Supporting Information

Synthesis of Enaminones Enabled by Potassium Persulfate Oxidative *N*-Dealkylation and Addition to Ynones

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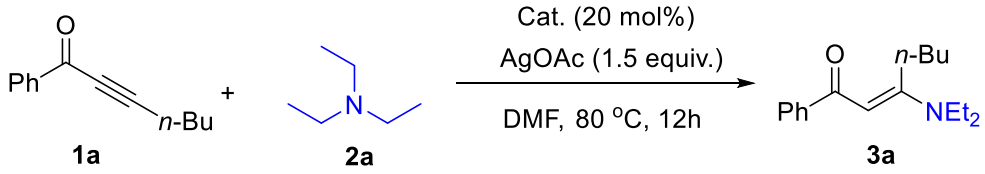
1. General Information

Unless noted otherwise, commercially available chemicals were used without further purification. Flash chromatography was performed with silica gel (200-300 mesh). Oil bath served as the heat source. NMR spectra were acquired on Bruker 400 MHz (^{1}H at 400 MHz, ^{13}C at 101 MHz) or Jeol 400 MHz (^{1}H at 400 MHz, ^{13}C at 101 MHz). Chemical shifts are reported in parts per million (ppm, δ), downfield from tetramethylsilane (TMS, δ = 0.00 ppm). The residual solvent signals were used as references for 1H and 13C NMR spectra ($CDCl_3$: δ_H = 7.26 ppm, δ_C = 77.16 ppm; DMSO-*d*$_6$: δ_H = 2.50 ppm, δ_C = 39.52 ppm; Acetone-*d*$_6$: δ_H = 2.05 ppm, δ_C = 29.8, 206.3 ppm). Coupling constants, *J* were reported in Hertz unitc(Hz). Data for ^{1}H NMR spectra were reported as follows: chemical shift (ppm, referenced to protium, s = singlet, d = doublet, t = triplet, q = quartet, dd = doublet of doublets, m = multiplet, coupling constant (Hz), and integration). Infrared (IR) data were acquired on a Bruker Invenio-R FT-IR spectrometer. Absorbance frequencies are reported in reciprocal centimeters (cm^{-1}). Mass spectra were acquired on a BrukerDaltonics S2 MicroTof-Q II mass spectrometer. Reaction mixture monitoring was performed by GC-MS 2010plus.

2. Experimental Section

2.1 Condition optimization for synthesis of enaminones

Table S1. Screening of catalysts[a]

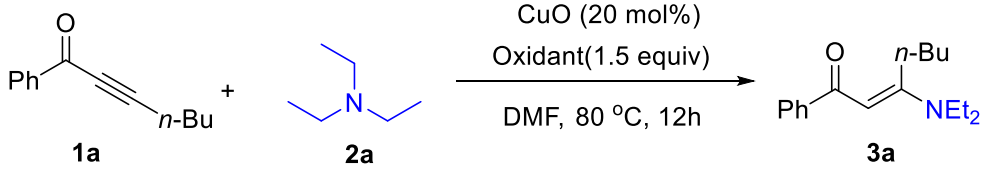


1a **2a** **3a**

Entry	Cat.	Yield[b]
1	CuO	32
2	CuI	Trace
3	$CuCl_2$	Trace
4	$Cu(OAc)_2$	Trace
5	CuOAc	Trace
6	$Cu(TFA)_2$	5
7	$CuSO_4$	12
8	$Cu(OTf)_2$	3
9	$Cu(NO_3)_2$ $3H_2O$	9
10	$[Cu(CH_3CN)_4]PF_6$	Trace
11	$[Cu(CH_3CN)_4]BF_4$	Trace

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (3 equiv.) in DMF (2 mL) were stirred at 80 ℃ for 12 h. [b]Isolated yield.

Table S2. Screening of oxidants[a]



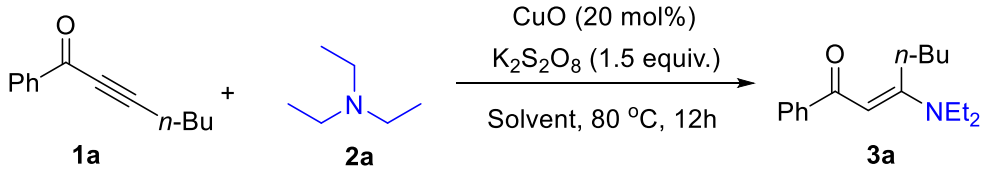
1a **2a** **3a**

Entry	Oxidant	Yield[b]
1	AgOAc	32
2	BQ	9
3	DDQ	5

4	Oxone	49
5	$K_2S_2O_8$	66
6	$(NH_4)_2S_2O_8$	62
7	$Na_2S_2O_8$	59
8	$PhI(OAc)_2$	3
9	*m*-CPBA	25
10	IBX	21

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (3 equiv.) in DMF (2 mL) were stirred at 80 ℃ for 12 h. [b]Isolated yield.

Table S3. Screening of solvents[a]

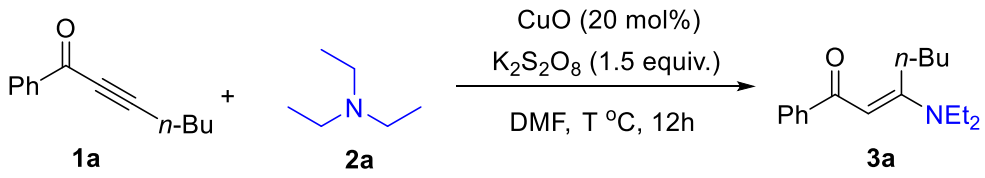


1a **2a** **3a**

Entry	Solvent	Yield[b]
1	DMF	66
2	DMSO	26
3	DCE	43
4	THF	8
5	MeCN	56
6	1,4-Dioxane	9
7	Acetone	40
8	$CHCl_3$	Trace
9	PhMe	Trace
10	CF_3CH_2OH	Trace
11	Isopropyl alcohol	49
12	*t*-BuOH	46

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (3 equiv.) in solvent (2 mL) were stirred at 80 ℃ for 12 h. [b]Isolated yield.

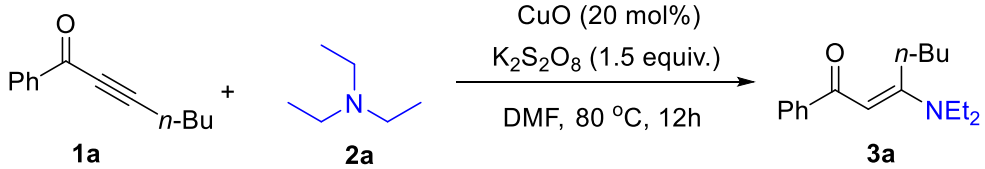
Table S4. Screening of temperature[a]



Entry	Temperature (℃)	Yield[b]
1	r.t.	5
2	40	21
3	50	33
4	60	46
5	70	56
6	80	66
7	90	64
8	100	60

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (3 equiv.) in DMF (2 mL) were stirred at T ℃ for 12 h. [b]Isolated yield.

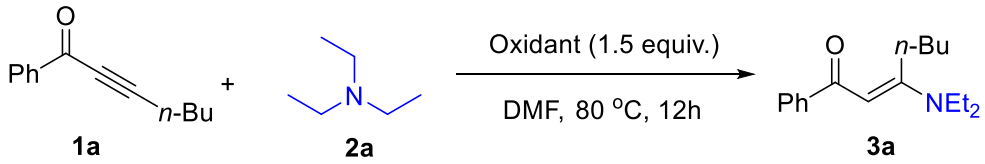
Table S5. Control experiments[a]



Entry		Yield[b]
1	None	66
2	No CuO	63
3	No $K_2S_2O_8$	26
4	No CuO and $K_2S_2O_8$	31

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (3 equiv.) in DMF (2 mL) were stirred at 80 ℃ for 12 h. [b]Isolated yield.

Table S6. Screening of oxidants[a]

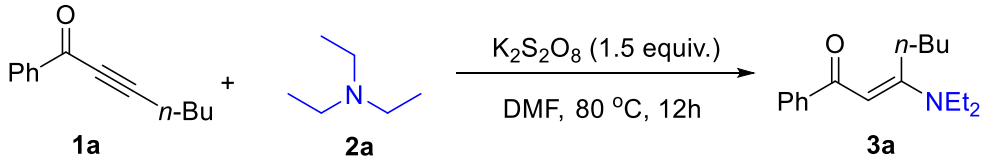


1a 2a 3a

Entry	Oxidant	Yield[b]
1	BQ	9
2	DDQ	6
3	Oxone	16
4	$K_2S_2O_8$	63
5	$Na_2S_2O_8$	60
6	$(NH_4)_2S_2O_8$	57
7	DTBP	37
8	TBHP	60
9	CHP	21
10	BPO	51
12	H_2O_2	23

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (3 equiv.) in DMF (2 mL) were stirred at 80 ℃ for 12 h. [b]Isolated yield.

Table S7. Screening of $K_2S_2O_8$ loading[a]



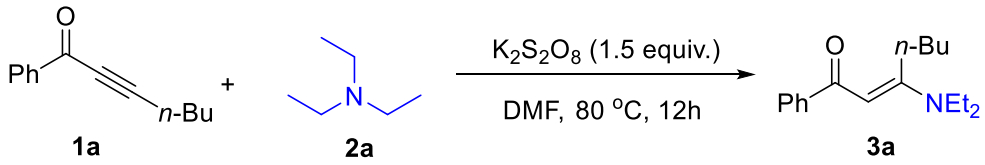
1a 2a 3a

Entry	$K_2S_2O_8$ loading	Yield[b]
1	1.0 equiv	54
2	1.5 equiv	63
3	2.0 equiv	65
4	2.5 equiv	64
5	3.0 equiv	60

6	5.0 equiv	Trace

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (3 equiv.) in DMF (2 mL) were stirred at 80 ℃ for 12 h. [b]Isolated yield.

Table S8. Screening of NEt_3 loading[a]

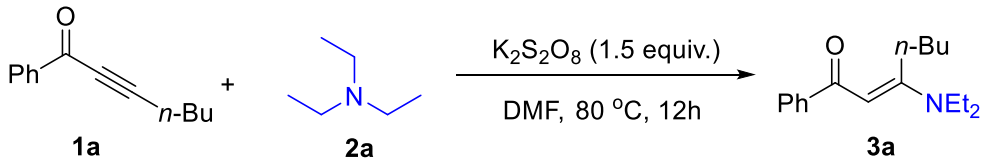


1a **2a** **3a**

Entry	NEt_3 loading	Yield[b]
1	1.5 equiv	N.R.
2	2.0 equiv	39
3	2.5 equiv	43
4	3.0 equiv	63
5	3.5 equiv	65
6	4.0 equiv	68
7	4.5 equiv	68

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (x equiv.) in DMF (2 mL) were stirred at 80 ℃ for 12 h. [b]Isolated yield.

Table S9. Screening of water loading[a]



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

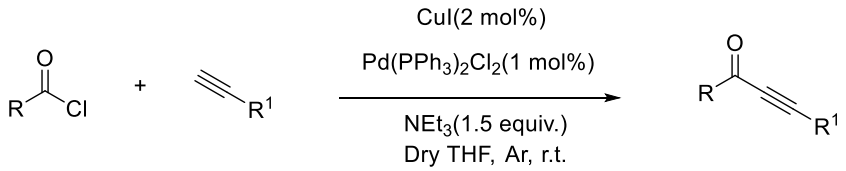
Entry	H_2O loading	Yield[b]
1	-	68
2	1.0 equiv	66
3	2.0 equiv	67
4	5.0 equiv	66
5	10.0 equiv	65

[a]Reaction conditions: **1a** (0.4 mmol) and **2a** (4 equiv.) in DMF (2 mL) were stirred at

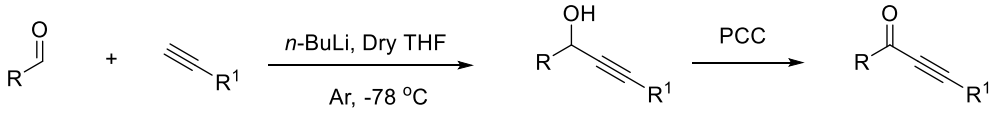
80 ℃ for 12 h. [b]Isolated yield.

2.2 Procedure for the Synthesis of Starting Materials

1a[1], **1b**[3], **1c**[4], **1d**[5], **1e**[1], **1f-1g**[6], **1i**[7], **1k**[4], **1l**[2], **1m**[4], **1n**[8], **1o**[1], **1p**[9], **1q**[10], **1r**[2], **1s**[1], **1t**[11], **1u**[1], **1v**[2], **1w**[12] **1y**[13], are known compounds and their characterization data were consistent with these reported in the literature. **1a-1m**, **1n-1s**, **1u-1w** were prepared by general procedure A. **1t**, **1x-1y** were prepared by general procedure B.



General procedure A: An oven-dried 100 mL round bottomed flask equipped with a stirring bar was charged with $Pd(PPh_3)_2Cl_2$ (0.05 mmol, 0.01 equiv.), CuI (0.1 mmol, 0.02 equiv.). After three cycles of evacuation/backfilling sequence with argon, anhydrous THF (40 mL), acetylene (5.0 mmol, 1.0 equiv.), NEt_3 (7.5 mmol, 1.5 equiv.) and acyl chloride (6.0 mmol, 1.2 equiv.) were added to the above mixture. The resulting reaction mixture was stirred at room temperature for 12 h. After completion of the reaction, the solution was concentrated by evaporation to give the residue. EtOAc (80 mL) was added, and the mixture was washed three times with H_2O (3 × 3mL) and brine (3 × 3 mL). Then the combined organic layers were dried with Na_2SO_4 and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the corresponding product.



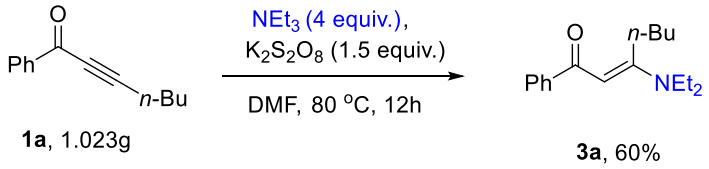
General procedure B: An oven-dried 100 mL round bottomed flask equipped with a stirring bar was charged with acetylene (5.0 mmol, 1.0 equiv.) in anhydrous THF (40 mL) at -78 ℃ , n-BuLi (6.0 mmol, 2.5 M in THF, 1.2 equiv.) was slowly added under Ar. The resulting reaction mixture was stirred at -78 ℃ for 8 h. Upon completion, the mixture was quenched with saturated NH_4Cl (10 mL), extracted with EtOAc (3 × 30 mL). The combined extracts were washed with brine, dried over anhydrous Na_2SO_4, and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the desired corresponding alcohols.

To a solution of the preceding alcohols in DCM (0.25 M) were added Pyridinium chlorochromate (PCC, 2.0 equiv.), then the mixture was stirred for 8 h. After completion of the reaction, the mixture was cooled to room temperature, EtOAc (80 mL) was added, and the mixture was washed three times with H_2O (3 × 3 mL) and brine (3 × 3 mL). Then the combined organic layers were dried with Na_2SO_4 and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the desired product.

2.3 Procedure for the Synthesis of enaminones

A 15 mL sealed tube containing a magnetic stir bar was charged with $K_2S_2O_8$ (0.6 mmol, 1.5 equiv.), ynones (0.4 mmol, 1.0 equiv.), DMF (2 mL) and NEt_3 (1.6 mmol, 4.0 equiv.) sequentially. The tube was sealed and the mixture was stirred at 80 ℃ for 12 h. After cooling to room temperature, the reaction mixture was diluted with EtOAc (40 mL) and washed with H_2O (3 × 1 mL) and brine (3 × 1 mL). The combined organic layer was dried over anhydrous Na_2SO_4, and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the desired product.

2.4 Gram-scale experiment



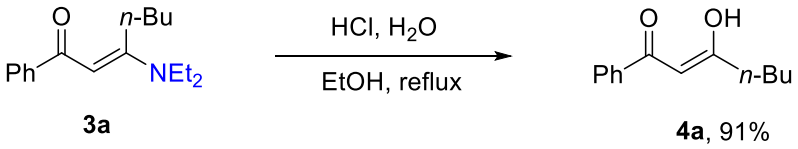
1a, 1.023g

3a, 60%

A 50 mL round bottom flask containing a magnetic stir bar was charged with $K_2S_2O_8$ (2.227 g, 8.25 mmol, 1.5 equiv.), ynone (**1a**, 1.023 g, 5.5 mmol, 1.0 equiv.), DMF (11 mL) and NEt_3 (**2a**, 2.222 g, 22 mmol, 4.0 equiv.) sequentially. The reaction mixture was stirred at 80 ℃ for 12 h. After completion of the reaction, the mixture was cooled to room temperature, EtOAc (80 mL) was added, and the mixture was washed three times with H_2O (3 × 2 mL) and brine (3 × 2 mL). Then the combined organic layers were dried with anhydrous Na_2SO_4 and concentrated by rotary evaporation. The crude reaction mixture was further purified by silica gel column chromatography to provide desired product **3a** in 60 % yield.

2.5 Product diversification

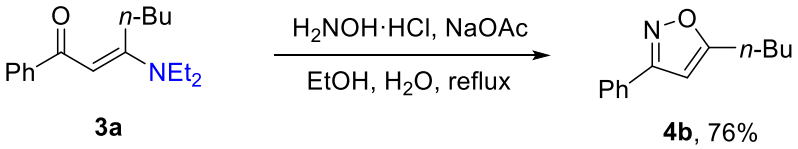
2.5.1 Preparation of (*Z*)-3-hydroxy-1-phenylhept-2-en-1-one (4a)



3a **4a**, 91%

A 10 mL round bottomed flask equipped with a stirring bar was charged with **3a** (0.4 mmol), EtOH (2 mL), 3 drop of concentrated hydrochloric acid and 50 microlitres of water. Then the mixture was refluxed and stirred at 80 ℃ for 12 h. After completion of the reaction, the mixture was cooled to room temperature, EtOAc (40 mL) was added, and the mixture was washed three times with H_2O (3 × 1 mL) and brine (3 × 1 mL). Then the combined organic layers were dried with Na_2SO_4 and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the desired product.

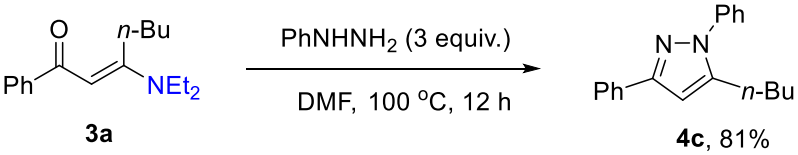
2.5.2 Preparation of 5-butyl-3-phenylisoxazole (4b)



3a **4b**, 76%

An oven-dried 10 mL round bottomed flask equipped with a stirring bar was charged with **3a** (0.4 mmol), NaOAc (2.5 equiv.), $H_2NOH·HCl$ (1.5 equiv.), EtOH (5 mL), and water (1.5 mL). Then the mixture was refluxed and stirred at 85 ℃ for 12 h. After completion of the reaction, the mixture was cooled to room temperature, EtOAc (40 mL) was added, and the mixture was washed three times with H_2O (3 × 1 mL) and brine (3 × 1 mL). Then the combined organic layers were dried with Na_2SO_4 and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the desired product.

2.5.3 Preparation of 5-butyl-1,3-diphenyl-1*H*-pyrazole (4c)



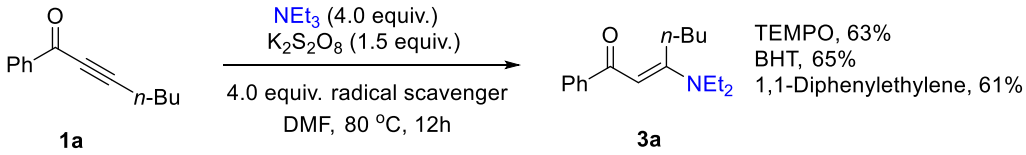
3a **4c**, 81%

An oven-dried 10 mL round bottomed flask equipped with a stirring bar was charged with **3a** (0.4 mmol), $PhNHNH_2$ (3.0 equiv.) and DMF (2 ml). Then the

reaction mixture was stirred in a preheated oil bath at 100 ℃ for 12 h. After completion of the reaction, the mixture was cooled to room temperature, EtOAc (40 mL) was added, and the mixture was washed three times with H_2O (3 × 1 mL) and brine (3 × 1 mL). Then the combined organic layers were dried with Na_2SO_4 and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the desired product.

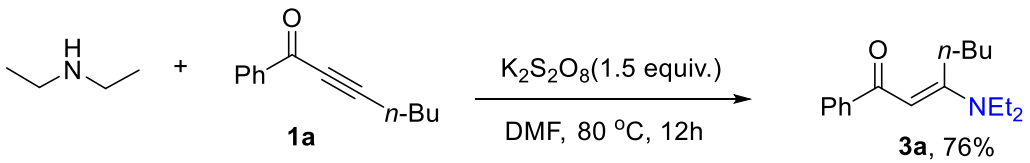
3. Mechanistic Studies

3.1 Radical Experiment



A 15 mL sealed tube containing a magnetic stir bar was charged with $K_2S_2O_8$ (162 mg, 0.6 mmol, 1.5 equiv.), ynone (**1a**, 0.4 mmol, 1.0 equiv.), NEt_3 (161.6 mg, 1.6 mmol, 4.0 equiv.), DMF (2 mL), followed by radical scavenger (TEMPO, 1.6 mmol, 4.0 equiv.; or BHT, 1.6 mmol, 4.0 equiv.; or 1,1-Diphenylethylene, 1.6 mmol, 4.0 equiv.). The resulting reaction mixture was stirred at 80 ℃ for 12 h. After completion of the reaction, the mixture was cooled to room temperature, EtOAc (40 mL) was added, and the mixture was washed three times with H_2O (3 × 1 mL) and brine (3 × 1 mL). Then the combined organic layers were dried with Na_2SO_4 and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the desired product.

3.2 Control experiment



A 15 mL sealed tube containing a magnetic stir bar was charged with $K_2S_2O_8$ (162 mg, 0.6 mmol, 1.5 equiv.), ynone (**1a**, 0.4 mmol, 1.0 equiv.), diethylamine (116.8 mg, 1.6 mmol, 4.0 equiv.), DMF (2 mL). The resulting reaction mixture was stirred at 80 ℃ for 12 h. After completion of the reaction, the mixture was cooled to room temperature, EtOAc (40 mL) was added, and the mixture was washed three

times with H_2O (3 × 1 mL) and brine (3 × 1 mL). Then the combined organic layers were dried with Na_2SO_4 and concentrated to give the residue, which was further purified by silica gel column chromatography to afford the desired product.

3.3 CG-MS and ^{1}H NMR study of the reaction system

A 15 mL sealed tube containing a magnetic stir bar was charged with $K_2S_2O_8$ (162 mg, 0.6 mmol, 1.5 equiv.), ynone (**1a**, 74.4 mg, 0.4 mmol, 1.0 equiv.), DMF (2 mL) and NPr_3 (**2b**, 228.8 mg, 1.6 mmol, 4.0 equiv.) sequentially. The tube was sealed and the mixture was stirred at 80 ℃ for 5 h. After cooling to room temperature, the reaction mixture was diluted with EtOAc (40 mL) and washed with H_2O (3 × 1 mL) and brine (3 × 1 mL). The combined organic layers were concentrated to give the residue. Then the mixture was tested by GC-MS and ^{1}H NMR.

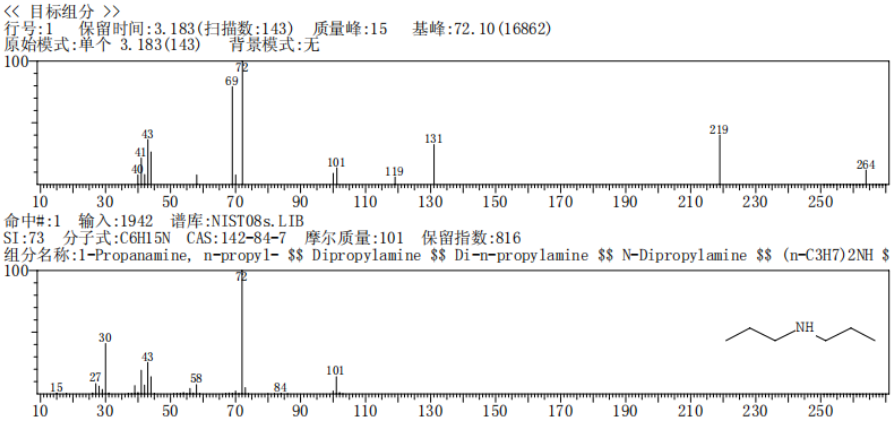


Figure S1. GC-MS spectrum of the reaction mixture of NPr_3

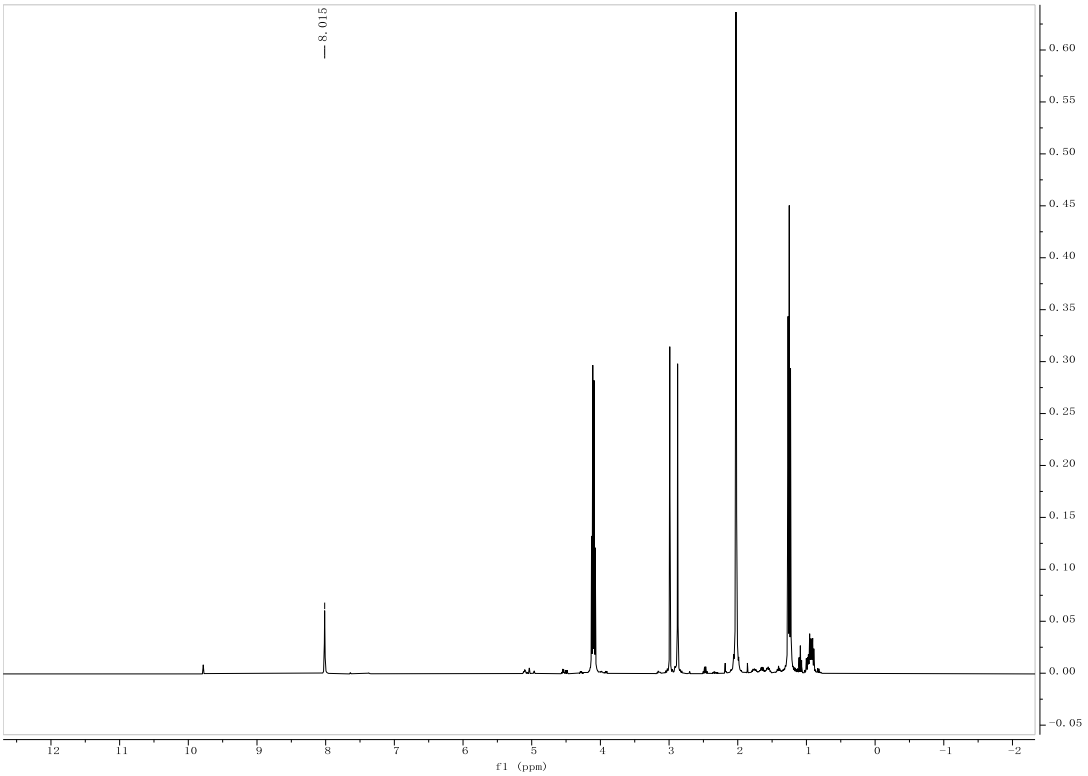


Figure S2. ^{1}H NMR spectrum of the reaction mixture of NPr_3

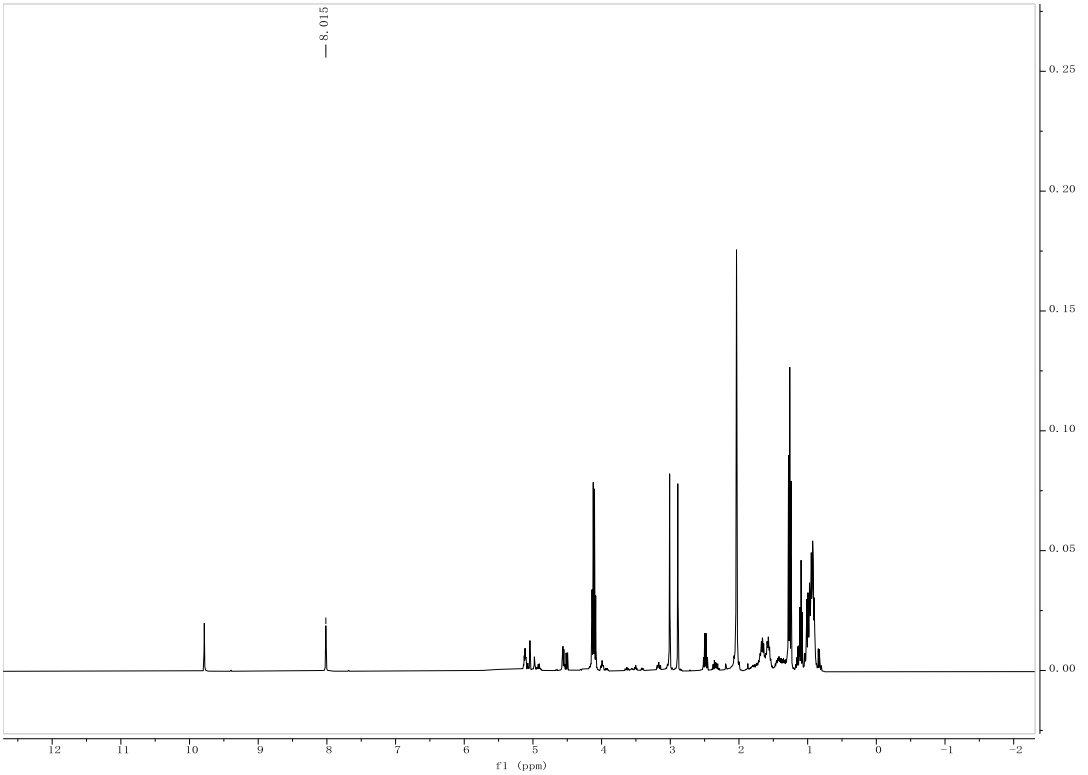


Figure S3. ^{1} H NMR spectrum of the NPr_3 reaction mixture after the addition of propionaldehyde.

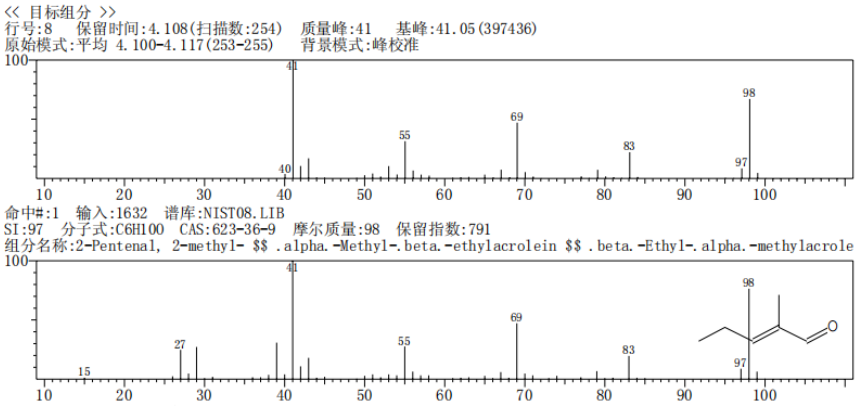
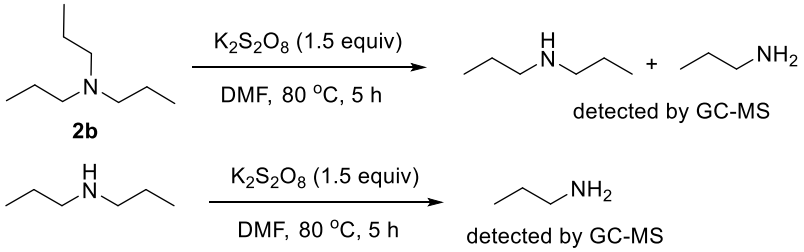
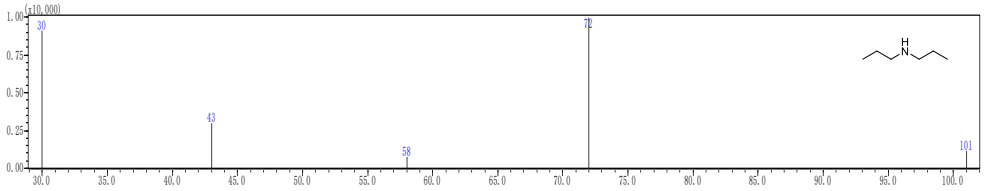


Figure S4. GC-MS spectrum of the reaction mixture of NPr_3

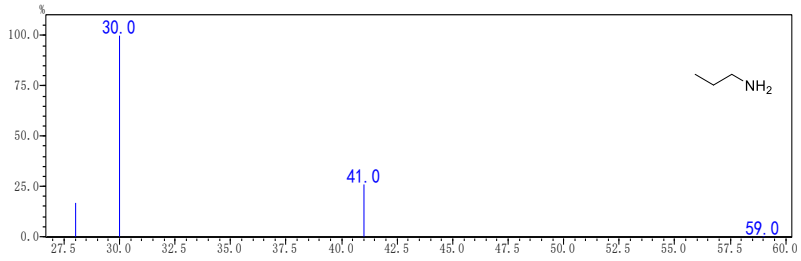


A 15 mL sealed tube containing a magnetic stir bar was charged with $K_2S_2O_8$ (0.6 mmol, 1.5 equiv.), DMF (2 mL) and NPr_3 or $HNPr_2$ (1.6 mmol, 4.0 equiv.) sequentially. The tube was sealed and the mixture was stirred at 80 ℃ for 5 h. After cooling to room temperature, the reaction mixture was diluted with EtOAc (40 mL) and washed with H_2O (3 × 1 mL) and brine (3 × 1 mL). The combined organic layers were concentrated to give the residue. Then the mixture was tested by GC-MS.



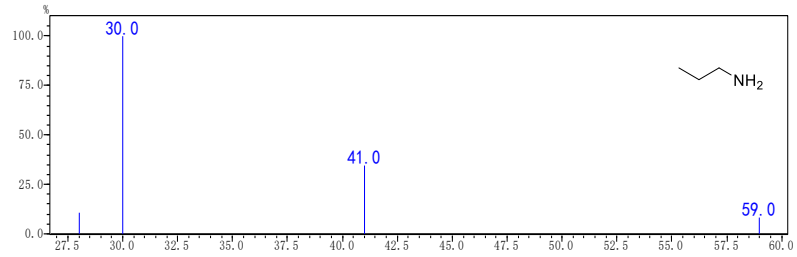
[MS Spectrum]			
# of Peaks	5		
Raw Spectrum	4.090 (scan : 1228)	Base Peak	m/z 72.00 (Inten : 10,000)
Background	No Background Spectrum		
m/z	Absolute Intensity	Relative Intensity	
30	9098	90.98	
43	3005	30.05	
58	808	8.08	
72	10000	100	
101	1174	11.74	

Figure S5. GC-MS spectrum of the oxidative cleavage of NPr_3



[MS Spectrum]			
# of Peaks	5		
Raw Spectrum	4.350 (scan : 1306)	Base Peak	m/z 30.00 (Inten : 952,019)
Background	No Background Spectrum		
m/z	Absolute Intensity	Relative Intensity	
28	163204	17.14	
30	952019	100	
41	251241	26.39	
59	4195	0.44	

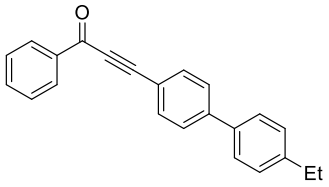
Figure S6. GC-MS spectrum of the oxidative cleavage of NPr_3



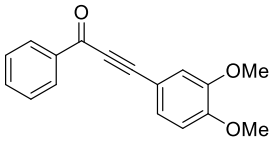
[MS Spectrum]			
# of Pea	4		
Raw Spec	8.960 (scan : 2689)	Base Peak	m/z 30.00 (Inten : 2,806,875)
Backgrou	No Background Spectrum		
m/z	Absolute Intensity	Relative Intensity	
28	309803	11.04	
30	2806875	100	
41	976298	34.78	
59	237214	8.45	

Figure S7. GC-MS spectrum of the oxidative cleavage of $HNPr_2$

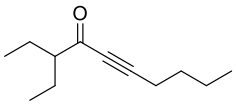
4. Characterization datas for compounds



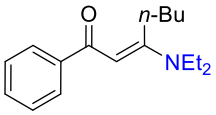
3-(4'-ethyl-[1,1'-biphenyl]-4-yl)-1-phenylprop-2-yn-1-one (1h). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 6.8 Hz, 2H), 7.76 (d, *J* = 8.3 Hz, 2H), 7.66 – 7.63 (m, 3H), 7.58 – 7.51 (m, 4H), 7.31 (d, *J* = 8.0 Hz, 2H), 2.72 (q, *J* = 7.6 Hz, 2H), 1.29 (t, *J* = 7.6 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.1, 144.7, 143.7, 137.2, 137.1, 134.2, 133.7, 129.7, 128.8, 128.7, 127.3, 127.2, 118.6, 93.6, 87.7, 28.7, 15.6. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{23}H_{19}O$ 311.1430; Found 311.1438. IR: 3026, 2198, 1788, 1634, 1492, 1288, 1209, 999, 820, 689 cm^{-1}.



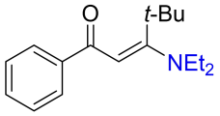
3-(3,4-dimethoxyphenyl)-1-phenylprop-2-yn-1-one (1j). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (d, *J* = 8.1 Hz, 2H), 7.64 – 7.58 (m, 1H), 7.54 – 7.47 (m, 2H), 7.33 (d, *J* = 8.3 Hz, 1H), 7.15 (s, 1H), 6.88 (d, *J* = 8.3 Hz, 1H), 3.92 (s, 3H), 3.91 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 178.1, 151.8, 149.0, 137.1, 134.1, 129.6, 128.7, 127.6, 115.5, 112.0, 111.2, 94.4, 86.7, 56.2, 56.1. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{17}H_{15}O_3$ 267.1016; Found 267.1021. IR: 2934, 2179, 1630, 1509, 1199, 1135, 1014, 696, 617, 544 cm^{-1}.



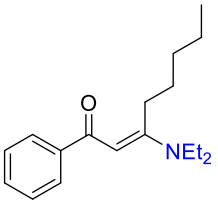
3-ethyldec-5-yn-4-one (1x). ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.35 (t, *J* = 7.0 Hz, 2H), 2.31 – 2.23 (m, 1H), 1.75 – 1.62 (m, 2H), 1.59 – 1.47 (m, 4H), 1.44 – 1.37 (m, 2H), 0.95 – 0.82 (m, 9H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 192.6, 94.7, 80.0, 57.8, 29.9, 24.2, 22.0, 18.7, 13.6, 11.7. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{12}H_{21}O$ 181.1587; Found 181.1591. IR: 2962, 2933, 2210, 1668, 1459, 1262, 1219, 1181, 1000, 806 cm^{-1}.



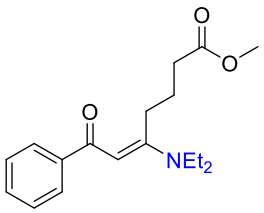
(*E*)-3-diethylamino-1-phenylhept-2-en-1-one (3a). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (70.44 mg, 68% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 – 7.82 (m, 2H), 7.39 – 7.34 (m, 3H), 5.68 (s, 1H), 3.36 (q, *J* = 7.1 Hz, 4H), 3.12 – 3.01 (m, 2H), 1.60 – 1.46 (m, 4H), 1.22 (t, *J* = 7.1 Hz, 6H), 0.97 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.2, 166.6, 143.6, 130.0, 128.0, 127.3, 90.9, 44.0, 31.0, 28.9, 23.3, 14.0, 13.0. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{17}H_{26}NO$ 260.2009; Found 260.1999. IR: 3324, 2972, 2877, 1597, 1571, 1086, 1045, 879, 733, 652 cm^{-1}.



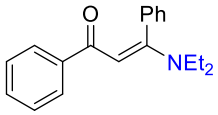
(*E*)-3-diethylamino-4,4-dimethyl-1-phenylpent-2-en-1-one (3b). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (22.79 mg, 22% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.89 – 7.86 (m, 2H), 7.41 – 7.38 (m, 3H), 6.08 (s, 1H), 3.39 (q, *J* = 7.0 Hz, 4H), 1.33 (s, 9H), 1.13 (t, *J* = 7.1 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 185.4, 174.0, 142.0, 130.6, 128.2, 127.9, 97.4, 47.0, 38.6, 30.9, 13.9. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{17}H_{26}NO$ 260.2009; Found 260.1996. IR: 2967, 2870, 1653, 1599, 1576, 1518, 848, 768, 696, 649 cm^{-1}.



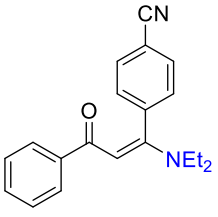
(*E*)-3-diethylamino-1-phenyloct-2-en-1-one (3c). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (70.98 mg, 65% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 – 7.79 (m, 2H), 7.37 – 7.26 (m, 3H), 5.66 (s, 1H), 3.34 (q, *J* = 7.1 Hz, 4H), 3.11 – 3.01 (m, 2H), 1.62 – 1.52 (m, 2H), 1.50 – 1.41 (m, 2H), 1.39 – 1.31 (m, 2H), 1.20 (t, *J* = 7.1 Hz, 6H), 0.90 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.1, 166.6, 143.5, 130.0, 128.0, 127.2, 90.8, 44.1, 32.3, 29.0, 28.8, 22.6, 14.1, 13.2. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{18}H_{27}NNaO$ 296.1985; Found 296.1987. IR: 2956, 2929, 1621, 1525, 1472, 1355, 1215, 1093, 770, 705 cm^{-1}.



methyl (*E*)-5-diethylamino-7-oxo-7-phenylhept-5-enoate (3d). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (88.47 mg, 73% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.25). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 (d, *J* = 7.0 Hz, 2H), 7.38 – 7.33 (m, 3H), 5.69 (s, 1H), 3.65 (s, 3H), 3.40 (q, *J* = 7.2 Hz, 4H), 3.16 – 3.04 (m, 2H), 2.55 (t, *J* = 7.0 Hz, 2H), 1.92 – 1.85 (m, 2H), 1.22 (t, *J* = 7.1 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.3, 174.3, 165.4, 143.4, 130.1, 128.0, 127.2, 91.0, 51.5, 44.2, 33.6, 28.3, 23.9, 13.7. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{18}H_{26}NO_3$ 304.1907; Found 304.1896. IR: 3344, 2941, 2360, 1733, 1524, 1473, 1223, 1022, 772, 652 cm^{-1}.

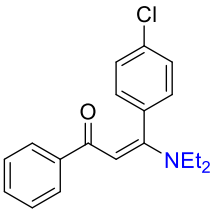


(*E*)-3-diethylamino-1,3-diphenylprop-2-en-1-one (3e).[14] Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow solid. (81.46 mg, 73% yield). m. p. = 53 – 55 ℃. Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.3). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 6.7 Hz, 2H), 7.37 – 7.23 (m, 6H), 7.17 (dd, *J* = 6.0, 2.6 Hz, 2H), 5.87 (s, 1H), 3.34 – 3.03 (m, 4H), 1.25 – 0.96 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.2, 163.3, 142.2, 137.3, 130.5, 128.5, 128.3, 128.0, 127.9, 127.6, 93.2, 44.3, 12.8. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{19}H_{22}NO$ 280.1696; Found 280.1689. IR: 2974, 2361, 1631, 1517, 1474, 1357, 1212, 895, 768, 698 cm^{-1}.

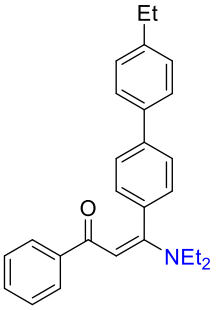


(*E*)-4-(1-diethylamino-3-oxo-3-phenylprop-1-en-1-yl)benzonitrile (3f). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow solid. (79.04 mg, 65% yield). m. p. = 103 – 105 ℃. Eluant: ethyl acetate/petroleum ether (1:8, R_f = 0.25). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 – 7.78 (m, 2H), 7.74 – 7.69 (m, 2H), 7.44 – 7.33 (m, 5H), 5.98 (s, 1H), 3.39 – 3.10 (m, 4H), 1.29 – 1.08 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.2, 161.0, 142.5,

141.4, 132.4, 131.0, 128.8, 128.1, 127.5, 118.8, 112.1, 93.3, 44.5, 13.3. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{20}H_{21}N_2O$ 305.1648; Found 305.1644. IR: 3326, 2973, 2883, 2360, 1653, 1380, 1087, 1046, 880, 649 cm^{-1}.

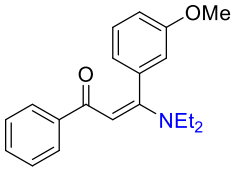


(*E*)-3-(4-chlorophenyl)-3-(diethylamino)-1-phenylprop-2-en-1-one (3g). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow solid. (95.15 mg, 76% yield). m. p. = 99 – 102 ℃. Eluant: ethyl acetate/petroleum ether (1:8, R_f = 0.25). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 – 7.80 (m, 2H), 7.43 – 7.33 (m, 5H), 7.24 – 7.15 (m, 2H), 5.96 (s, 1H), 3.43 – 3.11 (m, 4H), 1.31 – 1.06 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.2, 162.0, 141.8, 135.7, 134.2, 130.7, 129.3, 128.9, 128.0, 127.6, 93.3, 44.4, 13.2. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{19}H_{21}ClNO$ 314.1306; Found 314.1296. IR: 3324, 2973, 2881, 2361, 1653, 1379, 1087, 1045, 879, 642 cm^{-1}.

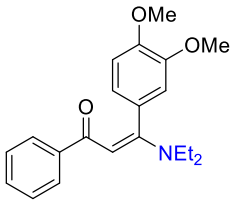


(*E*)-3-diethylamino-3-(4'-ethyl-[1,1'-biphenyl]-4-yl)-1-phenylprop-2-en-1-one (3h). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow solid. (88.85 mg, 58% yield). m. p. = 121 – 123 ℃. Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 – 7.83 (m, 2H), 7.67 – 7.61 (m, 2H), 7.55 – 7.60 (m, 2H), 7.41 – 7.23 (m, 7H), 5.98 (s, 1H), 3.48 – 3.12 (m, 4H), 2.69 (q, *J* = 7.6 Hz, 2H), 1.28 (t, *J* = 7.6 Hz, 6H), 1.30 – 1.12 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.4, 163.3, 143.4, 142.2, 140.9, 138.2, 135.9, 130.5, 128.4, 128.3, 128.0, 127.7, 127.1, 127.0,

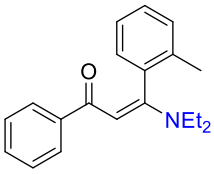
93.5, 44.4, 28.6, 15.6, 13.1. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{27}H_{30}NO$ 384.2322; Found 384.2315. IR: 3323, 2973, 2882, 2361, 1653, 1379, 1087, 1045, 879, 649 cm^{-1}.



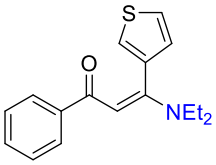
(*E*)-3-diethylamino-3-(3-methoxyphenyl)-1-phenylprop-2-en-1-one (3i). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (86.52 mg, 70% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 7.4 Hz, 2H), 7.41 – 7.31 (m, 4H), 6.97 – 6.74 (m, 3H), 5.93 (s, 1H), 3.80 (s, 3H), 3.47 – 3.06 (m, 4H), 1.37 – 1.03 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.2, 163.0, 159.7, 142.1, 138.6, 130.5, 129.6, 128.0, 127.6, 120.4, 113.7, 113.5, 93.1, 55.2, 44.3, 14.7. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{20}H_{23}NNaO_2$ 332.1621; Found 332.1608. IR: 3325, 2973, 2882, 2361, 1653, 1379, 1087, 1045, 879, 657 cm^{-1}.



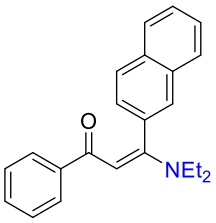
(*E*)-3-diethylamino-3-(3,4-dimethoxyphenyl)-1-phenylprop-2-en-1-one (3j). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (84.07 mg, 62% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, Acetone-d_6) δ 7.81 (d, *J* = 7.8 Hz, 2H), 7.40 – 7.33 (m, , 3H), 6.93 (d, *J* = 8.1 Hz, 1H), 6.79 (d, *J* = 1.9 Hz, 1H), 6.73 (dd, *J* = 8.2, 1.9 Hz, 1H), 5.99 (s, 1H), 3.83 (s, 3H), 3.78 (s, 3H), 3.43 – 3.21 (m, 4H), 1.26 – 1.14(m, 6H). ^{13}C NMR (101 MHz, Acetone-d_6) δ 186.1, 163.3, 150.2, 150.1, 143.5, 130.9, 130.8, 128.7, 128.1, 121.7, 113.3, 112.2, 93.7, 56.1, 55.9, 44.6, 13.1. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{21}H_{25}NNaO_3$ 362.1727; Found 362.1735. IR: 3338, 2939, 2831, 2360, 1607, 1509, 1437, 1256, 1024, 701 cm^{-1}.



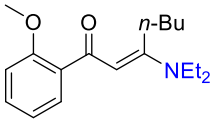
(*E*)-3-diethylamino-1-phenyl-3-(*o*-tolyl)prop-2-en-1-one (3k). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (23.44 mg, 20% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, *J* = 8.0 Hz, 2H), 7.39 – 7.21 (m, 6H), 7.08 (d, *J* = 7.2 Hz, 1H), 6.00 (s, 1H), 3.66 – 3.36 (m, 2H), 3.04 – 2.91 (m, 2H), 2.21 (s, 3H), 1.42 – 1.30 (m, 3H), 1.02 – 0.88 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 186.2, 161.9, 142.1, 136.7, 135.0, 130.3, 129.9, 128.1, 127.9, 127.5, 127.2, 125.9, 91.8, 44.4, 43.4, 19.0, 14.3, 11.2. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{20}H_{24}NO$ 294.1852; Found 294.1841. IR: 2974, 2361, 2341, 1629, 1517, 1357, 1213, 900, 761, 657 cm^{-1}.



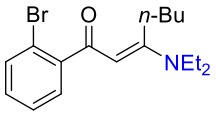
(*E*)-3-diethylamino-1-phenyl-3-(thiophen-3-yl)prop-2-en-1-one (3l). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (76.36 mg, 74% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.74 (d, *J* = 6.5 Hz, 2H), 7.54 (dd, *J* = 4.9, 2.9 Hz, 1H), 7.45 – 7.36 (m, 3H), 7.34 (d, *J* = 2.8 Hz, 1H), 6.94 (d, *J* = 4.9 Hz, 1H), 5.93 (s, 1H), 3.32 – 3.17 (m, 4H), 1.12 (t, *J* = 7.0 Hz, 6H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 184.8, 157.5, 142.0, 136.5, 130.3, 128.1, 128.0, 127.0, 125.6, 123.6, 92.7, 43.8, 12.8. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{17}H_{20}NOS$ 286.1260; Found 286.1261. IR: 3391, 2973, 2360, 1625, 1505, 1435, 1355, 1211, 893, 766, 701, 649 cm^{-1}.



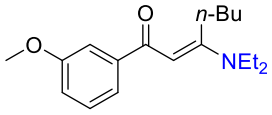
(*E*)-3-diethylamino-3-(naphthalen-2-yl)-1-phenylprop-2-en-1-one (3m). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow solid. (81.59 mg, 62% yield). m. p. = 112 – 115 ℃. Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.99 – 7.92 (m, 3H), 7.79 – 7.71 (m, 3H), 7.57 – 7.51 (m, 2H), 7.44 – 7.36 (m, 3H), 7.32 (d, *J* = 8.4 Hz, 1H), 6.04 (s, 1H), 3.45 – 2.91 (m, 4H), 1.39 – 0.84 (m, 6H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 184.6, 162.3, 141.8, 134.9, 132.9, 132.6, 130.4, 128.1, 128.0, 127.6, 127.5, 127.0, 126.4, 126.2, 126.2, 126.1, 92.1, 43.9, 13.8. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{23}H_{24}NO$ 330.1852; Found 330.1841. IR: 3367, 2974, 2360, 1627, 1514, 1471, 1356, 1213, 1052, 908, 700, 653 cm^{-1}.



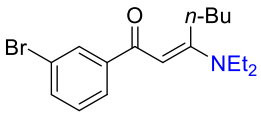
(*E*)-3-diethylamino-1-(2-methoxyphenyl)hept-2-en-1-one (3n). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (73.98 mg, 64% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.35 (dd, *J* = 7.5, 1.8 Hz, 1H), 7.33 – 7.28 (m, 1H), 7.01 (d, *J* = 8.3 Hz, 1H), 6.94 – 6.90 (m, 1H), 5.46 (s, 1H), 3.77 (s, 3H), 3.29 (q, *J* = 7.0 Hz, 4H), 3.01 – 2.89 (m, 2H), 1.47 – 1.39 (m, 4H), 1.13 (t, *J* = 7.0 Hz, 6H), 0.93 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 185.7, 164.0, 156.1, 134.5, 130.0, 129.0, 120.1, 111.8, 95.0, 55.5, 43.6, 30.6, 28.0, 22.5, 13.8, 12.9. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{18}H_{27}NNaO_2$ 312.1934; Found 312.1919. IR: 3336, 2935, 2360, 1588, 1519, 1458, 1087, 1024, 754, 646 cm^{-1}.



(*E*)-1-(2-bromophenyl)-3-(diethylamino)hept-2-en-1-one (3o). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (93.28 mg, 69% yield). Eluant: ethyl acetate/petroleum ether (1:8, R_f = 0.25). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.55 (d, *J* = 8.0 Hz, 1H), 7.37 – 7.29 (m, 2H), 7.22 (m, 1H), 5.02 (s, 1H), 3.38 – 3.23 (m, 4H), 3.07 – 2.94 (m, 2H), 1.55 – 1.39 (m, 4H), 1.11 (t, *J* = 7.1 Hz, 6H), 0.93 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 186.8, 165.4, 146.8, 132.5, 129.4, 128.1, 127.4, 118.2, 92.8, 43.6, 30.5, 27.9, 22.5, 14.3, 13.8. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{17}H_{25}BrNO$ 338.1114; Found 338.1100. IR: 3325, 2937, 2360, 1558, 1523, 1458, 1090, 1024, 741, 669 cm^{-1}.

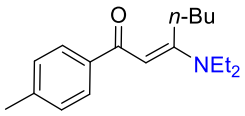


(*E*)-3-diethylamino-1-(3-methoxyphenyl)hept-2-en-1-one (3p). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (78.61 mg, 68% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.38 – 7.27 (m, 3H), 6.98 (d, *J* = 8.0 Hz, 1H), 5.64 (s, 1H), 3.78 (s, 3H), 3.36 (q, *J* = 6.8 Hz, 4H), 3.04 – 2.95 (m, 2H), 1.38 – 1.49 (m, 4H), 1.14 (t, *J* = 7.0 Hz, 6H), 0.92 (t, *J* = 6.9 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 184.4, 165.6, 159.2, 144.7, 129.0, 119.1, 115.7, 112.0, 89.6, 55.0, 43.6, 30.6, 28.0, 22.6, 13.8, 11.8. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{18}H_{27}NNaO_2$ 312.1934; Found 312.1921. IR: 2958, 2932, 2360, 1576, 1525, 1472, 1251, 1088, 779, 685 cm^{-1}.

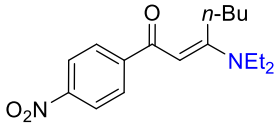


(*E*)-1-(3-bromophenyl)-3-(diethylamino)hept-2-en-1-one (3q). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (94.64 mg, 70% yield). Eluant: ethyl acetate/petroleum ether (1:8, R_f = 0.25). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.89 (s, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.60 (d, *J* = 8.0 Hz, 1H), 7.37 – 7.33 (m, 1H), 5.59 (s, 1H), 3.38 (q, *J* = 7.2 Hz, 4H), 3.04 – 2.94 (m, 2H), 1.49 – 1.37 (m, 4H), 1.14 (t, *J* = 7.0 Hz, 6H), 0.91 (t, *J* = 6.8

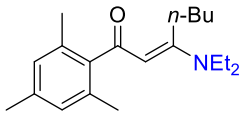
Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 182.6, 166.5, 145.3, 132.5, 130.3, 129.6, 125.8, 121.7, 89.0, 43.7, 30.5, 28.0, 22.5, 13.8, 11.2. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{17}H_{25}BrNO$ 338.1114; Found 338.1098. IR: 3366, 2958, 2360, 1558, 1522, 1458, 1212, 1087, 1029, 750, 669 cm^{-1}.



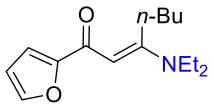
(*E*)-3-diethylamino-1-(*p*-tolyl)hept-2-en-1-one (3r). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (65.52 mg, 60% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.3). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.73 – 7.66 (m, 2H), 7.21 – 7.15 (m, 2H), 5.65 (s, 1H), 3.34 (q, *J* = 7.0 Hz, 4H), 3.06 – 2.93 (m, 2H), 2.31 (s, 3H), 1.49 – 1.37 (m, 4H), 1.13 (t, *J* = 7.0 Hz, 6H), 0.92 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 184.6, 165.2, 140.4, 139.6, 128.6, 126.9, 89.4, 43.5, 30.7, 27.9, 22.6, 20.9, 13.8, 12.9. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{18}H_{28}NO$ 274.2165; Found 274.2172. IR: 3343, 2933, 2360, 1604, 1524, 1472, 1225, 1089, 1025, 784 cm^{-1}.



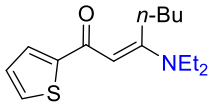
(*E*)-3-diethylamino-1-(4-nitrophenyl)hept-2-en-1-one (3s). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (51.07 mg, 42% yield). Eluant: ethyl acetate/petroleum ether (1:5, R_f = 0.3). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 – 8.17 (m, 2H), 7.96 – 7.88 (m, 2H), 5.59 (s, 1H), 3.40 (q, *J* = 7.1 Hz, 4H), 3.12 – 3.03 (m, 2H), 1.60 – 1.48 (m, 4H), 1.25 (t, *J* = 7.1 Hz, 6H), 0.97 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 184.4, 168.3, 149.4, 148.6, 128.1, 123.4, 90.8, 44.5, 31.0, 29.1, 23.3, 14.0. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{17}H_{25}N_2O_3$ 305.1860; Found 305.1850. IR: 2922, 2361, 1525, 1458, 1343, 1215, 1091, 848, 750, 657 cm^{-1}.



(*E*)-3-diethylamino-1-mesitylhept-2-en-1-one (3t). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow solid. (91.50 mg, 76% yield). m. p. = 69 – 72 ℃. Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.80 (s, 2H), 5.09 (s, 1H), 3.28 (q, *J* = 7.2 Hz, 4H), 3.17 – 3.05 (m, 2H), 2.27 (s, 6H), 2.26 (s, 3H), 1.61– 1.46 (m, 4H), 1.16 (t, *J* = 7.2 Hz, 6H), 0.98 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 193.3, 165.6, 144.0, 136.2, 133.1, 128.0, 95.4, 43.9, 31.2, 28.6, 23.2, 21.1, 19.4, 14.0. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{20}H_{32}NO$ 302.2478; Found 302.2472. IR: 3338, 2933, 2360, 1635, 1519, 1458, 1089, 1027, 796, 733 cm^{-1}.

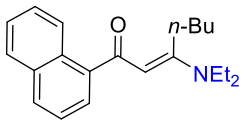


(*E*)-3-diethylamino-1-(furan-2-yl)hept-2-en-1-one (3u). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (74.69 mg, 75% yield). Eluant: ethyl acetate/petroleum ether (1:8, R_f = 0.25). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (d, *J* = 2.5 Hz, 1H), 6.91 (d, *J* = 3.3 Hz, 1H), 6.36 (dd, *J* = 3.4, 1.7 Hz, 1H), 5.67 (s, 1H), 3.30 (q, *J* = 7.1 Hz, 4H), 3.05 – 2.91 (m, 2H), 1.56 – 1.40 (m, 4H), 1.15 (t, *J* = 7.1 Hz, 6H), 0.90 (t, *J* = 6.9 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.8, 166.7, 156.6, 143.0, 111.7, 111.6, 89.3, 44.0, 31.0, 29.0, 23.1, 13.8, 12.7. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{15}H_{24}NO_2$ 250.1802; Found 250.1808. IR: 3359, 2958, 2933, 2360, 1611, 1524, 1460, 1090, 1010, 793 cm^{-1}.

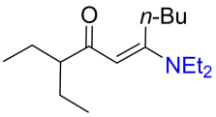


(*E*)-3-diethylamino-1-(thiophen-2-yl)hept-2-en-1-one (3v). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (80.56 mg, 76% yield). Eluant: ethyl acetate/petroleum ether (1:8, R_f = 0.25). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 (d, *J* = 3.7 Hz, 1H), 7.35 (d, *J* = 4.9 Hz, 1H), 7.00 (dd, *J* = 5.0, 3.7 Hz, 1H), 5.62 (s, 1H), 3.33 (q, *J* = 7.1 Hz, 4H), 3.10 – 2.92 (m, 2H), 1.58 – 1.43 (m, 4H), 1.20 (t, *J* = 7.1 Hz, 6H), 0.93 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 179.2, 166.3, 150.4, 129.1, 127.4, 126.9, 90.1, 44.2, 31.1,

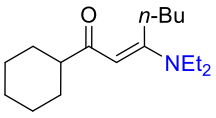
28.9, 23.2, 14.0, 13.1. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{15}H_{24}NOS$ 266.1573; Found 266.1577. IR: 3421, 2959, 2932, 2360, 1595, 1529, 1472, 1215, 1090, 783 cm^{-1}.



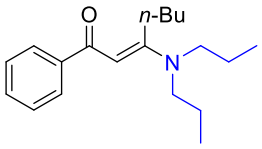
(*E*)-3-diethylamino-1-(naphthalen-1-yl)hept-2-en-1-one (3w). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow solid. (90.23 mg, 73% yield). m. p. = 59 – 62 ℃. Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.25). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (d, *J* = 7.1 Hz, 1H), 7.84 –7.80 (m, 2H), 7.58 (d, *J* = 7.0 Hz, 1H), 7.51 – 7.41 (m, 3H), 5.42 (s, 1H), 3.42 – 3.27 (m, 4H), 3.23 – 3.10 (m, 2H), 1.70 – 1.51 (m, 4H), 1.19 (t, *J* = 7.2 Hz, 6H), 1.01 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.8, 166.1, 144.1, 133.7, 130.3, 128.6, 128.0, 126.3, 126.0, 125.7, 125.0, 124.2, 95.2, 44.0, 31.2, 28.7, 23.2, 14.0, 12.6. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{21}H_{28}NO$ 310.2165; Found 310.2169. IR: 2959, 2931, 2360, 1558, 1523, 1473, 1089, 785, 749, 658 cm^{-1}.



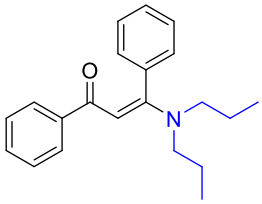
(*E*)-6-diethylamino-3-ethyldec-5-en-4-one (3x). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (64.76 mg, 64% yield). Eluant: petroleum ether (R_f = 0.5). ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.96 (s, 1H), 3.24 (q, *J* = 7.1 Hz, 4H), 2.98 – 2.86 (m, 2H), 2.06 – 1.99 (m, 1H), 1.60 – 1.50 (m, 2H), 1.44 – 1.30 (m, 6H), 1.13 (t, *J* = 7.1 Hz, 6H), 0.90 (t, *J* = 6.4 Hz, 3H), 0.82 (t, *J* = 7.4 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.6, 164.5, 94.3, 57.3, 43.8, 31.3, 28.5, 26.2, 23.2, 14.0, 13.0, 12.4. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{16}H_{31}NNaO$ 276.2298; Found 276.2289. IR: 3321, 2941, 2831, 2360, 1525, 1457, 1356, 1022, 736, 669 cm^{-1}.



(*E*)-1-cyclohexyl-3-(diethylamino)hept-2-en-1-one (3y). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (50.88 mg, 48% yield). Eluant: petroleum ether (R_f = 0.5). ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.96 (s, 1H), 3.24 (q, *J* = 7.2 Hz, 4H), 2.98 – 2.81 (m, 2H), 2.17 – 2.10 (m, 1H), 1.70 – 1.77 (m, 4H), 1.44 – 1.11 (m, 16H), 0.89 (t, *J* = 5.0 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.7, 164.9, 92.3, 52.5, 43.7, 31.2, 30.2, 28.6, 26.4, 26.2, 23.2, 14.0, 13.2. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{17}H_{31}NNaO$ 299.2298; Found 288.2292. IR: 3357, 2929, 2855, 2360, 1615, 1525, 1449, 1089, 1030, 735 cm^{-1}.

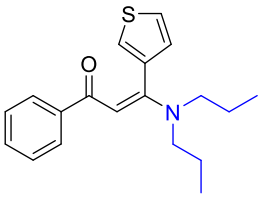


(*E*)-3-dipropylamino-1-phenylhept-2-en-1-one (3z). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (80.36 mg, 70% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, Chloroform-d) δ 7.84 – 7.80 (m, 2H), 7.39 – 7.34 (m, 3H), 5.65 (s, 1H), 3.23 (t, *J* = 7.8 Hz, 4H), 3.13 – 3.02 (m, 2H), 1.71 – 1.60 (m, 4H), 1.58 – 1.47 (m, 4H), 0.98 – 0.91 (m, 9H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 187.0, 166.9, 143.5, 130.0, 128.0, 127.2, 91.2, 52.1, 31.1, 28.8, 23.2, 20.8, 14.0, 11.4. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{19}H_{30}NO$ 288.2322; Found 288.2332. IR: 2958, 2361, 1621, 1520, 1458, 1205, 1088, 765, 701, 666 cm^{-1}.

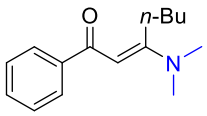


(*E*)-3-dipropylamino-1,3-diphenylprop-2-en-1-one (3aa). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (88.41 mg, 72% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.74 (d, *J* = 6.5 Hz, 2H), 7.44 – 7.36 (m, 6H), 7.16 – 7.11 (m, 2H), 5.93 (s, 1H), 3.51 – 2.73 (m, 4H), 1.86 – 1.26 (m, 4H), 1.09 – 0.52(m, 6H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 184.6, 162.9, 141.9, 137.2, 130.5,

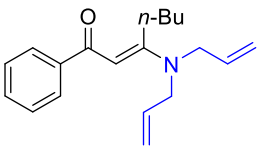
128.1, 128.1, 128.0, 127.8, 127.0, 92.5, 51.2, 19.1, 11.2. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{21}H_{25}NNaO$ 330.1828; Found 330.1819. IR: 3411, 2962, 2360, 1630, 1514, 1208, 1051, 1024, 1004, 764 cm^{-1}.



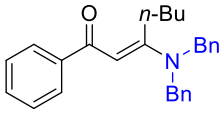
(*E*)-3-dipropylamino-1-phenyl-3-(thiophen-3-yl)prop-2-en-1-one (3ab). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (95.15 mg, 76% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.76 – 7.69 (m, 2H), 7.54 (dd, *J* = 4.9, 2.9 Hz, 1H), 7.43 – 7.36 (m, 3H), 7.31 (dd, *J* = 2.9, 1.3 Hz, 1H), 6.91 (dd, *J* = 4.9, 1.3 Hz, 1H), 5.91 (s, 1H), 3.27 – 3.02 (m, 4H), 1.67 – 1.50 (m, 4H), 0.79 (t, *J* = 7.2 Hz, 6H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 184.8, 158.0, 141.9, 136.6, 130.4, 128.2, 128.1, 127.0, 125.6, 123.7, 93.3, 51.5, 20.3, 11.2. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{19}H_{23}NNaOS$ 336.1393; Found 336.1382. IR: 3380, 2964, 2360, 1624, 1508, 1433, 1206, 1049, 765, 702 cm^{-1}.



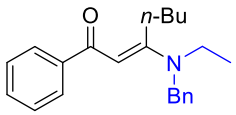
(*E*)-3-dimethylamino-1-phenylhept-2-en-1-one (3ac). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (42.51 mg, 46% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.85 – 7.79 (m, 2H), 7.44 – 7.36 (m, 3H), 5.61 (s, 1H), 3.14 – 3.01 (m, 8H), 1.49 – 1.39 (m, 4H), 0.92 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 185.0, 167.2, 142.8, 130.1, 128.0, 127.0, 90.4, 29.7, 28.0, 22.5, 13.8, 13.7. HRMS (ESI) m/z: $[M + H]^+$ Calcd for $C_{15}H_{22}NO$ 232.1696; Found 232.1688. IR: 2954, 2929, 2361, 1621, 1525, 1431, 1225, 762, 700, 656 cm^{-1}.



(*E*)-3-diallylamino-1-phenylhept-2-en-1-one (3ad). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (35.09 mg, 31% yield). Eluant: ethyl acetate/petroleum ether (1:15, R_f = 0.30). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.77 (d, *J* = 7.1 Hz, 2H), 7.45 – 7.36 (m, 3H), 5.91 – 5.82 (m, 2H), 5.74 (s, 1H), 5.21 (d, *J* = 10.3 Hz, 2H), 5.15 (d, *J* = 17.2 Hz, 2H), 4.03 – 3.93 (m, 4H), 3.08 – 2.95 (m, 2H), 1.53 – 1.38 (m, 4H), 0.92 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 185.3, 166.5, 142.6, 133.6, 130.2, 128.1, 126.9, 116.4, 91.0, 51.9, 30.7, 28.1, 22.6, 13.8. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{19}H_{25}NNaO$ 306.1828; Found 306.1834. IR: 3380, 2964, 2360, 1624, 1508, 1433, 1206, 1049, 765, 702 cm^{-1}.

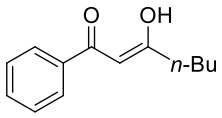


(*E*)-3-dibenzylamino-1-phenylhept-2-en-1-one (3ae). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (45.56 mg, 30% yield). Eluant: ethyl acetate/petroleum ether (1:10, R_f = 0.30). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 8.0 Hz, 2H), 7.43 – 7.29 (m, 9H), 7.21 (d, *J* = 7.4 Hz, 4H), 5.91 (s, 1H), 4.63 (s, 4H), 3.33 – 3.21 (m, 2H), 1.78 – 1.69 (m, 2H), 1.61 – 1.49 (m, 2H), 0.99 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 188.1, 167.4, 142.8, 136.4, 130.4, 129.0, 128.0, 127.7, 127.3, 126.5, 93.2, 53.1, 31.4, 29.1, 23.3, 14.0. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{27}H_{29}NNaO$ 406.2141; Found 406.2130. IR: 3446, 2956, 2360, 1623, 1518, 1458, 1196, 1093, 920, 766, 703, 669 cm^{-1}.

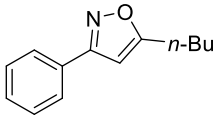


(*E*)-3-(benzyl(ethyl)amino)-1-phenylhept-2-en-1-one (3af). Prepared according to general procedure and purified by flash column chromatography to afford the product as a yellow oil. (47.51 mg, 37% yield). Eluant: acetone/dichloromethane/petroleum ether (1:80:200, R_f = 0.35). ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.82 – 7.51 (m, 2H), 7.41 – 7.32 (m, 5H), 7.28 – 7.21 (m, 3H), 5.71 (s, 1H), 4.63 (s, 2H), 3.46 (q, *J* = 7.2 Hz, 2H), 3.15 – 2.98 (m, 2H), 1.60 – 1.37 (m, 4H), 1.17 (t, *J* = 7.0 Hz, 3H), 0.91 (t, *J*

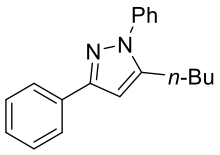
= 7.0 Hz, 3H). ^{13}C NMR (101 MHz, DMSO-d_6) δ 185.2, 166.1, 142.7, 137.5, 130.1, 128.7, 128.0, 127.1, 126.9, 126.2, 91.1, 65.0, 52.2, 45.0, 30.7, 28.2, 22.6, 13.8. HRMS (ESI) m/z: $[M + Na]^+$ Calcd for $C_{22}H_{27}NNaO$ 344.1985; Found 344.1992. IR: 2956, 2360, 1597, 1521, 1450, 1355, 1211, 1089, 765, 695 cm^{-1}



(*Z*)-3-hydroxy-1-phenylhept-2-en-1-one (4a).[15] Prepared according to procedure and purified by flash column chromatography to afford the product as a brown oil. (74.25 mg, 91% yield). Eluant: ethyl acetate/petroleum ether (1:100, R_f = 0.35). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 7.1 Hz, 2H), 7.53 – 7.40 (m, 3H), 6.17 (s, 1H), 2.42 (t, *J* = 7.6 Hz, 2H), 1.70 – 1.62 (m, 2H), 1.44 – 1.35 (m, 2H), 0.94 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 197.1, 183.5, 135.1, 132.2, 128.6, 127.0, 96.1, 39.0, 28.0, 22.4, 13.9.

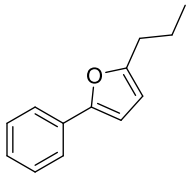


5-butyl-3-phenylisoxazole (4b).[16] Prepared according to procedure and purified by flash column chromatography to afford the product as a white oil. (61.10 mg, 76% yield). Eluant: ethyl acetate/petroleum ether (1:50, R_f = 0.35). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J* = 8.0 Hz, 2H), 7.47 – 7.38 (m, 3H), 6.37 (s, 1H), 2.71 (t, *J* = 7.6 Hz, 2H), 1.73 – 1.66 (m, 2H), 1.47 – 1.38 (m, 2H), 0.96 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.6, 164.9, 130.0, 129.0, 127.8, 125.8, 99.2, 30.5, 25.9, 22.4, 13.9.



5-butyl-1,3-diphenyl-1*H*-pyrazole (4c).[14] Prepared according to procedure and purified by flash column chromatography to afford the product as a white oil. (89.42 mg, 81% yield). Eluant: ethyl acetate/petroleum ether (1:50, R_f = 0.35). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 – 7.21 (m, 10H), 6.35 (s, 1H), 2.76 (t, *J* = 7.6 Hz, 2H), 1.79 – 1.71 (m, 2H), 1.53 – 1.43 (m, 2H), 0.99 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (101 MHz,

$CDCl_3$) δ 154.3, 143.5, 140.2, 130.9, 128.9, 128.7, 128.4, 128.0, 127.1, 125.2, 106.8, 31.9, 28.1, 22.7, 14.1.



2-phenyl-5-propylfuran (5).[11] Eluant: ethyl acetate/petroleum ether (1:00, R_f = 0.35). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 – 7.53 (m, 2H), 7.29 – 7.25 (m, 2H), 7.16 – 7.10 (m, 1H), 6.47 (d, *J* = 3.2 Hz, 1H), 6.00 – 5.97 (m, 1H), 2.62 – 2.55 (m, 2H), 1.64 (q, *J* = 7.4 Hz, 2H), 0.92 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 156.4, 152.3, 131.4, 128.7, 126.8, 123.5, 107.1, 105.8, 30.3, 21.6, 13.9.

5. References

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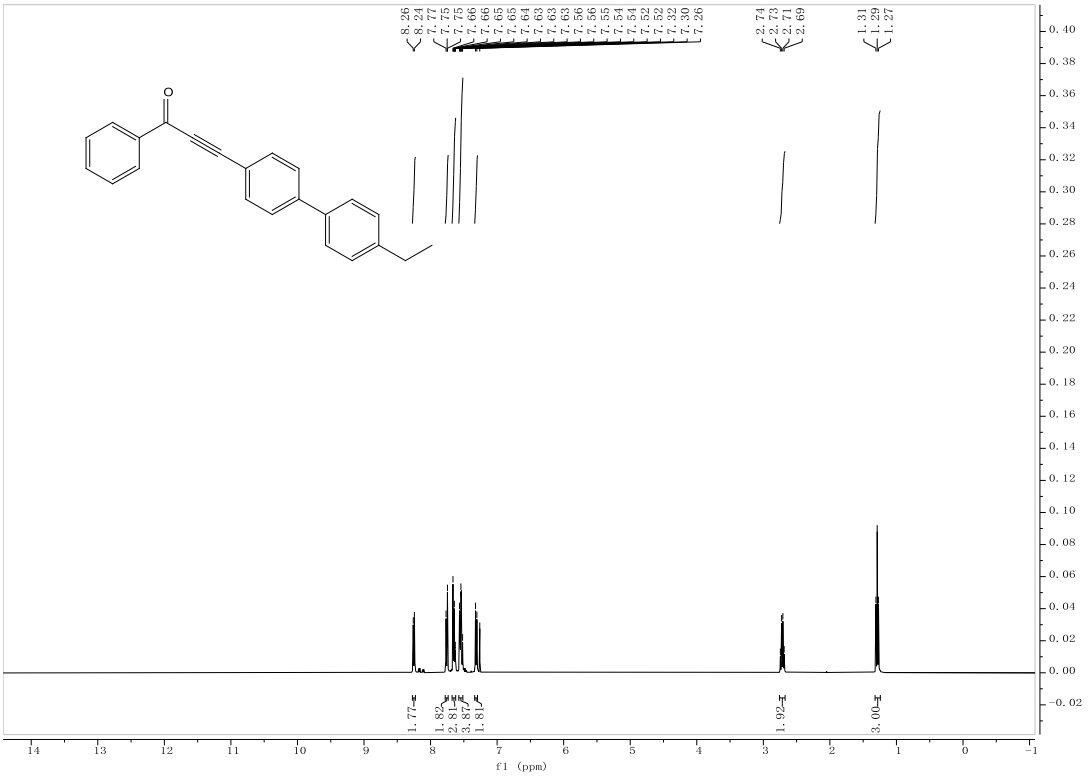
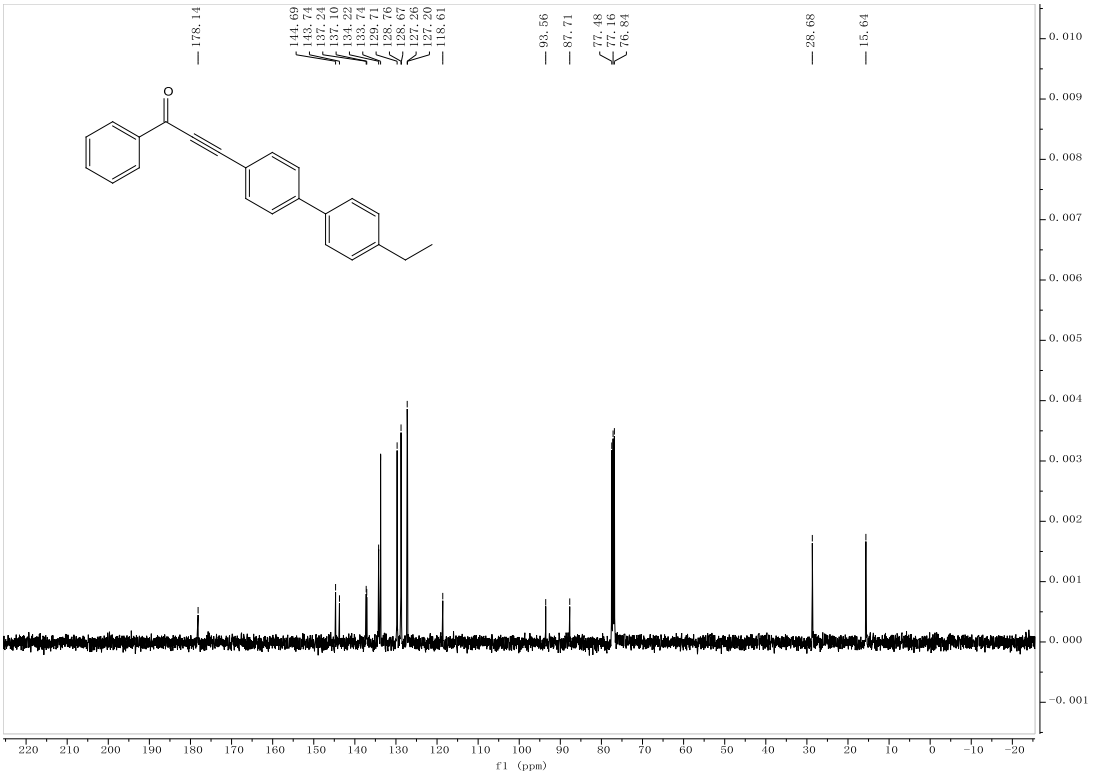
6. NMR spectra

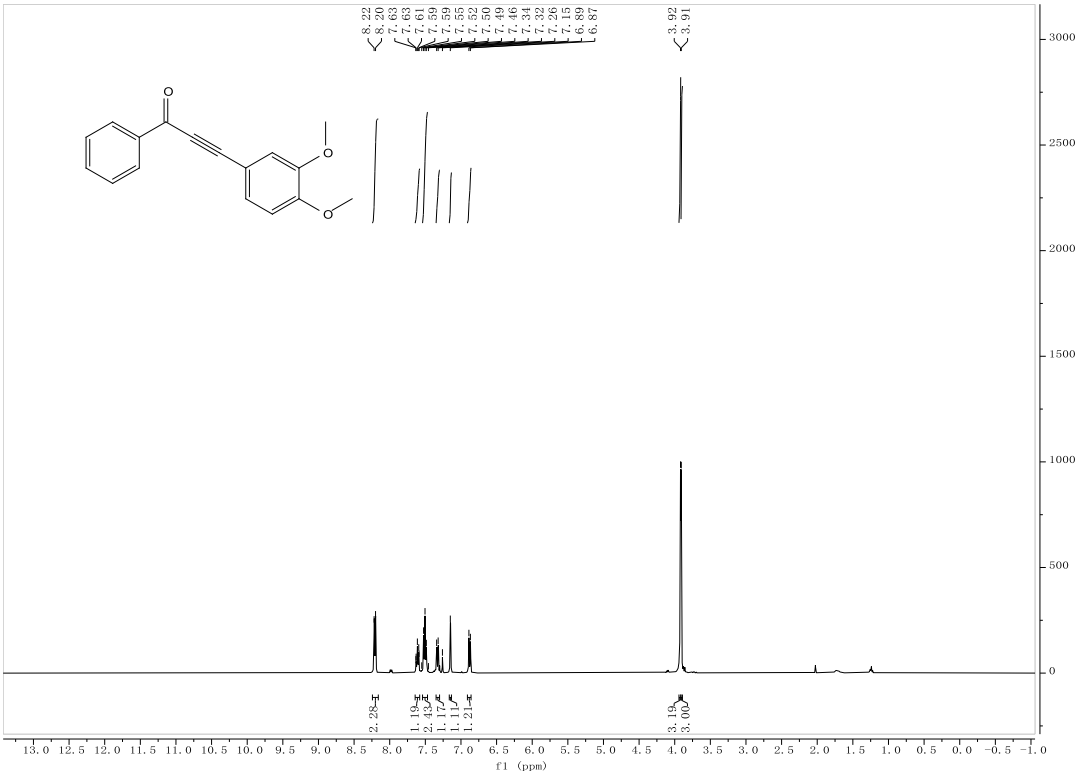
^{1}H NMR spectrum of compound **1h** (400 MHz, $CDCl_3$)



^{13}C NMR spectrum of compound **1h** (101 MHz, $CDCl_3$)



^{1}H NMR spectrum of compound **1j** (400 MHz, $CDCl_3$)



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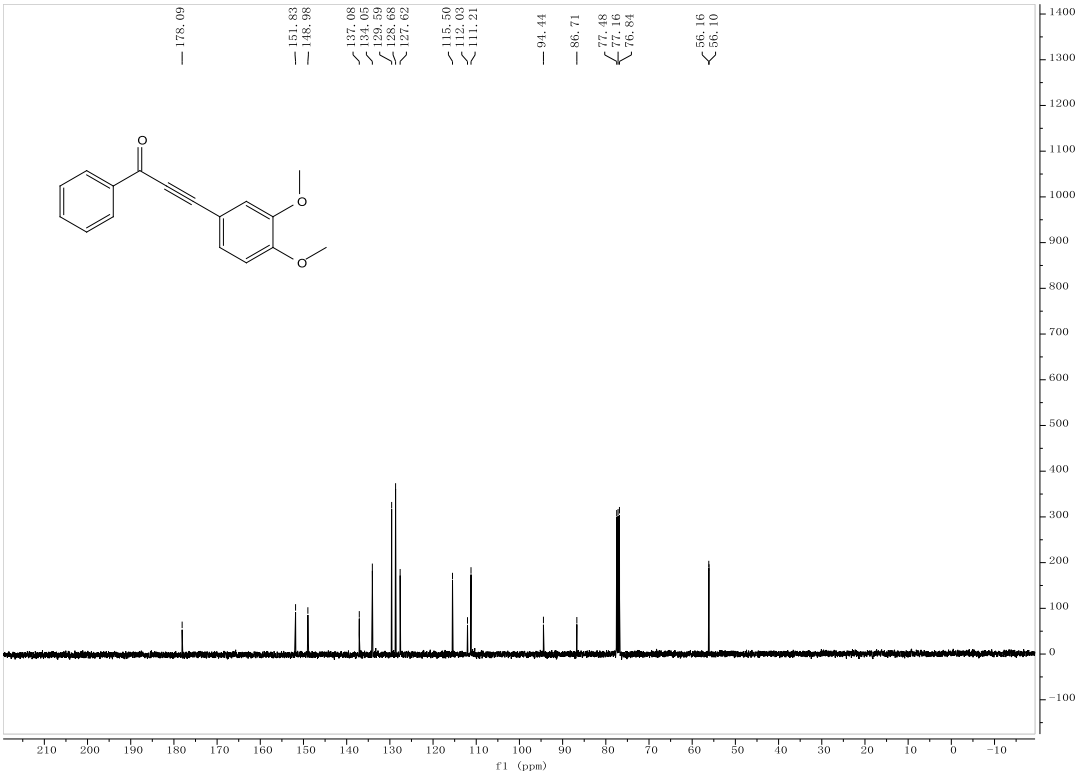
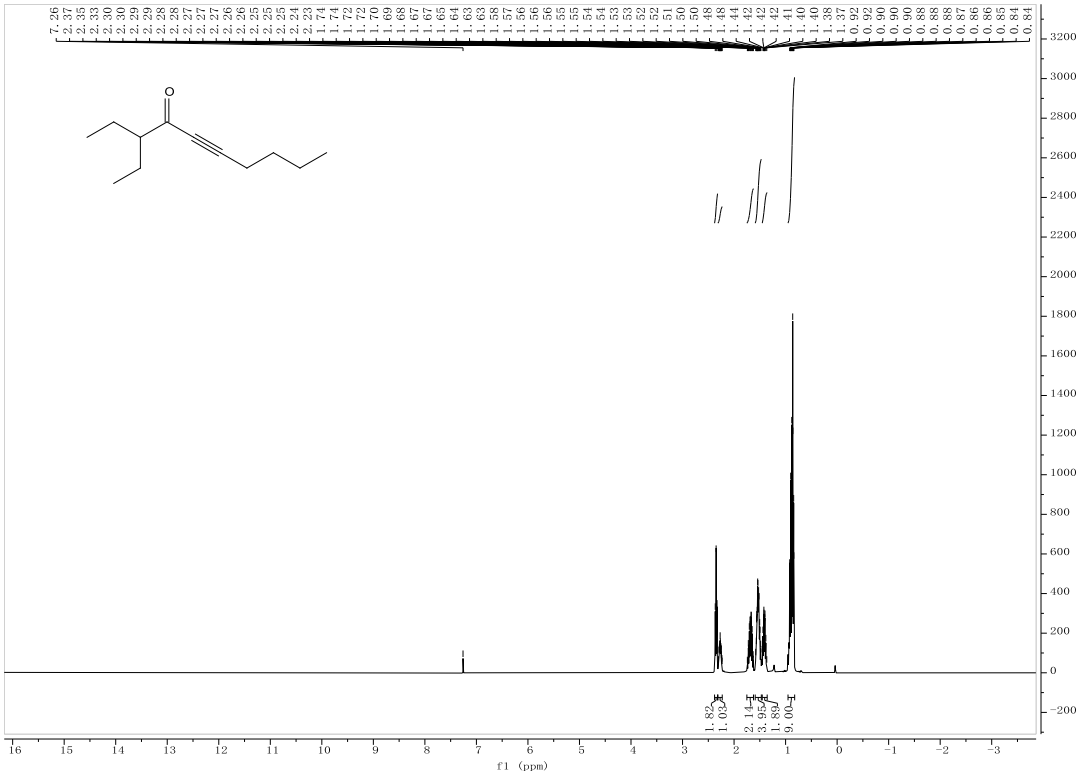
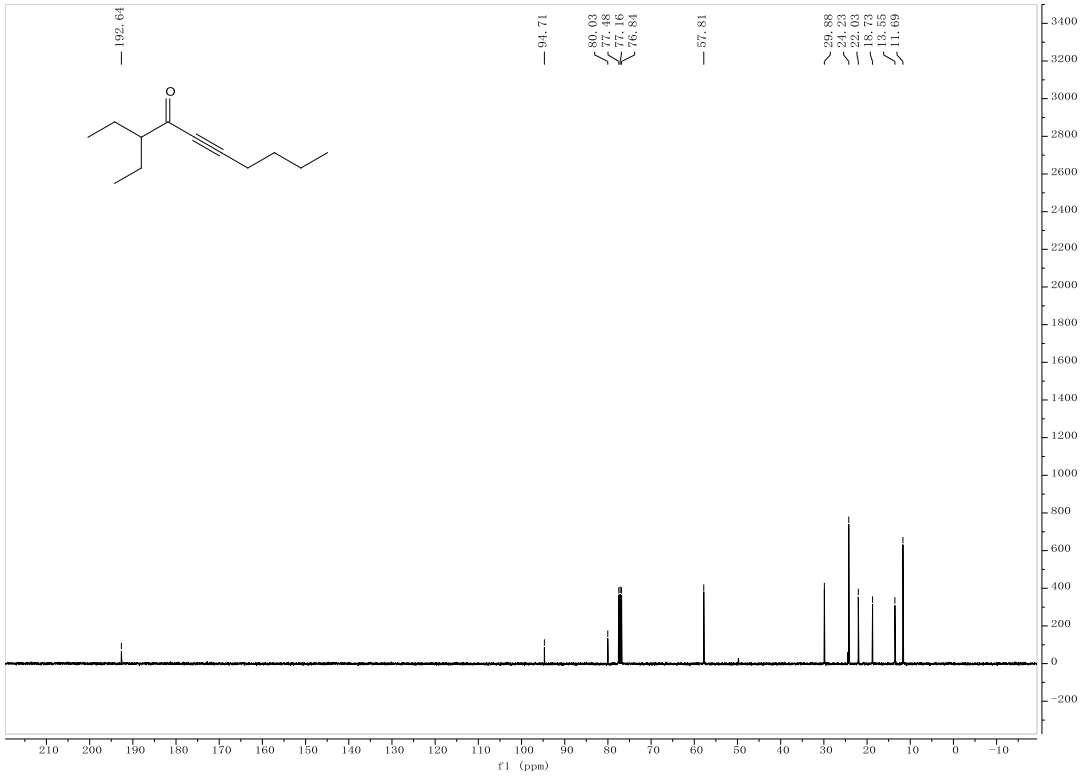


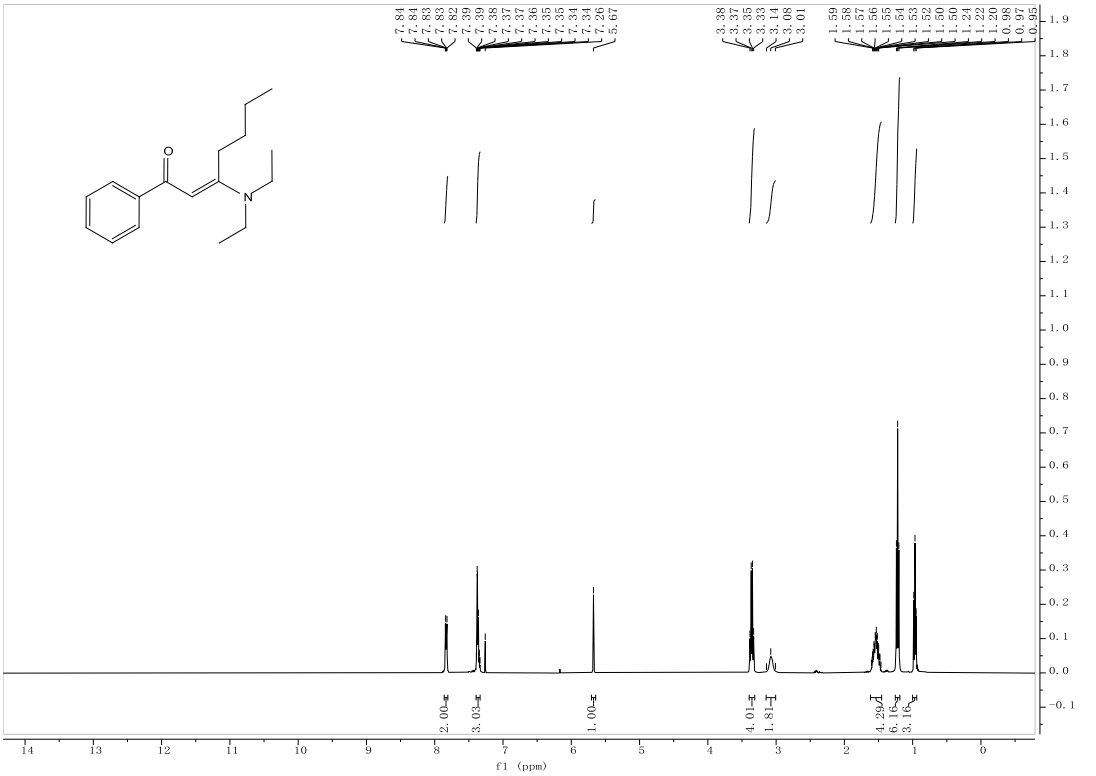
^{1}H NMR spectrum of compound **1x** (400 MHz, $CDCl_3$)



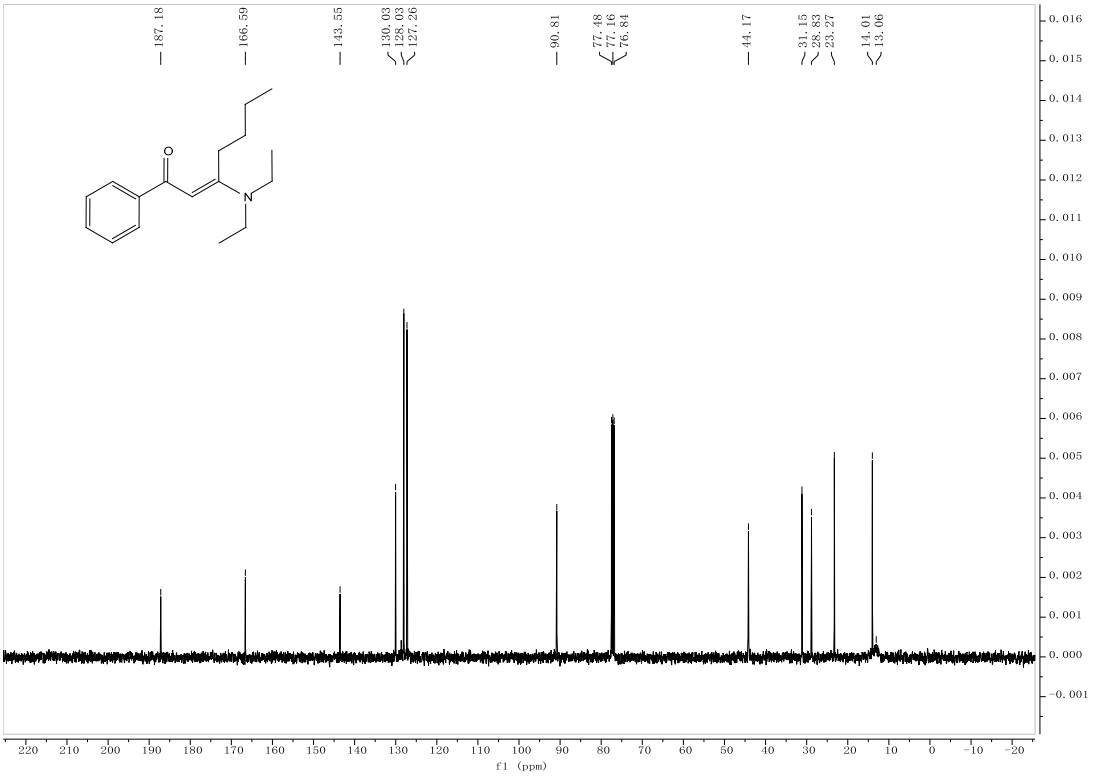
^{13}C NMR spectrum of compound **1x** (101 MHz, $CDCl_3$)



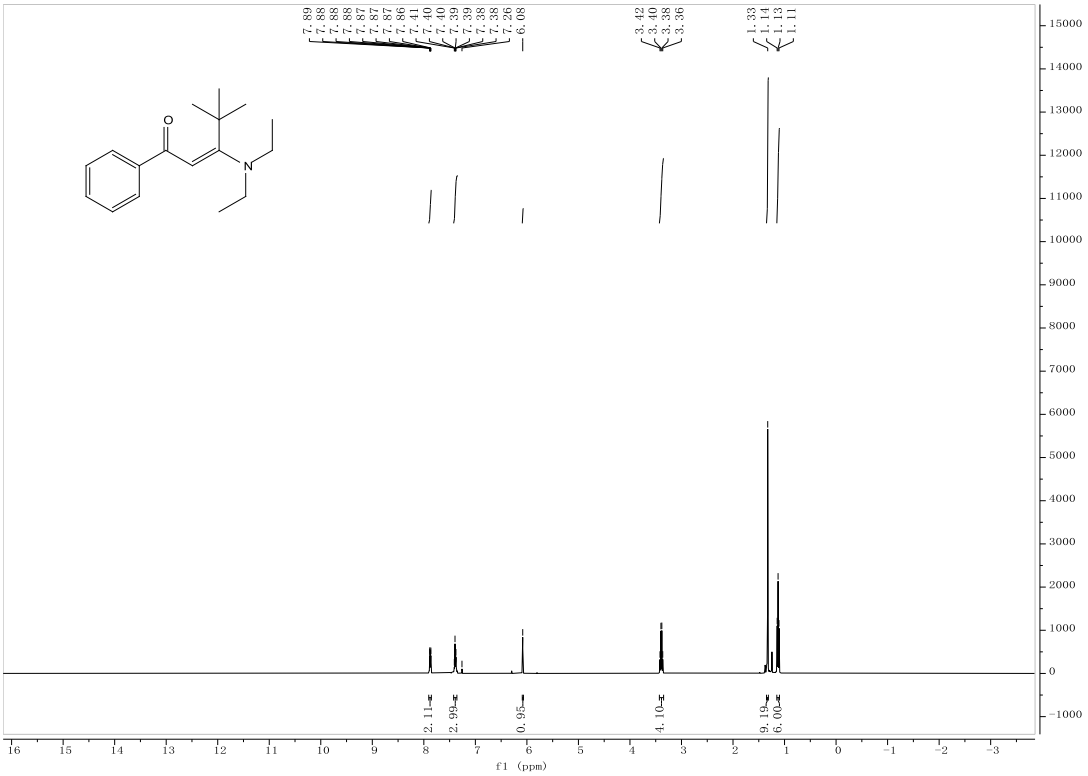
^{1}H NMR spectrum of compound **3a** (400 MHz, $CDCl_3$)



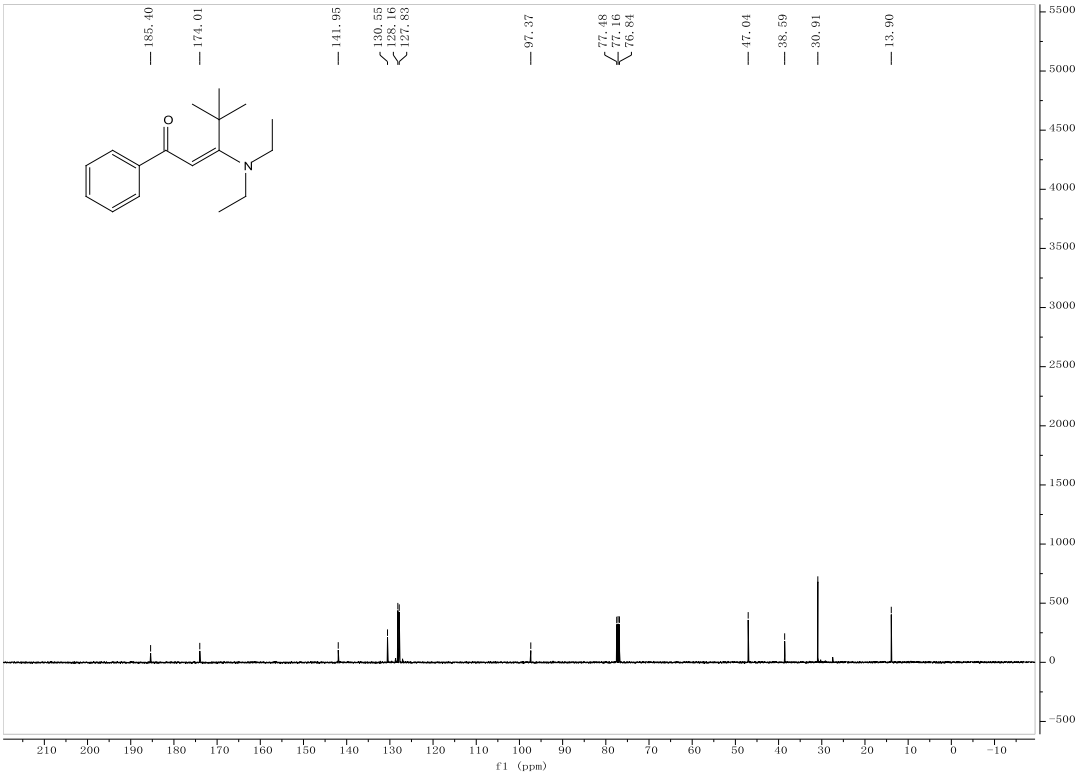
^{13}C NMR spectrum of compound **3a** (101 MHz, $CDCl_3$)



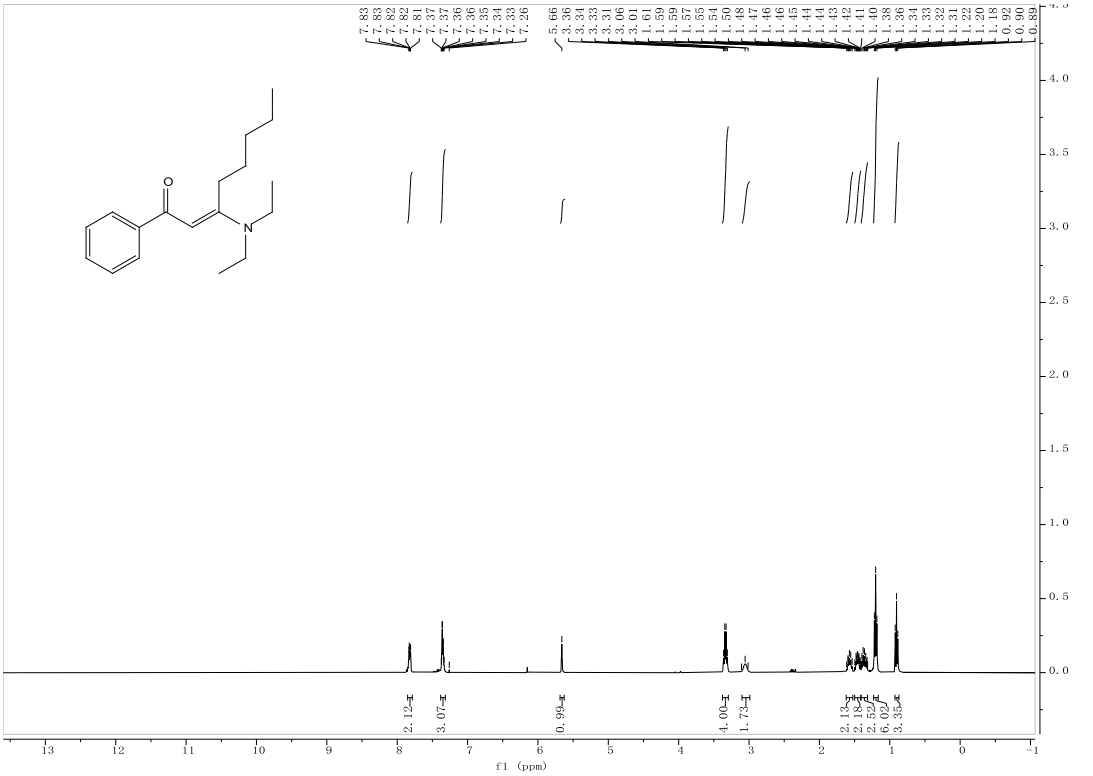
^{1}H NMR spectrum of compound **3b** (400 MHz, $CDCl_3$)



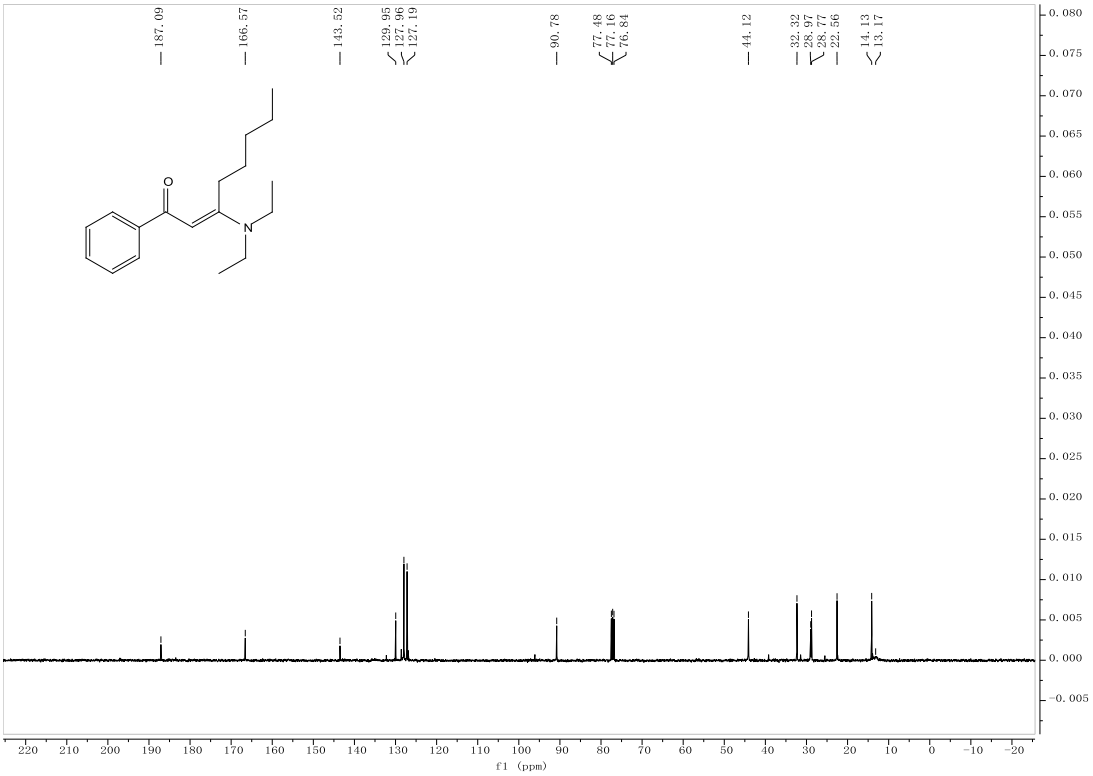
^{13}C NMR spectrum of compound **3b** (101 MHz, $CDCl_3$)



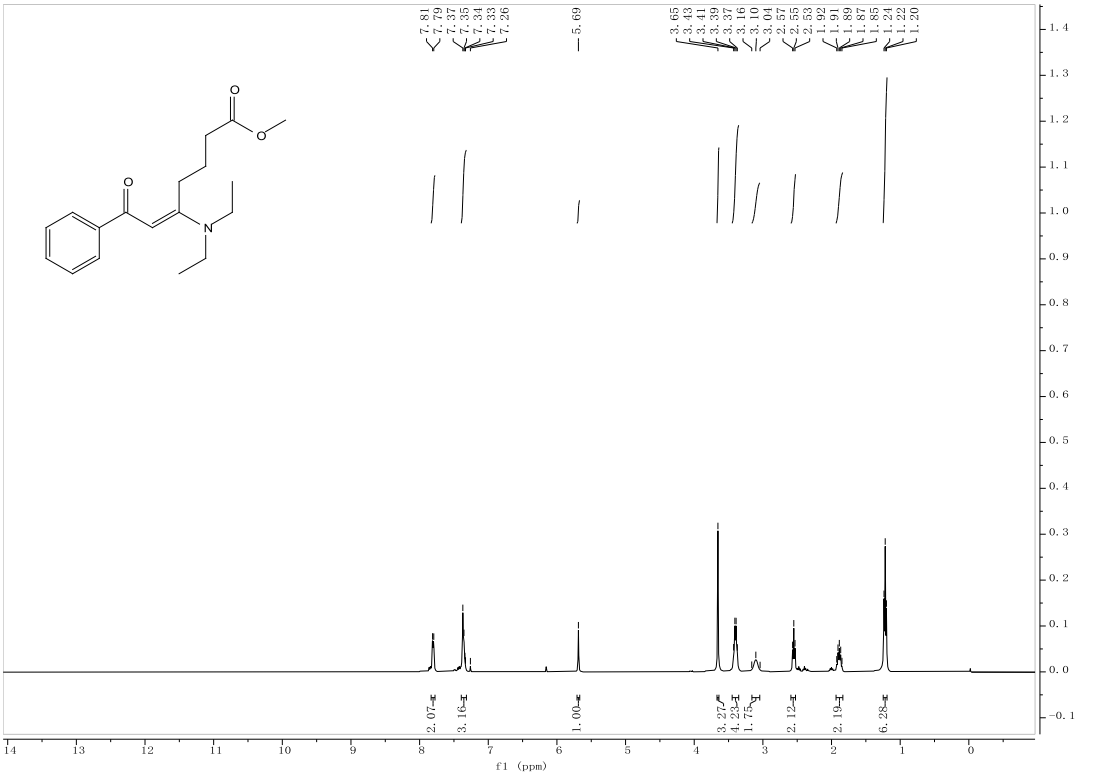
^{1}H NMR spectrum of compound **3c** (400 MHz, $CDCl_3$)



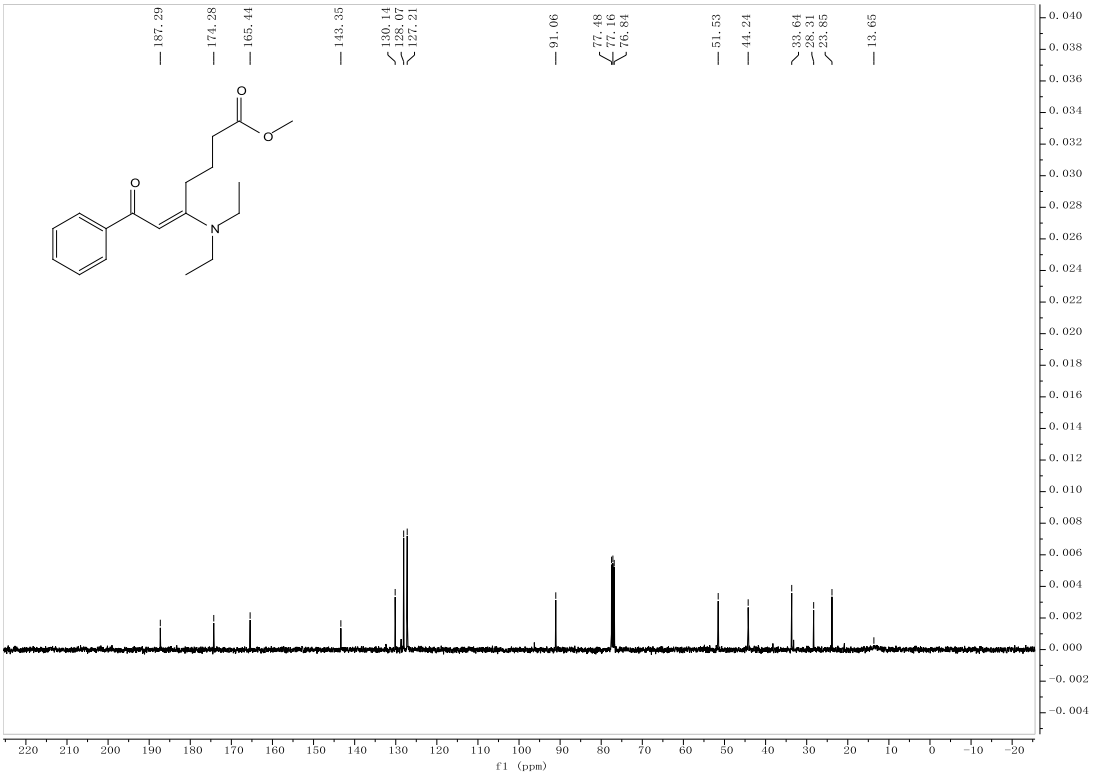
^{13}C NMR spectrum of compound **3c** (101 MHz, $CDCl_3$)



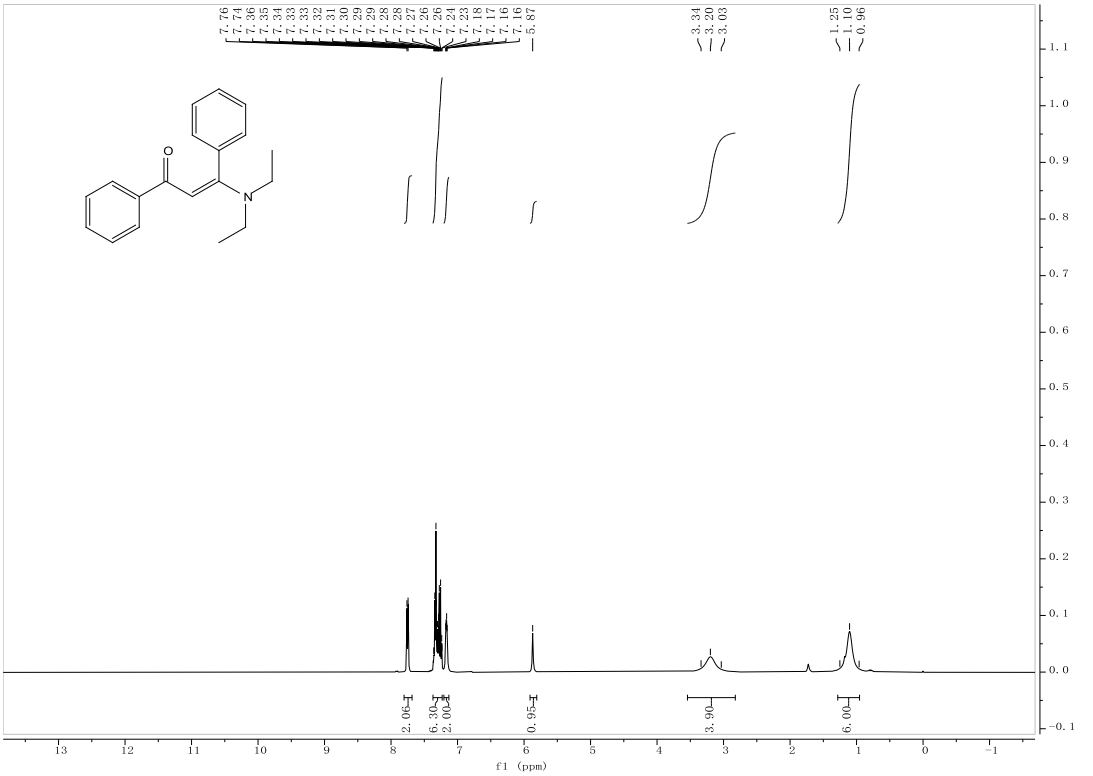
^{1}H NMR spectrum of compound **3d** (400 MHz, $CDCl_3$)



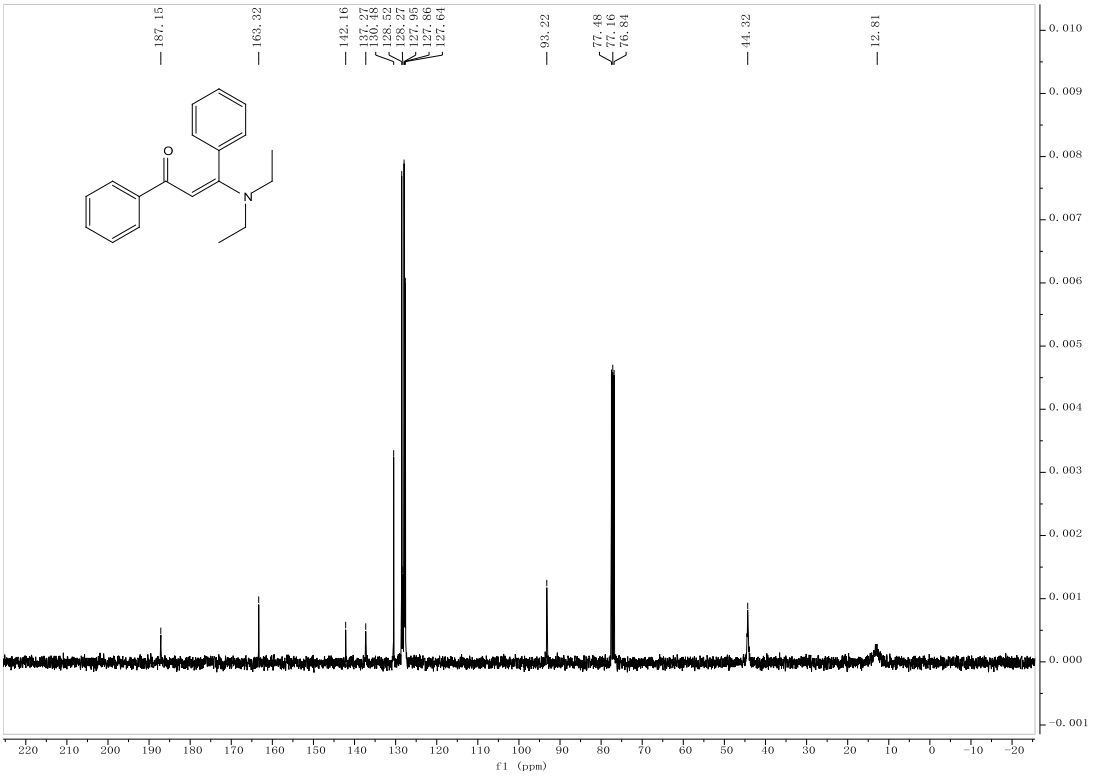
^{13}C NMR spectrum of compound **3d** (101 MHz, $CDCl_3$)



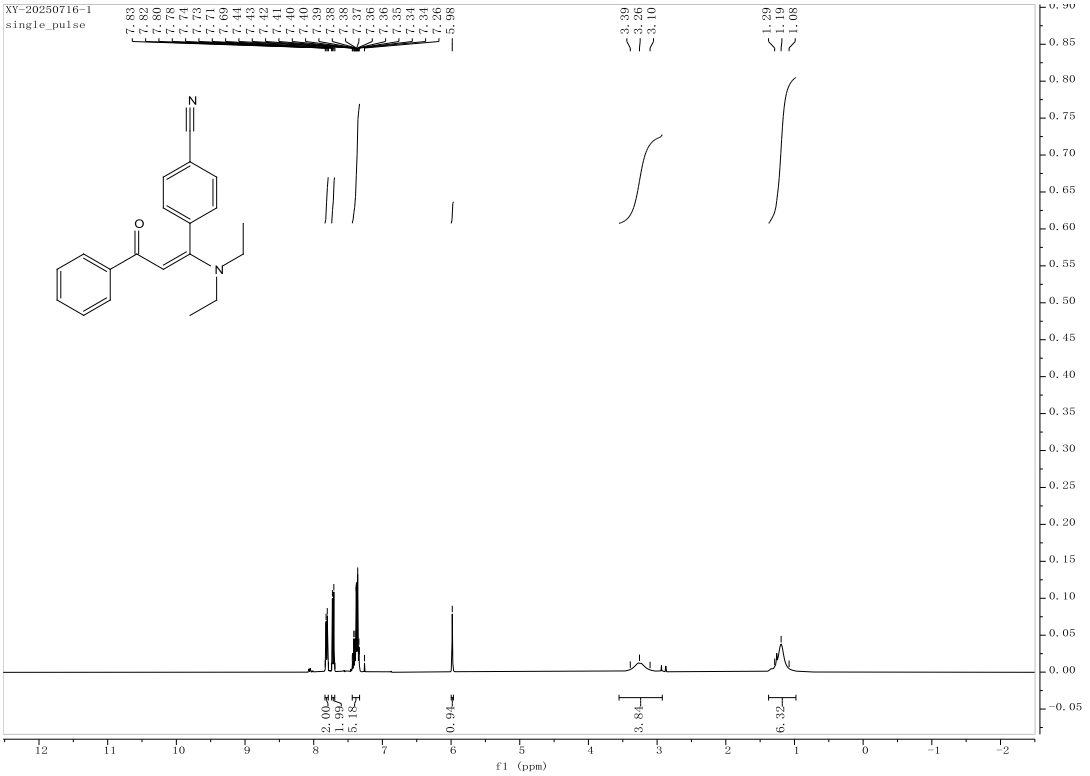
^{1}H NMR spectrum of compound **3e** (400 MHz, $CDCl_3$)



^{13}C NMR spectrum of compound **3e** (101 MHz, $CDCl_3$)



^{1}H NMR spectrum of compound **3f** (400 MHz, $CDCl_3$)



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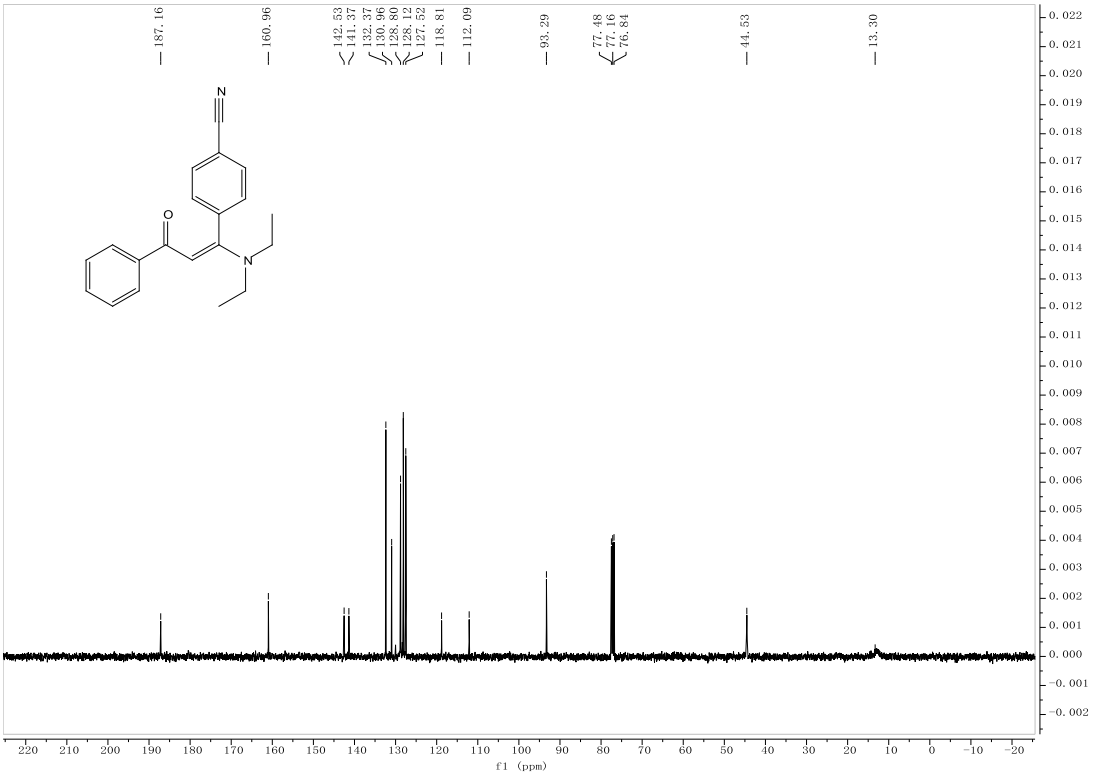
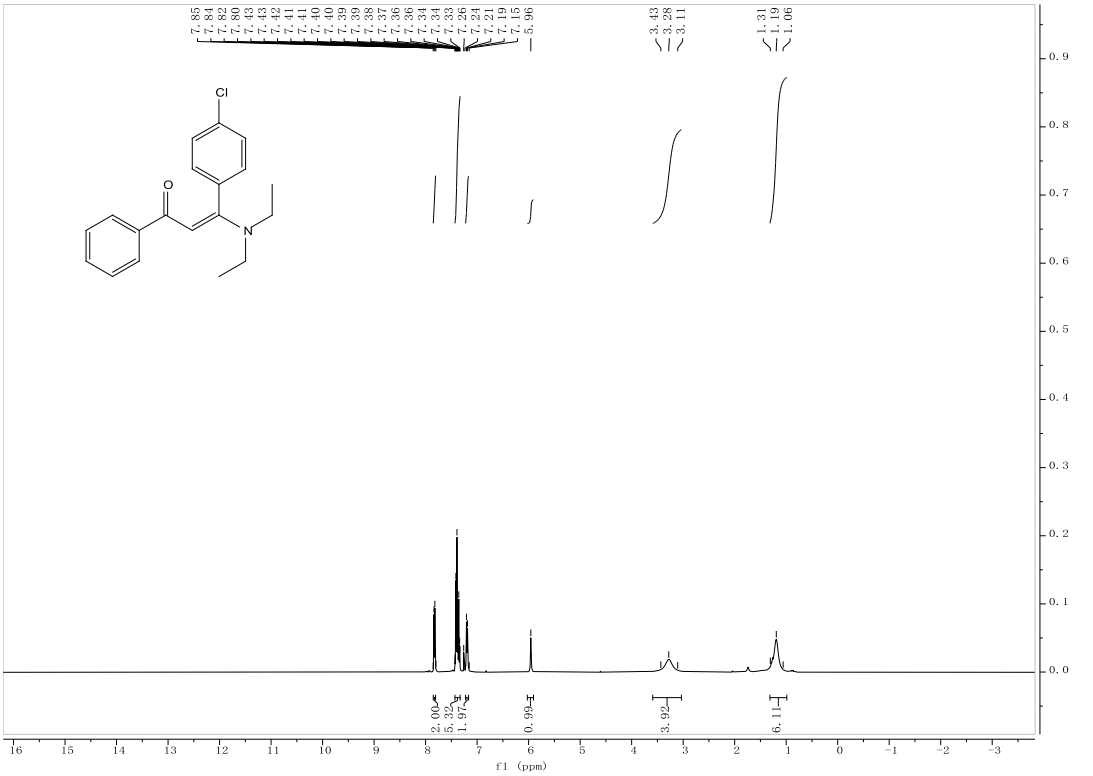
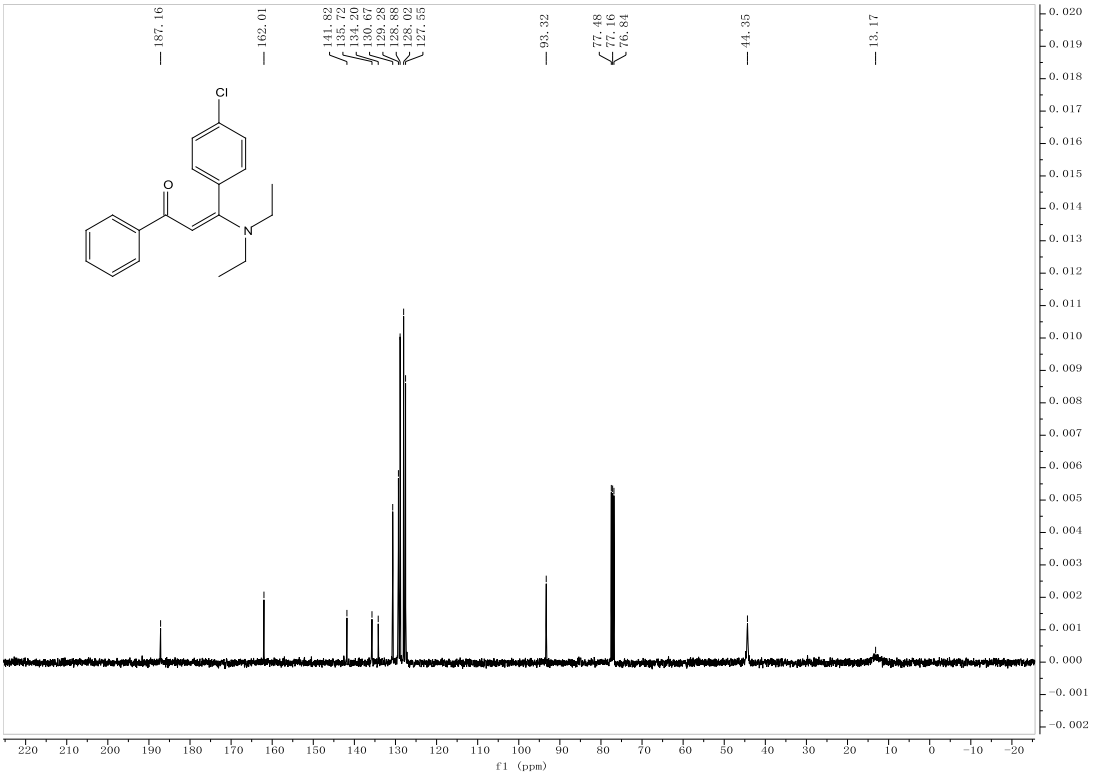


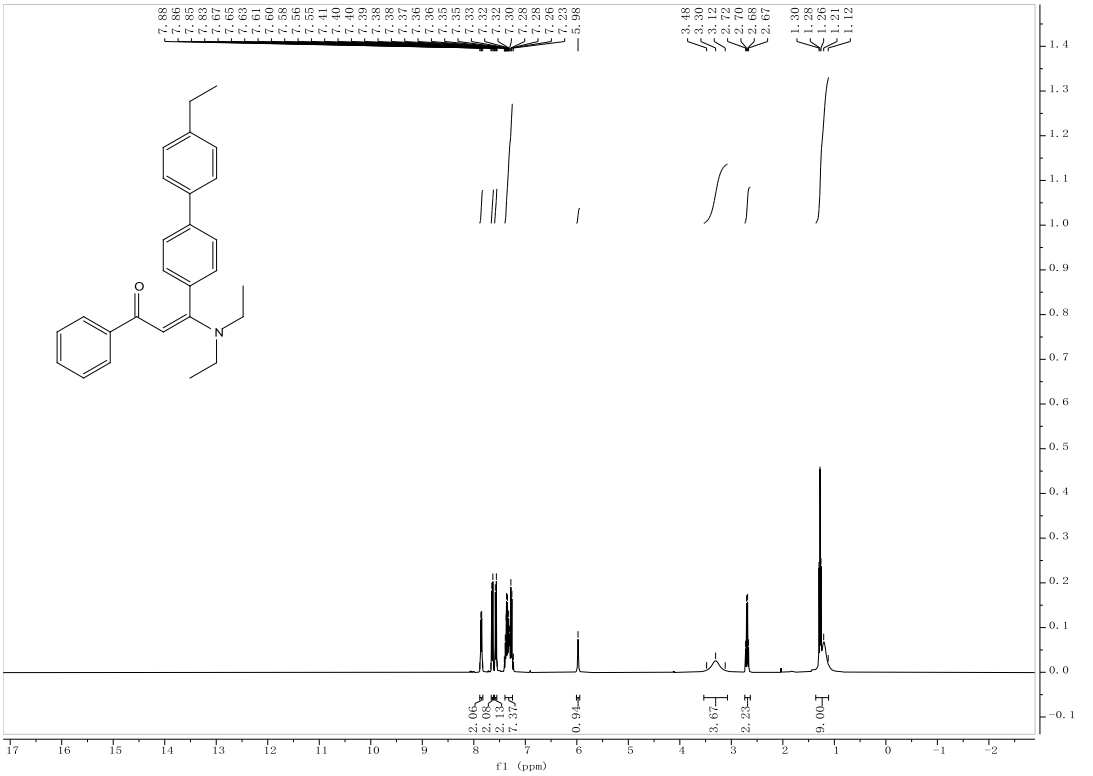
^{1}H NMR spectrum of compound **3g** (400 MHz, $CDCl_3$)



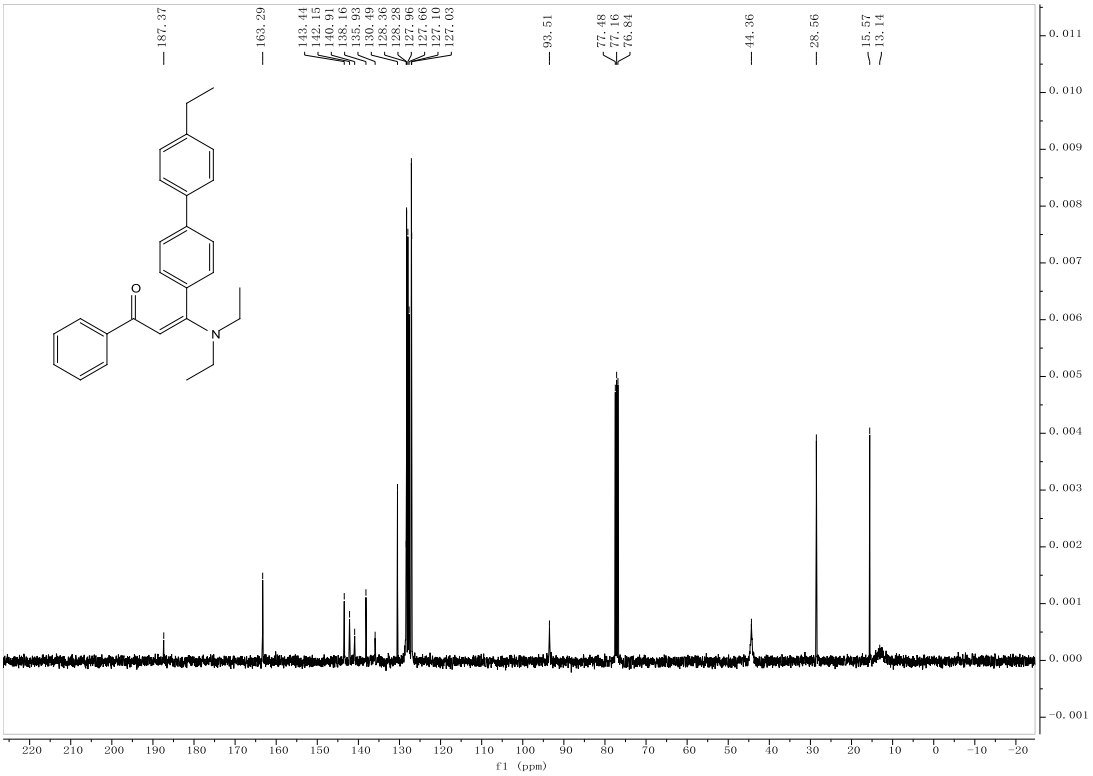
^{13}C NMR spectrum of compound **3g** (101 MHz, $CDCl_3$)



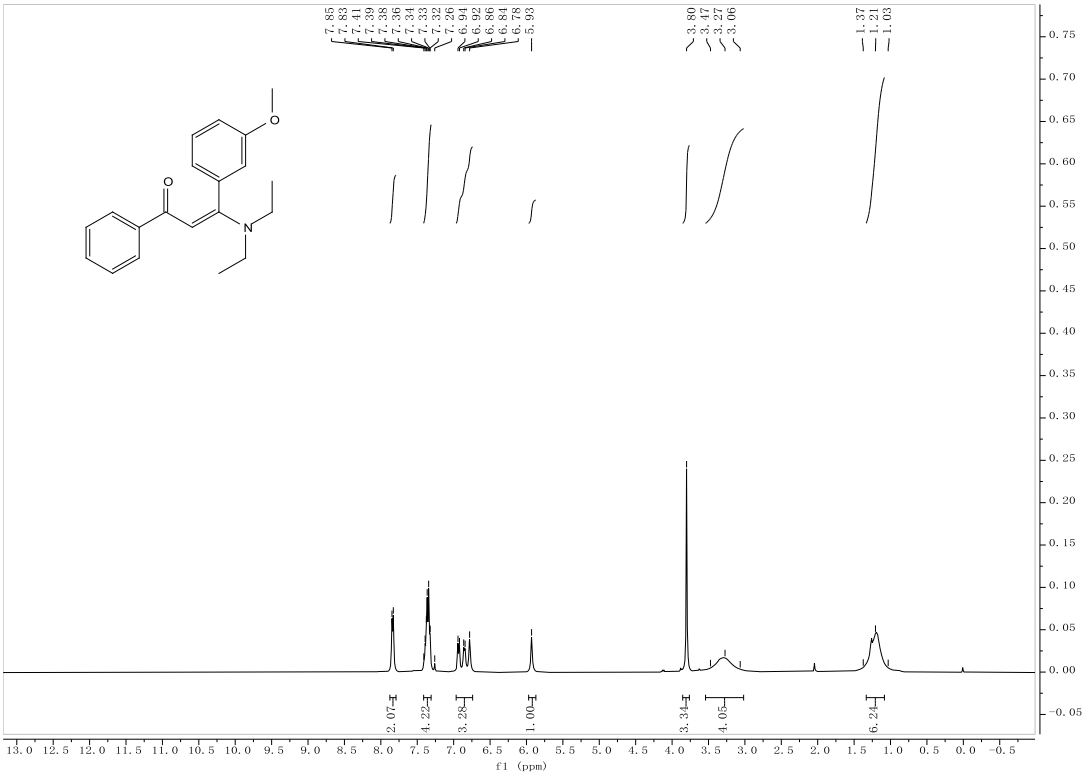
^{1}H NMR spectrum of compound **3h** (400 MHz, $CDCl_3$)



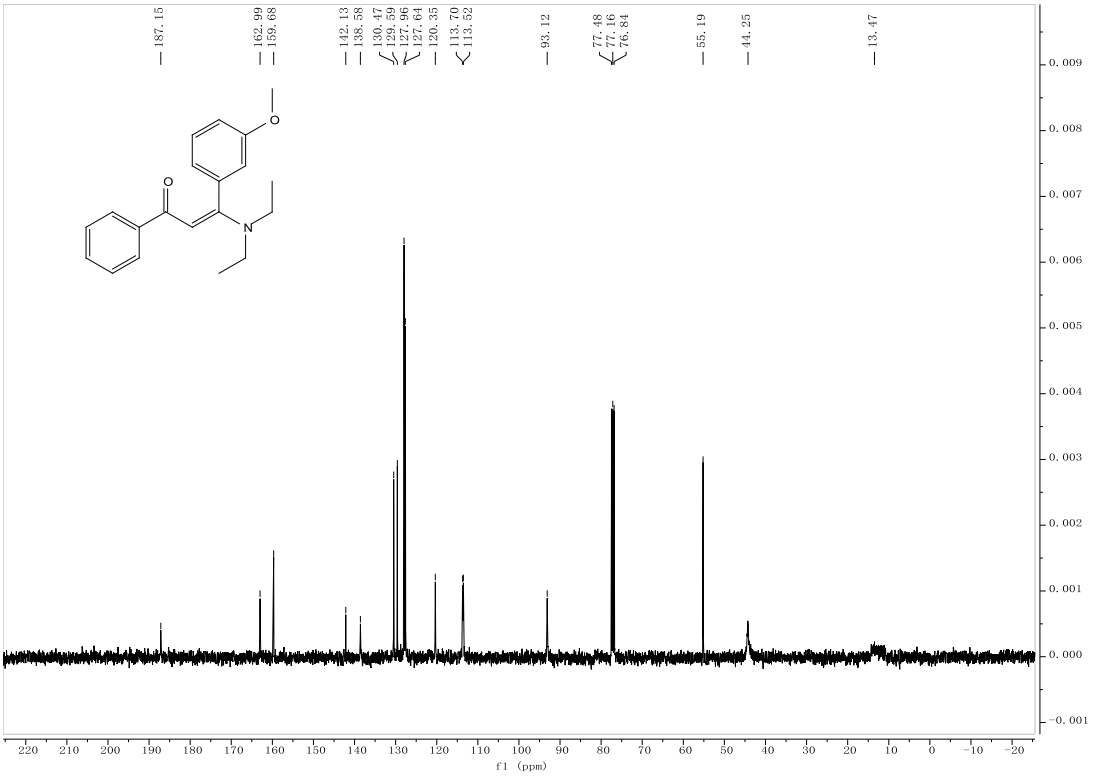
^{13}C NMR spectrum of compound **3h** (101 MHz, $CDCl_3$)



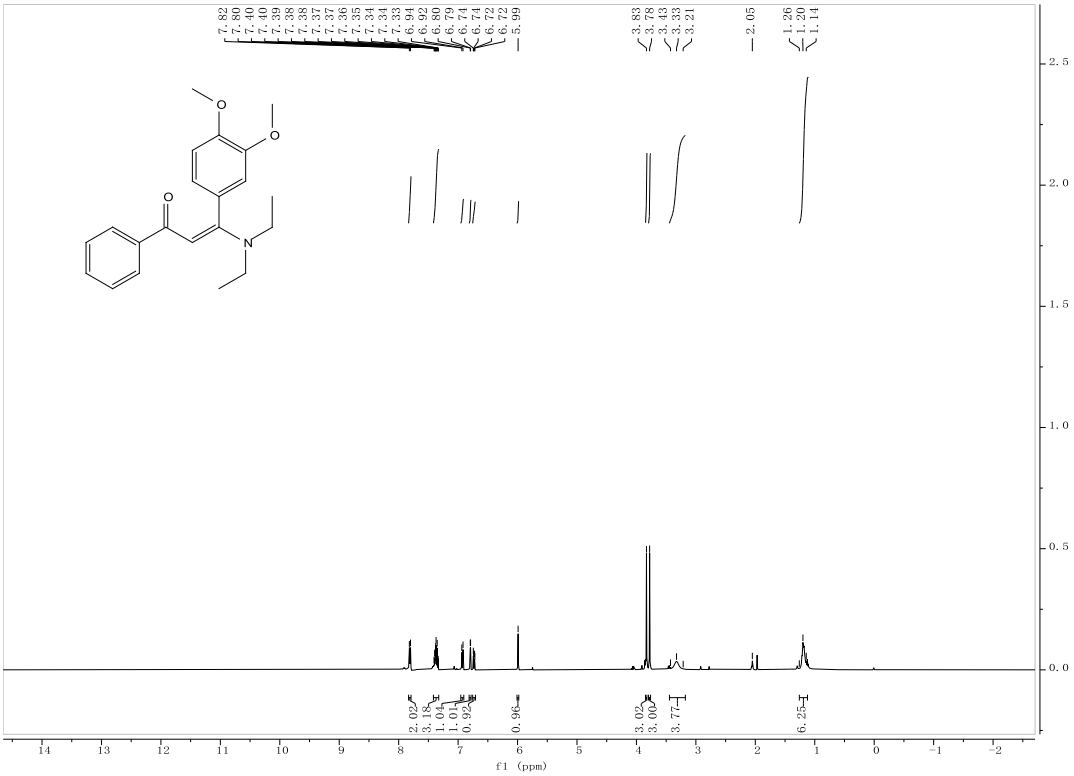
^{1}H NMR spectrum of compound **3i** (400 MHz, $CDCl_3$)



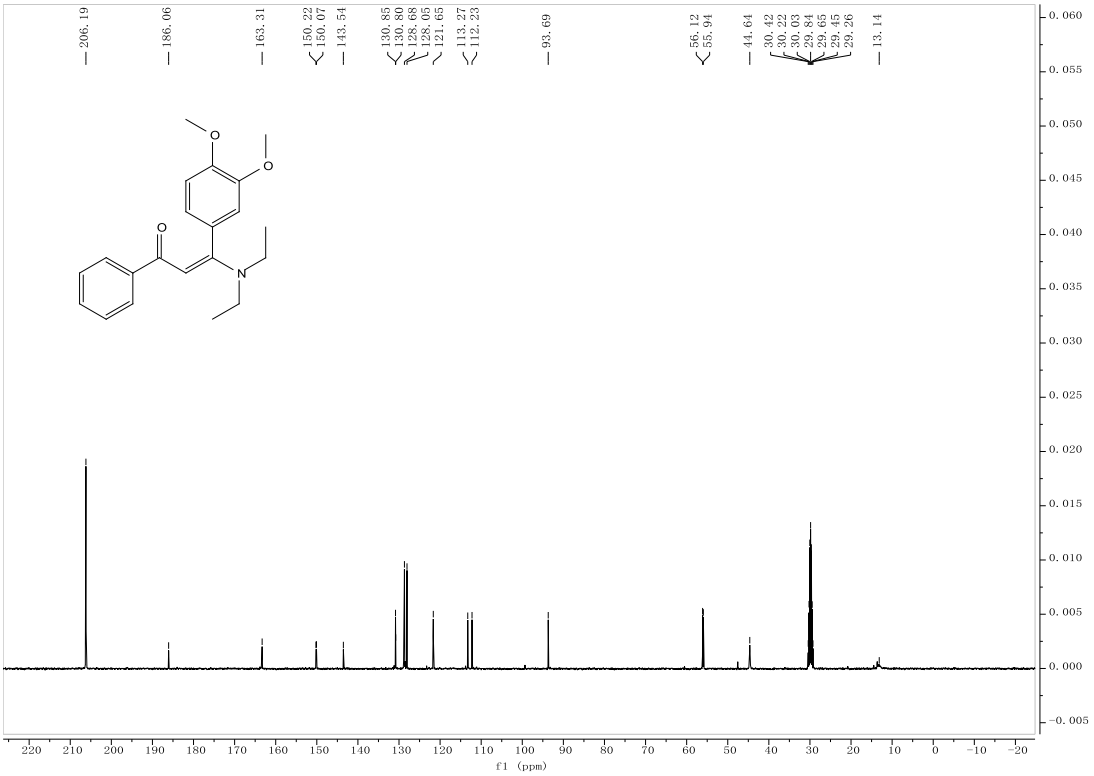
^{13}C NMR spectrum of compound **3i** (101 MHz, $CDCl_3$)



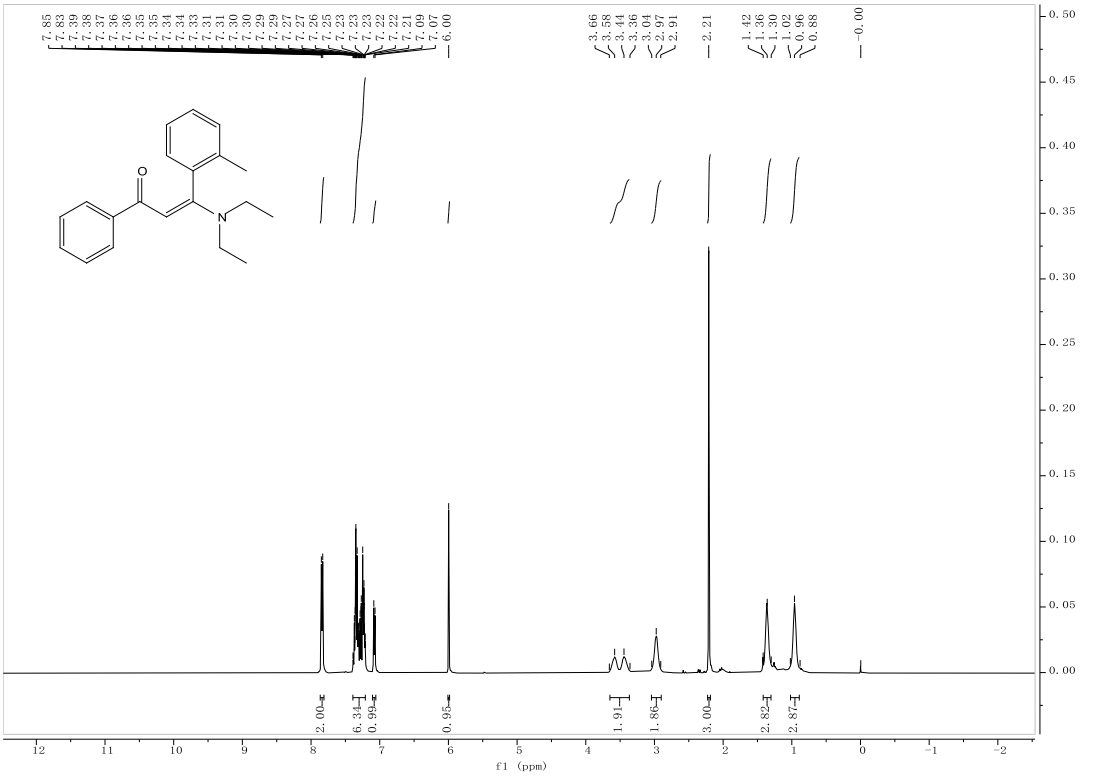
^{1}H NMR spectrum of compound **3j** (400 MHz, Acetone-d_6)



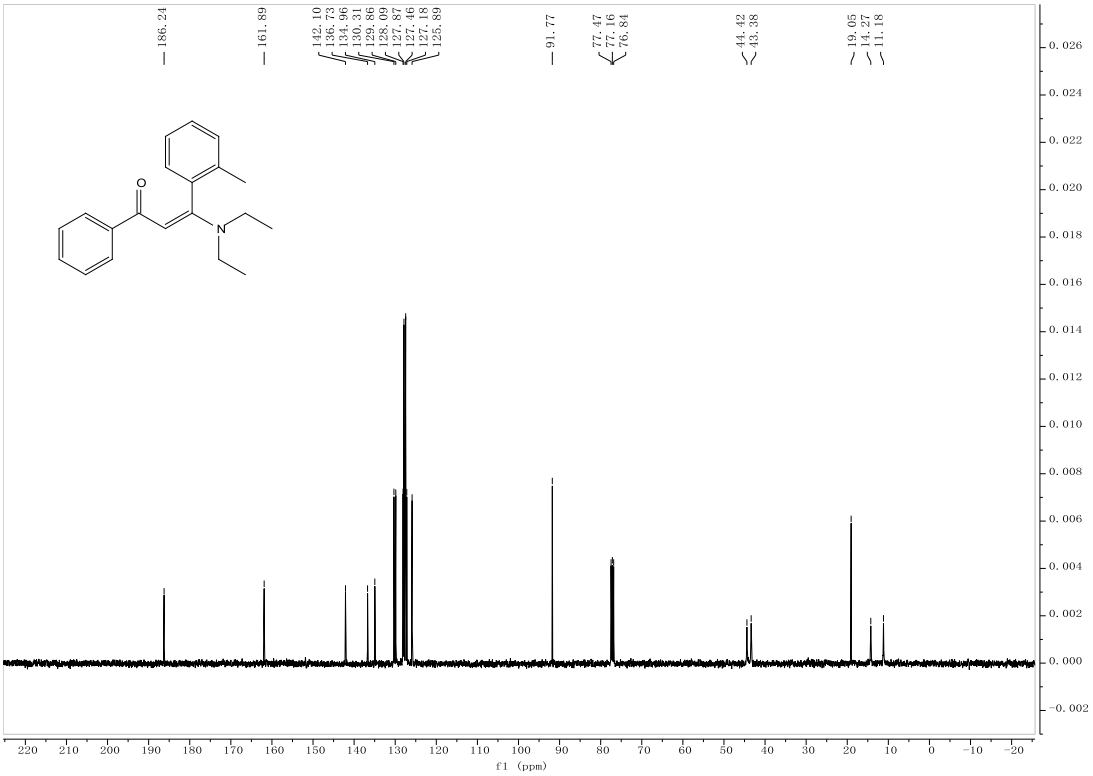
^{13}C NMR spectrum of compound **3j** (101 MHz, Acetone-d_6)



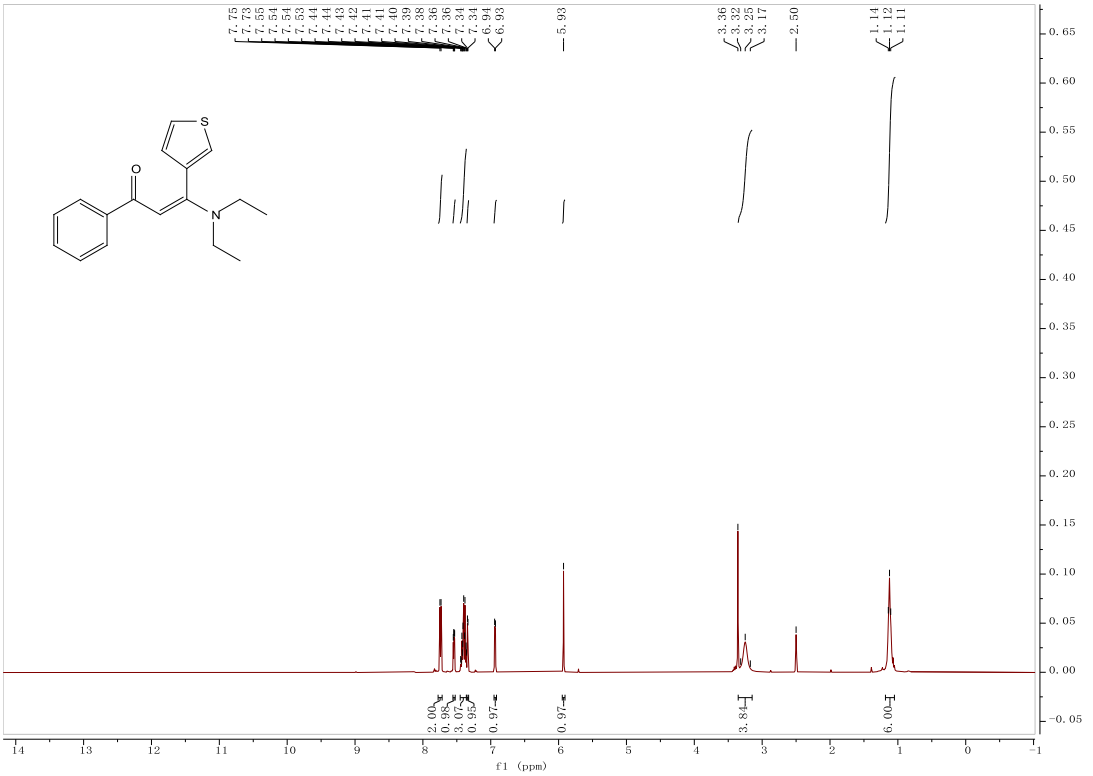
^{1}H NMR spectrum of compound **3k** (400 MHz, $CDCl_3$)



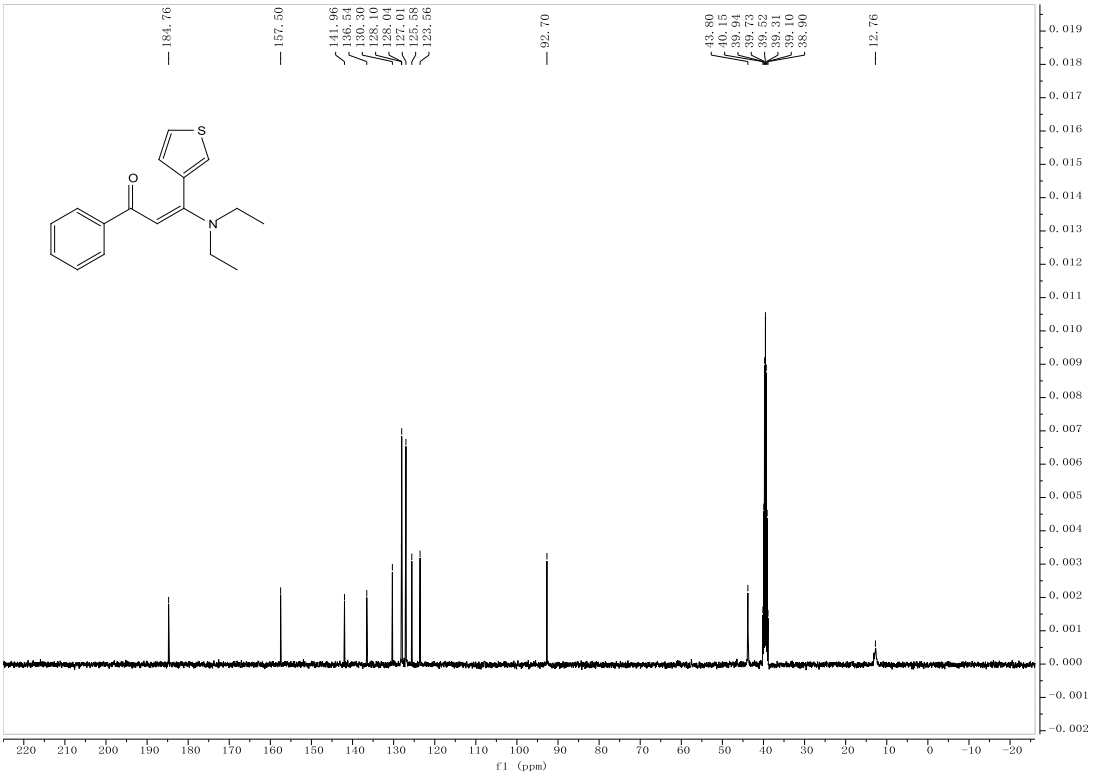
^{13}C NMR spectrum of compound **3k** (101 MHz, $CDCl_3$)



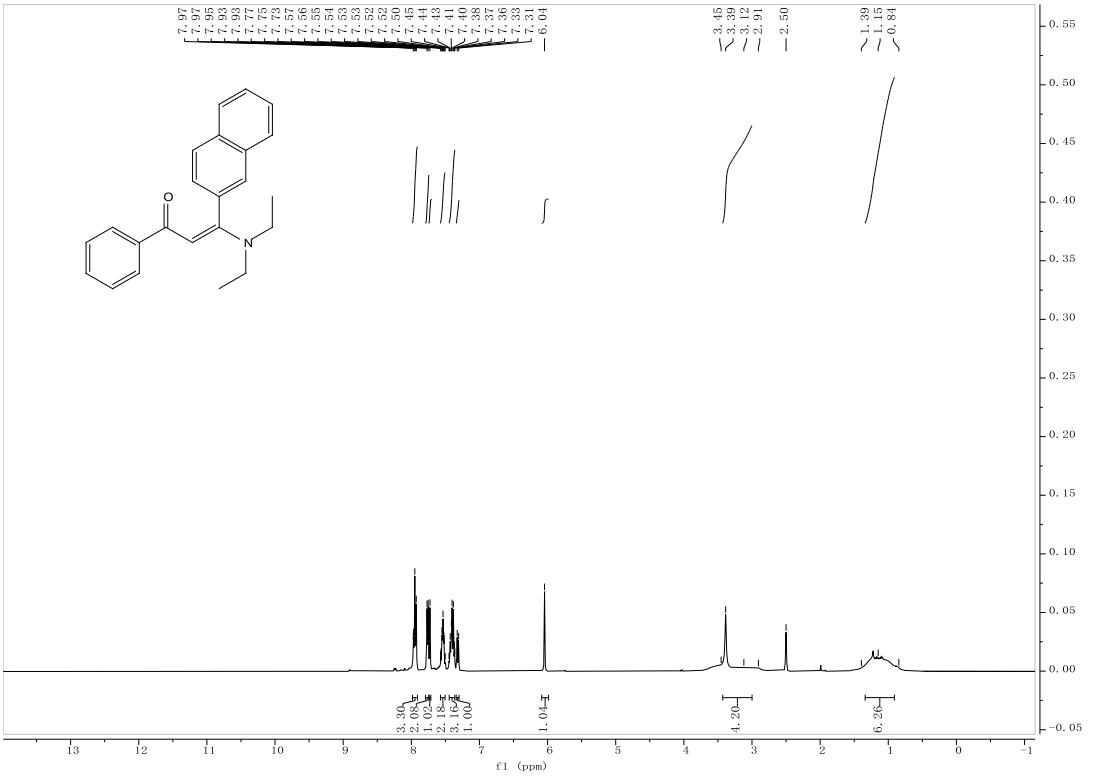
^{1}H NMR spectrum of compound **3l** (400 MHz, DMSO-d_6)



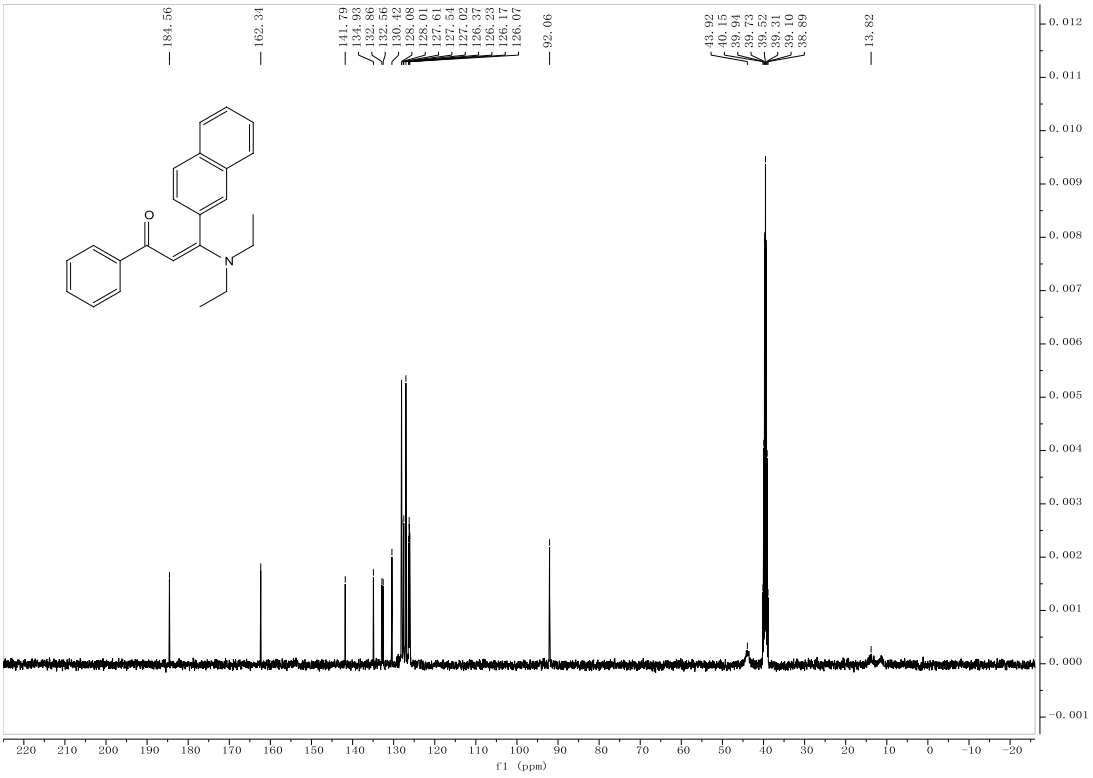
^{13}C NMR spectrum of compound **3l** (101 MHz, DMSO-d_6)



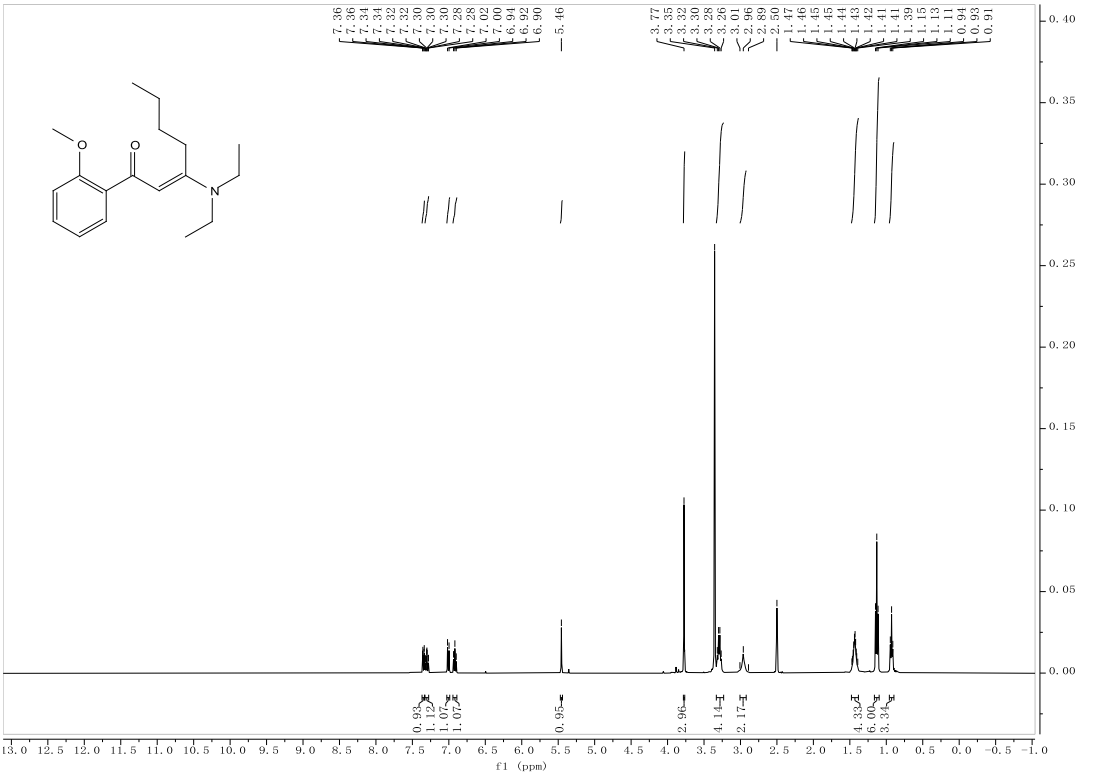
^{1}H NMR spectrum of compound **3m** (400 MHz, DMSO-d_6)



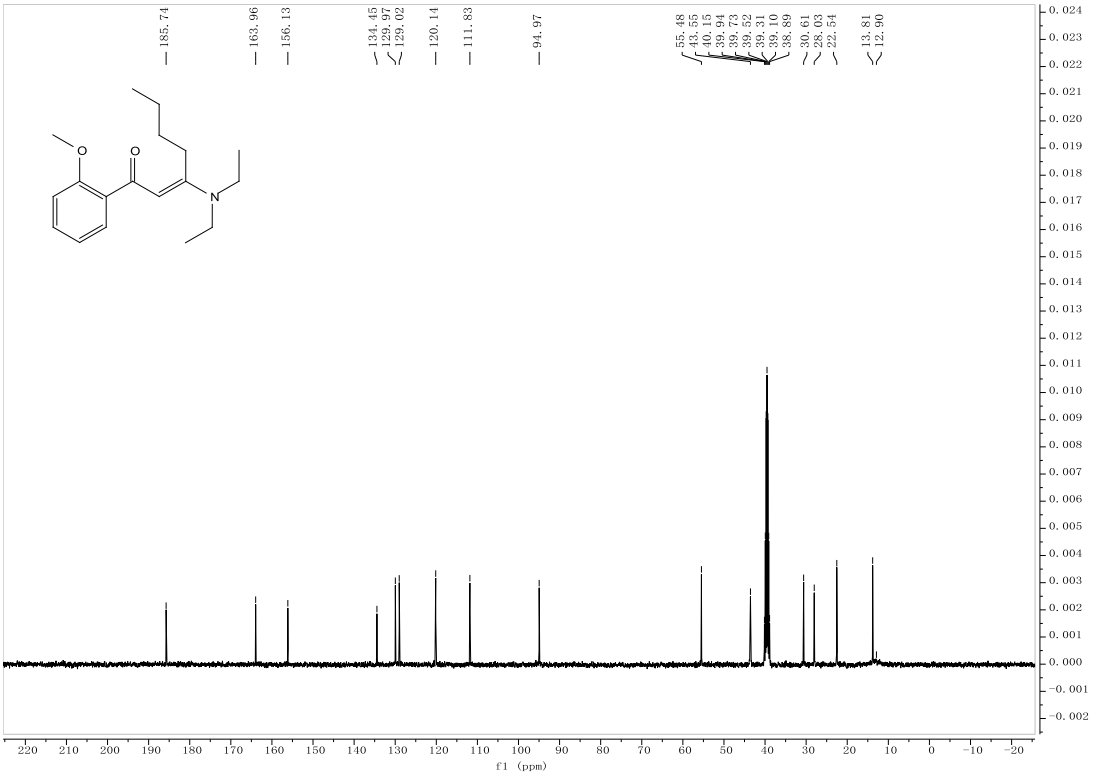
^{13}C NMR spectrum of compound **3m** (101 MHz, DMSO-d_6)



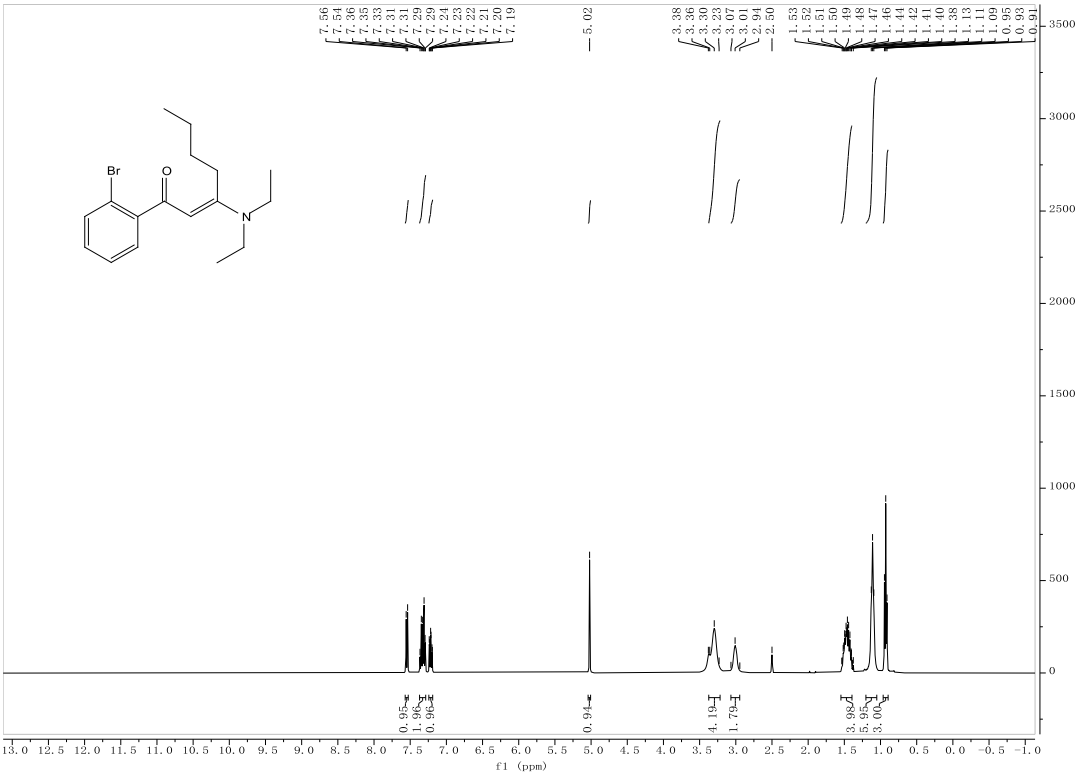
^{1}H NMR spectrum of compound **3n** (400 MHz, DMSO-d_6)



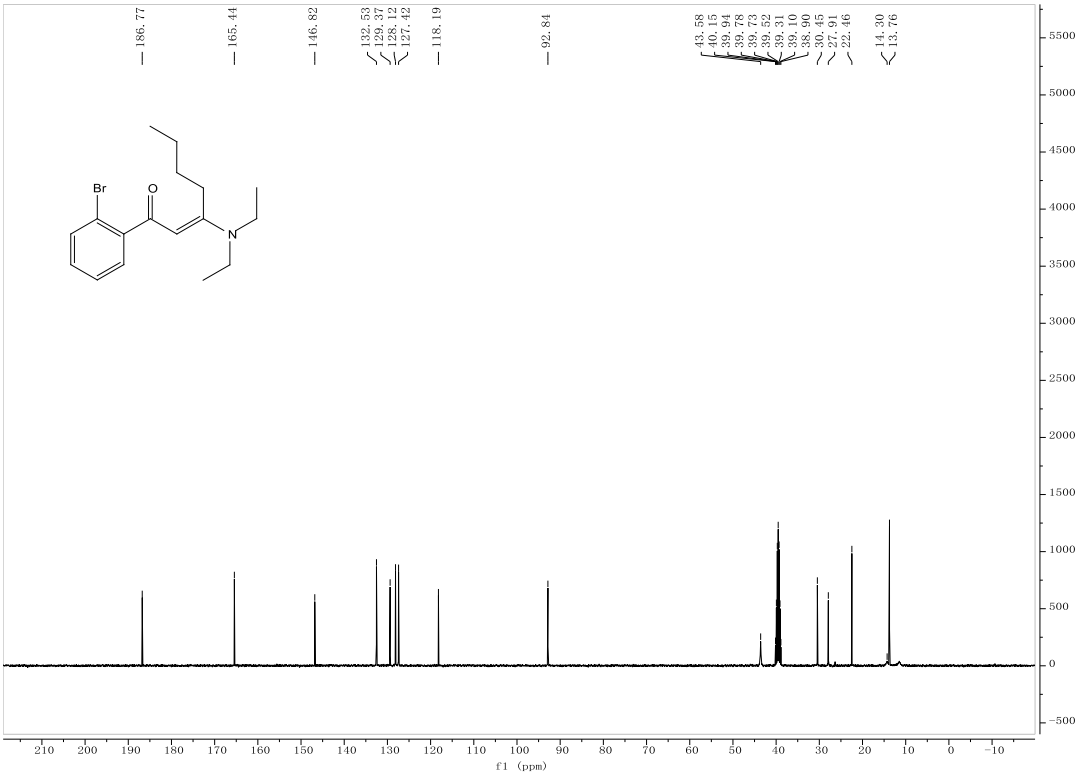
^{13}C NMR spectrum of compound **3n** (101 MHz, DMSO-d_6)



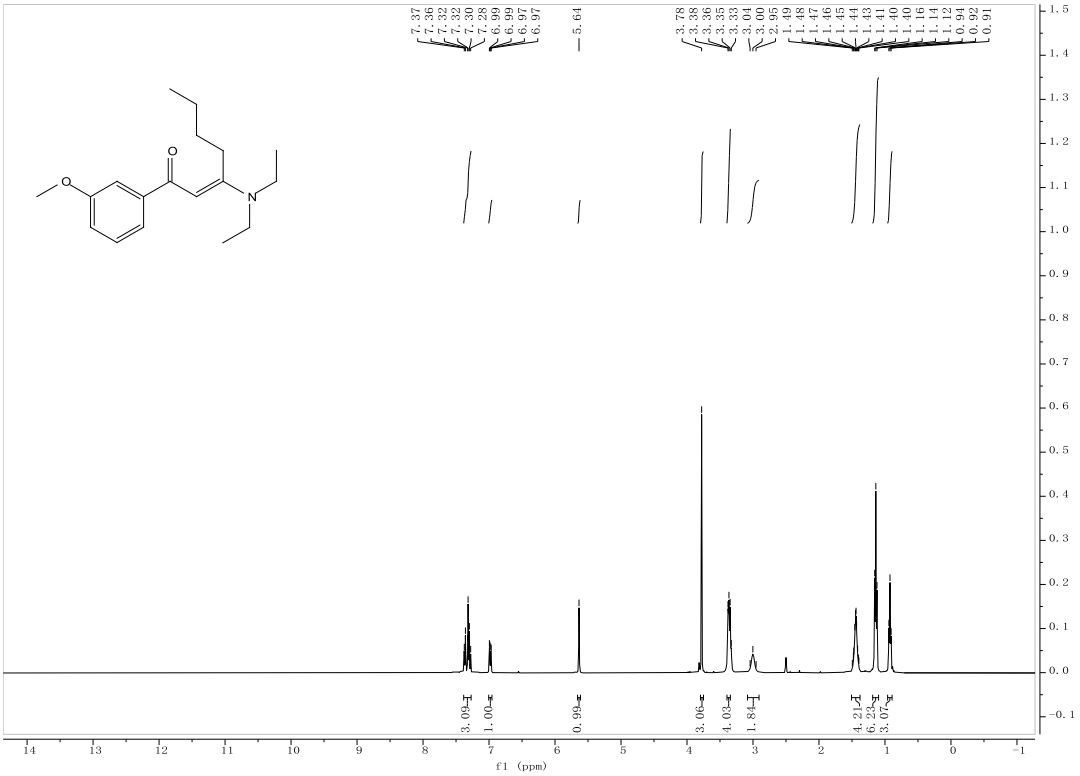
^{1}H NMR spectrum of compound **3o** (400 MHz, DMSO-d_6)



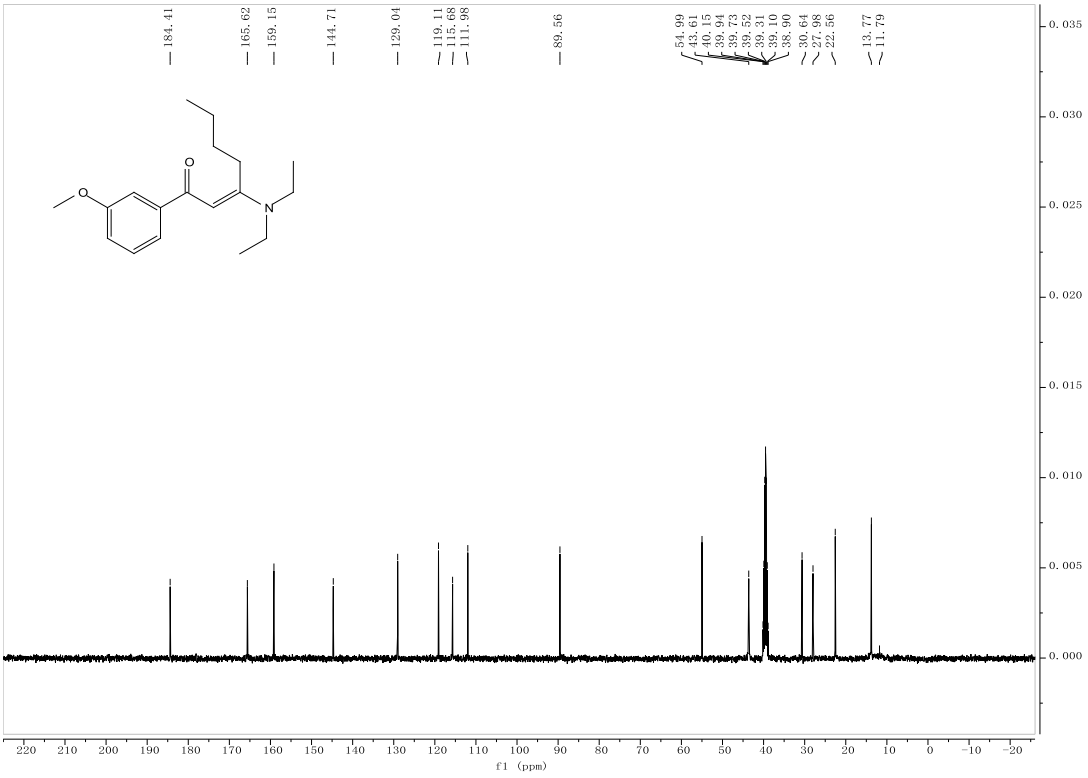
^{13}C NMR spectrum of compound **3o** (101 MHz, DMSO-d_6)



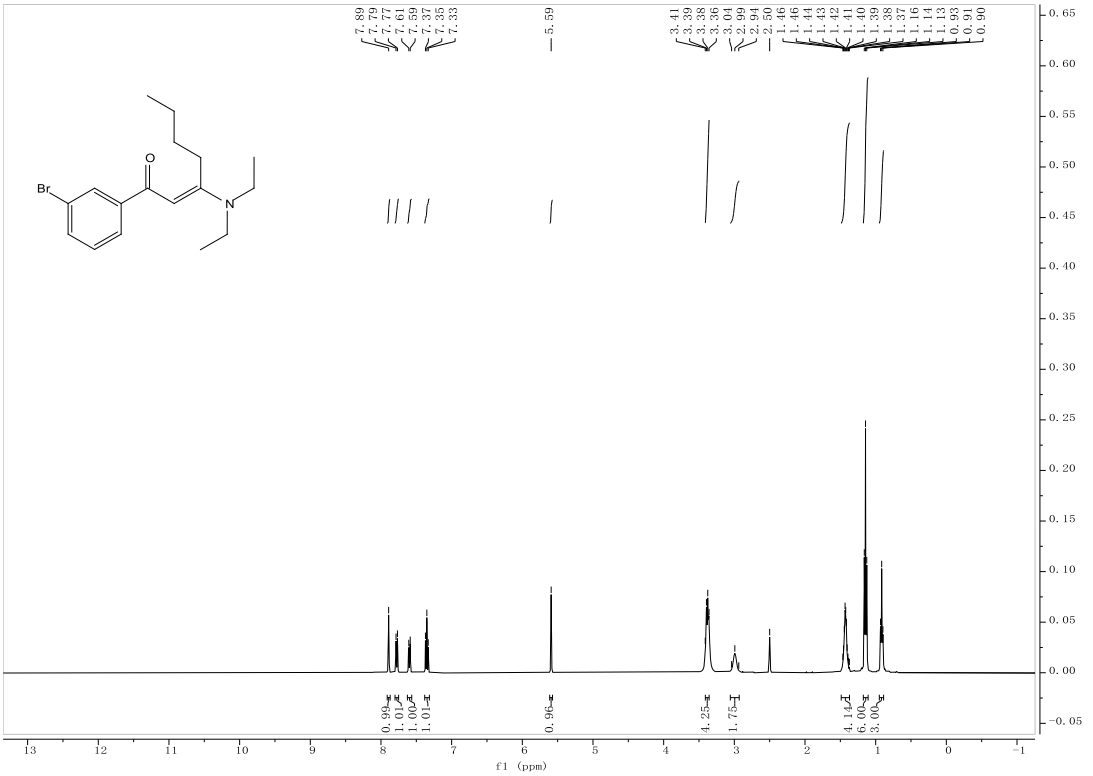
^{1}H NMR spectrum of compound **3p** (400 MHz, DMSO-d_6)



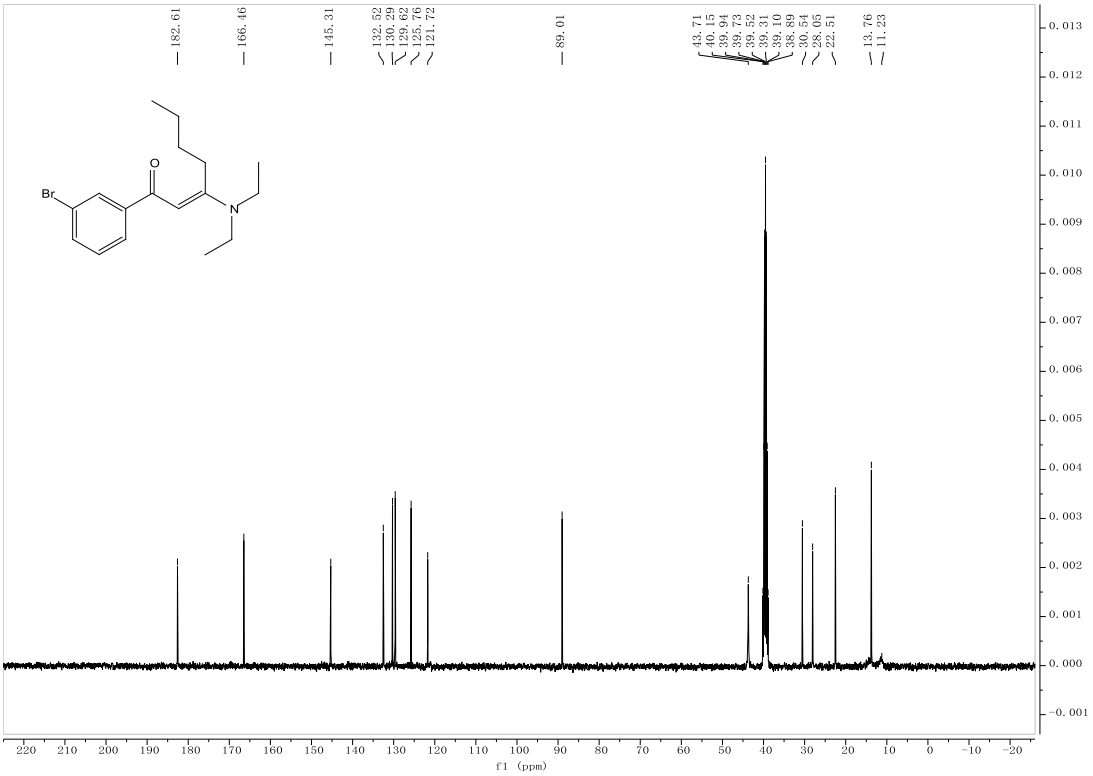
^{13}C NMR spectrum of compound **3p** (101 MHz, DMSO-d_6)



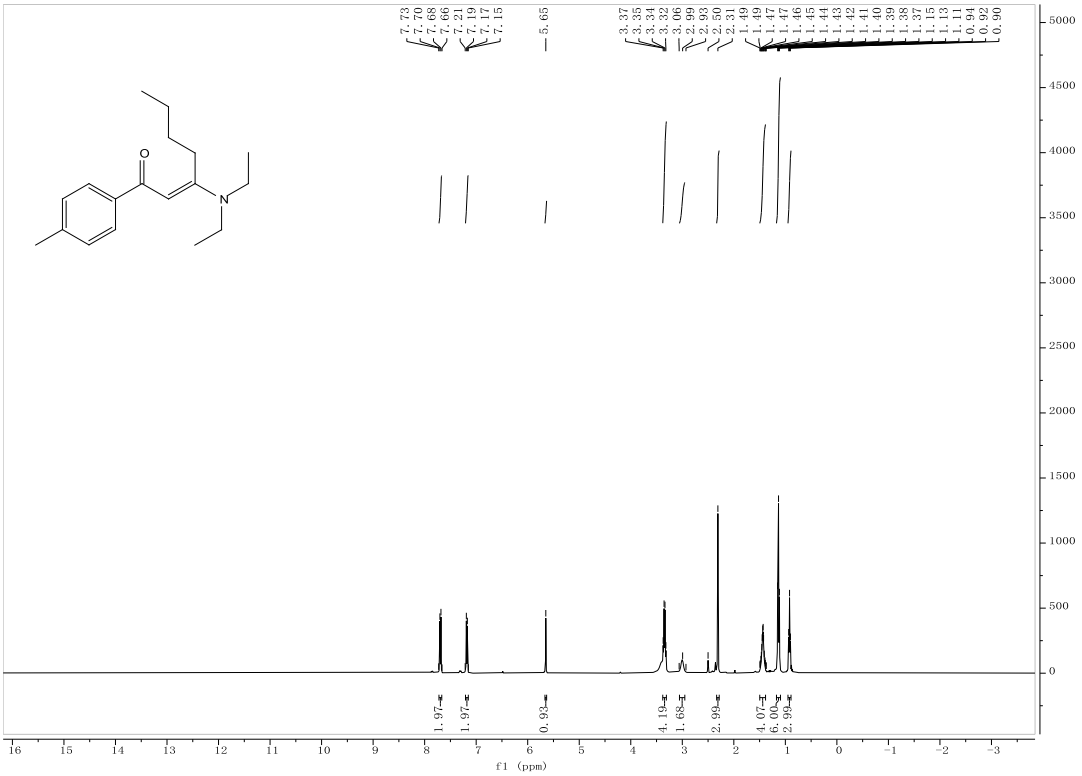
^{1}H NMR spectrum of compound **3q** (400 MHz, DMSO-d_6)



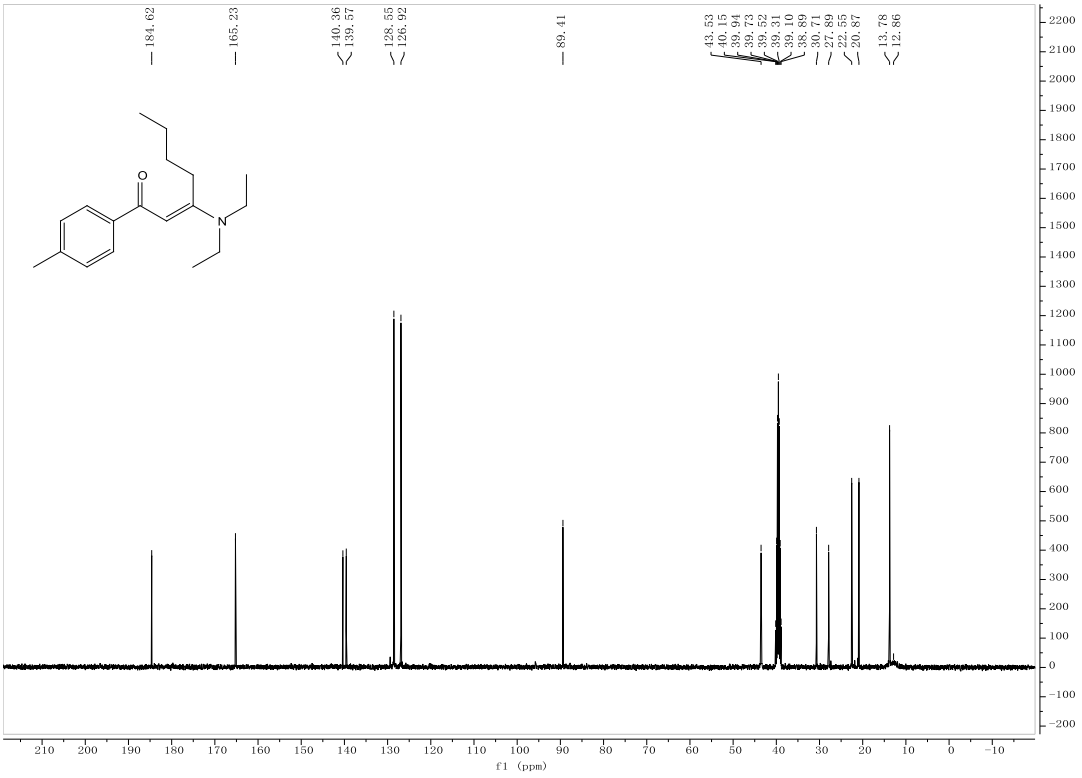
^{13}C NMR spectrum of compound **3q** (101 MHz, DMSO-d_6)



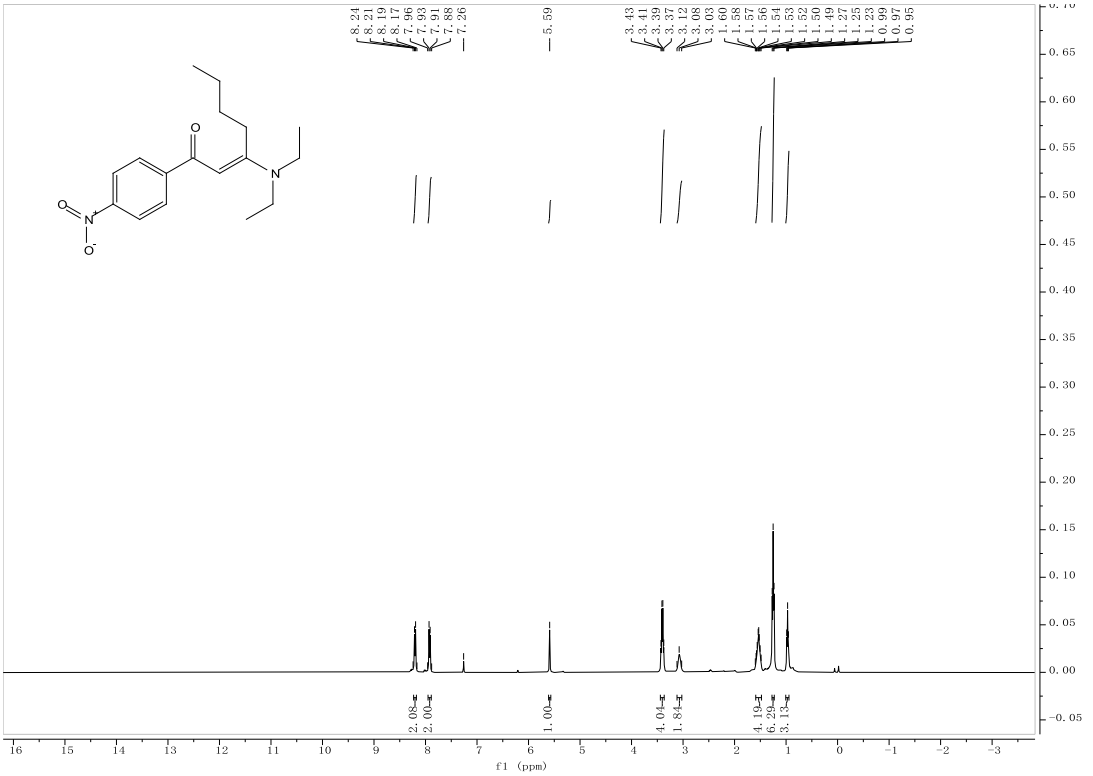
^{1}H NMR spectrum of compound **3r** (400 MHz, DMSO-d_6)



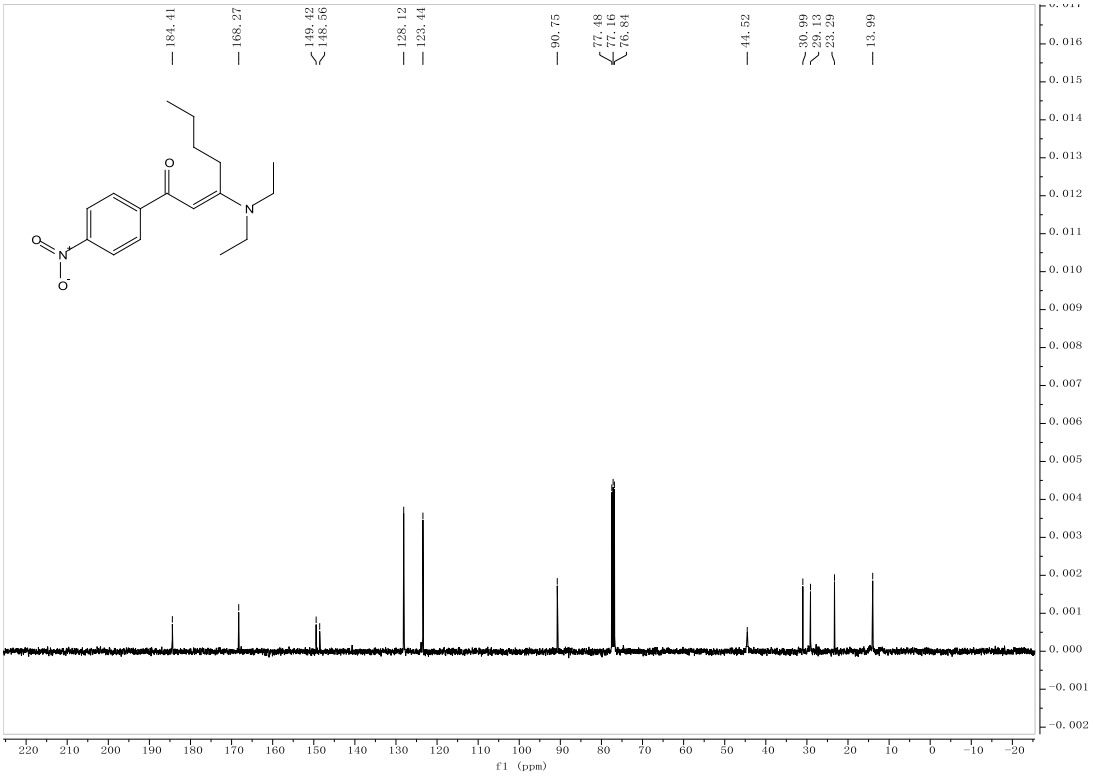
^{13}C NMR spectrum of compound **3r** (101 MHz, DMSO-d_6)



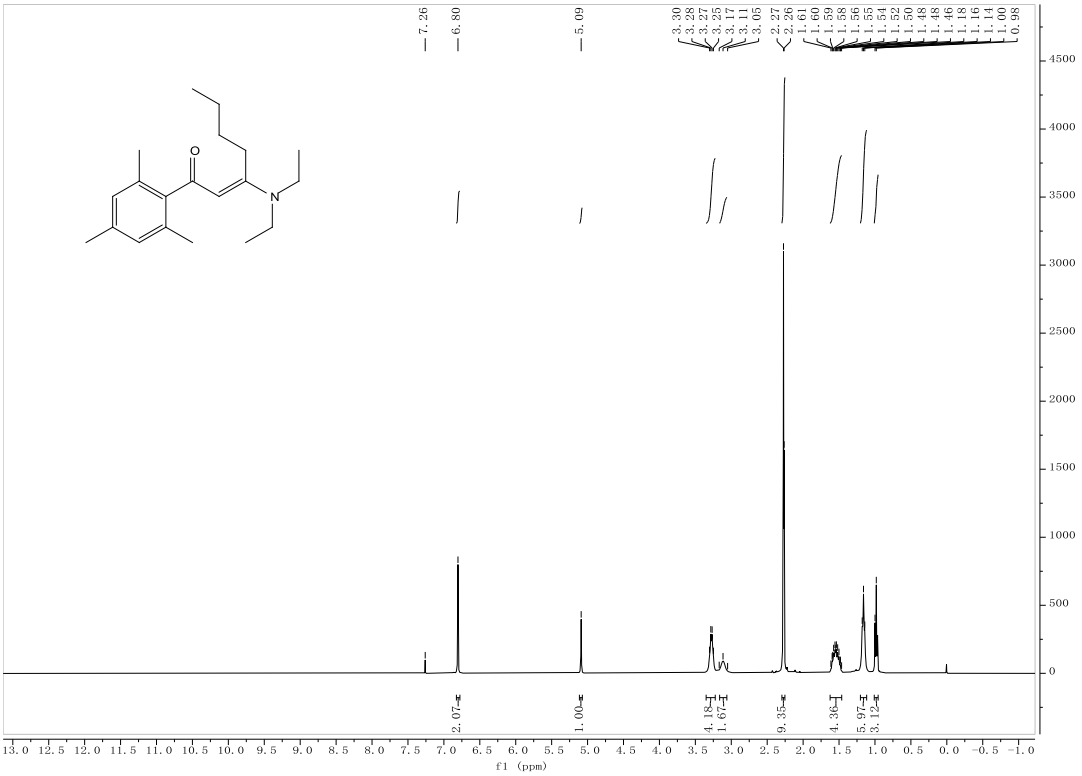
^{1}H NMR spectrum of compound **3s** (400 MHz, $CDCl_3$)



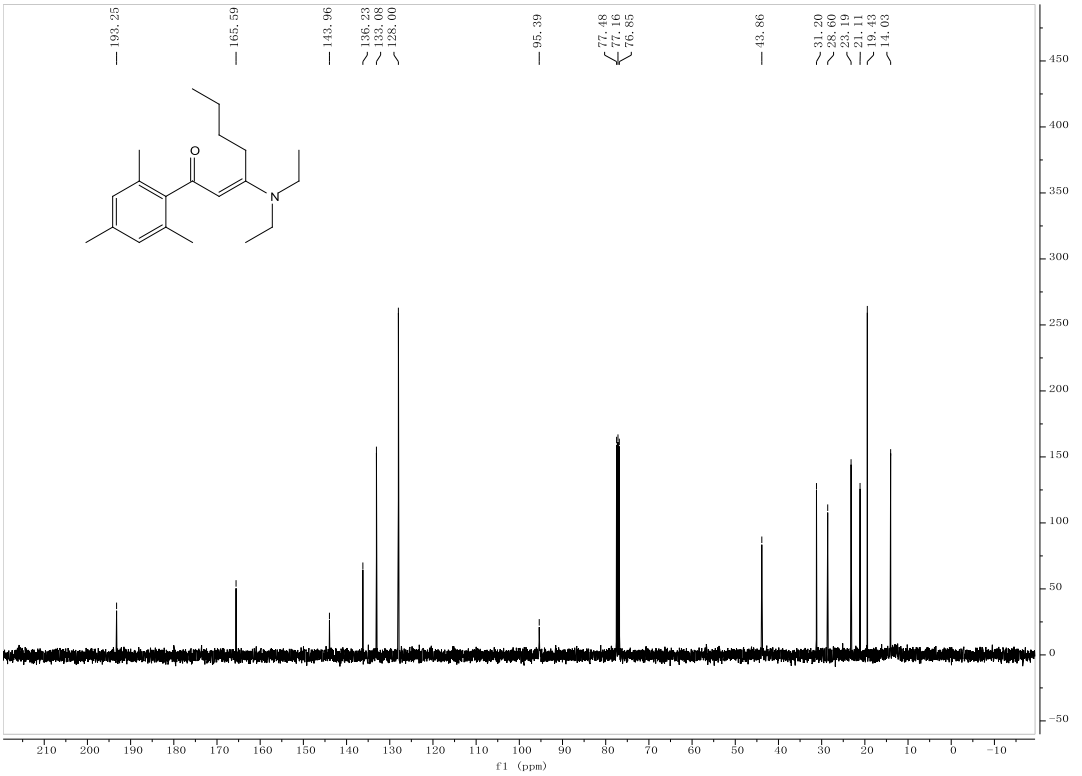
^{13}C NMR spectrum of compound **3s** (101 MHz, $CDCl_3$)



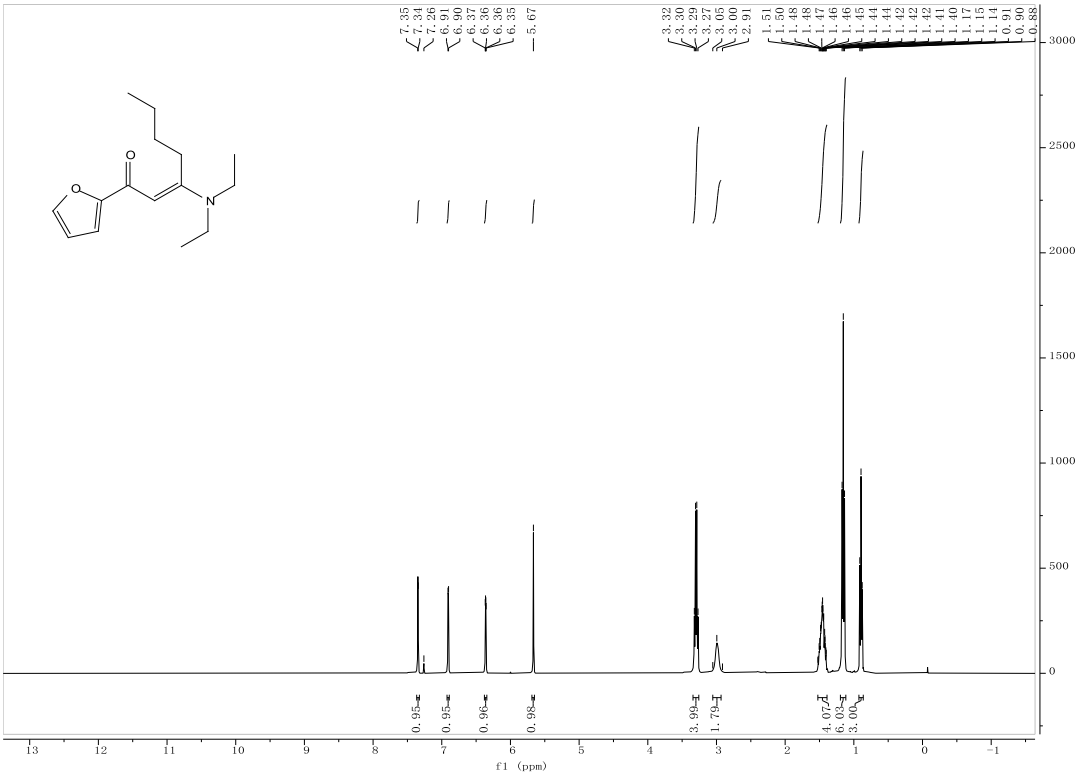
^{1}H NMR spectrum of compound **3t** (400 MHz, $CDCl_3$)



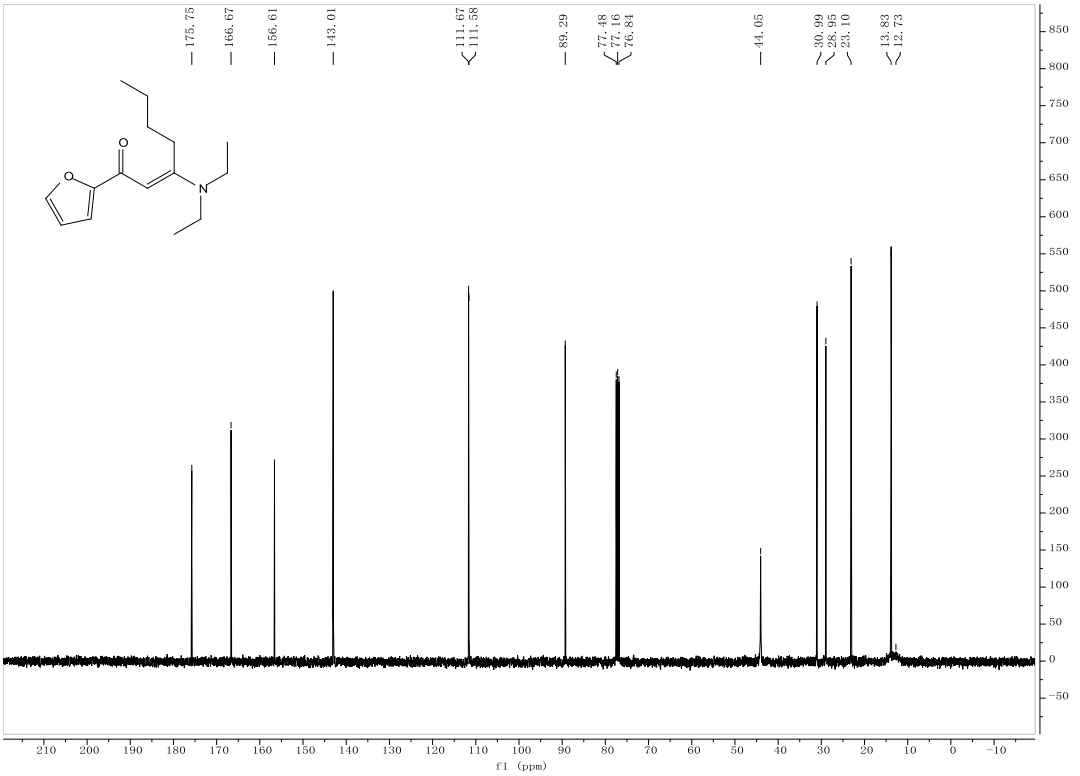
^{13}C NMR spectrum of compound **3t** (101 MHz, $CDCl_3$)



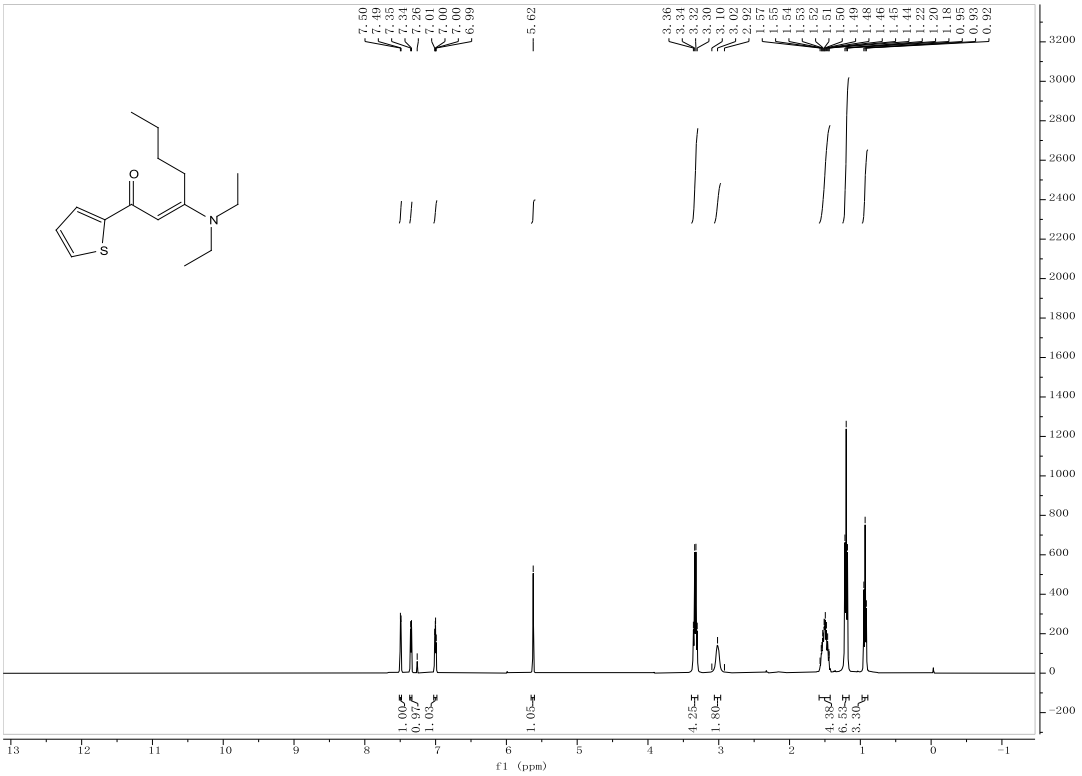
^{1}H NMR spectrum of compound **3u** (400 MHz, $CDCl_3$)



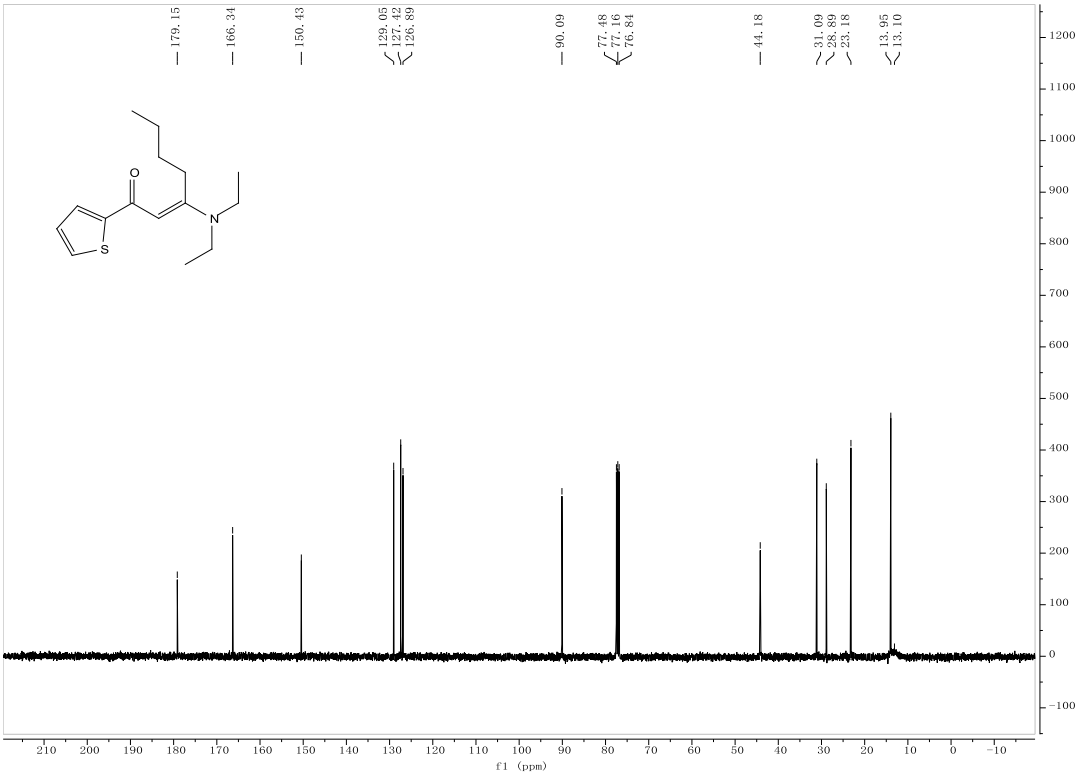
^{13}C NMR spectrum of compound **3u** (101 MHz, $CDCl_3$)



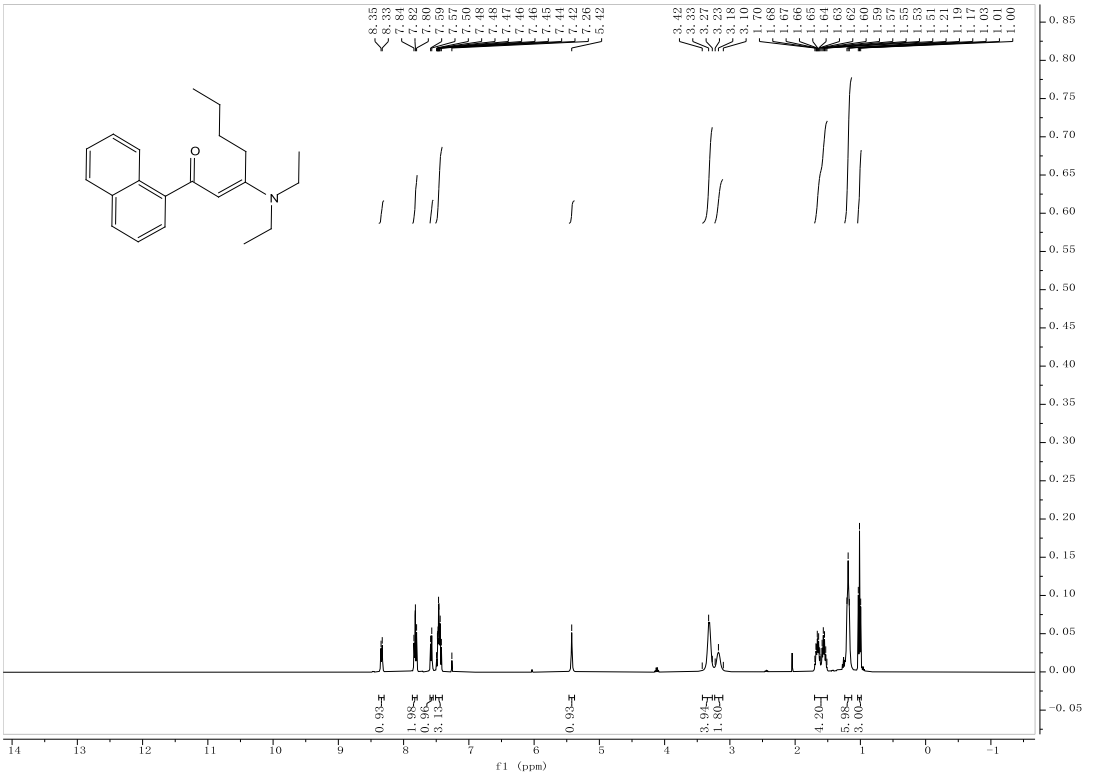
^{1}H NMR spectrum of compound **3v** (400 MHz, $CDCl_3$)



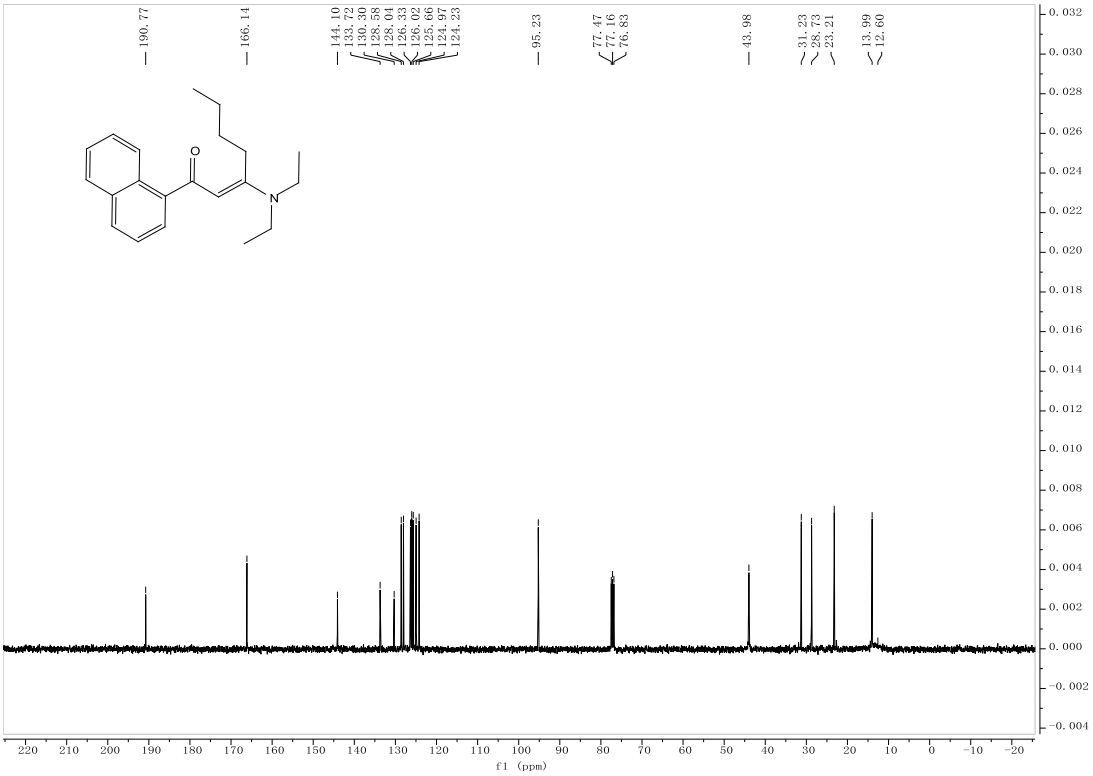
^{13}C NMR spectrum of compound **3v** (101 MHz, $CDCl_3$)



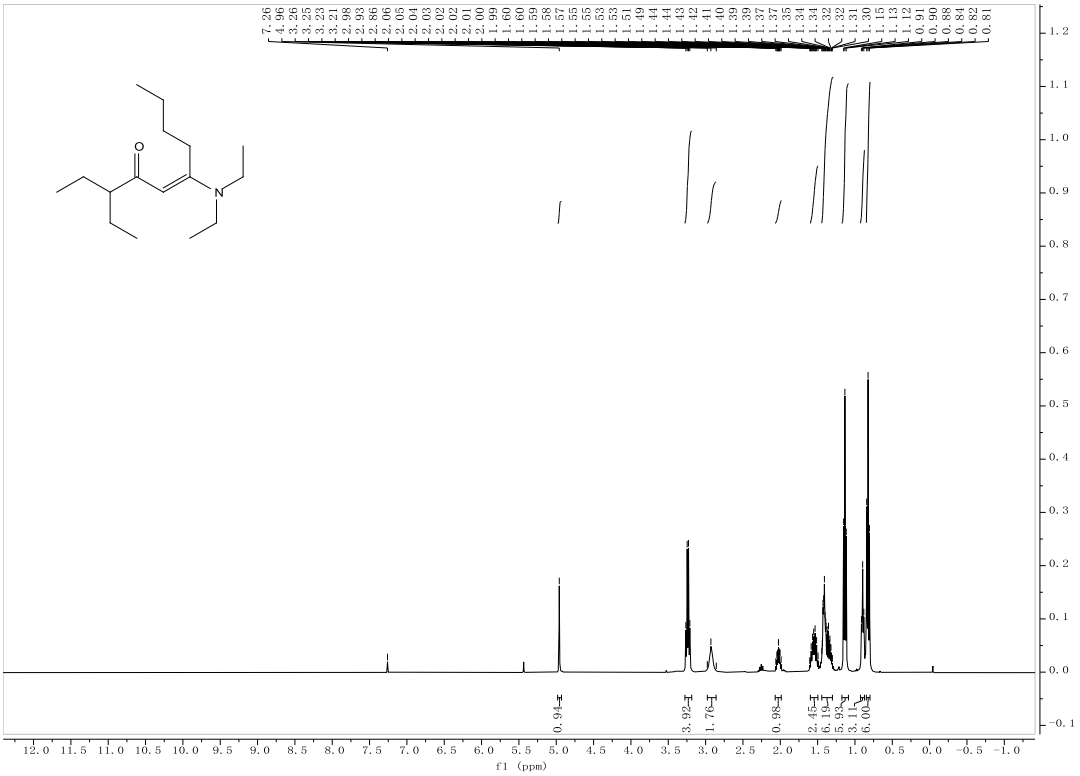
^{1}H NMR spectrum of compound **3w** (400 MHz, $CDCl_3$)



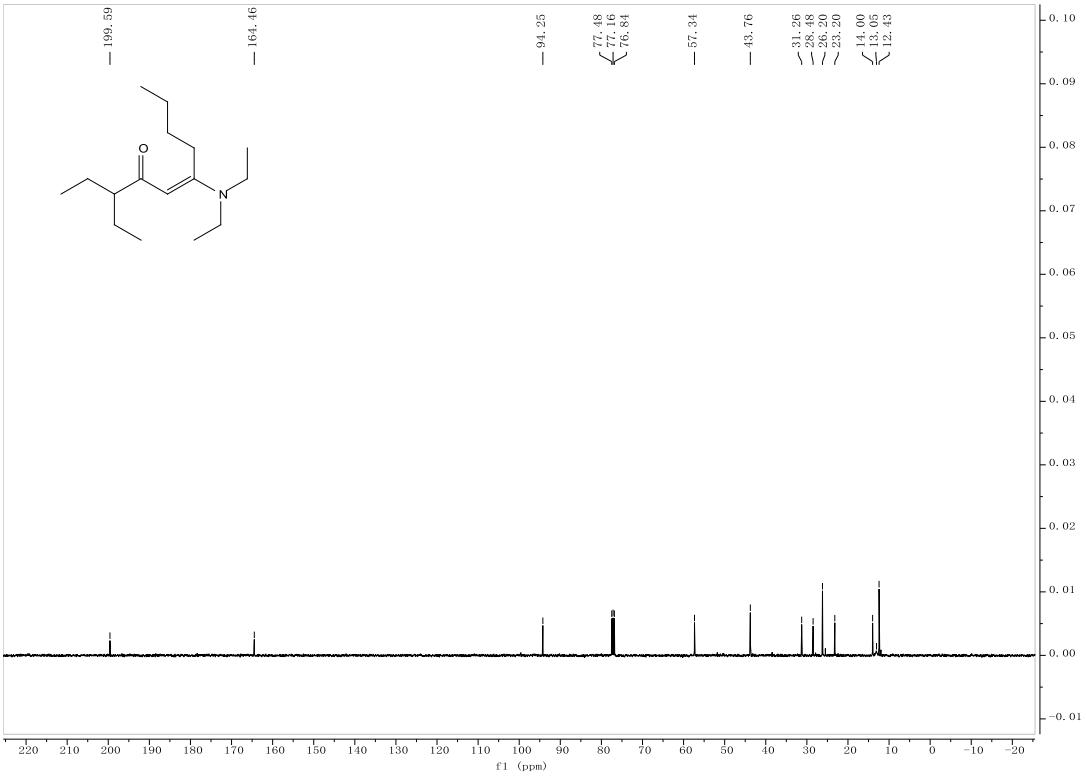
^{13}C NMR spectrum of compound **3w** (101 MHz, $CDCl_3$)



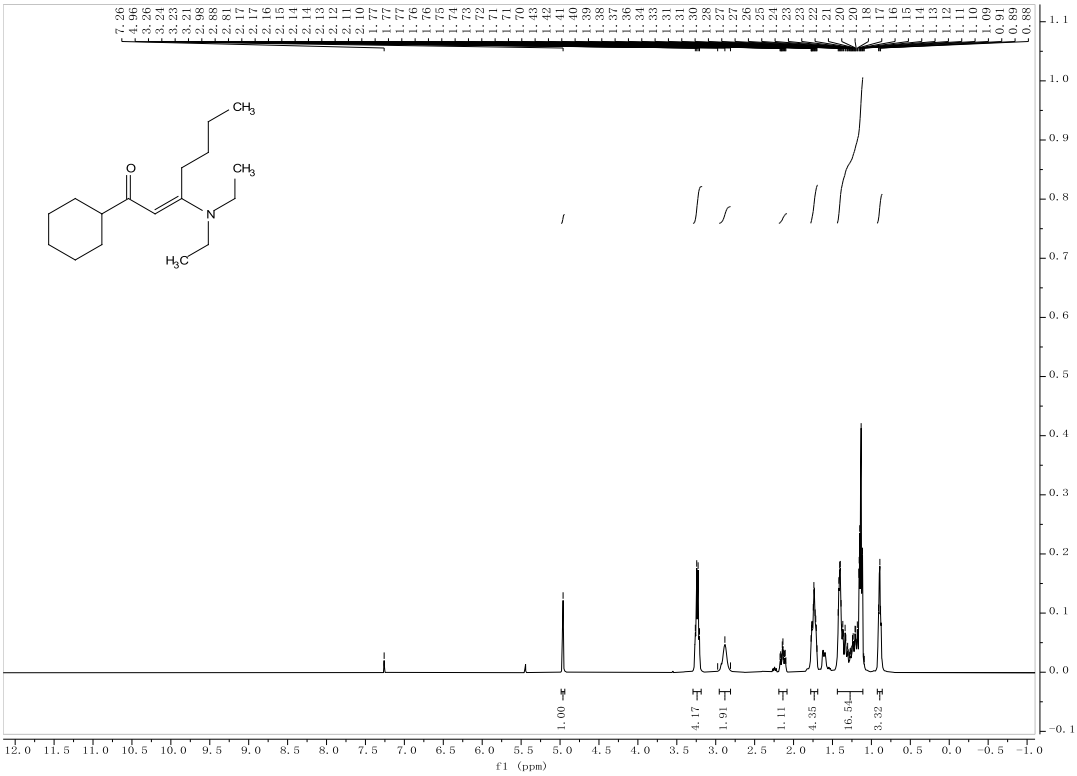
^{1}H NMR spectrum of compound **3x** (400 MHz, $CDCl_3$)



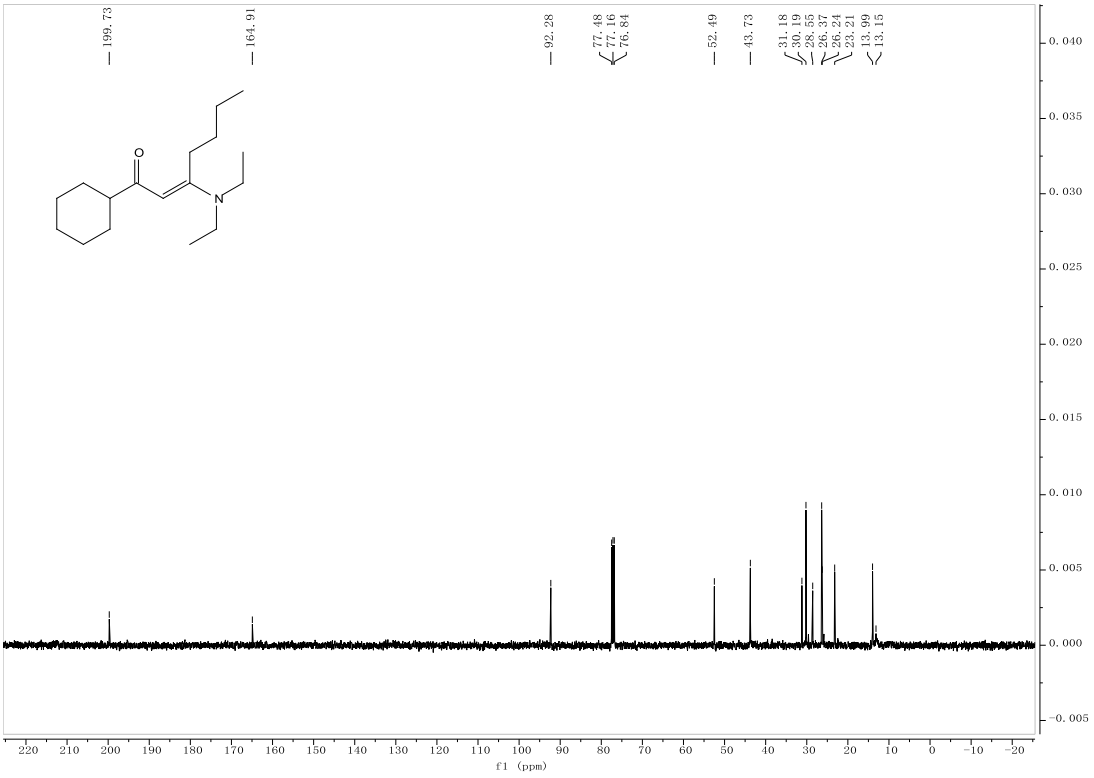
^{13}C NMR spectrum of compound **3x** (101 MHz, $CDCl_3$)



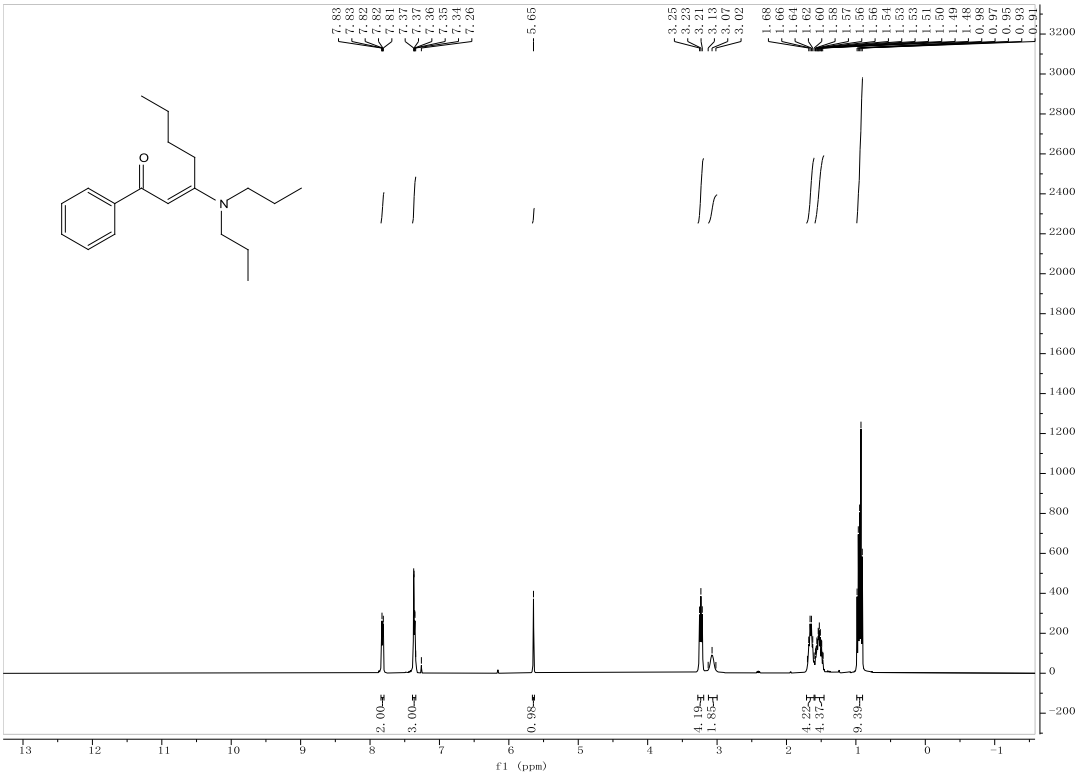
^{1}H NMR spectrum of compound **3y** (400 MHz, $CDCl_3$)



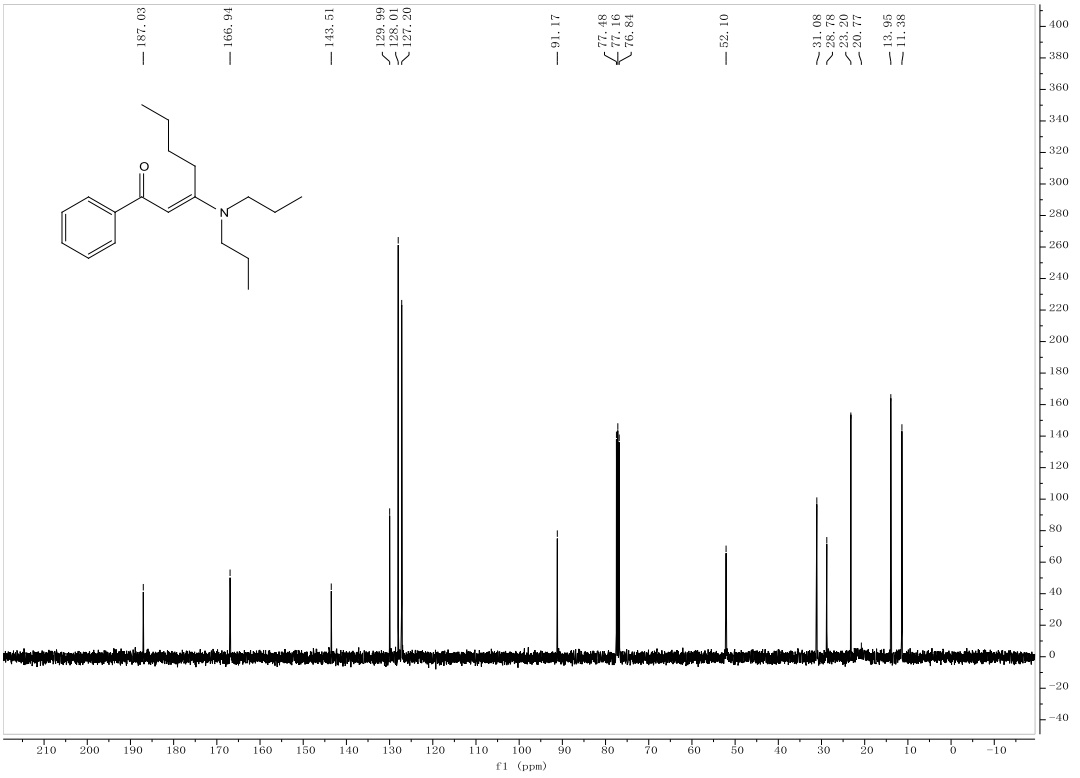
^{13}C NMR spectrum of compound **3y** (101 MHz, $CDCl_3$)



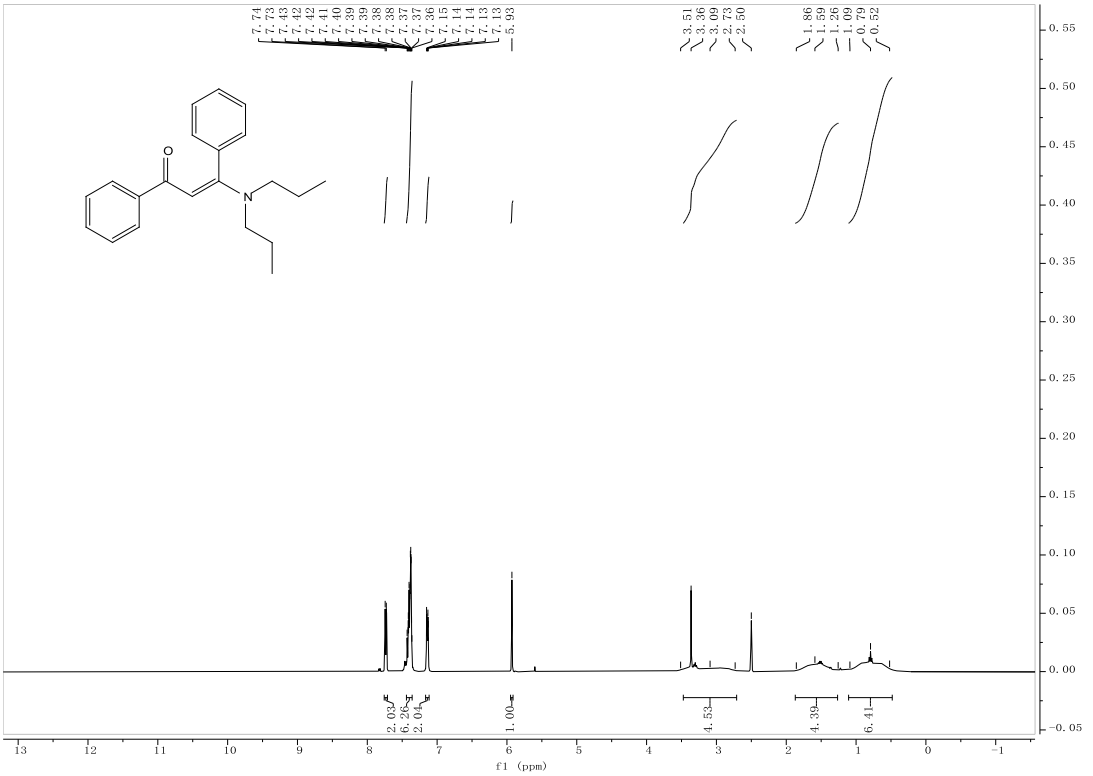
^{1}H NMR spectrum of compound **3z** (400 MHz, $CDCl_3$)



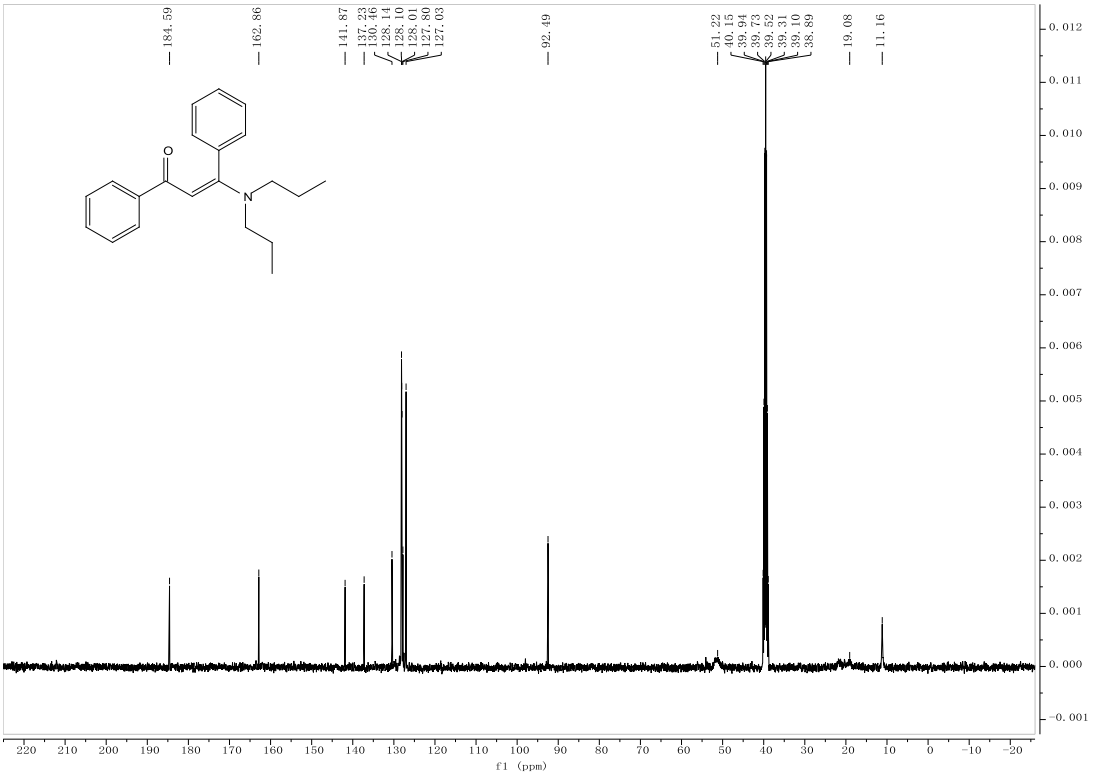
^{13}C NMR spectrum of compound **3z** (101 MHz, $CDCl_3$)



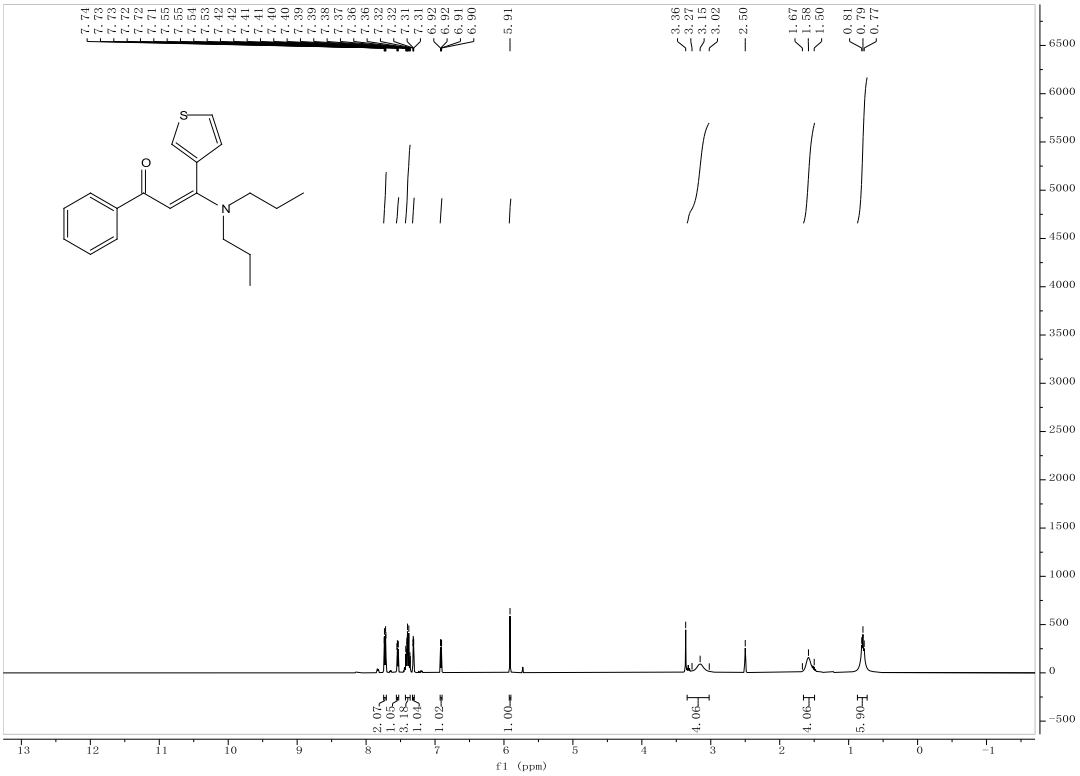
^{1}H NMR spectrum of compound **3aa** (400 MHz, DMSO-d_6)



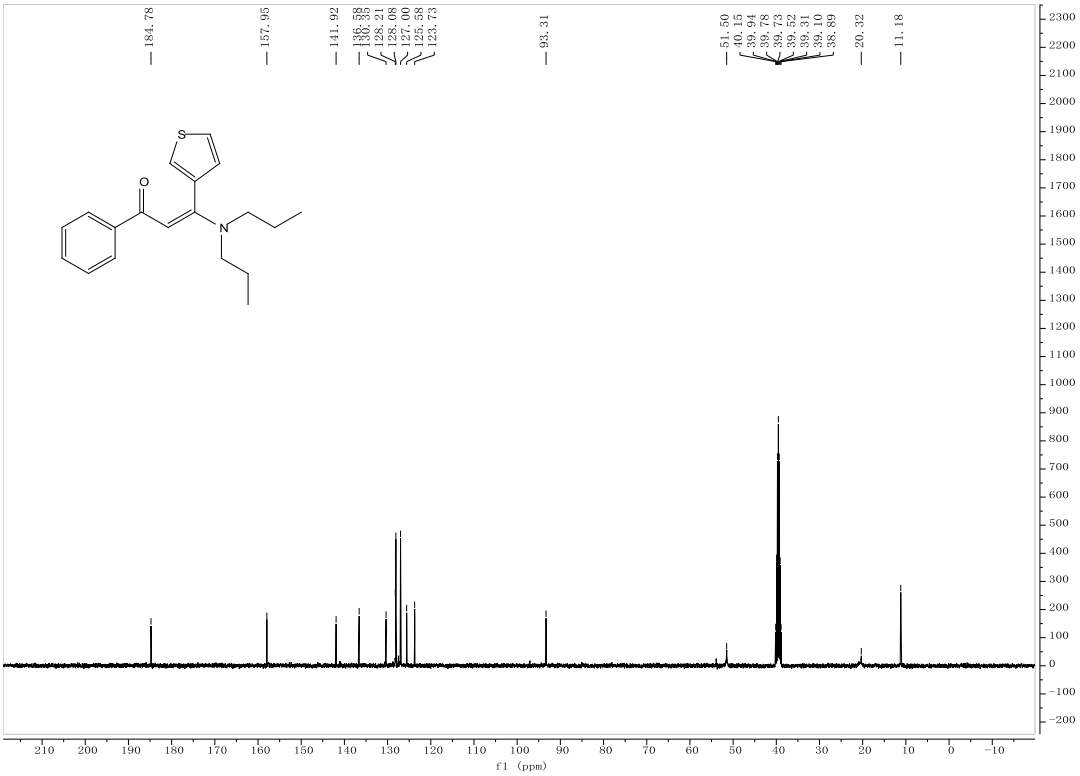
^{13}C NMR spectrum of compound **3aa** (101 MHz, DMSO-d_6)



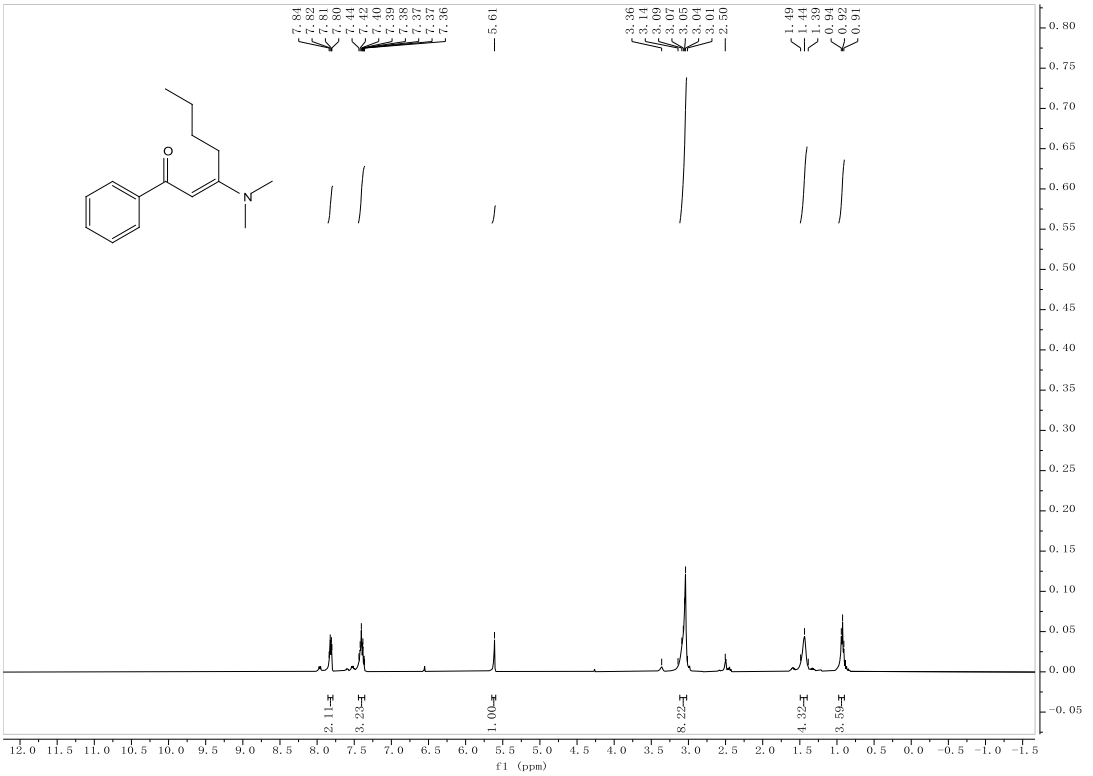
^{1}H NMR spectrum of compound **3ab** (400 MHz, DMSO-d_6)



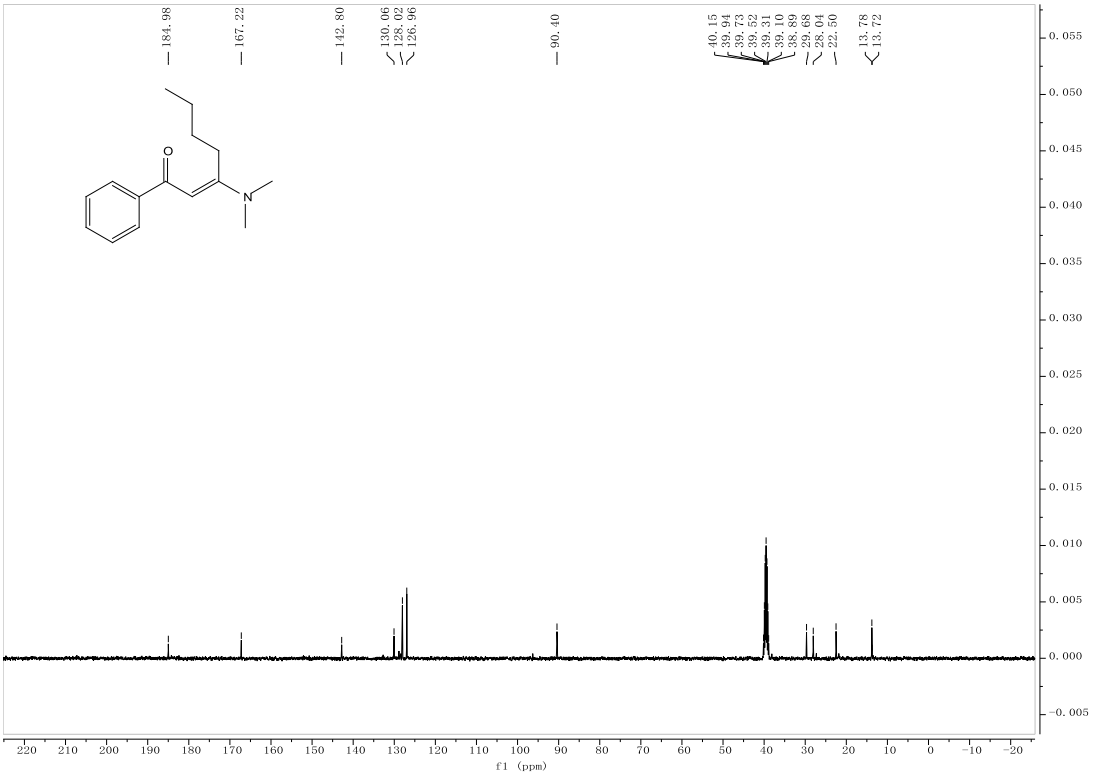
^{13}C NMR spectrum of compound **3ab** (101 MHz, DMSO-d_6)



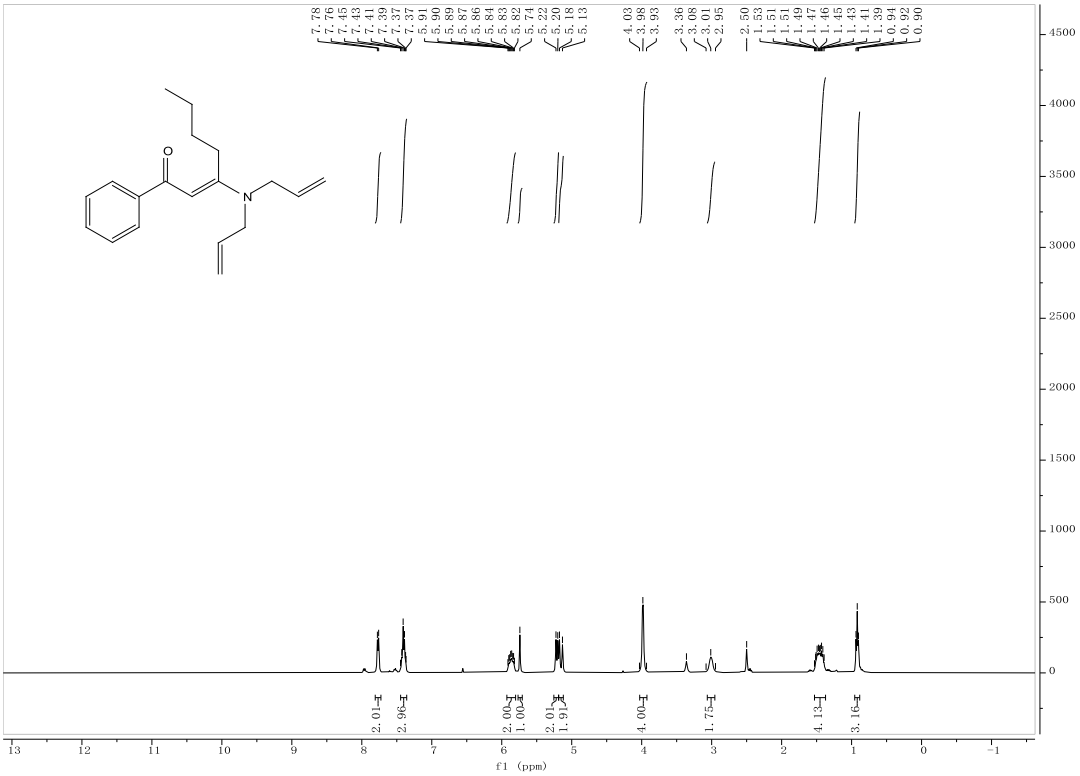
^{1}H NMR spectrum of compound **3ac** (400 MHz, DMSO-d_6)



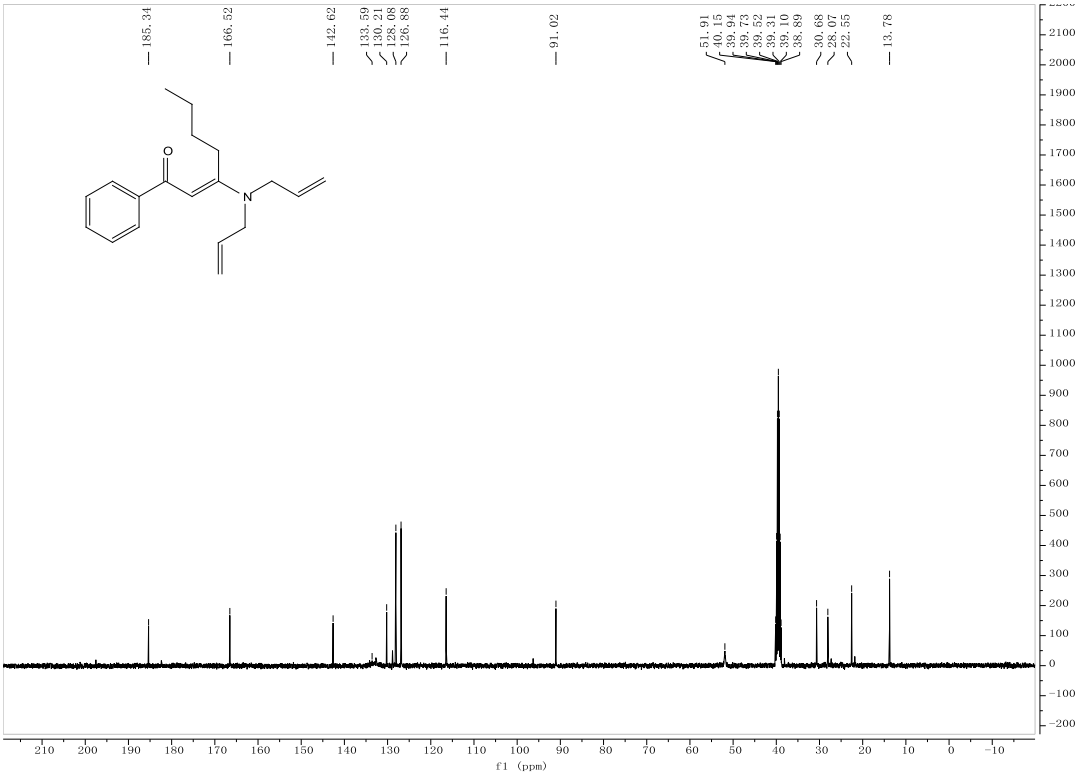
^{13}C NMR spectrum of compound **3ac** (101 MHz, DMSO-d_6)



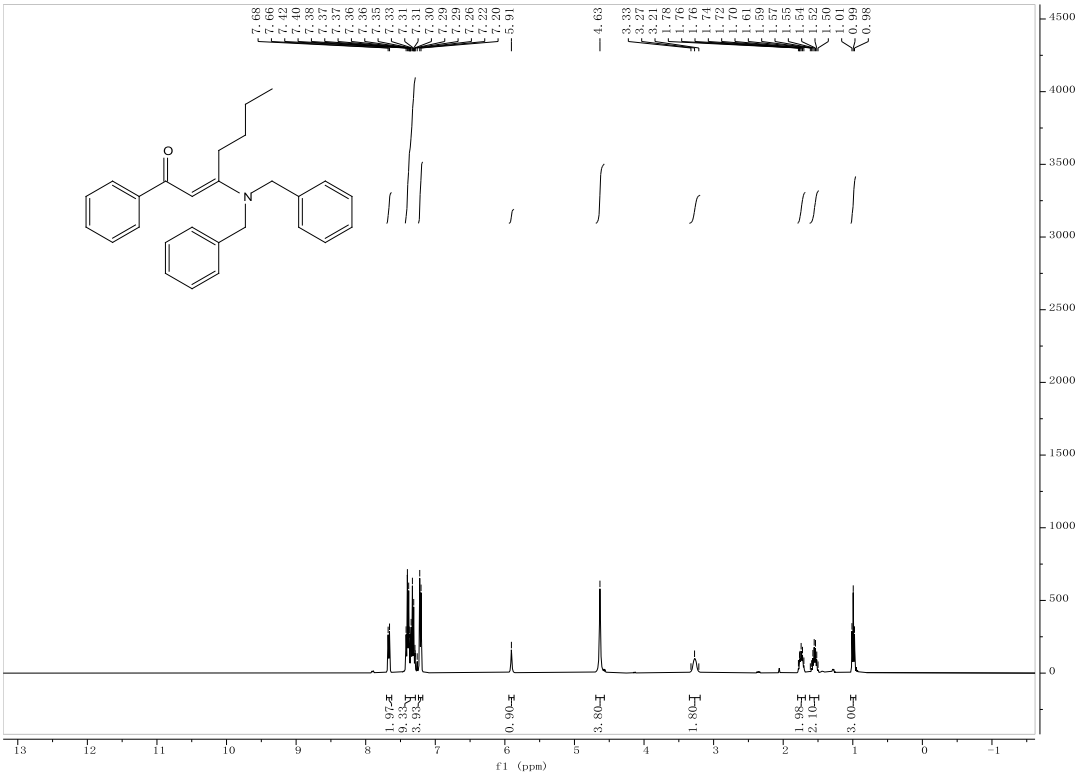
^{1}H NMR spectrum of compound **3ad** (400 MHz, DMSO-d_6)



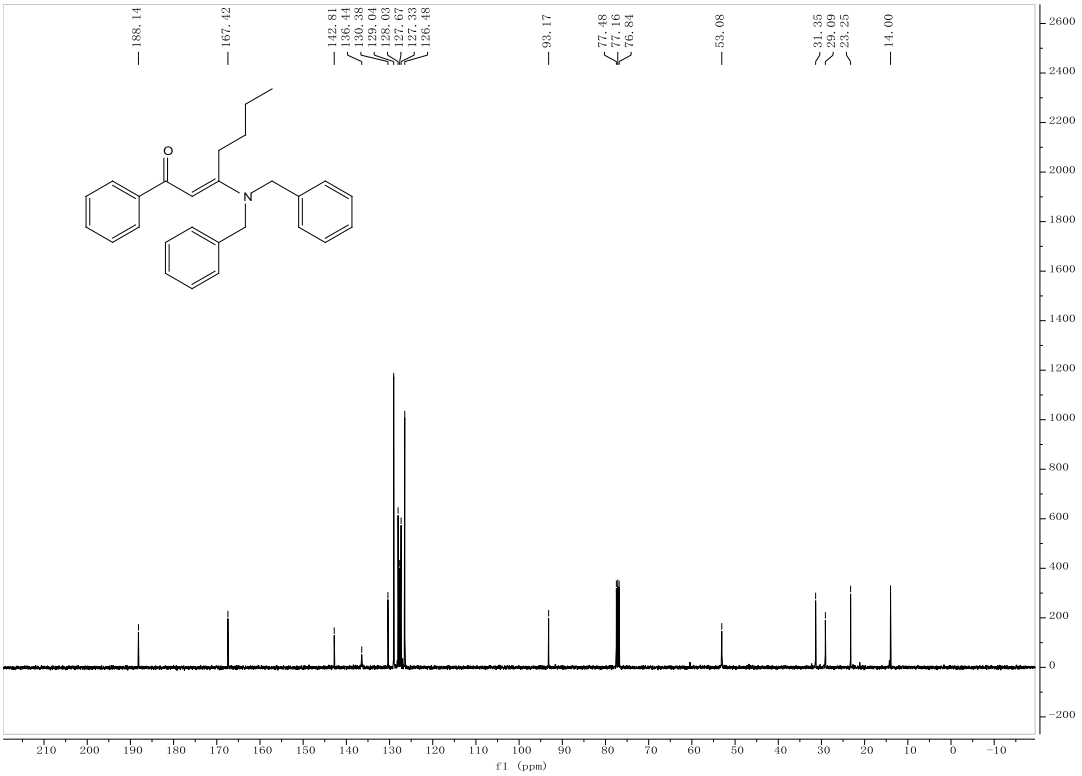
^{13}C NMR spectrum of compound **3ad** (101 MHz, DMSO-d_6)



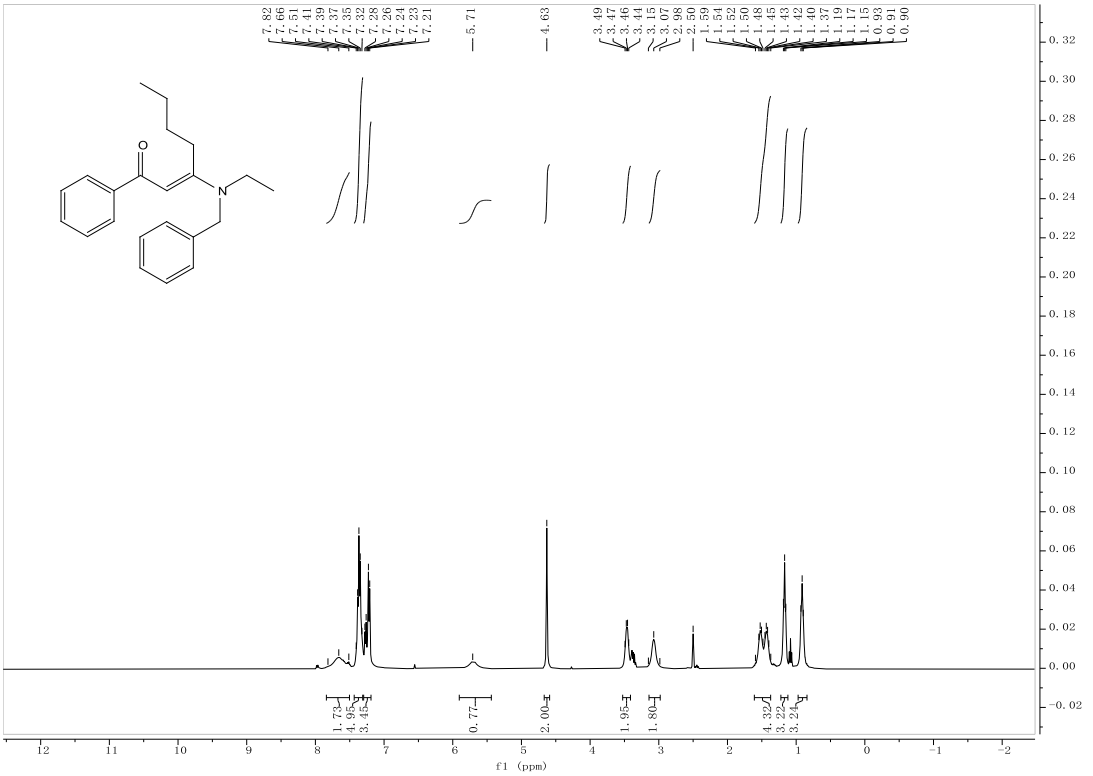
^{1}H NMR spectrum of compound **3ae** (400 MHz, $CDCl_3$)



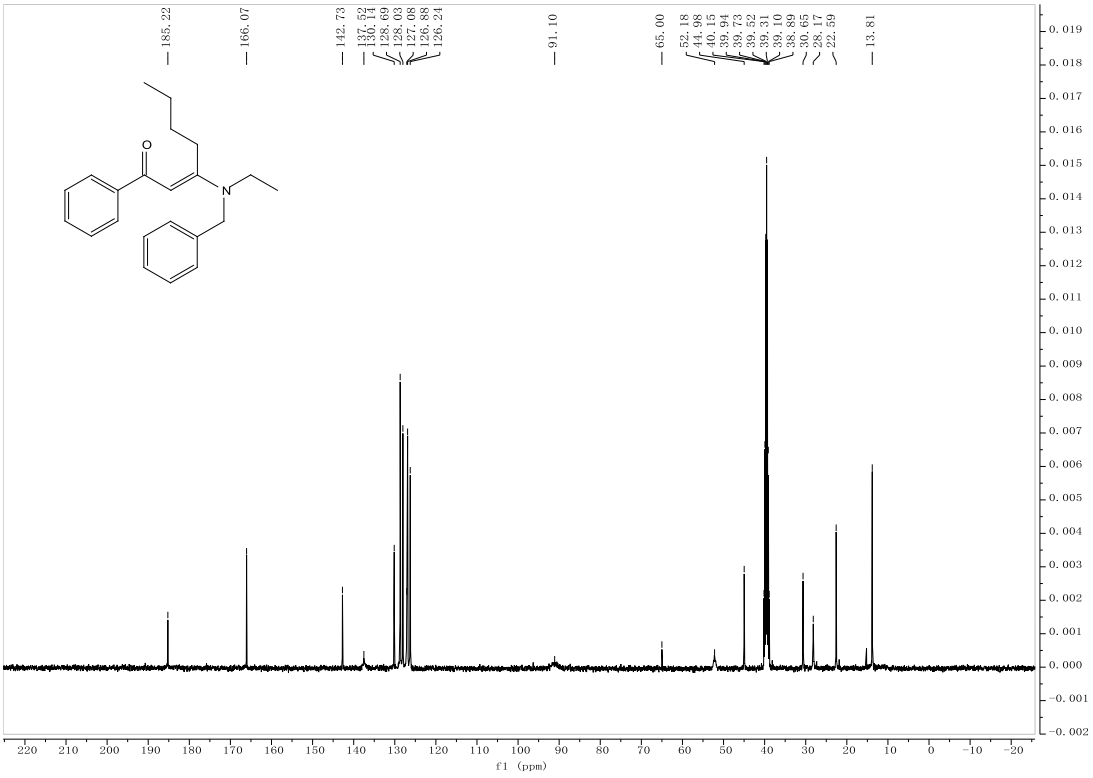
^{13}C NMR spectrum of compound **3ae** (101 MHz, $CDCl_3$)



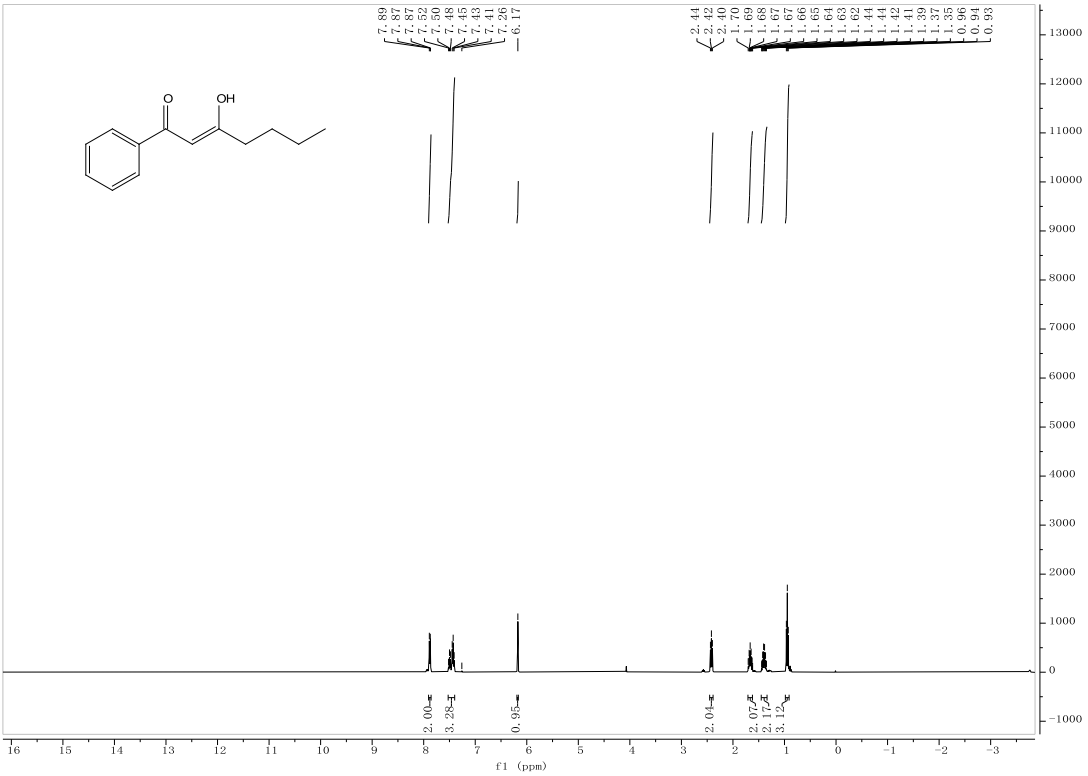
^{1}H NMR spectrum of compound **3af** (400 MHz, DMSO-d_6)



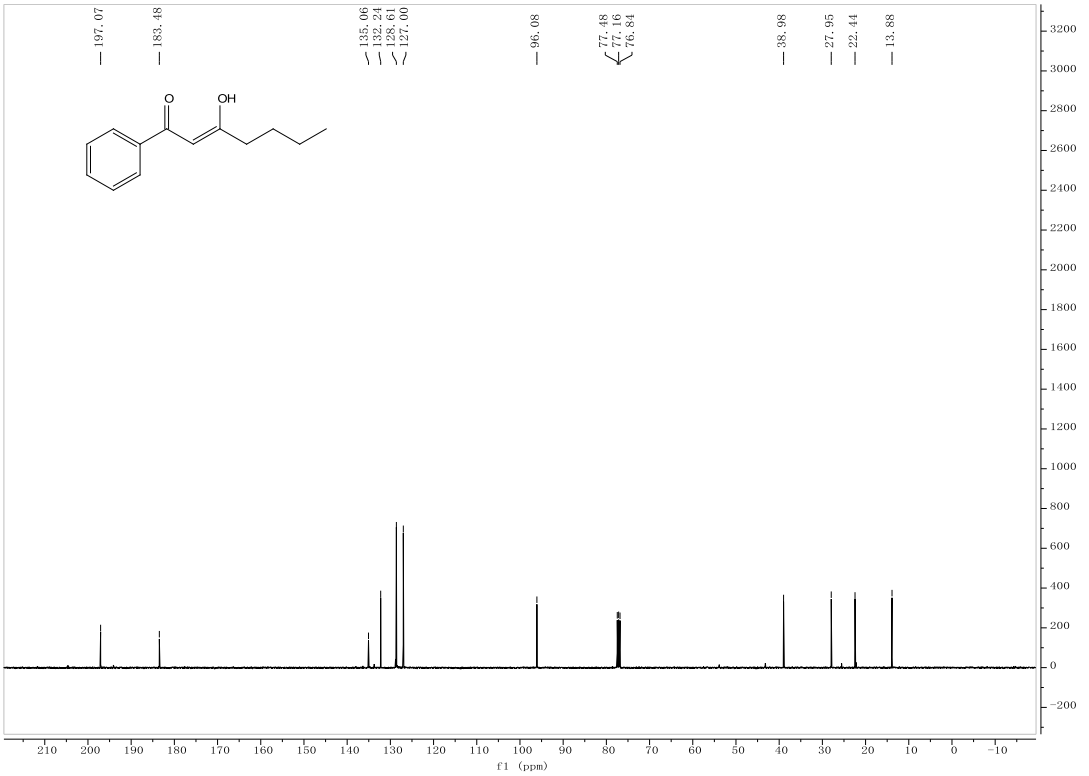
^{13}C NMR spectrum of compound **3af** (101 MHz, DMSO-d_6)



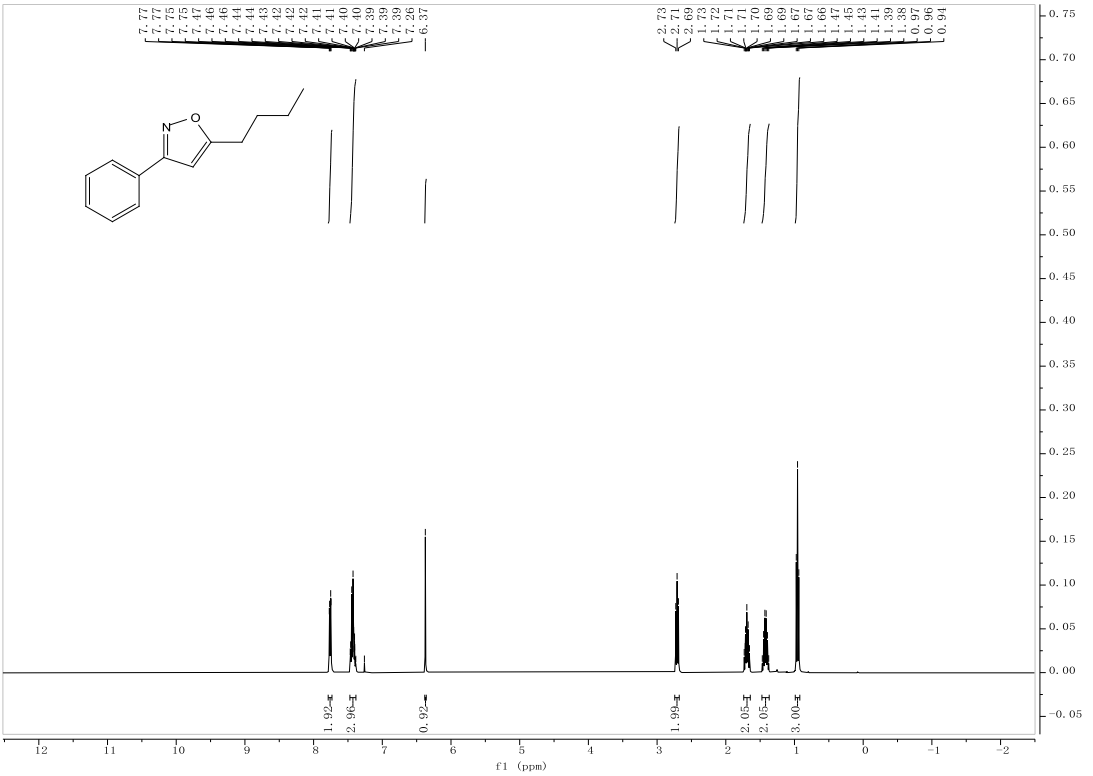
^{1}H NMR spectrum of compound **4a** (400 MHz, $CDCl_3$)



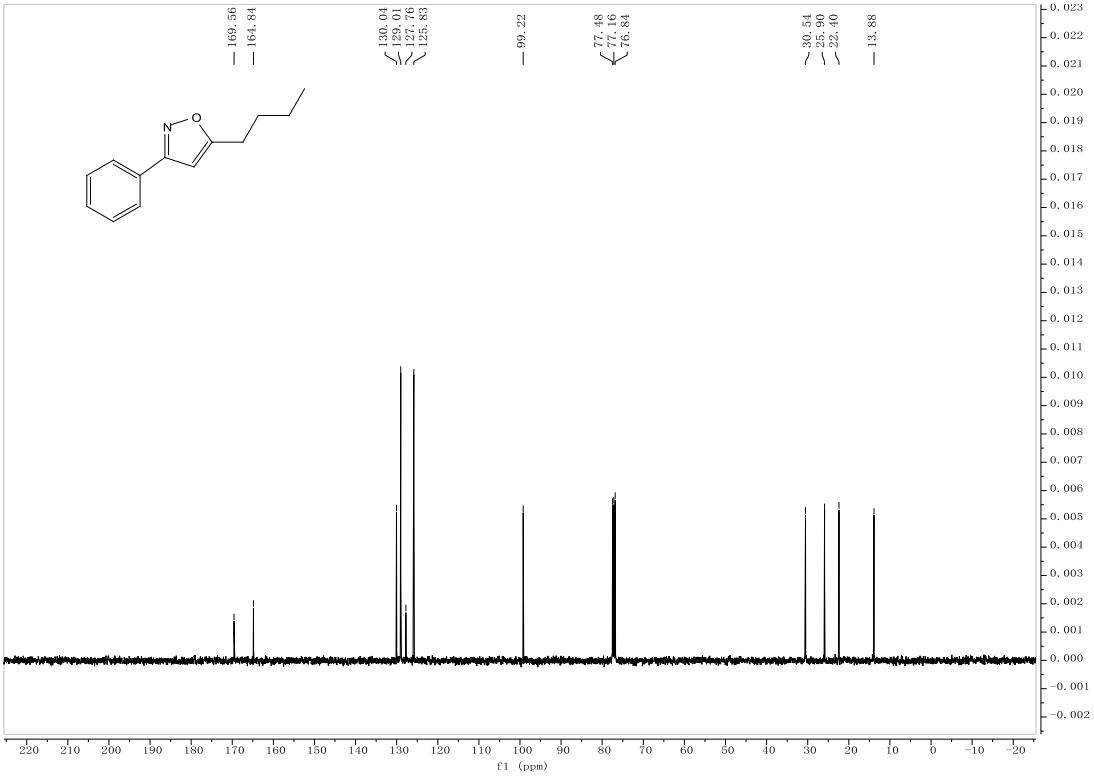
^{13}C NMR spectrum of compound **4a** (101 MHz, $CDCl_3$)



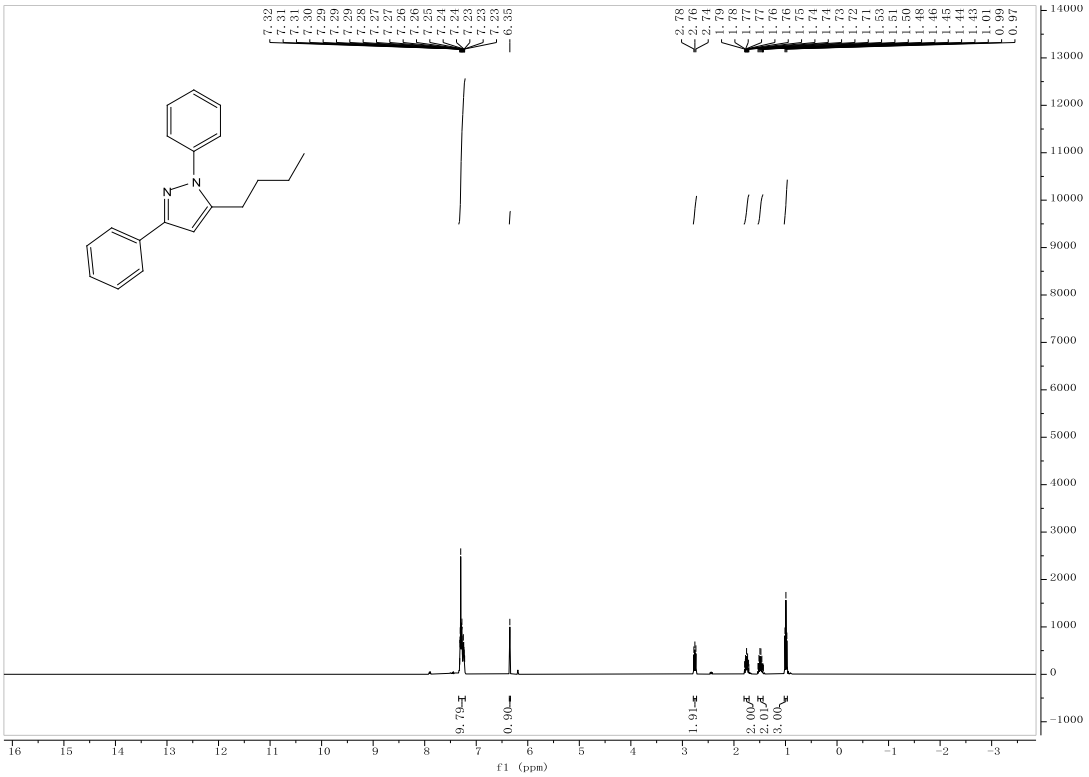
^{1}H NMR spectrum of compound **4b** (400 MHz, $CDCl_3$)



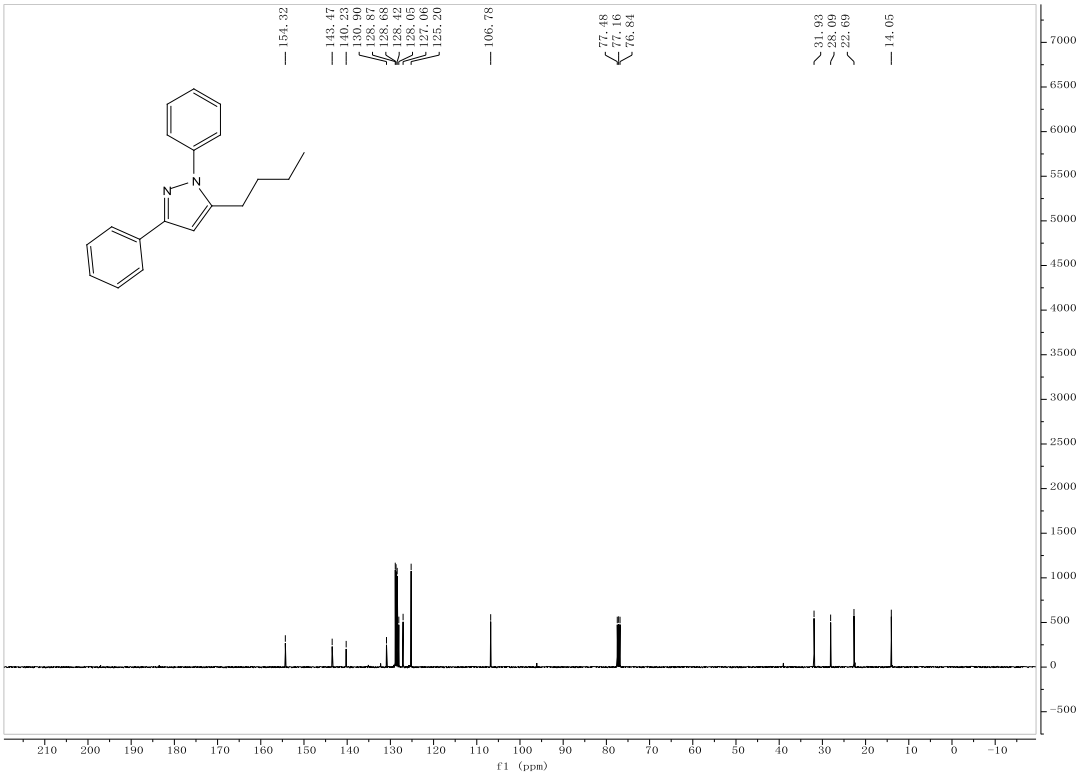
^{13}C NMR spectrum of compound **4b** (101 MHz, $CDCl_3$)



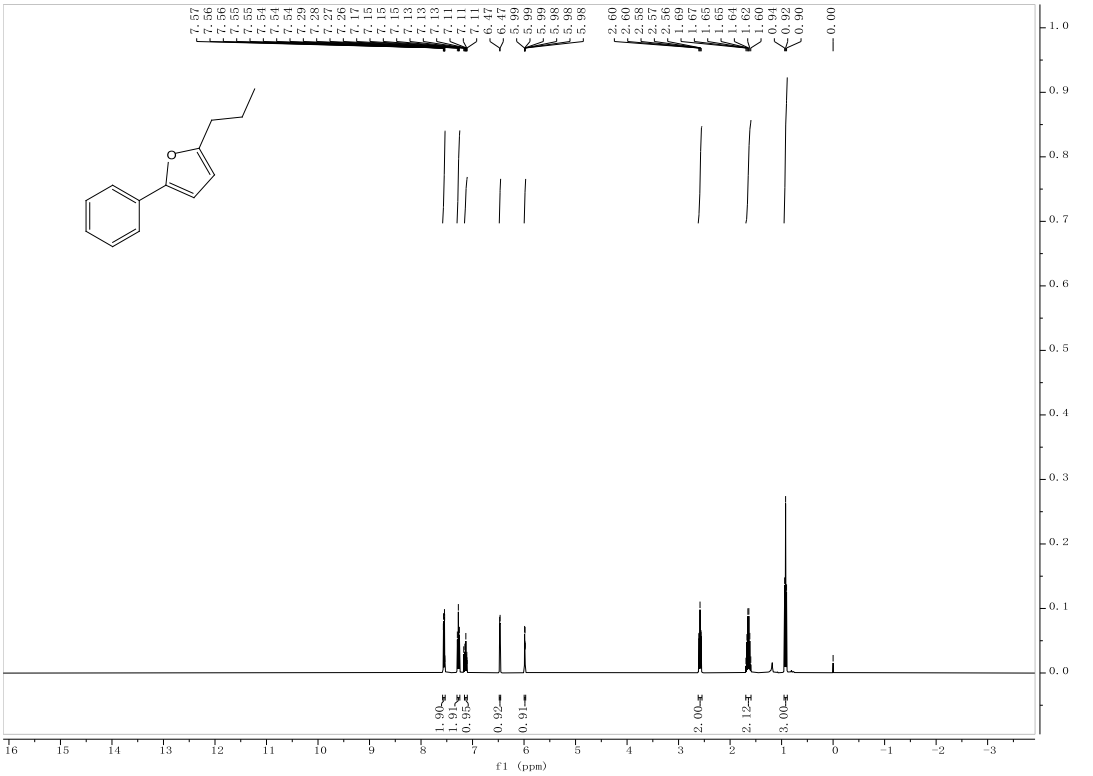
^{1}H NMR spectrum of compound **4c** (400 MHz, $CDCl_3$)



^{13}C NMR spectrum of compound **4c** (101 MHz, $CDCl_3$)



^{1}H NMR spectrum of compound **5** (400 MHz, $CDCl_3$)



^{13}C NMR spectrum of compound **5** (101 MHz, $CDCl_3$)