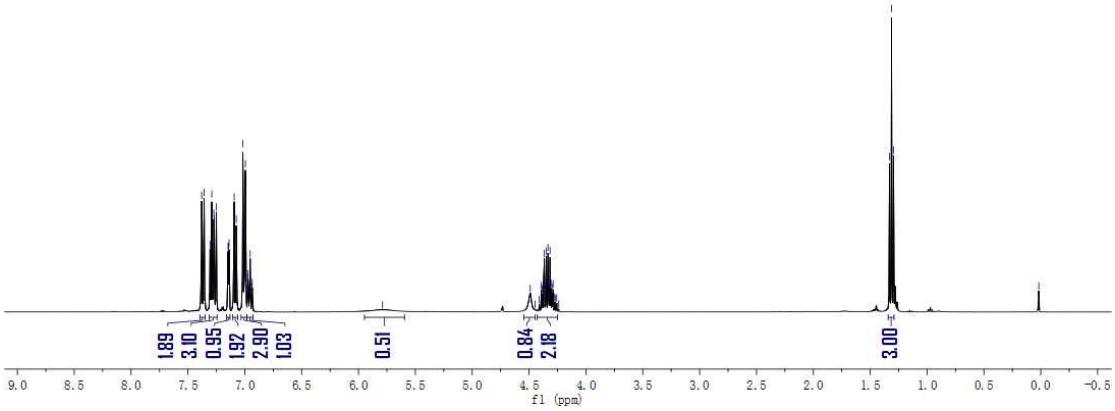

f1 (ppm)

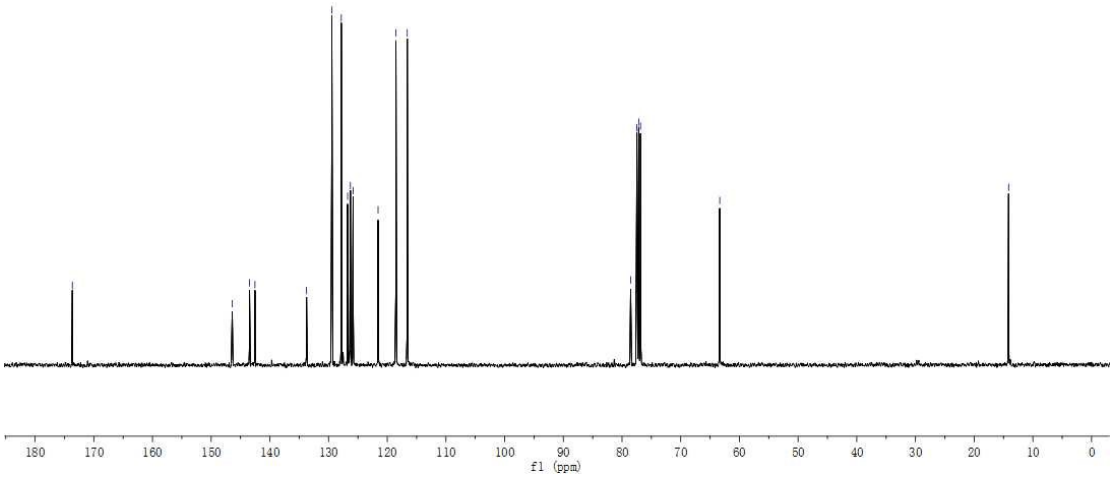

HO
CO2Me
NHPh
19
1.00
3.10
1.06
1.95
3.45
1.00
2.04
2.06
1.00
0.90
1.00
2.96
f1 (ppm)

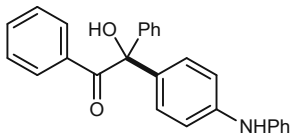

f1 (ppm)


HO
CO2Et
S
NHPh

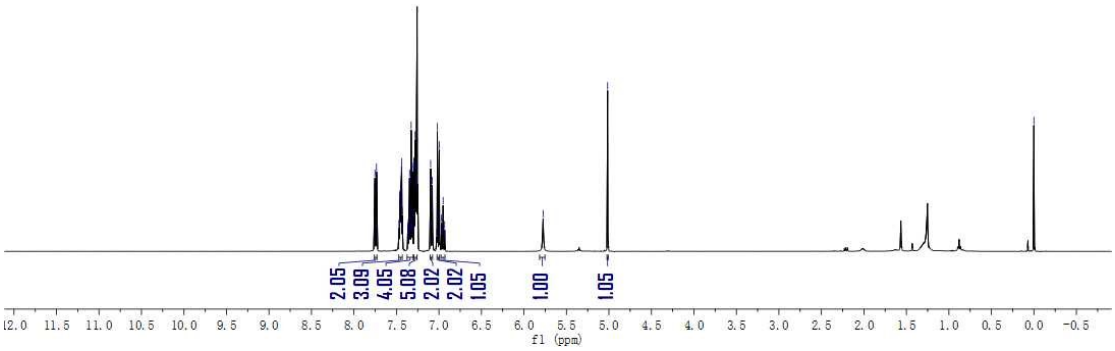
20


1.89
3.10
0.95
1.92
2.90
1.03
0.51
0.84
2.18
3.00
f1 (ppm)

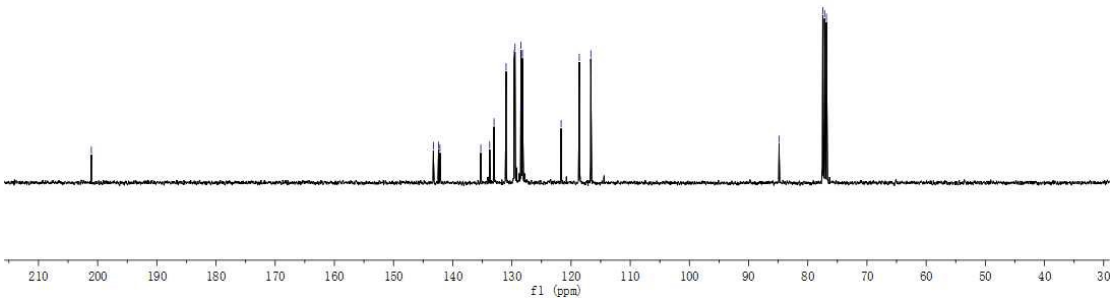

f1 (ppm)

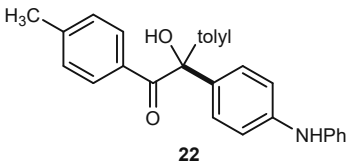

HO
Ph
O
NHPh

21

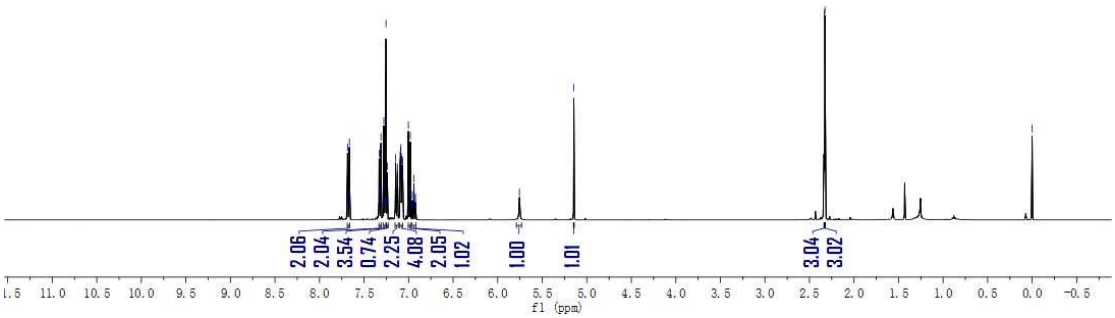

2.05
3.09
4.05
5.08
2.02
2.02
1.05
1.00
1.05
f1 (ppm)

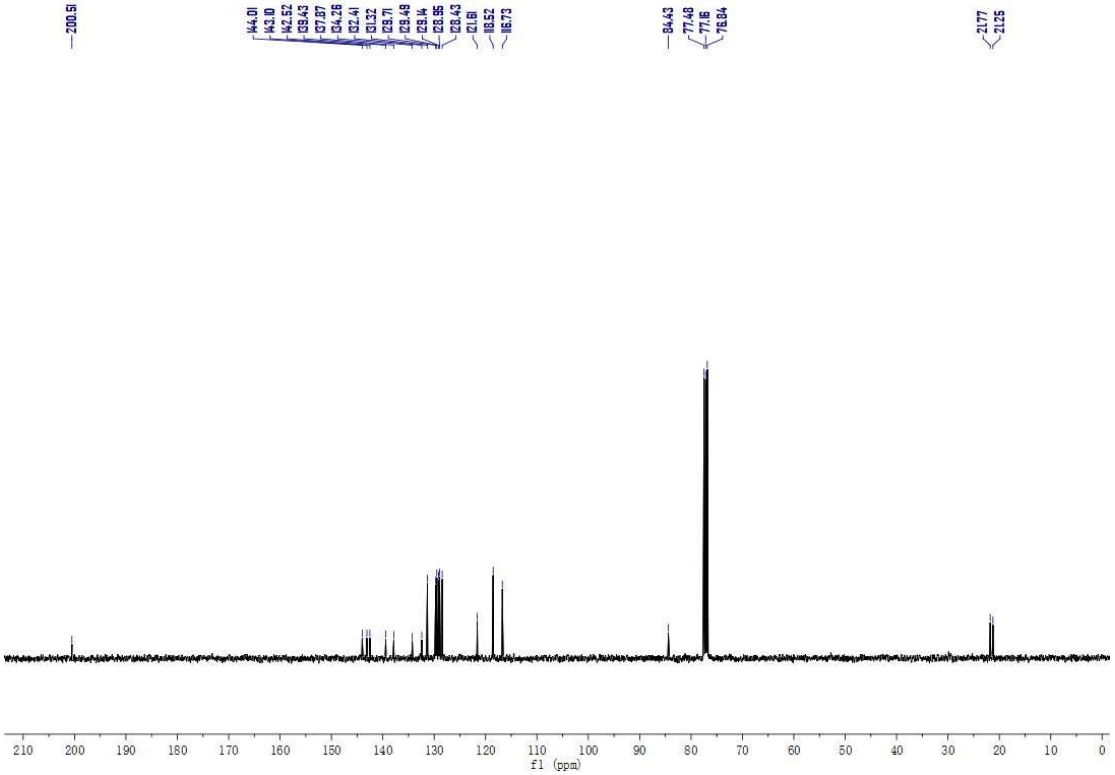

201.06
143.27
142.40
142.15
135.25
133.75
133.01
130.98
129.61
129.47
128.47
128.41
128.22
128.17
121.68
118.61
116.66
84.86
77.48
77.16
76.84

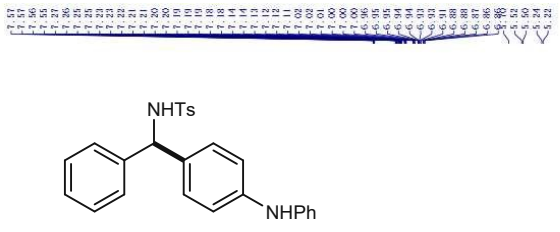

f1 (ppm)


H3C
HO
tolyl
O
NHPh

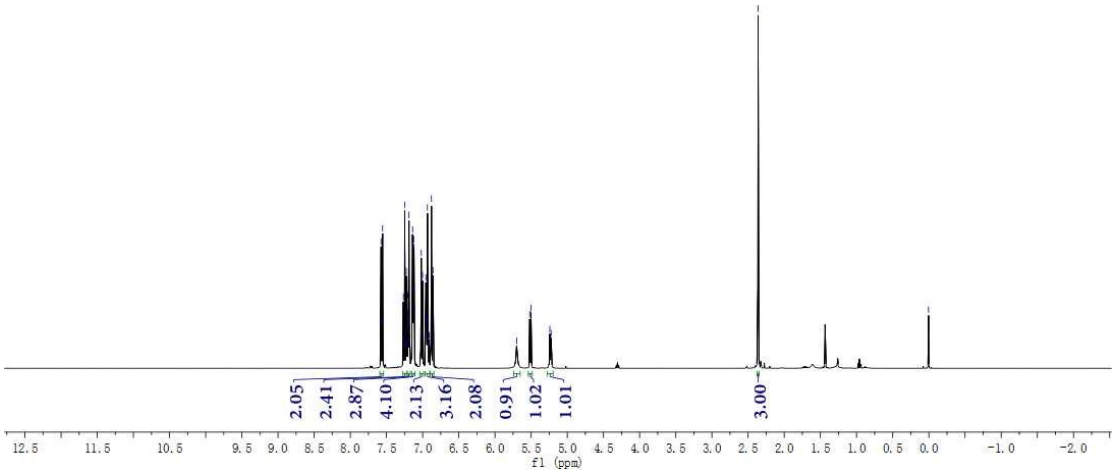
22

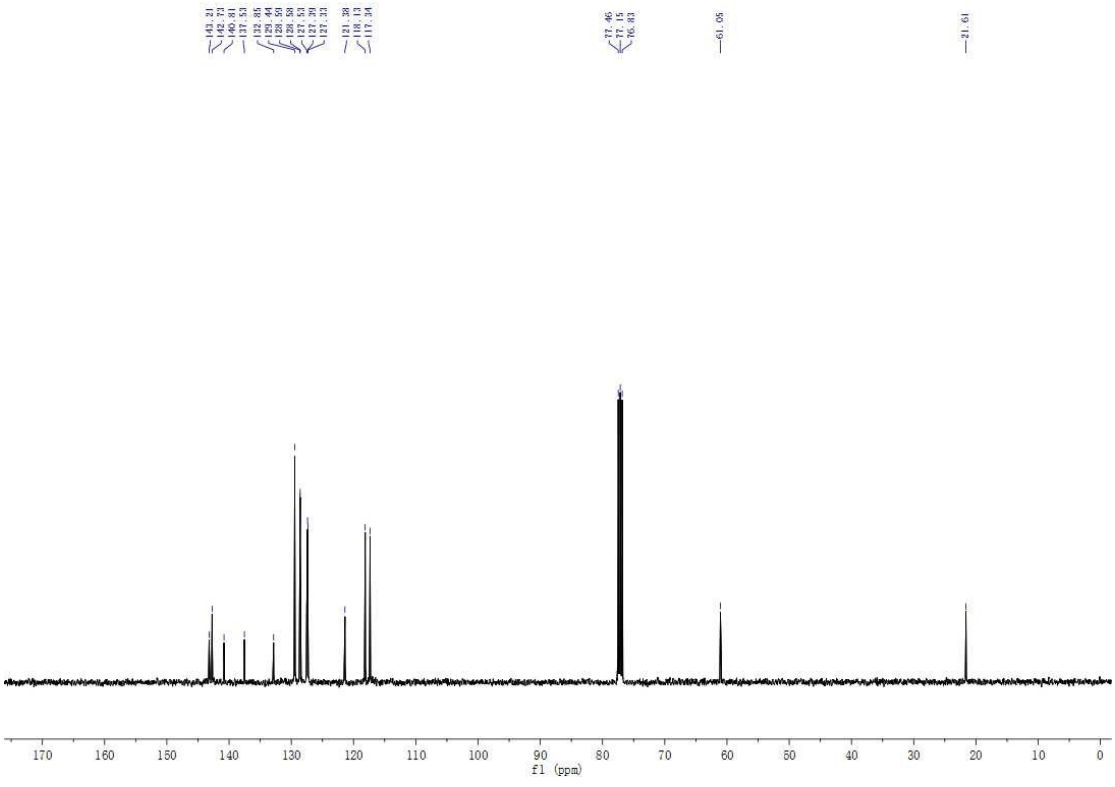

2.06
2.04
3.54
0.74
2.25
4.08
2.05
1.02
1.00
1.01
3.04
3.02
f1 (ppm)

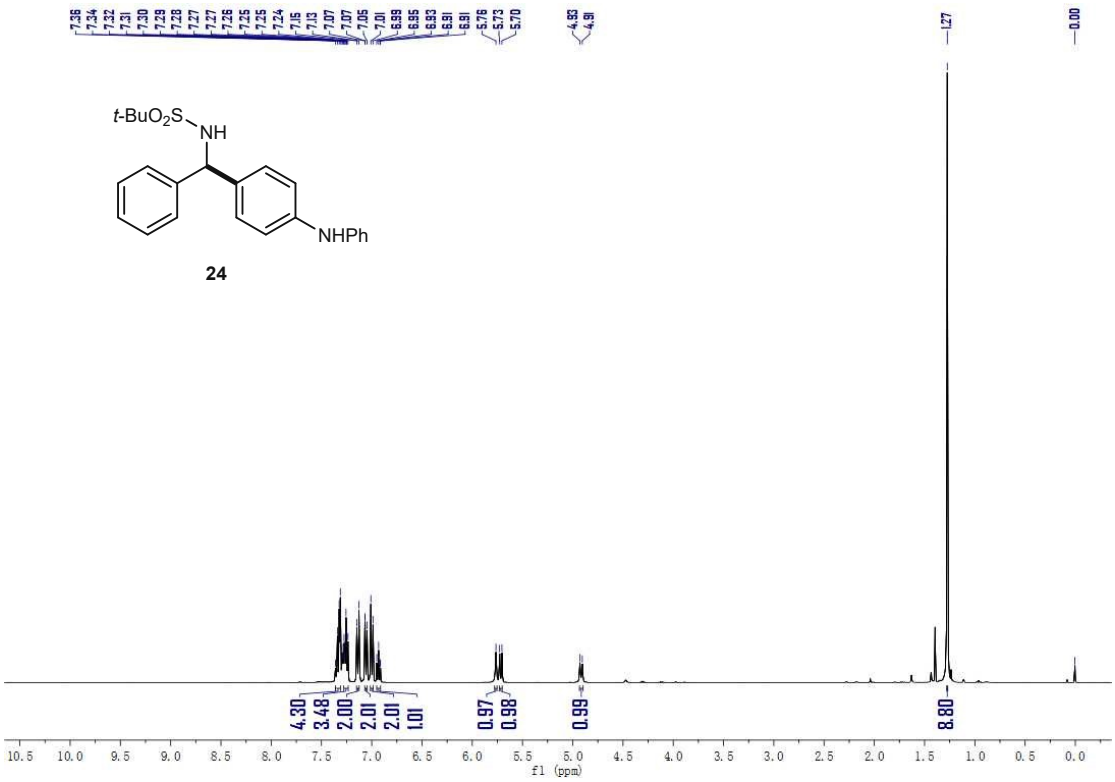

f1 (ppm)

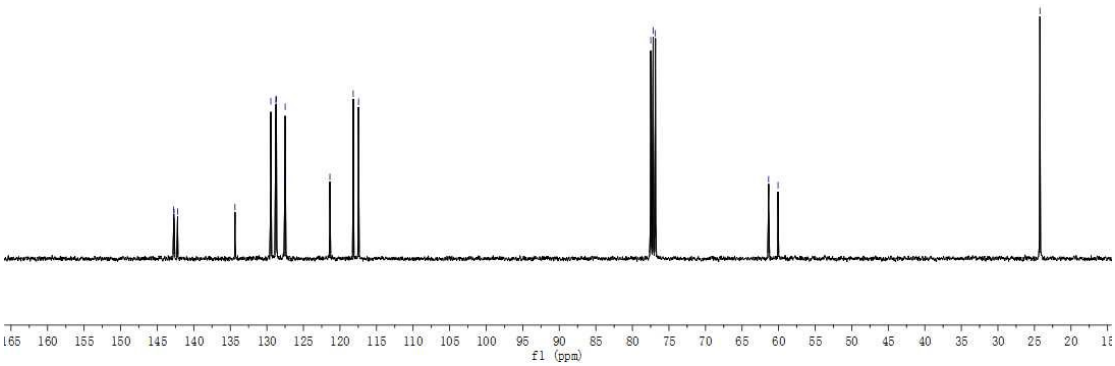

NHTs
NHPh

23

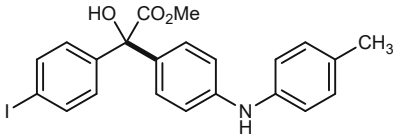

2.05
2.41
2.87
4.10
2.13
3.16
2.08
0.91
1.02
1.01
3.00
f1 (ppm)


f1 (ppm)

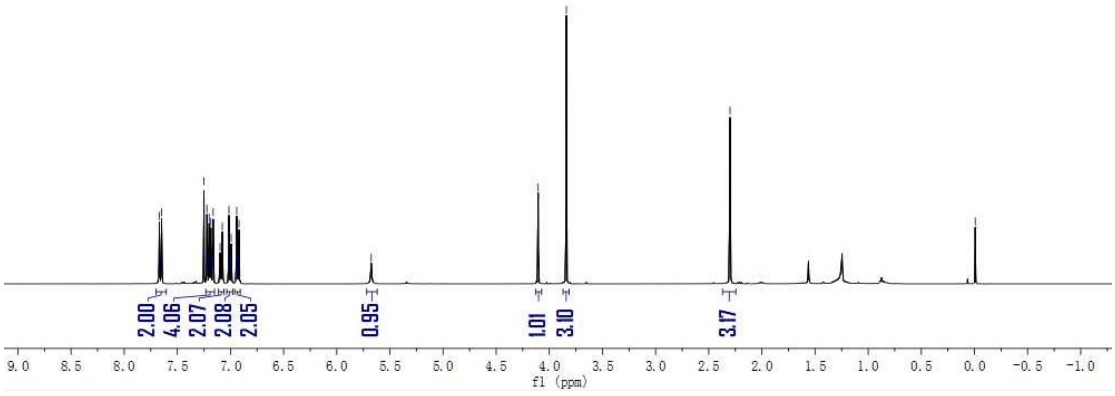

t-BuO2S
NH
NHPh
24
f1 (ppm)

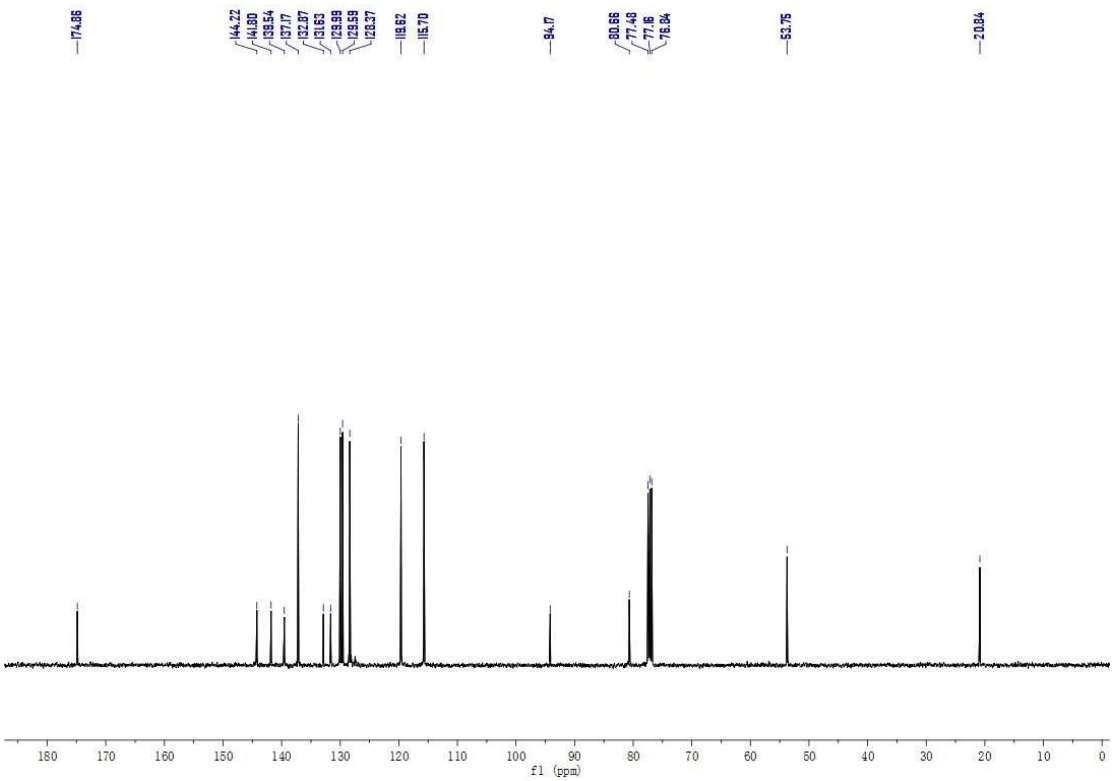

f1 (ppm)

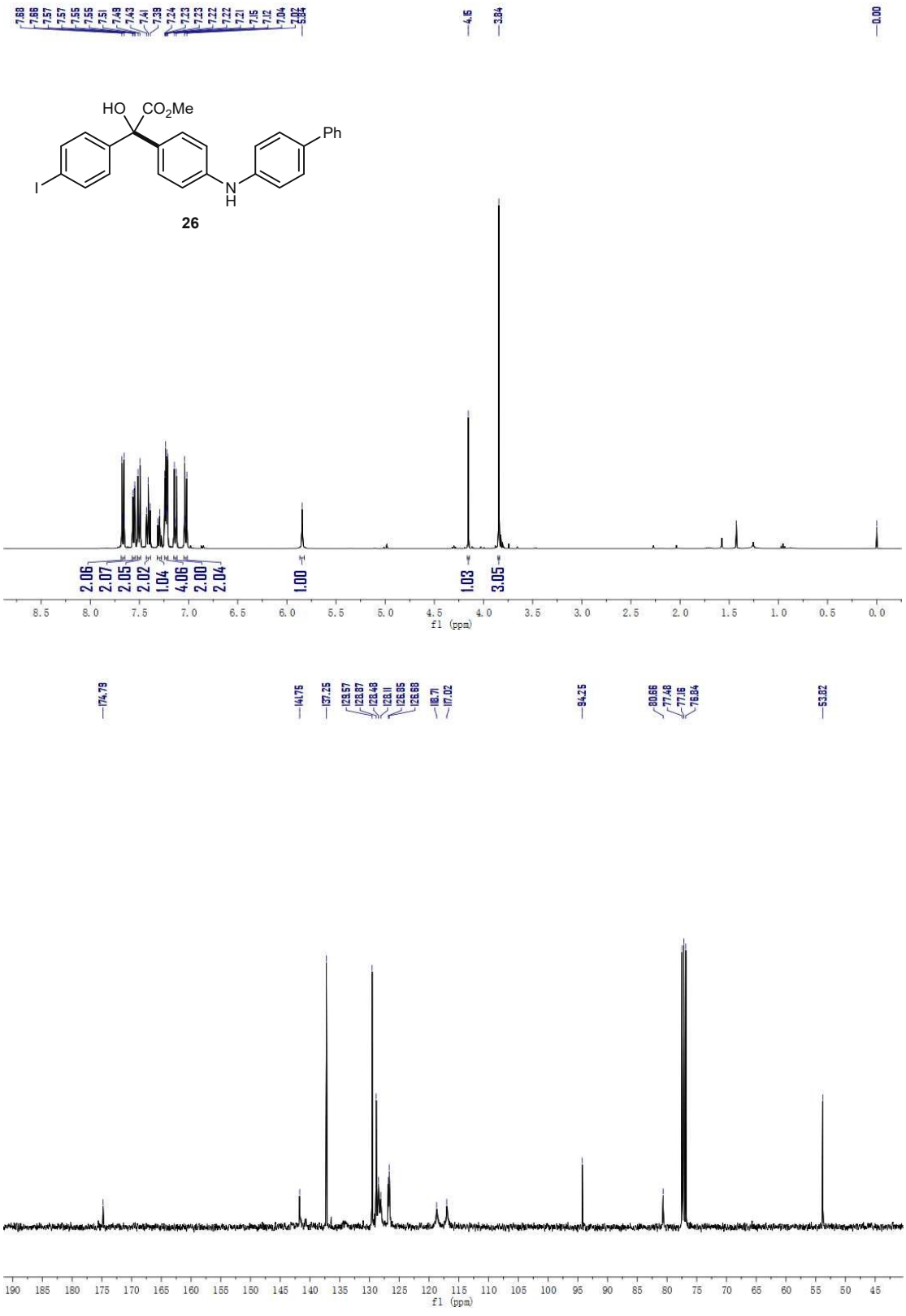

7.68
7.67
7.66
7.65
7.65
7.64
7.25
7.22
7.20
7.18
7.16
7.08
7.01
6.94
6.82
6.68
4.10
3.84
2.30
0.01

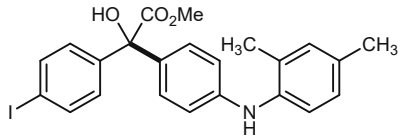

HO
CO2Me
CH3
I
N
H

25

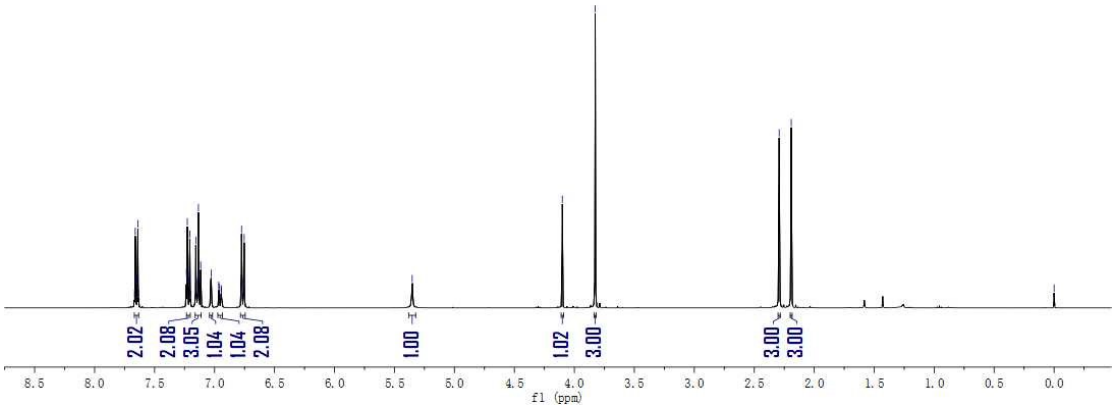

2.00
4.06
2.07
2.08
2.05
0.95
1.01
3.10
3.17
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


174.86
144.22
141.80
138.54
137.17
132.87
131.63
129.99
129.59
128.37
119.62
115.70
94.17
80.66
77.48
77.16
76.84
53.75
20.84
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

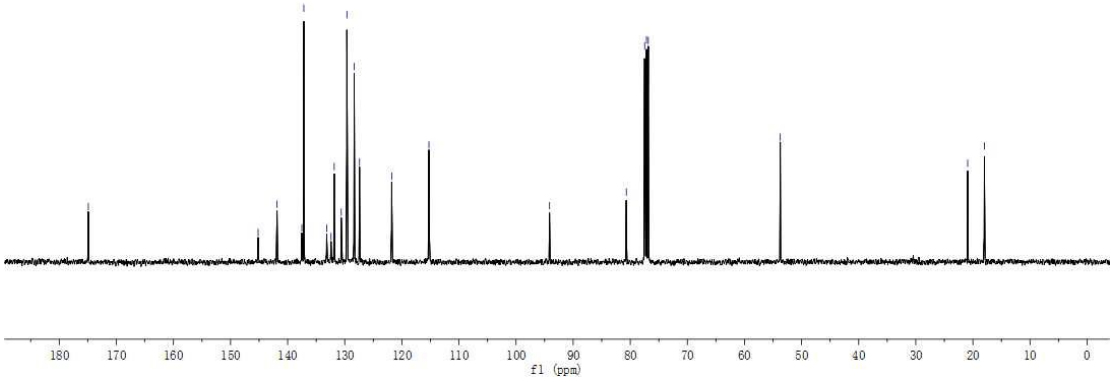

HO
CO2Me
Ph
I
N
H
26
f1 (ppm)

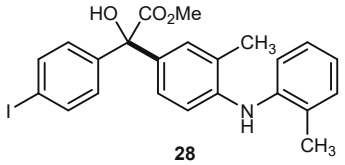

HO
CO2Me
H3C
CH3
I
N
H

27

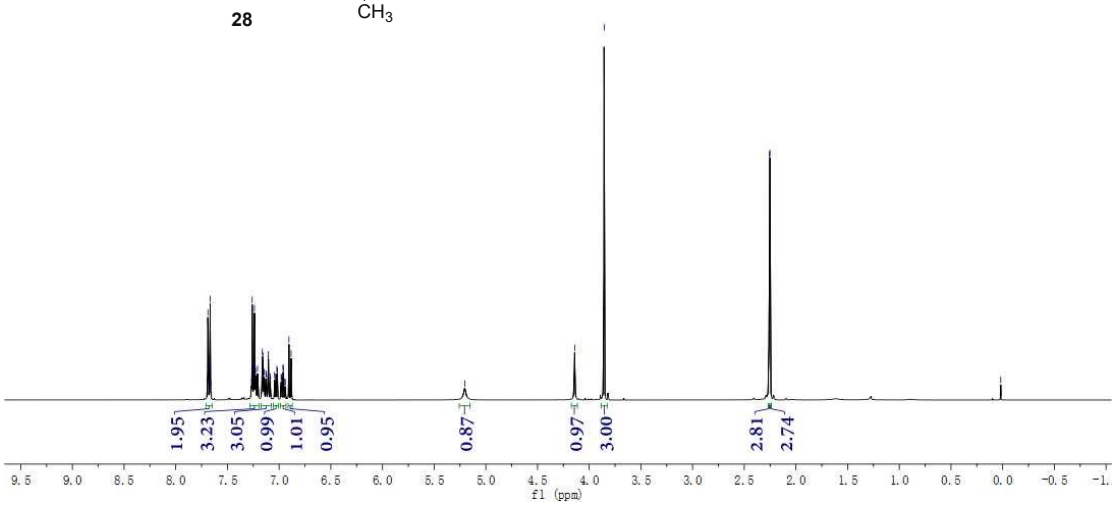

2.02
2.08
3.05
1.04
1.04
2.08
1.00
1.02
3.00
3.00
3.00
f1 (ppm)

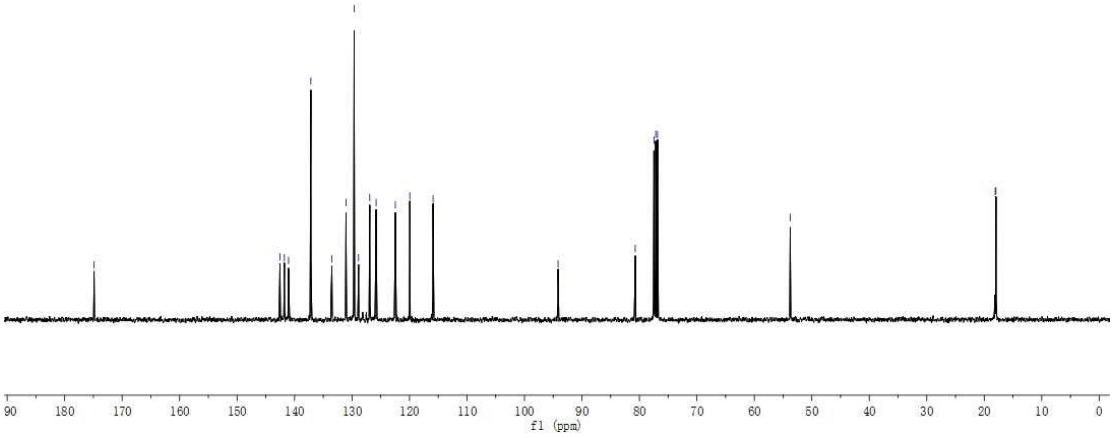

174.91
145.07
141.06
137.51
137.17
133.16
132.40
131.85
130.81
129.83
128.34
127.42
121.78
115.26
94.13
80.69
77.48
77.16
76.84
53.73
20.91
17.99

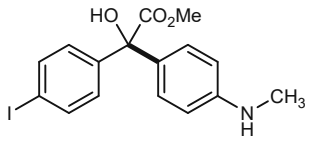

f1 (ppm)


HO
CO2Me
CH3
I
N
H
CH3

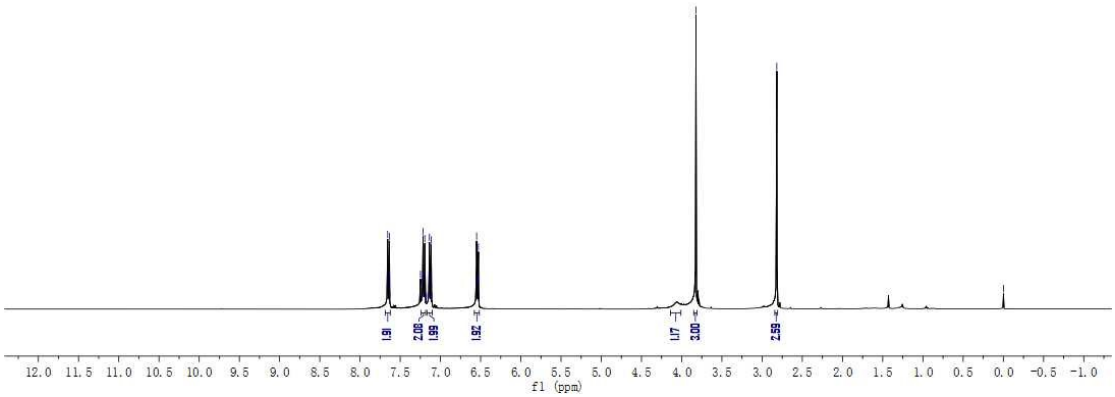
28

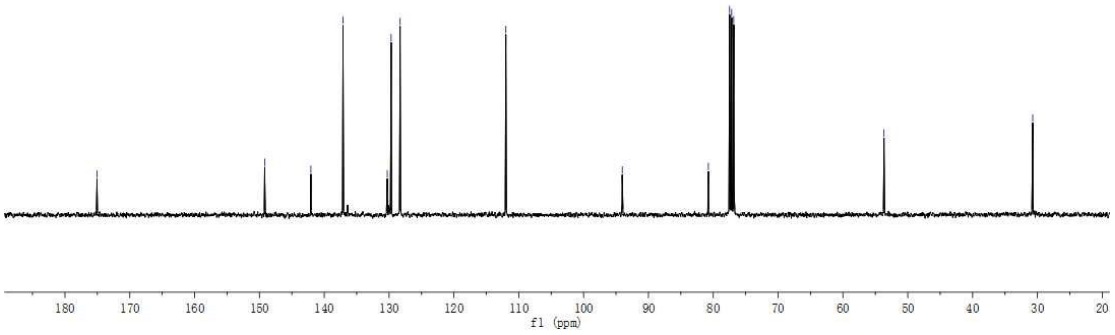

1.95
3.23
3.05
0.99
1.01
0.95
0.87
0.97
3.00
2.81
2.74
f1 (ppm)

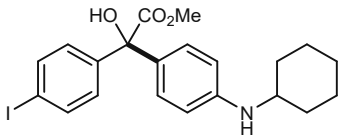

f1 (ppm)



29

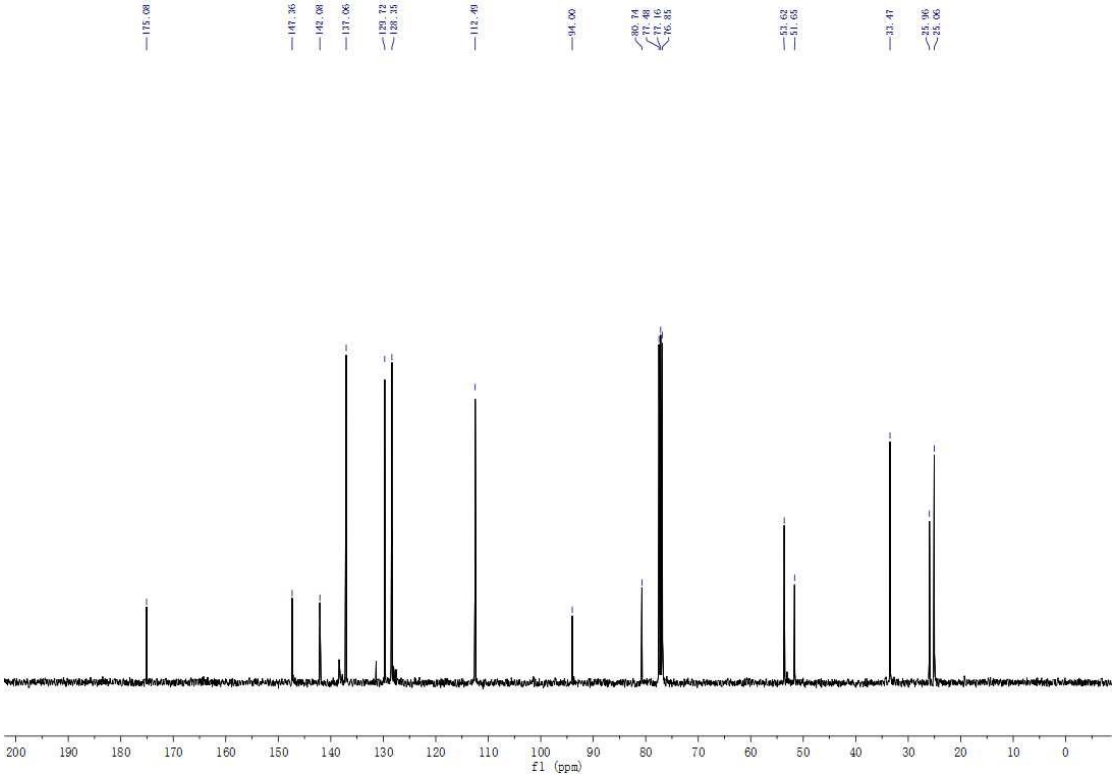


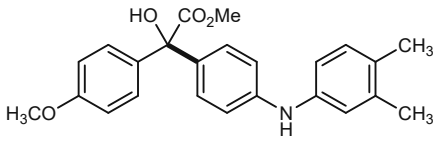



HO
CO2Me
I
N
H

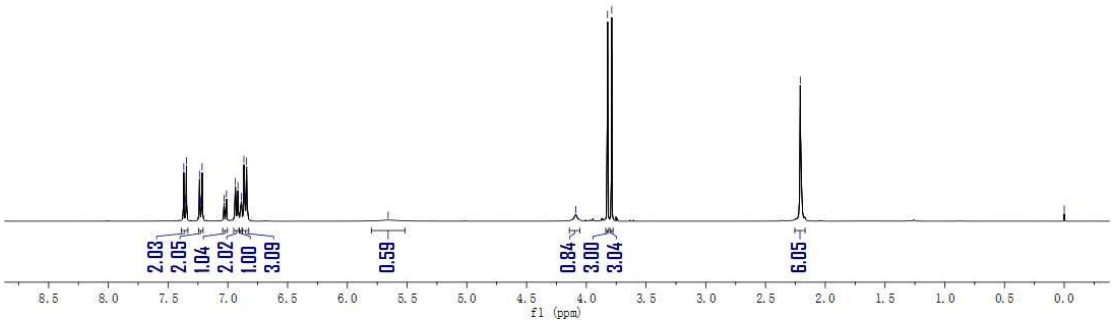
30

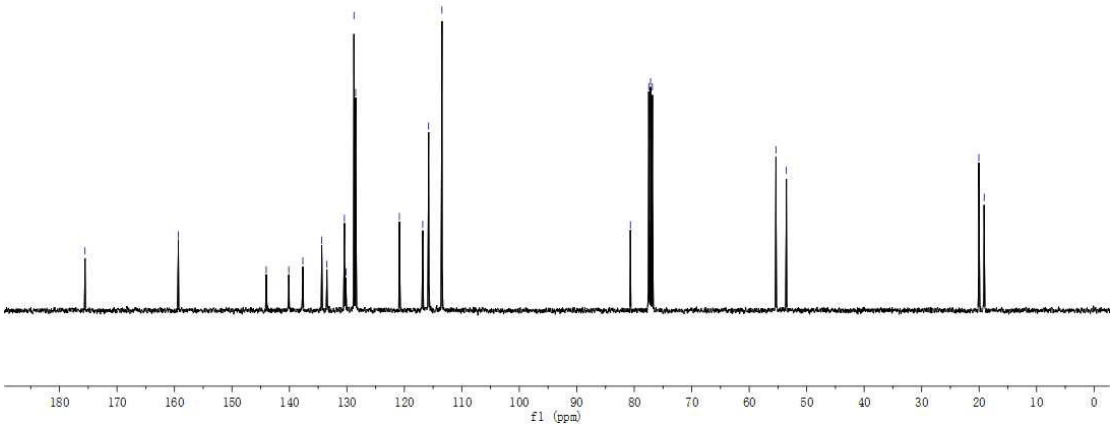
1.91
1.91
1.93
2.05
0.88
3.12
0.66
1.00
2.09
2.05
1.14
2.24
1.02
2.36
f1 (ppm)

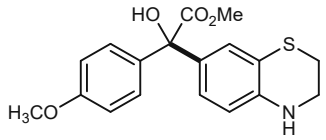

f1 (ppm)


HO
CO2Me
CH3
H3CO
N
H
CH3

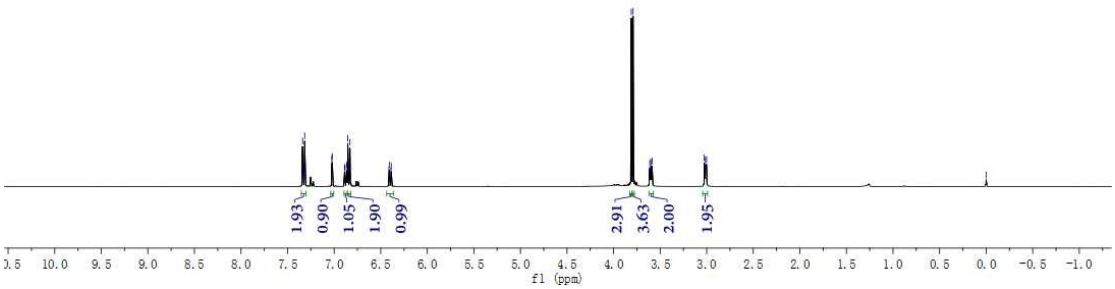
31

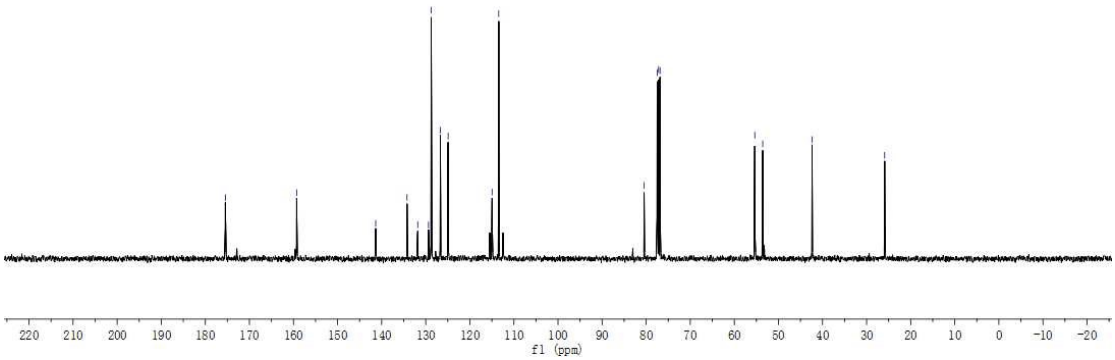

2.03
2.05
1.04
2.02
1.00
3.09
0.59
0.84
3.00
3.04
6.05
f1 (ppm)

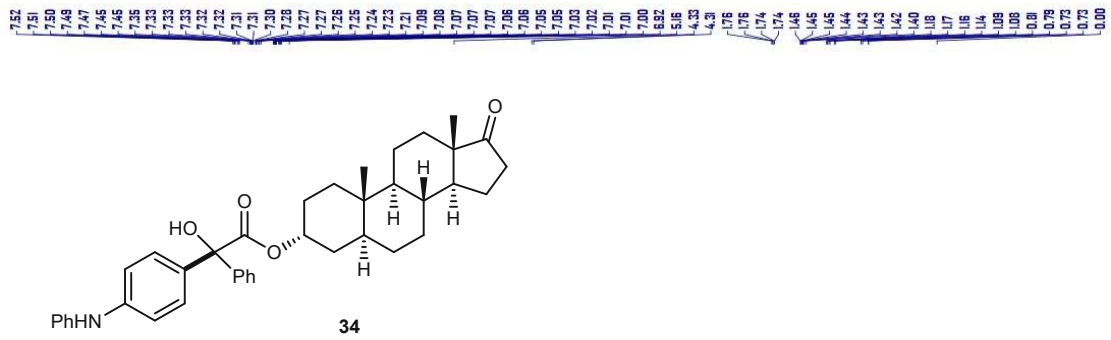

f1 (ppm)


HO
CO2Me
S
H3CO
N
H

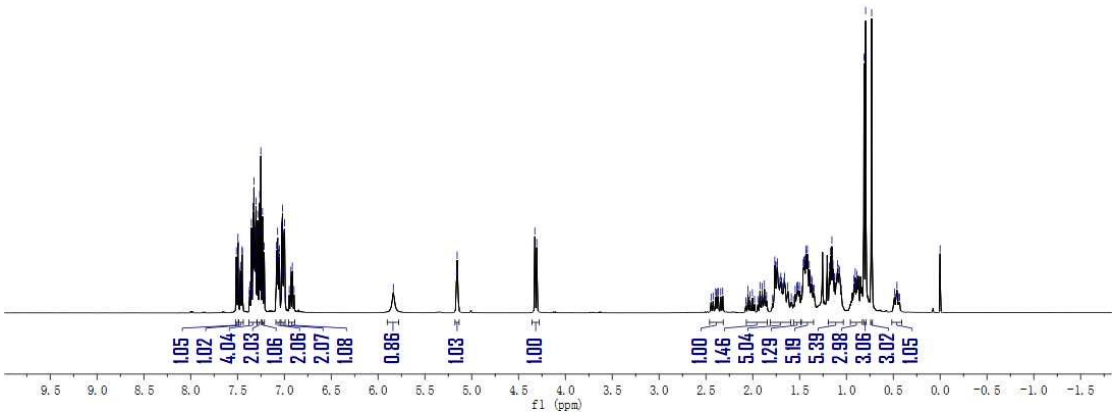
32

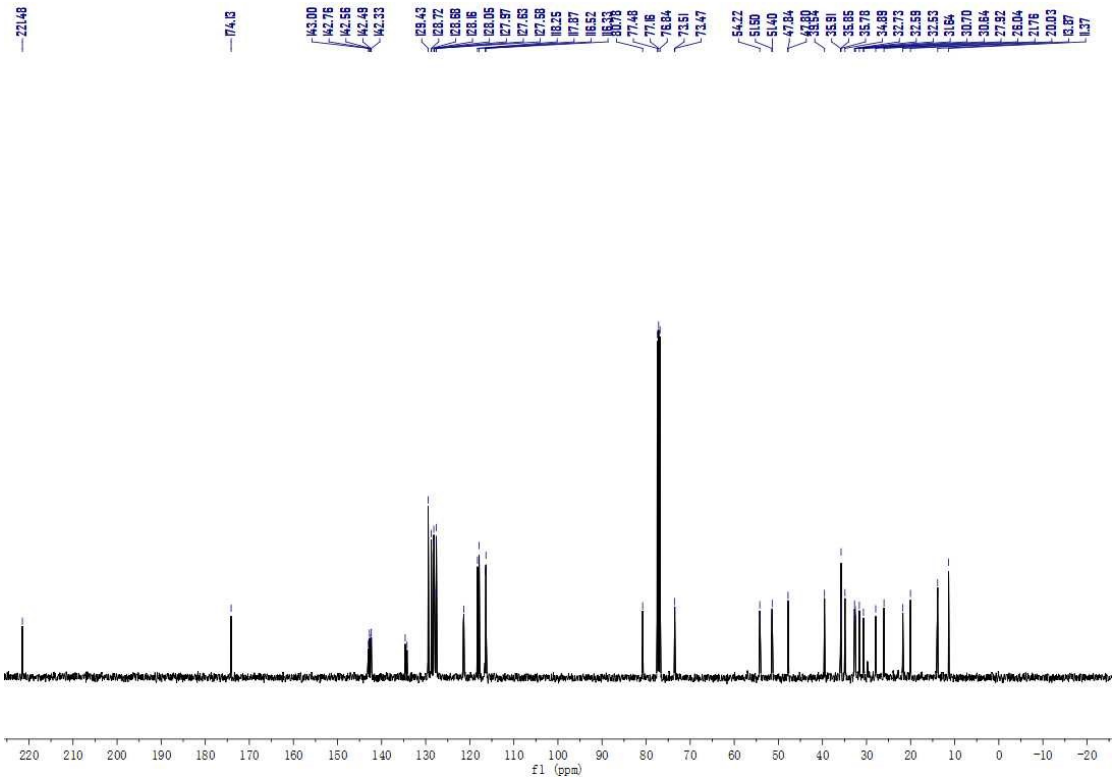

1.93
0.90
1.05
1.90
0.99
2.91
3.63
2.00
1.95
f1 (ppm)

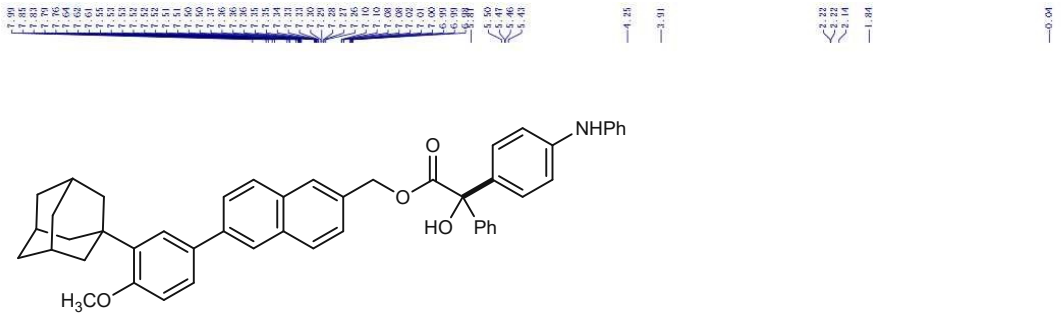

f1 (ppm)


HO
O
O
Ph
PhHN
H
H
H
O

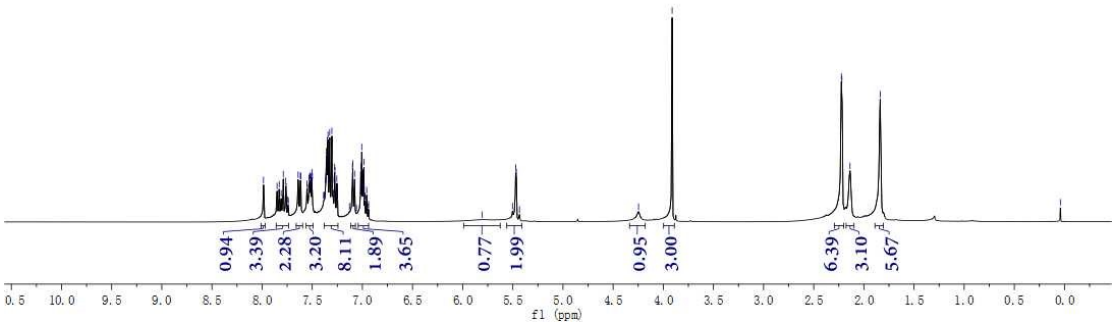
34

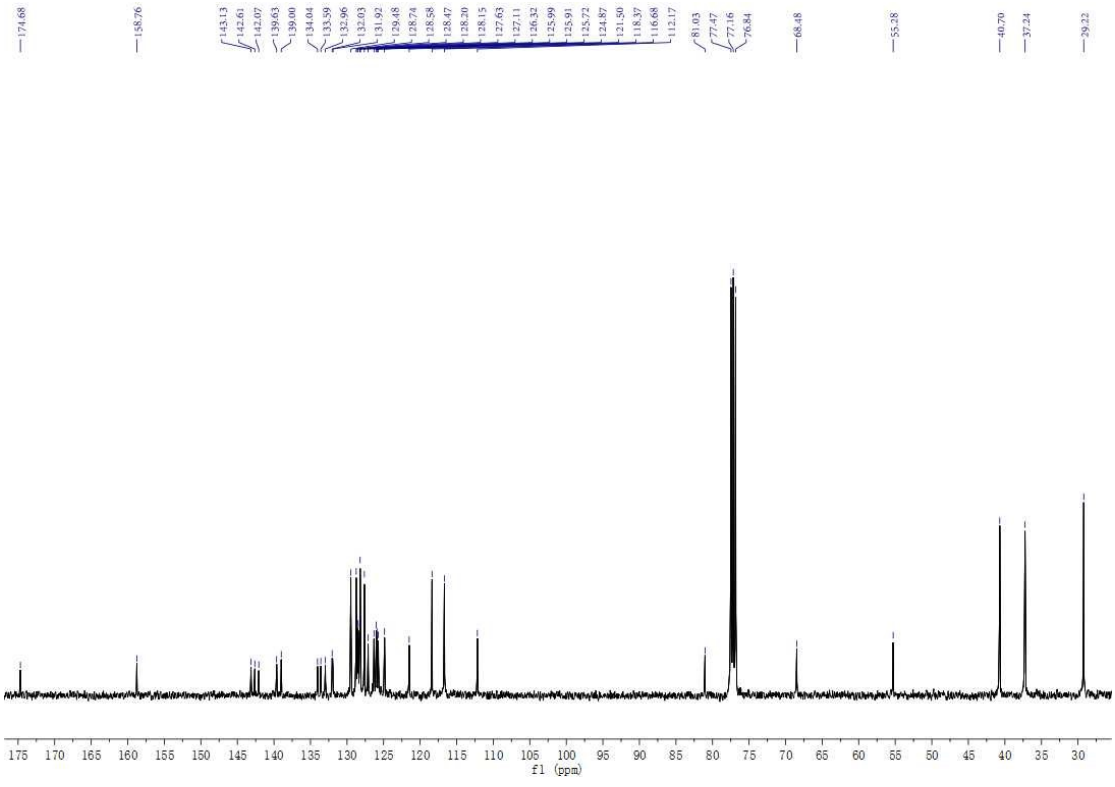

1.05
1.02
4.04
2.03
1.06
2.06
2.07
1.08
0.86
1.03
1.00
1.00
1.46
5.04
1.29
5.19
5.39
2.98
3.06
3.02
1.05
f1 (ppm)

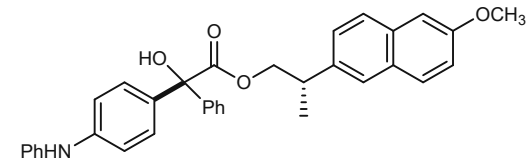

f1 (ppm)


NHPh
O
O
HO
Ph
H3CO

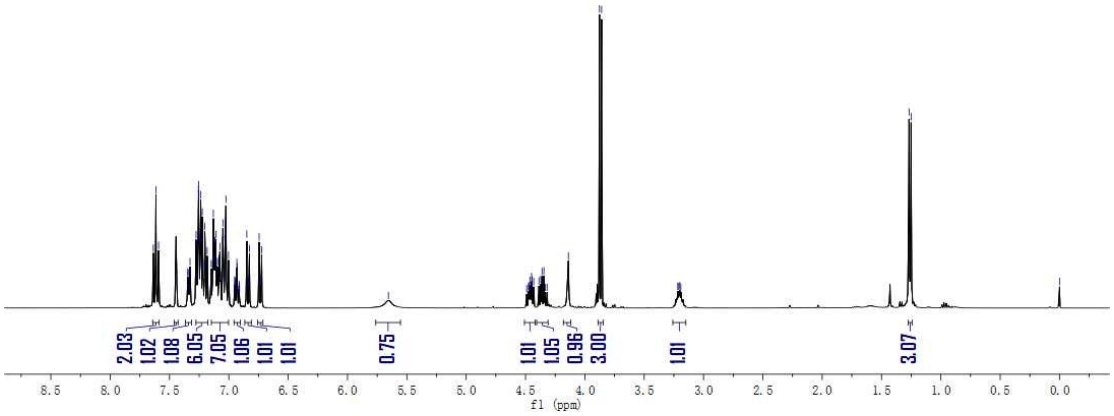
35

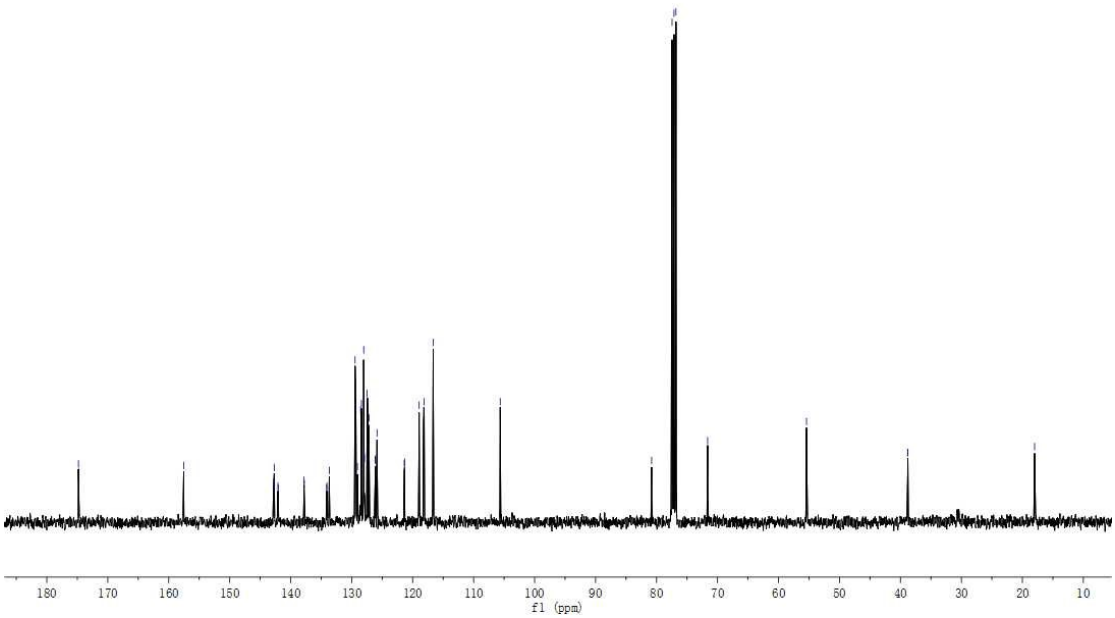

0.94
3.39
2.28
3.20
8.11
1.89
3.65
0.77
1.99
0.95
3.00
6.39
3.10
5.67
f1 (ppm)

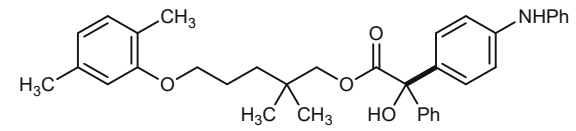

f1 (ppm)


OCH3
O
HO
O
Ph
PhHN

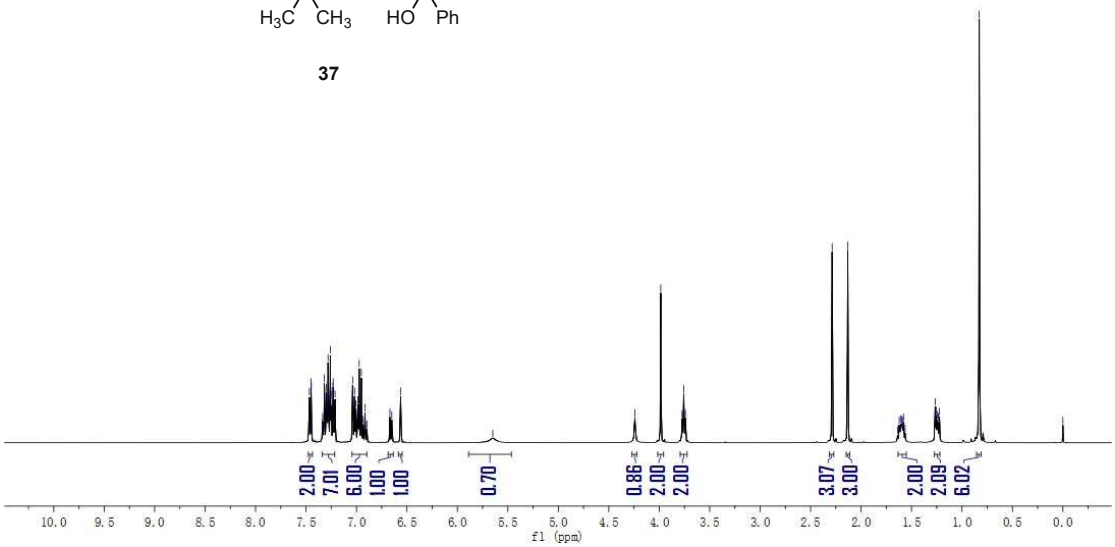
36

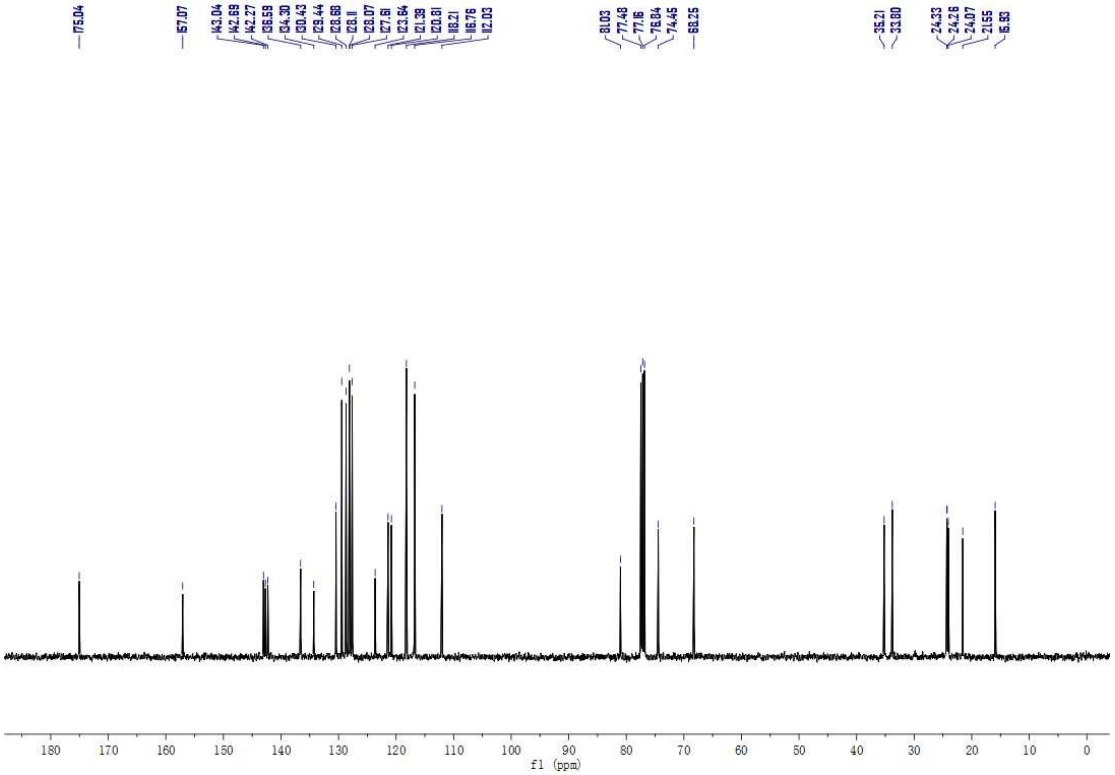

2.03
1.02
1.08
6.05
7.05
1.06
1.01
1.01
0.75
1.01
1.05
0.96
3.00
1.01
3.07
f1 (ppm)

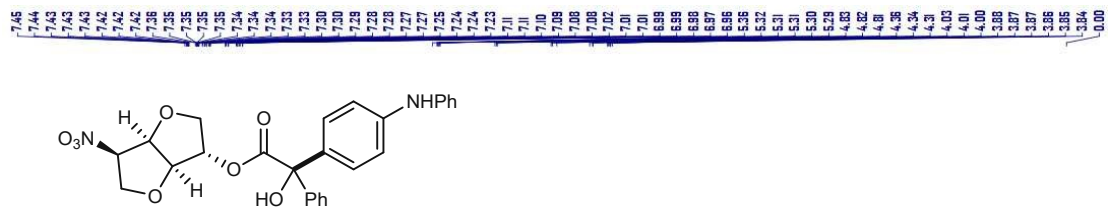

f1 (ppm)


CH3
H3C
O
O
O
NHPh
H3C
CH3
HO
Ph

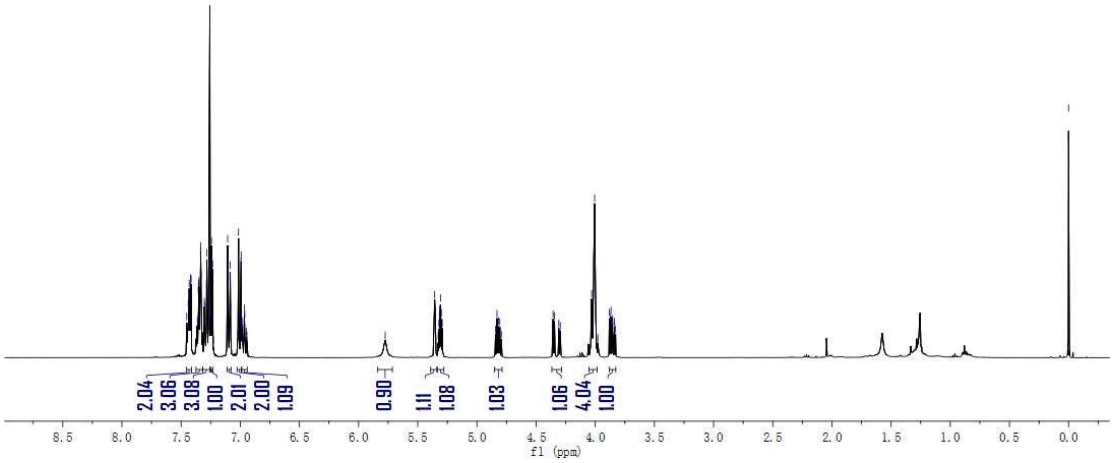
37

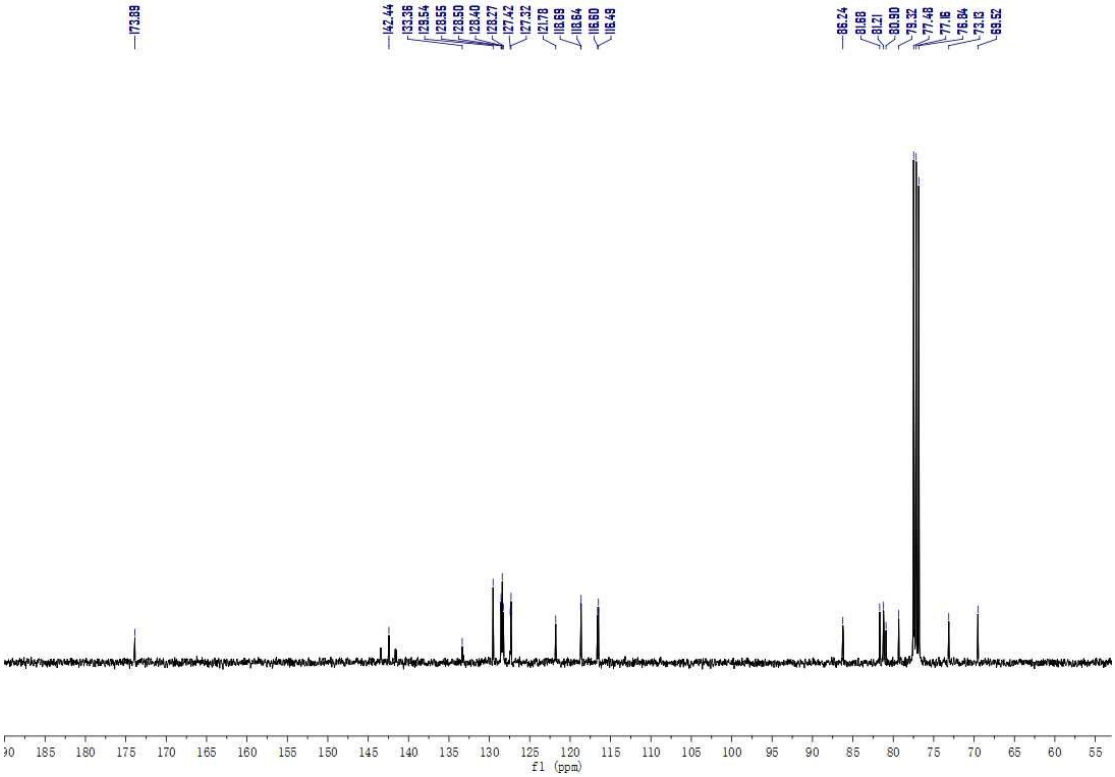

2.00
7.01
6.00
1.00
1.00
0.70
0.86
2.00
2.00
3.07
3.00
2.00
2.09
6.02
f1 (ppm)

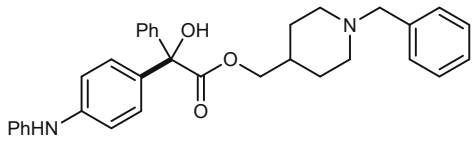

175.04
167.07
143.04
142.69
142.27
136.59
134.30
130.43
129.44
128.88
128.11
128.07
127.81
123.84
121.39
120.81
118.21
116.76
112.03
81.03
77.48
77.16
76.84
74.45
68.25
35.21
33.80
24.33
24.26
24.07
21.55
6.83
f1 (ppm)


NHPh
O3N
H
O
O
O
H
O
HO
Ph

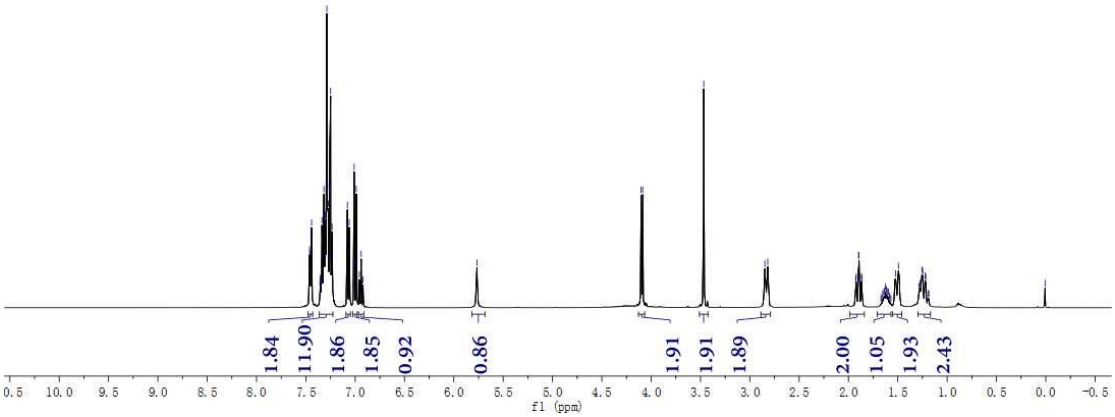
38

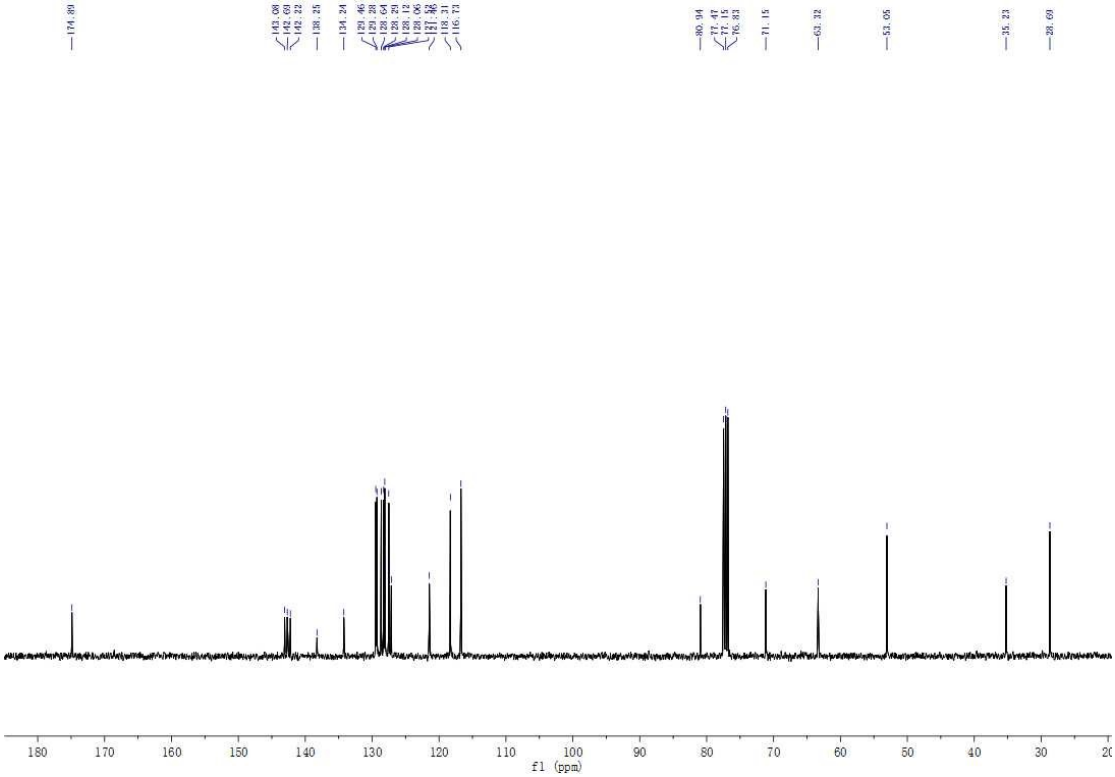

2.04
3.06
3.08
1.00
2.01
2.00
1.09
0.90
1.11
1.08
1.03
1.06
4.04
1.00
f1 (ppm)


173.89
142.44
133.38
129.54
128.55
128.50
128.40
128.27
127.42
127.32
121.78
118.69
118.64
116.60
116.49
86.24
81.68
81.21
80.90
79.32
77.48
77.16
76.84
73.13
69.52
f1 (ppm)


Ph
OH
O
O
N
PhHN

40


1.84
11.90
1.86
1.85
0.92
0.86
1.91
1.91
1.89
2.00
1.05
1.93
2.43
f1 (ppm)


f1 (ppm)