Supporting Information

Photoinduced decarboxylative 1,6-addition of *para*-quinone methides with *α*-keto acids: an eco-friendly access to *α,α′*-diarylated ketones

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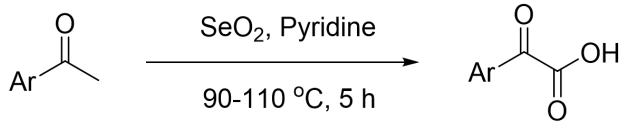
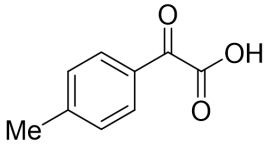
1. General experimental methods:

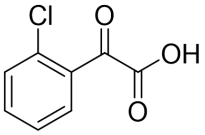
Unless otherwise stated, all commercial reagents were used as received. All solvents were dried and distilled according to standard procedures. Flash column chromatography was performed using silica gel (60-Å pore size, 32-63 μm, standard grade). Analytical thin-layer chromatography was performed using glass plates pre-coated with 0.25 mm 230-400 mesh silica gel impregnated with a fluorescent indicator (254 nm). Thin layer chromatography plates were visualized by exposure to ultraviolet light. Organic solutions were concentrated on rotary evaporators at ~20 Torr at 25-35 °C. Nuclear magnetic resonance (NMR) spectra are recorded in parts per million from internal tetramethylsilane on the δ scale. ^{1}H and ^{13}C NMR spectra were recorded in $CDCl_3$ on a Bruker DRX-400 spectrometer operating at 400 MHz and 100 MHz, respectively. All chemical shift values are quoted in ppm and coupling constants quoted in Hz. High resolution mass spectrometry (HRMS) spectra were obtained on a micrOTOF II Instrument. The fluorescence spectra were recorded on ThermoFisher Varioskan LUX. *para*-Quinone methides (**1a-1p**) were prepared according the literature.[1,2] *α*-keto acids (**2f-2j**) were prepared according the literature.[3]

2. Synthesis of *α*-keto acids [3]





2f



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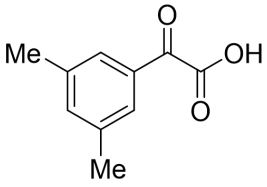

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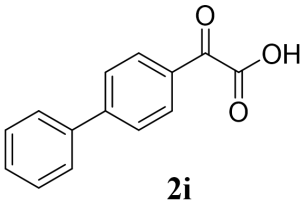
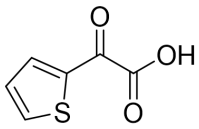


2i

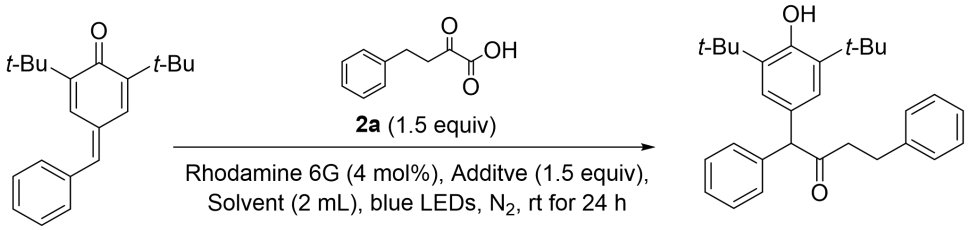


2j

Methyl ketones (5 mmol), SeO_2 (6 mmol), 20 mL of pyridine were added in a 50 mL round bottom flask. The reaction mixture was stirred at 110 ºC for 1 h in an oil bath, then reduce the temperature to 90 ºC for 4 h. The desired products were isolated by flash chromatography on silica

gel using (methanol / dichloromethane = 1: 10) to give α-keto acids **2f-2j** in 60-86% yield. Other α-keto acids are commerical.

3. Table S1. Optimization of the Reaction Conditions [a]



1a **3aa**

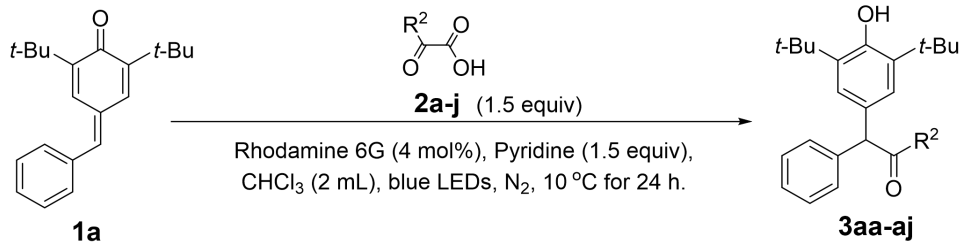
Entry	Additive	Solvent	Yield (%) [b]
1	DMAP	DCE	40
2	2,6-dimethoxypyridine	DCE	trace
3	2,6-bis(tert-butyl) pyridine	DCE	trace
4	2,6-pyridinedicarbonitrile	DCE	trace
5	2,4,6-trimethyl-pyridine	DCE	trace
6	Cs_2CO_3	DCE	trace
7	KOH	DCE	trace
8	t-BuOK	DCE	trace
9	t-BuOLi	DCE	n.d
10	CsF	DCE	trace
11	Pyridine	1,4-dioxane	trace
12	Pyridine	EA	53
13	Pyridine	MeOH	trace
14	Pyridine	DMF	trace
15	Pyridine	DMSO	trace
16	Pyridine	CF_3CH_2OH	trace
17	Pyridine	MeO-*t*-Bu	n.d
[c,d] 18	Pyridine	$CHCl_3$	47
[c,e] 19	Pyridine	$CHCl_3$	56
[c,f] 20	Pyridine	$CHCl_3$	n.r

[a] Reaction conditions: 2,5-cyclohexadien-1-one,2,6-bis(1,1-dimethylethyl)-4-(phenylmethylene) **1a** (0.2 mmol),

2-oxo-4-phenylbutyric acid **2a** (0.3 mmol), Rhodamine 6G (4 mol%), additive (0.3 mmol), solvent (2.0 mL), N_2, blue LEDs (10 W), rt for 24 h; rt = room temperature; n.d = no desired product; n.r = no reaction; [b] Isolated yield. [c] 10 ℃ was used instead of rt. [d] Pyridine (0.4 mmol) was used. [e] Rhodamine 6G (8 mol%) was used. [f] in the dark.

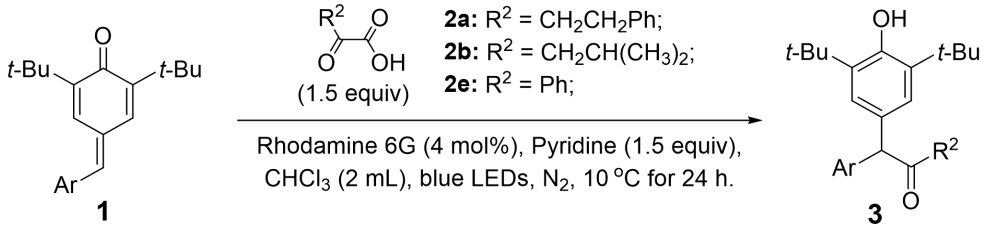
4. General experimental procedure and characterization data

4.1 General procedure for the synthesis of *α,α′*-diaryl ketone 3aa-aj



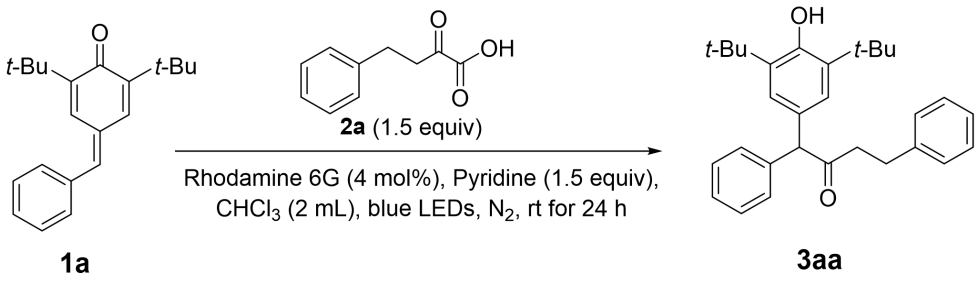
To a solution of 2,5-cyclohexadien-1-one,2,6-bis(1,1-dimethylethyl)-4-(phenylmethylene) **1a** (0.2 mmol), *α*-keto acids **2a-j** (0.3 mmol), Rhodaminec 6G (4 mol%) and pyridine (0.3 mmol) in $CHCl_3$ (2.0 mL) in 25 ml reaction tubes at N_2 atmosphere. The reaction was stirred under blue LEDs (10 W) for 24 h at 10 ℃, After completion of reaction as indicated by TLC, the solvent was evaporated and the residue was purified directly by flash column chromatography (n-hexane/ethyl acetate = 15:1-10:1) to give *α,α′*-diaryl ketones **3aa-aj**.

4.2 General procedure for the synthesis of *α,α′*-diaryl ketone 3



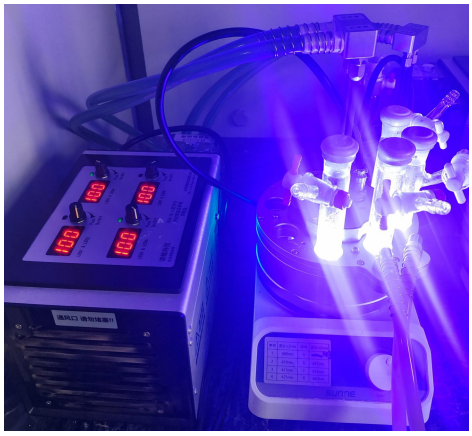
To a solution of *p*-QMs **1a-p** (0.2 mmol), *α*-keto acids **2** (0.3 mmol), Rhodamine 6G (4 mol%) and pyridine (0.3 mmol) in $CHCl_3$ (2.0 mL) in 25 ml reaction tubesat at N_2 atmosphere. The reaction was stirred under blue LEDs (10 W) for 24 h at 10 ℃ , After completion of reaction as indicated by TLC, the solvent was evaporated and the residue was purified directly by flash column chromatography (n-hexane/ethyl acetate = 15:1-10:1) to give *α,α′*-diaryl ketones **3**.

4.3 A typical experimental procedure for the synthesis of 3aa

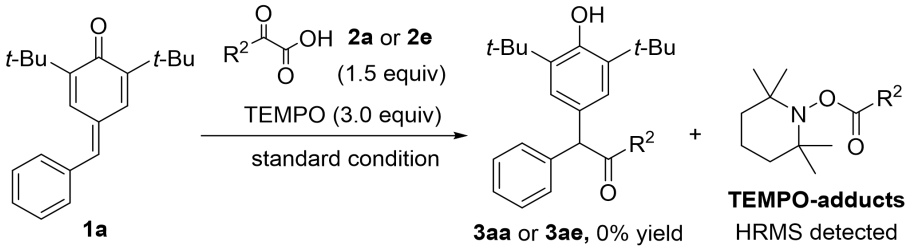


To a solution of 2,5-cyclohexadien-1-one,2,6-bis(1,1-dimethylethyl)-4-(phenylmethylene) **1a** (0.2 mmol), 2-oxo-4-phenylbutyric acid **2a** (0.3 mmol), Rhodamine 6G (4 mol%) and pyridine (0.3 mmol) in $CHCl_3$ (2.0 mL) in 25 ml reaction tube at N_2 atmosphere. The reaction was stirred under blue LEDs (10 W) for 24 h at 10 ℃, After completion of reaction as indicated by TLC, the solvent was evaporated and the residue was purified directly by flash column chromatography (n-hexane/ethyl acetate = 15:1-10:1) to give *α,α′*-diaryl ketone **3aa** in 70% yield.

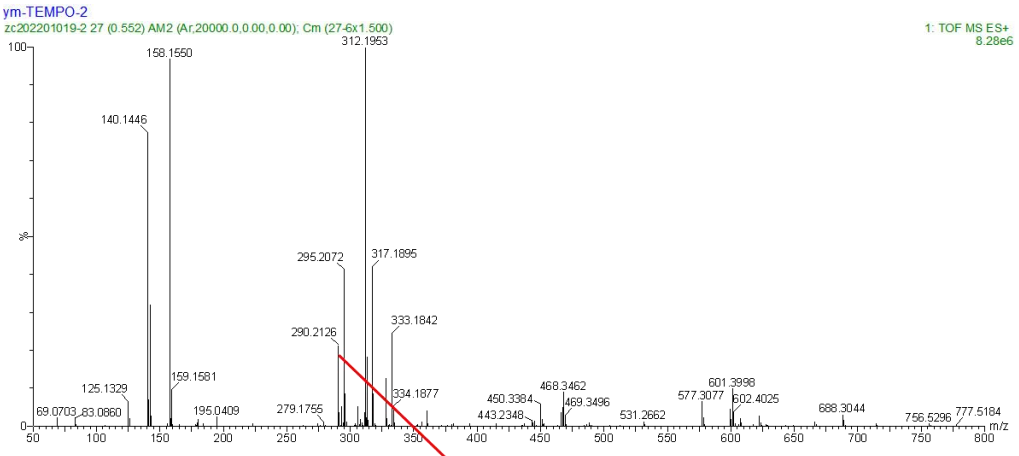
Experimental setup:



4.4 TEMPO radical trapping reaction



To a solution of 2,5-cyclohexadien-1-one,2,6-bis(1,1-dimethylethyl)-4-(phenylmethylene) **1a** (0.2 mmol), *α*-keto acid **2a** or **2e** (0.3 mmol), Rhodamine 6G (4 mol%), pyridine (0.3 mmol) and TEMPO (0.6 mmol) in $CHCl_3$ (2.0 mL) in 25 ml reaction tube at N_2 atmosphere. The reaction was stirred under blue LEDs (10 W) for 24 h at 10 ℃. According to TLC, no desired product **3aa** was detected. And the TEMPO-adducts were detected by HRMS measurements of the crude reaction mixture.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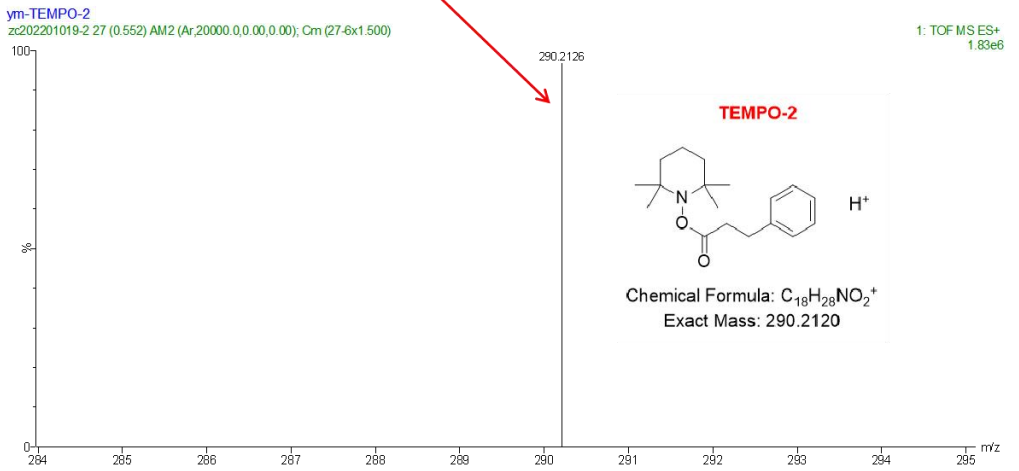
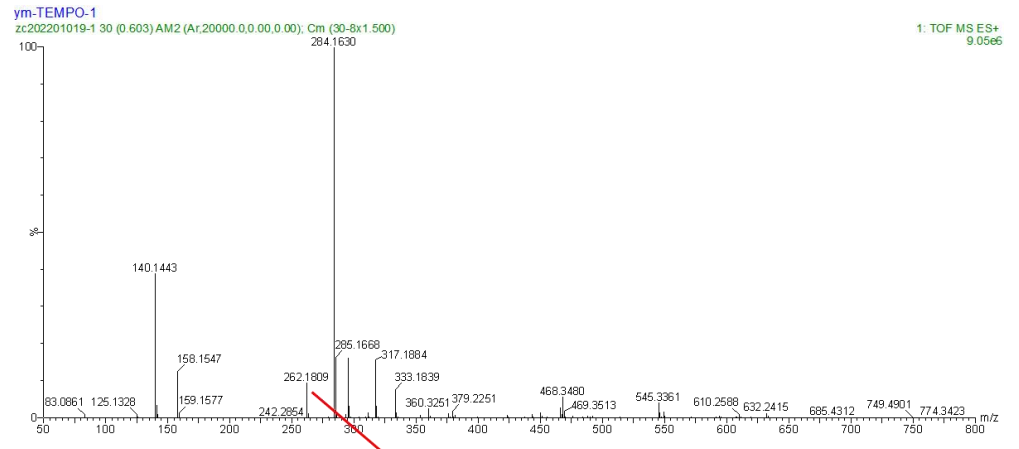
zc202201019-2 27 (0.552) AM2 (Ar,20000.0,0.00,0.00); Cm (27-6x1.500)
1: TOF MS ES+
8.28e6
312.1953
158.1550
140.1446
295.2072
317.1895
333.1842
290.2126
125.1329
159.1581
334.1877
468.3462
601.3998
577.3077
602.4025
450.3384
469.3496
443.2348
531.2662
688.3044
69.0703
83.0860
195.0409
279.1755
756.5296
777.5184
m/z


ym-TEMPO-2
zc202201019-2 27 (0.552) AM2 (Ar,20000.0,0.00,0.00); Cm (27-6x1.500)
1: TOF MS ES+
1.83e6
290.2126
m/z

TEMPO-2
H+
Chemical Formula: C18H28NO2+
Exact Mass: 290.2120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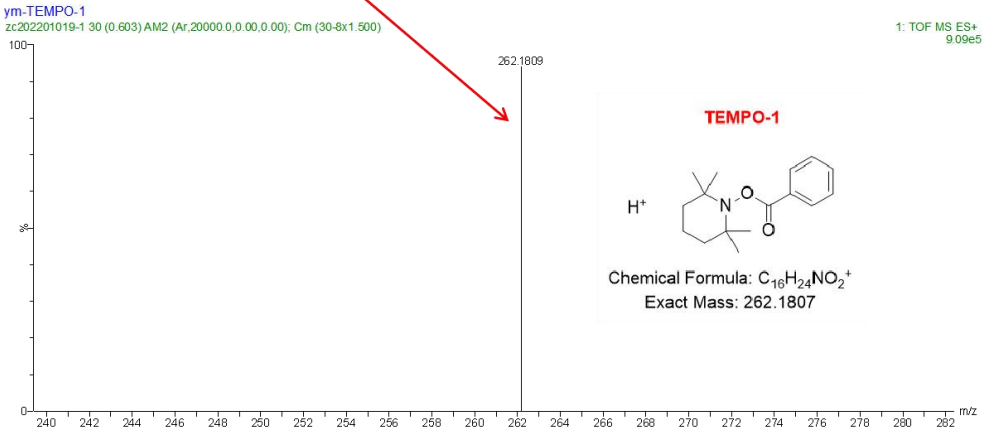
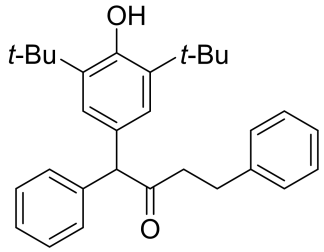
9.05e6
284.1630
140.1443
158.1547
285.1668
317.1884
262.1809
333.1839
159.1577
83.0861
125.1328
242.2854
360.3251
379.2251
468.3480
469.3513
545.3361
610.2588
632.2415
685.4312
749.4901
774.3423
m/z


ym-TEMPO-1
zc202201019-1 30 (0.603) AM2 (Ar,20000.0,0.00,0.00); Cm (30-8x1.500)
1: TOF MS ES+
9.09e5
262.1809
m/z

TEMPO-1
H+
Chemical Formula: C16H24NO2+
Exact Mass: 262.1807

4.5 Characterization datas of *α,α′*-diaryl ketones 3.

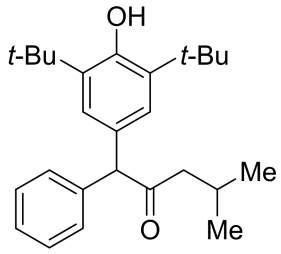


1-(3,5-di-tert-butyl-4-hydroxyphenyl)-1,4-diphenylbutan-2-one (**3aa**)

yellow solid, m. p. = 100-102 °C

58.2 mg, 70%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 (t, *J*= 7.2 Hz, 2H), 7.24-7.18 (m, 3H), 7.18-7.12 (m, 3H), 7.11-7.06 (m, 2H), 6.95 (s, 2H), 5.12 (s, 1H), 4.93 (s, 1H), 2.90-2.79 (m, 4H), 1.36 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 208.4, 153.0, 141.0, 138.9, 136.0, 128.9, 128.7, 128.6, 128.5, 128.4, 127.0, 126.1, 125.6, 64.5, 44.1, 34.4, 30.3, 30.2. IR (neat): 3269.13, 2960.29, 1662.32, 1611.97, 1492.46, 1347.23, 1264.27, 1148.88, 1065.54, 732.98. HRMS (ESI) calcd for $C_{30}H_{26}NaO_2^+$: 451.2613 ($M+Na^+$), found: 451.2617.

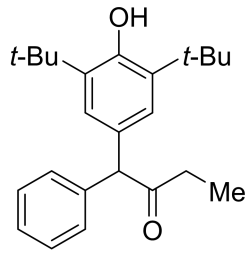


1-(3,5-di-tert-butyl-4-hydroxyphenyl)-4-methyl-1-phenylpentan-2-one (**3ab**)

light yellow solid, m. p. = 80-82 °C

50.1 mg, 66%; n-hexane/ethyl acetate = 10/1, R_f = 0.6

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34-7.28 (m, 2H), 7.24 (t, *J*= 7.6 Hz, 3H), 7.01 (s, 2H), 5.14 (s, 1H), 4.99 (s, 1H), 2.41 (d, *J*= 6.9 Hz, 2H), 2.20-2.13 (m, 1H), 1.40 (s, 18H), 0.90-0.83 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 208.7, 152.9, 139.1, 135.9, 129.0, 128.8, 128.5, 126.9, 125.7, 64.5, 51.6, 34.4, 30.3, 24.5, 22.5, 22.4. IR (neat): 3638.49, 2956.13, 1714.43, 1433.97, 1361.48, 1317.69, 1235.90, 1154.66, 1121.38, 1049.96, 894.04, 736.07, 700.22. HRMS (ESI) calcd for $C_{26}H_{36}NaO_2^+$: 403.2613 ($M+Na^+$), found: 403.2616.

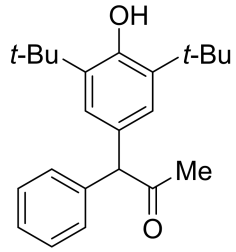


1-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylbutan-2-one (**3ac**)

light yellow oil

35.9 mg, 51%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (t, *J*= 7.4 Hz, 2H), 7.25 (d, *J*= 6.9 Hz, 3H), 7.04 (s, 2H), 5.14 (s, 1H), 5.03 (s, 1H), 2.58-2.55 (m, 2H), 1.41 (s, 18H), 1.05 (t, *J*= 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 209.9, 152.9, 139.3, 135.9, 129.1, 128.9, 128.5, 126.9, 125.6, 64.0, 35.9, 34.4, 30.3, 8.2. IR (neat): 3638.15, 2957.33, 1715.70, 1434.24, 1360.25, 1317.98, 1236.78, 1155.10, 1107.27, 1033.33, 739.51,. HRMS (ESI) calcd for $C_{24}H_{33}O_2^+$: 353.2480 ($M+H^+$), found: 353.2470.

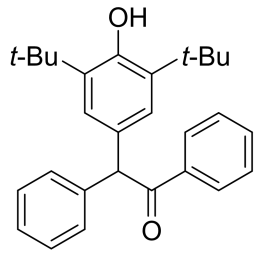


1-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylpropan-2-one (**3ad**)

light yellow oil

27.1 mg, 40%; n-hexane/ethyl acetate = 20/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33 (t, *J*= 7.5 Hz, 2H), 7.27-7.21 (m, 3H), 7.01 (s, 2H), 5.16 (s, 1H), 5.02 (s, 1H), 2.23 (s, 3H), 1.40 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 207.3, 153.0, 139.0, 136.0, 129.0, 128.7, 128.6, 127.0, 125.7, 65.1, 34.4, 30.3, 30.0. IR (neat): 3636.85, 2956.33, 1715.44, 1434.29, 1357.31, 1235.49, 1153.42, 1121.01, 1077.64, 1033.13, 733.33. HRMS (ESI) calcd for $C_{23}H_{30}NaO_2^+$: 361.2144 ($M+Na^+$), found: 361.2135.

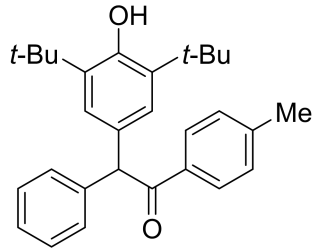


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1,2-diphenylethan-1-one (**3ae**)

light yellow solid, m. p. = 91-93 °C

67.3 mg, 84%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (s, 2H), 7.52-7.15 (m, 8H), 7.03 (s, 2H), 5.91 (s, 1H), 5.09 (s, 1H), 1.35 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.9, 152.9, 139.7, 137.3, 135.9, 132.8, 129.5, 129.1, 128.9, 128.6, 128.6, 126.9, 125.9, 59.3, 34.4, 30.3. IR (neat): 3627.83, 2955.34, 1685.84, 1596.19, 1434.67, 1203.90, 1008.75, 806.96, 733.40, 696.14.HRMS (ESI) calcd for $C_{28}H_{33}O_2^+$: 401.2475 ($M+H^+$), found: 401.2476. Spectral data match those previously reported.[4]

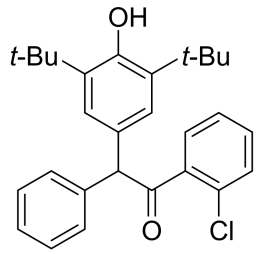


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-2-phenyl-1-(p-tolyl)ethan-1-one (**3af**)

yellow solid, m. p. = 150-151 °C

41.5 mg, 50%; n-hexane/ethyl acetate = 10/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91 (d, *J*= 8.0 Hz, 2H), 7.30 (d, *J*= 2.9 Hz, 4H), 7.20 (d, *J*= 8.0 Hz, 3H), 7.06 (s, 2H), 5.92 (s, 1H), 5.10 (s, 1H), 2.37 (s, 3H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.4, 152.8, 143.6, 139.9, 135.8, 129.6, 129.2, 129.1, 128.6, 126.8, 125.9, 59.1, 34.4, 30.3, 21.6. IR (neat): 3637.92, 2960.89, 1680.78, 1605.29, 1434.77, 1264.42, 1178.38, 894.49, 736.04, 702.37. HRMS (ESI) calcd for $C_{29}H_{35}O_2^+$: 415.2637 ($M+H^+$), found: 415.2654. Spectral data match those previously reported.[5]

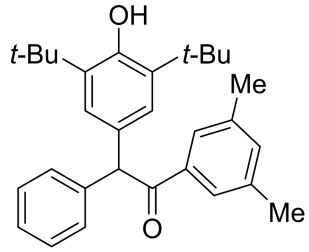


1-(2-chlorophenyl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-2-phenylethan-1-one (**3ag**)

yellow solid, m. p. = 130-132 °C

30.4 mg, 35%; n-hexane/ethyl acetate = 10/1, R_f = 0.5

1H NMR (400 MHz, $CDCl_3$) δ 7.40-7.26 (m, 7H), 7.22-7.15 (m, 2H), 7.07 (s, 2H), 5.78 (s, 1H), 5.14 (s, 1H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 152.9, 136.1, 135.9, 128.9, 128.5, 125.7, 125.3, 64.2, 51.5, 34.4, 34.4, 31.3, 30.3, 24.5, 22.5, 22.4. IR (neat): 3631.31, 2954.47, 1700.88, 1589.60, 1433.34, 1235.87, 1202.56, 1157.84,1064.64, 737.56. HRMS (ESI) calcd for $C_{28}H_{32}ClO_2^+$: 435.2091 ($M+H^+$), found: 435.2091.

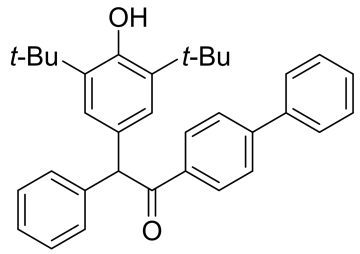


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-(3,5-dimethylphenyl)-2-phenylethan-1-one (**3ah**)

yellow solid, m. p. = 118-119 °C

47.1 mg, 55%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^1H NMR (400 MHz, $CDCl_3$) δ 7.63 (s, 2H), 7.32 (d, J= 4.2 Hz, 4H), 7.24 (d, J= 4.5 Hz, 1H), 7.15 (s, 1H), 7.09 (s, 2H), 5.94 (s, 1H), 5.12 (s, 1H), 2.33 (s, 6H), 1.39 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.2, 152.8, 139.9, 138.1, 137.5, 135.8, 134.5, 129.9, 129.6, 129.1, 129.0, 128.6, 127.6, 126.8, 126.7, 125.9, 59.2, 34.4, 30.3, 21.3. IR (neat): 3633.90, 2955.81, 1685.56, 1598.16, 1264.29, 1024.45, 859.79, 852.79, 734.38, 702.06. HRMS (ESI) calcd for $C_{30}H_{37}O_2^+$: 429.2793 ($M+H^+$), found: 429.2791.

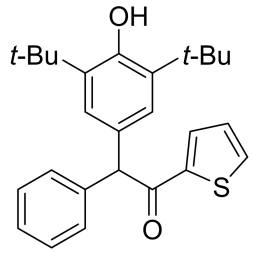


1-([1,1'-biphenyl]-4-yl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-2-phenylethan-1-one (**3ai**)

light yellow solid, m. p. = 157-160 °C

49.6 mg, 52%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10 (d, *J*= 8.0 Hz, 2H), 7.67-7.58 (m, 4H), 7.50-7.38 (m, 4H), 7.34 (d, *J*= 4.2 Hz, 4H), 7.10 (s, 2H), 5.99 (s, 1H), 5.14 (s, 1H), 1.40 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.4, 152.9, 145.5, 139.9, 139.8, 135.9, 135.9, 129.5, 129.5, 129.1, 128.9, 128.7, 128.2, 127.3, 127.2, 127.0, 125.9, 59.4, 34.4, 30.3. IR (neat): 3624.93, 2955.82, 1678.62 1601.30, 1433.46, 1264.56, 1236.11, 1005.62, 735.24, 697.99. HRMS (ESI) calcd for $C_{34}H_{36}NaO_2^+$: 499.2613 ($M+Na^+$), found: 499.2630.

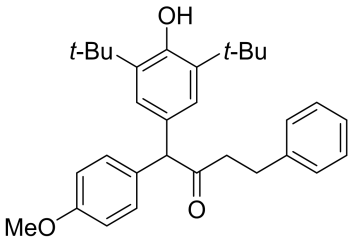


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-2-phenyl-1-(thiophen-2-yl)ethan-1-one (**3aj**)

light yellow solid, m. p. = 110-112 °C

53.7 mg, 66%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J*= 3.8 Hz, 1H), 7.59 (d, *J*= 5.0 Hz, 1H), 7.42-7.27 (m, 5H), 7.13 (s, 2H), 7.08 (t, *J*= 4.4 Hz, 1H), 5.76 (s, 1H), 5.14 (s, 1H), 1.40 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 191.6, 153.0, 144.5, 139.5, 135.9, 133.8, 132.6, 129.2, 128.9, 128.6, 128.1, 127.0, 125.8, 60.5, 34.4, 30.3. IR (neat): 3628.50, 2961.84, 1660.52, 1412.57, 1355.48, 1264.17, 1236.12, 1154.45, 1059.70, 894.65, 731.57. HRMS (ESI) calcd for $C_{26}H_{30}NaO_2^+$: 429.1865 ($M+Na^+$), found: 429.1858. Spectral data match those previously reported.[4]

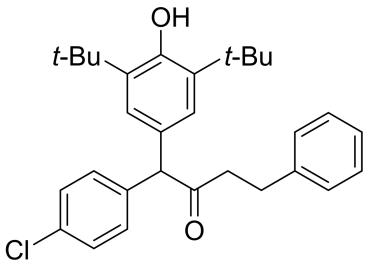


1-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-(4-methoxyphenyl)-4-phenylbutan-2-one (**3ga**)

light yellow solid, m. p. = 150-153 °C

35.7 mg, 39%; n-hexane/dichloromethane = 2/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25-7.19 (m, 2H), 7.19-7.13 (m, 1H), 7.12-7.04 (m, 4H), 6.94 (d, *J*= 2.7 Hz, 2H), 6.85-6.78 (m, 2H), 5.12 (s, 1H), 4.88 (s, 1H), 3.76 (s, 3H), 2.90-2.77 (m, 4H), 1.37 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 208.6, 158.5, 152.9, 141.1, 135.9, 131.0, 130.0, 129.0, 128.5, 128.4, 126.1, 125.5, 113.9, 63.7, 55.3, 44.0, 34.4, 30.3, 30.3. IR (neat): 3627.96, 2953.78, 1713.81, 1608.04, 1508.20, 1433.75, 1248.12, 1154.16, 1032.19, 736.55. HRMS (ESI) calcd for $C_{31}H_{38}NaO_3^+$: 481.2719 ($M+Na^+$), found: 481.2746.

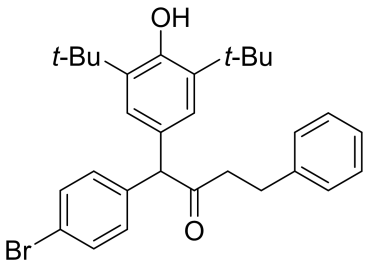


1-(4-chlorophenyl)-1-(3,5-di-tert-butyl-4-hydroxyphenyl)-4-phenylbutan-2-one (**3ha**)

light yellow oil

62.9 mg, 68%; n-hexane/dichloromethane = 2/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30-7.25 (m, 4H), 7.23-7.17 (m, 1H), 7.16-7.09 (m, 4H), 6.98 (s, 2H), 5.20 (s, 1H), 4.94 (s, 1H), 2.96-2.82 (m, 4H), 1.42 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 207.9, 153.2, 140.9, 137.5, 136.3, 132.8, 130.2, 128.6, 128.5, 128.4, 128.3, 126.1, 125.5, 63.7, 44.1, 34.4, 30.3, 30.2. IR (neat): 3638.13, 2956.08, 1715.44, 1490.13, 1433.97, 1235.33, 1154.50, 1090.32, 1015.35, 730.93. HRMS (ESI) calcd for $C_{30}H_{36}ClO_2^+$: 463.2398 ($M+H^+$), found: 463.2400.

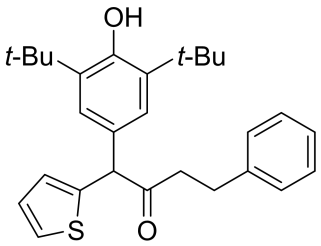


1-(4-bromophenyl)-1-(3,5-di-tert-butyl-4-hydroxyphenyl)-4-phenylbutan-2-one (**3ia**)

light yellow oil

53.6 mg, 53%; n-hexane/dichloromethane = 2/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48-7.39 (m, 2H), 7.30-7.25 (m, 2H), 7.24-7.18 (m, 1H), 7.17-7.10 (m, 2H), 7.06 (d, *J*= 8.5 Hz, 2H), 6.98 (s, 2H), 5.20 (s, 1H), 4.92 (s, 1H), 2.99-2.81 (m, 4H), 1.42 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 207.8, 153.2, 140.9, 138.1, 136.3, 131.5, 130.6, 128.5, 128.4, 128.2, 126.1, 125.4, 121.0, 63.8, 44.1, 34.4, 30.3, 30.2. IR (neat): 3633.88, 2953.72, 1714.05, 1486.71, 1433.09, 1235.52, 1153.55, 1120.54, 1010.56, 732.84. HRMS (ESI) calcd for $C_{30}H_{36}BrO_2^+$: 507.1893 ($M+H^+$), found: 507.1899.

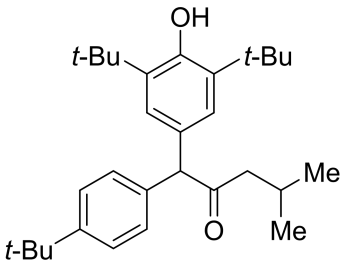


1-(3,5-di-tert-butyl-4-hydroxyphenyl)-4-phenyl-1-(thiophen-2-yl)butan-2-one (**3pa**)

light yellow oil

36.4 mg, 42%; n-hexane/dichloromethane = 2/1, R_f = 0.4

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26-7.20 (m, 3H), 7.19-7.14 (m, 1H), 7.09 (d, *J*= 11.3 Hz, 4H), 6.94-6.92 (m, 1H), 6.82 (d, *J*= 3.5 Hz, 1H), 5.18 (s, 1H), 5.13 (s, 1H), 2.88-2.86 (m, 4H), 1.40 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 206.1, 153.3, 140.9, 136.3, 128.4, 128.3, 126.4, 126.1, 126.0, 125.3, 125.0, 59.5, 43.2, 34.4, 30.3, 30.2. IR (neat): 3671.92, 2921.74, 1715.19, 1456.78, 1435.42, 1403.85, 1241.19, 1065.84, 897.54. HRMS (ESI) calcd for $C_{28}H_{34}NaO_2S^+$: 457.2177 ($M+H^+$), found: 457.2176.

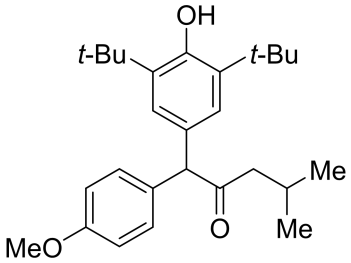


1-(4-(tert-butyl)phenyl)-1-(3,5-di-tert-butyl-4-hydroxyphenyl)-4-methylpentan-2-one (**3fb**)

light yellow oil

34.9 mg, 40%; n-hexane/dichloromethane = 2/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35-7.29 (m, 2H), 7.15 (d, *J*= 8.4 Hz, 2H), 7.03 (s, 2H), 5.13 (s, 1H), 4.95 (s, 1H), 2.40 (d, *J*= 6.9 Hz, 2H), 2.17 (dq, *J*= 13.4, 6.6 Hz, 1H), 1.41 (s, 18H), 1.29 (s, 9H), 0.88-0.85 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 152.9, 136.1, 135.9, 128.9, 128.5, 125.7, 125.3, 64.2, 51.5, 34.4, 34.4, 31.3, 30.3, 24.5, 22.5, 22.4. IR (neat): 3645.65, 2954.57, 1712.96, 1434.13, 1362.48, 1234.66, 1155.01, 1121.11, 1048.22, 740.66. HRMS (ESI) calcd for $C_{30}H_{45}O_2^+$: 437.3420 ($M+H^+$), found: 437.3425.

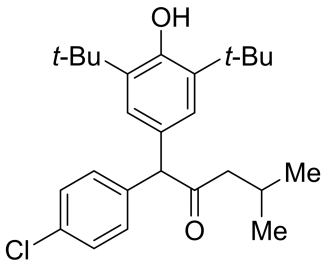


1-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-(4-methoxyphenyl)-4-methylpentan-2-one (**3gb**)

yellow oil

35.3 mg, 43%; n-hexane/dichloromethane = 2/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.15 (d, *J*=8.7 Hz, 2H), 7.00 (s, 2H), 6.86 (d, *J*= 8.7 Hz, 2H), 5.13 (s, 1H), 4.94 (s, 1H), 3.79 (s, 3H), 2.40 (d, *J*= 6.9 Hz, 2H), 2.22-2.12 (m, 1H), 1.41 (s, 18H), 0.88-0.86 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 209.0, 158.5, 152.8, 135.9, 131.2, 130.0, 129.2, 125.5, 113.9, 63.7, 55.2, 51.5, 34.4, 30.3, 24.6, 22.5, 22.4. IR (neat): 3637.44, 2956.04, 1714.18, 1610.38, 1509.67, 1434.61, 1361.36, 1249.20, 1034.87, 732.75. HRMS (ESI) calcd for $C_{27}H_{39}O_3^+$: 411.2899 ($M+H^+$), found: 411.2900.

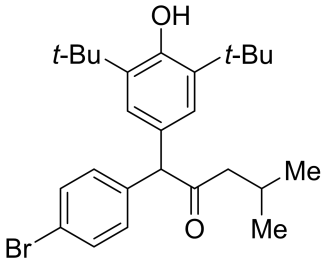


1-(4-chlorophenyl)-1-(3,5-di-tert-butyl-4-hydroxyphenyl)-4-methylpentan-2-one (**3hb**)

yellow oil

36.4 mg, 44%; n-hexane/dichloromethane = 2/1, R_f = 0.5

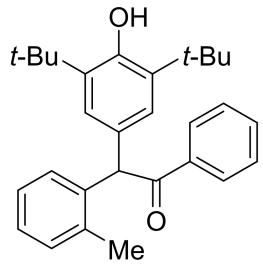
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29-7.26 (m, 2H), 7.18-7.10 (m, 2H), 6.98 (s, 2H), 5.17 (s, 1H), 4.95 (s, 1H), 2.40 (d, *J*= 6.9 Hz, 2H), 2.21-2.11 (m, 1H), 1.40 (s, 18H), 0.89-0.84 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 207.0 153.1, 137.7, 136.2, 130.3, 128.5, 128.3, 125.5, 63.7, 51.6, 34.4, 30.3, 24.5, 22.5, 22.4. IR (neat): 3635.78, 2955.14, 1711.93, 1490.51, 1433.66, 1362.13, 1153.49, 1049.32, 1015.43, 738.22. HRMS (ESI) calcd for $C_{26}H_{36}ClO_2^+$: 415.2404 ($M+H^+$), found: 415.2409.



1-(4-bromophenyl)-1-(3,5-di-tert-butyl-4-hydroxyphenyl)-4-methylpentan-2-one (**3ib**)
yellow oil

37.6 mg, 41%; n-hexane/dichloromethane = 2/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49-7.42 (m, 2H), 7.16-7.10 (m, 2H), 7.01 (s, 2H), 5.20 (s, 1H), 4.97 (s, 1H), 2.44 (d, *J*= 6.9 Hz, 2H), 2.24-2.14 (m, 1H), 1.44 (s, 18H), 0.92-0.87 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 208.1, 153.1, 138.3, 136.2, 131.5, 130.7, 128.2, 125.5, 120.9, 63.8, 51.6, 34.4, 30.3, 24.5, 22.6, 22.4. IR (neat): 3634.62, 2954.87, 1713.24, 1434.57, 1362.95, 1263.81, 1236.54, 1155.34, 1049.48, 732.82. HRMS (ESI) calcd for $C_{26}H_{36}BrO_2^+$: 459.1893 ($M+H^+$), found: 459.1882.

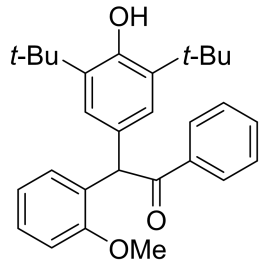


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenyl-2-(o-tolyl)ethan-1-one (**3be**)

yellow oil

57.2 mg, 69%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (d, *J*= 7.2 Hz, 2H), 7.48 (d, *J*= 7.3 Hz, 1H), 7.39 (t, *J*= 7.6 Hz, 2H), 7.23-7.09 (m, 3H), 7.05 (d, *J*= 7.8 Hz, 1H), 7.00 (s, 2H), 6.01 (s, 1H), 5.12 (s, 1H), 2.35 (s, 3H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.1, 152.8, 138.5, 137.2, 135.8, 132.7, 130.7, 128.7, 128.6, 128.6, 128.0, 127.0, 126.4, 126.2, 56.5, 34.4, 30.3, 30.1, 20.2. IR (neat): 3634.54, 2955.84, 1684.90, 1434.22, 1305.86, 1264.49, 1204.52, 1155.52, 1009.97, 734.70, 702.53. HRMS (ESI) calcd for $C_{29}H_{35}O_2^+$: 415.2637 ($M+H^+$), found: 415.2633. Spectral data match those previously reported.[4]

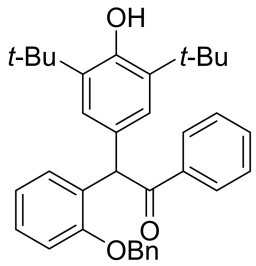


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-2-(2-methoxyphenyl)-1-phenylethan-1-one (**3ce**)

light yellow solid, m. p. = 158-161 °C

64.5 mg, 75%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, *J*= 7.1 Hz, 2H), 7.47 (d, *J*= 7.5 Hz, 1H), 7.40 (t, *J*= 7.6 Hz, 2H), 7.23 (s, 1H), 7.11 (s, 2H), 6.94 (d, *J*= 7.6 Hz, 1H), 6.88 (t, *J*= 8.6 Hz, 2H), 6.21 (s, 1H), 5.13 (s, 1H), 3.76 (s, 3H), 1.39 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.5, 156.3, 152.9, 137.7, 135.9, 132.3, 129.7, 129.7, 128.6, 128.4, 128.1, 127.5, 126.5, 120.6, 110.3, 55.4, 53.0, 34.4, 30.4. IR (neat): 3631.26, 2956.96, 1685.24, 1598.21, 1489.12, 1434.46, 1240.31, 1159.01, 1207.96, 847.71, 752.55, 702.22. HRMS (ESI) calcd for $C_{29}H_{35}O_3^+$: 431.2581 ($M+H^+$), found: 431.2569. Spectral data match those previously reported.[6]

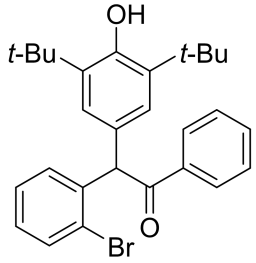


2-(2-(benzyloxy)phenyl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylethan-1-one (**3de**)

light yellow solid, m. p. = 146-149 °C

64.9 mg, 64%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96 (d, *J*= 7.7 Hz, 2H), 7.45 (t, *J*= 7.3 Hz, 1H), 7.32 (t, *J*= 7.6 Hz, 2H), 7.21 (d, *J*= 8.3 Hz, 5H), 7.12 (s, 2H), 6.98-6.91 (m, 4H), 6.29 (s, 1H), 5.14 (s, 1H), 5.03 (d, *J*= 4.5 Hz, 2H), 1.40 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.3, 155.4, 152.9, 137.5, 136.7, 136.0, 132.3, 130.0, 129.8, 128.8, 128.3, 128.3, 128.0, 127.7, 127.4, 127.2, 126.5, 120.8, 111.4, 70.0, 53.1, 34.4, 30.3. IR (neat): 3633.90, 2955.81, 1685.56, 1598.16, 1488.37, 1435.04, 1264.29, 1024.45, 859.79, 734.38. HRMS (ESI) calcd for $C_{35}H_{38}NaO_3^+$: 529.2719 ($M+Na^+$), found: 529.2720.

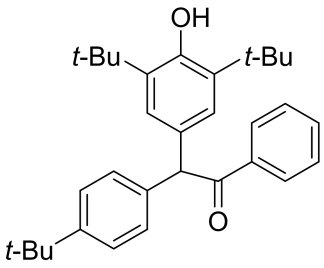


2-(2-bromophenyl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylethan-1-one (**3ee**)

light yellow solid, m. p. = 122-124 °C

33.5 mg, 35%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, *J*= 7.7 Hz, 2H), 7.58 (d, *J*= 7.9 Hz, 1H), 7.51 (t, *J*= 7.4 Hz, 1H), 7.42 (t, *J*= 7.6 Hz, 2H), 7.23 (d, *J*= 7.6 Hz, 1H), 7.10 (d, *J*= 10.2 Hz, 4H), 6.35 (s, 1H), 5.17 (s, 1H), 1.40 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.1, 153.1, 140.0, 137.1, 136.2, 132.8, 131.0, 128.8, 128.6, 128.5, 127.5, 127.3, 126.4, 124.9, 58.8, 34.4, 30.3. IR (neat): 3628.65, 2958.53, 1676.04, 1434.26, 1264.17, 1211.26, 1025.66, 895.50, 733.79, 702.72. HRMS (ESI) calcd for $C_{28}H_{32}BrO_2^+$: 479.1585 ($M+H^+$), found: 479.1582.

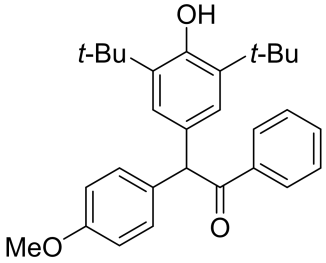


2-(4-(tert-butyl)phenyl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylethan-1-one (**3fe**)

light yellow solid, m. p. = 142-144 °C

48.4 mg, 53%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, *J*= 7.8 Hz, 2H), 7.50 (t, *J*= 7.3 Hz, 1H), 7.41 (t, *J*= 7.5 Hz, 2H), 7.33 (d, *J*= 8.1 Hz, 2H), 7.23 (d, *J*= 8.1 Hz, 2H), 7.10 (s, 2H), 5.91 (s, 1H), 5.11 (s, 1H), 1.39 (s, 18H), 1.28 (s, 9H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.0, 152.9, 149.6, 137.3, 136.7, 135.8, 132.7, 130.2, 129.5, 128.9, 128.6, 128.5, 125.8, 125.5, 58.8, 34.4, 31.3, 30.3, 29.7, 29.4. IR (neat): 3623.33, 2957.68, 2364.29, 1685.01, 1434.56, 1264.31, 1020.91, 896.25, 734.42, 702.71. HRMS (ESI) calcd for $C_{32}H_{41}O_2^+$: 457.3106 ($M+H^+$), found: 457.3113.

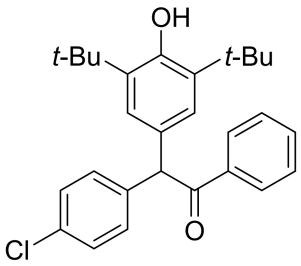


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-2-(4-methoxyphenyl)-1-phenylethan-1-one (**3ge**)

light yellow solid, m. p. = 128-131 °C

50.8 mg, 59%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J*= 7.5 Hz, 2H), 7.50 (t, *J*= 7.3 Hz, 1H), 7.41 (t, *J*= 7.6 Hz, 2H), 7.22 (d, *J*= 8.6 Hz, 2H), 7.05 (s, 2H), 6.86 (d, *J*= 8.7 Hz, 2H), 5.89 (s, 1H), 5.12 (s, 1H), 3.78 (s, 3H), 1.39 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.1, 158.5, 152.8, 137.2, 135.8, 132.8, 131.8, 130.1, 129.8, 128.9, 128.5, 125.8, 114.1, 58.4, 55.2, 34.4, 30.3·3. IR (neat):3634.21, 2953.62, 1681.70, 1509.16, 1433.58, 1248.56, 1176.74, 1033.87, 895.29, 736.16. HRMS (ESI) calcd for $C_{29}H_{35}O_3^+$: 431.2581 ($M+H^+$), found: 431.2569. Spectral data match those previously reported.[6]

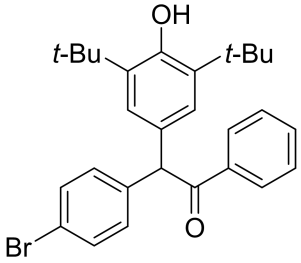


2-(4-chlorophenyl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylethan-1-one (**3he**)

light yellow oil

63.5 mg, 73%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (d, *J*= 7.1 Hz, 2H), 7.52 (s, 1H), 7.47-7.37 (m, 4H), 7.26 (s, 1H), 7.17 (d, *J*= 8.4 Hz, 2H), 7.05 (s, 2H), 5.90 (s, 1H), 5.16 (s, 1H), 1.39 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.4, 153.1, 138.9, 137.0, 136.1, 133.0, 131.7, 130.8, 128.9, 128.9, 128.6, 125.7, 121.0, 58.6, 34.4, 30.3. IR (neat): 3632.10, 2956.27, 1682.13, 1580.78, 1433.73, 1264.26, 1073.22, 1010.62, 895.99, 735.15. HRMS (ESI) calcd for $C_{28}H_{31}ClNaO_2^+$: 457.1911 ($M+Na^+$), found: 457.1899. Spectral data match those previously reported.[6]

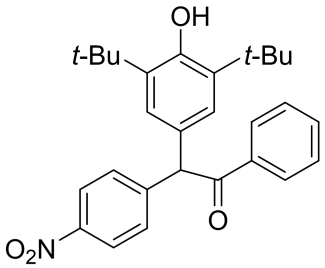


2-(4-bromophenyl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylethan-1-one (**3ie**)

light yellow solid, m. p. = 86-89 °C

71.0 mg, 74%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (d, *J*= 6.9 Hz, 2H), 7.51 (t, *J*= 7.4 Hz, 1H), 7.41 (t, *J*= 7.7 Hz, 2H), 7.30-7.19 (m, 4H), 7.04 (s, 2H), 5.91 (s, 1H), 5.15 (s, 1H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.5, 153.0, 138.4, 137.0, 136.1, 133.0, 132.8, 130.5, 129.0, 128.9, 128.7, 128.6, 125.7, 58.5, 34.4, 30.3. IR (neat): 3633.11, 2956.94, 1681.76, 1595.36, 1489.75, 1433.96, 1236.77, 1003.34, 843.24, 738.39. HRMS (ESI) calcd for $C_{28}H_{31}NaBrO_2^+$: 501.1405 ($M+Na^+$), found: 501.1419. Spectral data match those previously reported.[6]

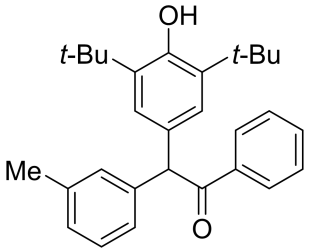


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-2-(4-nitrophenyl)-1-phenylethan-1-one (**3je**)

light yellow solid, m. p. = 164-166 °C

35.6 mg, 40%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.18 (d, *J*= 8.3 Hz, 2H), 7.99 (d, *J*= 7.8 Hz, 2H), 7.55 (t, *J*= 7.3 Hz, 1H), 7.44 (t, *J*= 7.4 Hz, 4H), 7.06 (s, 2H), 6.03 (s, 1H), 5.21 (s, 1H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.5, 156.3, 152.9, 137.7, 135.9, 132.3, 129.7, 129.7, 128.6, 128.4, 128.1, 127.5, 126.5, 120.6, 110.3, 55.4, 53.0, 34.4, 30.3. IR (neat): 3636.50, 2961.09, 1685.84, 1596.48, 1521.95, 1434.42, 1346.62, 1264.55, 802.80, 737.98. HRMS (ESI) calcd for $C_{28}H_{31}NNaO_4^+$: 468.2151 ($M+Na^+$), found: 468.2150. Spectral data match those previously reported.[6]

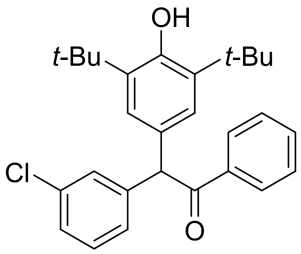


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenyl-2-(m-tolyl)ethan-1-one (**3ke**)

red solid, m. p. = 108-111 °C

41.5 mg, 50%; n-hexane/ethyl acetate = 20/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, *J*= 7.7 Hz, 2H), 7.54-7.47 (m, 1H), 7.41 (t, *J*= 7.6 Hz, 2H), 7.20 (t, *J*= 7.5 Hz, 1H), 7.08 (m, 5H), 5.90 (s, 1H), 5.11 (s, 1H), 2.31 (s, 3H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.9, 152.8, 139.5, 138.2, 137.3, 135.7, 132.7, 129.8, 129.5, 128.9, 128.5, 127.7, 126.1, 125.9, 59.3, 34.4, 30.3, 21.5. IR (neat): 3632.69, 2958.46, 1685.65, 1596.91, 1434.66, 1264.62, 1155.78, 1009.91, 897.02, 736.85. HRMS (ESI) calcd for $C_{29}H_{35}O_2^+$: 415.2637 ($M+H^+$), found: 415.2633.

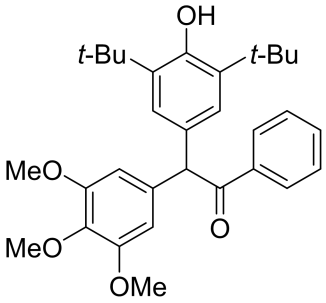


2-(3-chlorophenyl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylethan-1-one (**3le**)

light yellow solid, m. p. = 130-133 °C

57.4 mg, 66%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (d, *J*= 7.8 Hz, 2H), 7.51 (d, *J*= 6.8 Hz, 1H), 7.42 (t, *J*= 7.6 Hz, 2H), 7.30 (s, 1H), 7.21 (d, *J*= 15.7 Hz, 3H), 7.06 (s, 2H), 5.90 (s, 1H), 5.16 (s, 1H), 1.39 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.2, 153.1, 141.8, 137.0, 136.1, 134.4, 133.0, 129.7, 129.3, 128.9, 128.7, 128.6, 127.2, 127.1, 125.7, 58.8, 34.4, 30.3. IR (neat): 3634.13, 2962.00, 1683.47, 1595.05, 433.64, 1264.30, 1154.66, 1005.00, 896.07, 734.87. HRMS (ESI) calcd for $C_{28}H_{32}ClO_2^+$: 435.2091 ($M+H^+$), found: 435.2091. Spectral data match those previously reported.[6]

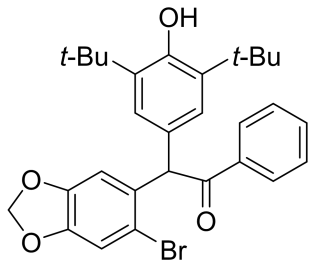


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenyl-2-(3,4,5-trimethoxyphenyl)ethan-1-one (**3me**)

yellow oil

62.8 mg, 64%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, *J*= 7.0 Hz, 2H), 7.53 (t, *J*= 7.4 Hz, 1H), 7.43 (t, *J*= 7.7 Hz, 2H), 7.11 (s, 2H), 6.54 (s, 2H), 5.86 (s, 1H), 5.15 (s, 1H), 3.81 (d, *J*= 2.0 Hz, 9H), 1.40 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.7, 153.3, 153.0, 137.2, 135.9, 135.1, 132.9, 129.1, 128.9, 128.6, 125.7, 106.1, 60.8, 59.3, 56.1, 34.4, 30.3. IR (neat): 3635.34, 2956.94, 1682.34, 1589.28, 1506.02, 1421.27, 1326.38, 1236.65, 1125.75, 1006.57, 812.81. HRMS (ESI) calcd for $C_{31}H_{39}O_5^+$: 491.2797 ($M+H^+$), found: 491.2805.

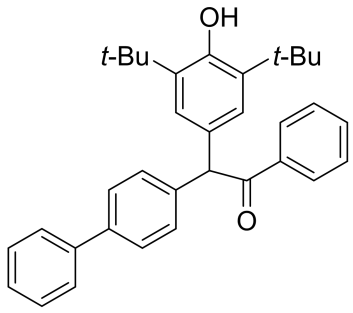


2-(6-bromobenzo[d][1,3]dioxol-5-yl)-2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenylethan-1-one (**3ne**)

light yellow solid, m. p. = 150-153 °C

73.3 mg, 70%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J*= 7.6 Hz, 2H), 7.56-47 (m, 1H), 7.42 (t, *J*= 7.5 Hz, 2H), 7.05 (d, *J*= 9.9 Hz, 3H), 6.59 (s, 1H), 6.27 (s, 1H), 5.93 (d, *J*= 8.5 Hz, 2H), 5.18 (s, 1H), 1.39 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.4, 153.2, 147.3, 147.3, 137.1, 136.3, 133.4, 132.8, 128.8, 128.6, 127.6, 126.1, 115.0, 112.6, 111.0, 101.7, 58.5, 34.4, 30.3. IR (neat): 3633.55, 2958.04, 1685.54, 1478.27, 1434.75, 1264.30, 1236.57, 1038.98. 932.80, 737.19. HRMS (ESI) calcd for $C_{29}H_{31}BrNaO_4^+$: 545.1304 (M+Na^+), found: 545.1304.

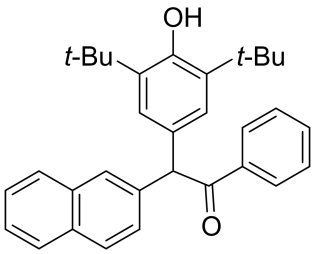


2-(3,5-di-tert-butyl-4-hydroxyphenyl)-2-(naphthalen-2-yl)-1-phenylethan-1-one (**3oe**)

white solid, m. p. = 159-162 °C

68.5 mg, 72%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.0 (d, *J*= 7.9 Hz, 2H), 7.6 (q, *J*= 8.6, 7.9 Hz, 5H), 7.5-7.3 (m, 7H), 7.1 (s, 2H), 6.0 (s, 1H), 5.1 (s, 1H), 1.4 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.8, 153.0, 140.8, 139.8, 138.9, 137.2, 136.0, 132.9, 129.4, 129.3, 129.0, 128.7, 128.6, 127.3, 127.2, 127.1, 125.8, 59.0, 34.4, 30.3. IR (neat): 3627.98, 2963.20, 1685.50, 1435.02, 1264.21,1233.19, 1206.88, 1075.58, 732.42. HRMS (ESI) calcd for $C_{34}H_{37}NaO_2^+$: 477.2788 (M+H^+), found: 477.2787.



2-(3,5-di-tert-butyl-4-hydroxyphenyl)-1-phenyl-2-(thiophen-2-yl)ethan-1-one (**3pe**)

yellow solid, m. p. = 181-186 °C

58.6 mg, 65%; n-hexane/ethyl acetate = 15/1, R_f = 0.5

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.07-8.01 (m, 1H), 8.01-7.97 (m, 2H), 7.91-7.86 (m, 1H), 7.77 (d, *J*= 8.2 Hz, 1H), 7.53-7.46 (m, 3H), 7.39 (td, *J*= 7.4, 4.7 Hz, 3H), 7.21 (m, 1H), 7.09 (s, 2H), 6.64 (s, 1H), 5.13 (s, 1H), 1.38 (s, 18H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.8, 153.0, 137.0, 136.0, 135.9, 134.2, 132.8, 131.4, 129.1, 128.8, 128.6, 128.1, 127.8, 126.9, 126.5, 126.4, 125.6, 125.5, 123.3, 55.8, 34.4, 30.3. IR (neat): 3623.33, 3056.69, 2957.68, 2364.29, 1685.01, 1434.56, 1264.31, 1202.91, 896.25, 734.42. HRMS (ESI) calcd for $C_{32}H_{35}O_2^+$: 451.2637 ($M+H^+$), found: 451.2635.

References:

[1] B. M. Sharma, J. Rathod, R. G. Gonnade and P. Kumar, *J. Org. Chem.*, 2018, **83**, 9353.

[2] V. K. Rai, WO2008067012 (A1), 2008.

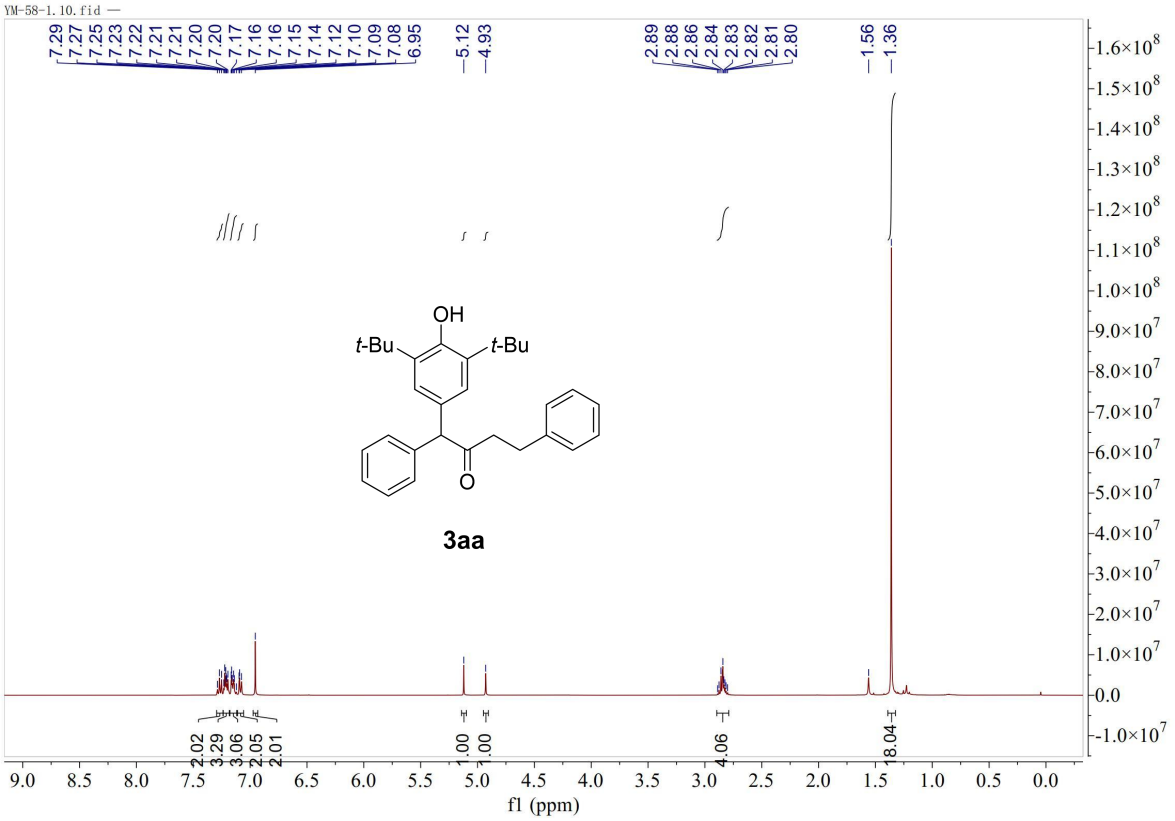
[3] J. Li, X. C. Lu, Y. Xu, J. X. Wen, G. Q. Hou and L. Liu, *Org. Lett.,*2020*,* **22***,* 9621.

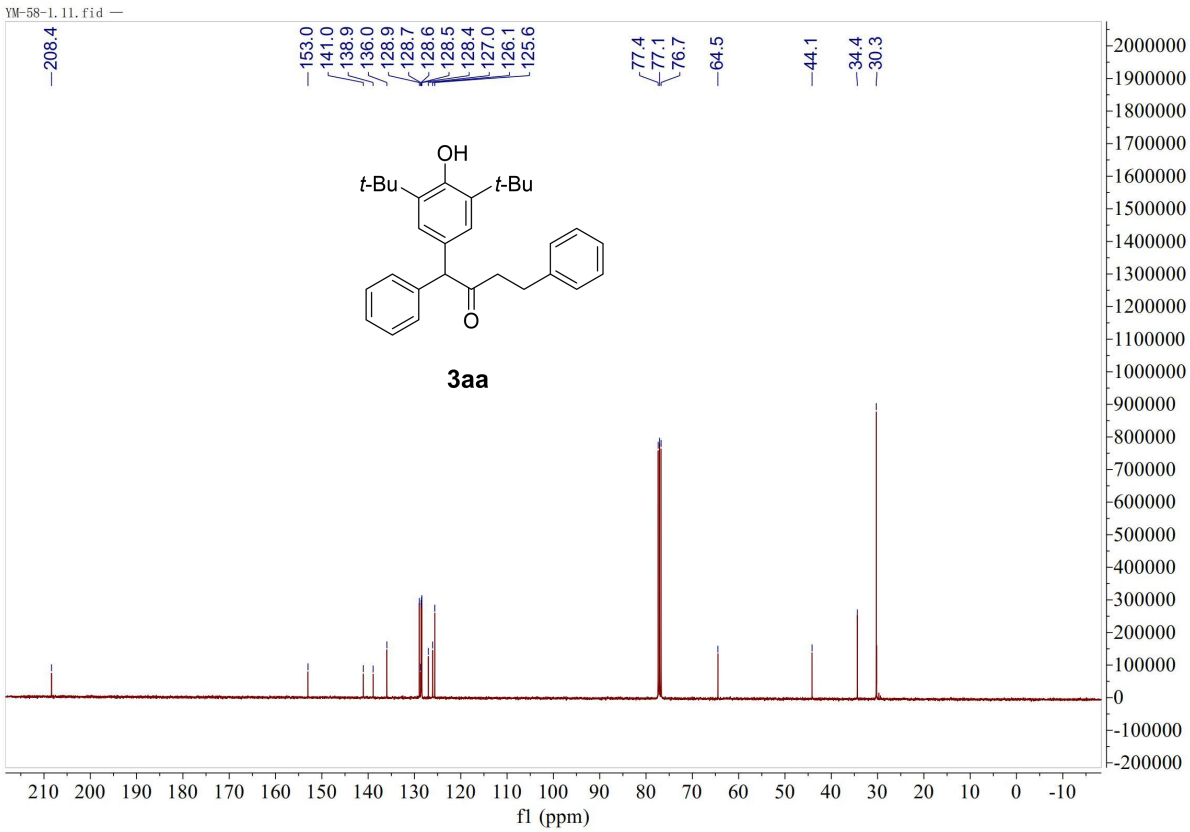
[4] Q. Yang, G. Pan, J. Wei, W. Wang, Y. Tang and Y. Cai, *ACS Sustainable Chem. Eng.*, 2021, **9**, 2367.

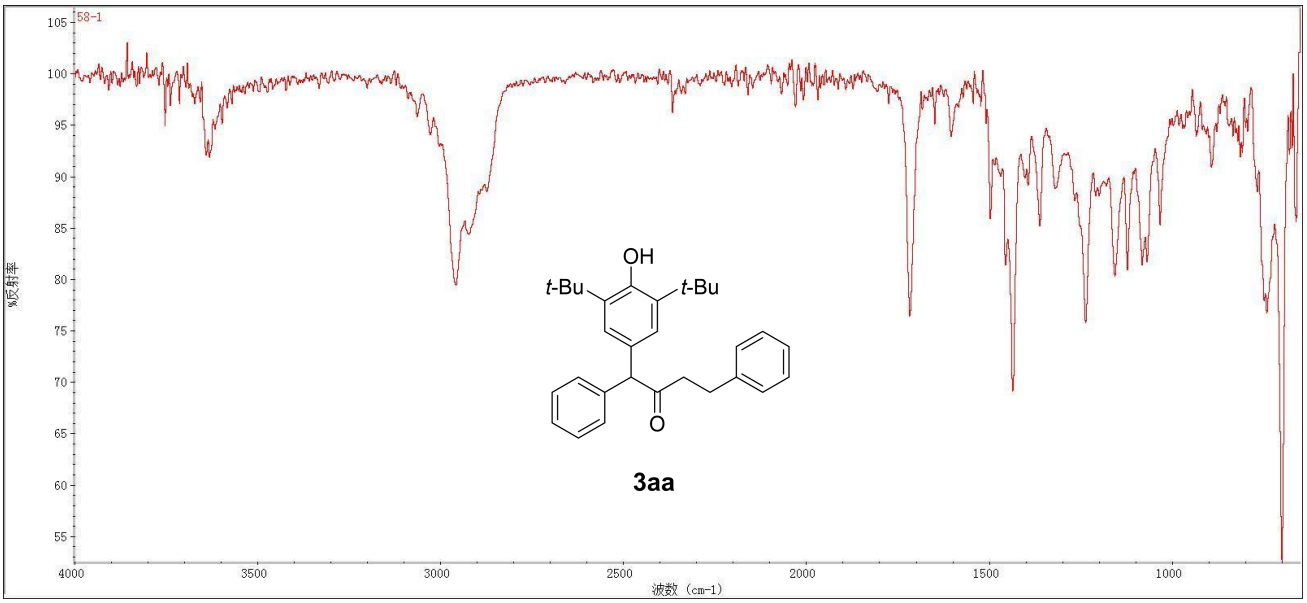
[5] T. Ikeda, S. Kobayashi and H. Taniguchi, *Chem. Let.*, 1982, **11**, 387.

[6] Z. J. Wu and J. W, *Acta. Chim. Sinica.*, 2017, **75**, 74.

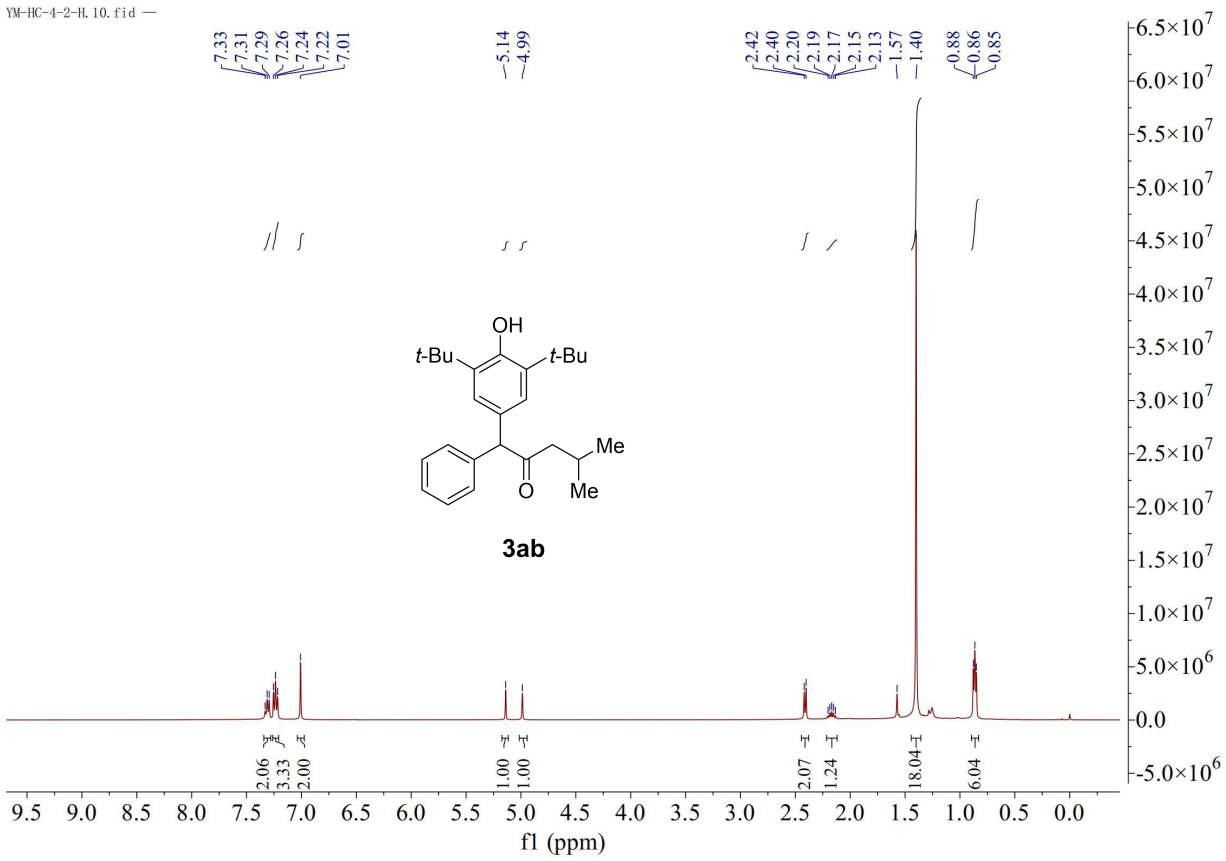
5. ^{1}H, ^{13}C NMR and IR spectra of *α,α′*-diaryl ketones.






58-1
%反射率
波数 (cm-1)
OH
t-Bu
t-Bu
O

3aa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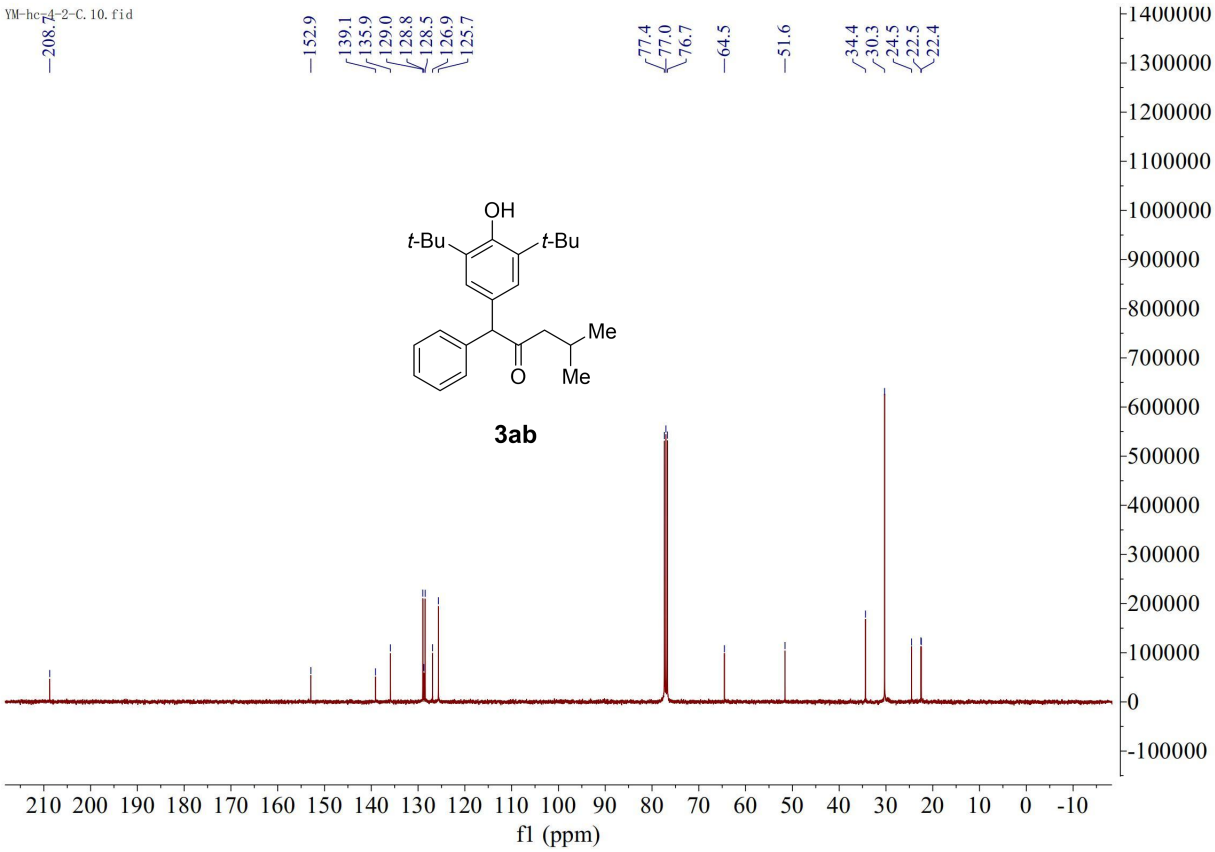
OH
t-Bu
t-Bu
Me
O
Me
fl (ppm)

3ab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152.9
139.1
135.9
129.0
128.8
128.5
126.9
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77.0
76.7
64.5
51.6
34.4
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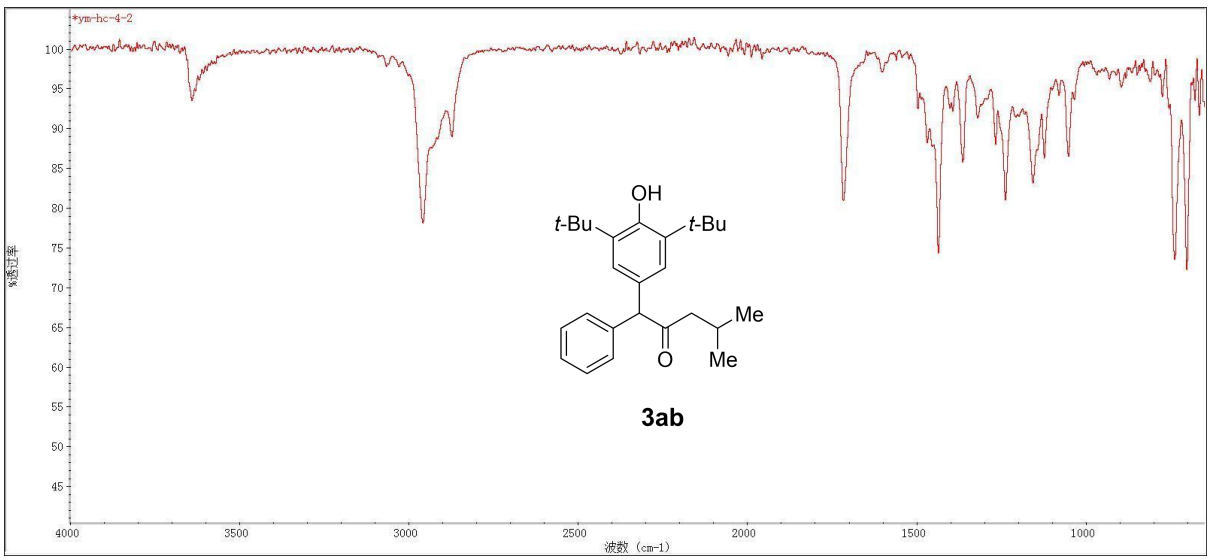
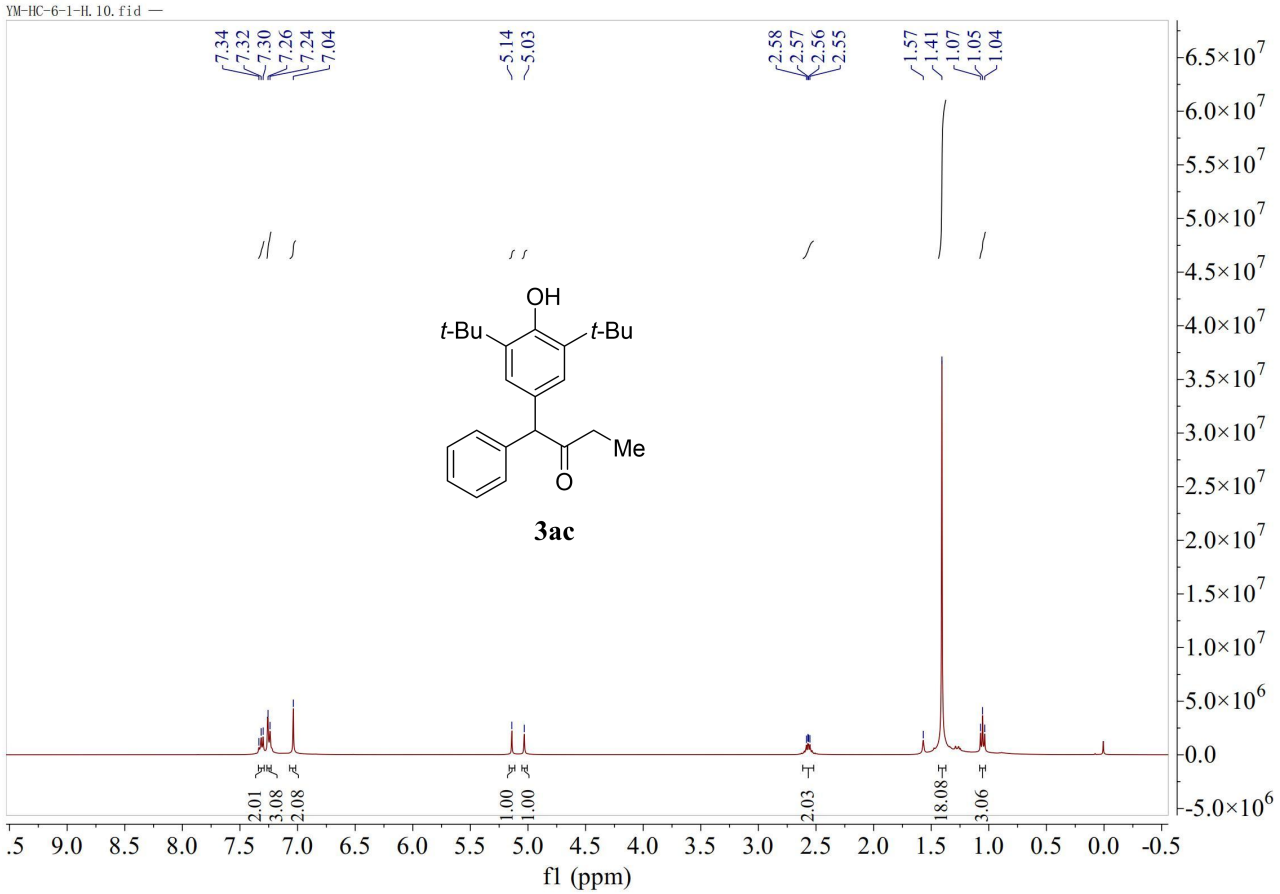
24.5
22.5
22.4
OH
t-Bu
t-Bu
Me
O
Me
3ab
f1 (ppm)


ym-hc-4-2
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Me
O
Me
3ab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2.56
2.55
1.57
1.41
1.07
1.05
1.04
OH
t-Bu
t-Bu
Me
O
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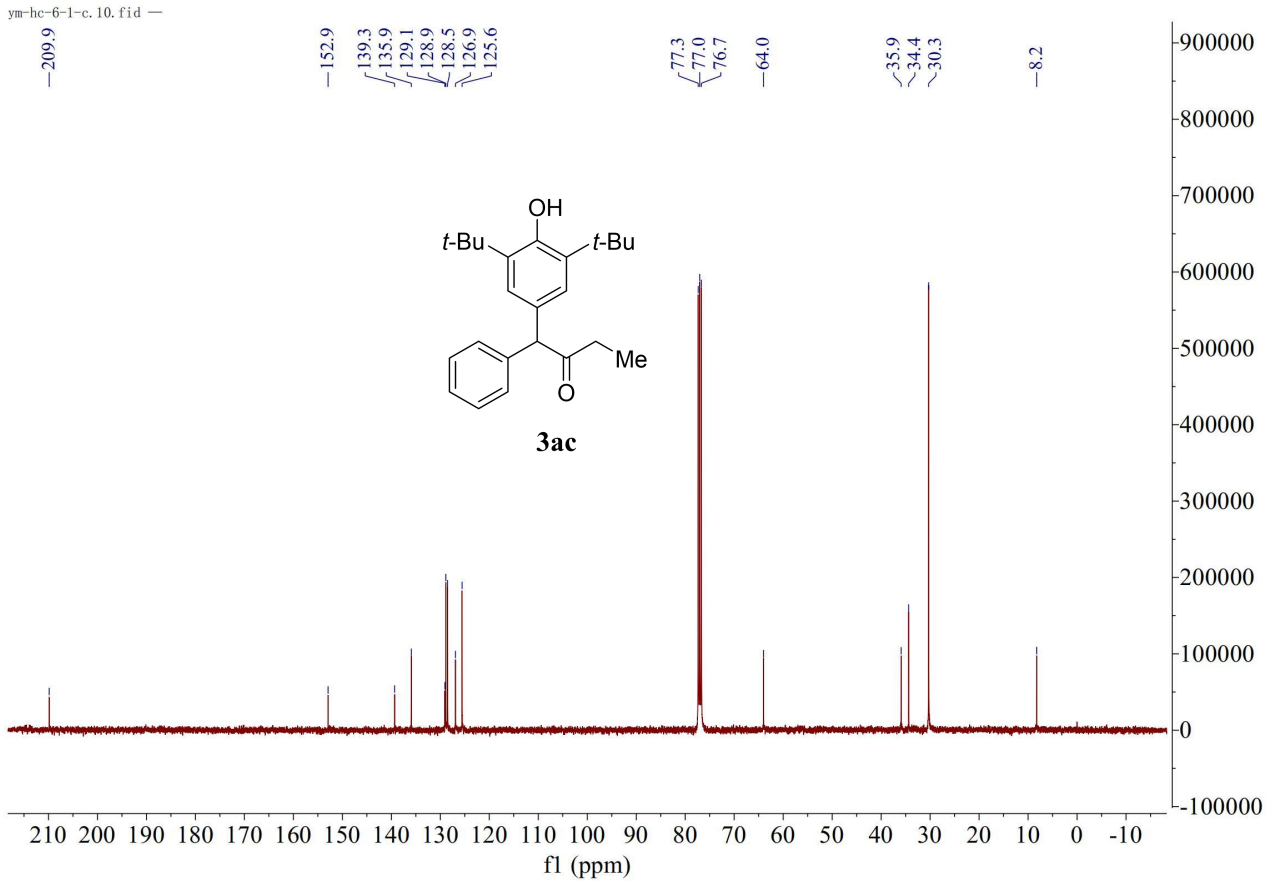
2.08
1.00
1.00
2.03
18.08
3.06
f1 (ppm)

3ac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135.9
129.1
128.9
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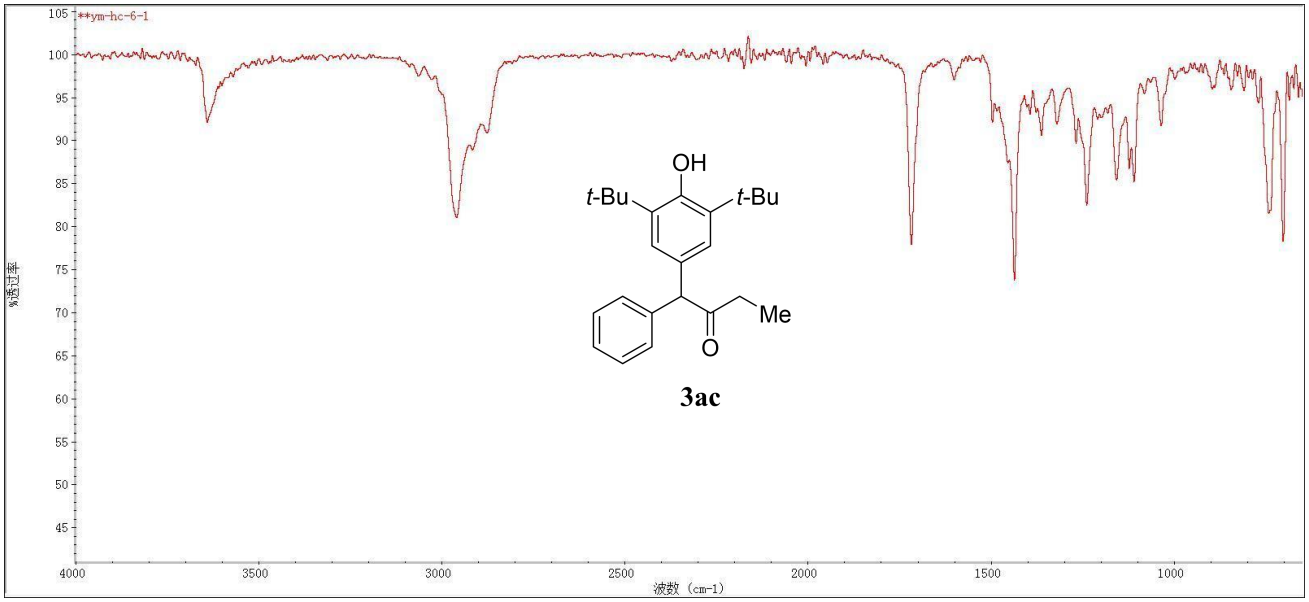
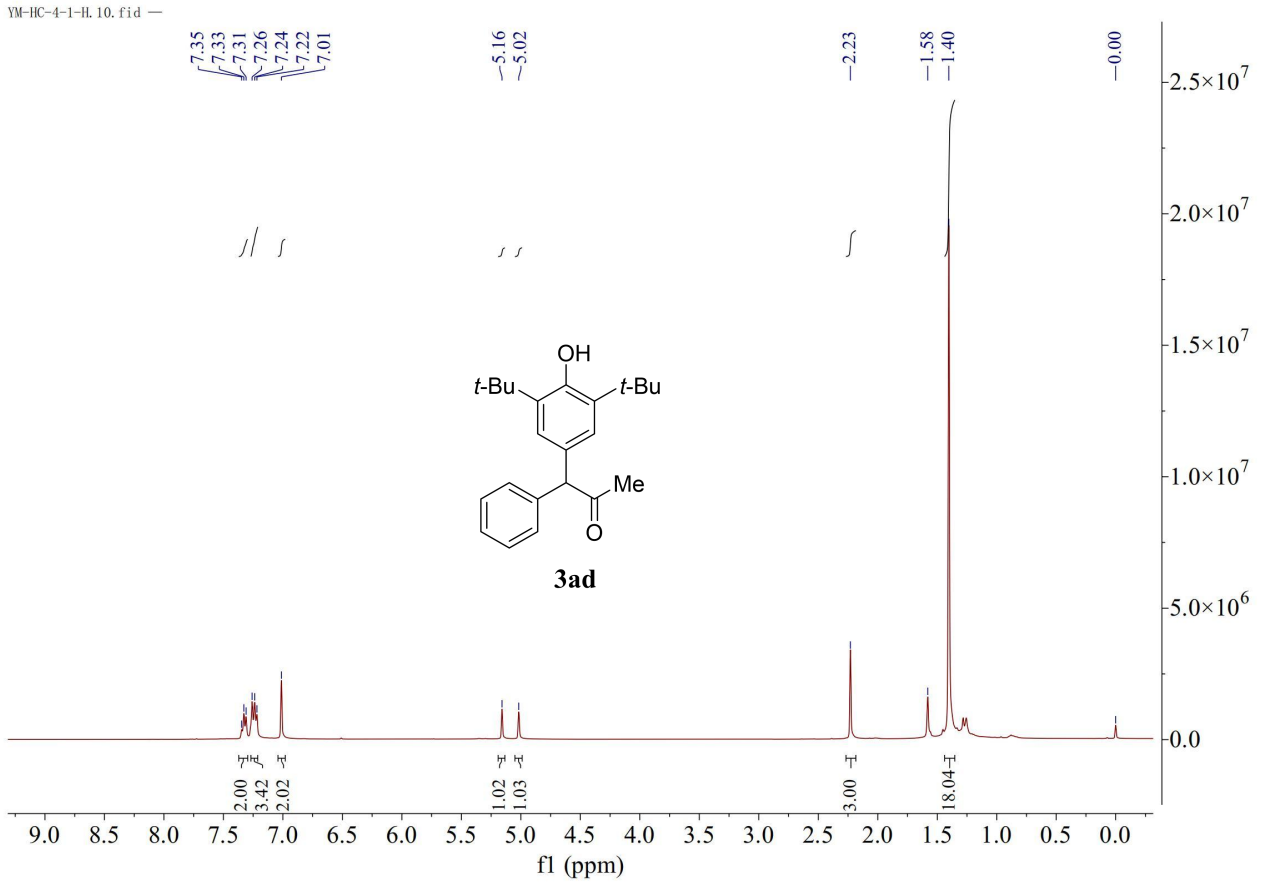
64.0
35.9
34.4
30.3
8.2
OH
t-Bu
t-Bu
Me
O
f1 (ppm)

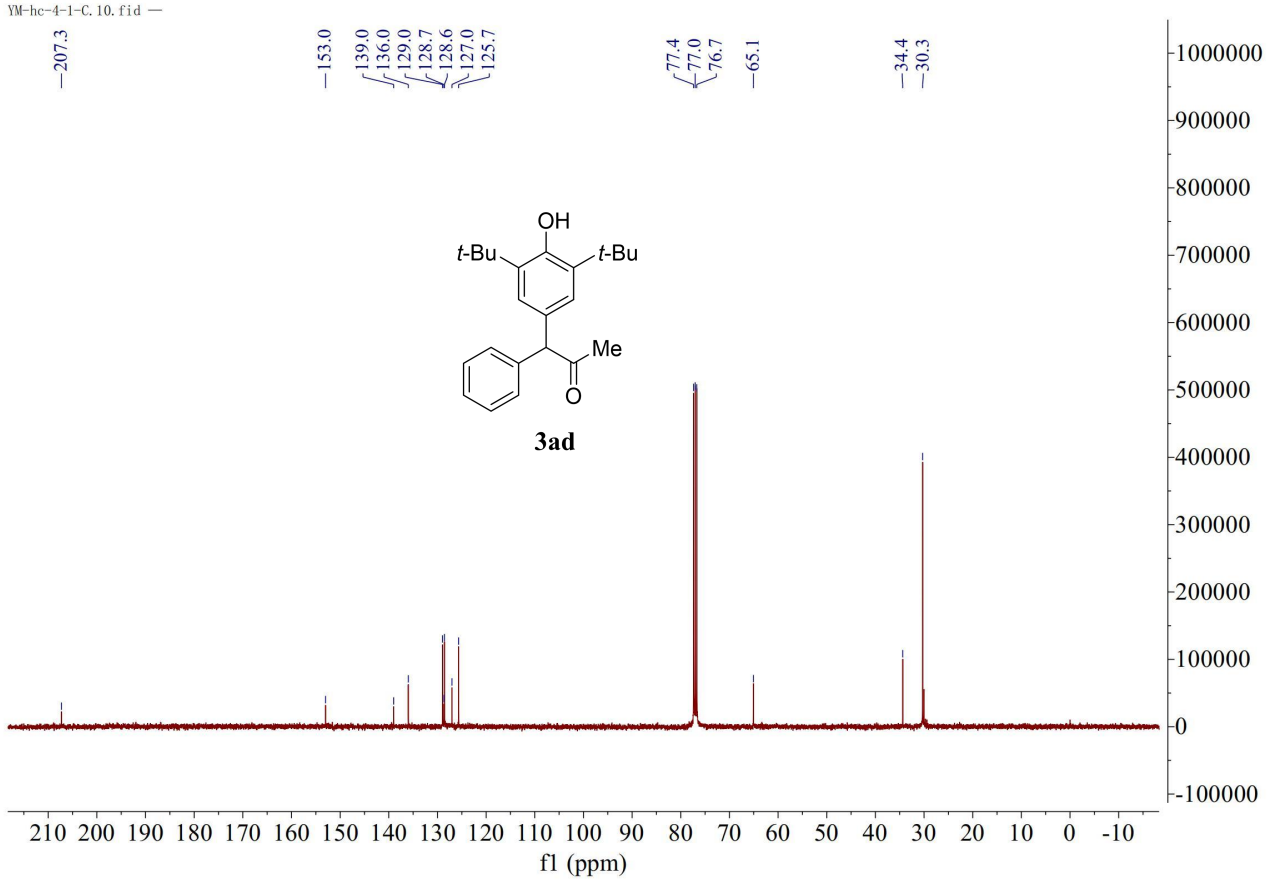
3ac

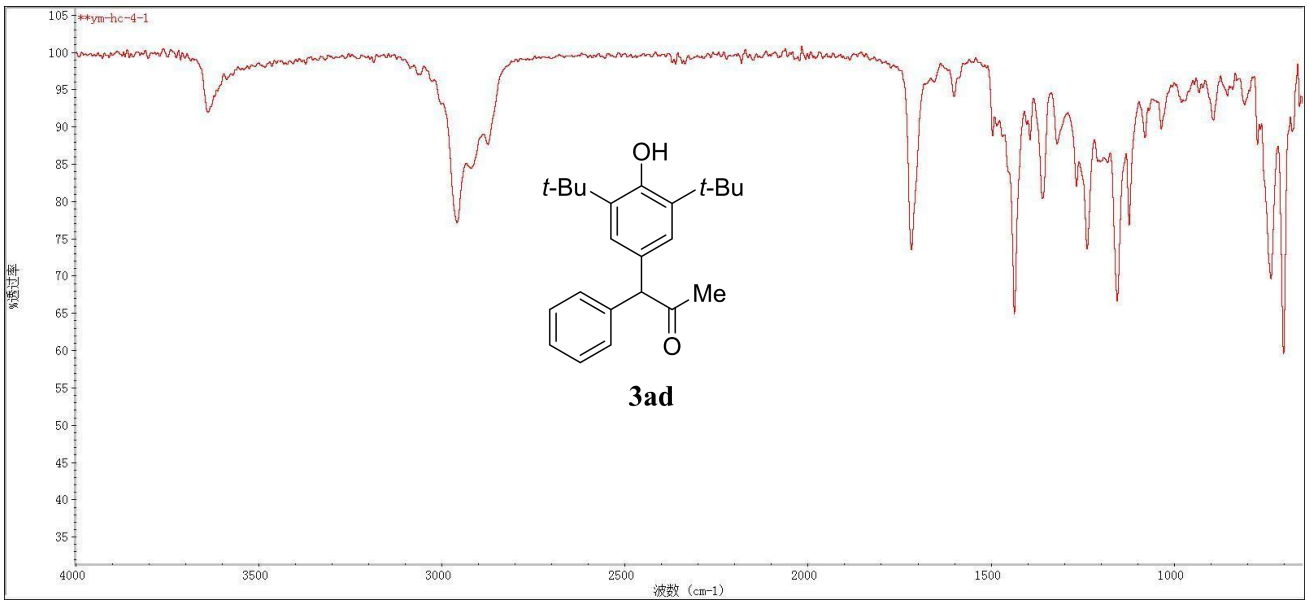

**ym-hc-6-1
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Me
O

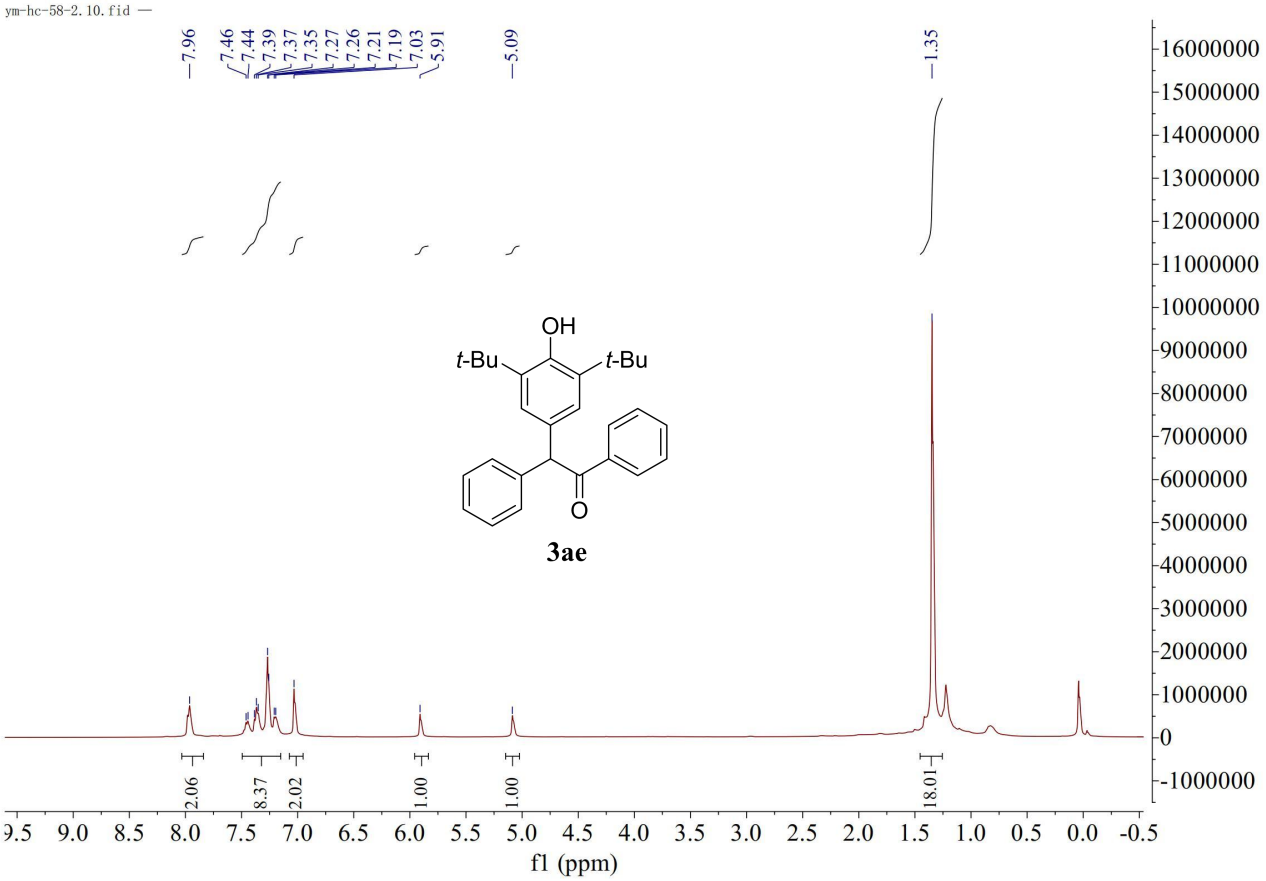
3ac


YM-HC-4-1-H.10.fid
7.35
7.33
7.31
7.26
7.24
7.22
7.01
5.16
5.02
2.23
1.58
1.40
0.00
OH
t-Bu
t-Bu
Me
O
2.5×10^7
2.0×10^7
1.5×10^7
1.0×10^7
5.0×10^6
0.0
2.00
3.42
2.02
1.02
1.03
3.00
18.04
f1 (ppm)

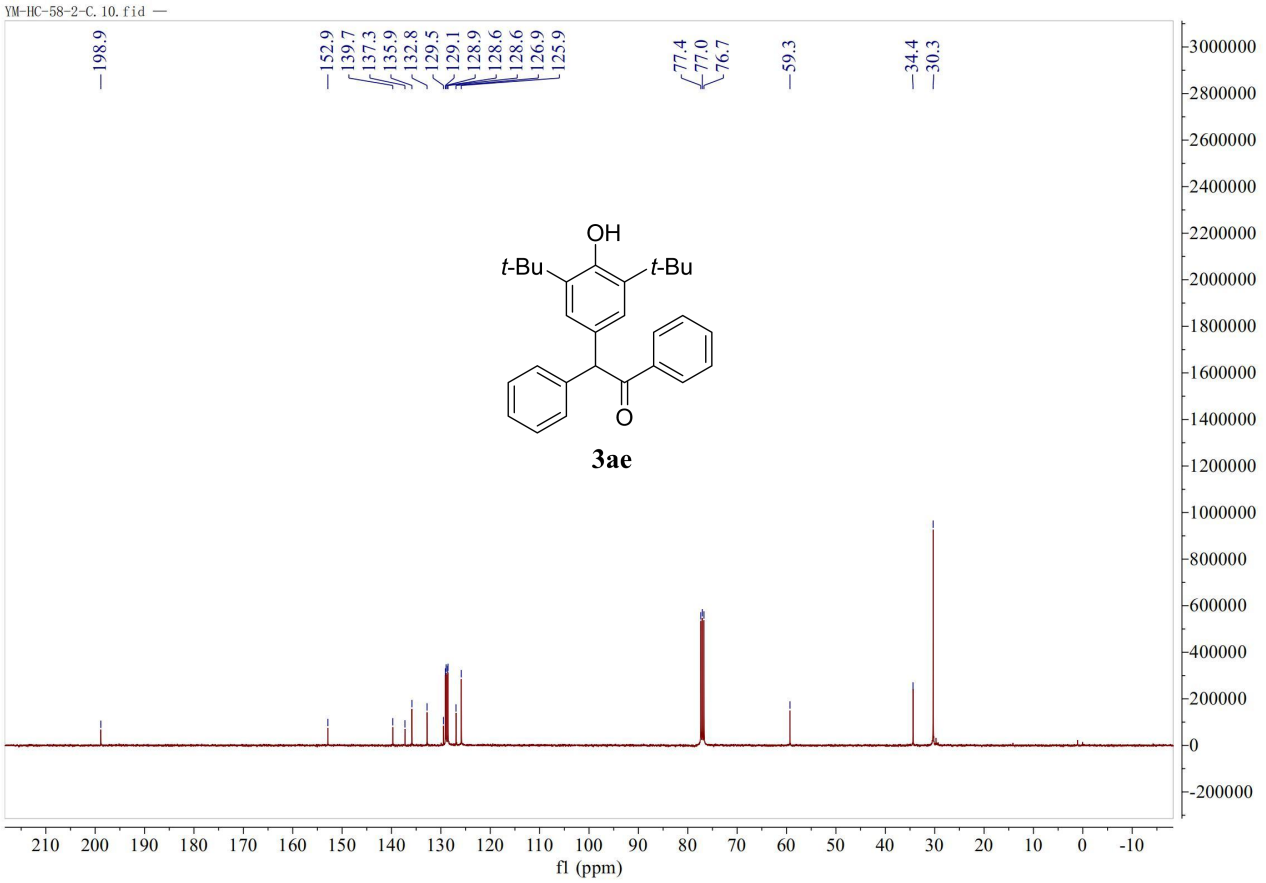
3ad


YM-hc-4-1-C.10.fid
207.3
153.0
139.0
136.0
129.0
128.7
128.6
127.0
125.7
77.4
77.0
76.7
65.1
34.4
30.3
OH
t-Bu
t-Bu
Me
O
3ad
fl (ppm)

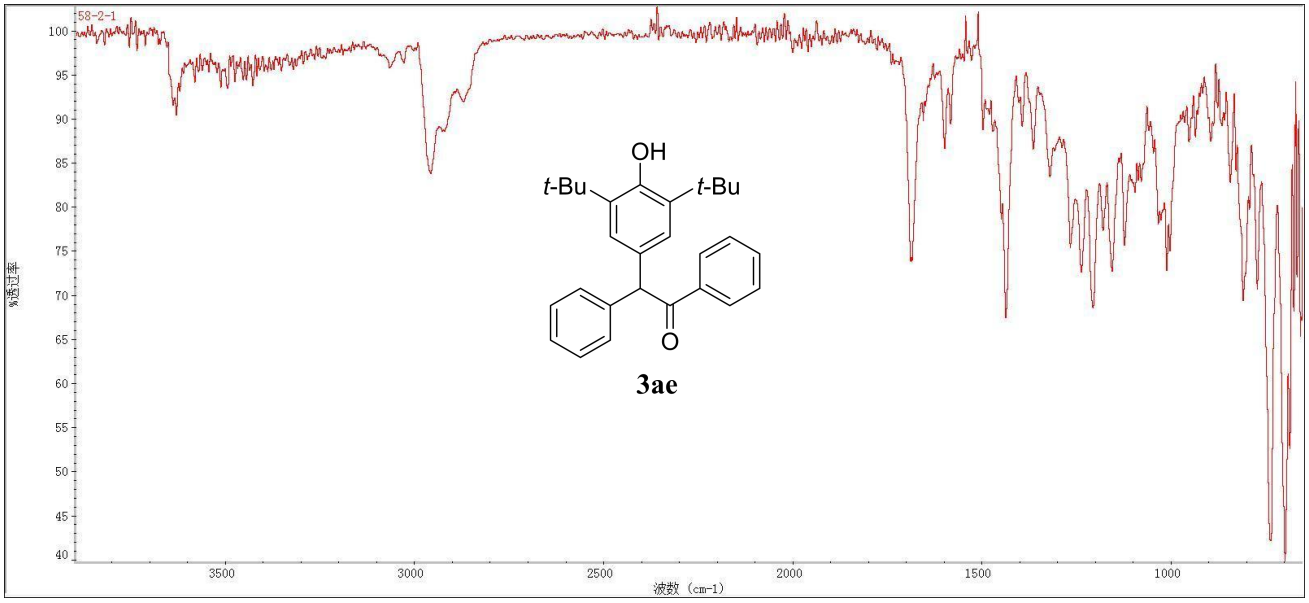

**ym-hc-4-1
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Me
O
3ad


ym-hc-58-2.10.fid
7.96
7.46
7.44
7.39
7.37
7.35
7.27
7.26
7.21
7.19
7.03
5.91
5.09
1.35
OH
t-Bu
t-Bu
O
2.06
8.37
2.02
1.00
1.00
18.01
f1 (ppm)

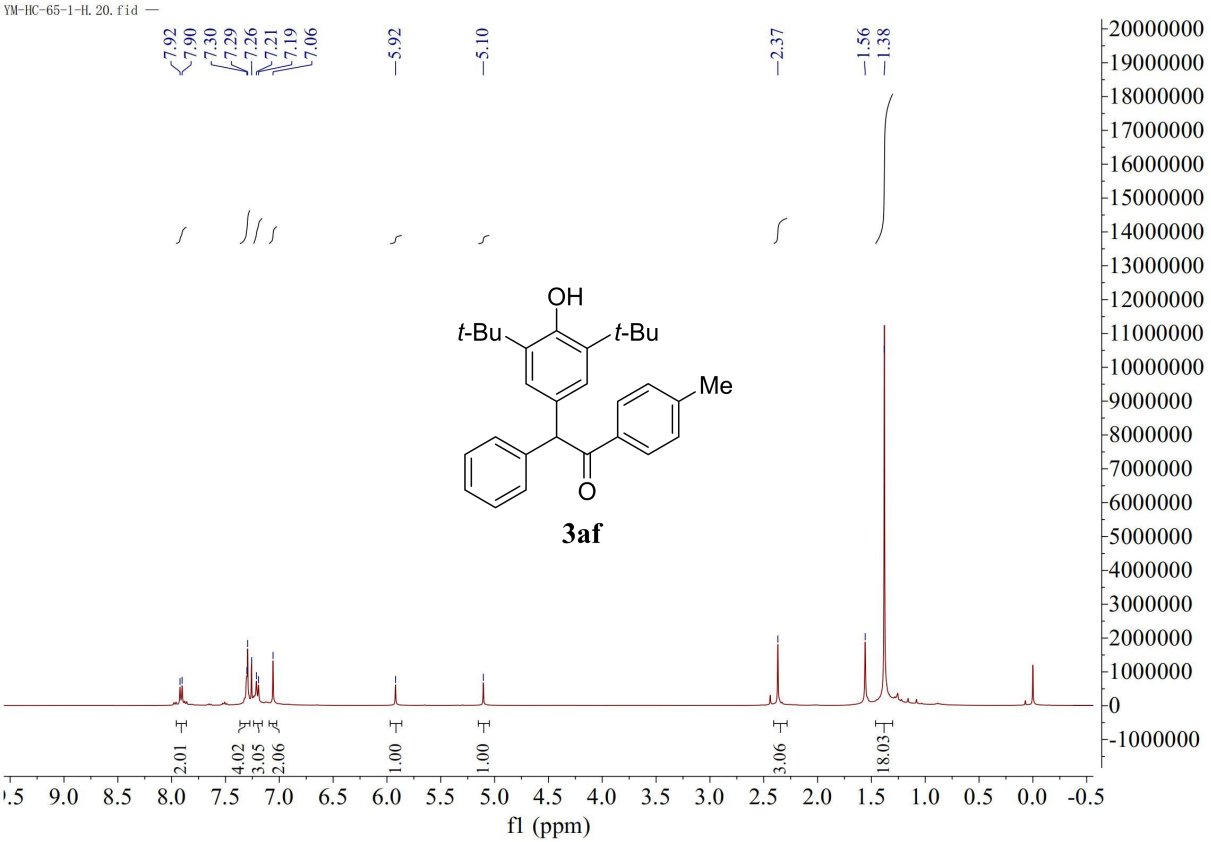
3ae


YM-HC-58-2-C.10.fid
198.9
152.9
139.7
137.3
135.9
132.8
129.5
129.1
128.9
128.6
128.6
126.9
125.9
77.4
77.0
76.7
59.3
34.4
30.3
OH
t-Bu
t-Bu
O
f1 (ppm)

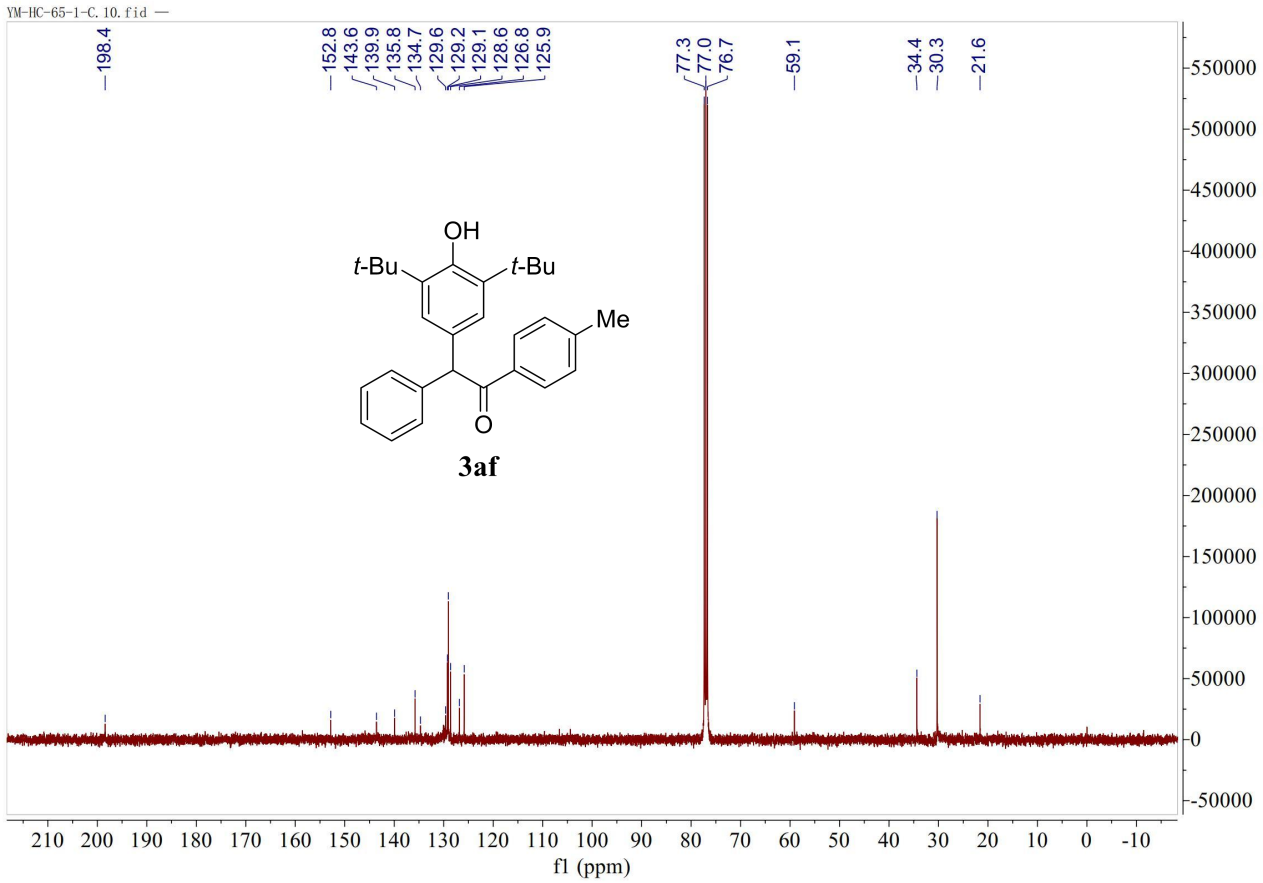
3ae

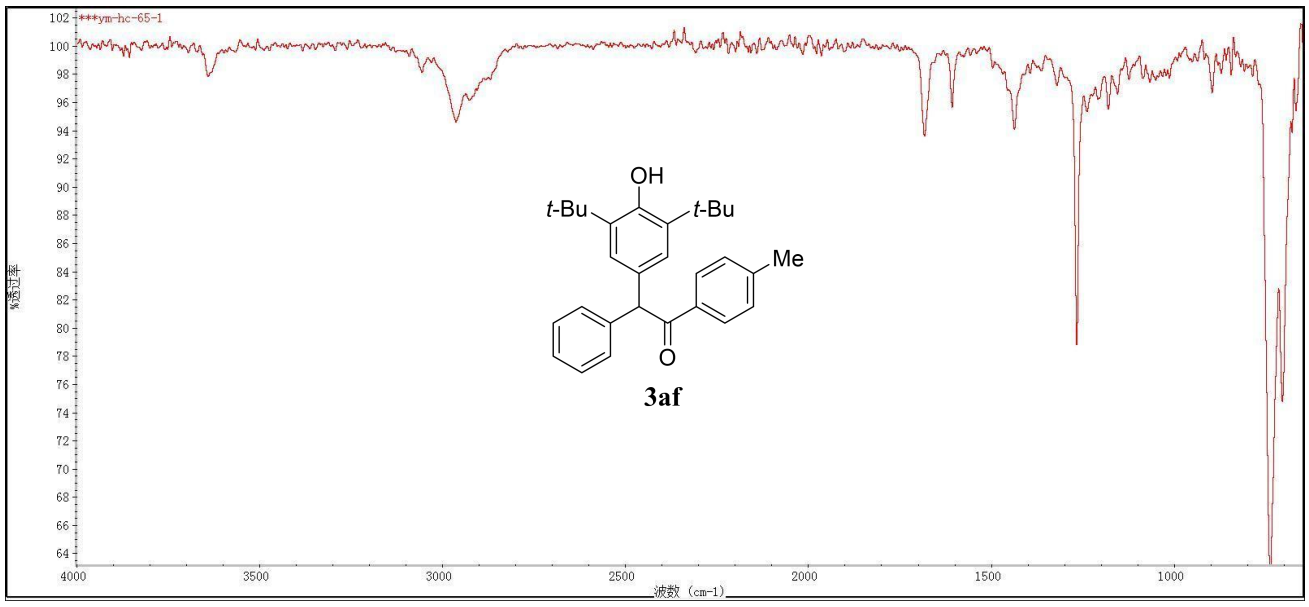

58-2-1
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
O

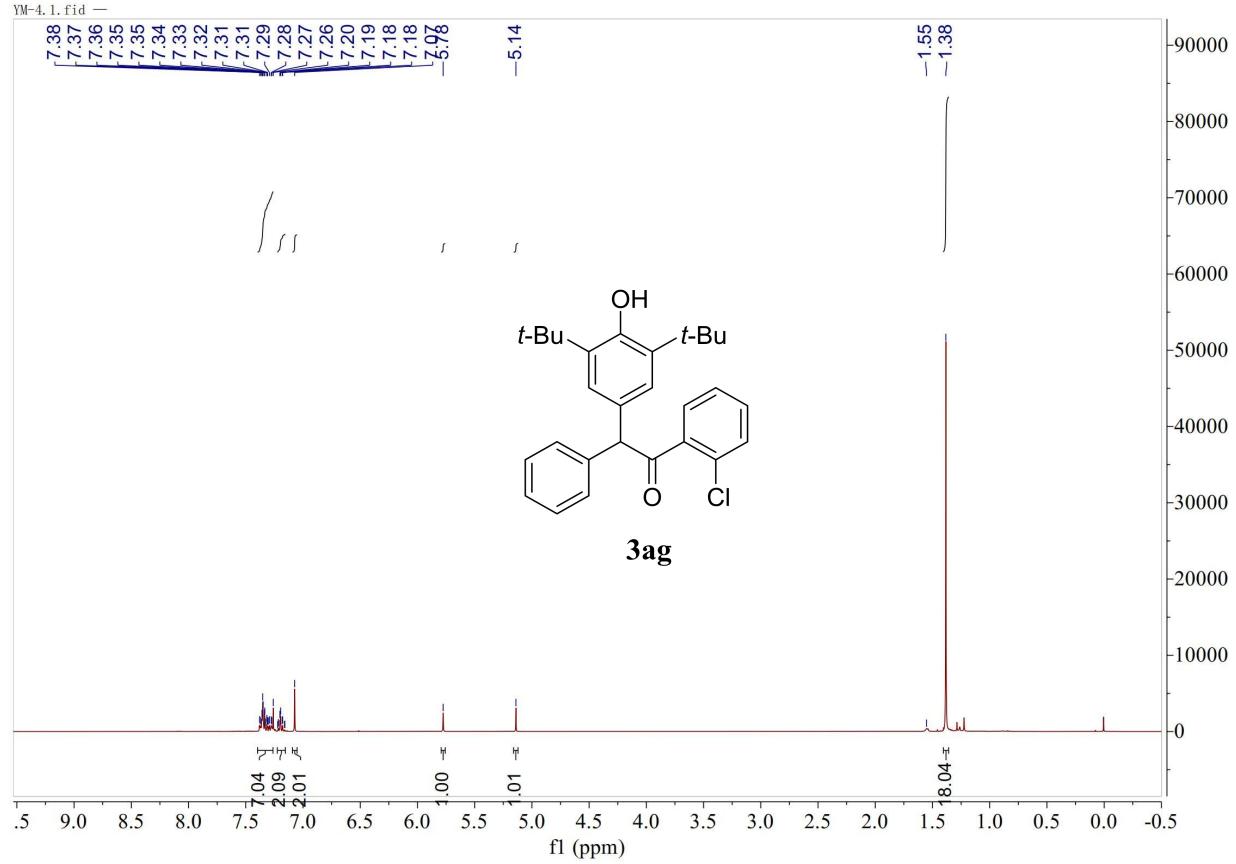
3ae


YM-HC-65-1-H.20.fid
7.92
7.90
7.30
7.29
7.26
7.21
7.19
7.06
5.92
5.10
2.37
1.56
1.38
OH
t-Bu
t-Bu
Me
O
2.01
4.02
3.05
2.06
1.00
1.00
3.06
18.03
f1 (ppm)

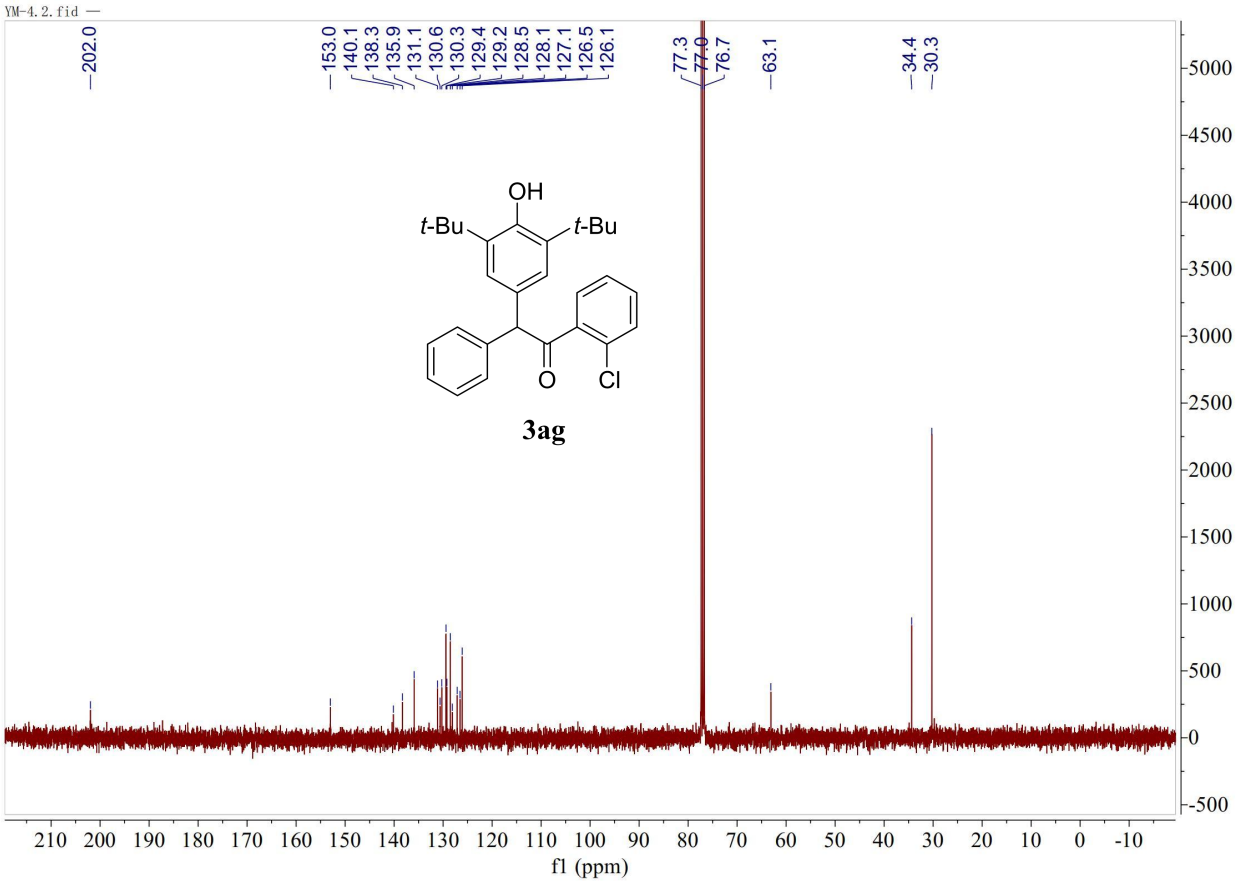
3af


YM-HC-65-1-C.10.fid
198.4
152.8
143.6
139.9
135.8
134.7
129.6
129.2
129.1
128.6
126.8
125.9
77.3
77.0
76.7
59.1
34.4
30.3
21.6
OH
t-Bu
t-Bu
Me
O
3af
f1 (ppm)

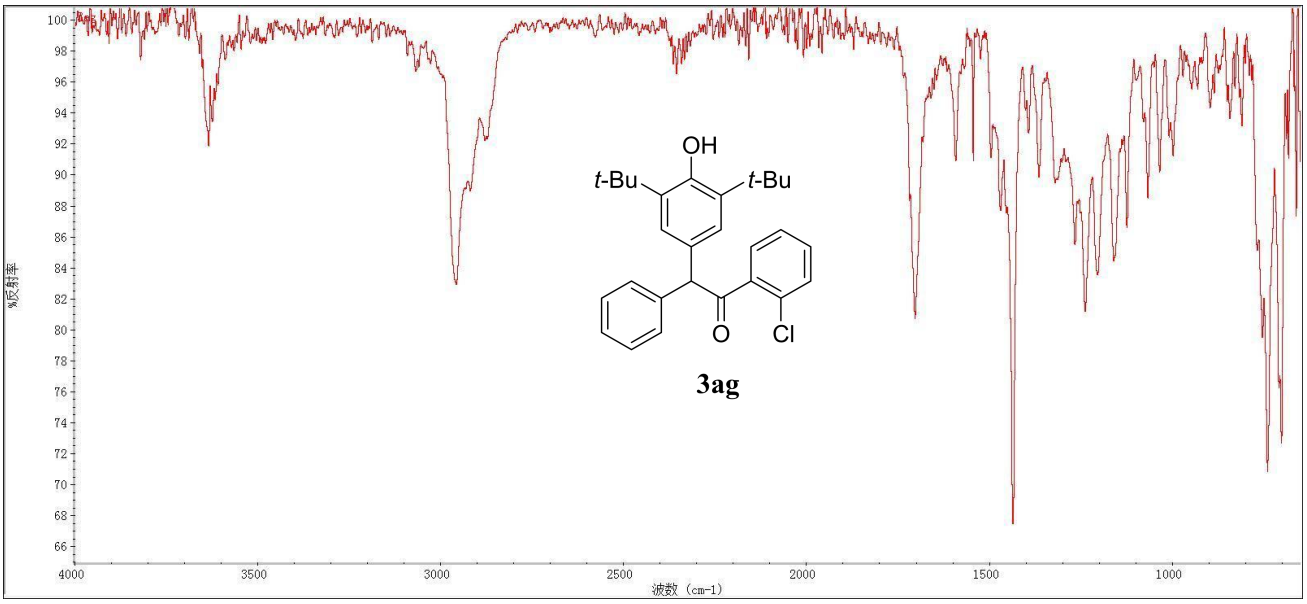

***ym-hc-65-1
%透过率
OH
t-Bu
t-Bu
Me
O
3af
波数 (cm-1)


YM-4.1.fid
7.38
7.37
7.36
7.35
7.35
7.34
7.33
7.32
7.31
7.31
7.29
7.28
7.27
7.26
7.20
7.19
7.18
7.18
5.14
1.55
1.38
OH
t-Bu
t-Bu
O
Cl
7.04
2.09
2.01
1.00
1.01
18.04
fl (ppm)

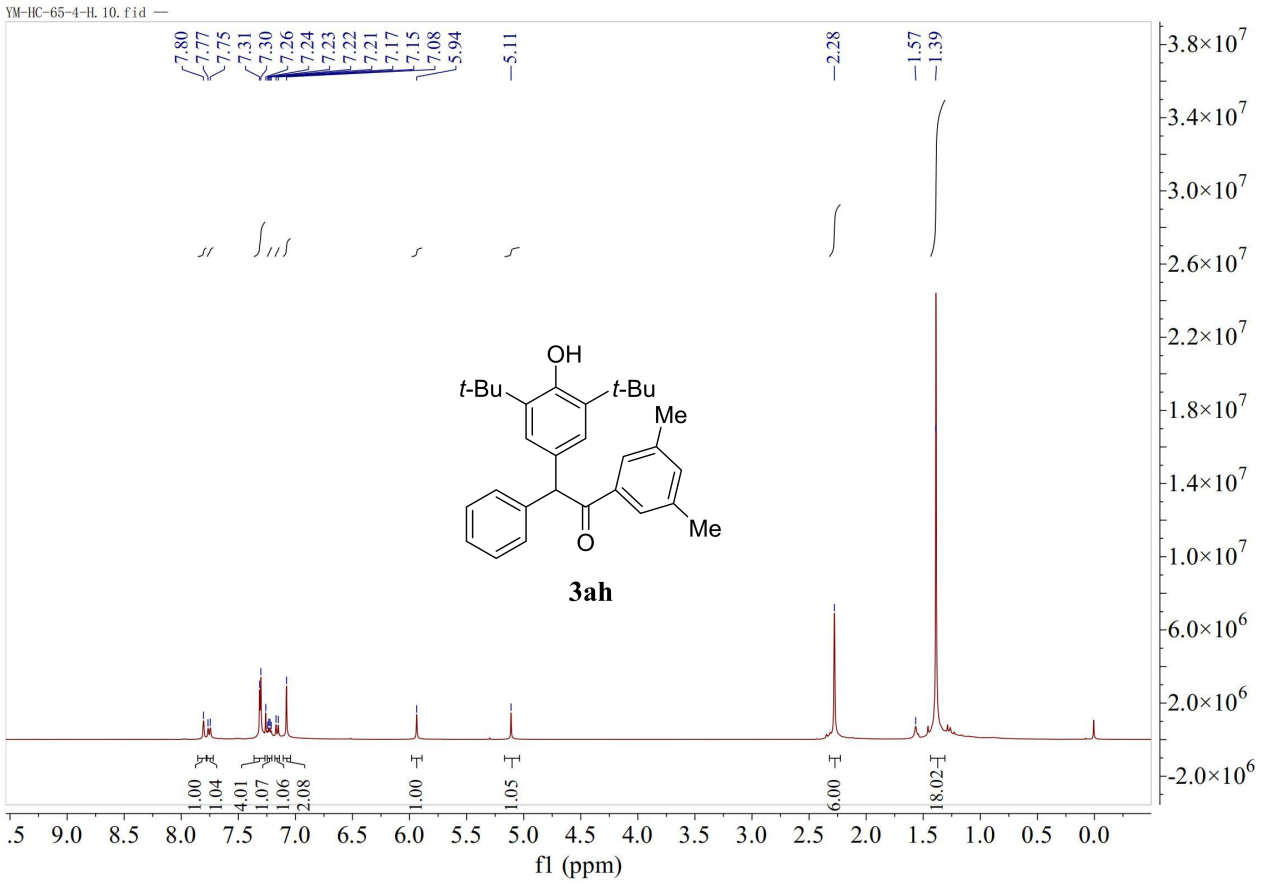
3ag


YM-4.2.fid
202.0
153.0
140.1
138.3
135.9
131.1
130.6
130.3
129.4
129.2
128.5
128.1
127.1
126.5
126.1
77.3
77.0
76.7
63.1
34.4
30.3
OH
t-Bu
t-Bu
O
Cl
fl (ppm)

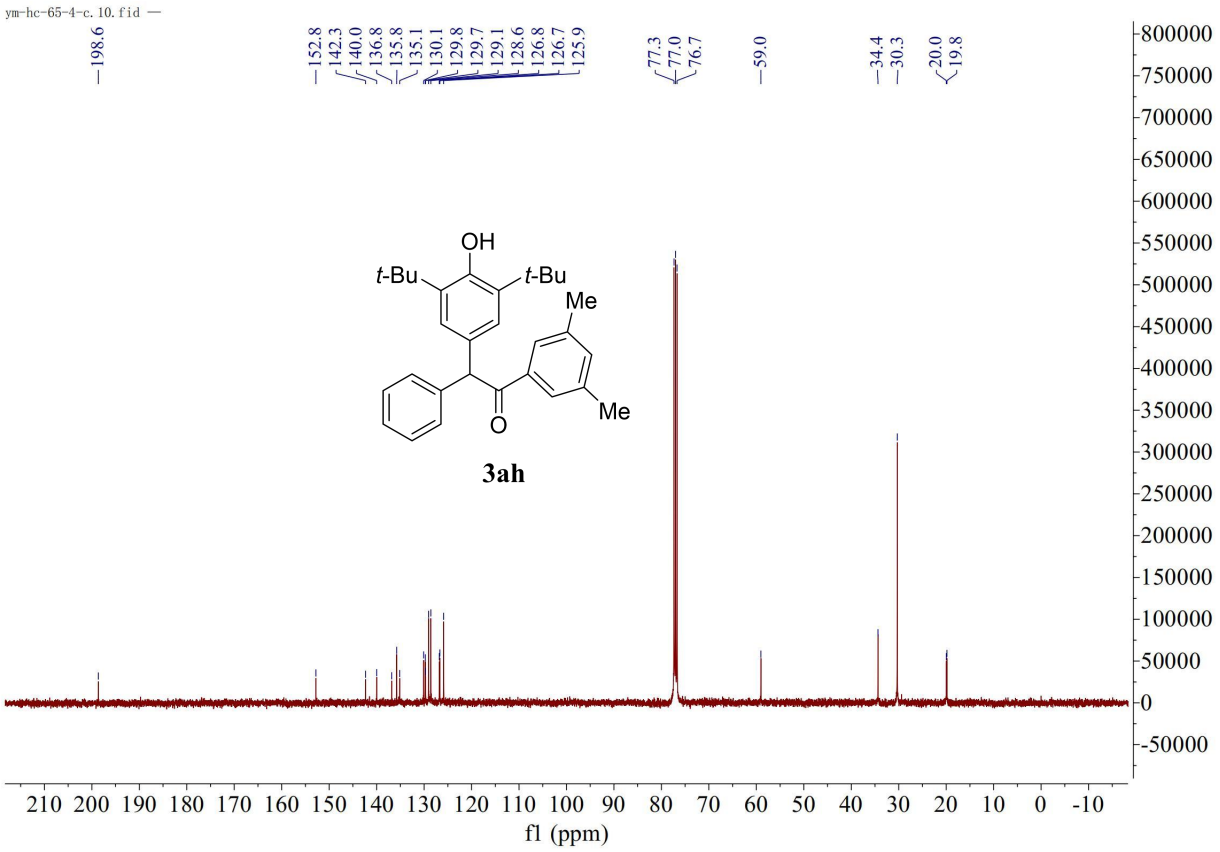
3ag

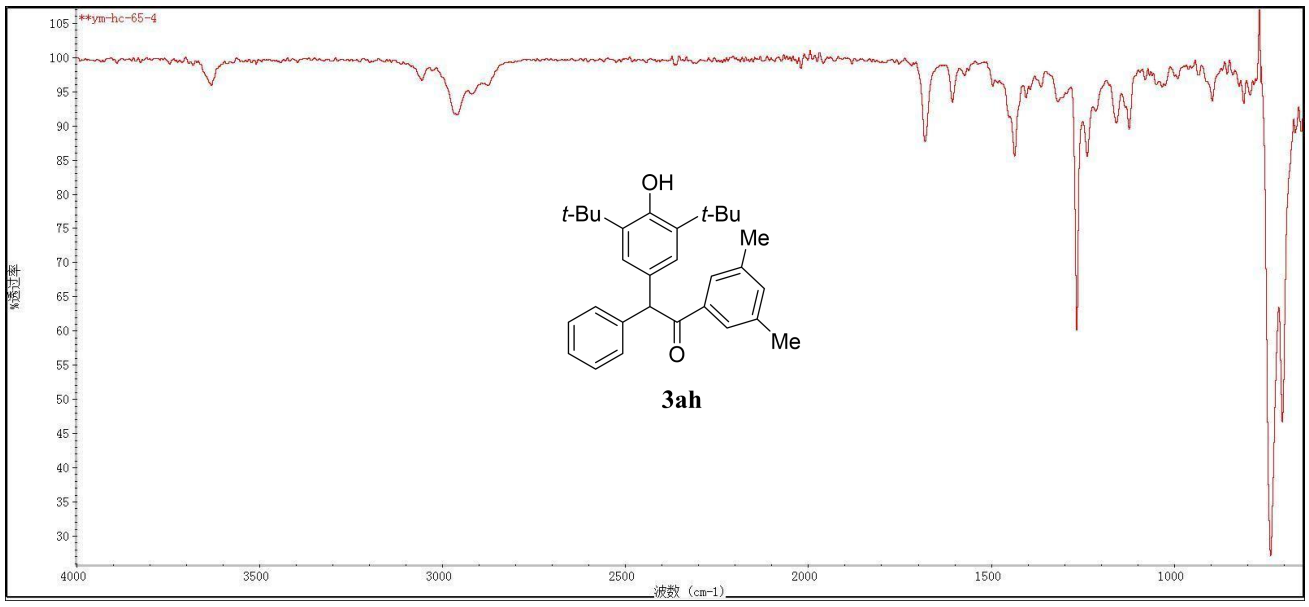

%反射率
波数 (cm-1)
OH
t-Bu
t-Bu
O
Cl

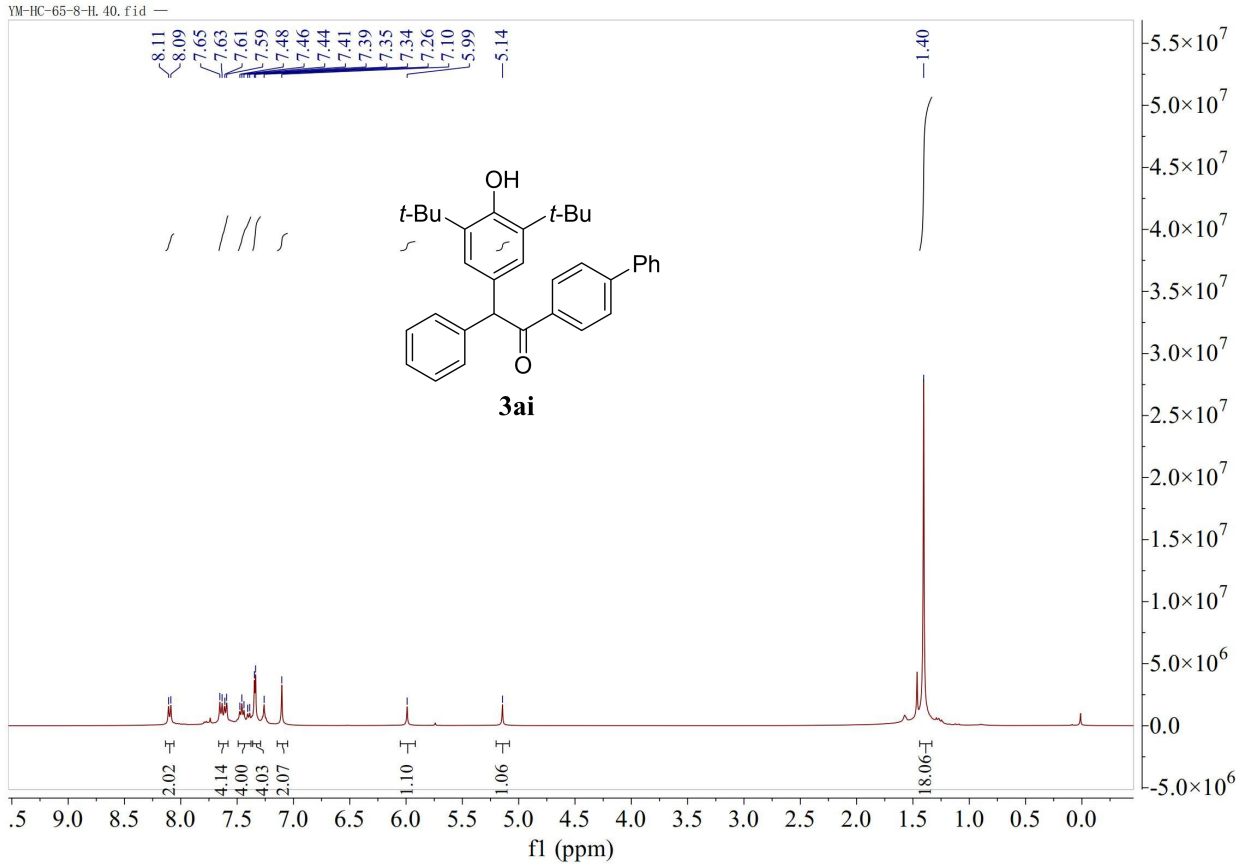
3ag

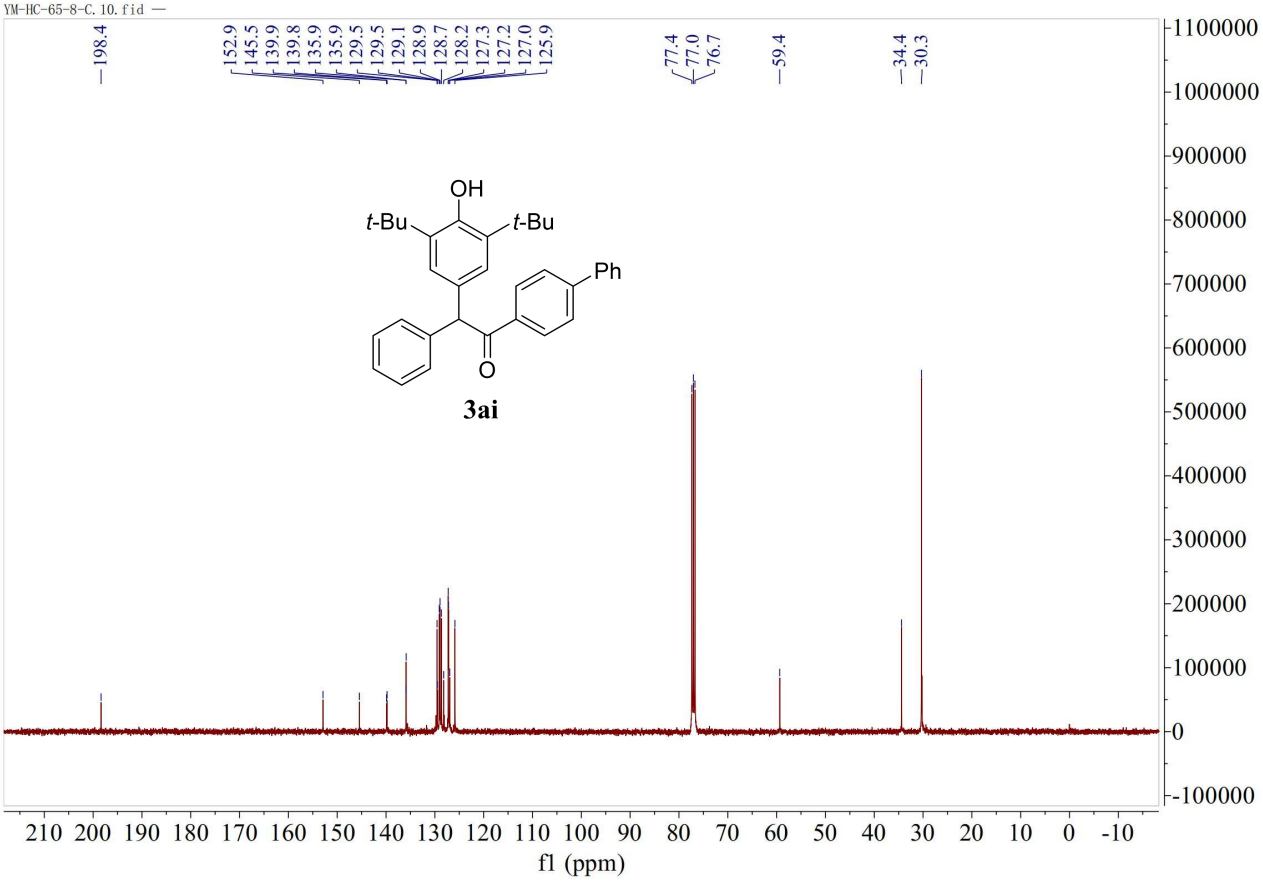

YM-HC-65-4-H.10.fid
7.80
7.77
7.75
7.31
7.30
7.26
7.24
7.23
7.22
7.21
7.17
7.15
7.08
5.94
5.11
2.28
1.57
1.39
OH
t-Bu
t-Bu
Me
Me
O
1.00
1.04
4.01
1.07
1.06
2.08
1.00
1.05
6.00
18.02
f1 (ppm)

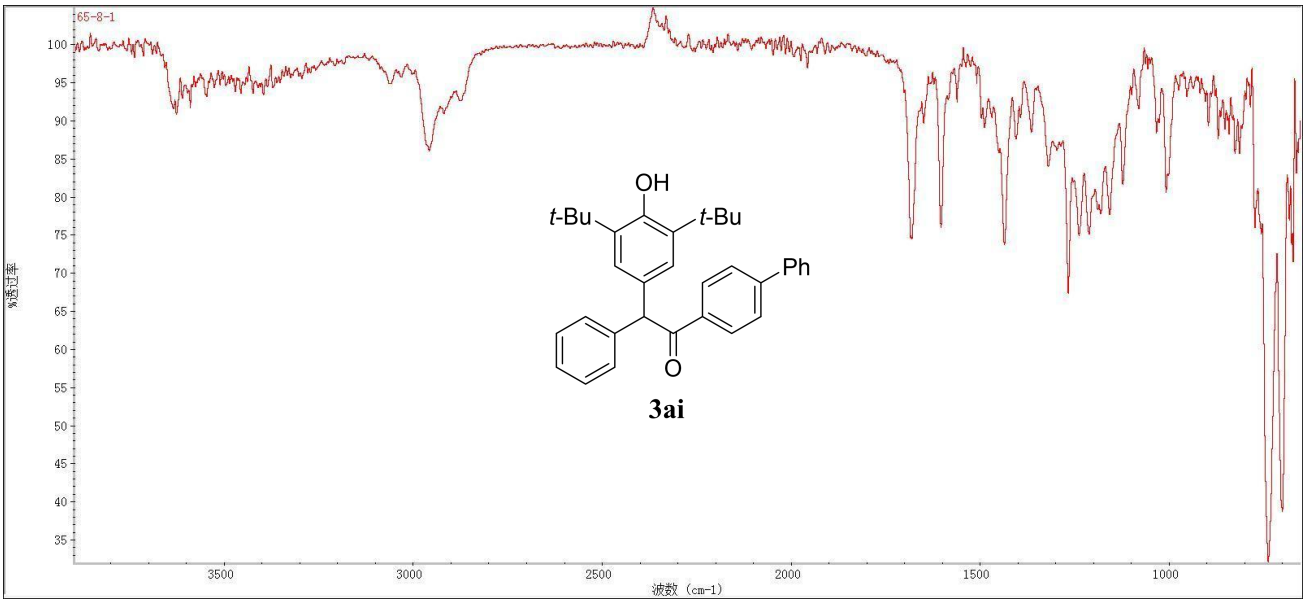
3ah


ym-hc-65-4-c.10.fid
198.6
152.8
142.3
140.0
136.8
135.8
135.1
130.1
129.8
129.7
129.1
128.6
126.8
126.7
125.9
77.3
77.0
76.7
59.0
34.4
30.3
20.0
19.8
OH
t-Bu
t-Bu
Me
Me
O
3ah
f1 (ppm)

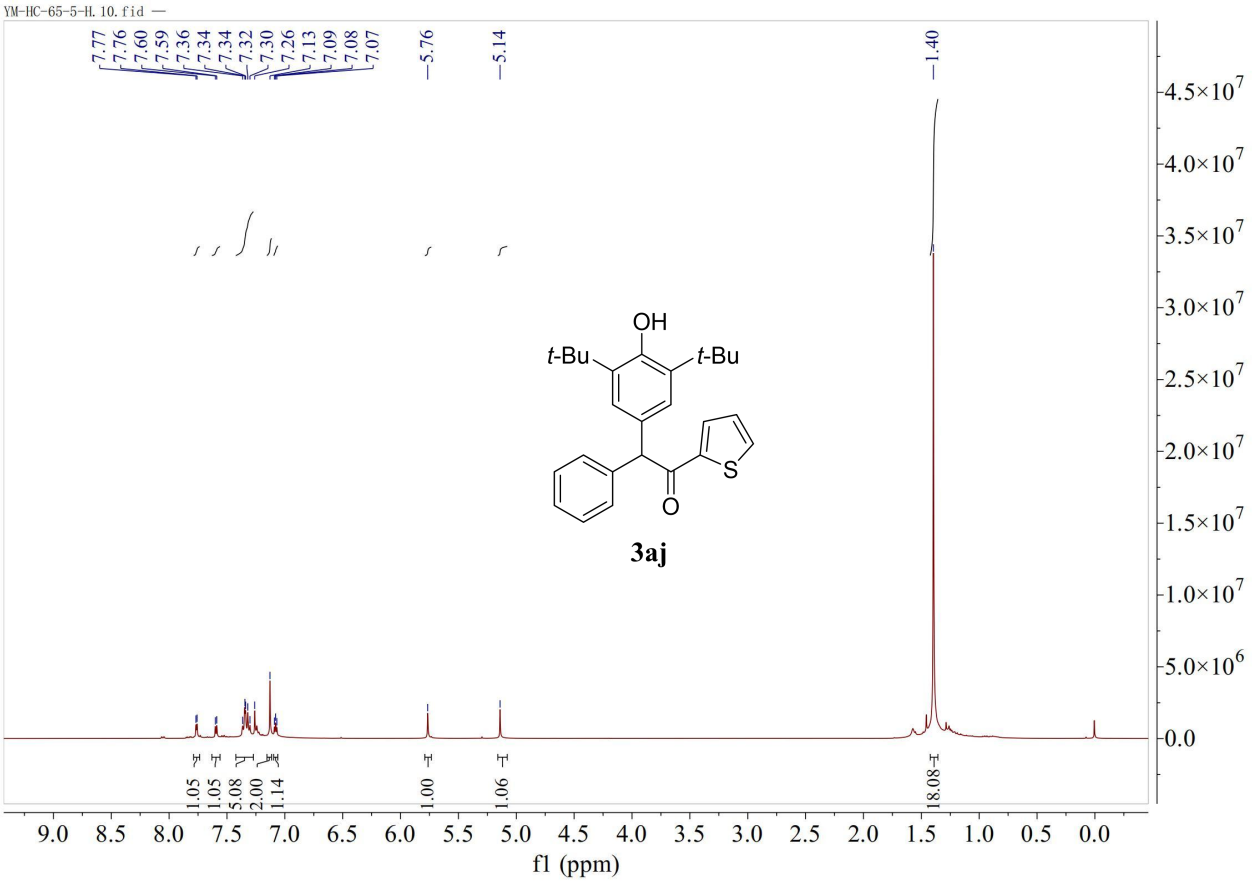

**ym-hc-65-4
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Me
Me
O
3ah


YM-HC-65-8-H.40.fid
8.11
8.09
7.65
7.63
7.61
7.59
7.48
7.46
7.44
7.41
7.39
7.35
7.34
7.26
7.10
5.99
5.14
1.40
OH
t-Bu
t-Bu
Ph
O
3ai
2.02
4.14
4.00
4.03
2.07
1.10
1.06
18.06
fl (ppm)

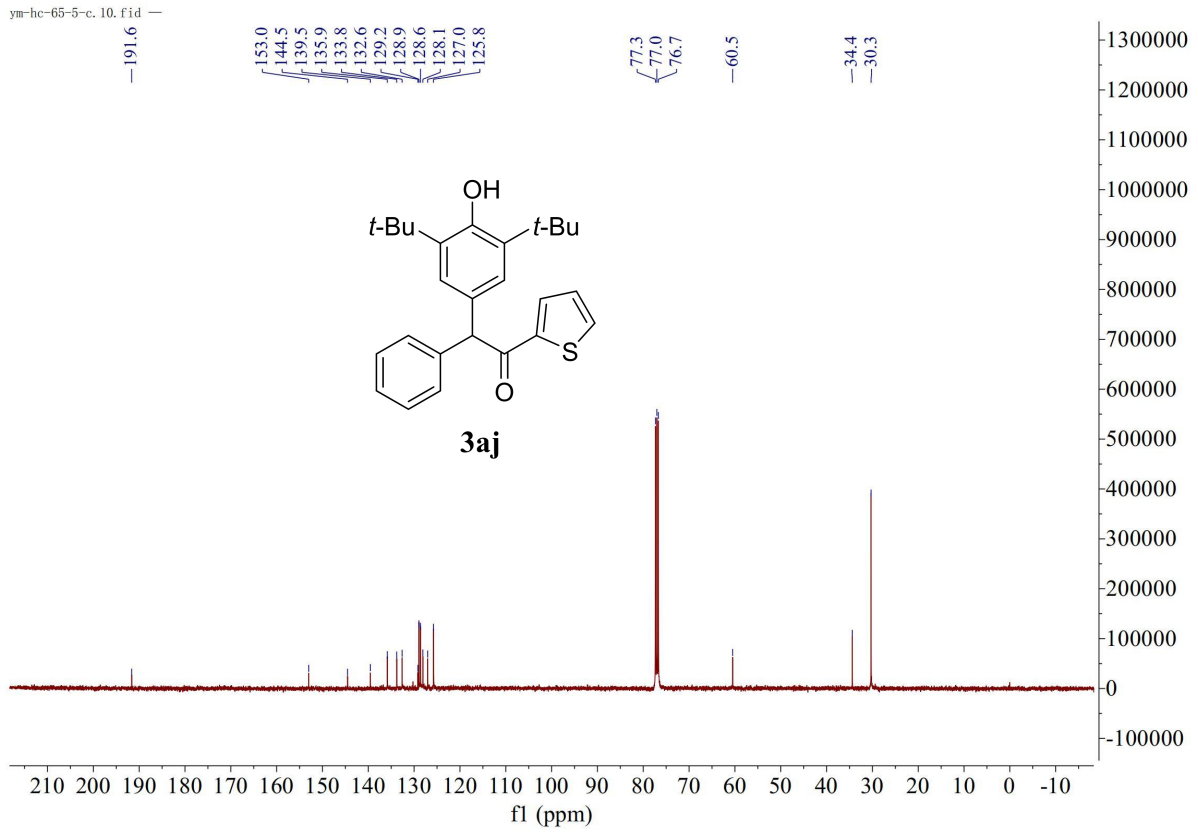

YM-HC-65-8-C.10.fid
198.4
152.9
145.5
139.9
139.8
135.9
135.9
129.5
129.5
129.1
128.9
128.7
128.2
127.3
127.2
127.0
125.9
77.4
77.0
76.7
59.4
34.4
30.3
OH
t-Bu
t-Bu
Ph
O
3ai
fl (ppm)

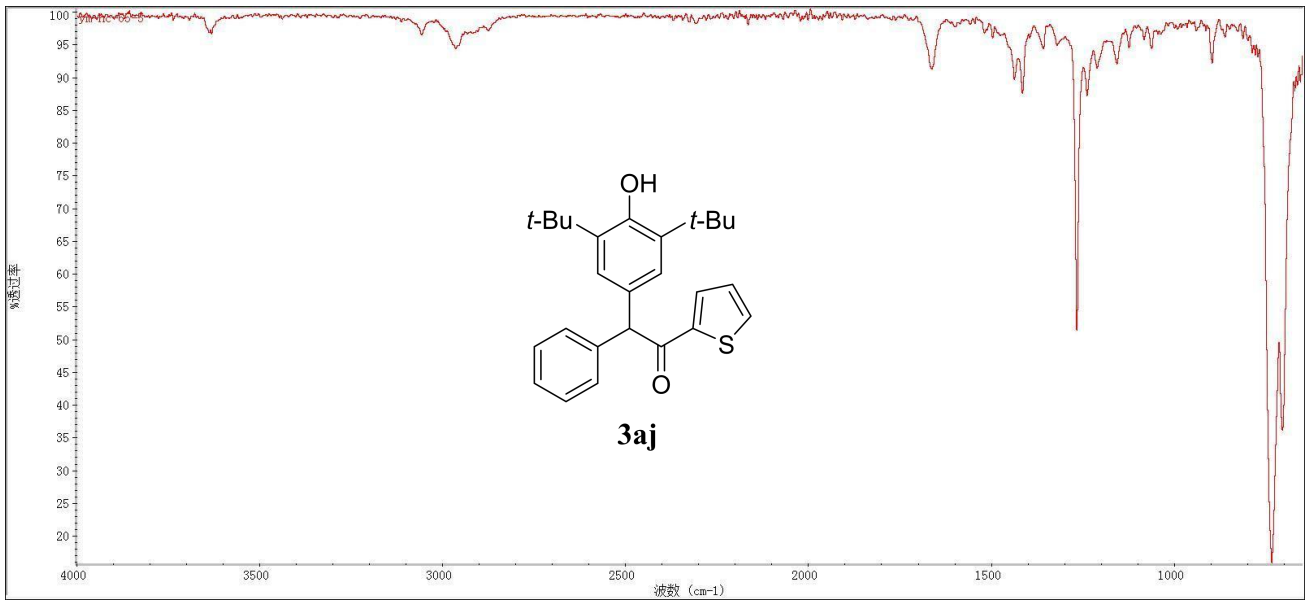

65-8-1
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Ph
O

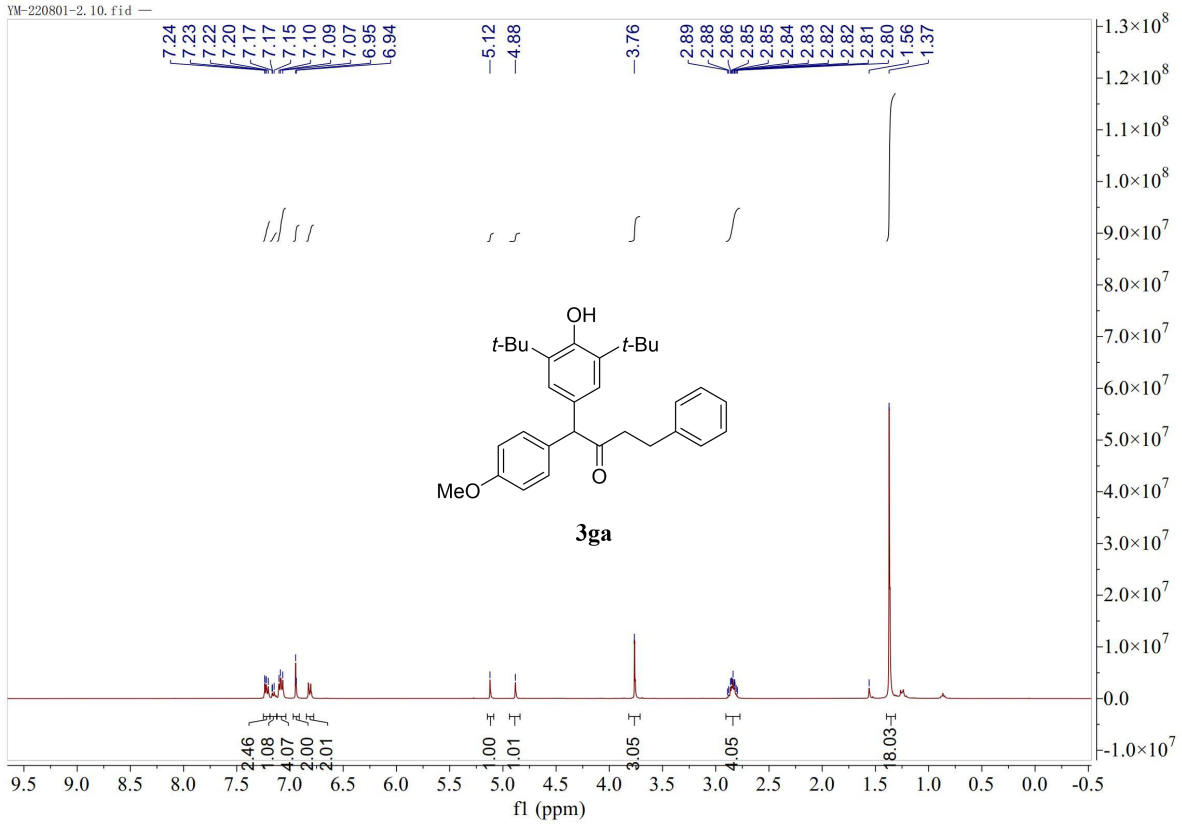
3ai

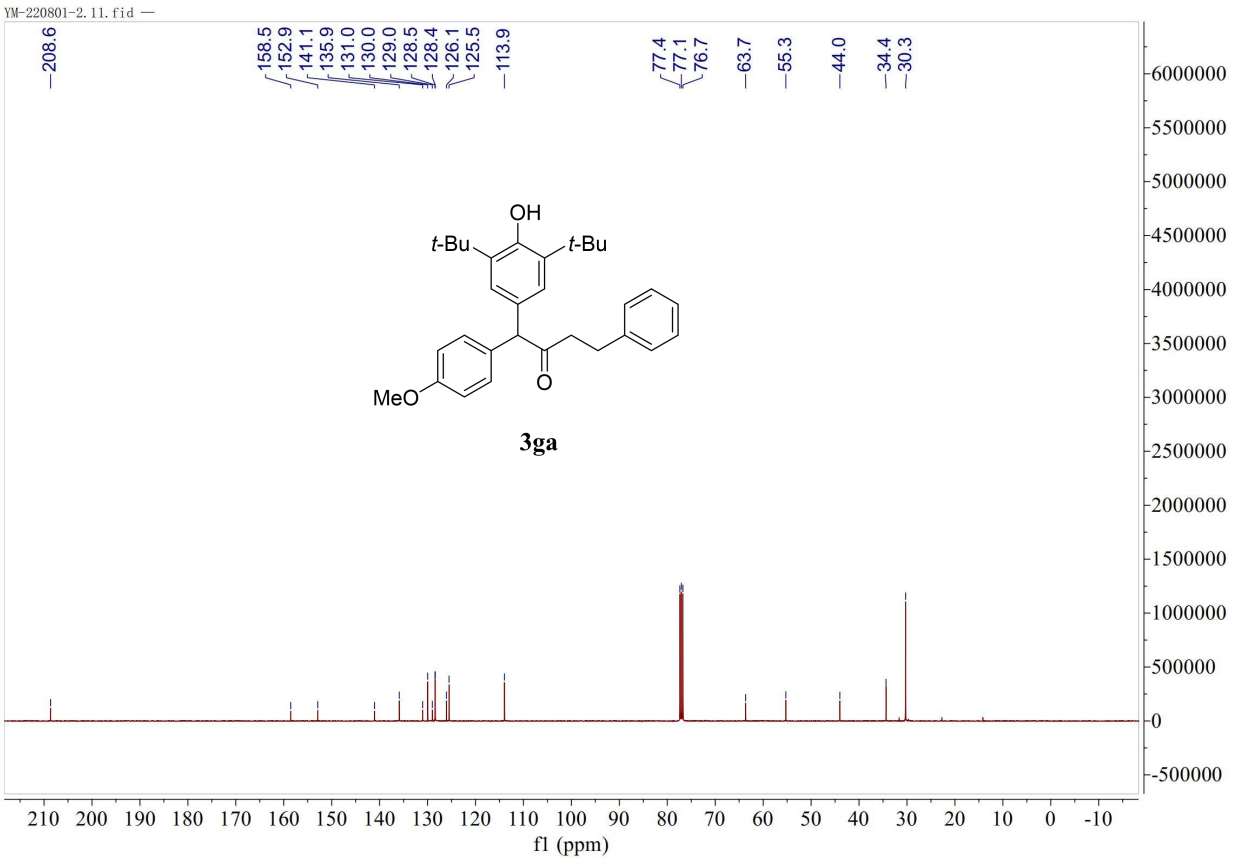

YM-HC-65-5-H.10.fid
7.77
7.76
7.60
7.59
7.36
7.34
7.34
7.32
7.30
7.26
7.13
7.09
7.08
7.07
5.76
5.14
1.40
OH
t-Bu
t-Bu
S
O
1.05
1.05
5.08
2.00
1.14
1.00
1.06
18.08
f1 (ppm)

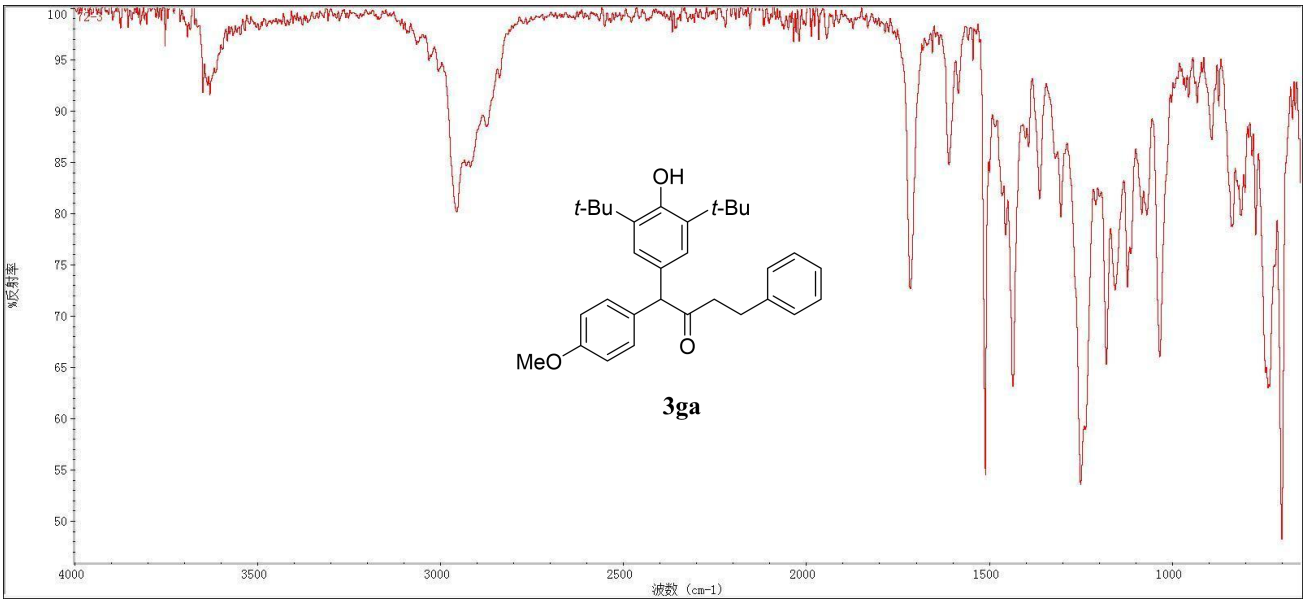
3aj


ym-hc-65-5-c.10.fid
191.6
153.0
144.5
139.5
135.9
133.8
132.6
129.2
128.9
128.6
128.1
127.0
125.8
77.3
77.0
76.7
60.5
34.4
30.3
OH
t-Bu
t-Bu
S
O
3aj
fl (ppm)

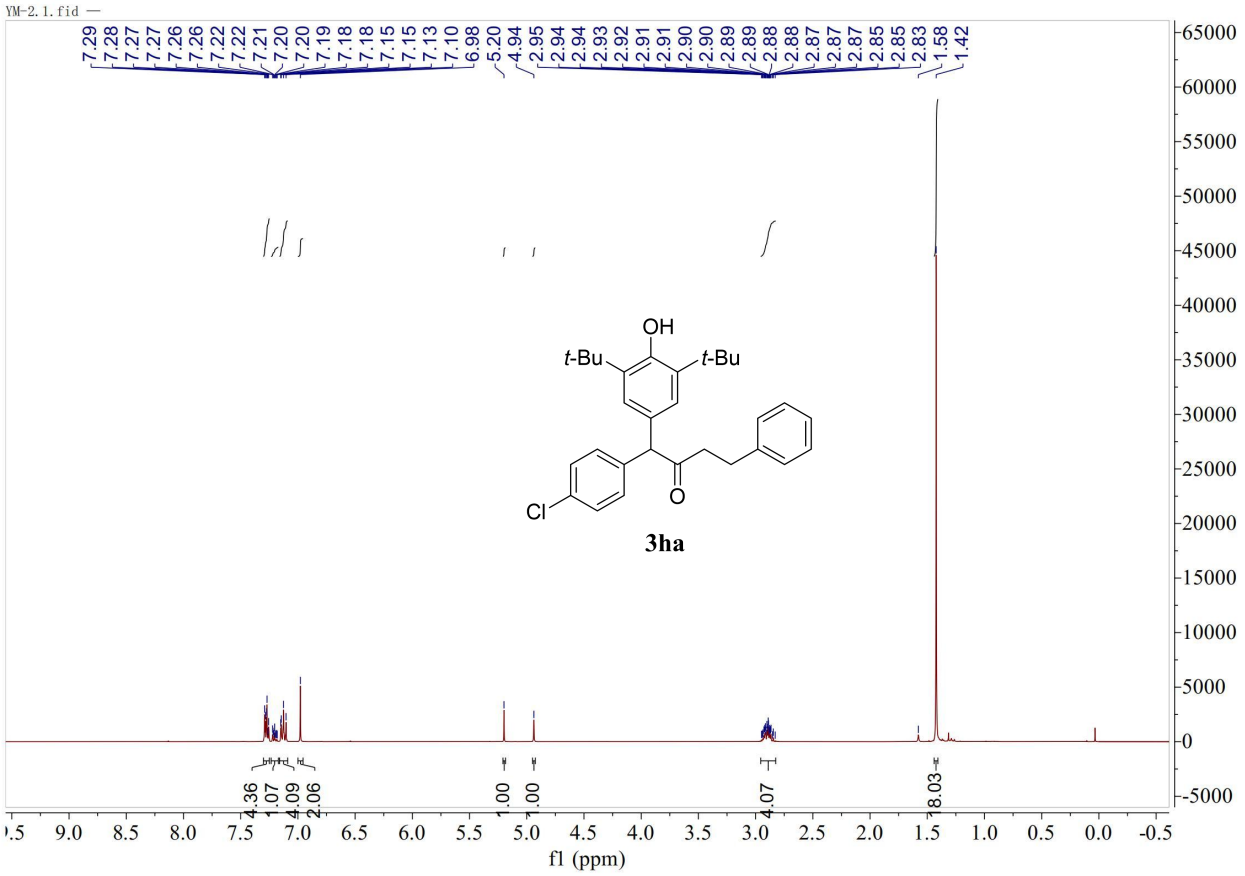

%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
S
O
3aj


YM-220801-2.10.fid
7.24
7.23
7.22
7.20
7.17
7.17
7.15
7.10
7.09
7.07
6.95
6.94
5.12
4.88
3.76
2.89
2.88
2.86
2.85
2.85
2.84
2.83
2.82
2.82
2.81
2.80
1.56
1.37
OH
t-Bu
t-Bu
MeO
O
3ga
2.46
1.08
4.07
2.00
2.01
1.00
1.01
3.05
4.05
18.03
fl (ppm)

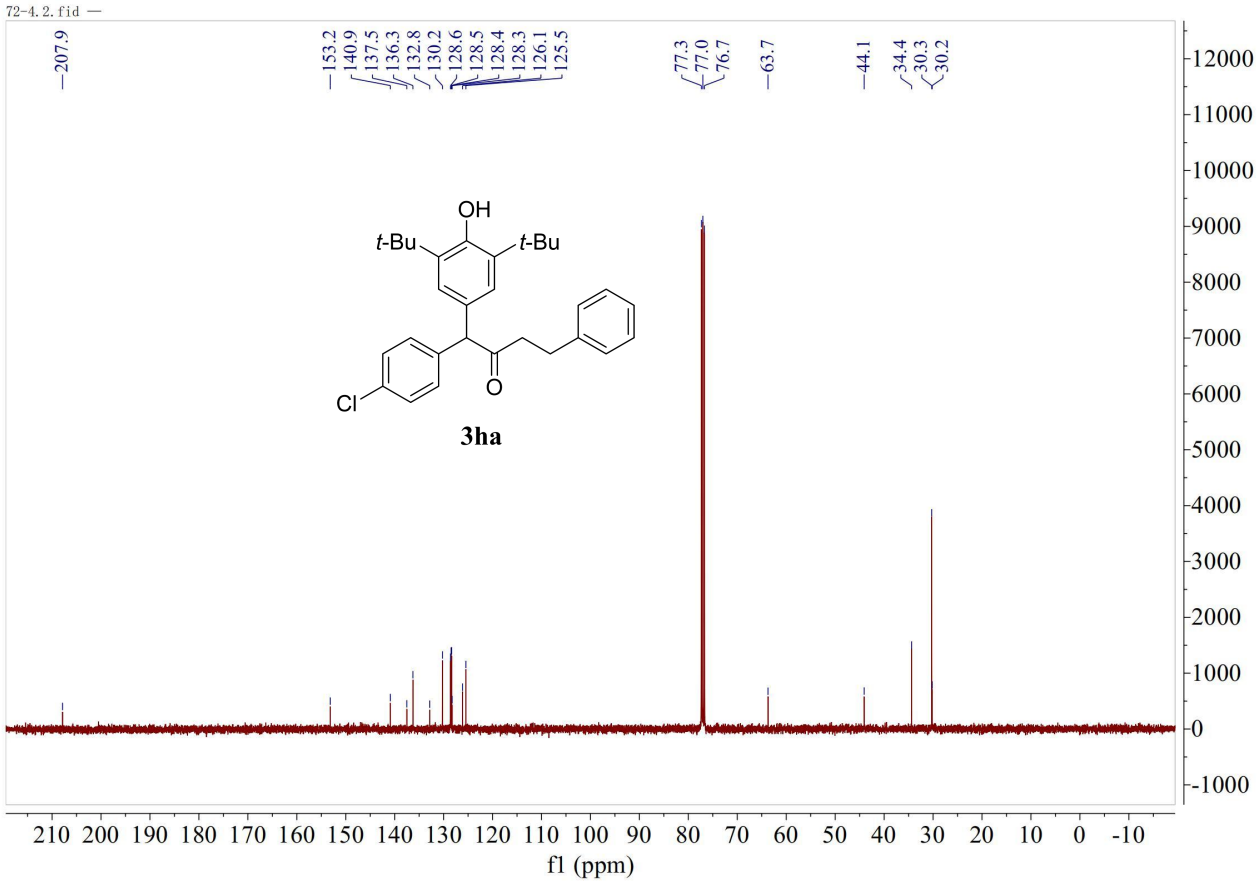

YM-220801-2.11.fid
208.6
158.5
152.9
141.1
135.9
131.0
130.0
129.0
128.5
128.4
126.1
125.5
113.9
77.4
77.1
76.7
63.7
55.3
44.0
34.4
30.3
OH
t-Bu
t-Bu
MeO
O
3ga
fl (ppm)

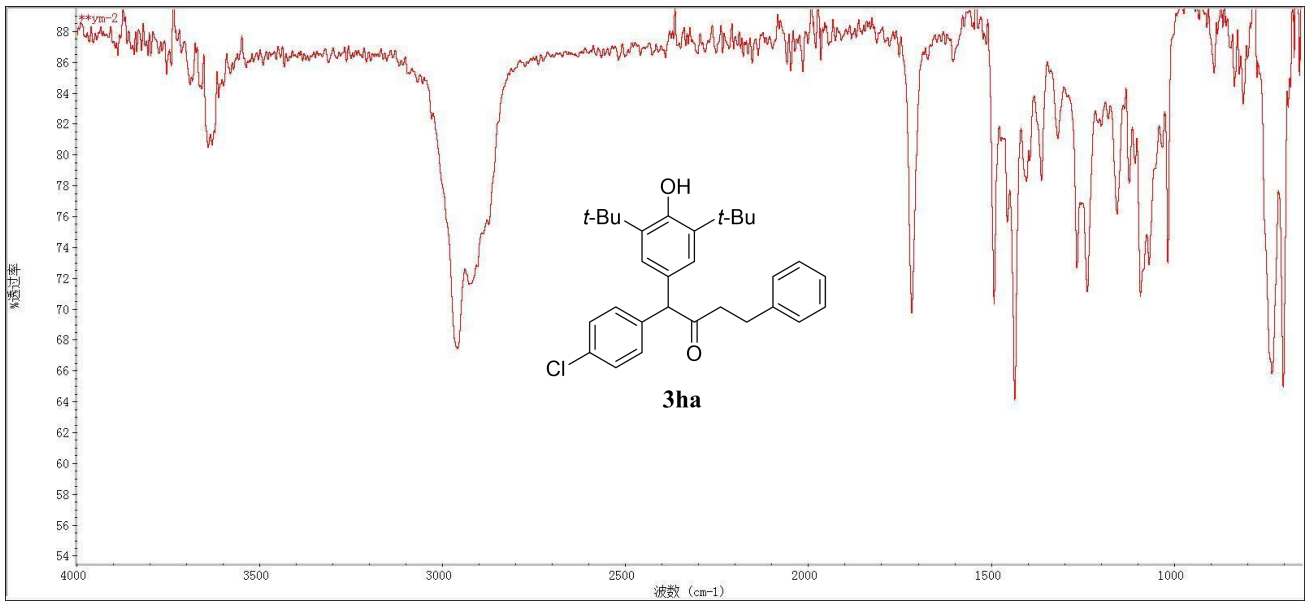


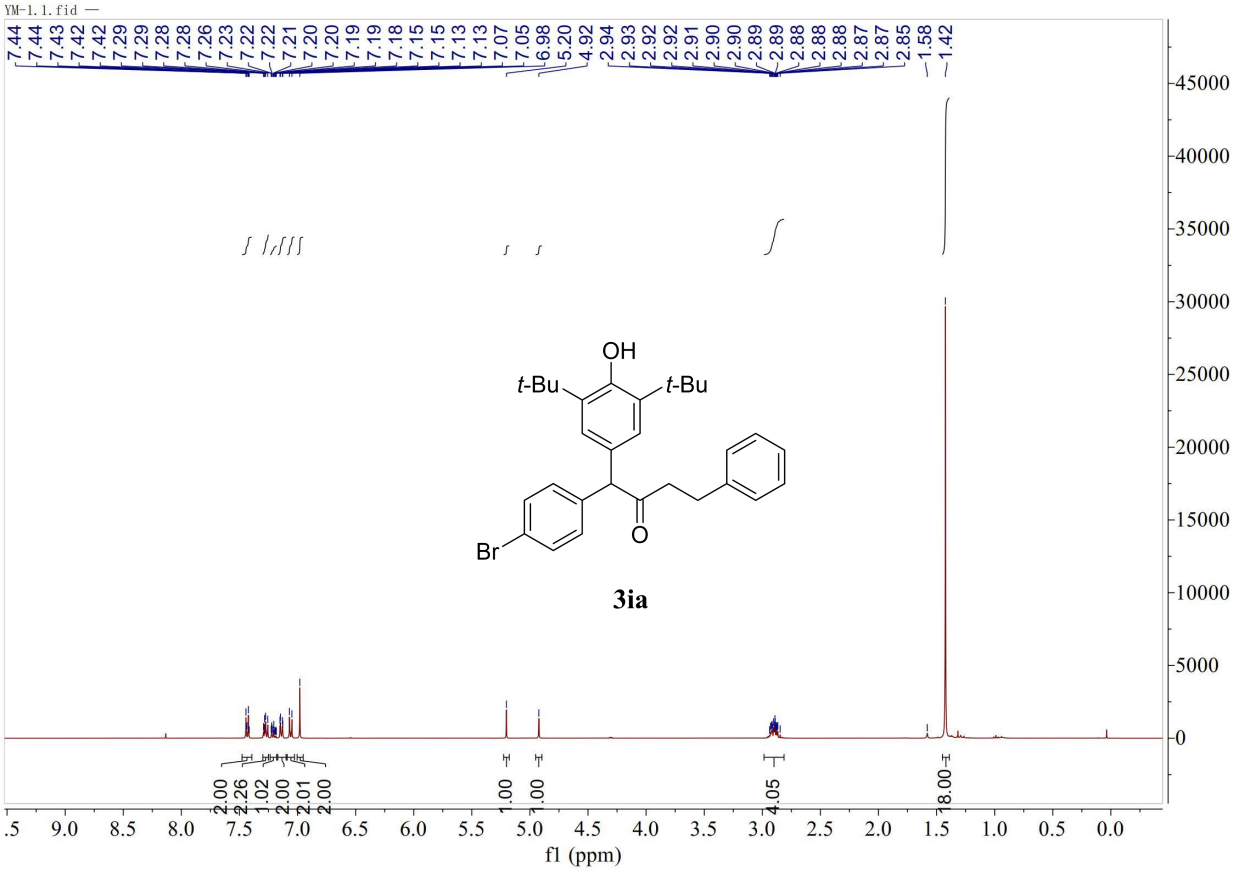
3ga

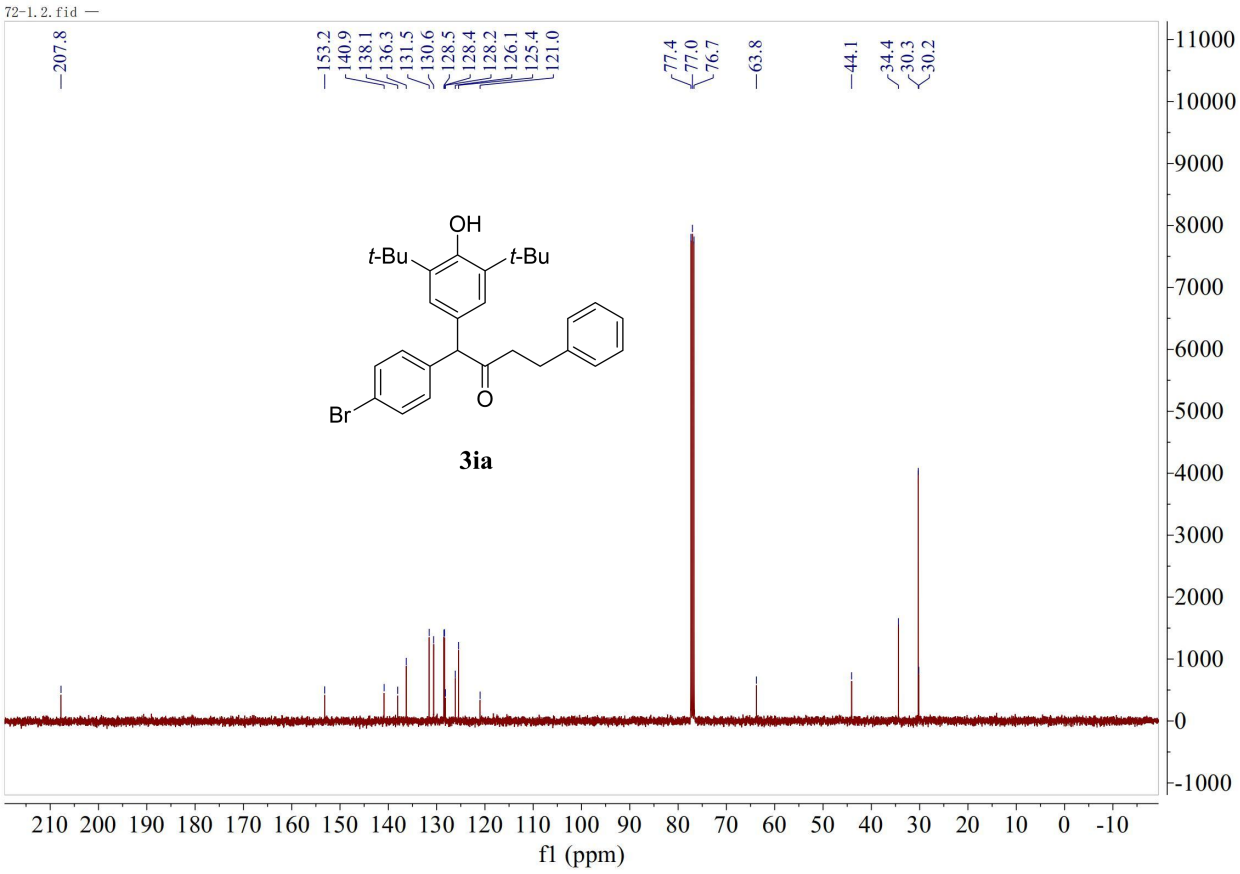


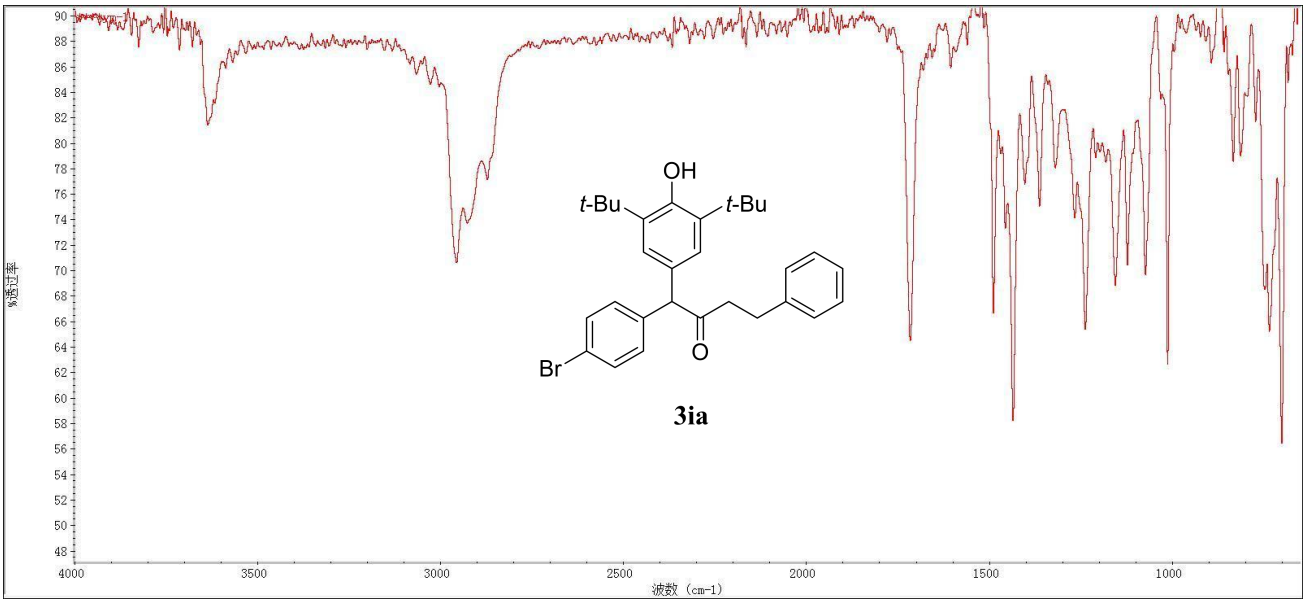
3ha


72-4.2.fid
207.9
153.2
140.9
137.5
136.3
132.8
130.2
128.6
128.5
128.4
128.3
126.1
125.5
77.3
77.0
76.7
63.7
44.1
34.4
30.3
30.2
OH
t-Bu
t-Bu
Cl
O
3ha
f1 (ppm)

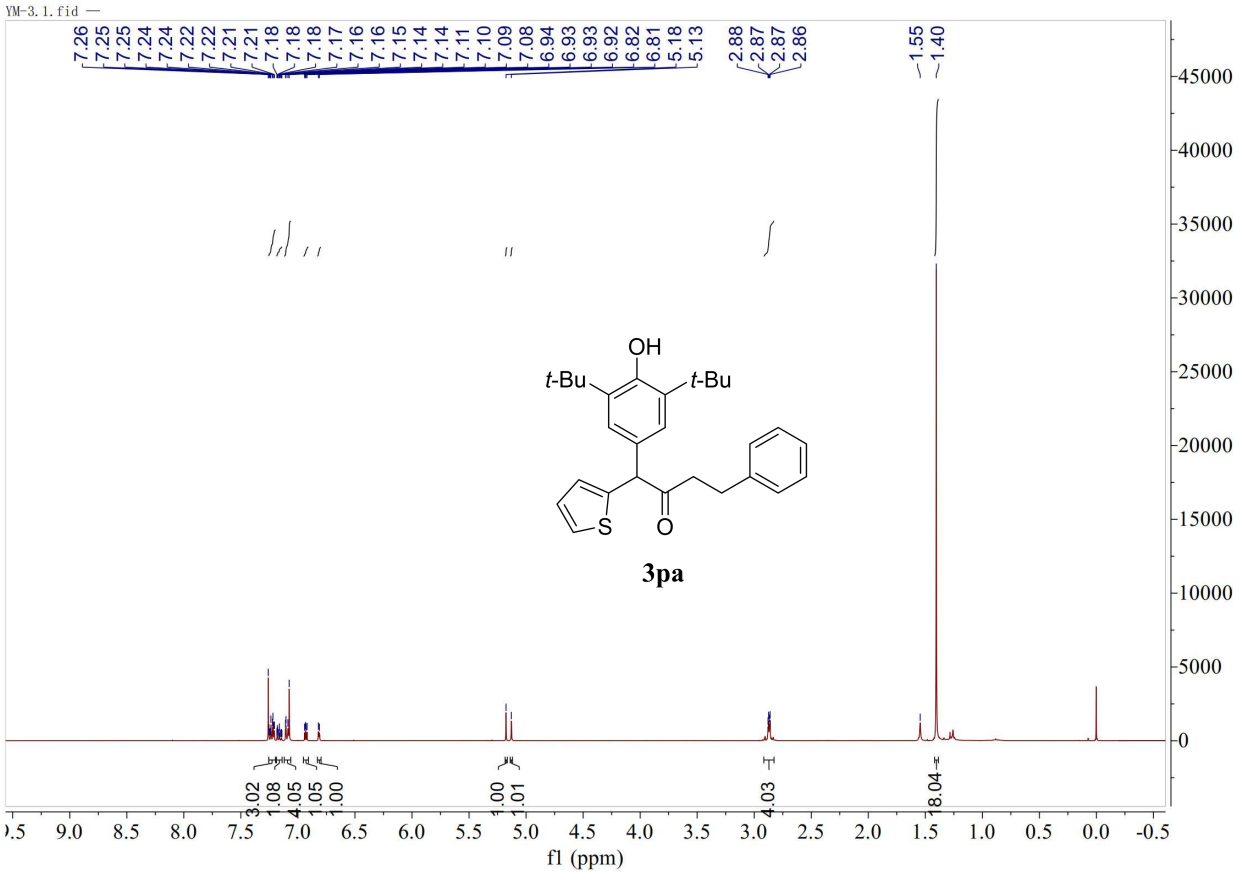

OH
t-Bu
t-Bu
Cl
O
3ha
%透过率
波数 (cm-1)


YM-1.1.fid
7.44 7.44 7.43 7.42 7.42 7.29 7.29 7.28 7.28 7.26 7.23 7.22 7.22 7.21 7.20 7.20 7.19 7.19 7.18 7.15 7.15 7.13 7.13 7.07 7.05 6.98 5.20 4.92 2.94 2.93 2.92 2.92 2.91 2.90 2.90 2.89 2.89 2.88 2.88 2.88 2.87 2.85 1.58 1.42
OH
t-Bu
t-Bu
Br
O
3ia
2.00 2.26 1.02 2.00 2.01 2.00 1.00 1.00 4.05 18.00
f1 (ppm)

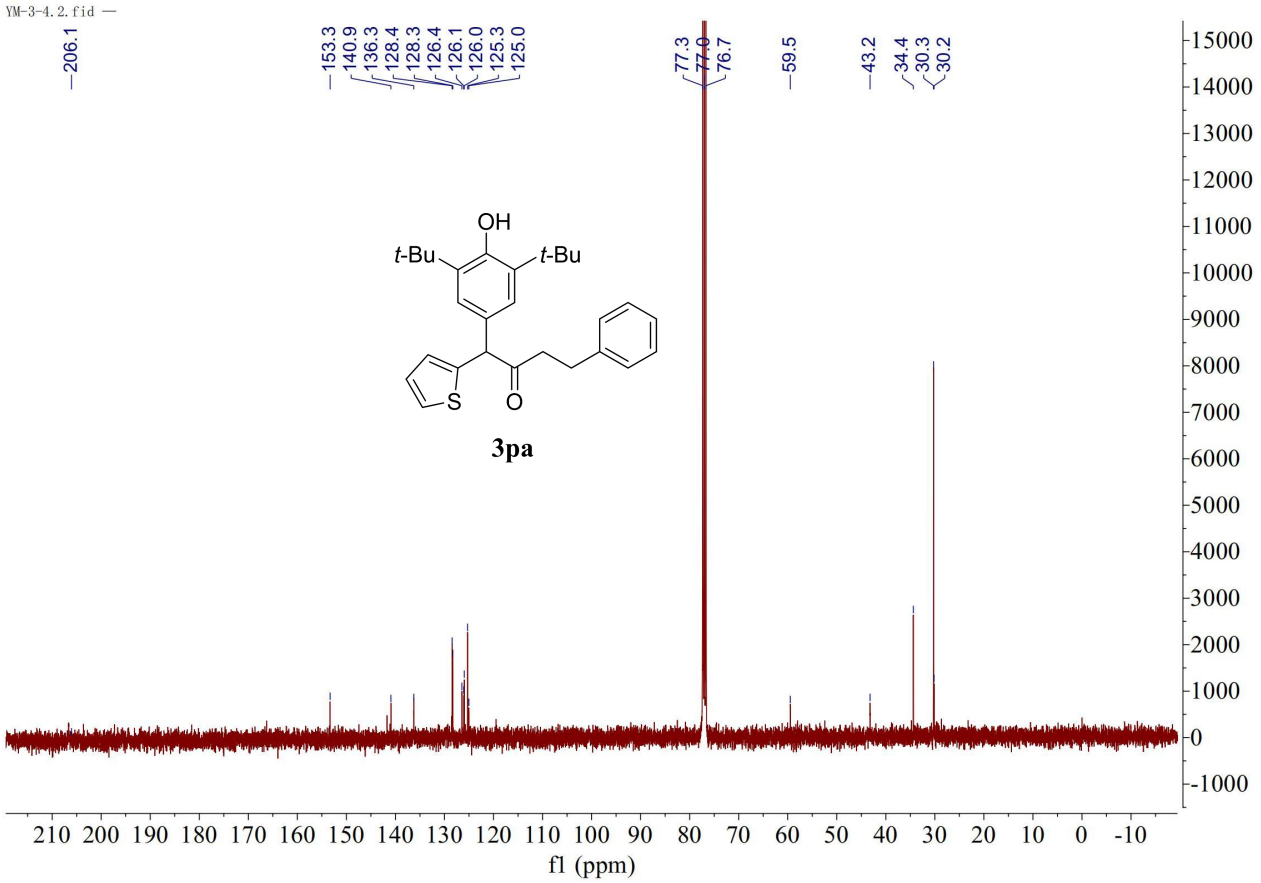

72-1.2.fid
207.8 153.2 140.9 138.1 136.3 131.5 130.6 128.5 128.4 128.2 126.1 125.4 121.0 77.4 77.0 76.7 63.8 44.1 34.4 30.3 30.2
OH
t-Bu
t-Bu
Br
O
3ia
f1 (ppm)

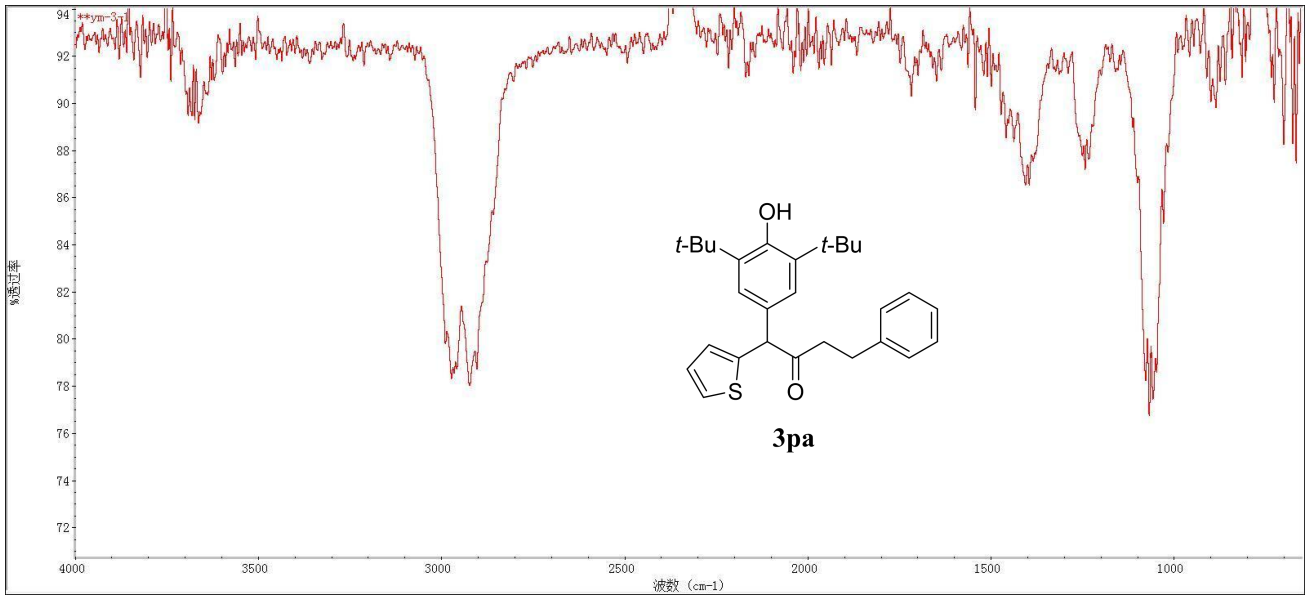


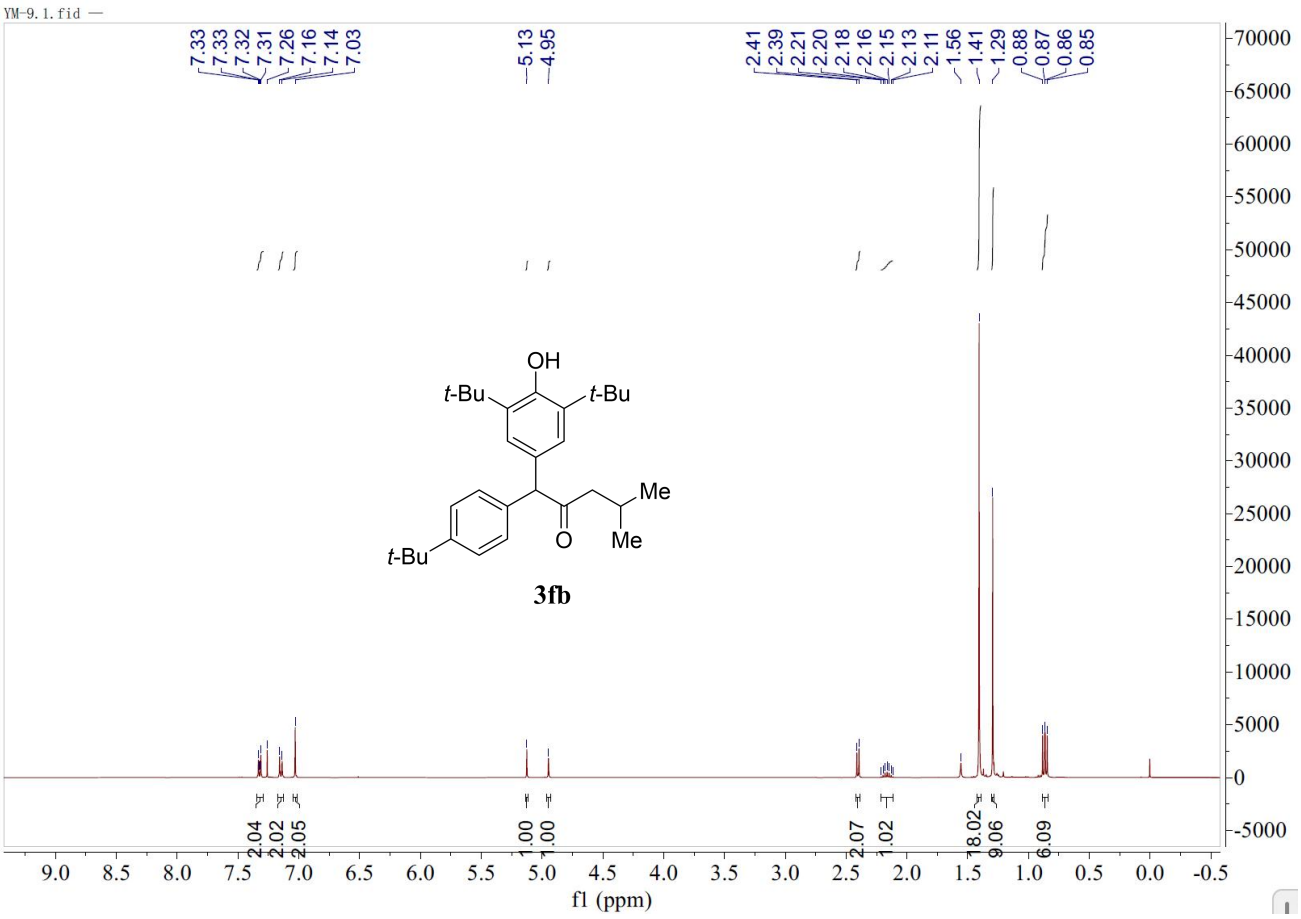
3ia



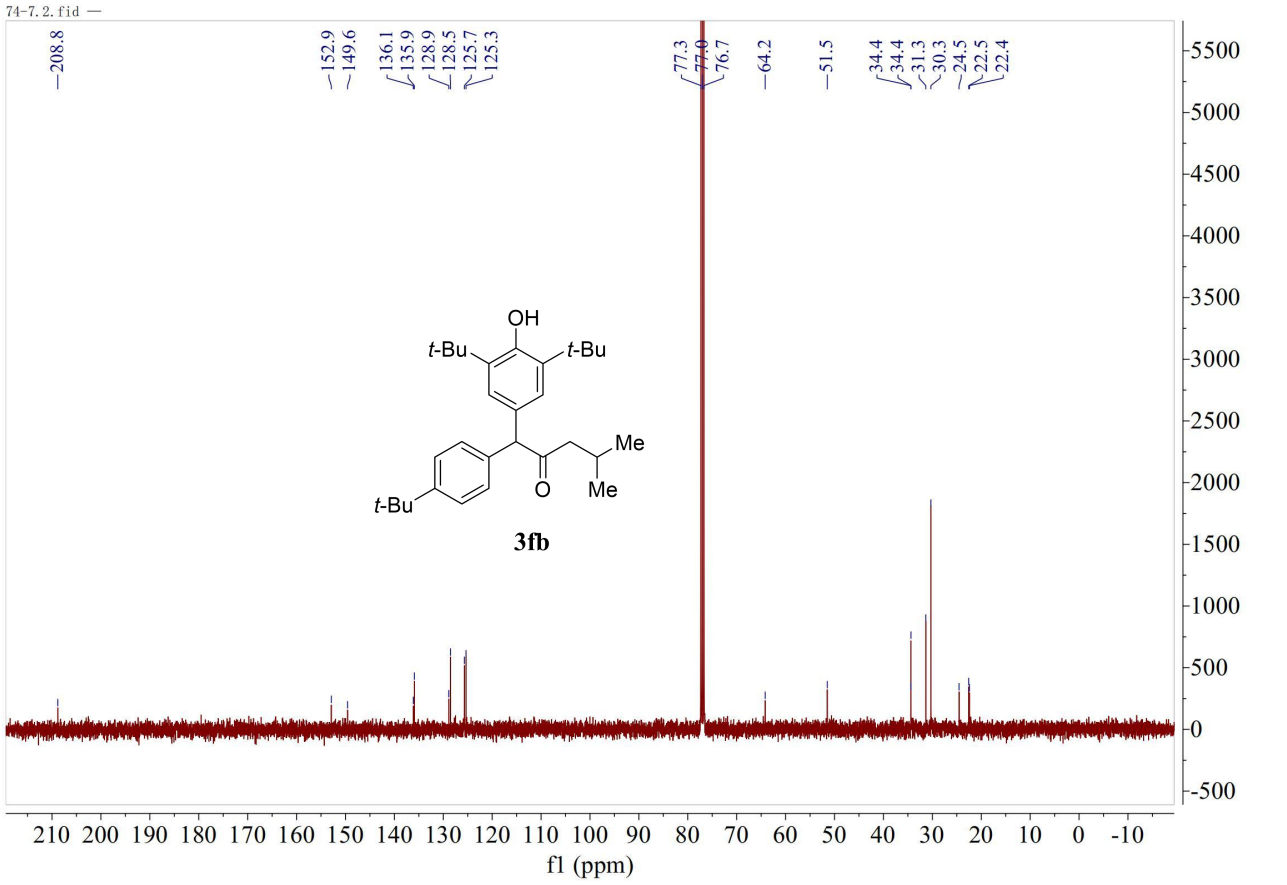
3pa


YM-3-4.2.fid
206.1
153.3
140.9
136.3
128.4
128.3
126.4
126.1
126.0
125.3
125.0
77.3
77.0
76.7
59.5
43.2
34.4
30.3
30.2
OH
t-Bu
t-Bu
S
O
3pa
fl (ppm)

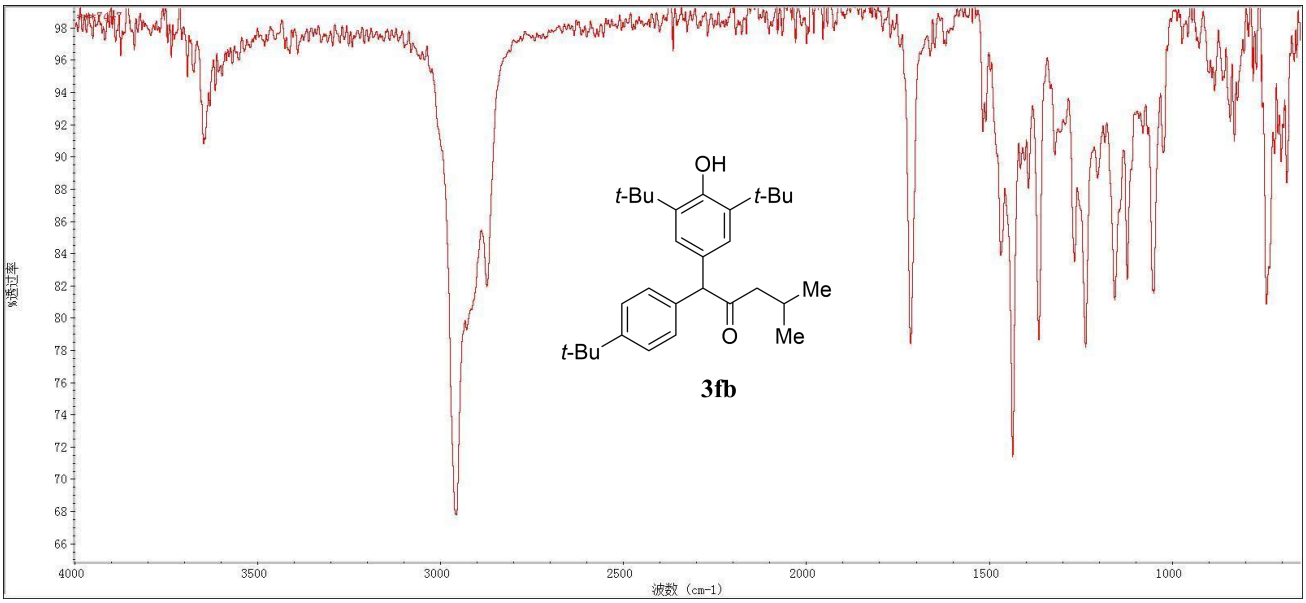

%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
S
O
3pa


YM-9.1.fid
7.33
7.33
7.32
7.31
7.26
7.16
7.14
7.03
5.13
4.95
2.41
2.39
2.21
2.20
2.18
2.16
2.15
2.13
2.11
1.56
1.41
1.29
0.88
0.87
0.86
0.85
OH
t-Bu
t-Bu
Me
O
Me
t-Bu
2.04
2.02
2.05
1.00
1.00
2.07
1.02
18.02
9.06
6.09
f1 (ppm)

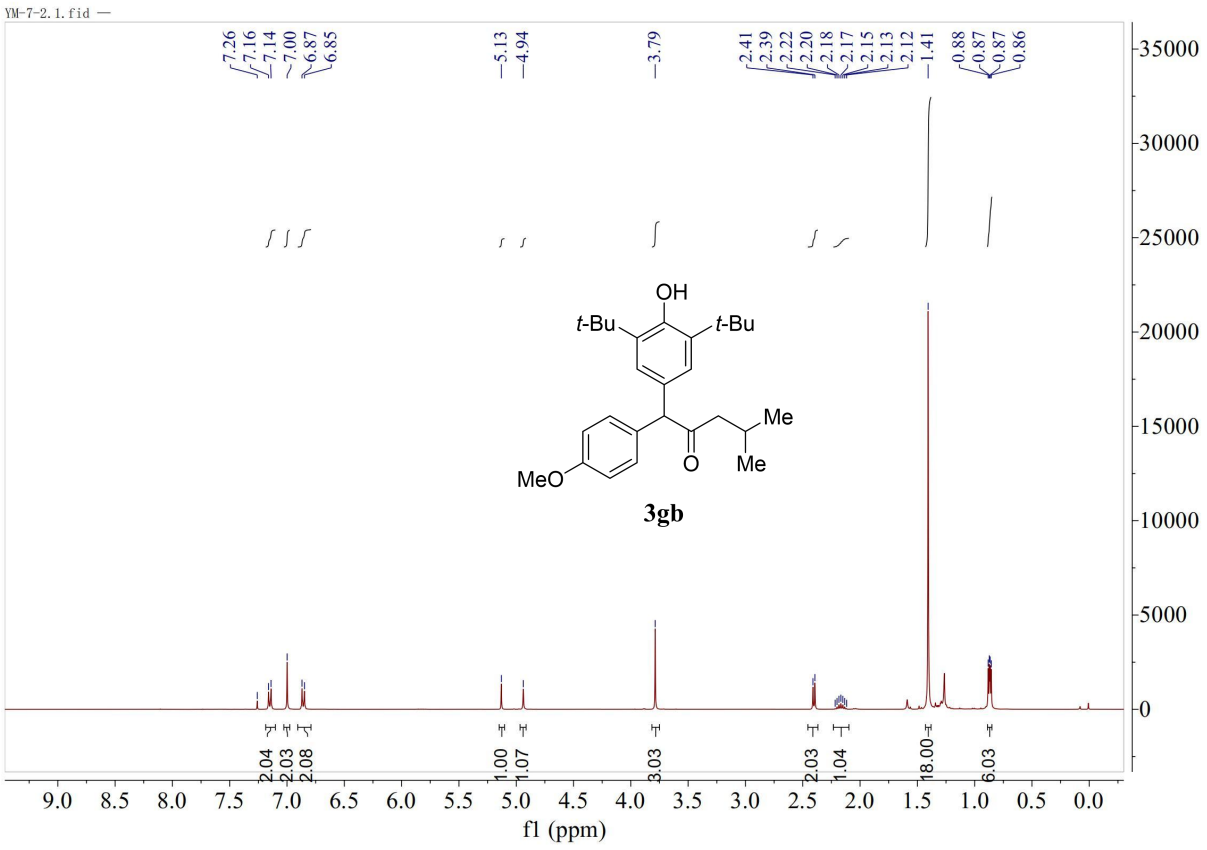
3fb


74-7.2.fid
208.8
152.9
149.6
136.1
135.9
128.9
128.5
125.7
125.3
77.3
77.0
76.7
64.2
51.5
34.4
34.4
31.3
30.3
24.5
22.5
22.4
OH
t-Bu
t-Bu
Me
O
Me
t-Bu
f1 (ppm)

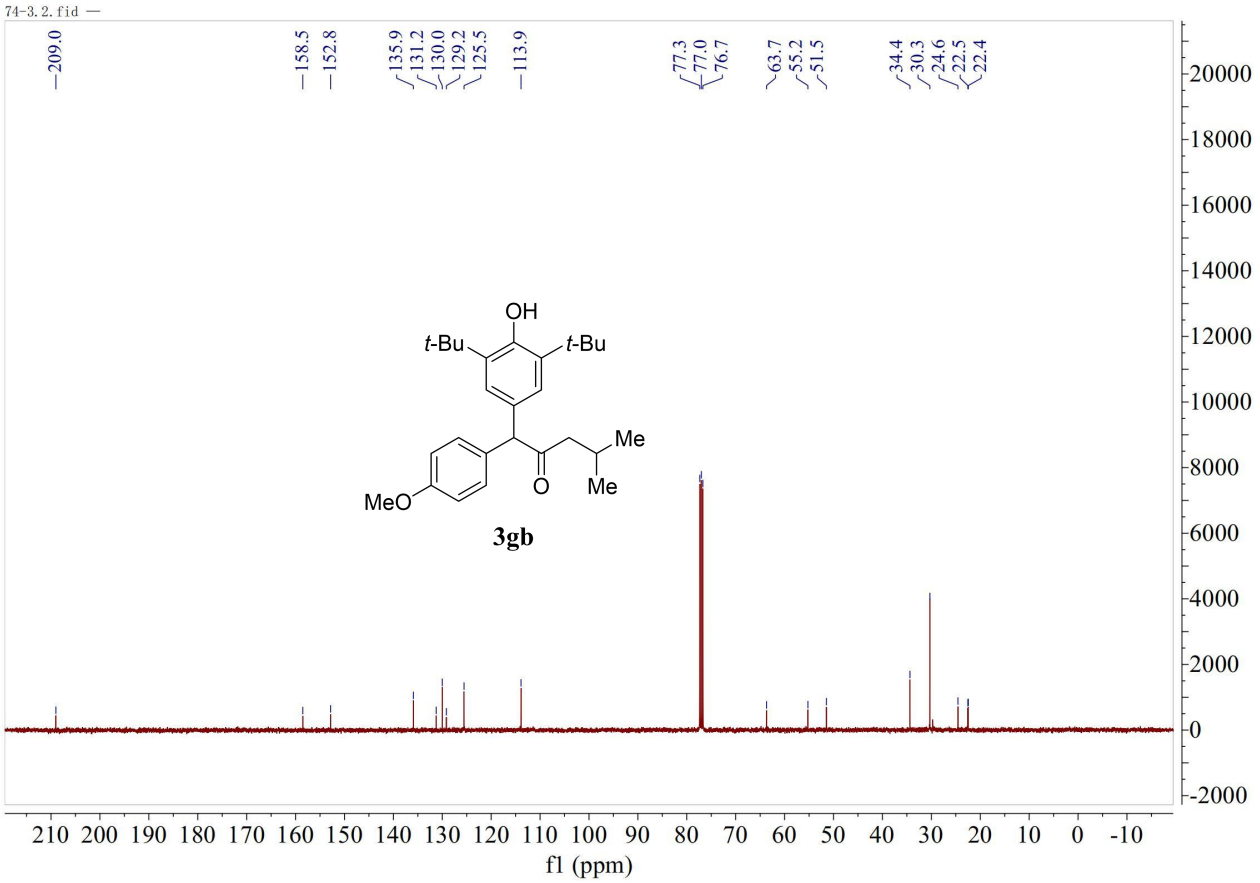
3fb

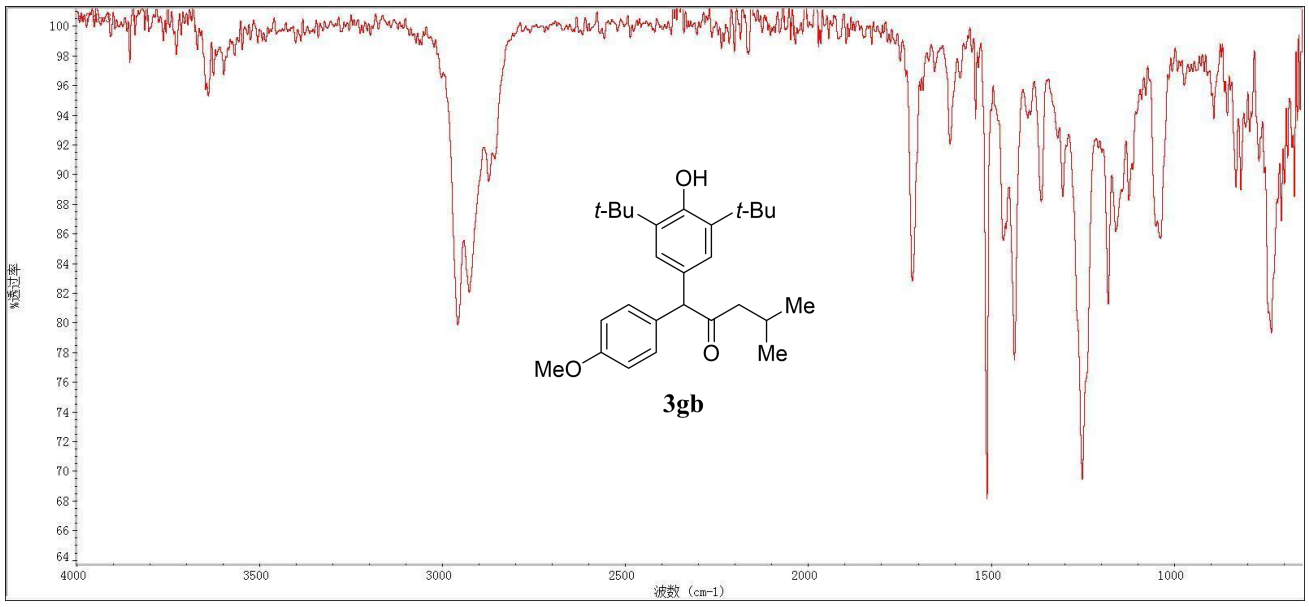

%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Me
O
Me
t-Bu

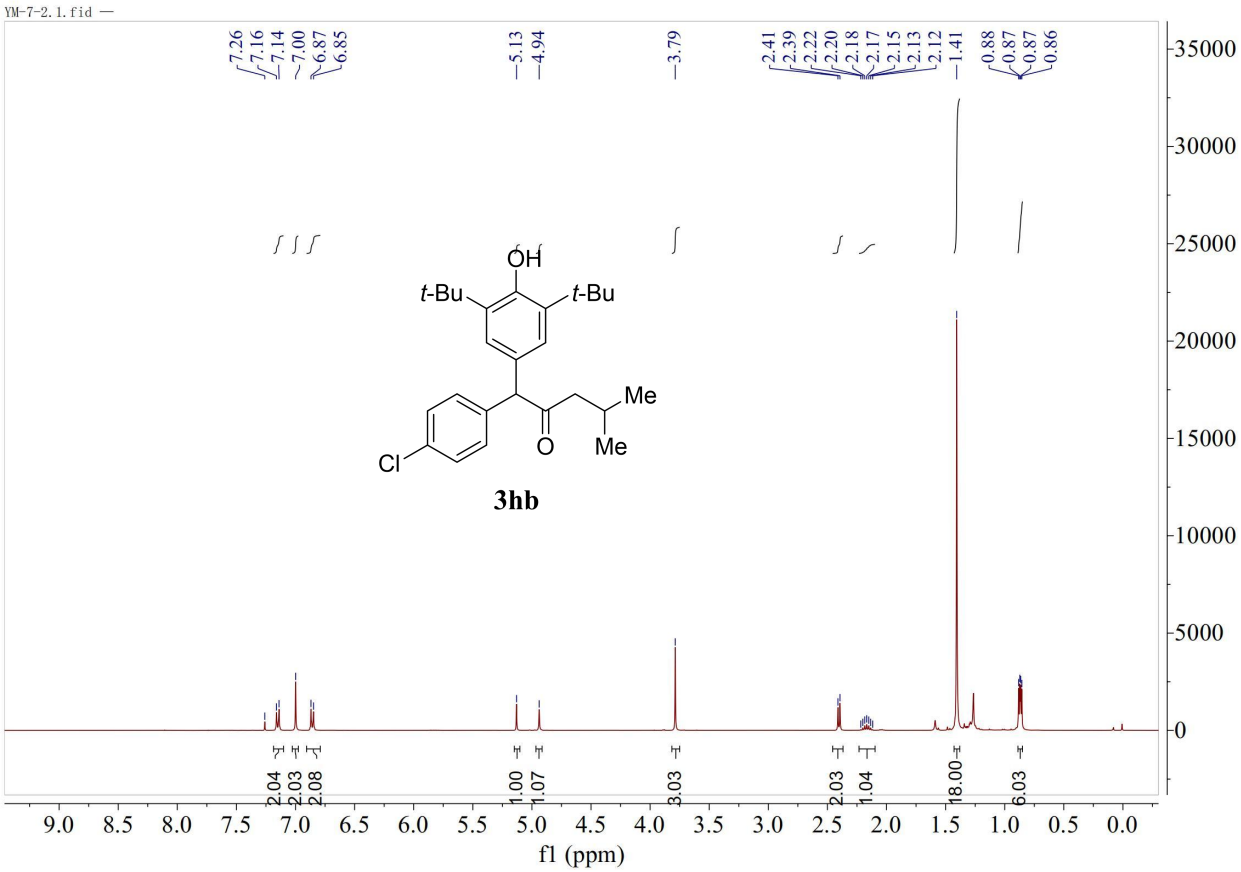
3fb

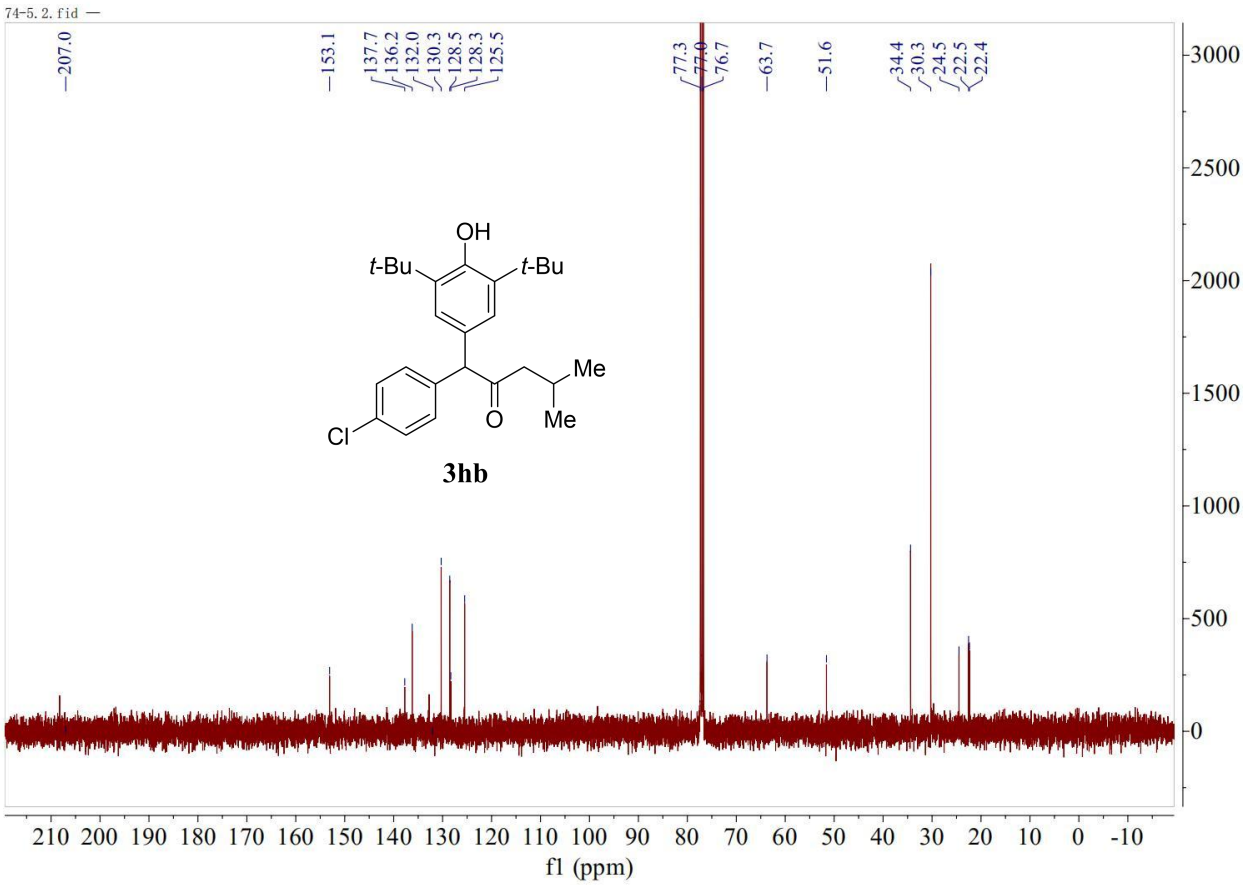

YM-7-2.1.fid
7.26
7.16
7.14
7.00
6.87
6.85
5.13
4.94
3.79
2.41
2.39
2.22
2.20
2.18
2.17
2.15
2.13
2.12
1.41
0.88
0.87
0.87
0.86
OH
t-Bu
t-Bu
Me
O
Me
MeO
2.04
2.03
2.08
1.00
1.07
3.03
2.03
1.04
18.00
6.03
f1 (ppm)

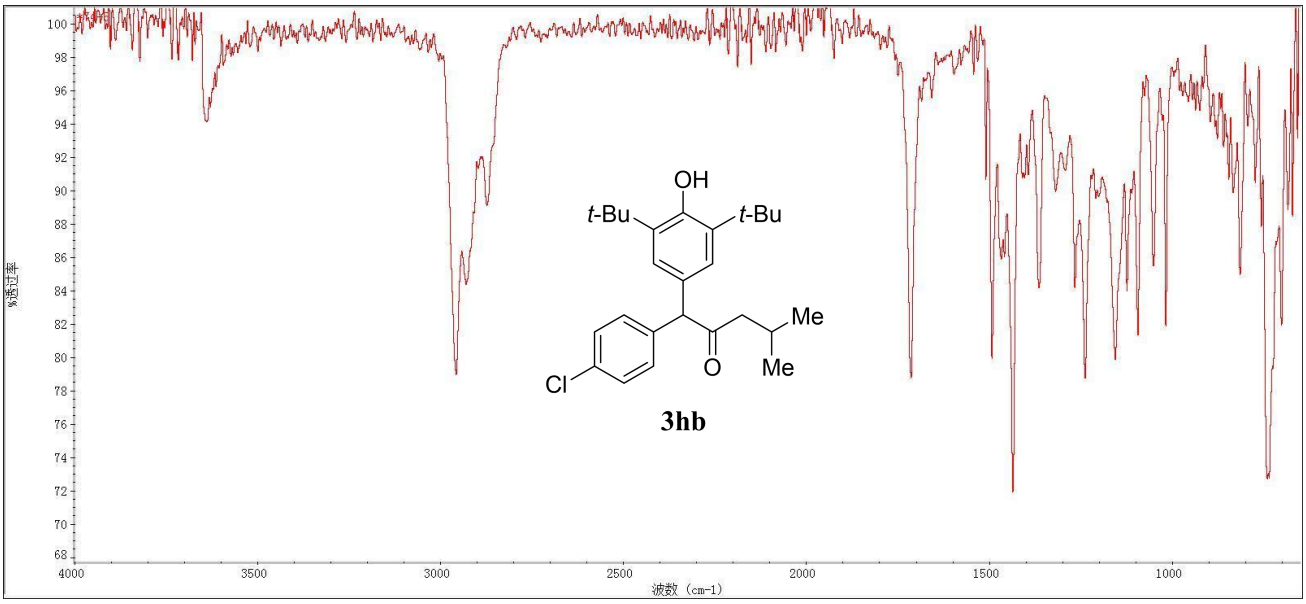
3gb


74-3.2.fid
209.0
158.5
152.8
135.9
131.2
130.0
129.2
125.5
113.9
77.3
77.0
76.7
63.7
55.2
51.5
34.4
30.3
24.6
22.5
22.4
OH
t-Bu
t-Bu
Me
O
Me
MeO
3gb
f1 (ppm)

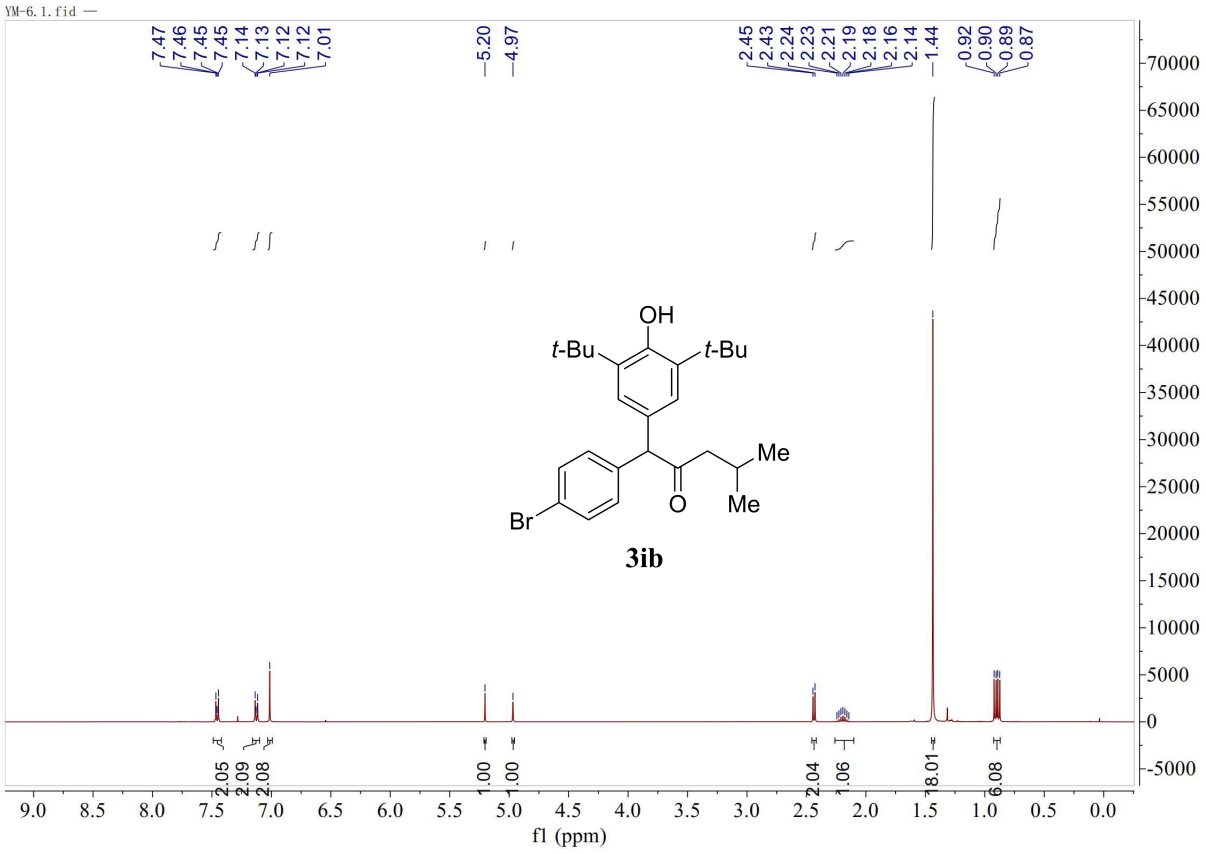

%透过率
OH
t-Bu
t-Bu
Me
O
Me
MeO
3gb
波数 (cm-1)


YM-7-2.1.fid
7.26
7.16
7.14
7.00
6.87
6.85
5.13
4.94
3.79
2.41
2.39
2.22
2.20
2.18
2.17
2.15
2.13
2.12
1.41
0.88
0.87
0.87
0.86
OH
t-Bu
t-Bu
Me
O
Me
Cl
3hb
2.04
2.03
2.08
1.00
1.07
3.03
2.03
1.04
18.00
6.03
fl (ppm)

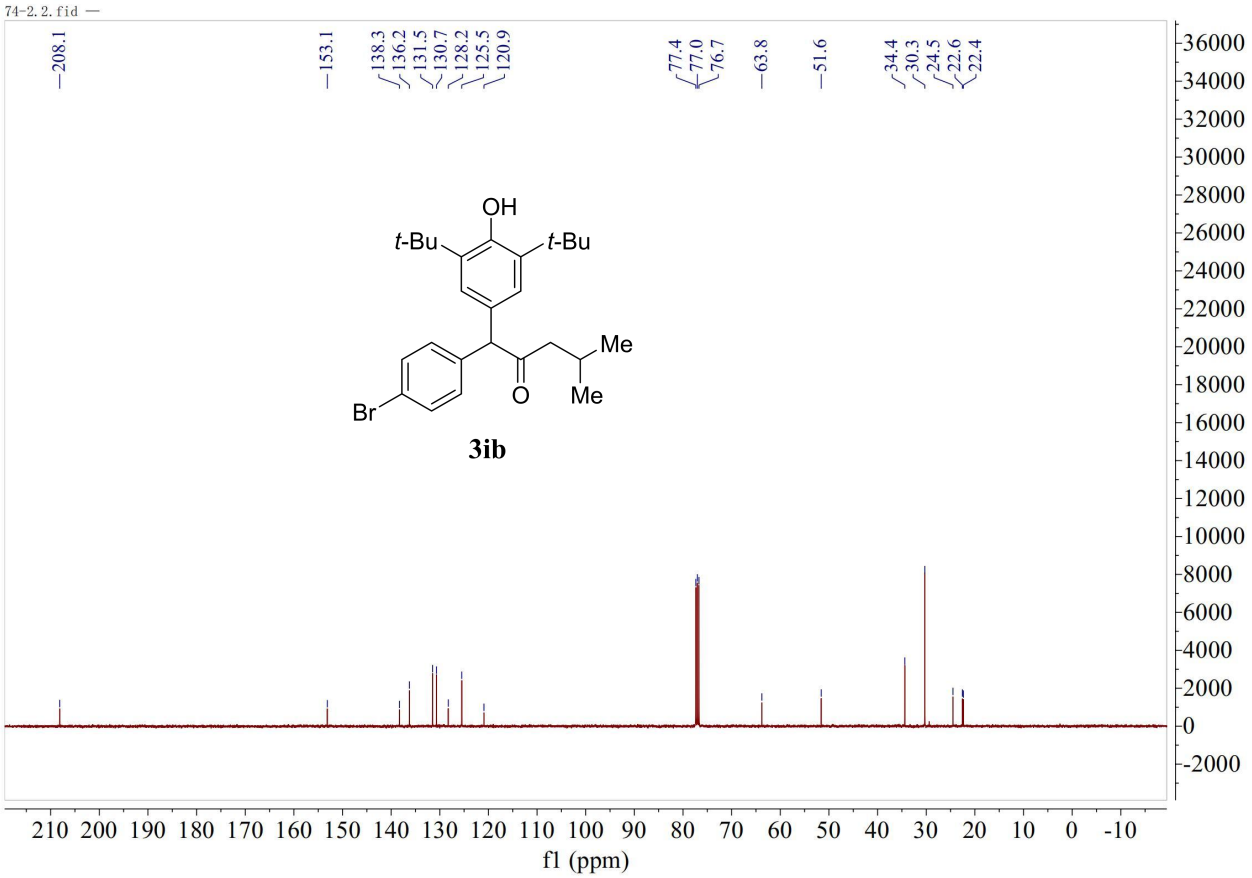

74-5.2.fid
207.0
153.1
137.7
136.2
132.0
130.3
128.5
128.3
125.5
77.3
77.0
76.7
63.7
51.6
34.4
30.3
24.5
22.5
22.4
OH
t-Bu
t-Bu
Me
O
Me
Cl
3hb
fl (ppm)

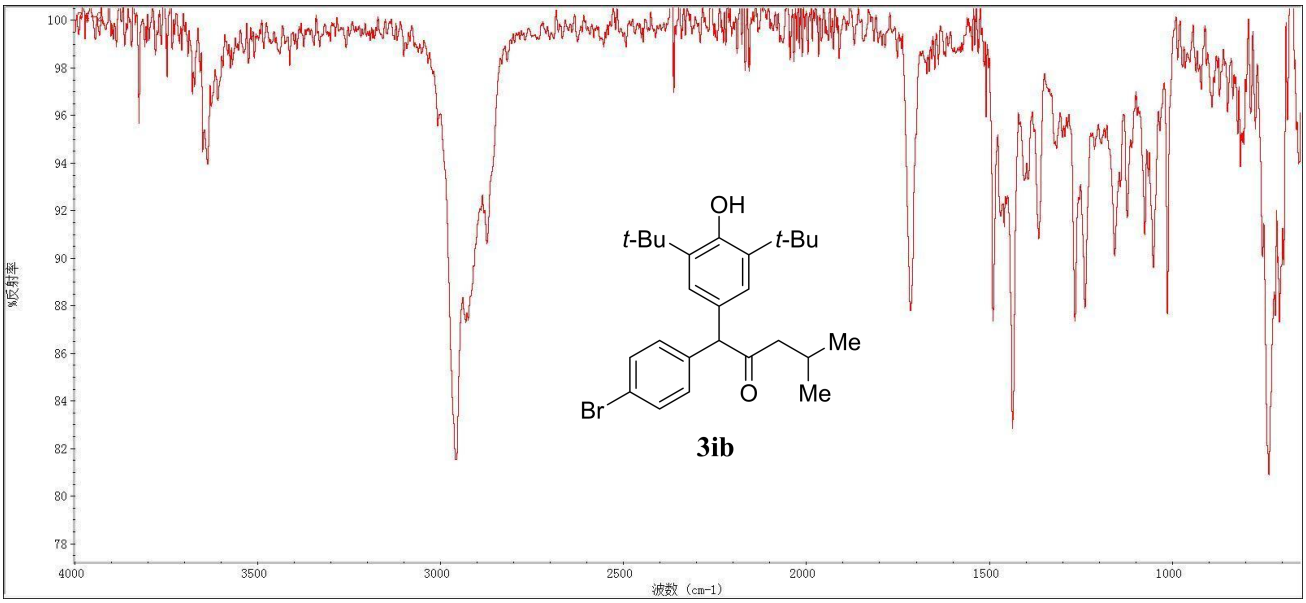

%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Me
O
Me
Cl

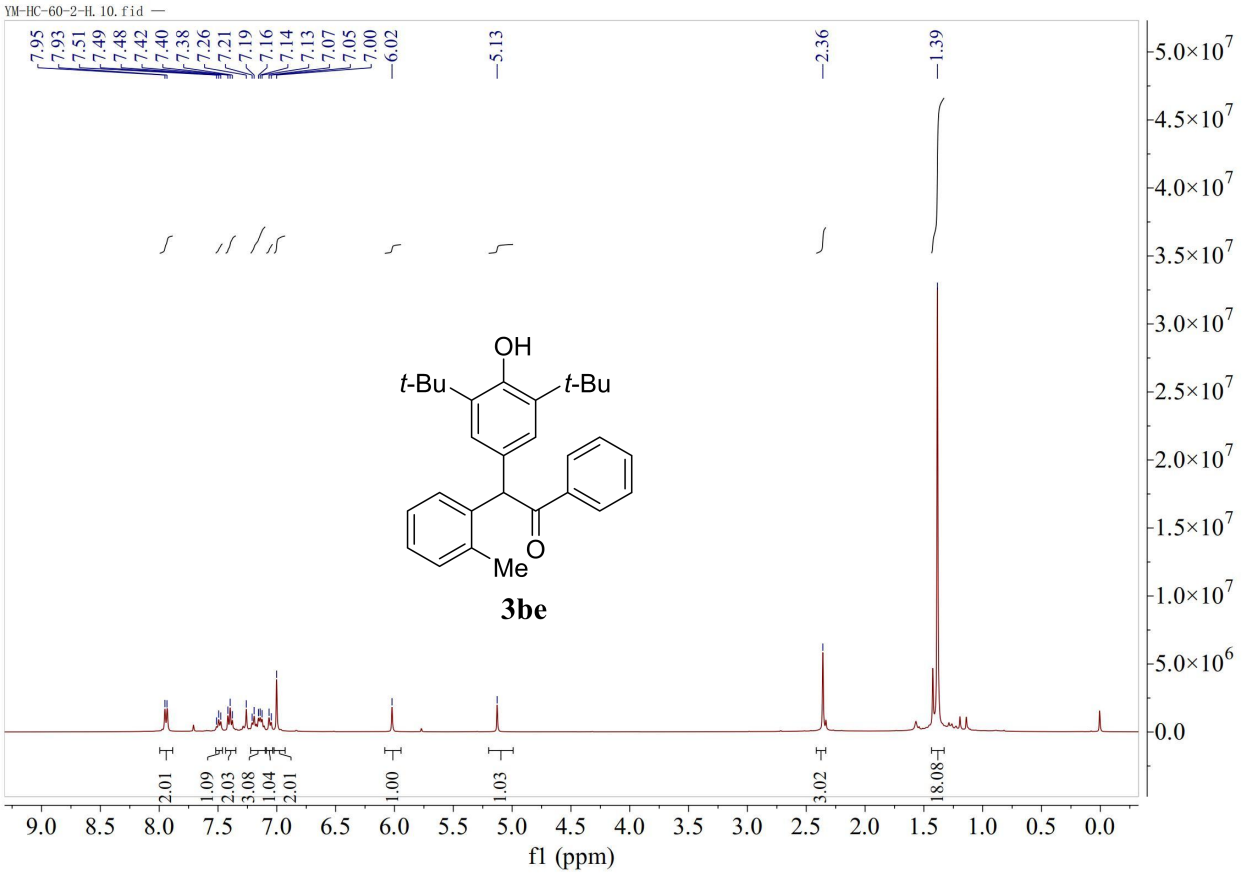
3hb

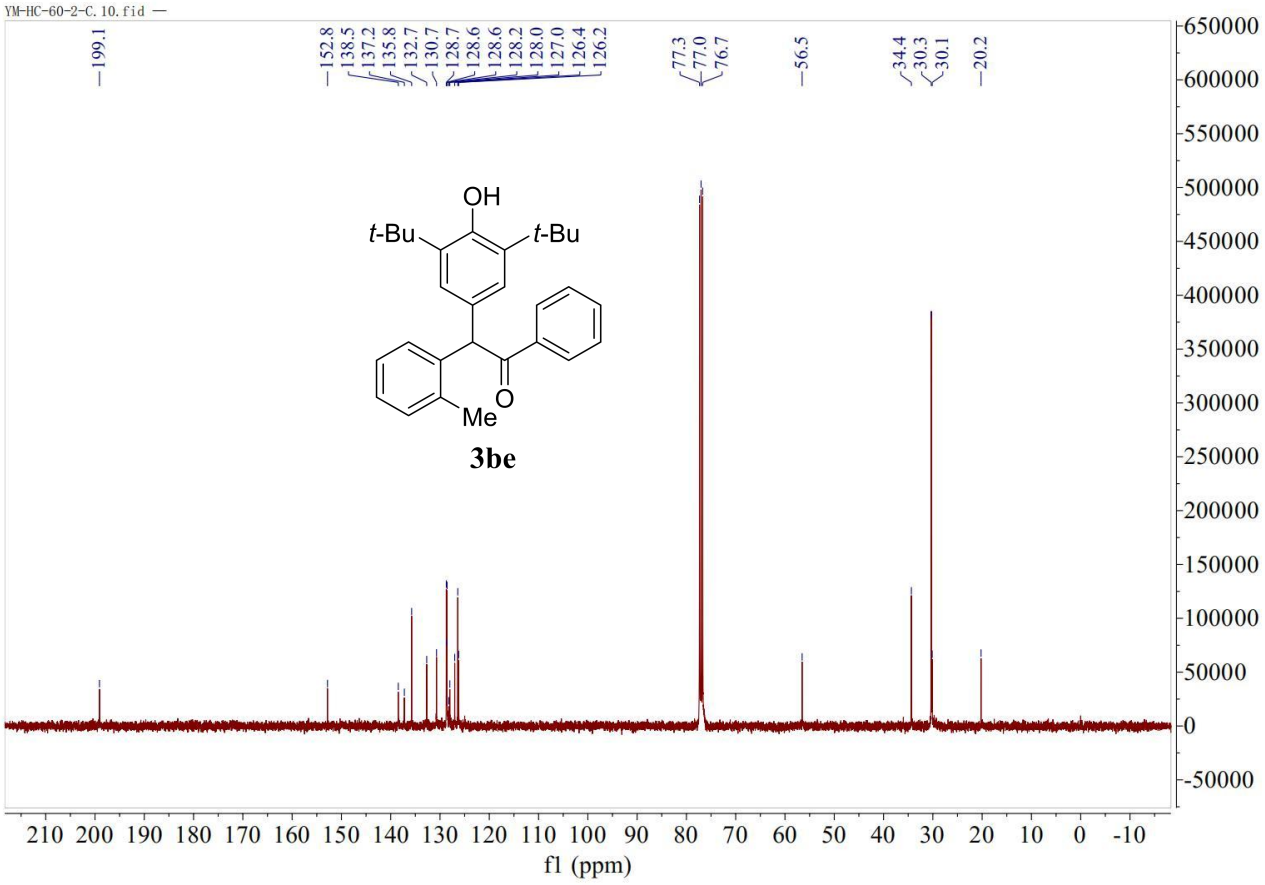

YM-6.1.fid
OH
t-Bu
t-Bu
Me
O
Me
Br
fl (ppm)

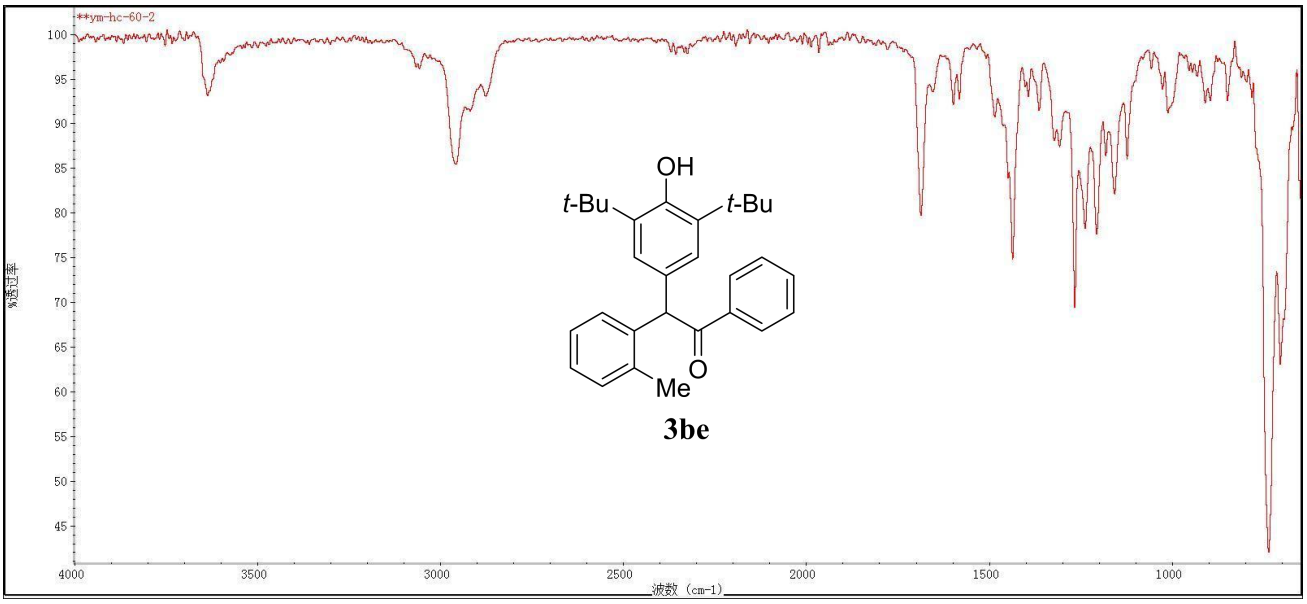
3ib


74-2.2.fid
208.1
153.1
138.3
136.2
131.5
130.7
128.2
125.5
120.9
77.4
77.0
76.7
63.8
51.6
34.4
30.3
24.5
22.6
22.4
OH
t-Bu
t-Bu
Me
O
Me
Br
3ib
f1 (ppm)

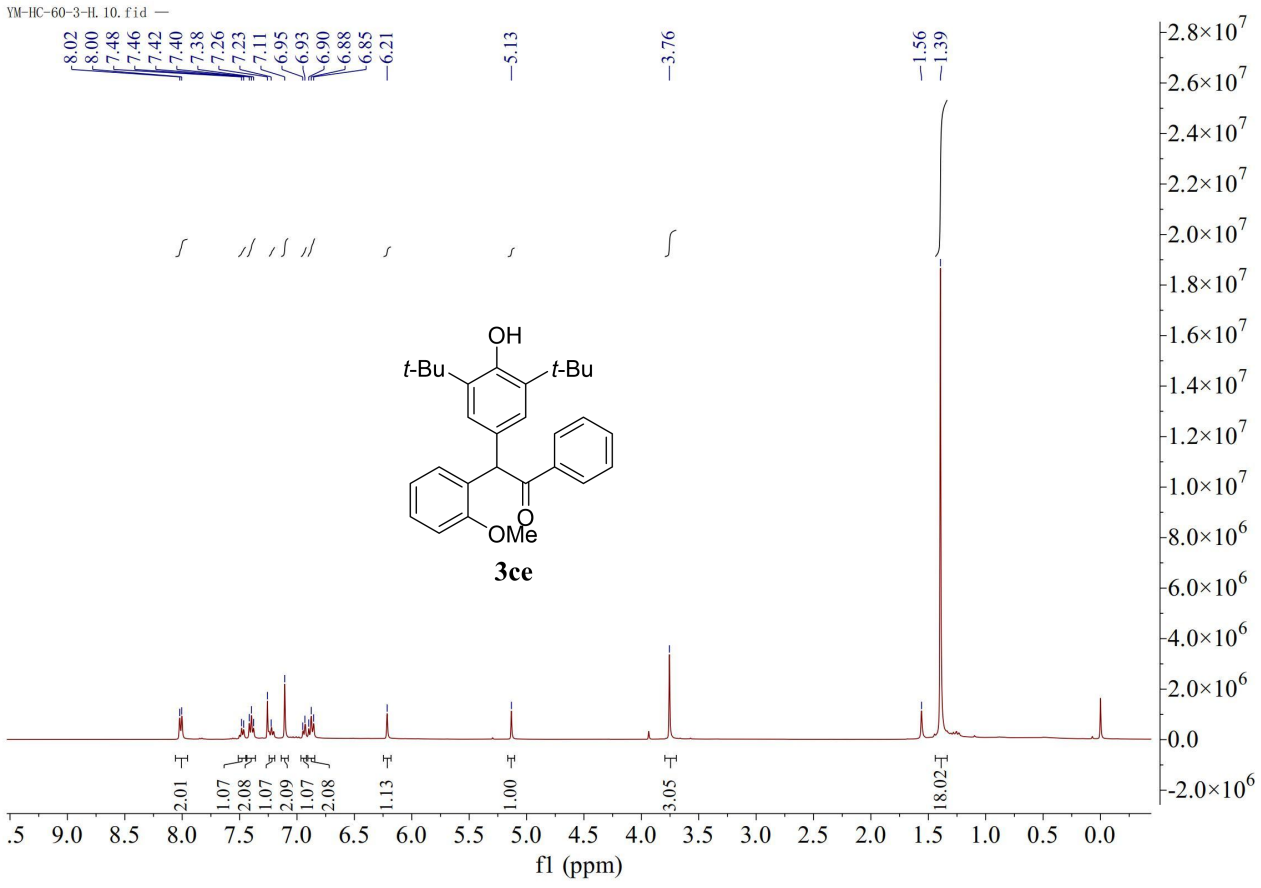

%反射率
波数（cm-1）
OH
t-Bu
t-Bu
Me
O
Me
Br
3ib


YM-HC-60-2-H.10.fid
7.95
7.93
7.51
7.49
7.48
7.42
7.40
7.38
7.26
7.21
7.19
7.16
7.14
7.13
7.07
7.05
7.00
6.02
5.13
2.36
1.39
OH
t-Bu
t-Bu
Me
O
3be
2.01
1.09
2.03
3.08
1.04
2.01
1.00
1.03
3.02
18.08
f1 (ppm)

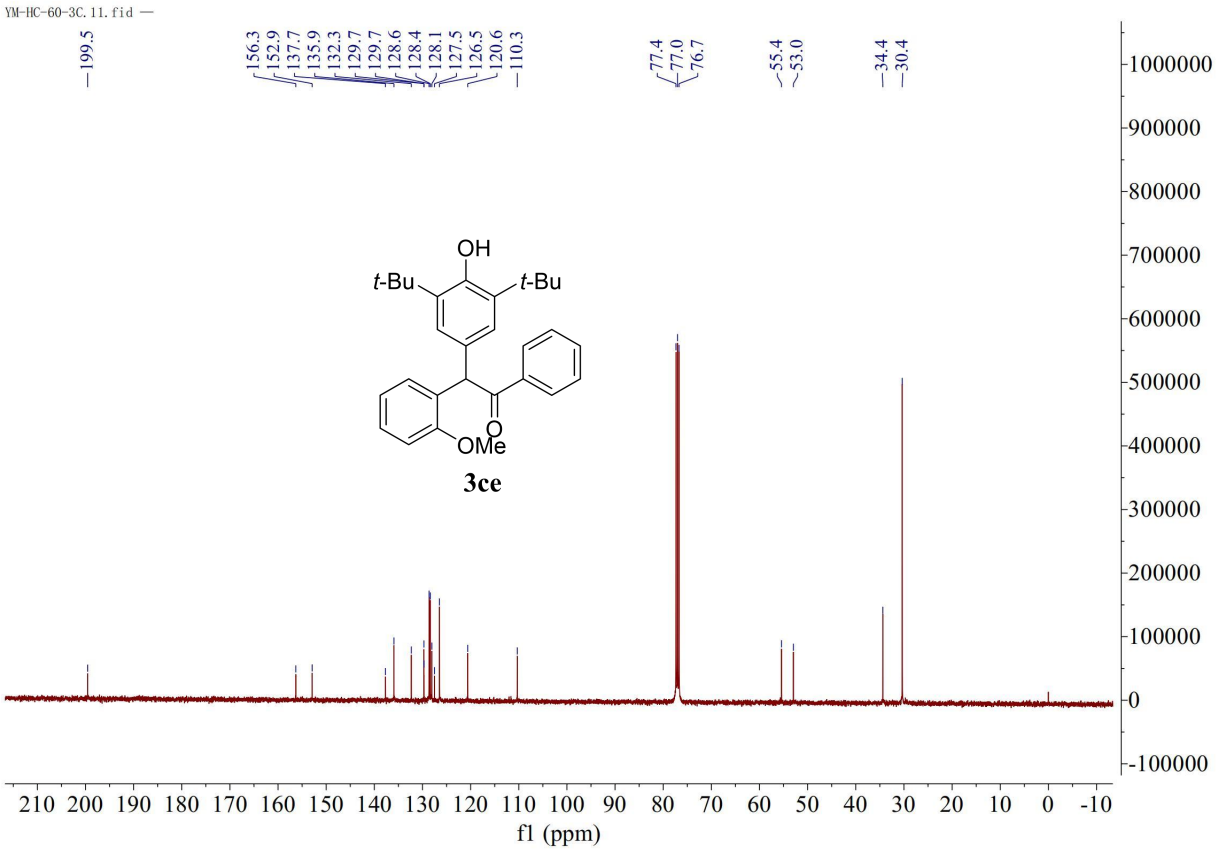

YM-HC-60-2-C.10.fid
199.1
152.8
138.5
137.2
135.8
132.7
130.7
128.7
128.6
128.6
128.2
128.0
127.0
126.4
126.2
77.3
77.0
76.7
56.5
34.4
30.3
30.1
20.2
OH
t-Bu
t-Bu
Me
O
3be
f1 (ppm)

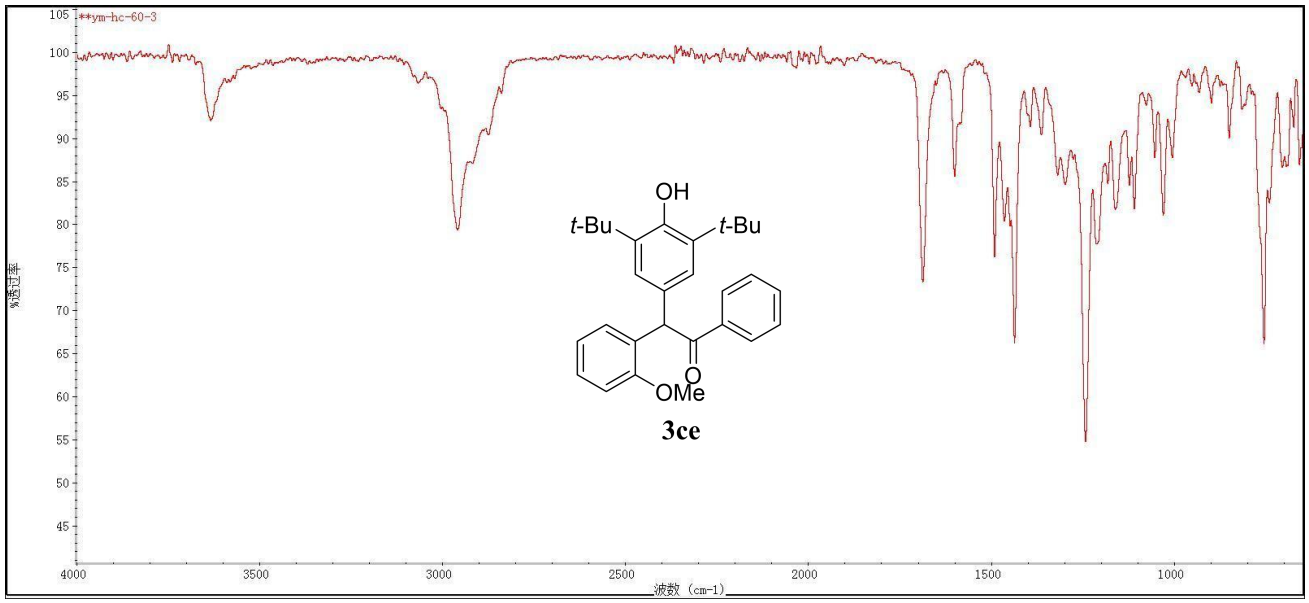

**ym-hc-60-2
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
O
Me

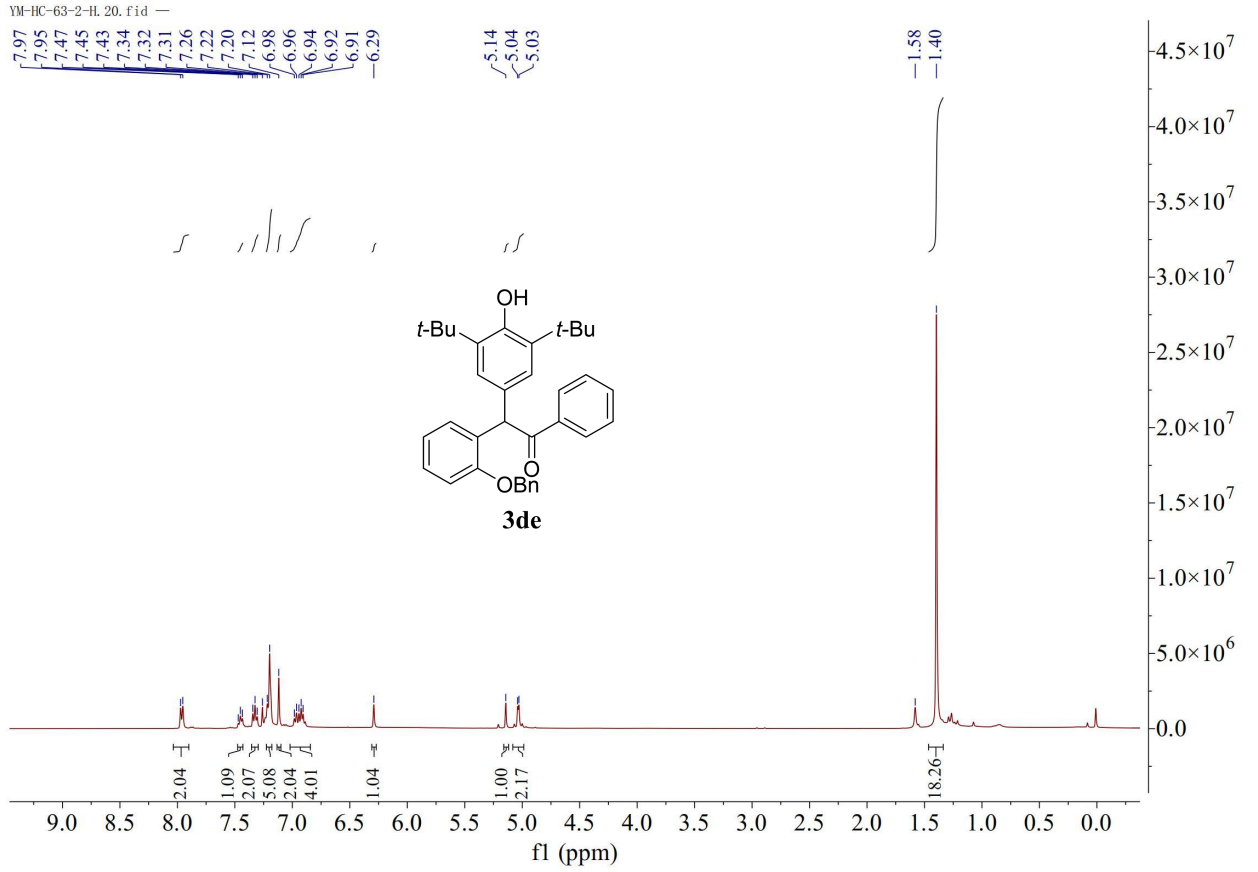
3be

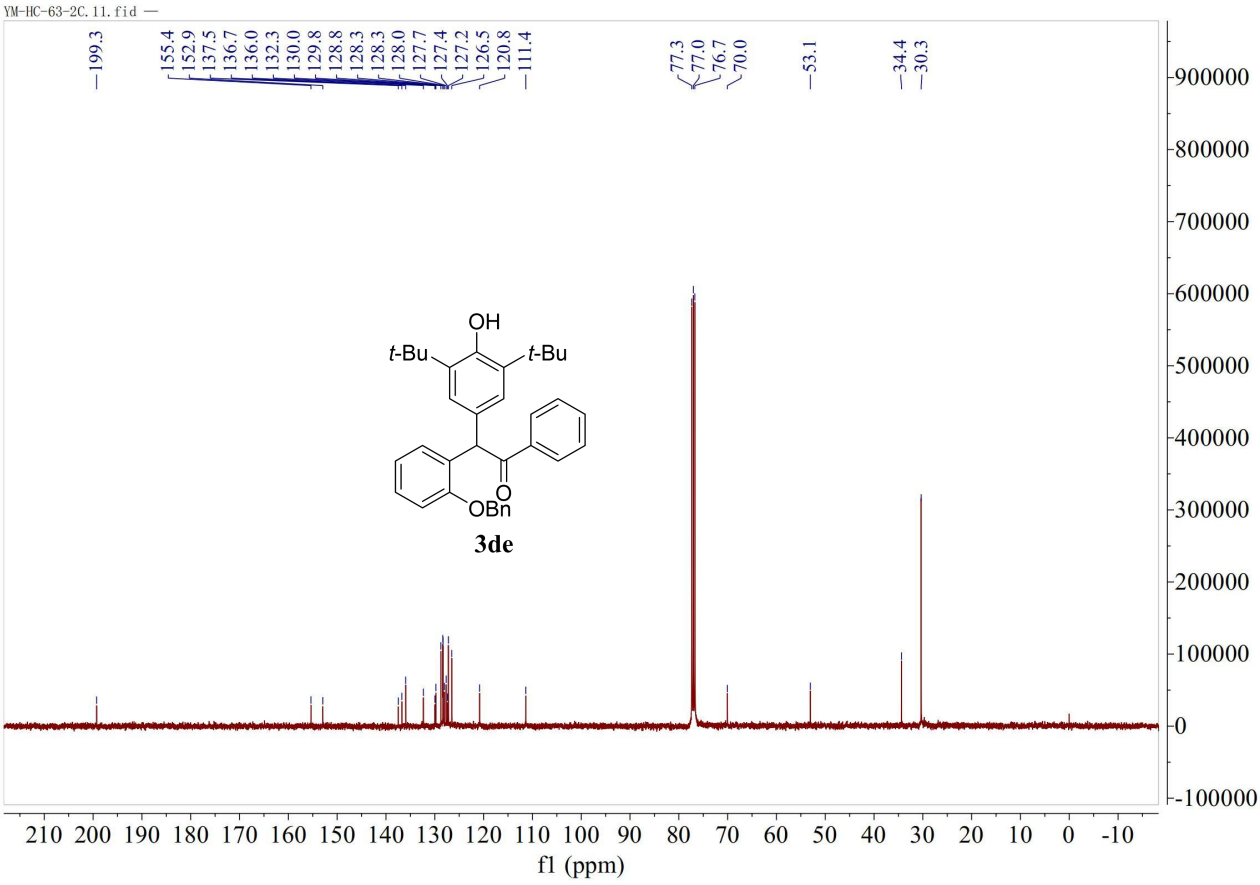

YM-HC-60-3-H.10.fid
8.02
8.00
7.48
7.46
7.42
7.40
7.38
7.26
7.23
7.11
6.95
6.93
6.90
6.88
6.85
6.21
5.13
3.76
1.56
1.39
OH
t-Bu
t-Bu
O
OMe
2.01
1.07
2.08
1.07
2.09
1.07
2.08
1.13
1.00
3.05
18.02
f1 (ppm)

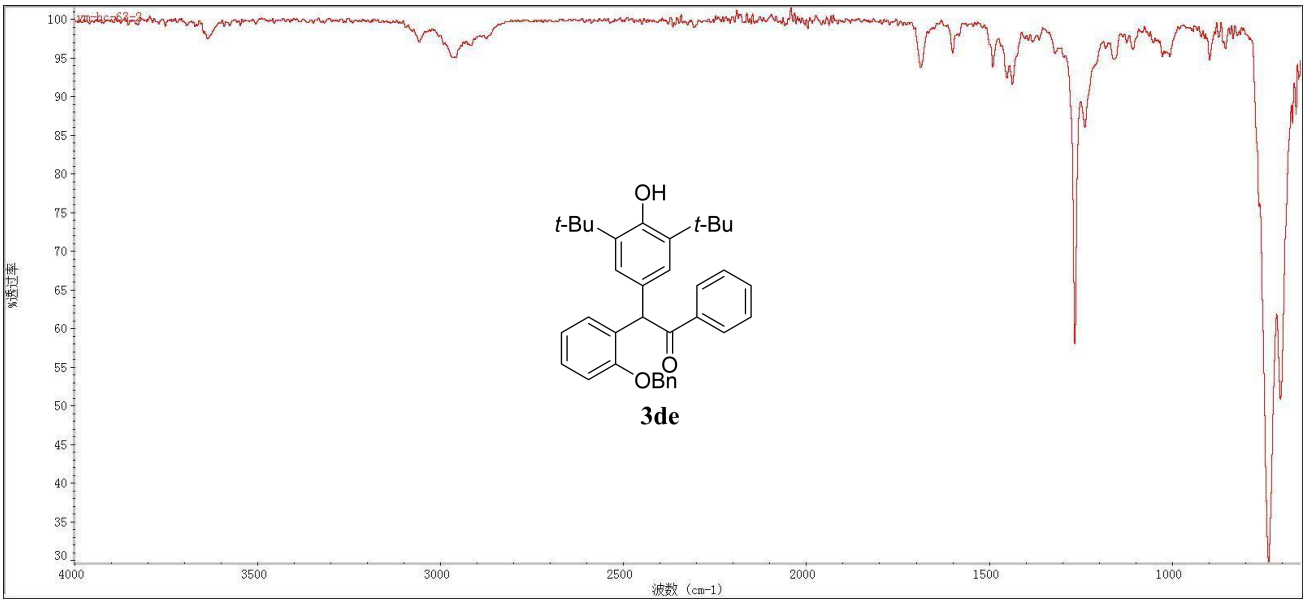
3ce


YM-HC-60-3C.11.fid
199.5
156.3
152.9
137.7
135.9
132.3
129.7
129.7
128.6
128.4
128.1
127.5
126.5
120.6
110.3
77.4
77.0
76.7
55.4
53.0
34.4
30.4
OH
t-Bu
t-Bu
O
OMe
3ce
f1 (ppm)

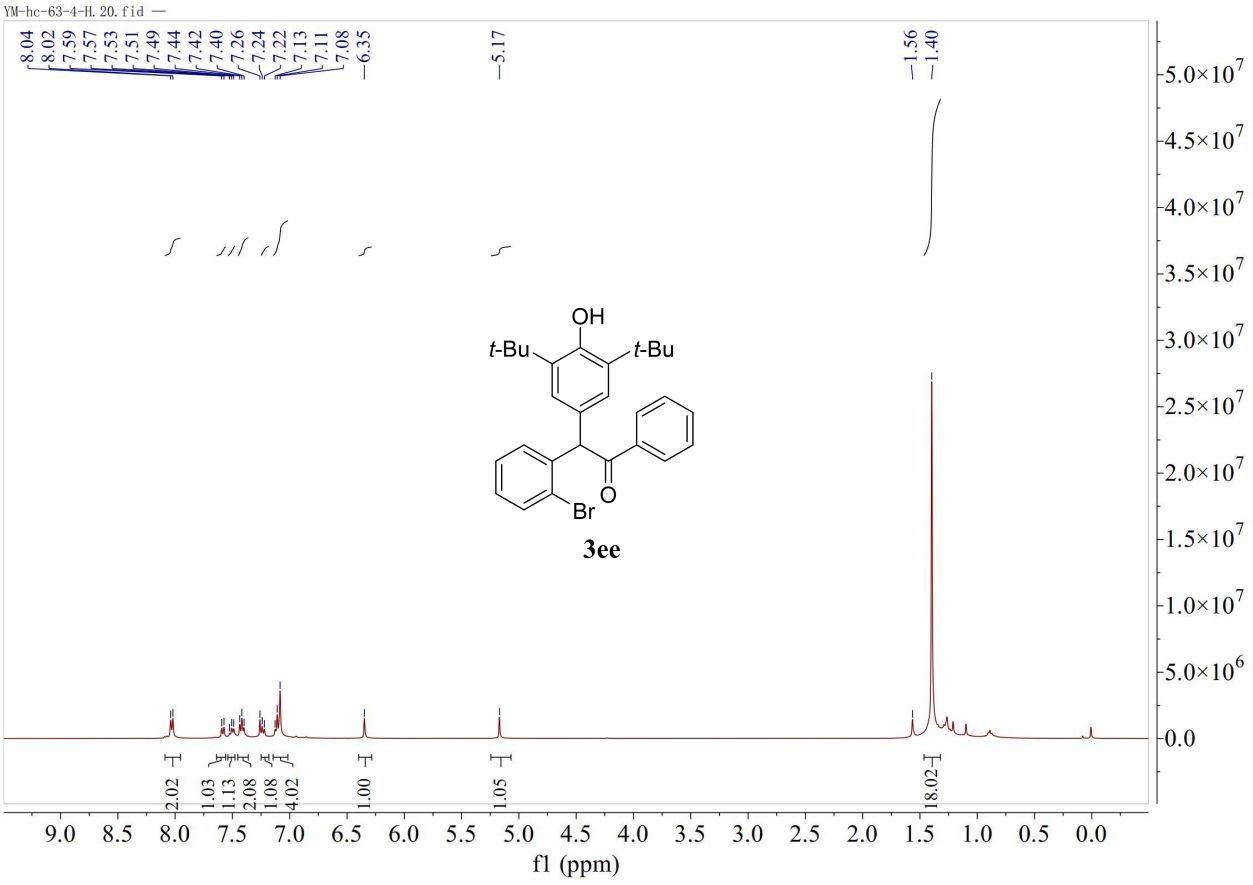

**ym-hc-60-3
%透过率
OH
t-Bu
t-Bu
O
OMe
3ce
波数 (cm-1)


YM-HC-63-2-H.20.fid
7.97
7.95
7.47
7.45
7.43
7.34
7.32
7.31
7.26
7.22
7.20
7.12
6.98
6.96
6.94
6.92
6.91
6.29
5.14
5.04
5.03
1.58
1.40
OH
t-Bu
t-Bu
O
OBn
3de
2.04
1.09
2.07
5.08
2.04
4.01
1.04
1.00
2.17
18.26
fl (ppm)

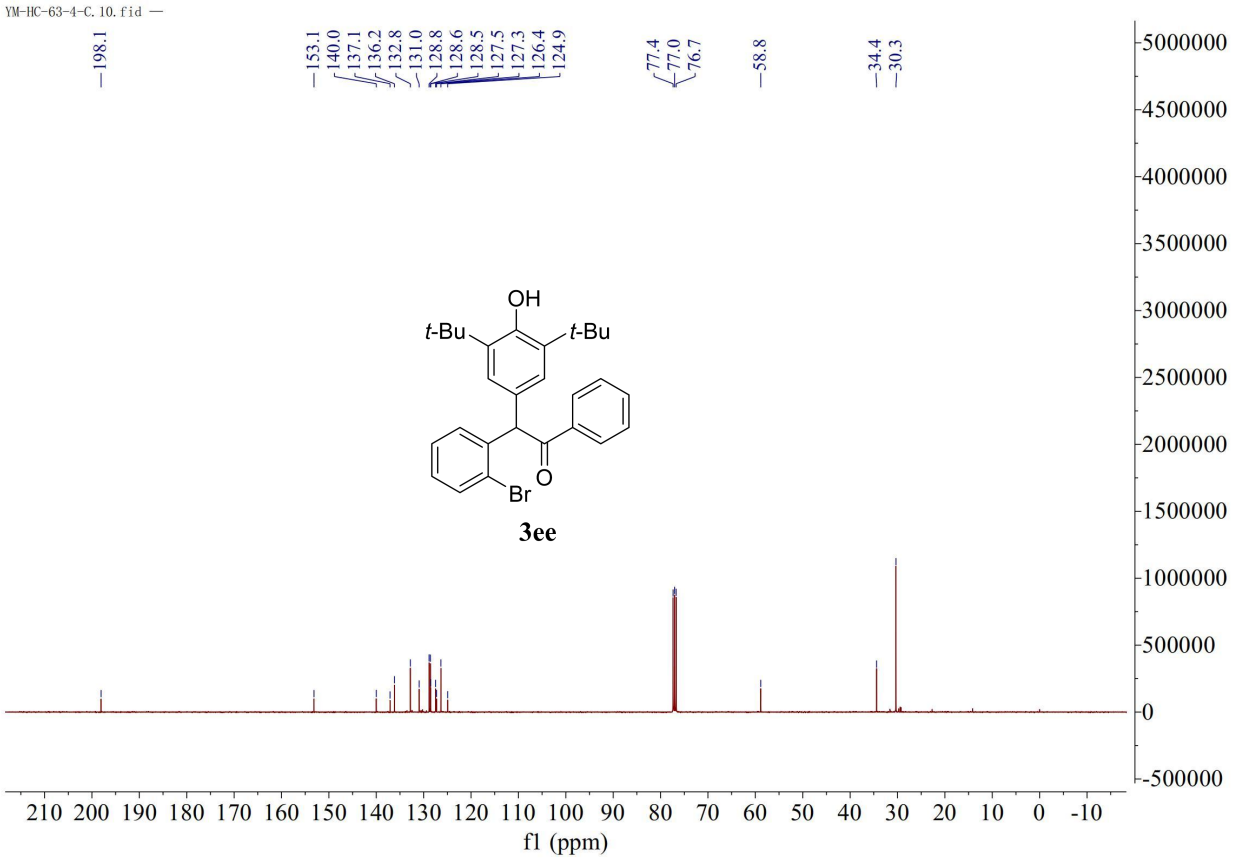

YM-HC-63-2C.11.fid
199.3
155.4
152.9
137.5
136.7
136.0
132.3
130.0
129.8
128.8
128.3
128.3
128.0
127.7
127.4
127.2
126.5
120.8
111.4
77.3
77.0
76.7
70.0
53.1
34.4
30.3
OH
t-Bu
t-Bu
O
OBn
3de
fl (ppm)

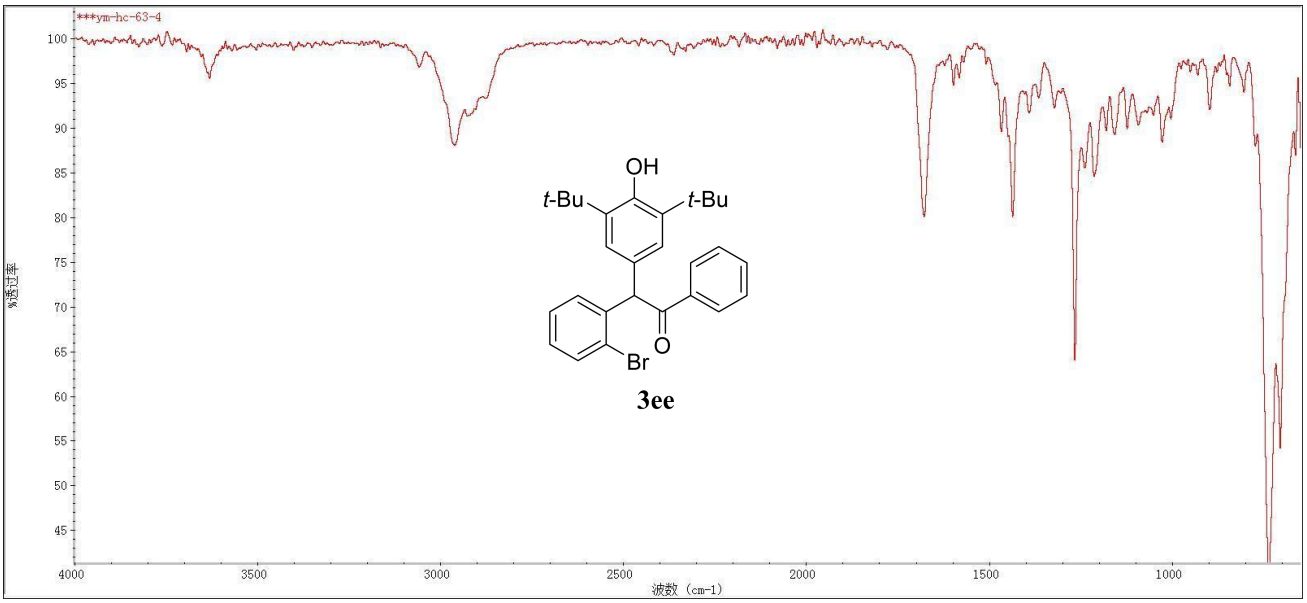

%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
O
OBn

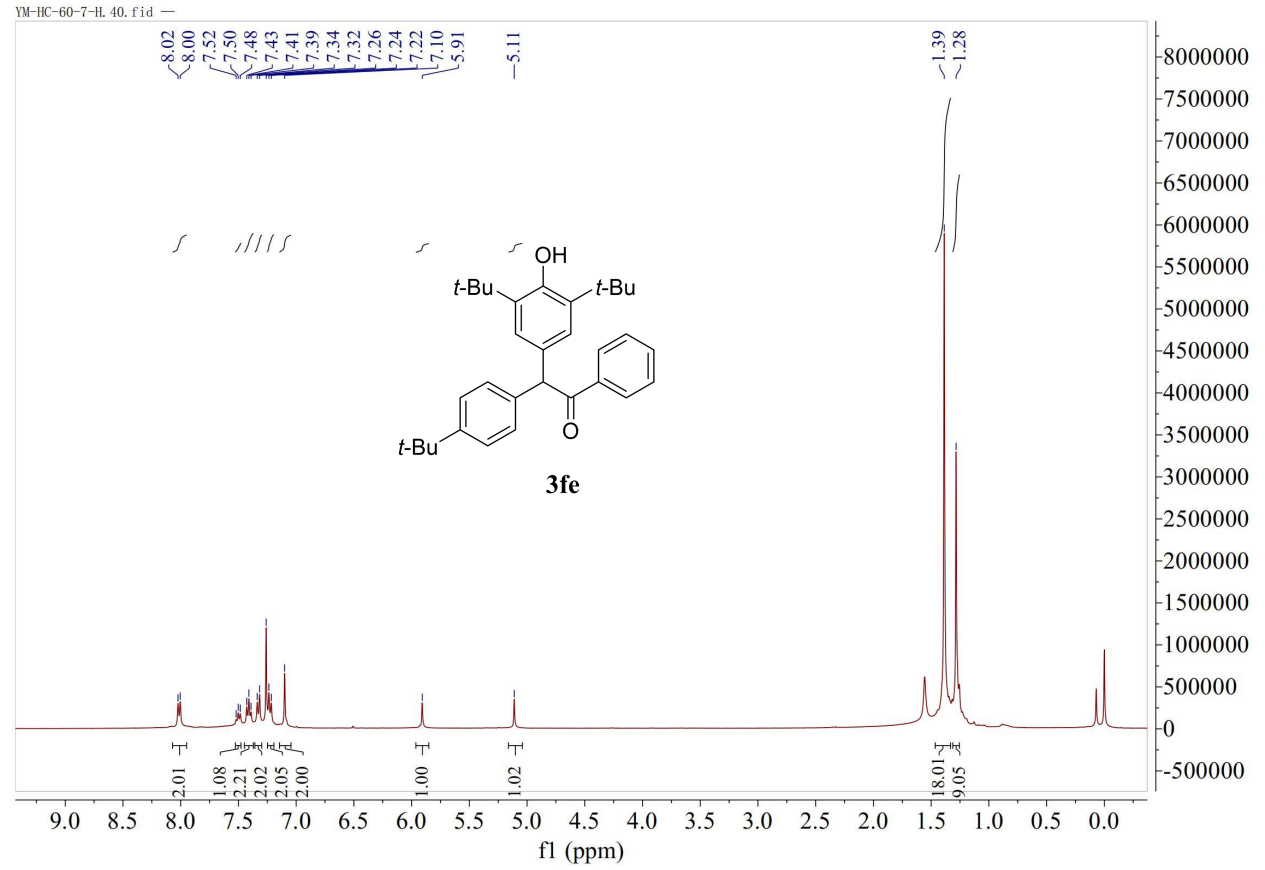
3de

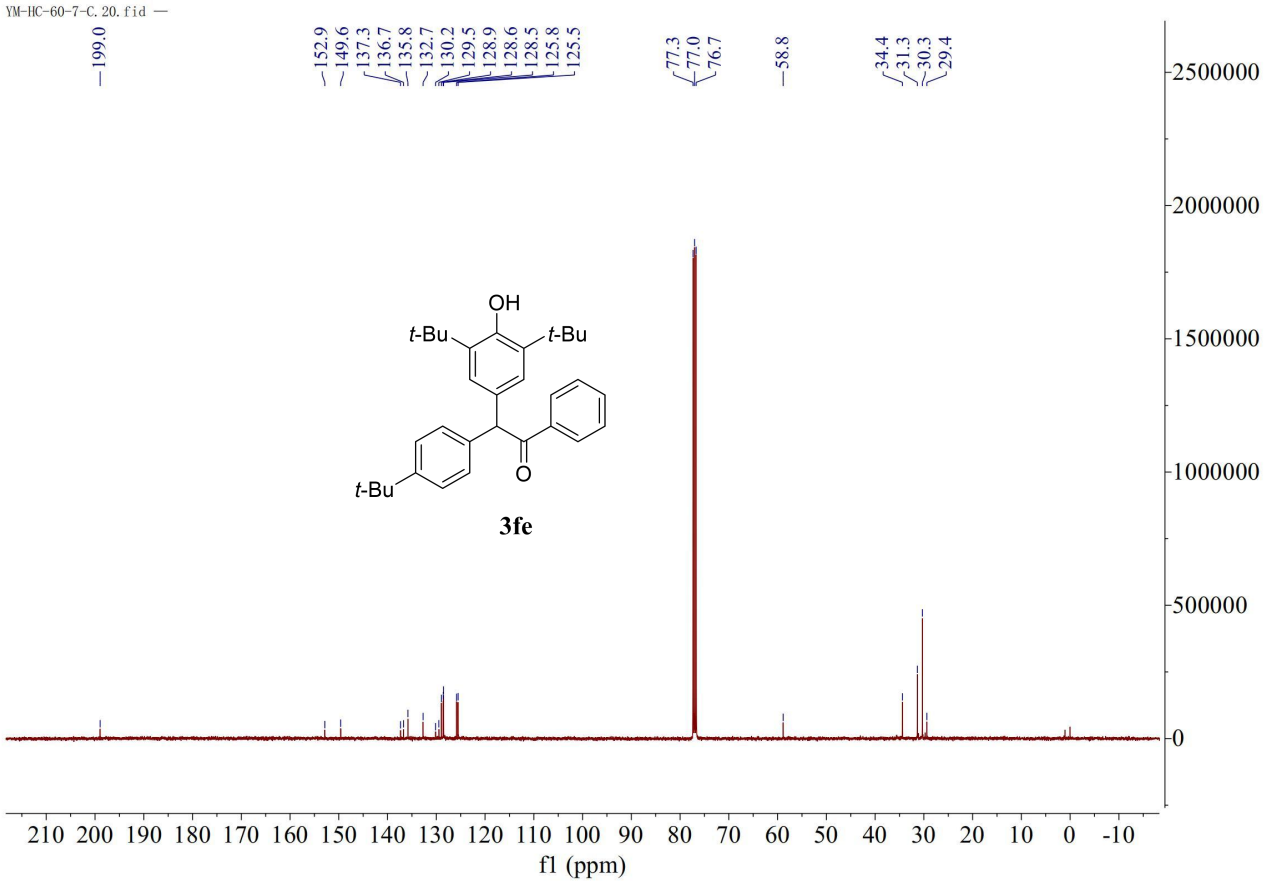

YM-hc-63-4-H.20.fid
8.04
8.02
7.59
7.57
7.53
7.51
7.49
7.44
7.42
7.40
7.26
7.24
7.22
7.13
7.11
7.08
6.35
5.17
1.56
1.40
OH
t-Bu
t-Bu
O
Br
2.02
1.03
1.13
2.08
1.08
4.02
1.00
1.05
18.02
f1 (ppm)

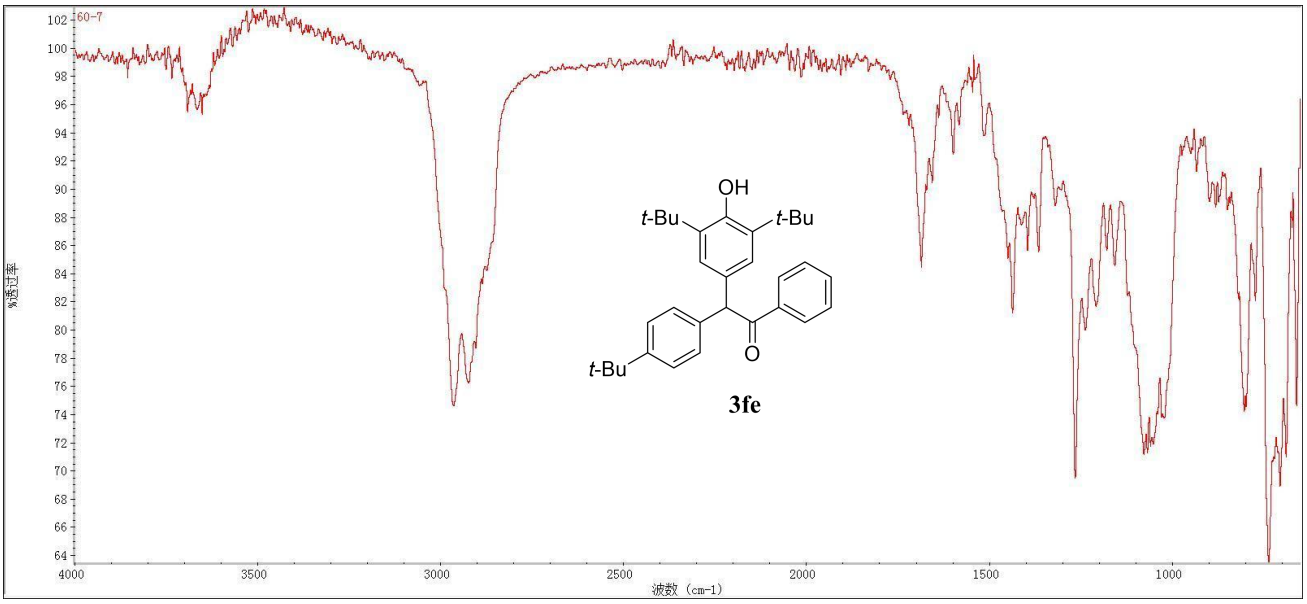
3ee


YM-HC-63-4-C.10.fid
198.1
153.1
140.0
137.1
136.2
132.8
131.0
128.8
128.6
128.5
127.5
127.3
126.4
124.9
77.4
77.0
76.7
58.8
34.4
30.3
OH
t-Bu
t-Bu
O
Br
3ee
f1 (ppm)

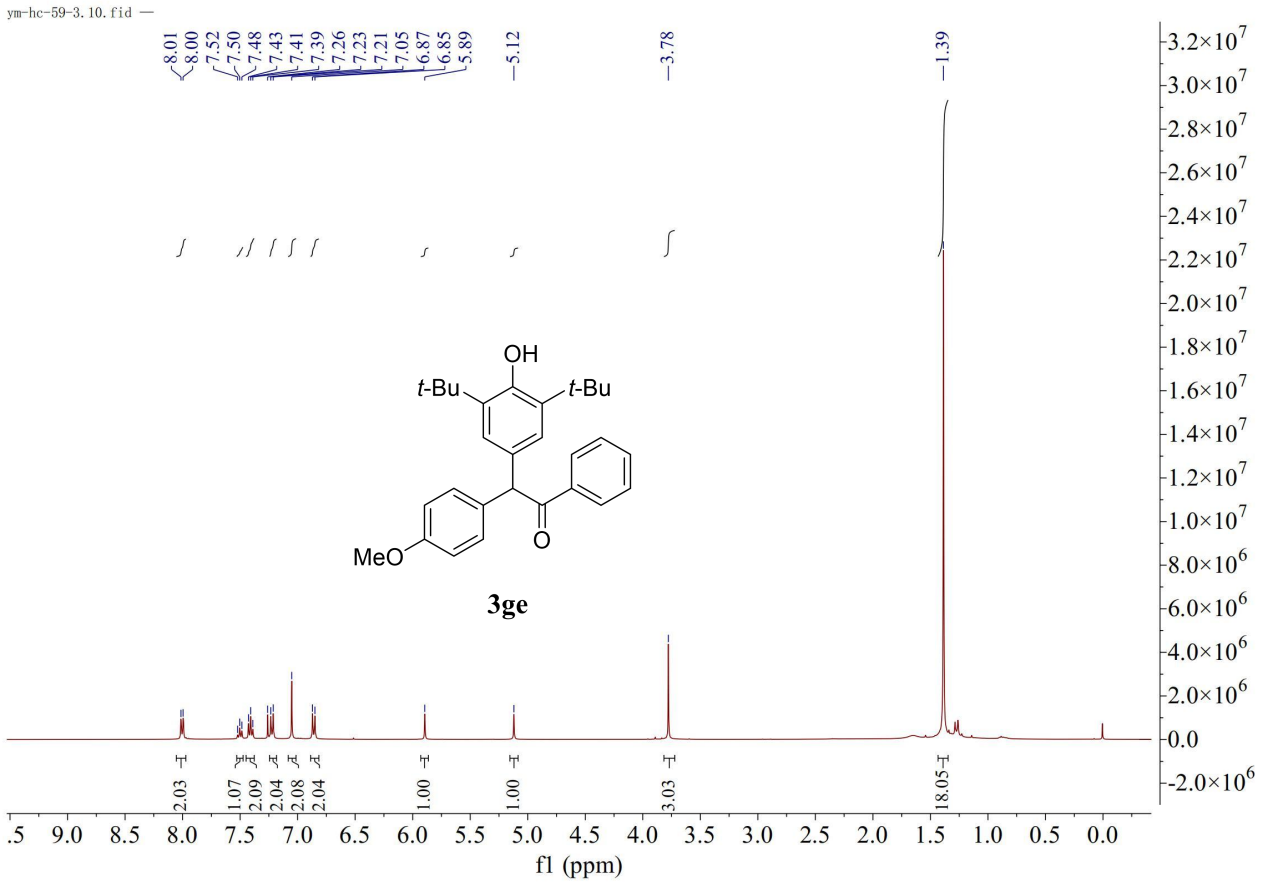

***ym-hc-63-4
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
O
Br
3ee


YM-HC-60-7-H.40.fid
8.02
8.00
7.52
7.50
7.48
7.43
7.41
7.39
7.34
7.32
7.26
7.24
7.22
7.10
5.91
5.11
1.39
1.28
OH
t-Bu
t-Bu
t-Bu
O
3fe
2.01
1.08
2.21
2.02
2.05
2.00
1.00
1.02
18.01
9.05
fl (ppm)

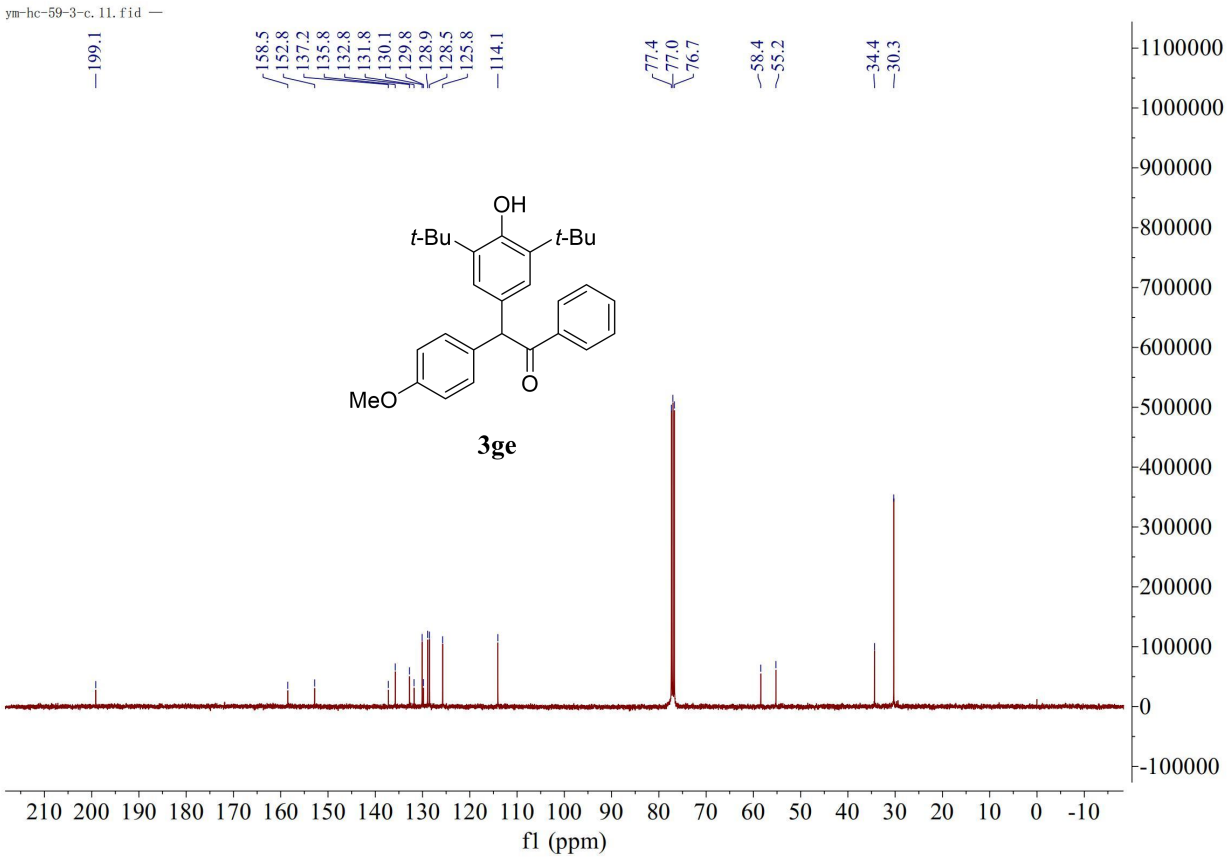

YM-HC-60-7-C.20.fid
199.0
152.9
149.6
137.3
136.7
135.8
132.7
130.2
129.5
128.9
128.6
128.5
125.8
125.5
77.3
77.0
76.7
58.8
34.4
31.3
30.3
29.4
OH
t-Bu
t-Bu
t-Bu
O
3fe
fl (ppm)

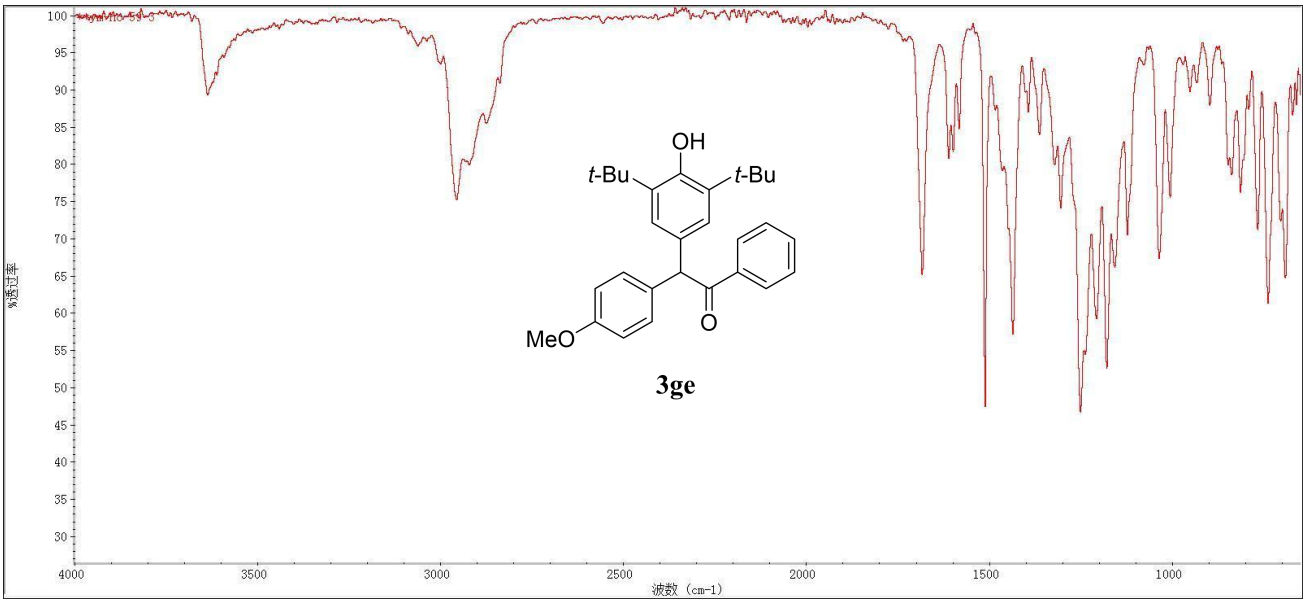

60-7
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
t-Bu
O

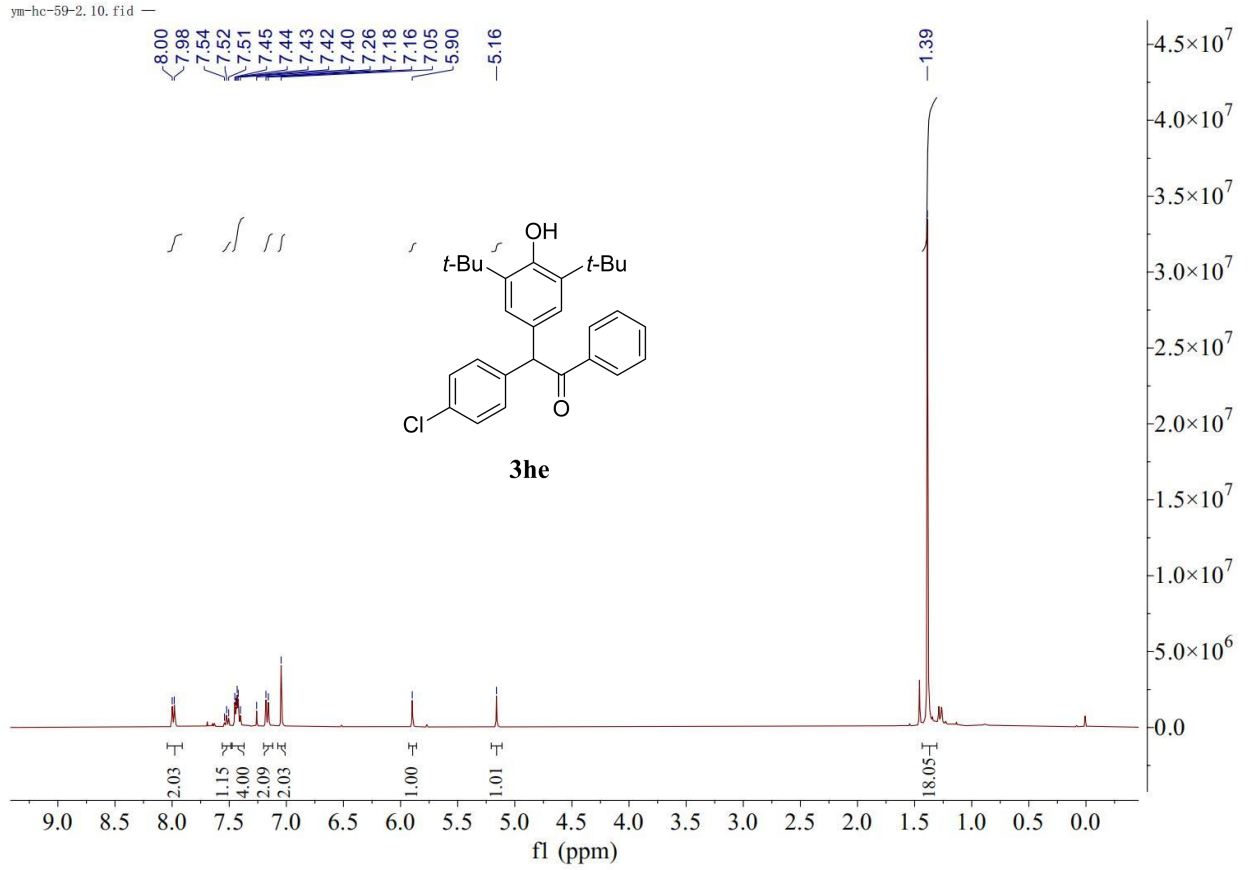
3fe


ym-hc-59-3.10.fid
8.01
8.00
7.52
7.50
7.48
7.43
7.41
7.39
7.26
7.23
7.21
7.05
6.87
6.85
5.89
5.12
3.78
1.39
OH
t-Bu
t-Bu
MeO
O
2.03
1.07
2.09
2.04
2.08
2.04
1.00
1.00
3.03
18.05
f1 (ppm)

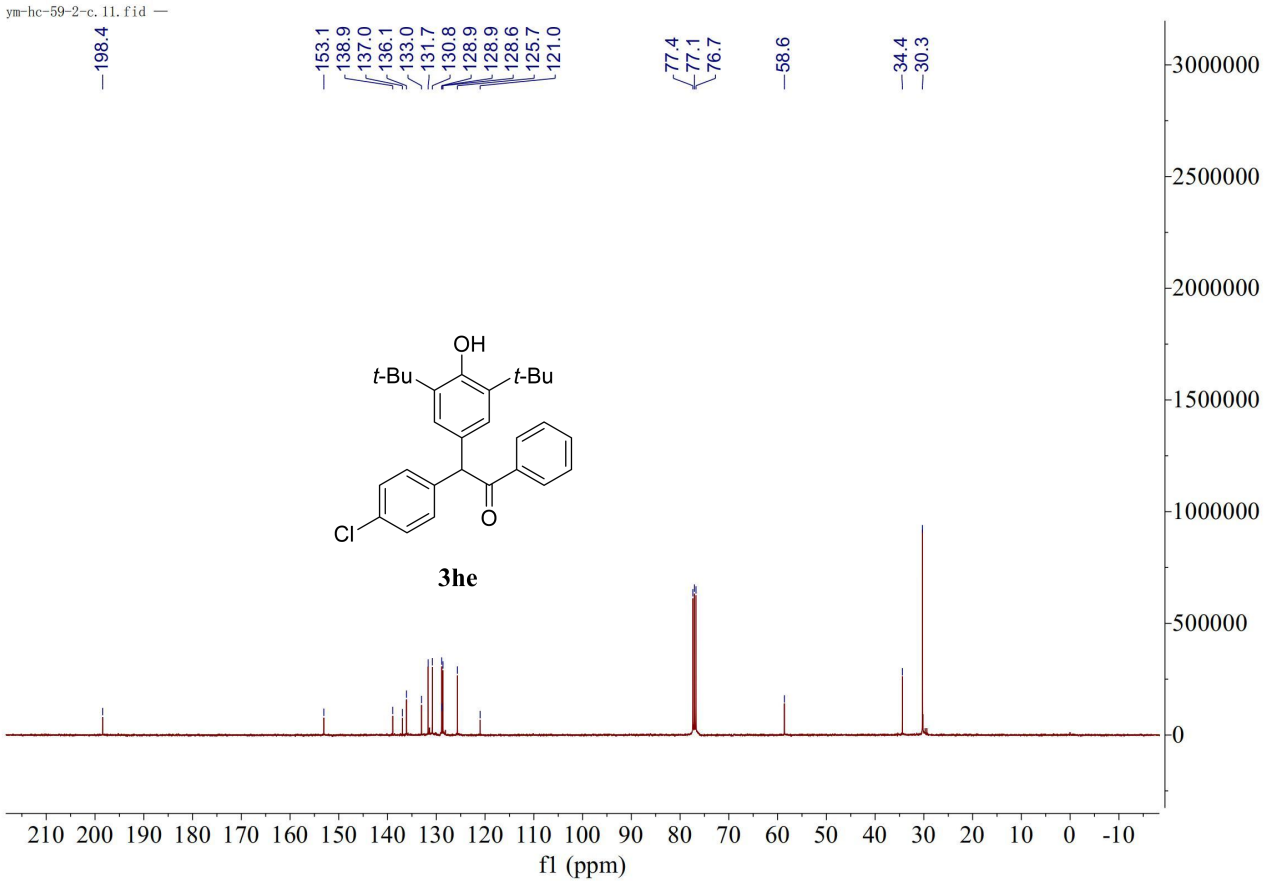
3ge


ym-hc-59-3-c.11.fid
199.1
158.5
152.8
137.2
135.8
132.8
131.8
130.1
129.8
128.9
128.5
125.8
114.1
77.4
77.0
76.7
58.4
55.2
34.4
30.3
OH
t-Bu
t-Bu
MeO
O
3ge
f1 (ppm)

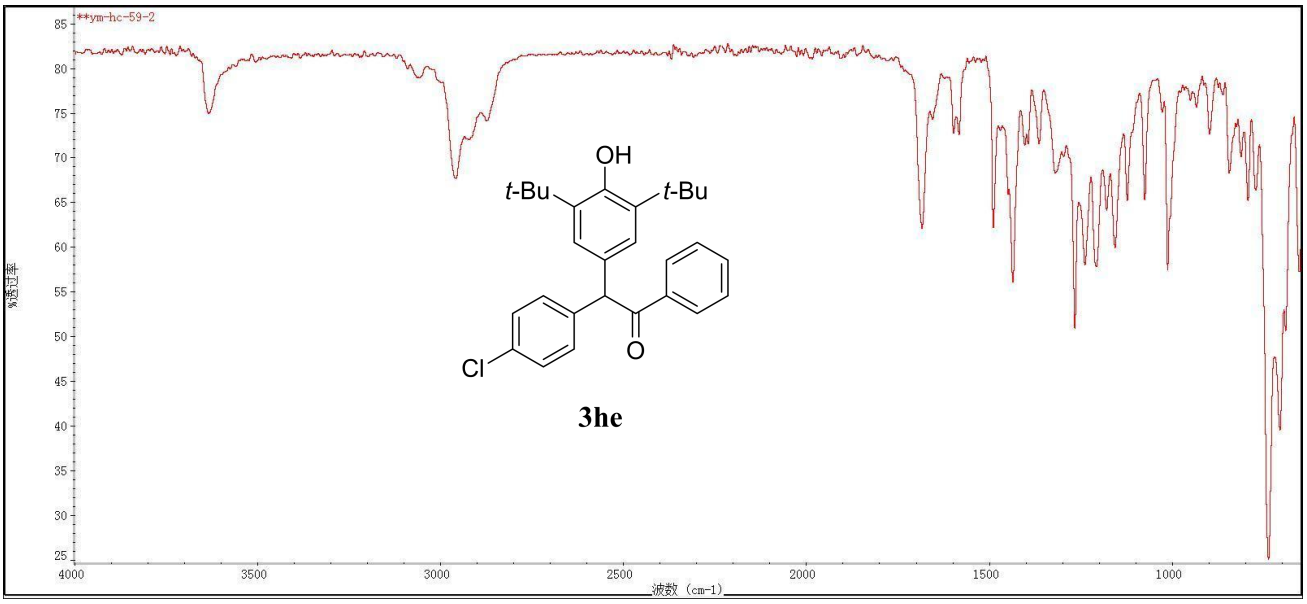

%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
MeO
O
3ge


ym-hc-59-2.10.fid
8.00
7.98
7.54
7.52
7.51
7.45
7.44
7.43
7.42
7.40
7.26
7.18
7.16
7.05
5.90
5.16
1.39
OH
t-Bu
t-Bu
Cl
O
2.03
1.15
4.00
2.09
2.03
1.00
1.01
18.05
fl (ppm)

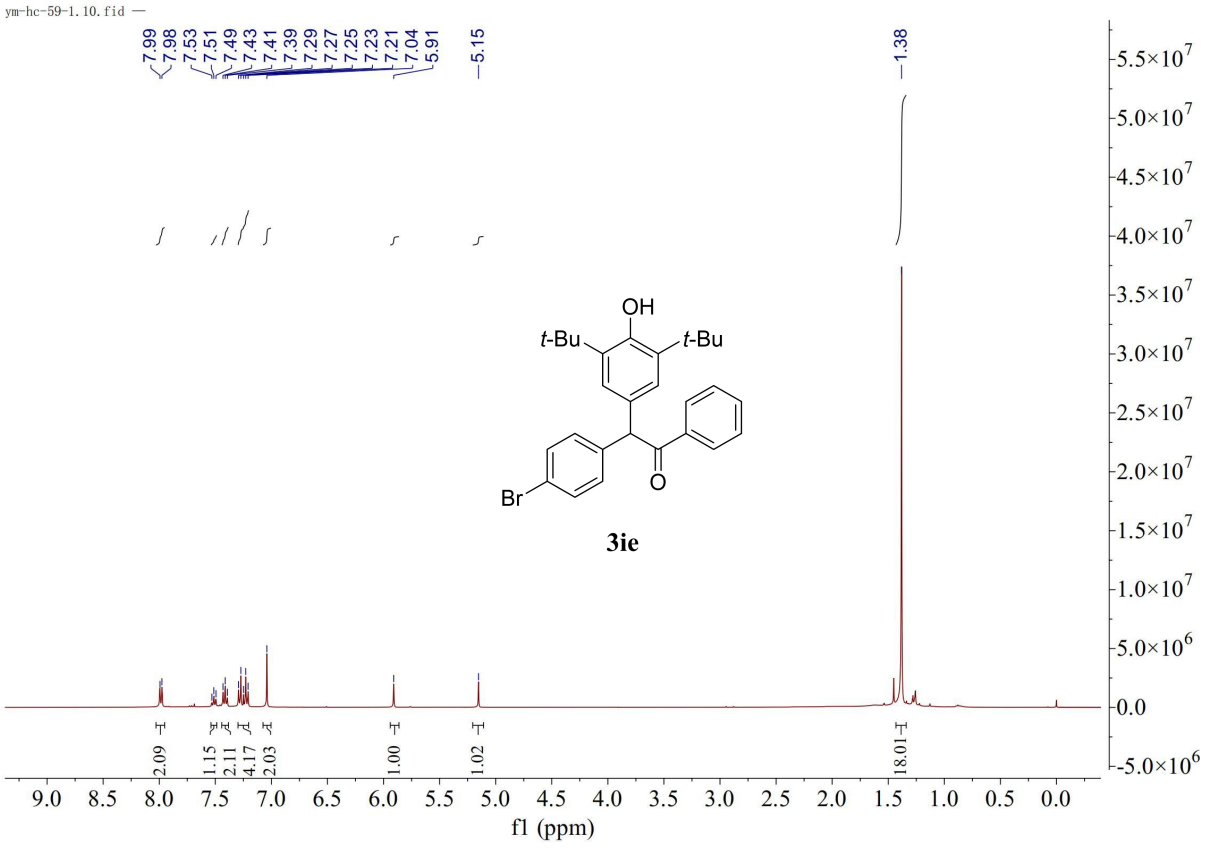
3he


ym-hc-59-2-c.11.fid
198.4
153.1
138.9
137.0
136.1
133.0
131.7
130.8
128.9
128.9
128.6
125.7
121.0
77.4
77.1
76.7
58.6
34.4
30.3
OH
t-Bu
t-Bu
Cl
O
fl (ppm)

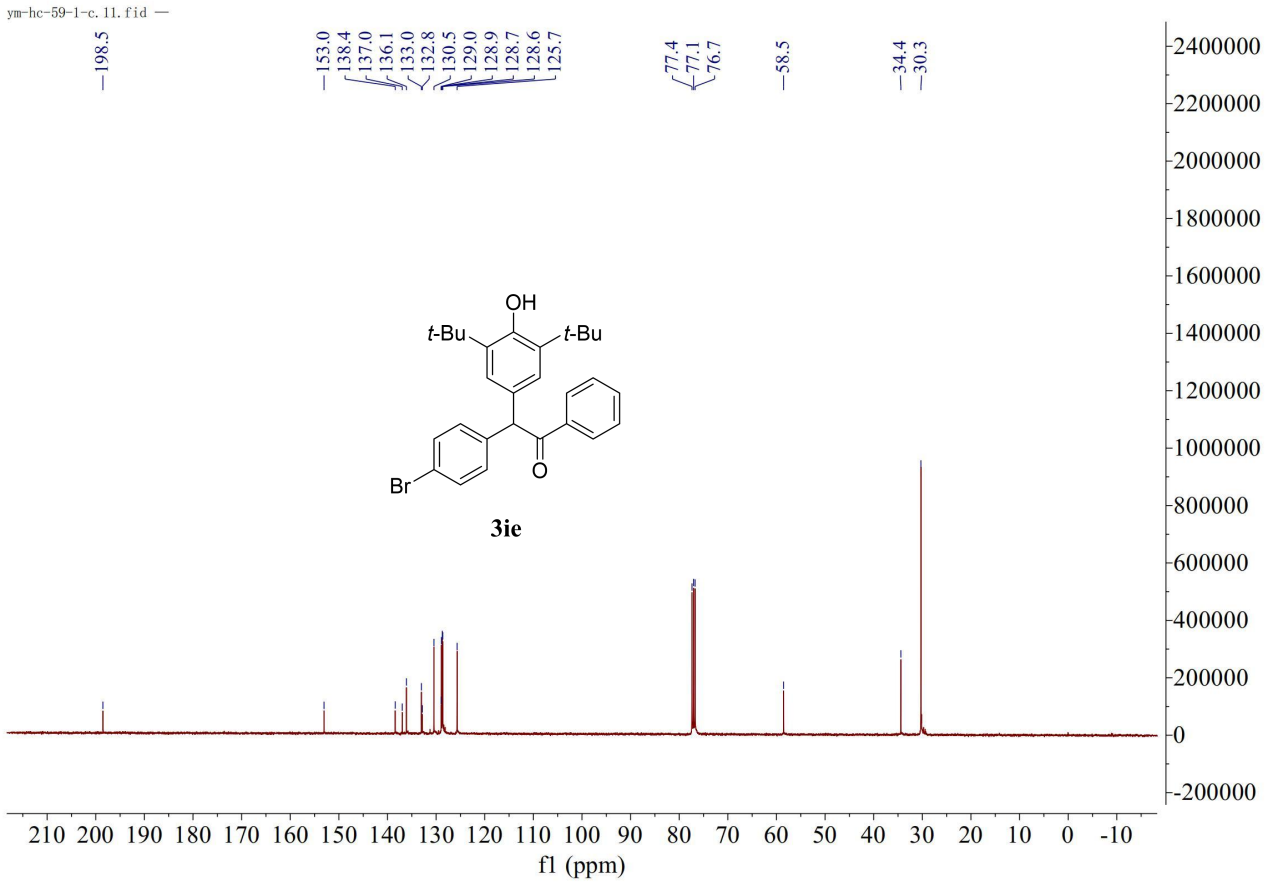
3he


**ym-hc-59-2
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Cl
O

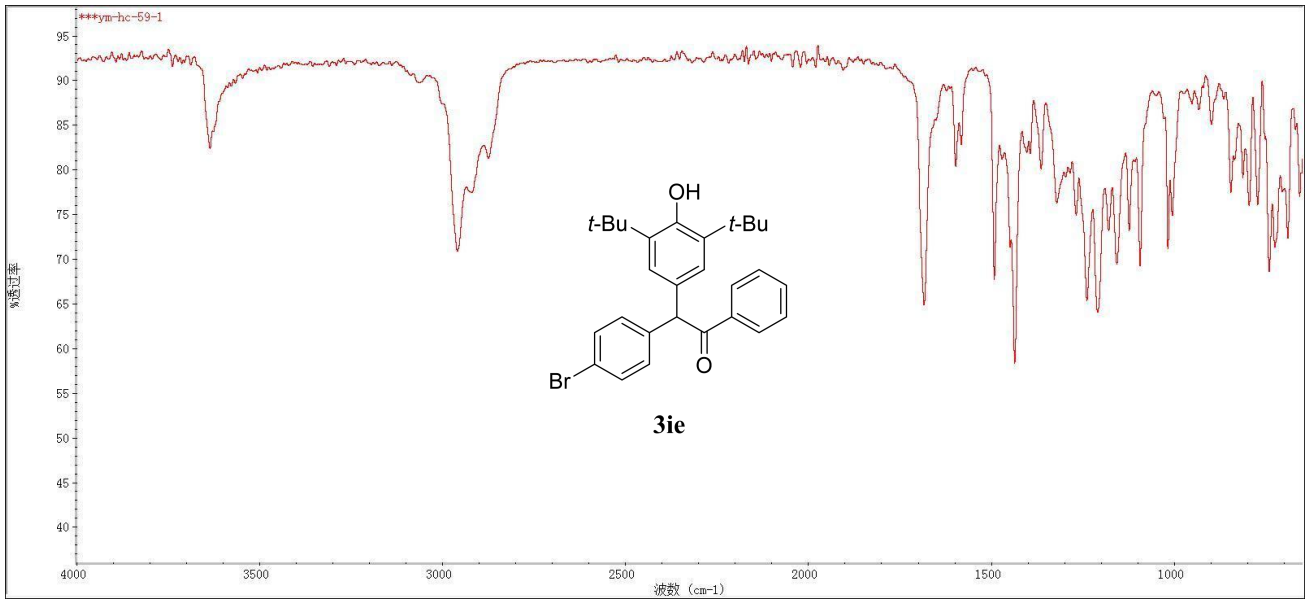
3he


ym-hc-59-1.10.fid
7.99
7.98
7.53
7.51
7.49
7.43
7.41
7.39
7.29
7.27
7.25
7.23
7.21
7.04
5.91
5.15
1.38
OH
t-Bu
t-Bu
Br
O
2.09
1.15
2.11
4.17
2.03
1.00
1.02
18.01
f1 (ppm)

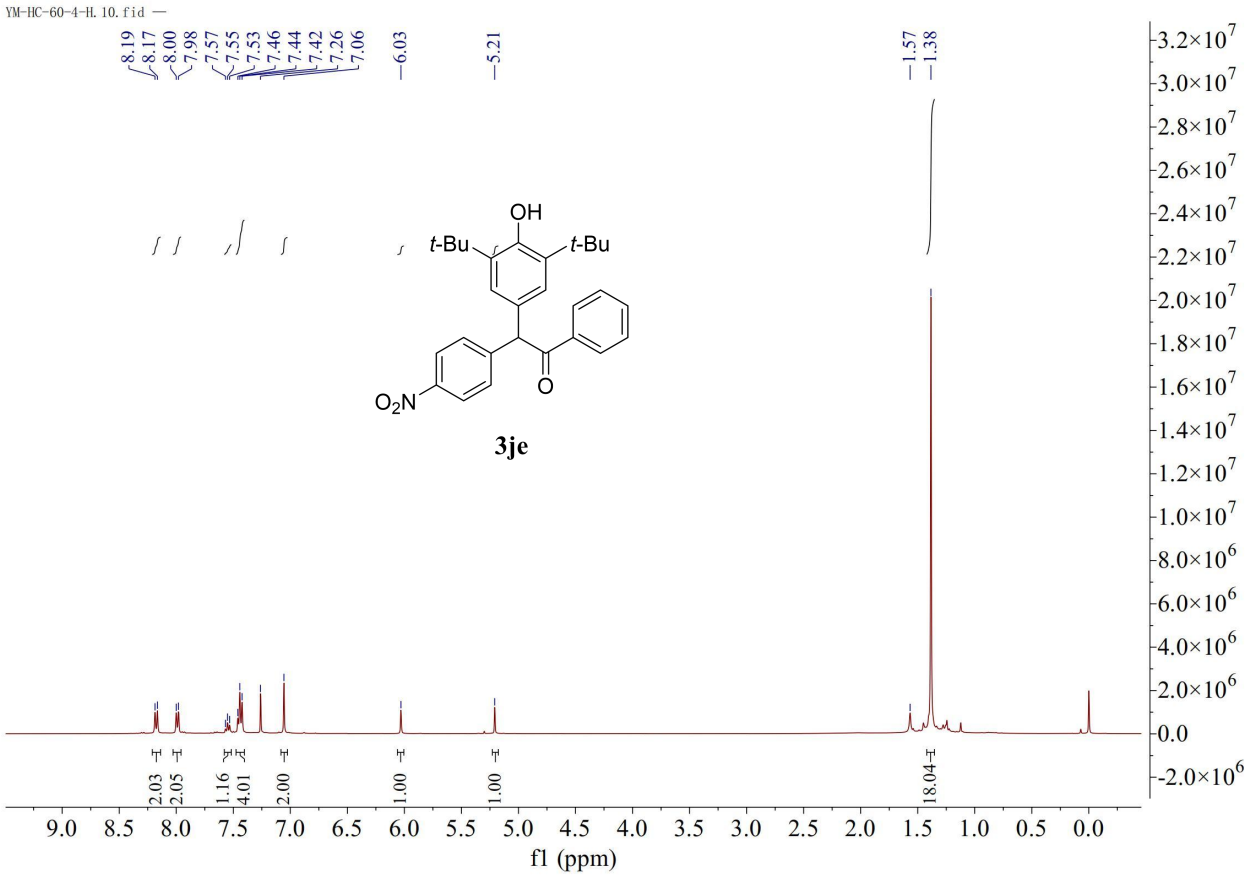
3ie

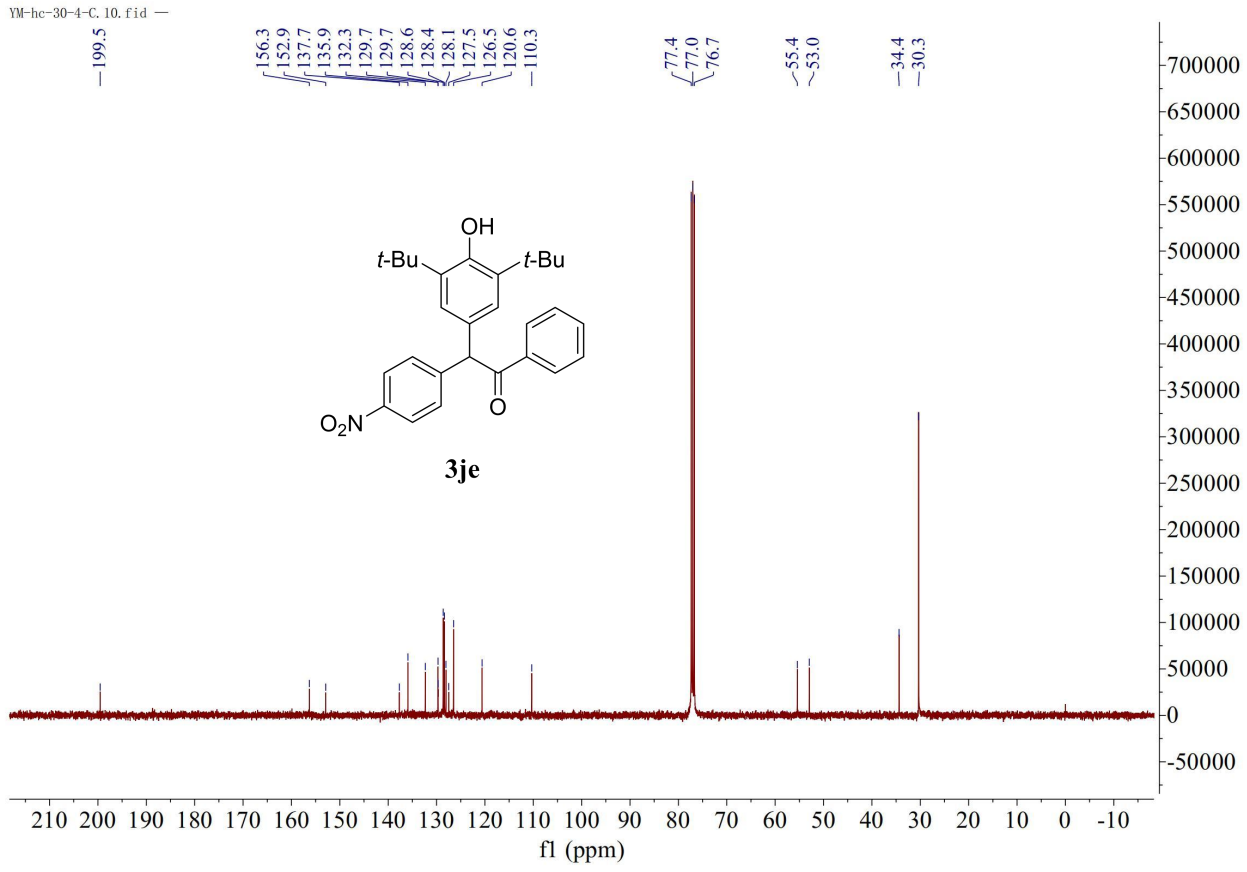

ym-hc-59-1-c.11.fid
198.5
153.0
138.4
137.0
136.1
133.0
132.8
130.5
129.0
128.9
128.7
128.6
125.7
77.4
77.1
76.7
58.5
34.4
30.3
OH
t-Bu
t-Bu
Br
O
2400000
2200000
2000000
1800000
1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
-200000
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

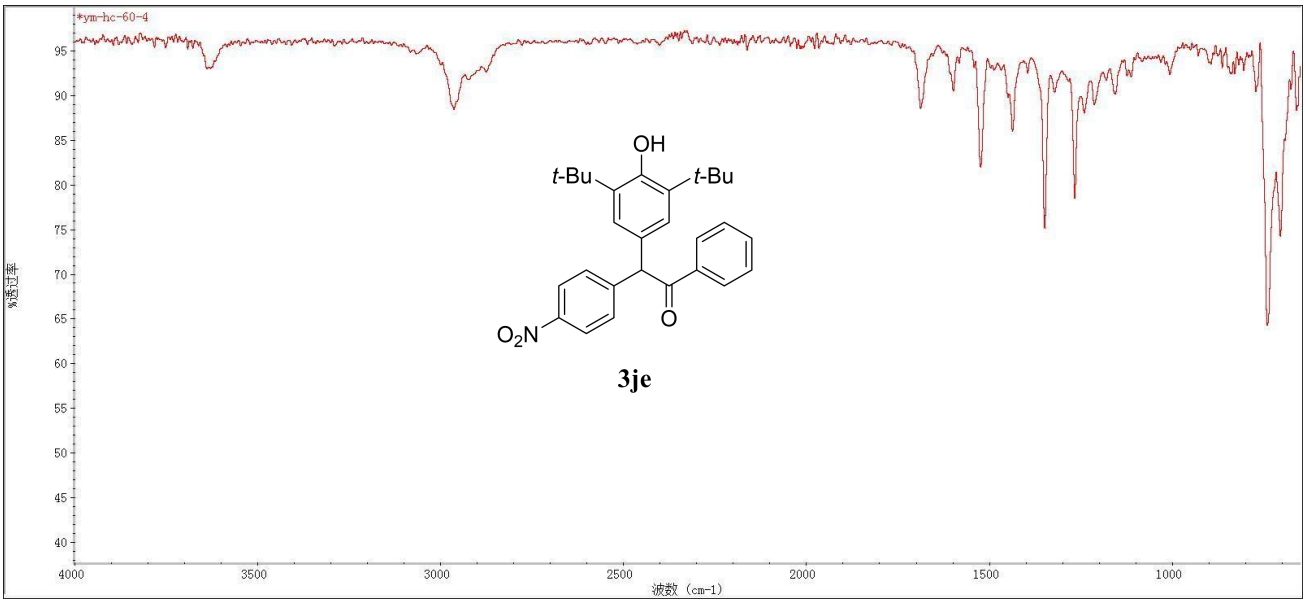
3ie


***ym-hc-59-1
%透过率
95
90
85
80
75
70
65
60
55
50
45
40
4000
3500
3000
2500
2000
1500
1000
波数 (cm-1)
OH
t-Bu
t-Bu
Br
O

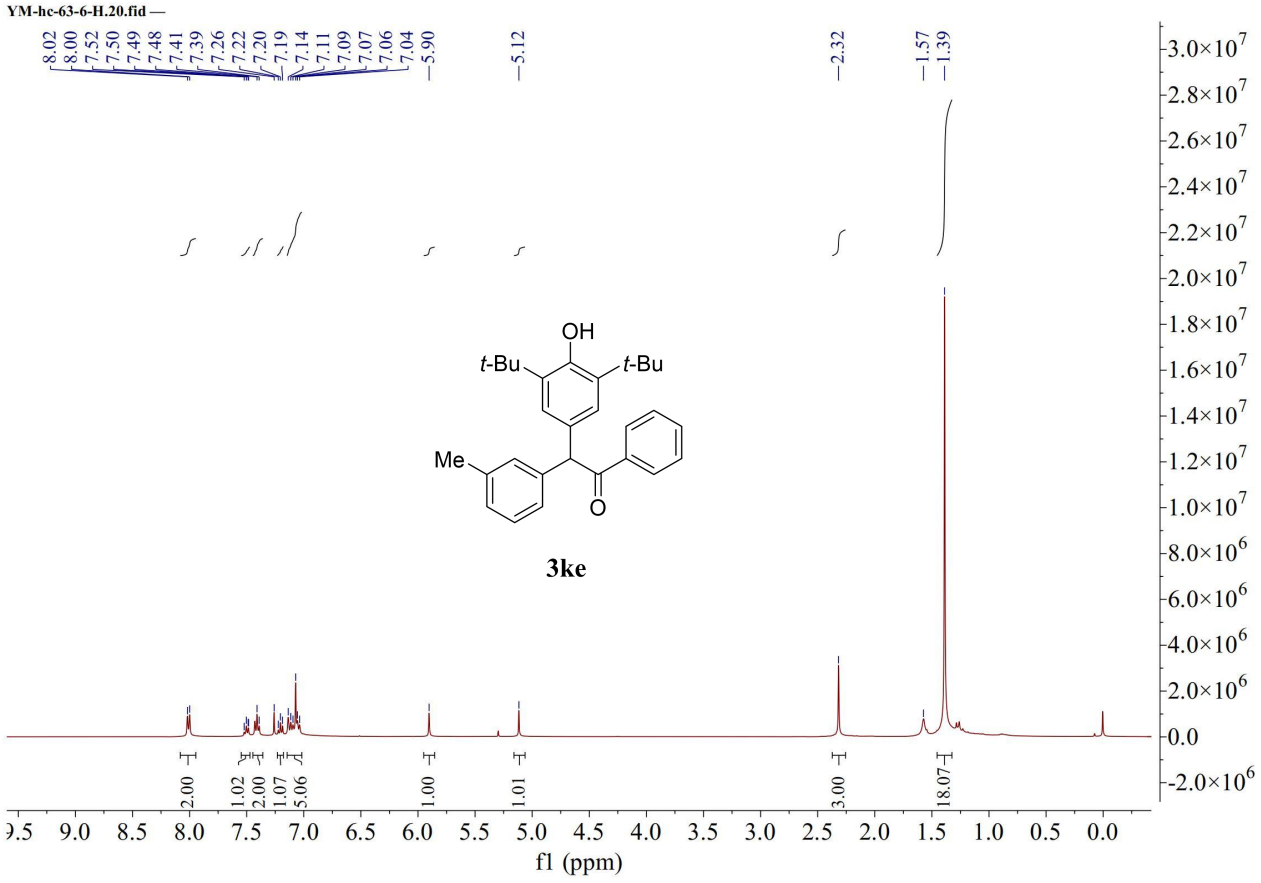
3ie


YM-HC-60-4-H.10.fid
8.19
8.17
8.00
7.98
7.57
7.55
7.53
7.46
7.44
7.42
7.26
7.06
6.03
5.21
1.57
1.38
OH
t-Bu
t-Bu
O2N
O
3je
2.03
2.05
1.16
4.01
2.00
1.00
1.00
18.04
f1 (ppm)

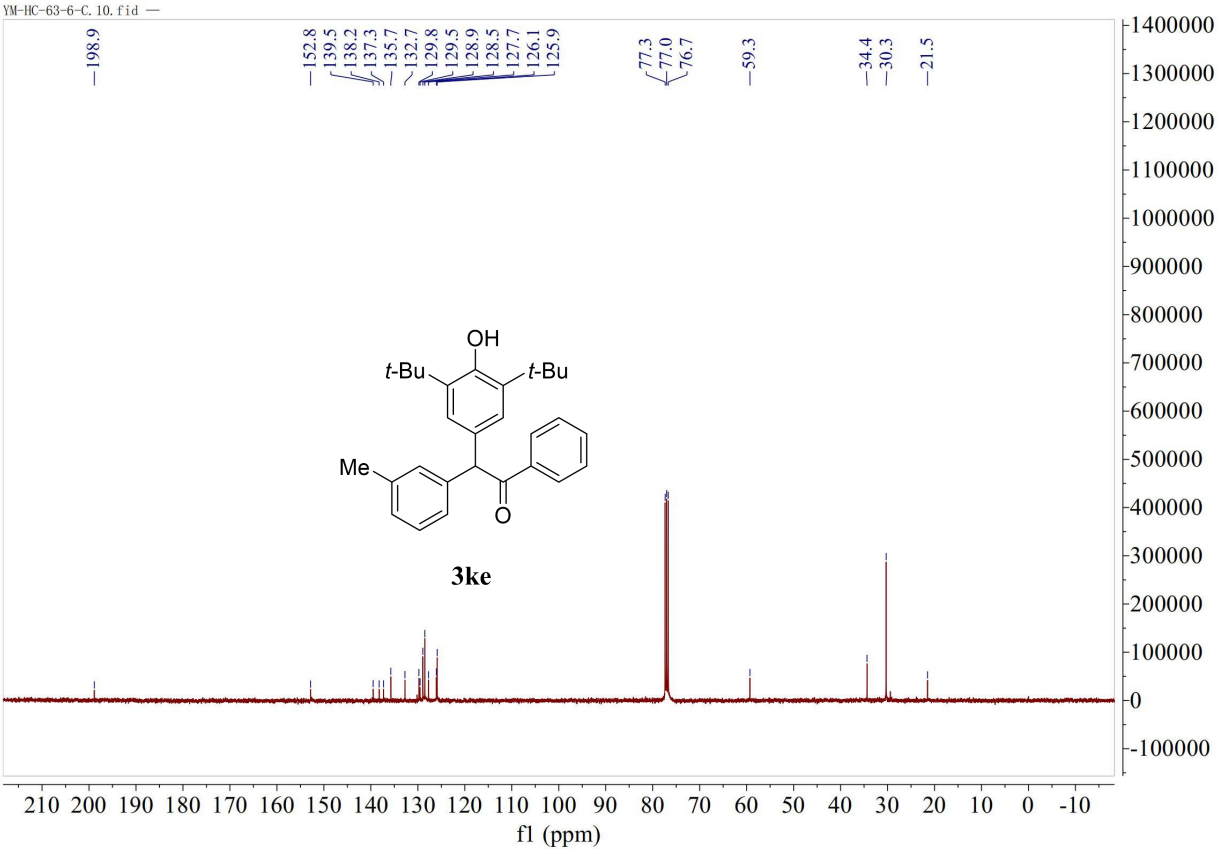

YM-hc-30-4-C.10.fid
199.5
156.3
152.9
137.7
135.9
132.3
129.7
129.7
128.6
128.4
128.1
127.5
126.5
120.6
110.3
77.4
77.0
76.7
55.4
53.0
34.4
30.3
OH
t-Bu
t-Bu
O2N
O
3je
f1 (ppm)

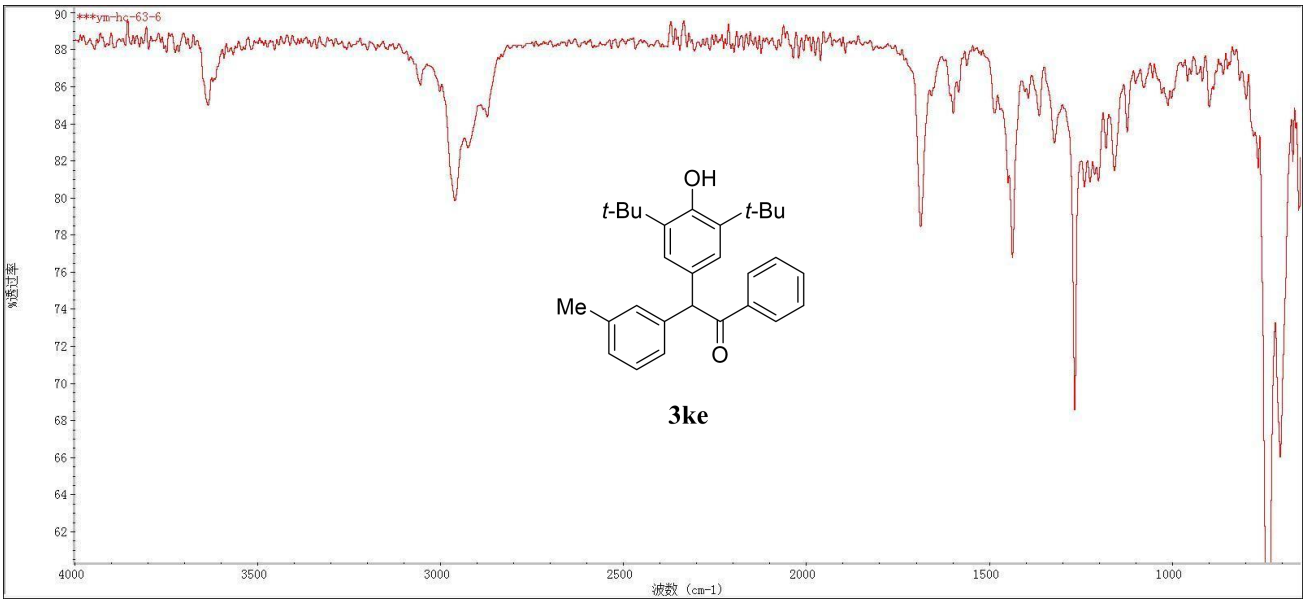

*ym-hc-60-4
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
O2N
O

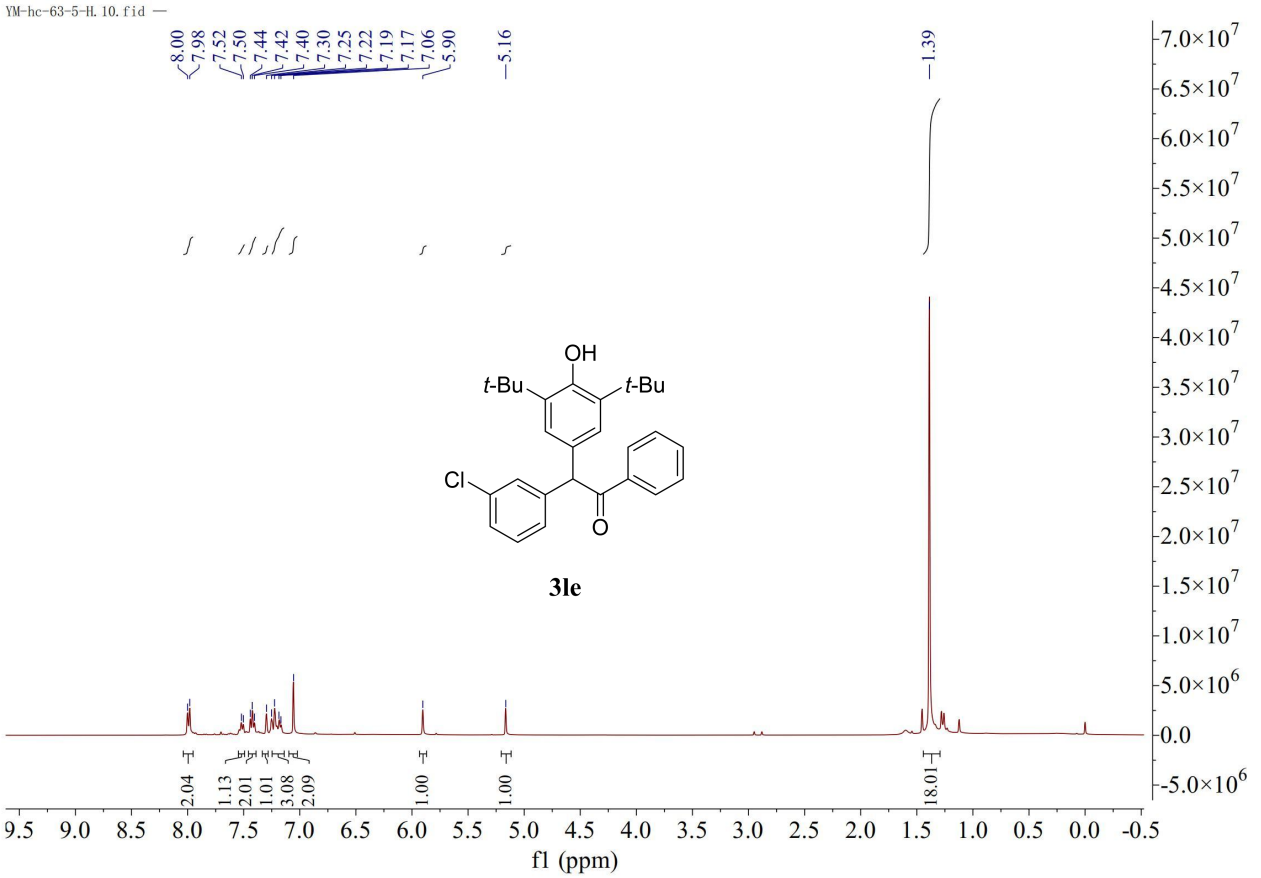
3je


YM-hc-63-6-H.20.fid
8.02
8.00
7.52
7.50
7.49
7.48
7.41
7.39
7.26
7.22
7.20
7.19
7.14
7.11
7.09
7.07
7.06
7.04
5.90
5.12
2.32
1.57
1.39
OH
t-Bu
t-Bu
Me
O
2.00
1.02
2.00
1.07
5.06
1.00
1.01
3.00
18.07
f1 (ppm)

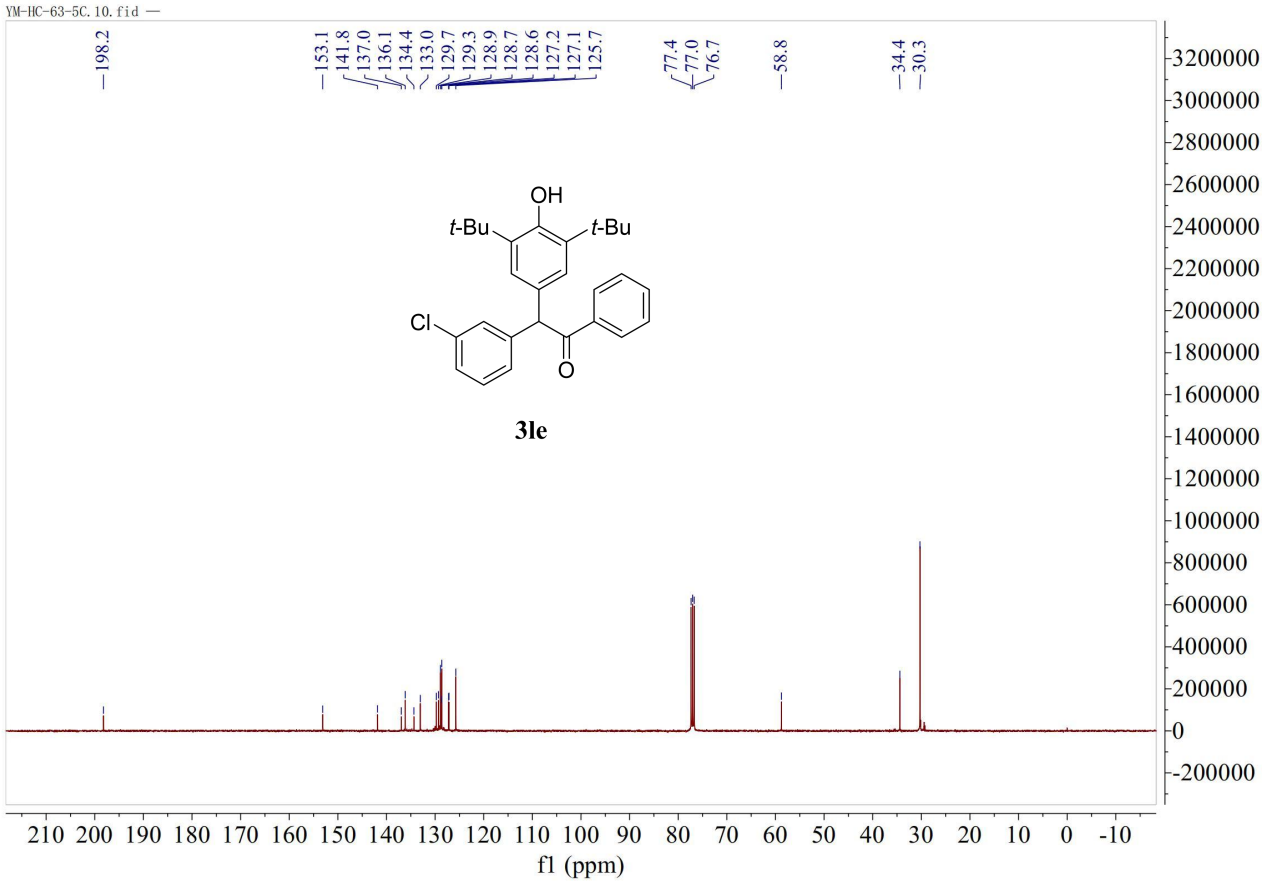
3ke


YM-HC-63-6-C.10.fid
198.9
152.8
139.5
138.2
137.3
135.7
132.7
129.8
129.5
128.9
128.5
127.7
126.1
125.9
77.3
77.0
76.7
59.3
34.4
30.3
21.5
OH
t-Bu
t-Bu
Me
O
3ke
f1 (ppm)

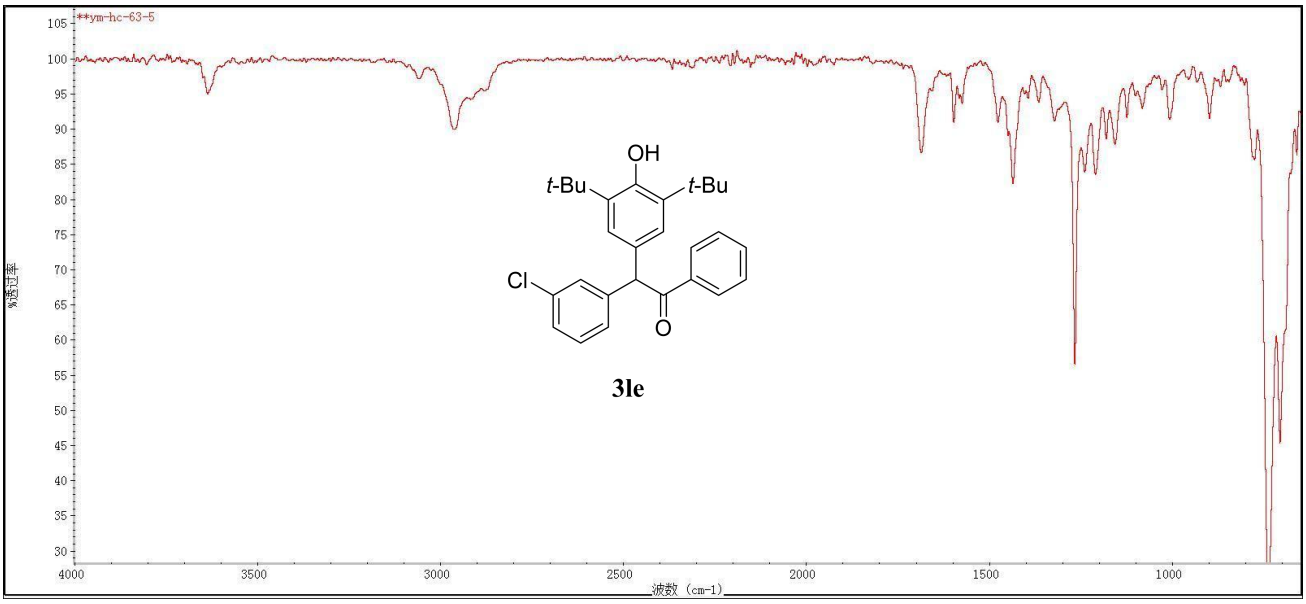

***ym-hc-63-6
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Me
O
3ke


YM-hc-63-5-H.10.fid
8.00
7.98
7.52
7.50
7.44
7.42
7.40
7.30
7.25
7.22
7.19
7.17
7.06
5.90
5.16
1.39
OH
t-Bu
t-Bu
Cl
O
2.04
1.13
2.01
1.01
3.08
2.09
1.00
1.00
18.01
f1 (ppm)

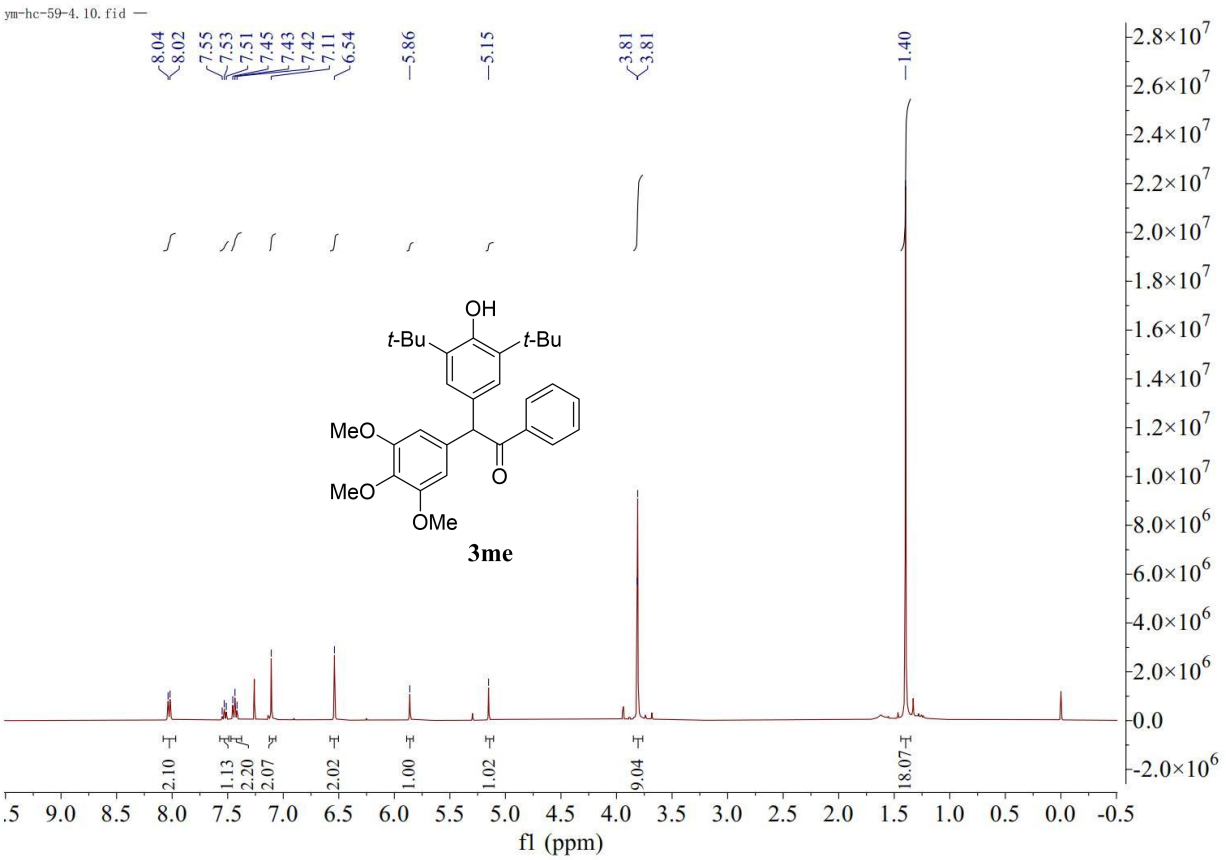
3le


YM-HC-63-5C.10.fid
198.2
153.1
141.8
137.0
136.1
134.4
133.0
129.7
129.3
128.9
128.7
128.6
127.2
127.1
125.7
77.4
77.0
76.7
58.8
34.4
30.3
OH
t-Bu
t-Bu
Cl
O
f1 (ppm)

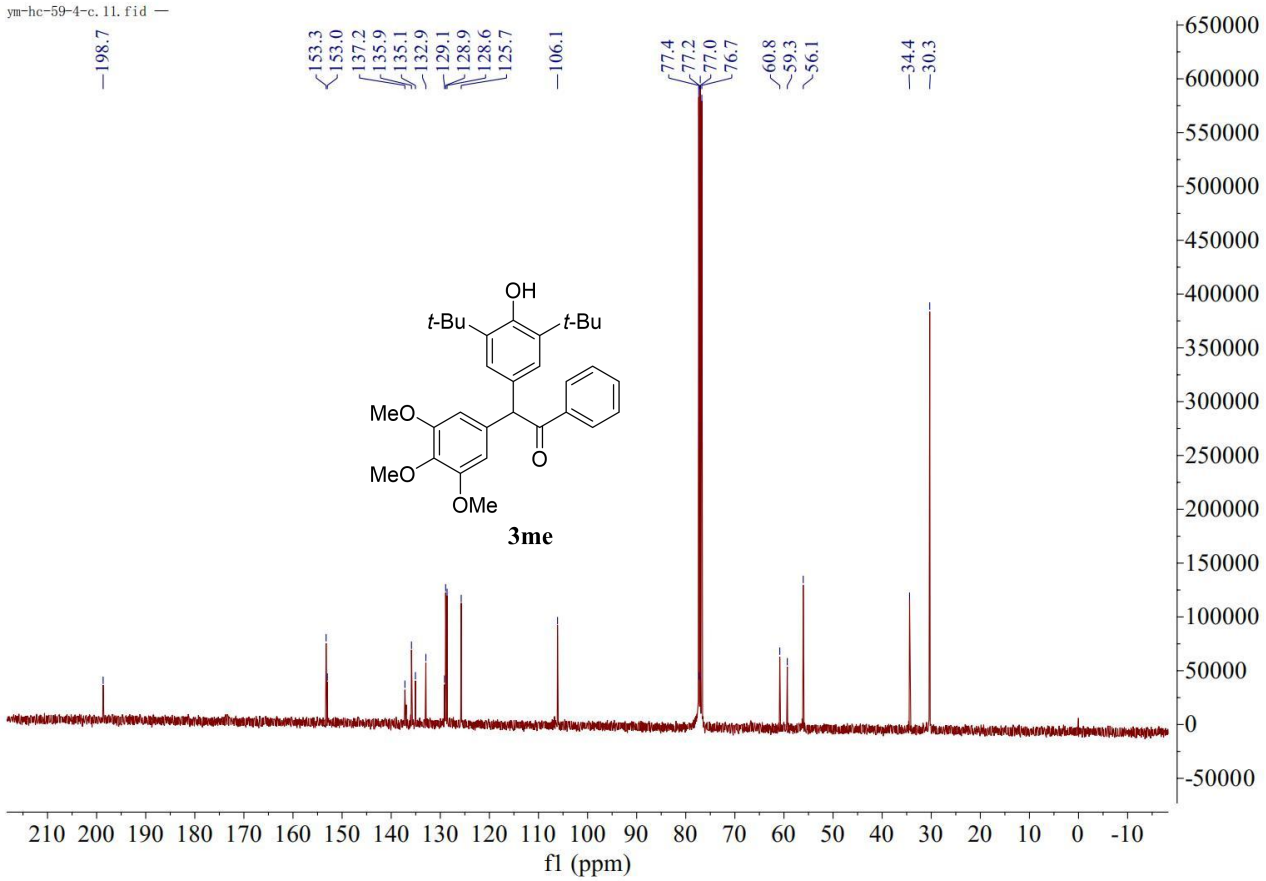
3le

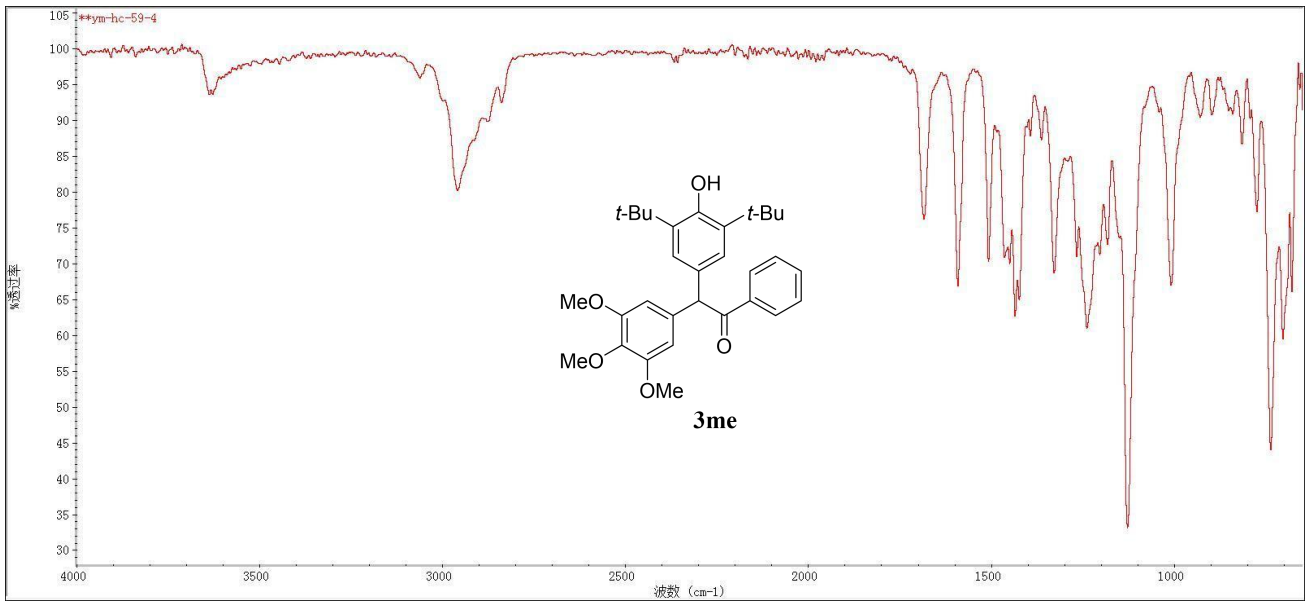

**ym-hc-63-5
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
Cl
O

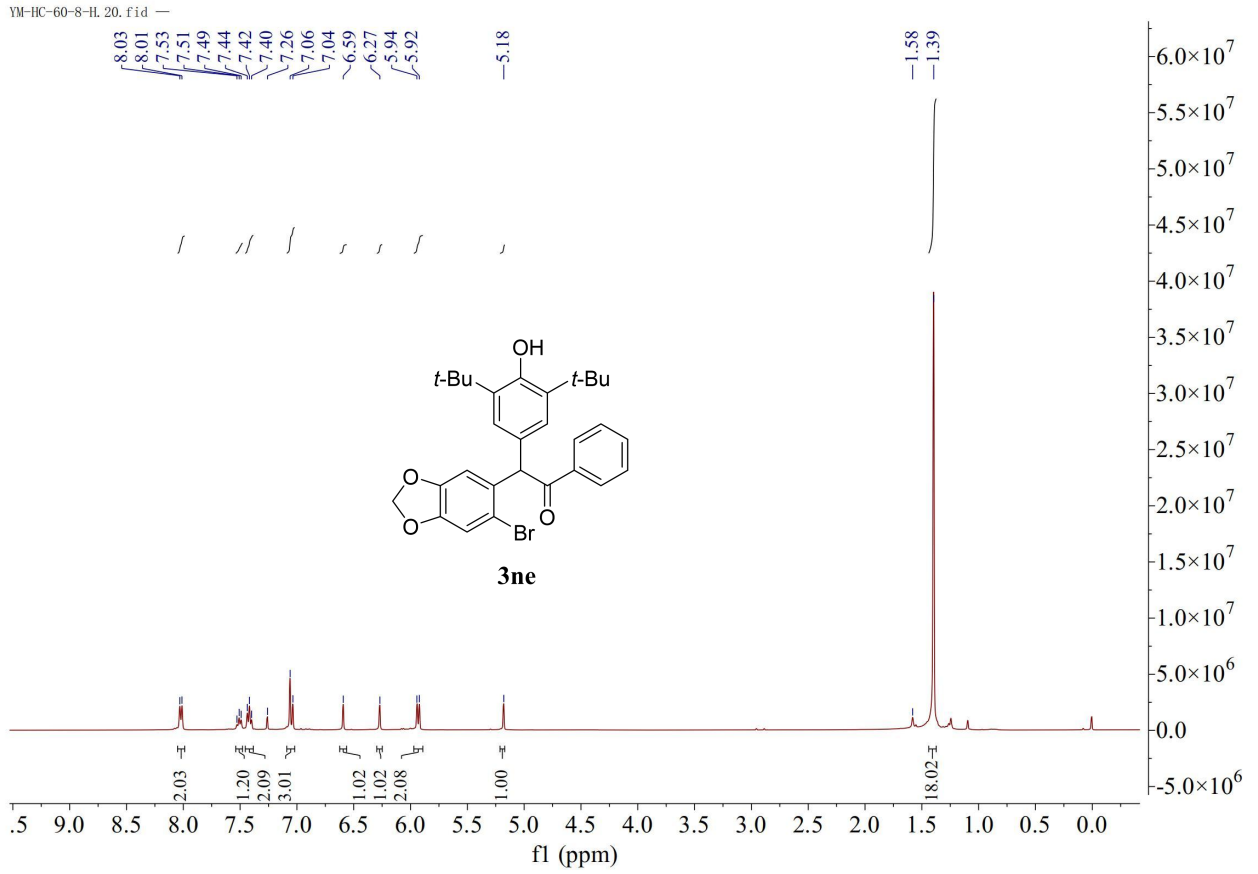
3le

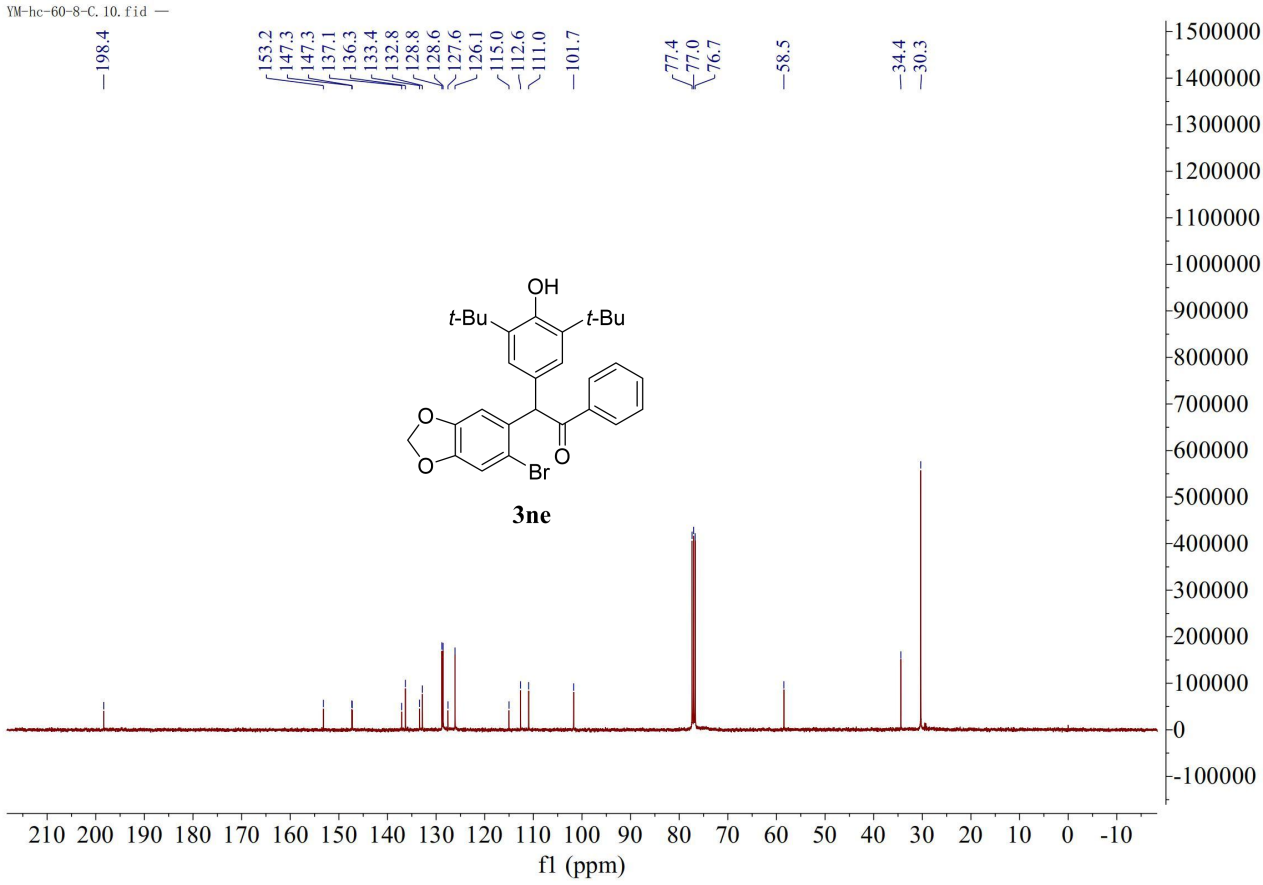

ym-hc-59-4.10.fid
8.04
8.02
7.55
7.53
7.51
7.45
7.43
7.42
7.11
6.54
5.86
5.15
3.81
3.81
1.40
OH
t-Bu
t-Bu
MeO
MeO
OMe
O
2.10
1.13
2.20
2.07
2.02
1.00
1.02
9.04
18.07
f1 (ppm)

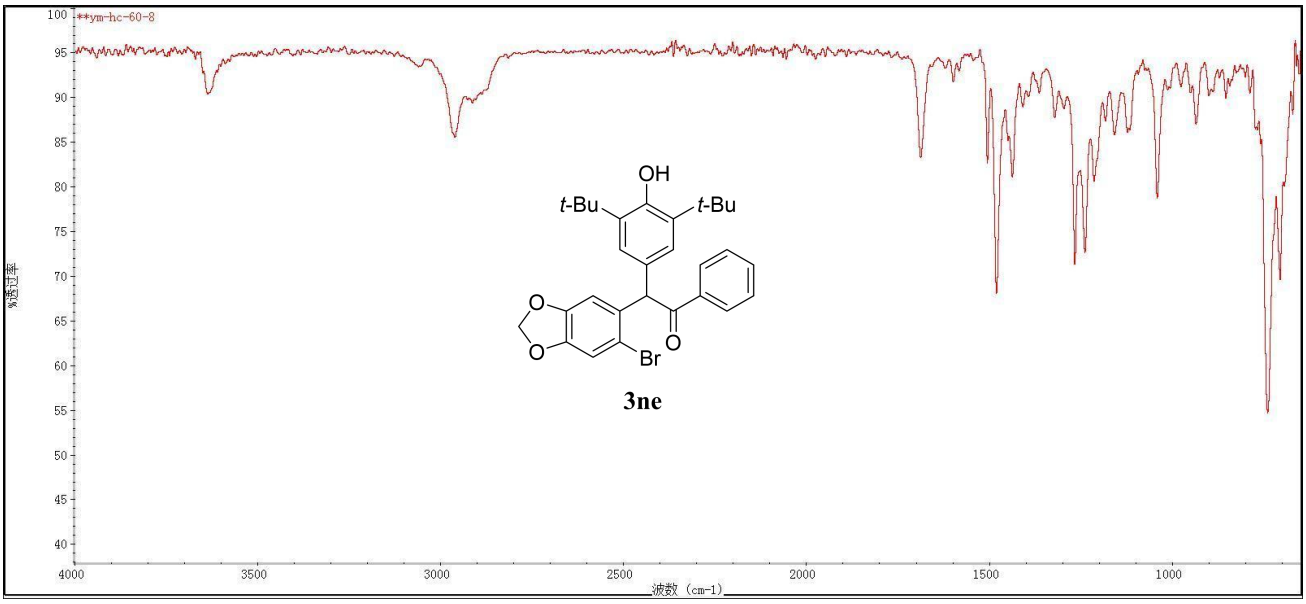
3me


ym-hc-59-4-c.11.fid
198.7
153.3
153.0
137.2
135.9
135.1
132.9
129.1
128.9
128.6
125.7
106.1
77.4
77.2
77.0
76.7
60.8
59.3
56.1
34.4
30.3
650000
600000
550000
500000
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
-50000
OH
t-Bu
t-Bu
MeO
MeO
OMe
O
3me
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

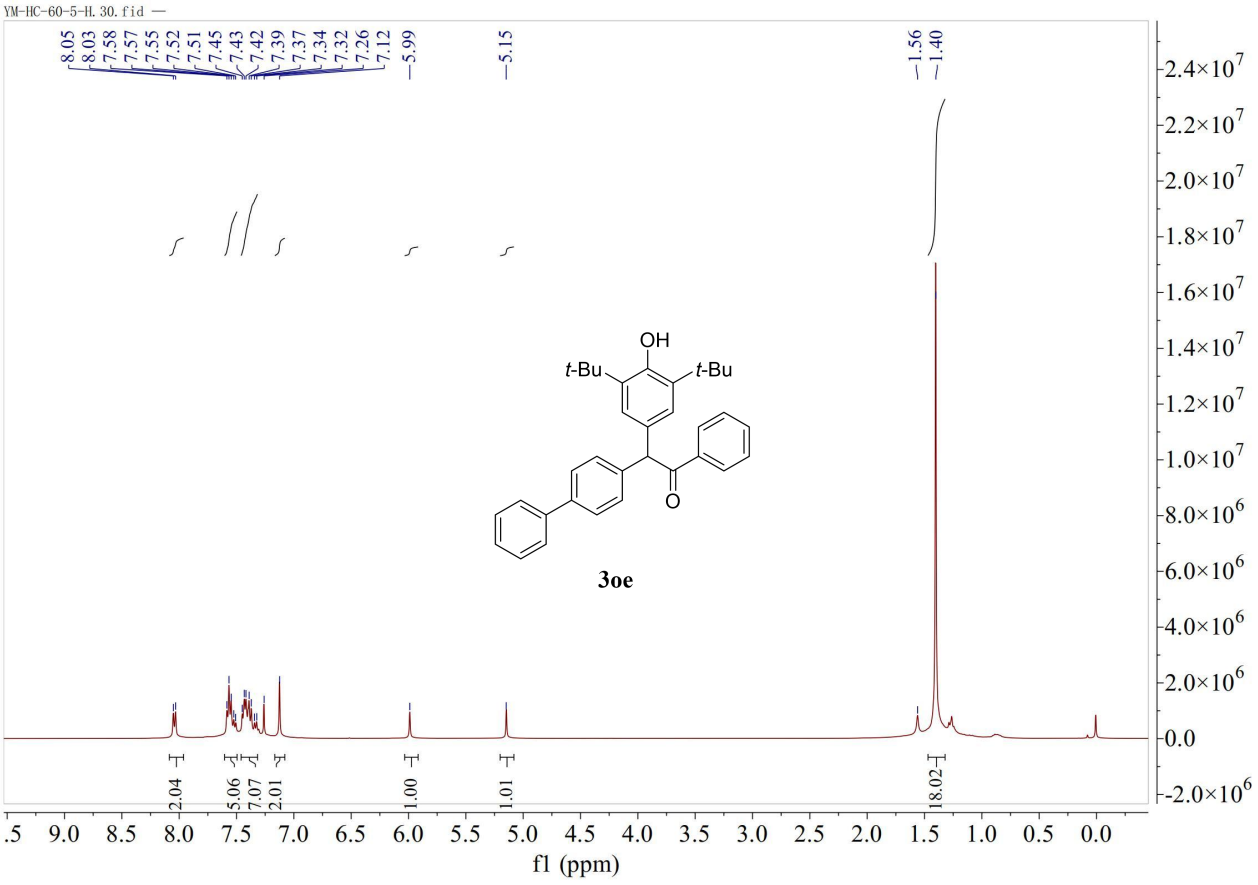

**ym-hc-59-4
%透过率
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
4000
3500
3000
2500
2000
1500
1000
波数 (cm-1)
OH
t-Bu
t-Bu
MeO
MeO
OMe
O
3me


YM-HC-60-8-H.20.fid
8.03
8.01
7.53
7.51
7.49
7.44
7.42
7.40
7.26
7.06
7.04
6.59
6.27
5.94
5.92
5.18
1.58
1.39
OH
t-Bu
t-Bu
O
O
Br
O
3ne
2.03
1.20
2.09
3.01
1.02
1.02
2.08
1.00
18.02
fl (ppm)

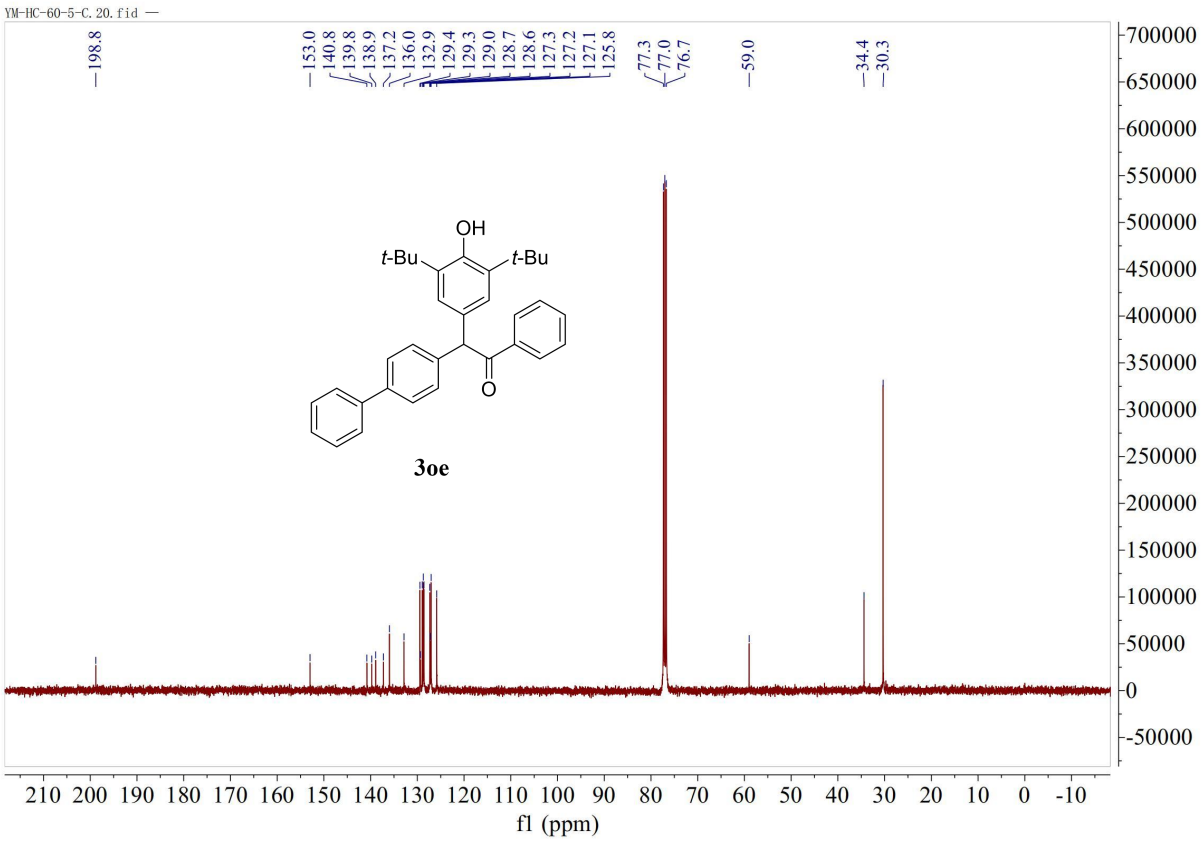

YM-hc-60-8-C.10.fid
198.4
153.2
147.3
147.3
137.1
136.3
133.4
132.8
128.8
128.6
127.6
126.1
115.0
112.6
111.0
101.7
77.4
77.0
76.7
58.5
34.4
30.3
OH
t-Bu
t-Bu
O
O
Br
O
3ne
fl (ppm)

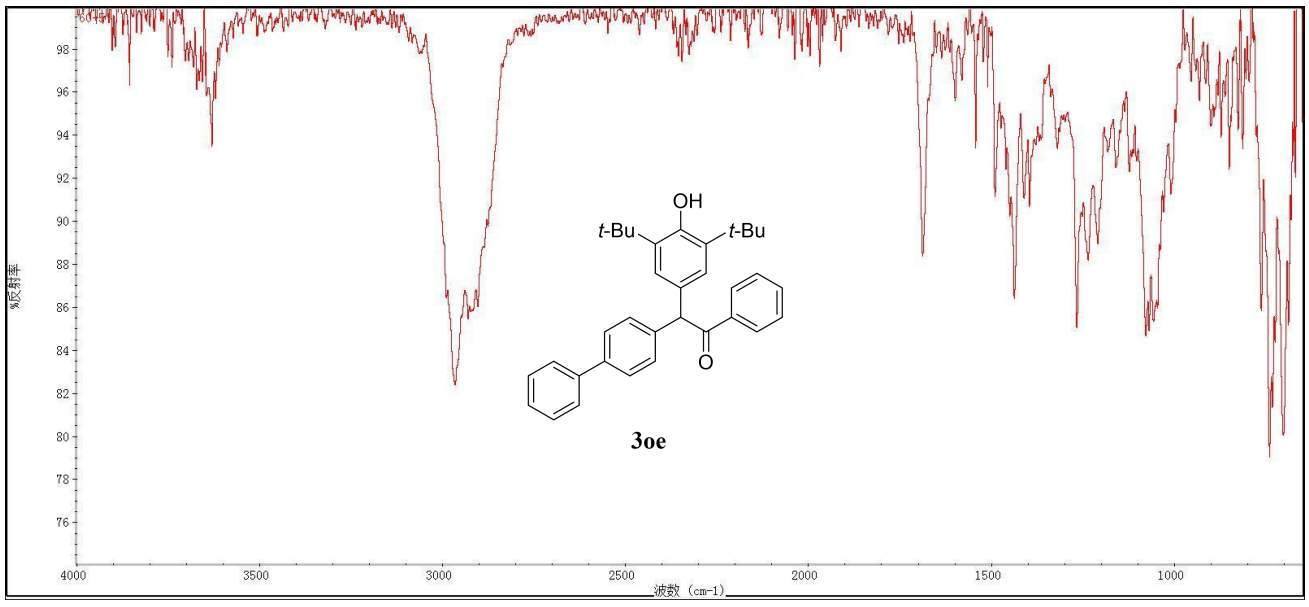

**ym-hc-60-8
%透过率
波数 (cm-1)
OH
t-Bu
t-Bu
O
O
O
Br

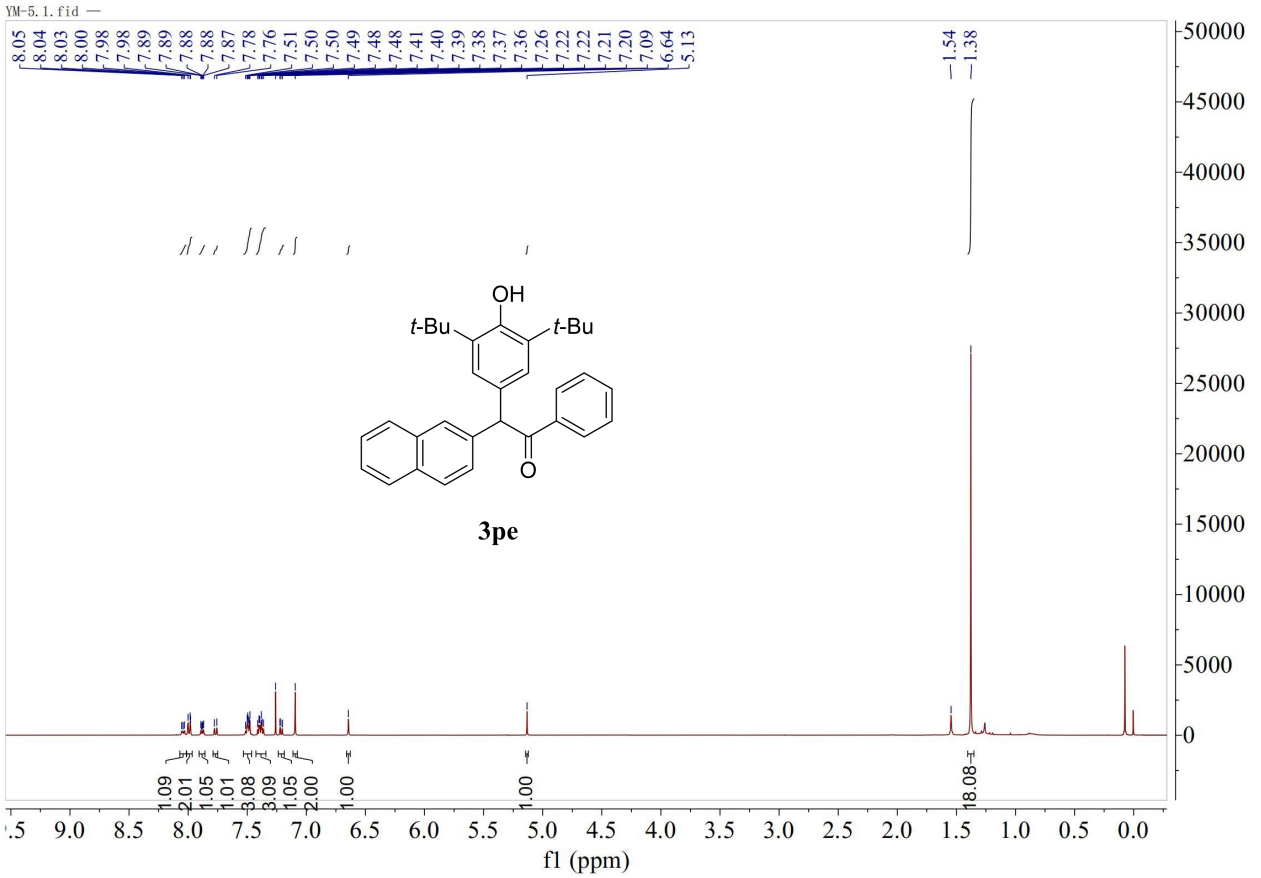
3ne

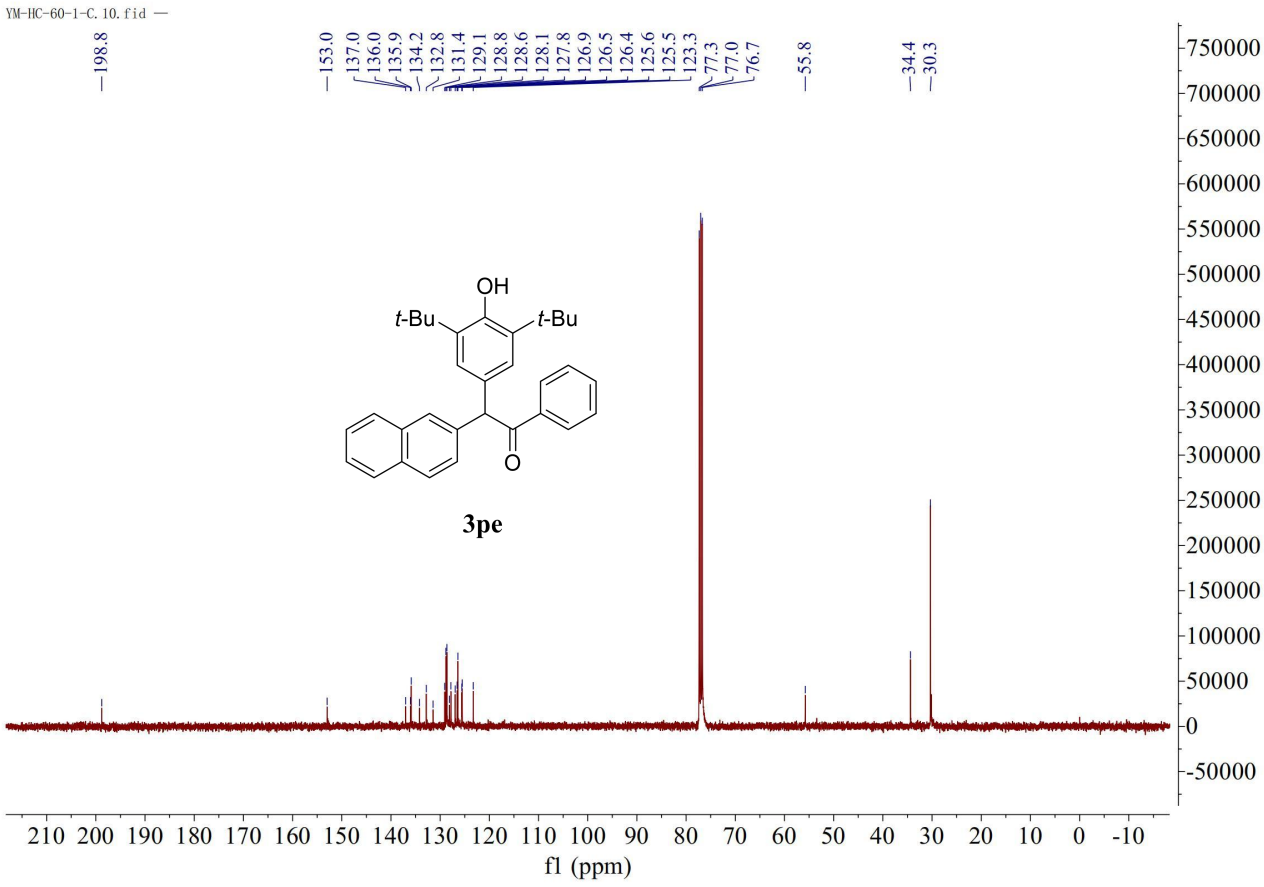

YM-HC-60-5-H.30.fid
8.05
8.03
7.58
7.57
7.55
7.52
7.51
7.45
7.43
7.42
7.39
7.37
7.34
7.32
7.26
7.12
5.99
5.15
1.56
1.40
OH
t-Bu
t-Bu
O
2.04
5.06
7.07
2.01
1.00
1.01
18.02
f1 (ppm)

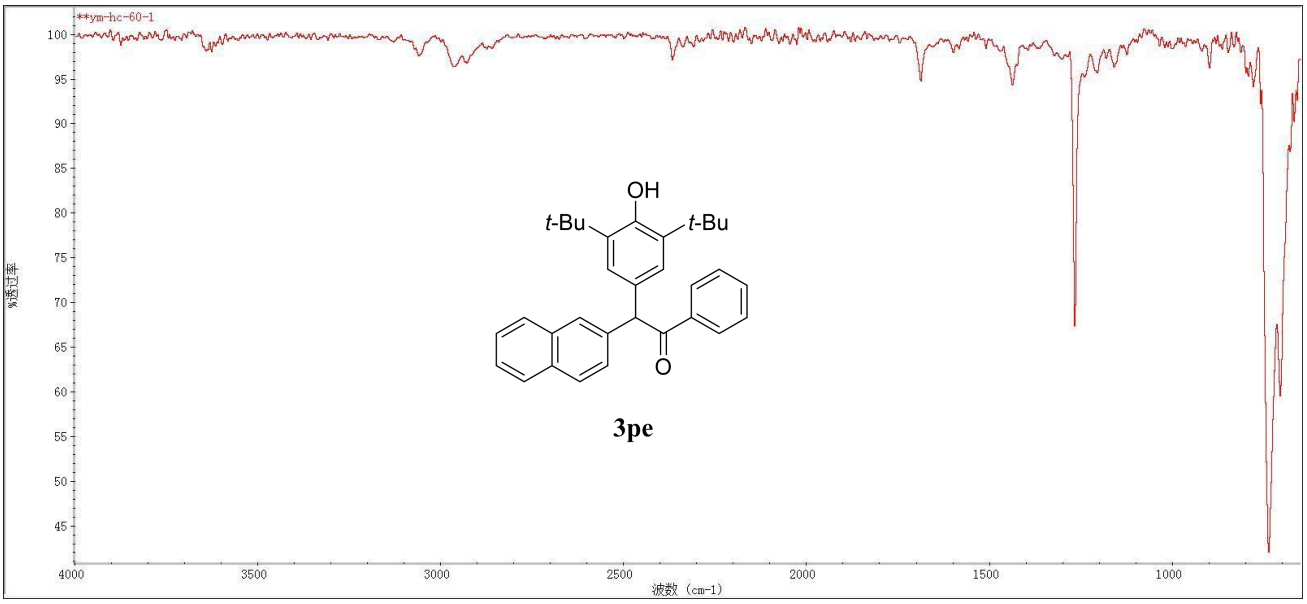
3oe


YM-HC-60-5-C.20.fid
198.8
153.0
140.8
139.8
138.9
137.2
136.0
132.9
129.4
129.3
129.0
128.7
128.6
127.3
127.2
127.1
125.8
77.3
77.0
76.7
59.0
34.4
30.3
OH
t-Bu
t-Bu
O
3oe
f1 (ppm)


OH
t-Bu
t-Bu
O
3oe
波数 (cm-1)


YM-5.1.fid
8.05 8.04 8.03 8.00 7.98 7.89 7.89 7.88 7.88 7.87 7.78 7.76 7.51 7.50 7.50 7.49 7.48 7.48 7.41 7.40 7.39 7.38 7.37 7.36 7.26 7.22 7.22 7.21 7.20 7.09 6.64 5.13
1.54 1.38
OH
t-Bu
t-Bu
O
3pe
1.09 2.01 1.05 1.01 3.08 3.09 1.05 2.00 1.00 1.00 18.08
f1 (ppm)


YM-HC-60-1-C.10.fid
198.8 153.0 137.0 136.0 135.9 134.2 132.8 131.4 129.1 128.8 128.6 128.1 127.8 126.9 126.5 126.4 125.6 125.5 123.3 77.3 77.0 76.7 55.8 34.4 30.3
OH
t-Bu
t-Bu
O
3pe
f1 (ppm)

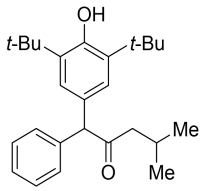
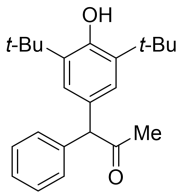

**ym-hc-60-1
%透过率
100
95
90
85
80
75
70
65
60
55
50
45
4000
3500
3000
2500
2000
1500
1000
波数 (cm-1)
OH
t-Bu
t-Bu
O

3pe

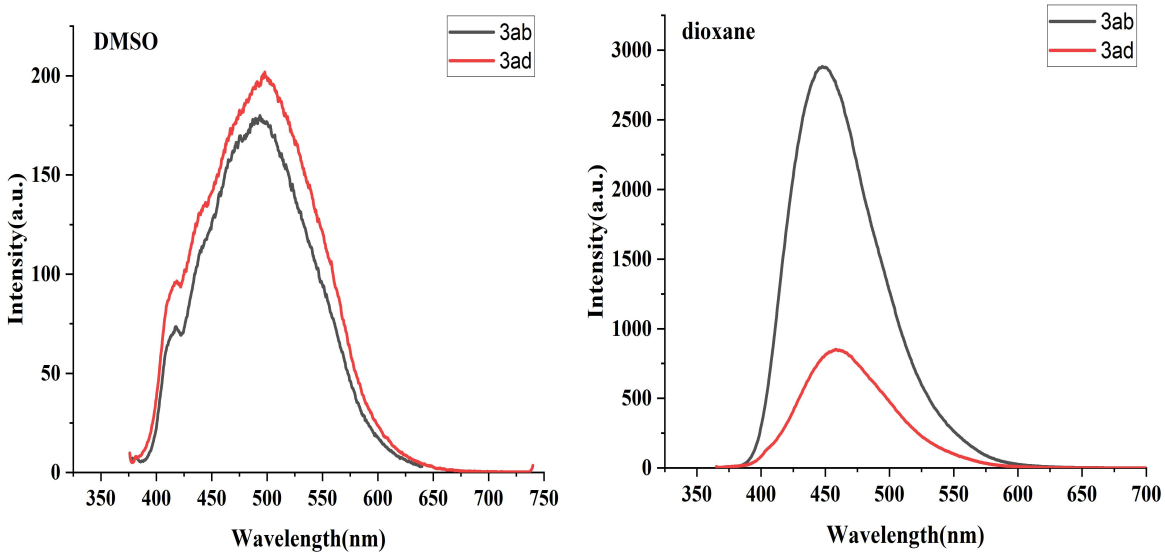
6. Fluorescence spectra analysis of pyridine compounds (3ab, 3ad).

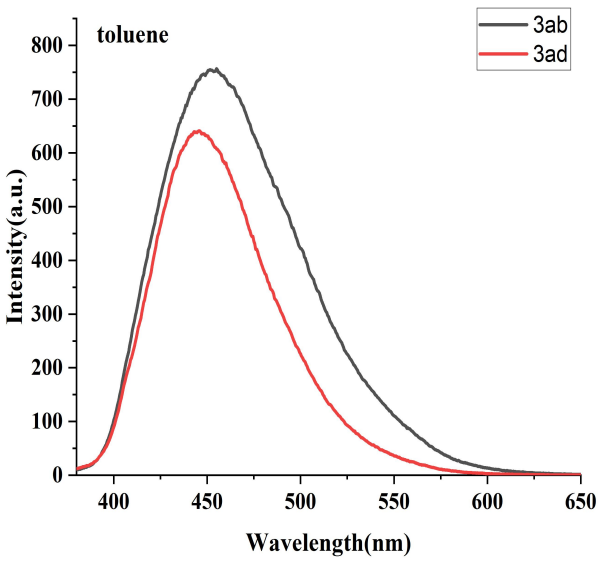
Experiments were set up using 96 well plates with black flat bottoms. 5 mM solution (**3ab, 3ad,**) in DMSO, dioxane, toluene, DCM and EtOH were separately placed in well plates and excited at range from 280 nm to 400 nm. The best results were chose to show as below.

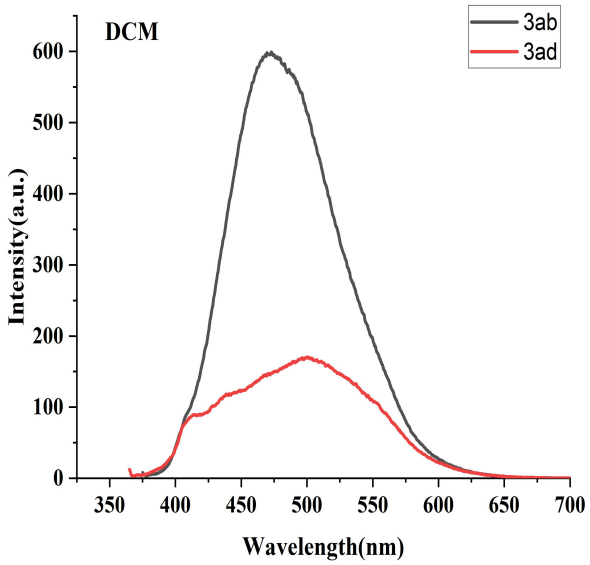
6.1 Maximum intensity (I) of 3ab, 3ad and their emission wavelength (λ_{em}) in organic solvents were obtained at the corresponding excitation wavelength.

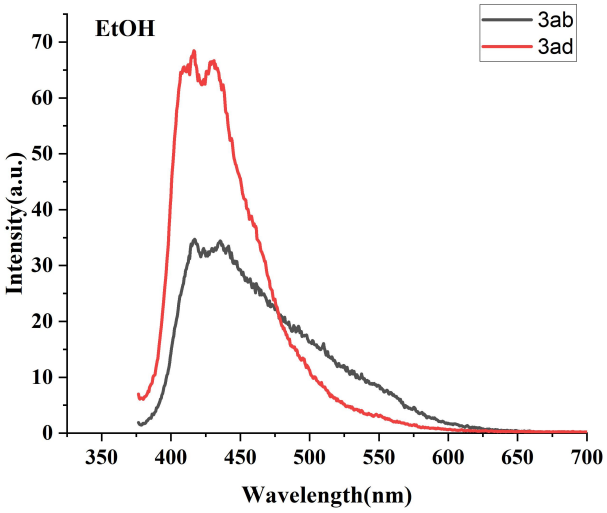
λ_{em} / I / Compound \ Solvent	DMSO	dioxane	toluene	DCM	EtOH
 **3ab**	494 nm 179	447 nm 2882	452 nm 754	473 nm 600	430 nm 33
 **3ad**	498 nm 201	458 nm 850	446 nm 640	500 nm 170	432 nm 66

6.2 Spectral characteristics of α,α'-diarylated ketones in DMSO, dioxane, toluene, DCM and EtOH.

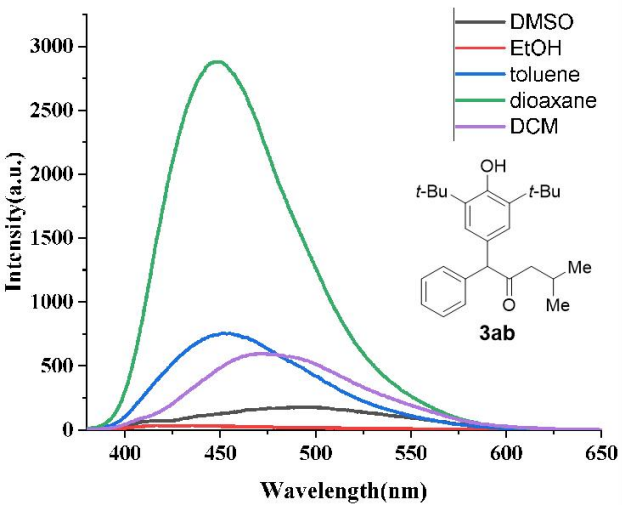


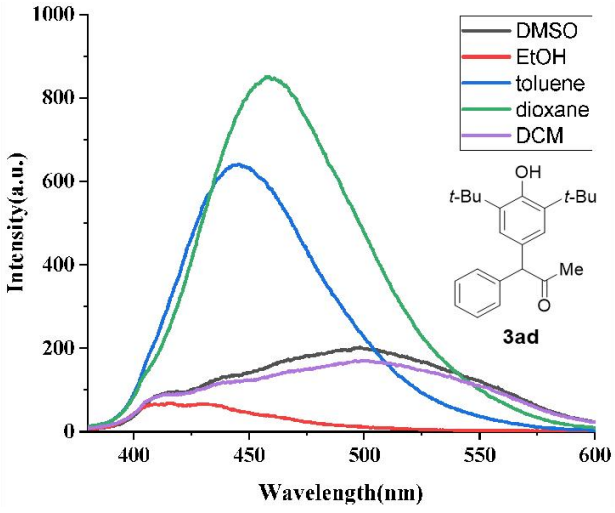




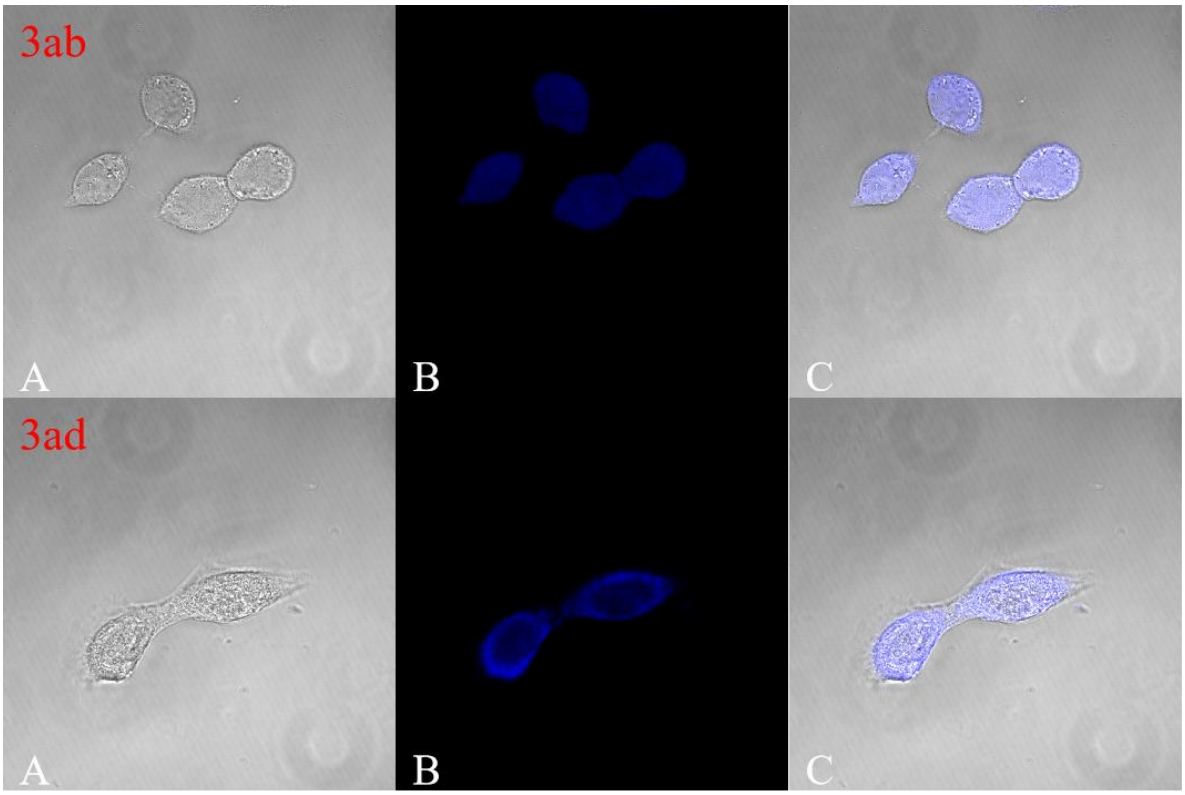


6.3 Hotophysical properties in five selected organic solvents.





7. Live HeLa cell Imaging of *α,α′*-diaryl ketones (3ab, 3ad).



Live HeLa cell imaging after 2 h incubation. (A) Bright field; (B) DAPI channel: λ_{ex}= 405 nm; (C) Merged image.