Supporting Information

For

Metal-Free Microwave-Assisted Decarboxylative Elimination for the Synthesis of Olefins

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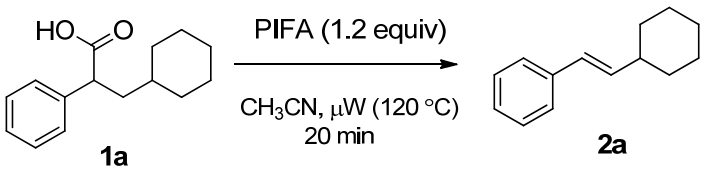
General information

^{1}H NMR spectra were recorded on 400 MHz (100 MHz for ^{13}C NMR) agilent NMR spectrometer with $CDCl_3$ as the solvent and tetramethylsilane (TMS) as the internal standard. Chemical shifts were reported in parts per million (ppm, δ scale) downfield from TMS at 0.00 ppm and referenced to the $CDCl_3$ at 7.26 ppm (for ^{1}H NMR) or 77.16 ppm (for ^{13}C NMR). HRMS was recorded on a GCT Premier^{TM} (CI) Mass Spectrometer. Infrared (FT-IR) spectra were recorded on a Varian 1000FT-IR, ν_{max} in cm^{-1}. Melting points were measured using SGW, X-4B and values are uncorrected. Microwave irradiation reaction was run with the CEM DISCOVER-SP W/ACTIVENT. All commercially available reagents were used as received unless otherwise specified. The substrates were readily afforded from arylacetic acids or amino acid (*Tetrahedron*, **2009** , 4351; *J. Am. Chem. Soc*. **2011**, *133*, 11936; *Org. Lett.* **2015**, *17*, 4476).

Typical experimental procedure

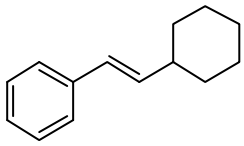


The reaction was carried out using a microwave tube (10 mL) equipped with a magnetic stirring bar in the presence of air. 3-Cyclohexyl-2-phenylpropanoic acid **1a** (46.4 mg, 0.2 mmol), phenyliodine bis(trifluoroacetate) (103 mg, 0.24 mmol) and CH_3CN (2 mL) were added in sequence. The resulting mixture was reacted by microwave irradiation (150 W) at 120℃ for 20 min in the sealed tube. After the reaction was finished, the solvent was removed under reduced pressure and the residue was purified by flash column chromatography on silica gel to give **2a** as a colorless oil (31.6 mg, 85% yield).

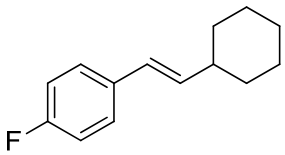
References for known products

Entry	Reference	Compound
1	Q.-W. Yao, P. E. Kinney, Y.- Zhi , *J. Org. Chem.*, **2003** , *68*, 7528.	**2a**
2	J.C.-Zhao, H. Fang, J.-L. Han, Y.-Pan *Beilstein.J. Org.Chem.*, **2013** , *9*, 1718.	**2b，2d，2e，2h**
3	W.-B. Liu; L. Li, Z.-W. Chen, C.-J. Li *Org. Biomol. Chem.*, **2015** , *13*, 6170.	**2c，2u，6a，6b**
4	S. Luo, D.-G. Yu, R.-Y. Zhu, *Chem. Commun.*, **2013** , *49*, 7794.	**2g**
5	C. S. Stefan, L.S. Adrian , *J. Org. Chem.*, **2012** , *77*, 10978.	**2n，2m**
6	J .V. Olsson, J. K.Szabo , *Angew. Chem.-Int. Edit.*, **2007** , *46*, 6891.	**2t**
7	P-Liu, Y.-M. Pan, K.Hu, *Tetrahedron*, **2013** , *69*, 7925.	**2w**
8	C.H. Oh, H.H. Jung , K.S. Kim *Angew. Chem.-Int. Edit.*, **2003** , *42*, 805.	**2x**
9	W.-H. Huang, J. Xu , *Synthetic Commun.*, **2015** , *45*, 1777.	**2s**
10	F.J. Reichwein, L.B. Pagenkopf , *J. Am. Chem. Soc.*, **2003** , *125*, 1821.	**2j**
11	P.C. Too, Pei , Y.L. Tnay, S. Chiba *Beilstein.J. Org.Chem.*, **2013** , *9*, 1217.	**2v**
12	H. Seo, H.-W. Dimitri, *J. Org. Chem.*, **2008** ,.73,.1983.	**2k**
13	A.Saddiqa, R.A. Raza , *Tetrahedron -Asymmetry*, **2014** , *25*, 736.	**8**

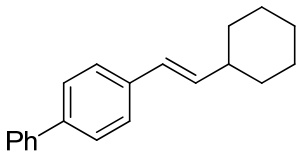
Characterization of the products



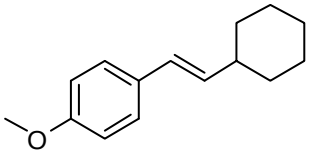
(*E*)-(2-Cyclohexylvinyl)benzene (2a): Colorless oil (32 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 – 7.23 (m, 4H), 7.18 (t, *J* = 7.2 Hz, 1H), 6.34 (d, *J* = 16.0 Hz, 1H), 6.18 (dd, *J* = 16.0, 6.9 Hz, 1H), 2.20 – 2.05 (m, 1H), 1.86 – 1.62 (m, 5H), 1.40 – 1.26 (m, 2H), 1.26 – 1.11 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 138.2, 137.0, 128.6, 127.4, 126.9, 126.1, 41.3, 33.1, 26.3, 26.2.



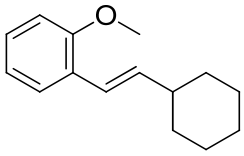
(*E*)-1-(2-Cyclohexylvinyl)-4-fluorobenzene (2b): Colorless oil (32 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33 – 7.26 (m, 2H), 7.02 – 6.92 (m, 2H), 6.29 (d, *J* = 16.0 Hz, 1H), 6.08 (dd, *J* = 16.0, 6.9 Hz, 1H), 2.16 – 2.04 (m, 1H), 1.84 – 1.72 (m, 4H), 1.72 – 1.63 (m, 1H), 1.38 – 1.25 (m, 2H), 1.25 – 1.11 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.0 (d, *J* = 245.3 Hz), 136.7 (d, *J* = 2.2 Hz), 134.3 (d, *J* = 3.3 Hz), 127.46 (d, *J* = 7.8 Hz), 126.2, 115.4 (d, *J* = 21.4 Hz), 41.3, 33.1, 26.3, 26.2.



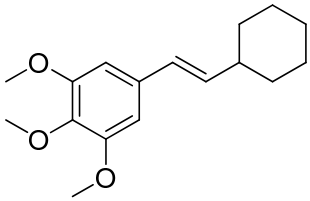
(*E*)-4-(2-Cyclohexylvinyl)biphenyl (2c): White solid (38 mg); m.p. 103-105 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, *J* = 7.5 Hz, 2H), 7.53 (d, *J* = 8.1 Hz, 2H), 7.47 – 7.38 (m, 4H), 7.32 (t, *J* = 7.3 Hz, 1H), 6.38 (d, *J* = 16.0 Hz, 1H), 6.22 (dd, *J* = 16.0, 6.9 Hz, 1H), 2.22 – 2.09 (m, 1H), 1.80 (m, *J* = 15.4 Hz, 4H), 1.69 (m, *J* = 11.8 Hz, 1H), 1.40 – 1.30 (m, 2H), 1.24 – 1.13 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.1, 139.6, 137.3, 137.2, 128.9, 127.3, 127.2, 127.0, 126.9, 126.5, 41.4, 33.1, 26.3, 26.2.



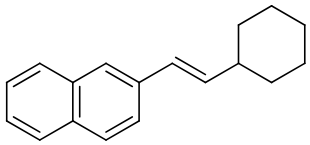
(*E*)-1-(2-Cyclohexylvinyl)-4-methoxybenzene (2d): White solid (32 mg); m.p. 37-39 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 (d, *J* = 8.4 Hz, 2H), 6.82 (d, *J* = 8.4 Hz, 2H), 6.28 (d, *J* = 16.0 Hz, 1H), 6.03 (dd, *J* = 15.9, 6.9 Hz, 1H), 3.78 (s, 3H), 2.17 – 2.01 (m, 1H), 1.88 – 1.62 (m, 5H), 1.39 – 1.09 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.7, 134.9, 131.0, 127.1, 126.7, 114.0, 55.4, 41.3, 33.2, 26.3, 26.2.



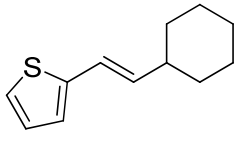
(*E*)-1-(2-Cyclohexylvinyl)-2-methoxybenzene (2e): White solid (28 mg); m.p. 39-41 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 7.5 Hz, 1H), 7.19 (t, *J* = 7.7 Hz, 1H), 6.96 – 6.81 (m, 2H), 6.70 (d, *J* = 16.1 Hz, 1H), 6.18 (dd, *J* = 16.1, 7.0 Hz, 1H), 3.85 (s, 3H), 2.24 – 2.09 (m, 1H), 1.92 – 1.65 (m, 5H), 1.43 – 1.13 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 156.4, 137.6, 127.9, 127.2, 126.3, 121.8, 120.7, 110.9, 55.6, 41.7, 33.2, 26.4, 26.2.



(*E*)-5-(2-Cyclohexylvinyl)-1,2,3-trimethoxybenzene (2f): White solid (40 mg); m.p. 57-58 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.57 (s, 2H), 6.27 (d, *J* = 15.9 Hz, 1H), 6.09 (dd, *J* = 15.8, 6.9 Hz, 1H), 3.87 (s, 6H), 3.83 (s, 3H), 2.17 – 2.05 (m, 1H), 1.84 – 1.65 (m, 5H), 1.35 – 1.25 (m, 2H), 1.25 – 1.11 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 153.4, 137.3, 136.5, 134.0, 127.3, 103.1, 61.0, 56.2, 41.2, 33.1, 26.3, 26.2; FT-IR (thin film, KBr): ν (cm^{-1}) 2919, 2849, 1679, 1042; HRMS (CI) calcd for $C_{17}H_{25}O_3$ [M + H]$^{+}$: 277.1804, found: 277.1800.

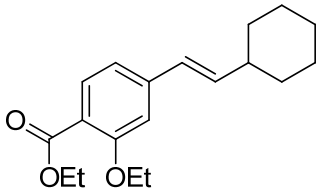


(*E*)-2-(2-Cyclohexylvinyl)naphthalene (2g): White solid (35 mg); m.p. 72-74 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 – 7.35 (m, 3H), 7.69 (s, 1H), 7.60 (d, *J* = 8.5 Hz, 1H), 7.50 – 7.36 (m, 2H), 6.52 (d, *J* = 16.0 Hz, 1H), 6.32 (dd, *J* = 15.9, 6.9 Hz, 1H), 2.26 – 2.14 (m, 1H), 1.93 – 1.66 (m, 5H), 1.45 – 1.31 (m, 2H), 1.31 – 1.17 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.5, 135.7, 133.9, 132.8, 128.1, 127.9, 127.8, 127.5, 126.2, 125.5, 125.4, 123.8, 41.4, 33.1, 26.3, 26.2.

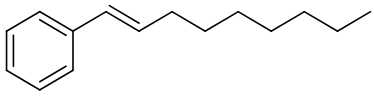


(*E*)-2-(2-Cyclohexylvinyl)thiophene (2h): Colorless oil (17 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.08 (d, *J* = 4.8 Hz, 1H), 6.96 – 6.90 (t, 1H), 6.89 – 6.84 (m, 1H), 6.47 (d, *J* = 15.8 Hz, 1H), 6.03 (dd, *J* = 15.8, 6.8 Hz, 1H), 2.09 (m, *J* = 7.0 Hz, 1H), 1.85 – 1.71 (m, 4H), 1.68 (d, *J* = 11.8 Hz, 1H), 1.35 – 1.25 (m, 2H), 1.25 – 1.12 (m, 3H); ^{13}C

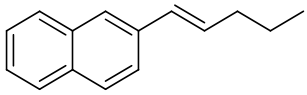
NMR (100 MHz, $CDCl_3$) δ 143.6, 137.0, 127.3, 124.3, 123.1, 120.7, 41.1, 32.9, 26.3, 26.1.



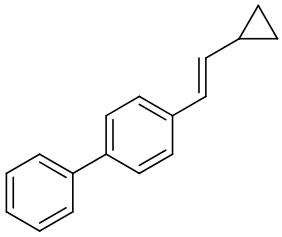
(*E*)-ethyl 4-(2-cyclohexylvinyl)-2-ethoxybenzoate (2i): Colorless oil (37 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 (d, *J* = 8.0 Hz, 1H), 6.95 (d, *J* = 8.0 Hz, 1H), 6.89 (s, 1H), 6.32 (d, *J* = 16.0 Hz, 1H), 6.25 (dd, *J* = 16.0, 6.1 Hz, 1H), 4.34 (q, *J* = 7.1 Hz, 2H), 4.12 (q, *J* = 7.0 Hz, 2H), 2.19 – 2.08 (m, 1H), 1.86 – 1.64 (m, 5H), 1.47 (t, *J* = 6.9 Hz, 3H), 1.37 (t, *J* = 7.1 Hz, 3H), 1.32 – 1.10 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.4, 159.2, 143.5, 139.5, 132.1, 126.9, 118.8, 117.9, 111.0, 64.7, 60.7, 41.3, 32.9, 26.2, 26.1, 14.9, 14.4; FT-IR (thin film , KBr): ν (cm^{-1}) 2979, 2850, 1724, 1648, 844; HRMS (CI) calcd for $C_{19}H_{27}O_3$ $[M + H]^+$: 303.1960, found: 303.1952.



(*E*)-Non-1-enylbenzene (2j): Colorless oil (34 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.33 (m, 2H), 7.32 – 7.27 (m, 2H), 7.22 – 7.17 (m, 1H), 6.39 (d, *J* = 15.8 Hz, 1H), 6.24 (dt, *J* = 15.8, 6.8 Hz, 1H), 2.27 – 2.16 (m, 2H), 1.53 – 1.42 (m, 2H), 1.39 – 1.26 (m, 8H), 0.90 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$, overlapping peaks) δ 138.1, 131.4, 129.8, 128.6, 126.8, 126.0, 33.2, 32.0, 29.5, 29.4, 22.8, 14.3.

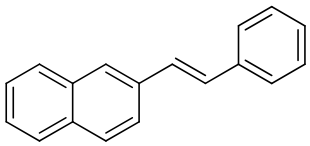


(*E*)-2-(Pent-1-enyl)naphthalene (2k): White solid (33 mg); m.p. 38-40 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 – 7.73 (m, 3H), 7.69 (s, 1H), 7.60 (d, *J* = 8.5 Hz, 1H), 7.53 – 7.37 (m, 2H), 6.57 (d, *J* = 15.8 Hz, 1H), 6.47 – 6.30 (m, 1H), 2.27 (q, *J* = 7.0 Hz, 2H), 1.65 – 1.47 (m, 2H), 1.01 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 135.5, 133.9, 132.8, 131.6, 130.1, 128.2, 128.0, 127.8, 126.2, 125.5, 125.4, 123.7, 35.4, 22.7, 13.9.

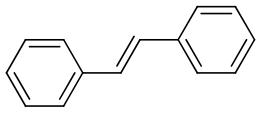


(*E*)-4-(2-Cyclopropylvinyl)biphenyl (2l): White solid (27 mg); m.p. 135-137 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 (d, *J* = 7.6 Hz, 2H), 7.55 (d, *J* = 7.9 Hz, 2H), 7.50 –

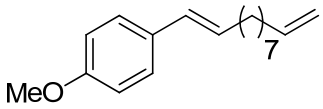
7.31 (m, 5H), 6.53 (d, *J* = 15.7 Hz, 1H), 5.80 (dd, *J* = 15.7, 8.9 Hz, 1H), 1.69 – 1.57 (m, 1H), 0.94 – 0.81 (m, 2H), 0.63 – 0.47 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.0, 139.4, 137.0, 135.2, 128.9, 127.3, 127.2, 127.1, 127.0, 126.1, 14.8, 7.5; FT-IR (thin film, KBr): ν (cm^{-1}) 3015, 2850, 1645, 718, 690; HRMS (CI) calcd for $C_{17}H_{17}$ $[M + H]^+$: 221.1330, found: 221.1332.



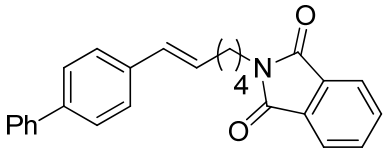
(*E*)-2-Styrylnaphthalene (2m): White solid (30 mg); m.p. 149-151 ℃; ^{1}H NMR (400 MHz, CD_3Cl) δ 7.90 – 7.77 (m, 4H), 7.74 (d, *J* = 8.5 Hz, 1H), 7.56 (d, *J* = 7.5 Hz, 2H), 7.51 – 7.41 (m, 2H), 7.38 (t, *J* = 7.4 Hz, 2H), 7.33 – 7.17 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.5, 135.0, 133.8, 133.2, 129.2, 128.9, 128.8, 128.5, 128.1, 127.84, 127.83, 126.8, 126.7, 126.5, 126.0, 123.6.



(*E*)-1,2-Diphenylethene (2n): Colorless oil (32 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (d, *J* = 7.5 Hz, 4H), 7.37 (t, *J* = 7.5 Hz, 4H), 7.31 – 7.22 (m, 2H), 7.12 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$, overlapping peaks) δ 137.4, 128.8, 127.8, 126.6.

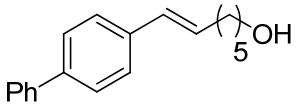


(*E*)-1-methoxy-4-(undeca-1,10-dienyl)benzene (2o): Colorless oil (42 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 (d, *J* = 8.5 Hz, 2H), 6.85 (d, *J* = 8.5 Hz, 2H), 6.33 (d, *J* = 15.8 Hz, 1H), 6.15 – 6.03 (m, 1H), 5.78 – 5.89 (m, 1H), 4.98 (dd, *J* = 24.9, 13.6 Hz, 2H), 3.81 (s, 3H), 2.19 (q, *J* = 6.9 Hz, 2H), 2.12 – 2.01 (m, 2H), 1.54 – 1.28 (m, 10H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.7, 139.3, 130.9, 129.17, 129.15, 127.1, 114.3, 114.0, 55.4, 33.9, 33.2, 29.7, 29.5, 29.3, 29.2, 29.1; FT-IR (thin film, KBr): ν (cm^{-1}) 2924, 2852, 1607, 1576, 1244; HRMS (CI) calcd for $C_{18}H_{27}O$ $[M + H]^+$: 259.2062, found: 259.2061.

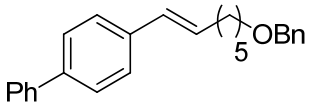


(*E*)-2-(6-(biphenyl-4-yl)hex-5-enyl)isoindoline-1,3-dione (2p): White solid (58 mg); m.p. 156-158 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (dd, *J* = 4.9, 3.1 Hz, 2H), 7.71 (dd, *J* = 5.0, 3.0 Hz, 2H), 7.59 (d, *J* = 7.5 Hz, 2H), 7.53 (d, *J* = 8.0 Hz, 2H), 7.47 – 7.37 (m, 4H), 7.33 (t, *J* = 7.2 Hz, 1H), 6.42 (d, *J* = 15.8 Hz, 1H), 6.31 – 6.16 (m, 1H), 3.73 (t, *J* = 7.1 Hz, 2H), 2.29 (q, *J* = 6.9 Hz, 2H), 1.84 – 1.69 (m, 2H), 1.64 – 1.48 (m,

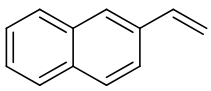
2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.6, 141.0, 139.8, 136.9, 134.0, 132.3, 130.5, 130.0, 128.9, 127.29, 127.26, 127.0, 126.5, 123.3, 38.0, 32.7, 28.3, 26.7; FT-IR (thin film, KBr): ν (cm^{-1}) 3030, 2986, 1696, 1336, 709; HRMS (CI) calcd for $C_{26}H_{24}NO_2$ $[M + H]^+$: 382.1807, found: 382.1801.



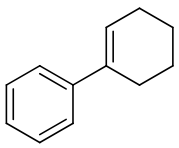
(*E*)-7-(biphenyl-4-yl)hept-6-en-1-ol(2q): White solid (22 mg); m.p. 107-109 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 – 7.57 (m, 2H), 7.55 (d, *J* = 8.3 Hz, 2H), 7.49 – 7.38 (m, 4H), 7.39 – 7.30 (m, 1H), 6.43 (d, *J* = 15.8 Hz, 1H), 6.31 – 6.24 (m, 1H), 3.67 (t, *J* = 6.6 Hz, 2H), 2.26 (q, *J* = 6.8 Hz, 2H), 1.67 – 1.58 (m, 2H), 1.56 – 1.50 (m, 2H), 1.48 – 1.42 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.0, 139.7, 137.0, 131.2, 129.6, 128.9, 127.36, 127.32, 127.0, 126.5, 63.1, 33.2, 32.8, 29.3, 25.5; FT-IR (thin film, KBr): ν (cm^{-1}) 3337, 2922, 1486, 963, 753; HRMS (CI) calcd for $C_{19}H_{23}O$ $[M + H]^+$: 267.1749, found: 267.1741.



(*E*)-4-(7-(benzyloxy)hept-1-enyl)biphenyl (2r): White solid (58 mg); m.p. 46-48 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, *J* = 7.4 Hz, 2H), 7.59 (d, *J* = 6.9 Hz, 2H), 7.52 – 7.43 (m, 4H), 7.43 – 7.29 (m, 6H), 6.47 (d, *J* = 15.8 Hz, 1H), 6.38 – 6.26 (m, 1H), 4.56 (s, 2H), 3.54 (t, *J* = 6.5 Hz, 2H), 2.29 (q, *J* = 6.8 Hz, 2H), 1.82 – 1.66 (m, 2H), 1.59 – 1.42 (m, 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.0, 139.6, 138.8, 137.1, 131.2, 129.6, 128.9, 128.5, 127.7, 127.6, 127.3, 127.2, 127.0, 126.4, 73.0, 70.5, 33.2, 29.8, 29.3, 25.9; FT-IR (thin film, KBr): ν (cm^{-1}) 3090, 2795, 1649, 951, 690; HRMS (CI) calcd for $C_{26}H_{29}O$ $[M + H]^+$: 357.2218, found: 357.2209.

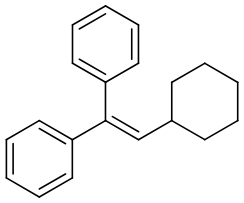


2-Vinylnaphthalene (2s) : White solid (24 mg); m.p. 64-66 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 – 7.80 (m, 3H), 7.78 (s, 1H), 7.68 (d, *J* = 8.5 Hz, 1H), 7.57 – 7.42 (m, 2H), 6.92 (dd, *J* = 17.5, 10.9 Hz, 1H), 5.91 (d, *J* = 17.6 Hz, 1H), 5.38 (d, *J* = 10.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.1, 135.1, 133.7, 133.3, 128.3, 128.2, 127.8, 126.5, 126.4, 126.1, 123.3, 114.3.

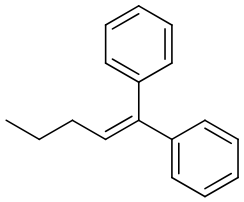


Cyclohexenylbenzene (2t): Colorless oil (25 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.37 (m, 2H), 7.36 – 7.29 (m, 2H), 7.25 – 7.19 (m, 1H), 6.17 – 6.10 (m, 1H),

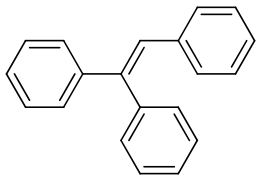
2.49 – 2.39 (m, 2H), 2.29 – 2.19 (m, 2H), 1.87 – 1.76 (m, 2H), 1.73 – 1.64 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.8, 136.7, 128.3, 126.6, 125.1, 124.9, 27.5, 26.0, 23.2, 22.3.



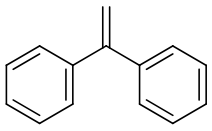
(2-Cyclohexylethene-1,1-diyl)dibenzene (2u): White solid (47 mg); m.p. 49-51 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 – 7.07 (m, 10H), 5.90 (d, *J* = 10.0 Hz, 1H), 2.21 – 2.04 (m, 1H), 1.73 – 1.55 (m, 5H), 1.30 – 1.02 (m, 5H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.1, 140.7, 139.8, 136.1, 129.9, 128.3, 128.2, 127.3, 126.9, 126.8, 38.4, 33.5, 26.1, 25.7.



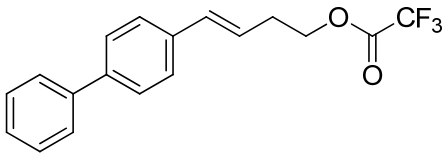
Pent-1-ene-1,1-diyldibenzene (2v): Colorless oil (40 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 – 7.05 (m, 10H), 6.08 (t, *J* = 7.4 Hz, 1H), 2.09 (q, *J* = 7.4 Hz, 2H), 1.58 – 1.31 (m, 2H), 0.89 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.1, 141.7, 140.5, 130.2, 130.1, 128.23, 128.18, 127.3, 126.92, 126.87, 32.0, 23.3, 14.0.



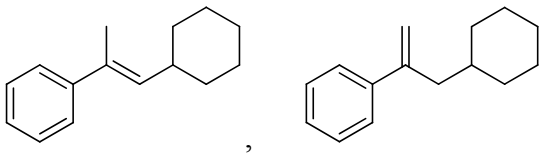
Ethene-1,1,2-triyltribenzene (2w): White solid (36 mg); m.p. 68-70 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 – 7.25 (m, 8H), 7.24 – 7.17 (m, 2H), 7.16 – 7.06 (m, 3H), 7.02 (d, *J* = 7.2 Hz, 2H), 6.96 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.6, 142.7, 140.5, 137.5, 130.5, 129.7, 128.8, 128. 33, 128.29, 128.1, 127.7, 127.6, 127.5, 126.9.



Ethene-1,1-diyldibenzene (2x): Colorless oil (19 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.21 (m, *J* = 6.6, 4.1 Hz, 10H), 5.44 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.2, 141.6, 128.4, 128.3, 127.8, 114.4.

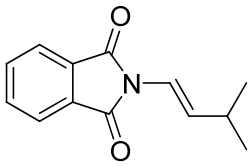


(*E*)-4-(Biphenyl-4-yl)but-3-enyl 2,2,2-trifluoroacetate (4): White solid (35 mg); m.p. 113- 115 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 – 7.52 (m, 4H), 7.50 – 7.40 (m, 4H), 7.35 (t, *J* = 7.2 Hz, 1H), 6.55 (d, *J* = 15.8 Hz, 1H), 6.29 – 6.06 (m, 1H), 4.49 (t, *J* = 6.6 Hz, 2H), 2.69 (q, *J* = 6.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.6 (q, *J* = 42.1 Hz), 140.8, 140.6, 136.0, 133.4, 128.9, 127.5, 127.4, 127.1, 126.8, 123.8, 114.67 (q, *J* = 285.6 Hz), 67.3, 32.1； ^{19}F NMR (376 MHz, $CDCl_3$) δ -75.0 (s, 3F)； FT-IR (thin film, KBr): ν (cm^{-1}): 3077, 2851, 1782, 1157, 772; HRMS (CI) calcd for $C_{18}H_{16}O_2F_3$ $[M + H]^+$: 321.1102, found: 321.1107.



6a **6b**

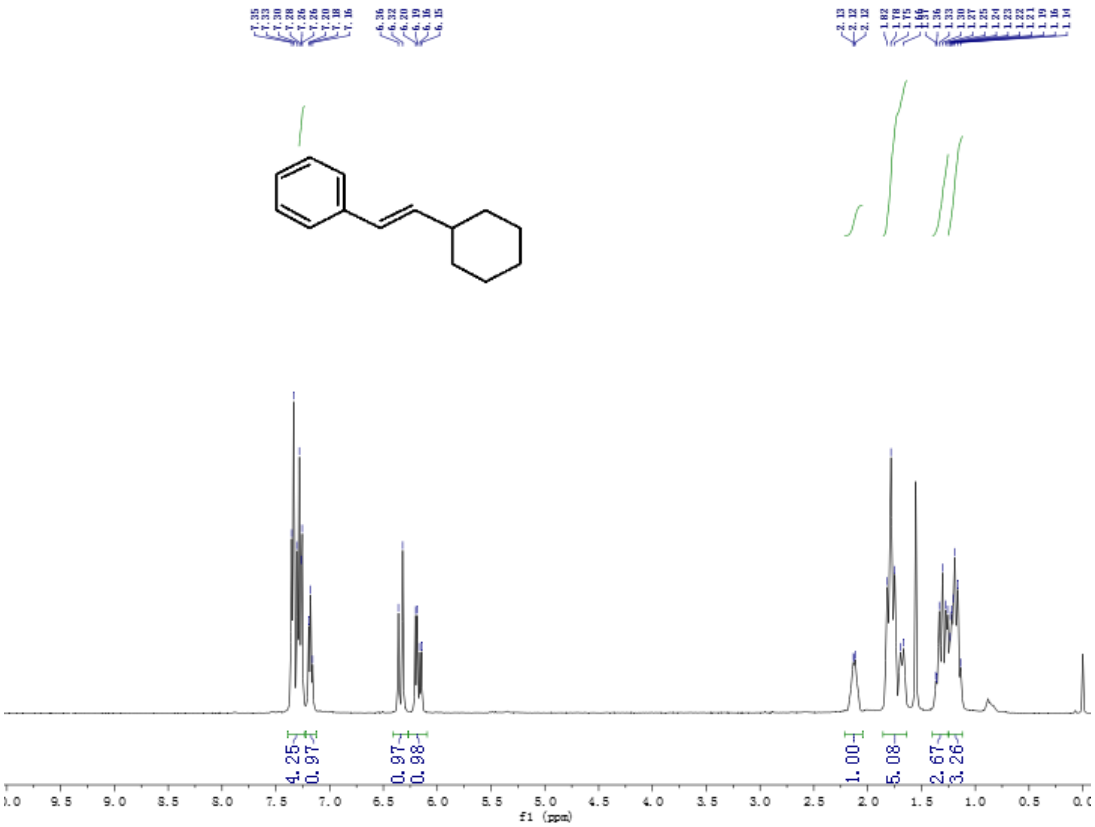
An inseparable mixture of **6a** and **6b** (8:1); Colorless oil (35 mg); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.15 (m, 5H), 5.62 (d, *J* = 8.8 Hz, 1H), 5.26 (s, 0.12H), 5.00 (s, 0.12H), 2.45 – 2.26 (m, 1H), 2.04 (s, 3H), 1.78 – 1.63 (m, 5H), 1.41 – 1.02 (m, 5H).



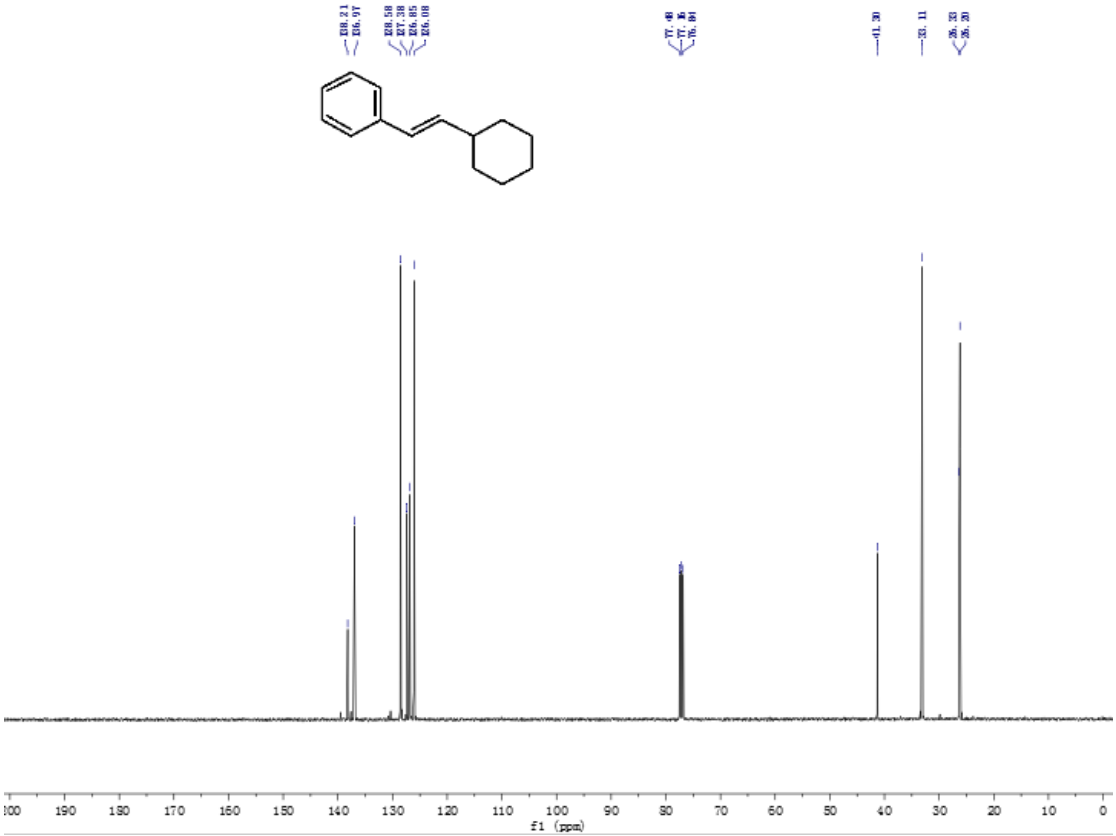
(*E*)-2-(3-Methylbut-1-enyl)isoindoline-1,3-dione (8) White solid (14 mg)； m.p. 58-60 ℃; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (dd, *J* = 5.4, 3.0 Hz, 2H), 7.72 (dd, *J* = 5.5, 3.0 Hz, 2H), 6.60 (d, *J* = 2.0 Hz, 1H), 6.59 (s, 1H), 2.50 – 2.40 (m, 1H), 1.11 (d, *J* = 6.8 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.9, 134.4, 131.9, 129.6, 123.6, 115.9, 30.5, 22.7.

NMR Spectra for the products

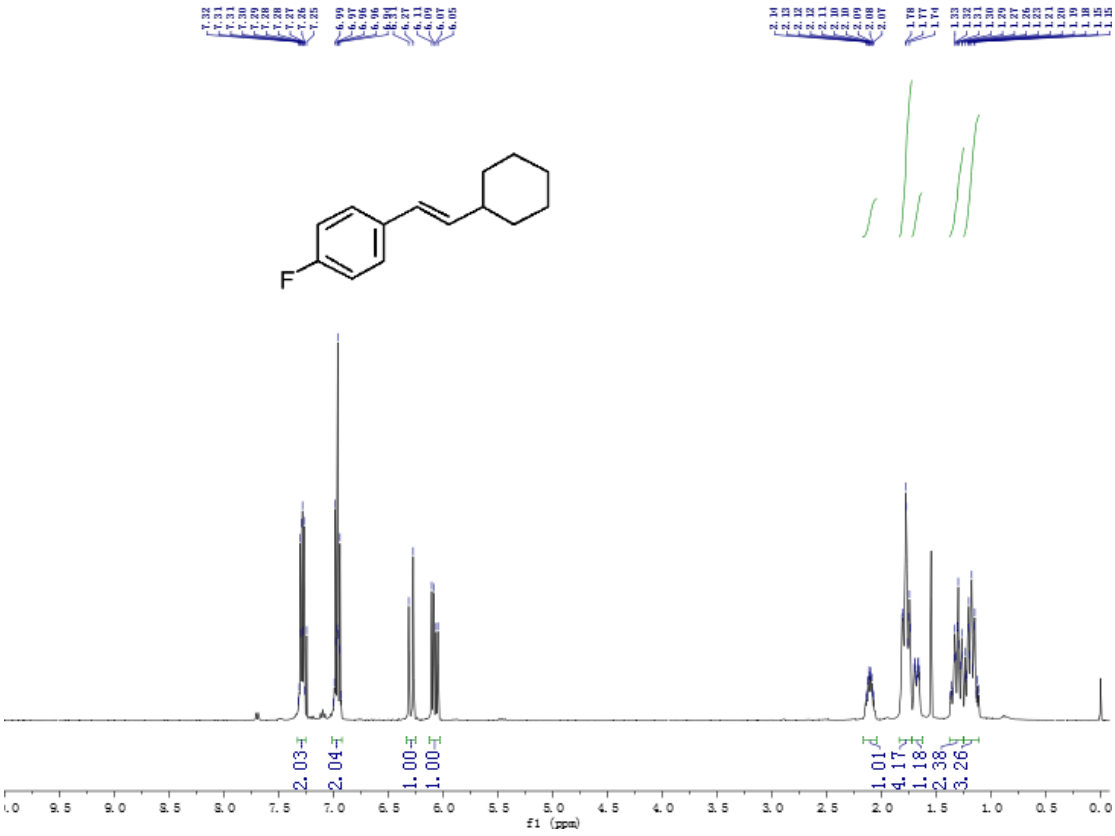
^{1}H NMR of **2a**



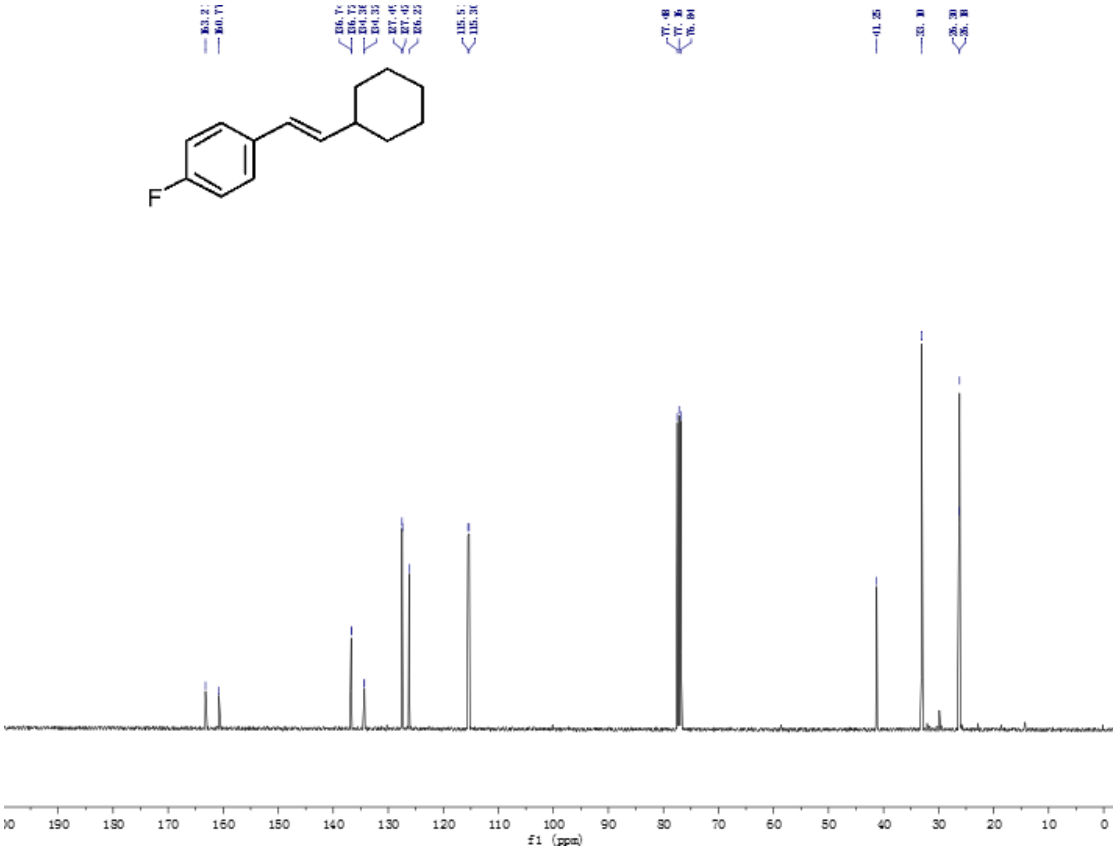
^{13}C NMR of **2a**



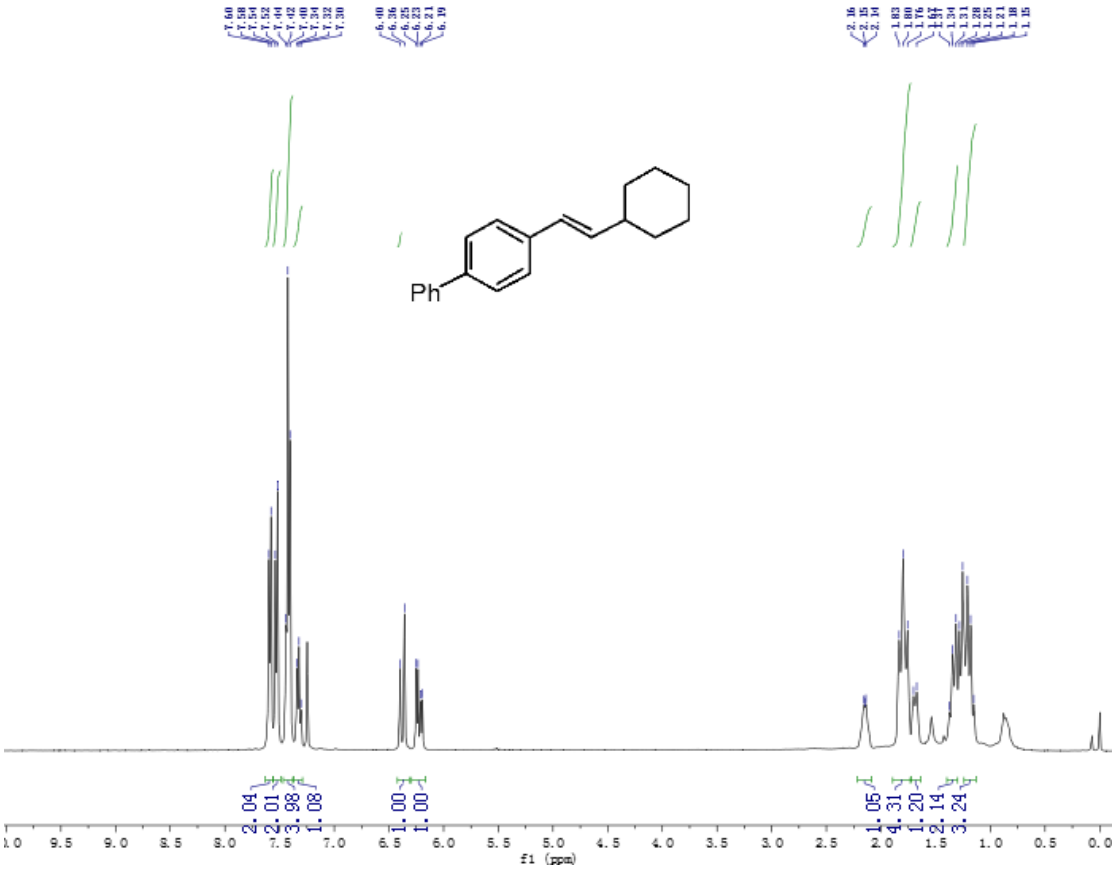
^{1}H NMR of **2b**



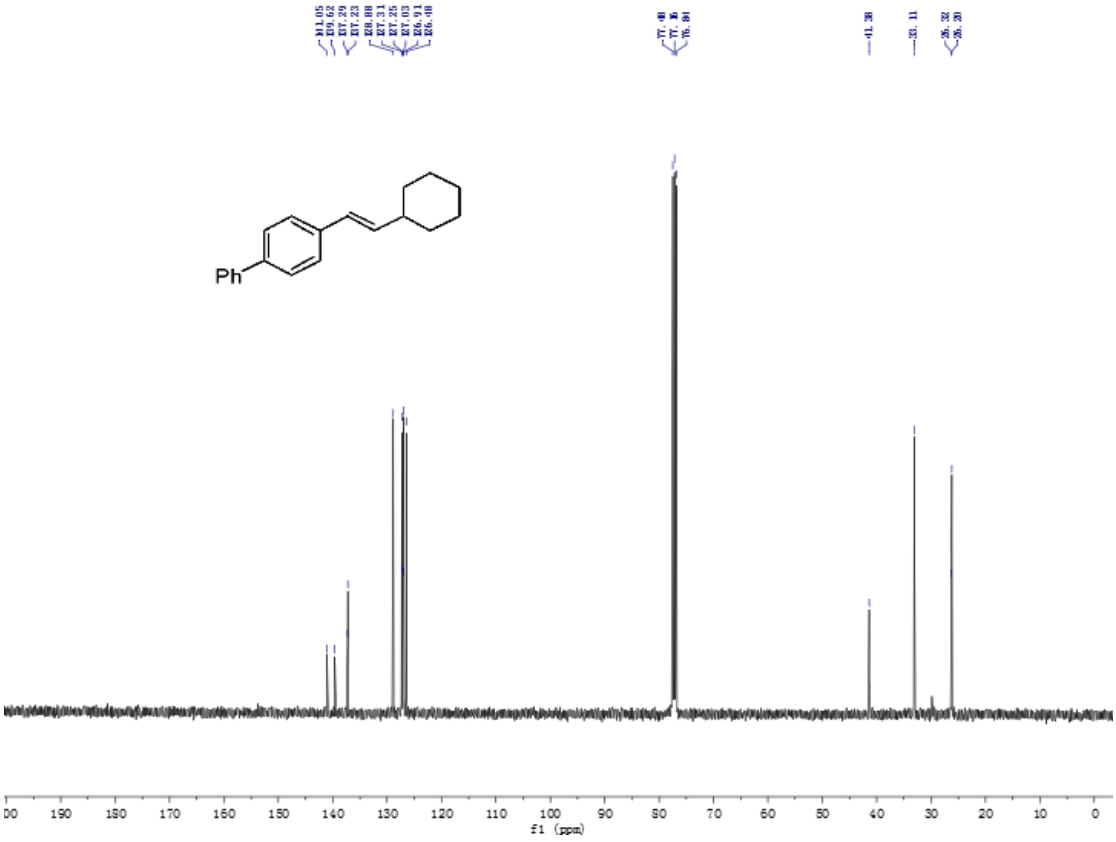
^{13}C NMR of **2b**



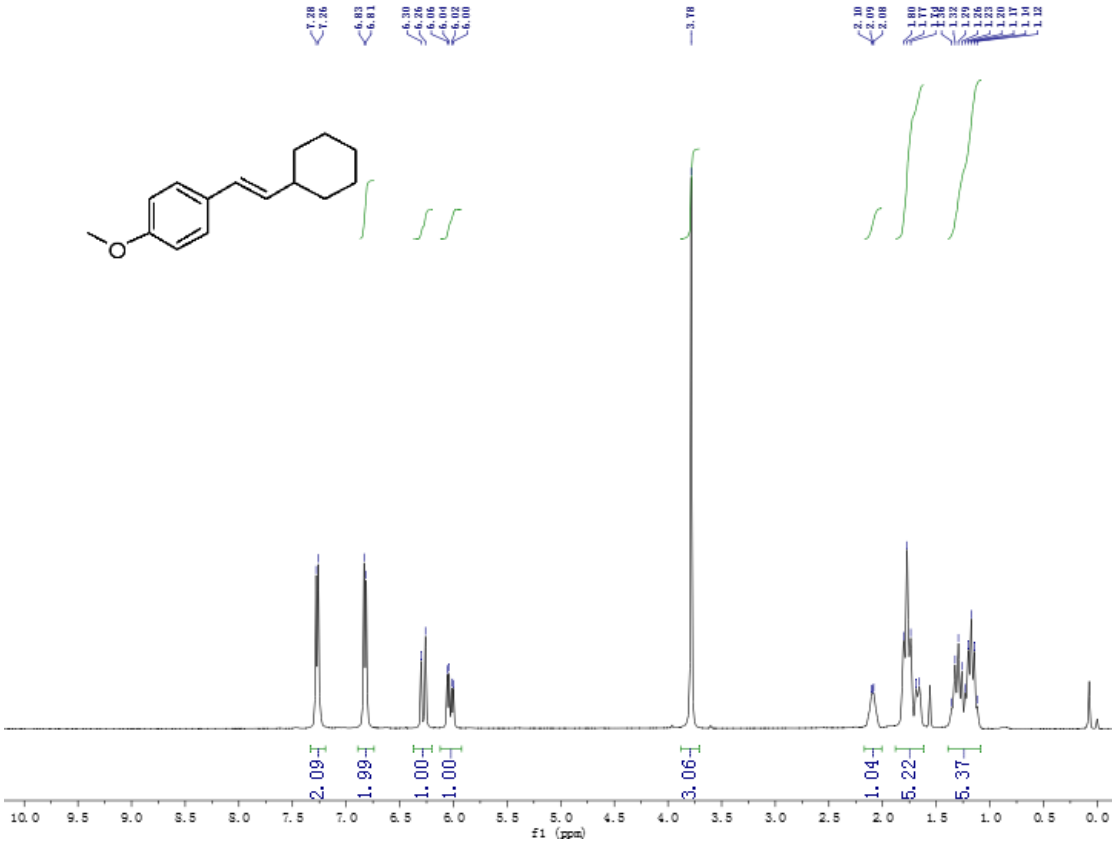
^{1}H NMR of **2c**



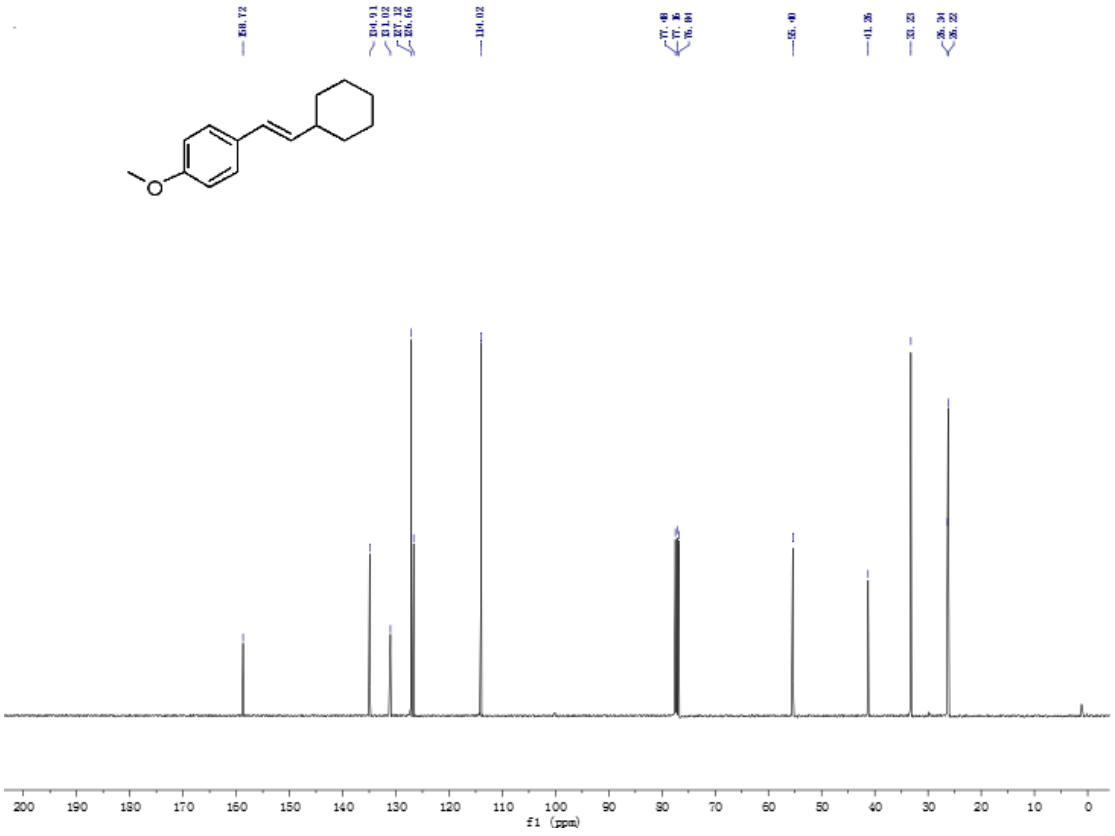
^{13}C NMR of **2c**



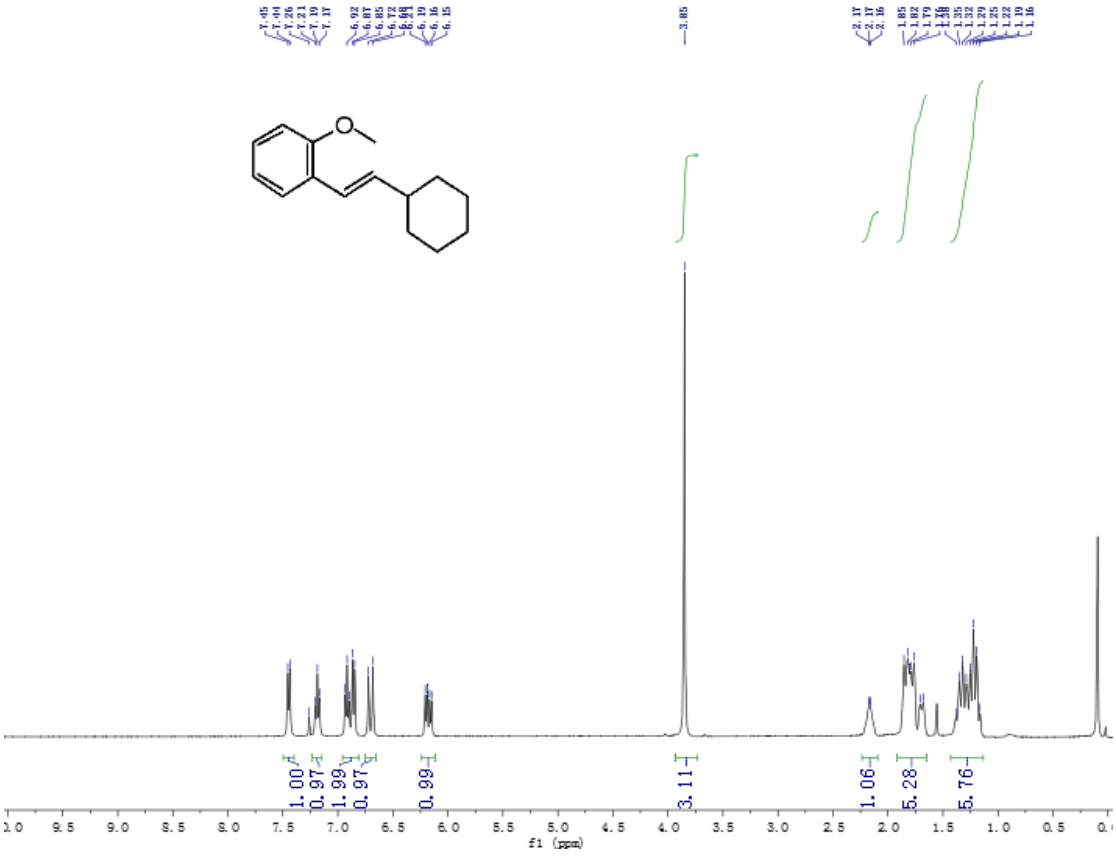
^{1}H NMR of **2d**



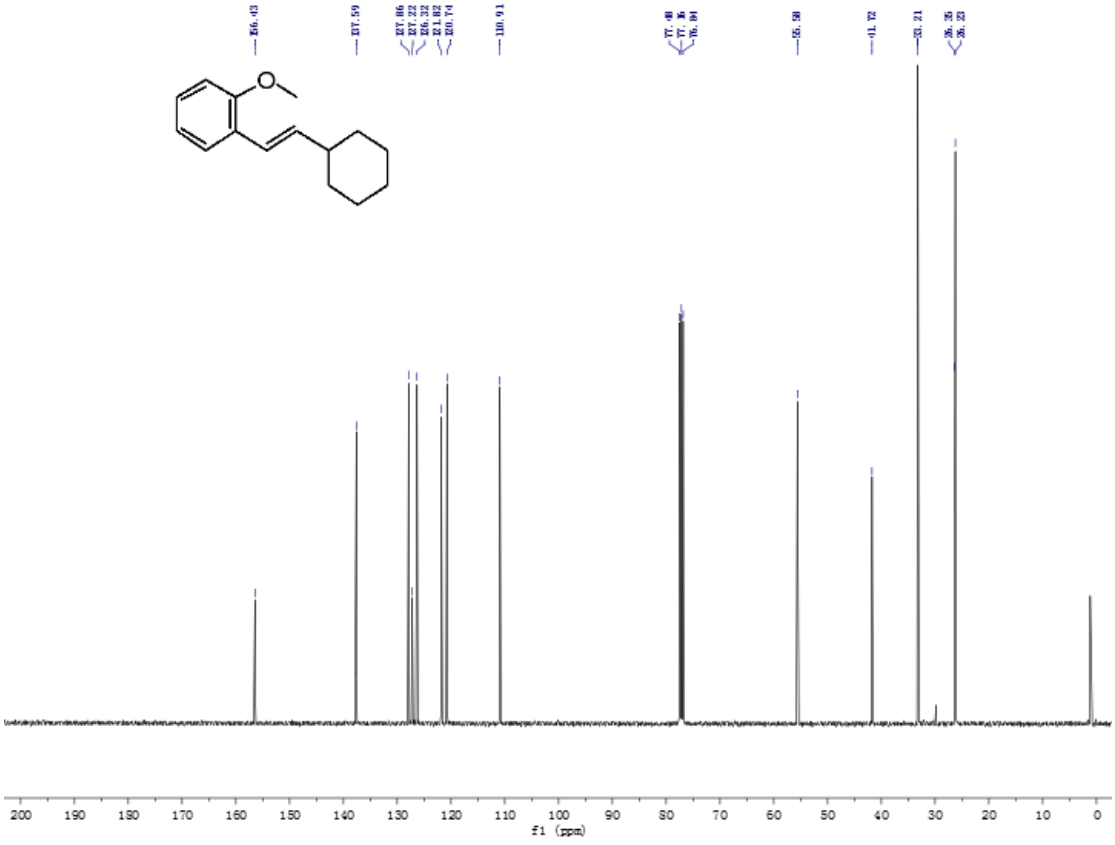
^{13}C NMR of **2d**



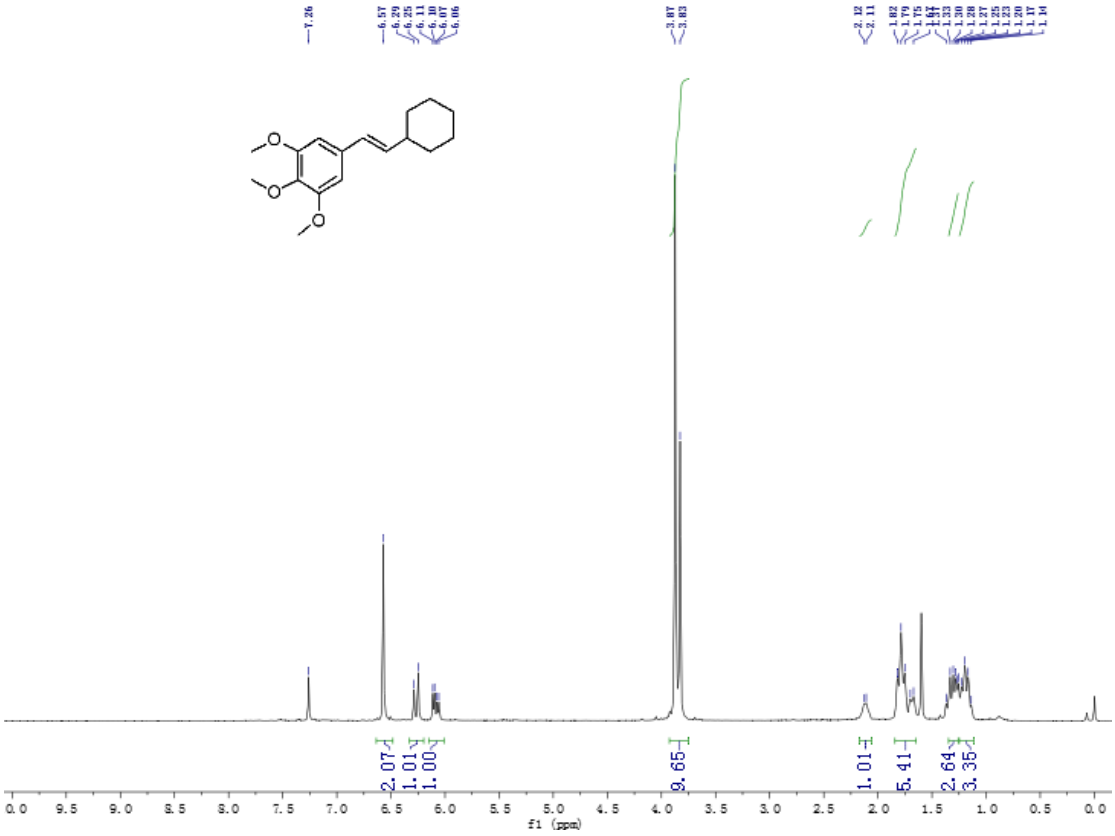
^{1}H NMR of **2e**



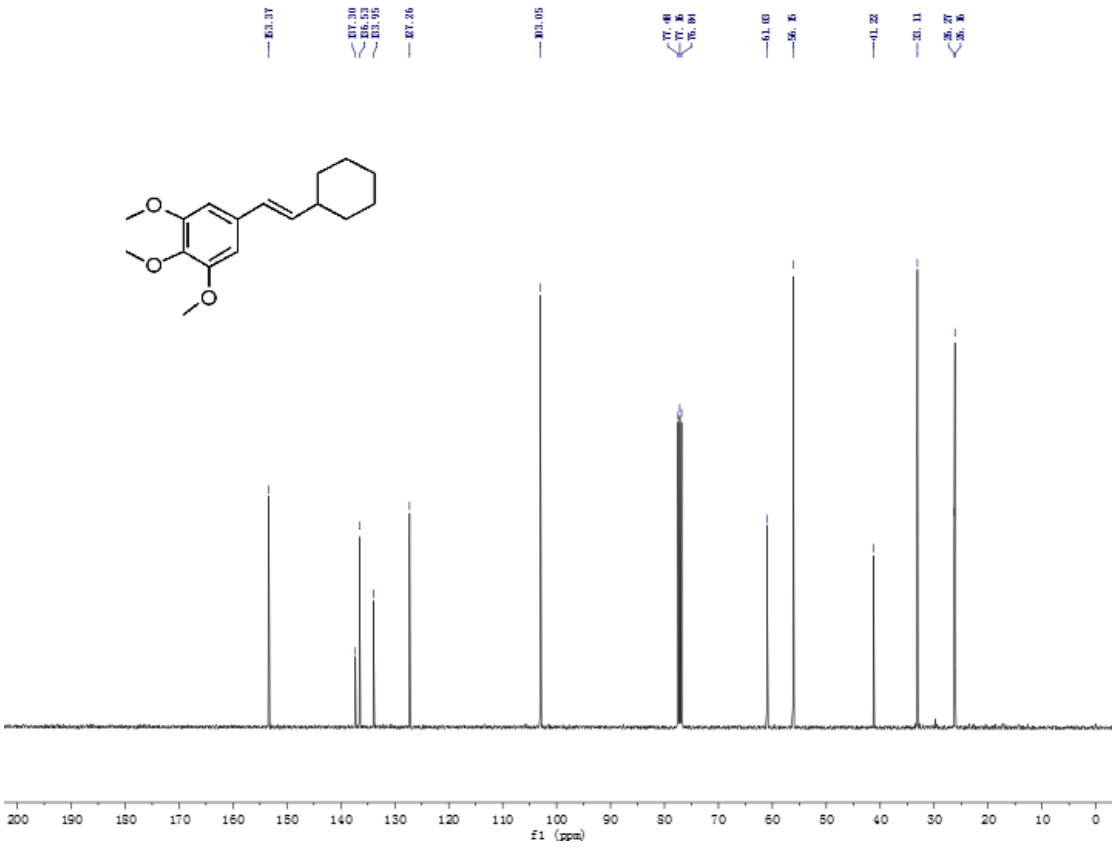
^{13}C NMR of **2e**



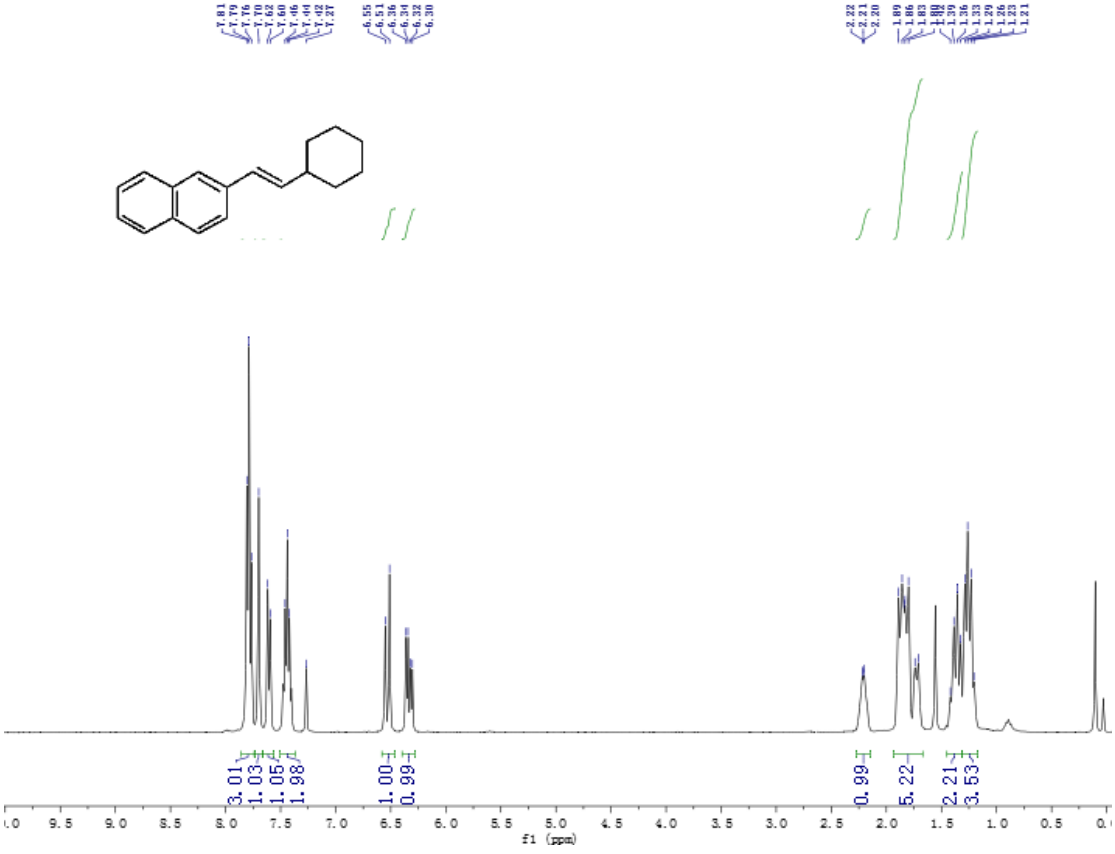
^{1}H NMR of **2f**



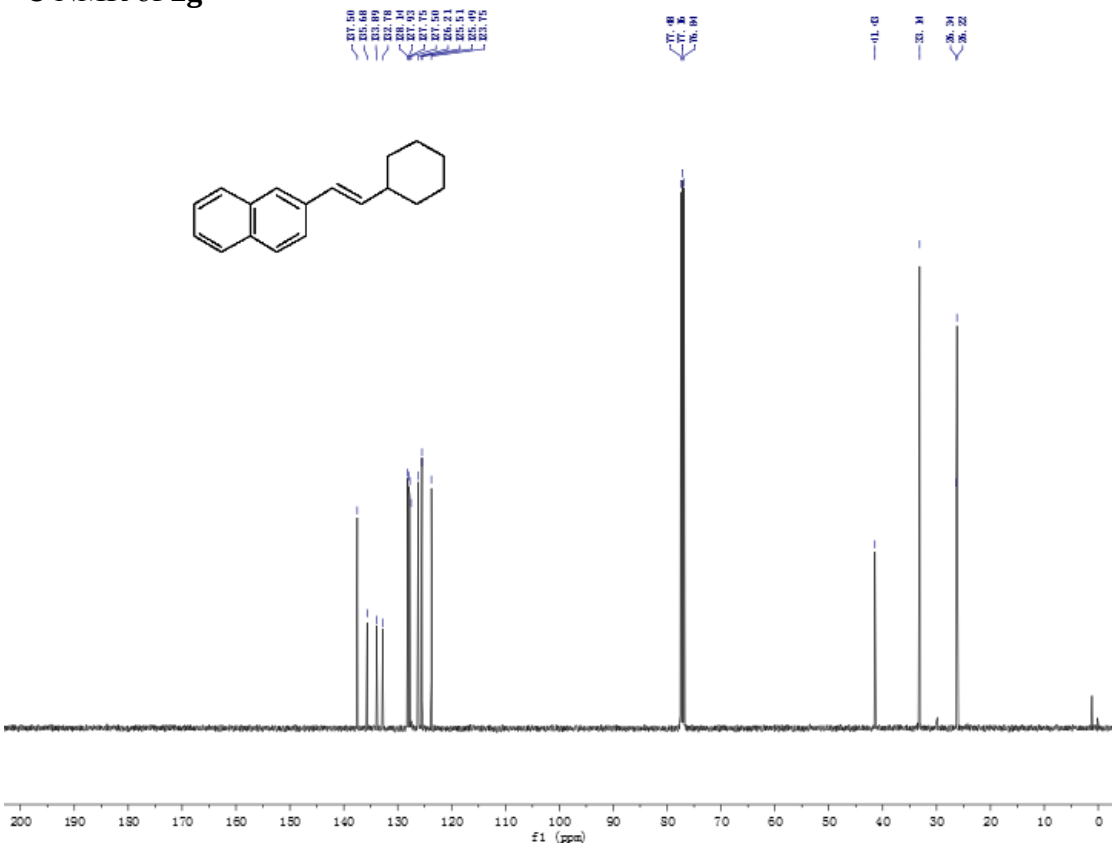
^{13}C NMR of **2f**



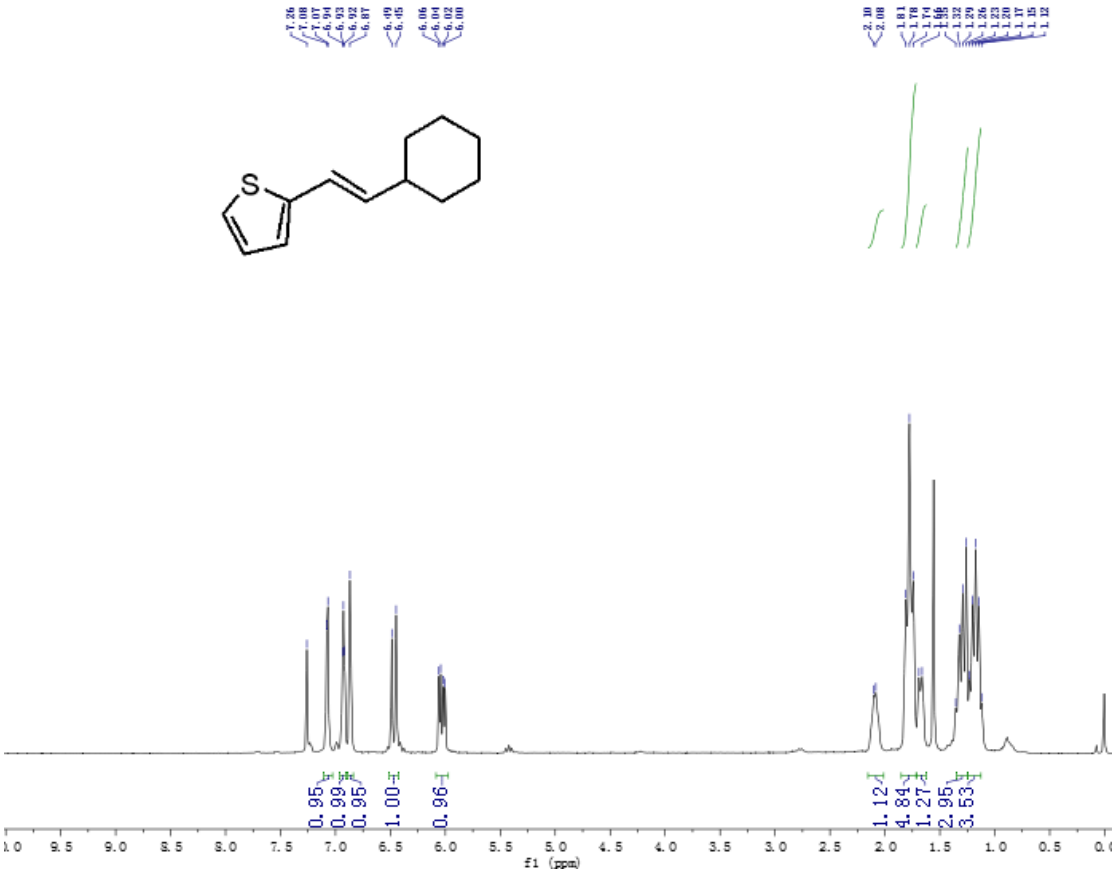
^{1}H NMR of **2g**



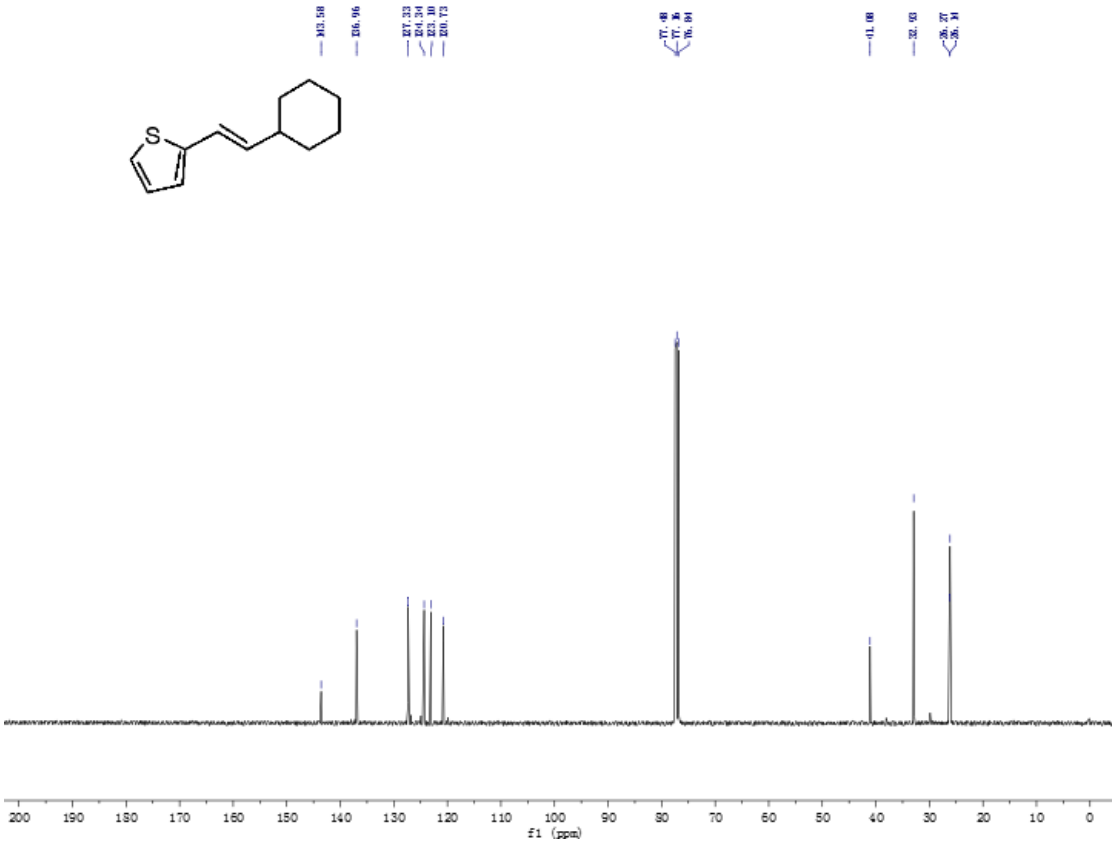
^{13}C NMR of **2g**



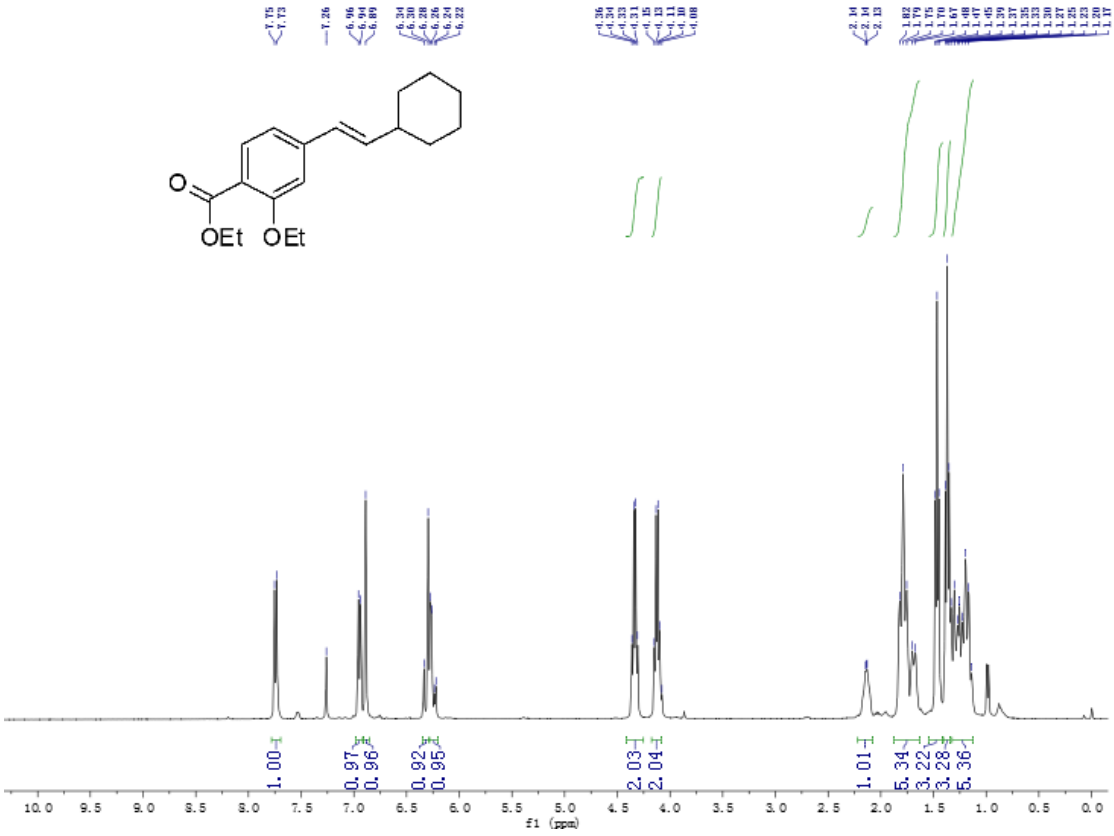
^{1}H NMR of **2h**



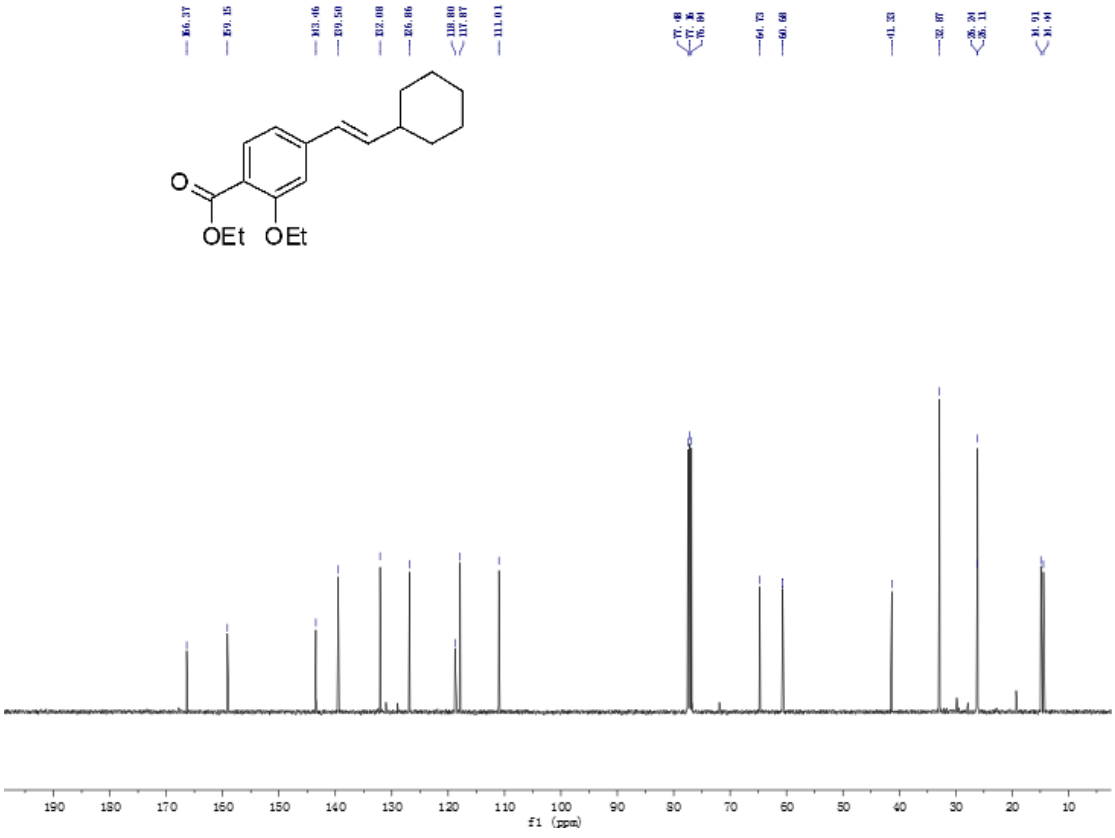
^{13}C NMR of **2h**



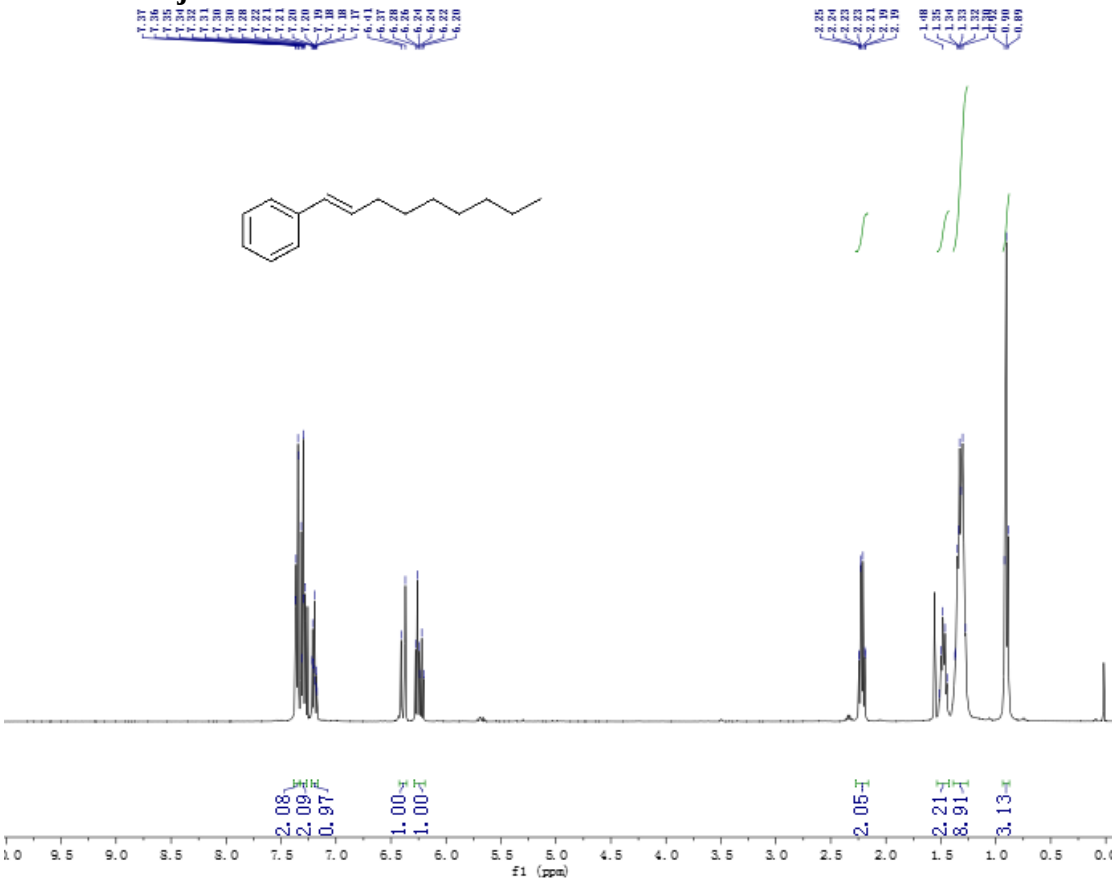
^{1}H NMR of **2i**



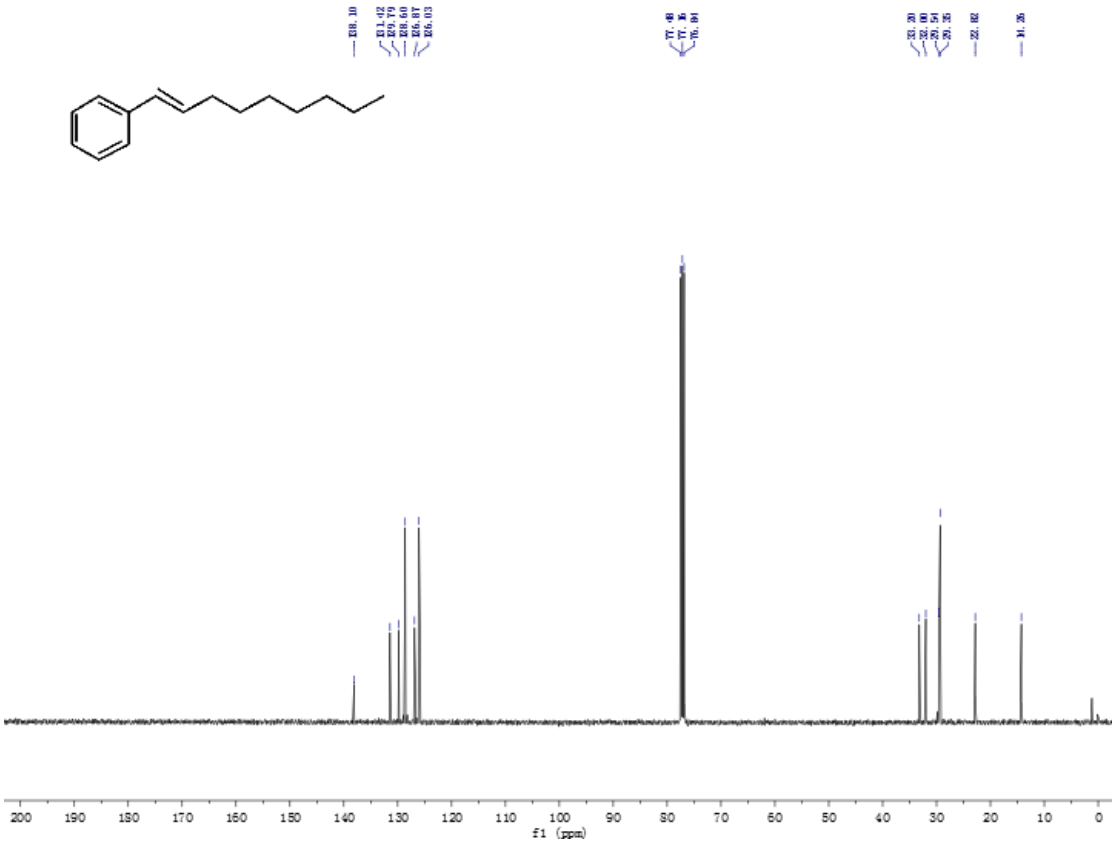
^{13}C NMR of **2i**



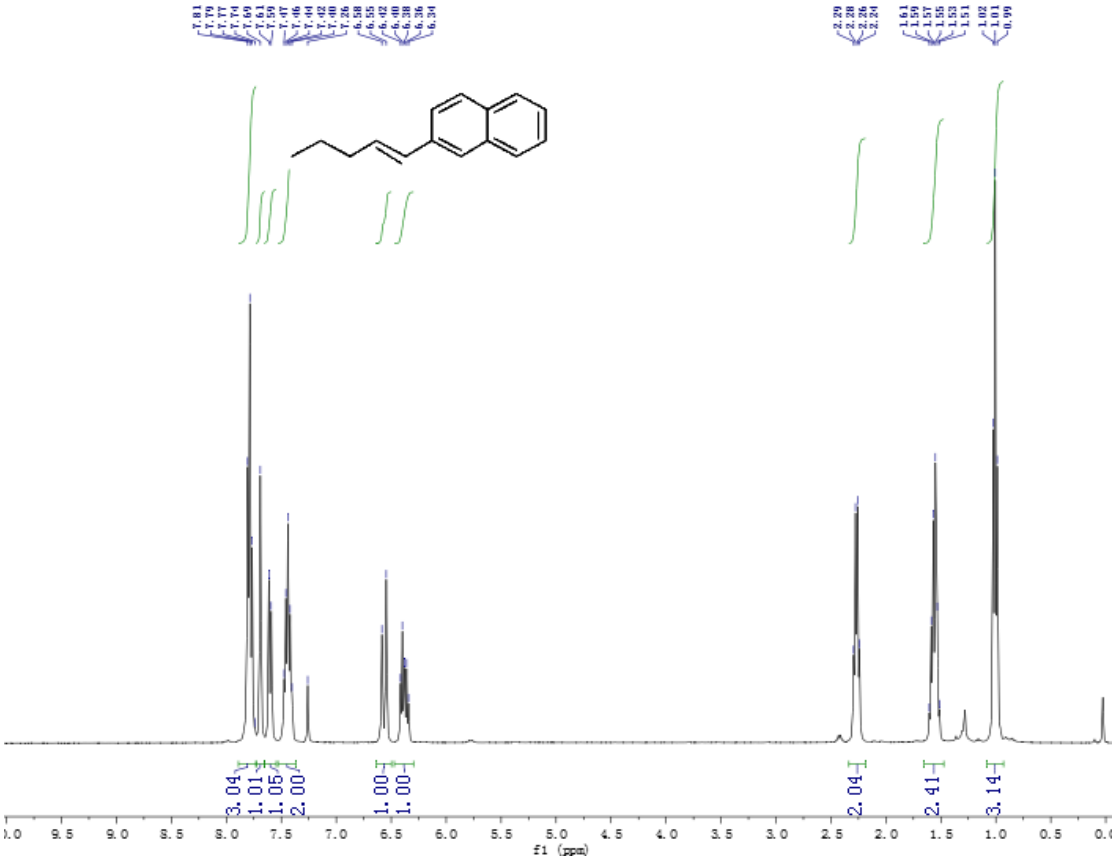
^{1}H NMR of **2j**



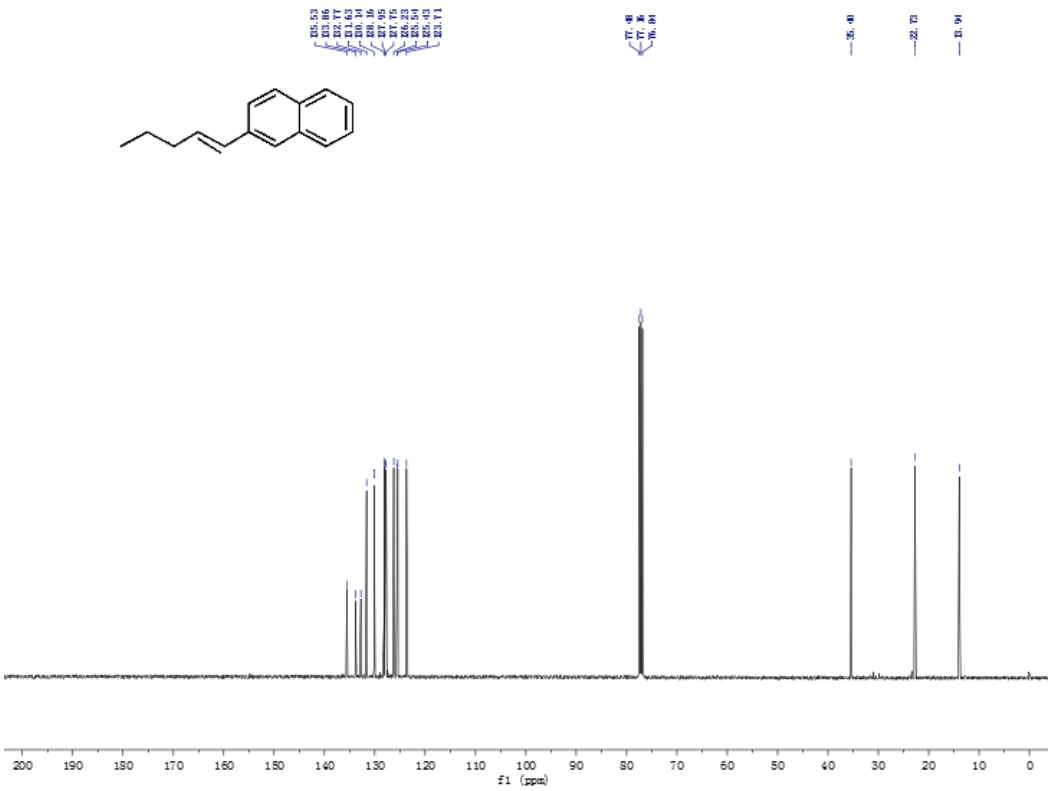
^{13}C NMR of **2j**



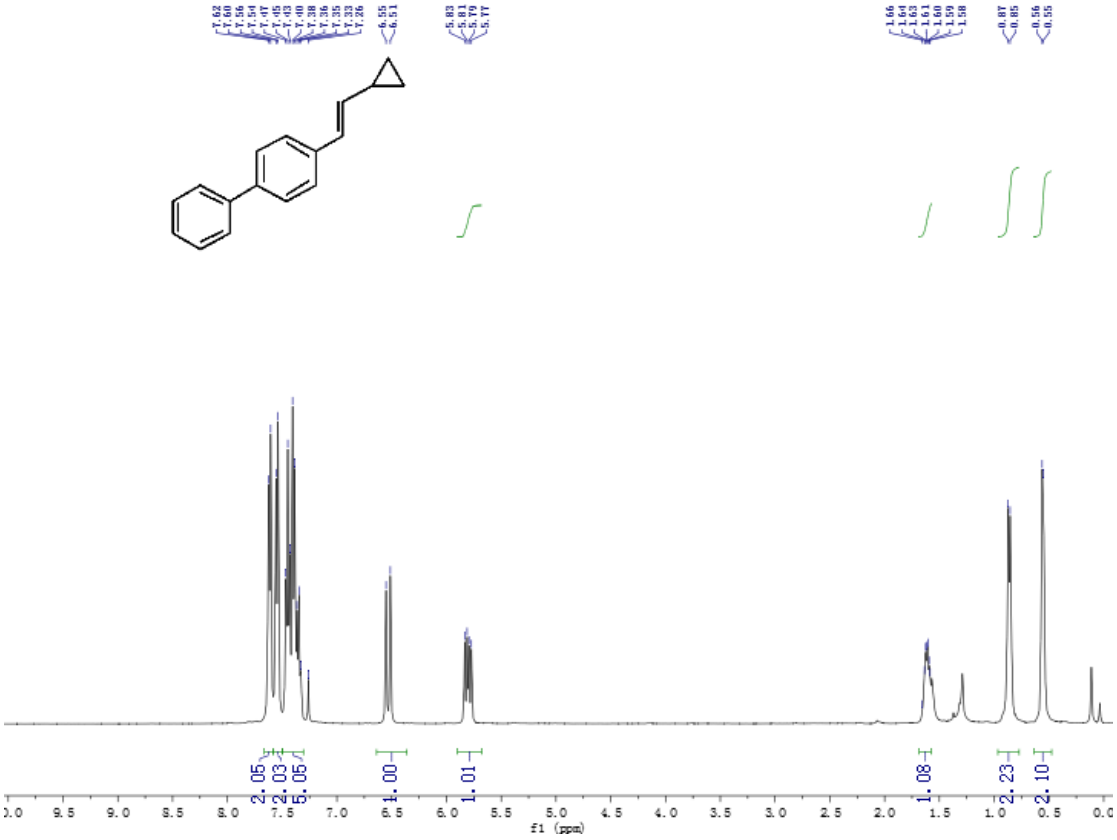
^{1}H NMR of **2k**



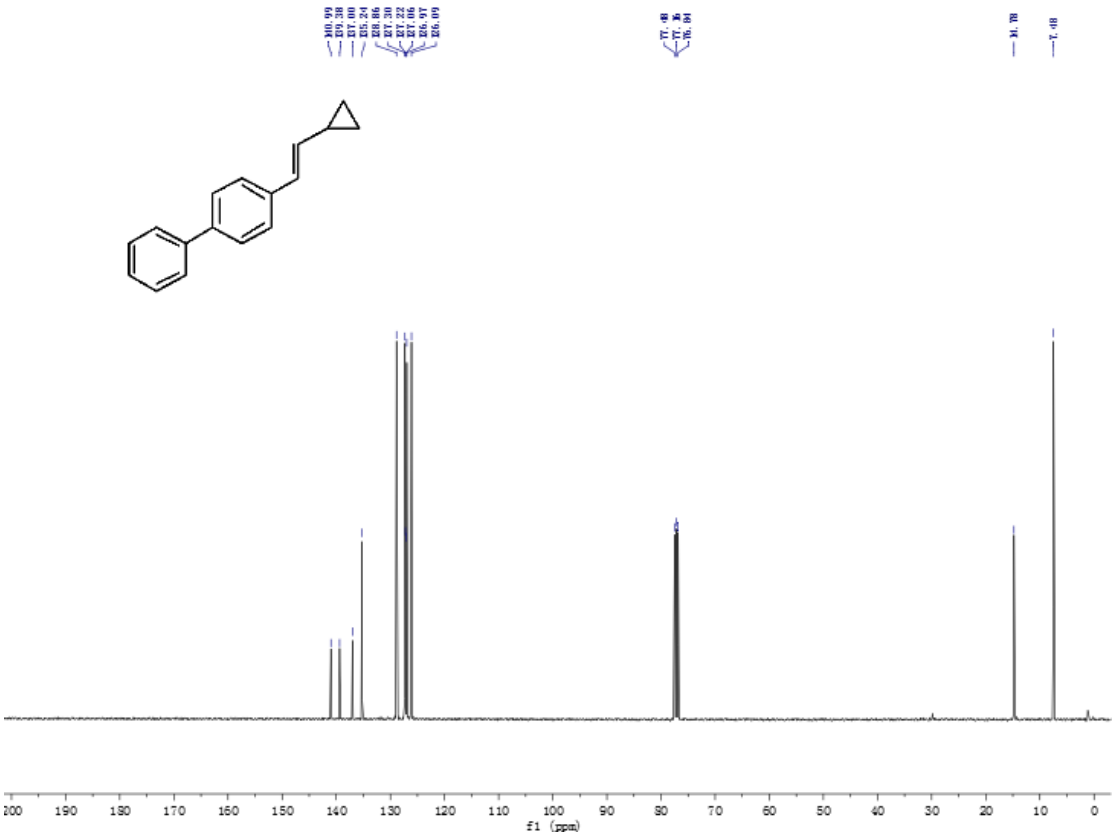
^{13}C NMR of **2k**



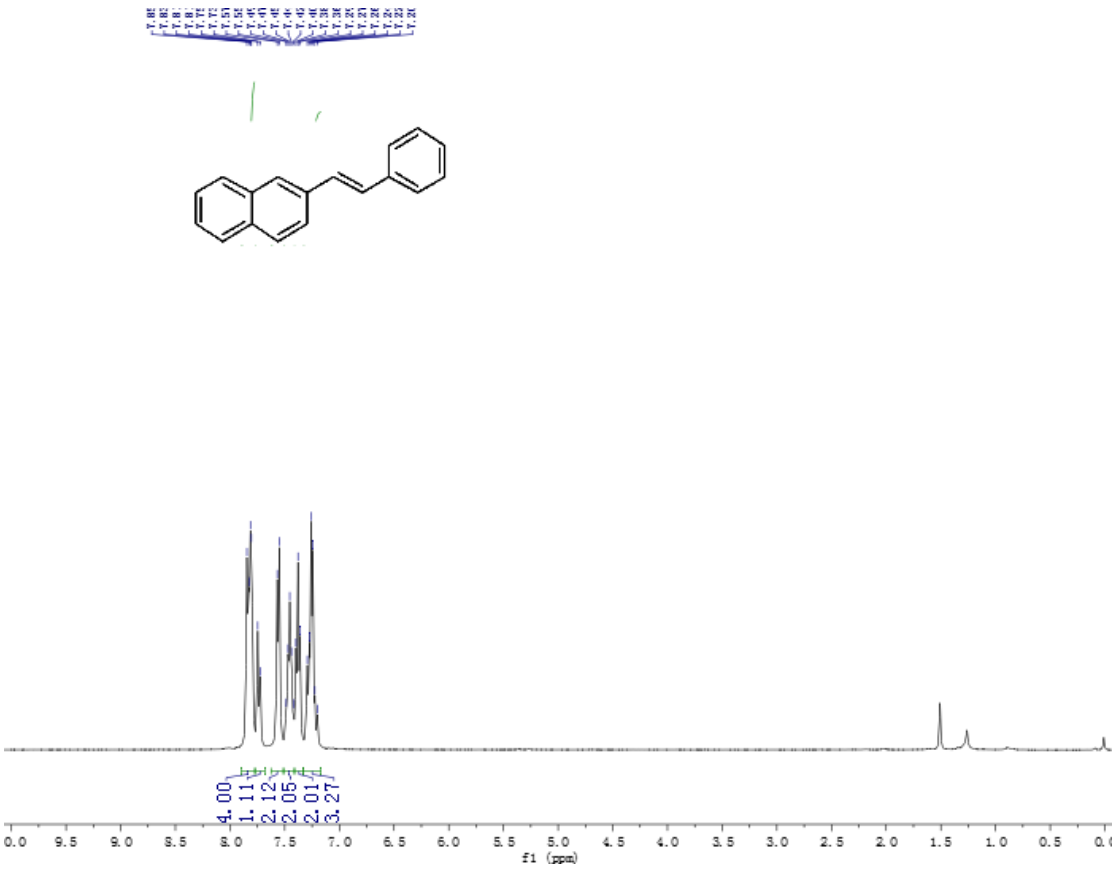
^{1}H NMR of **2l**



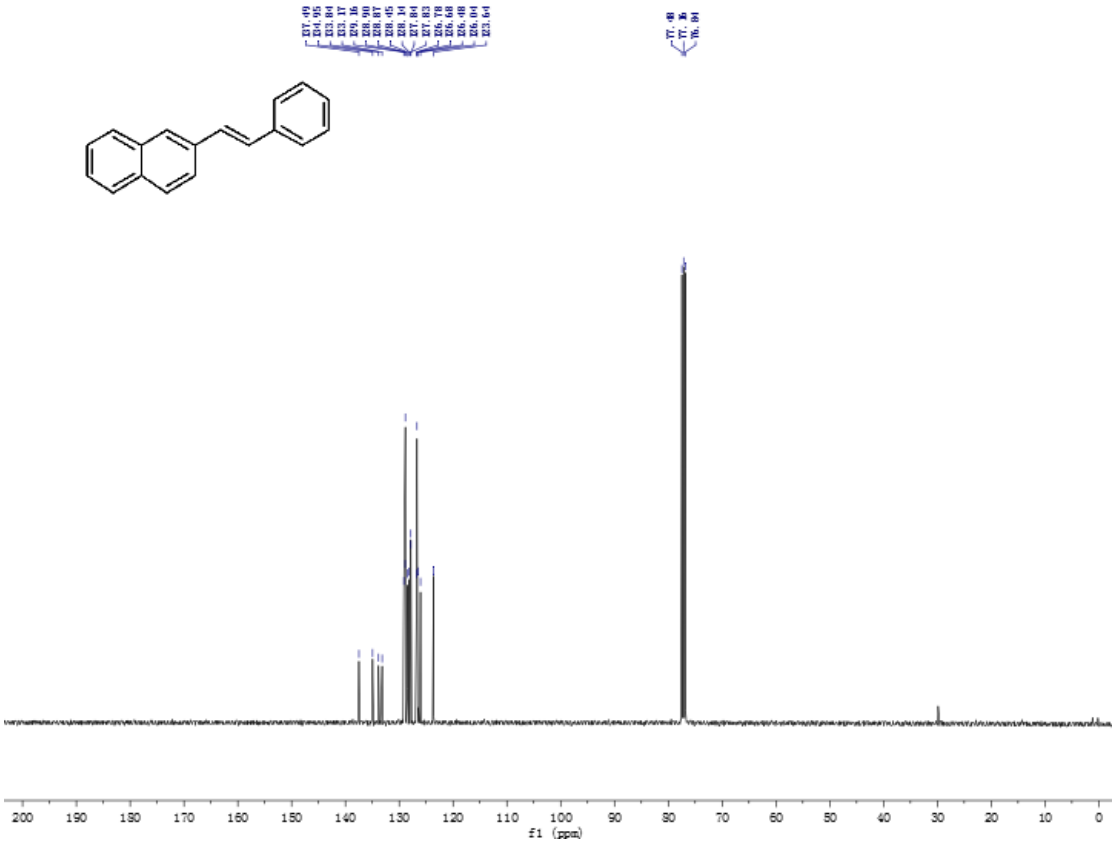
^{13}C NMR of **2l**



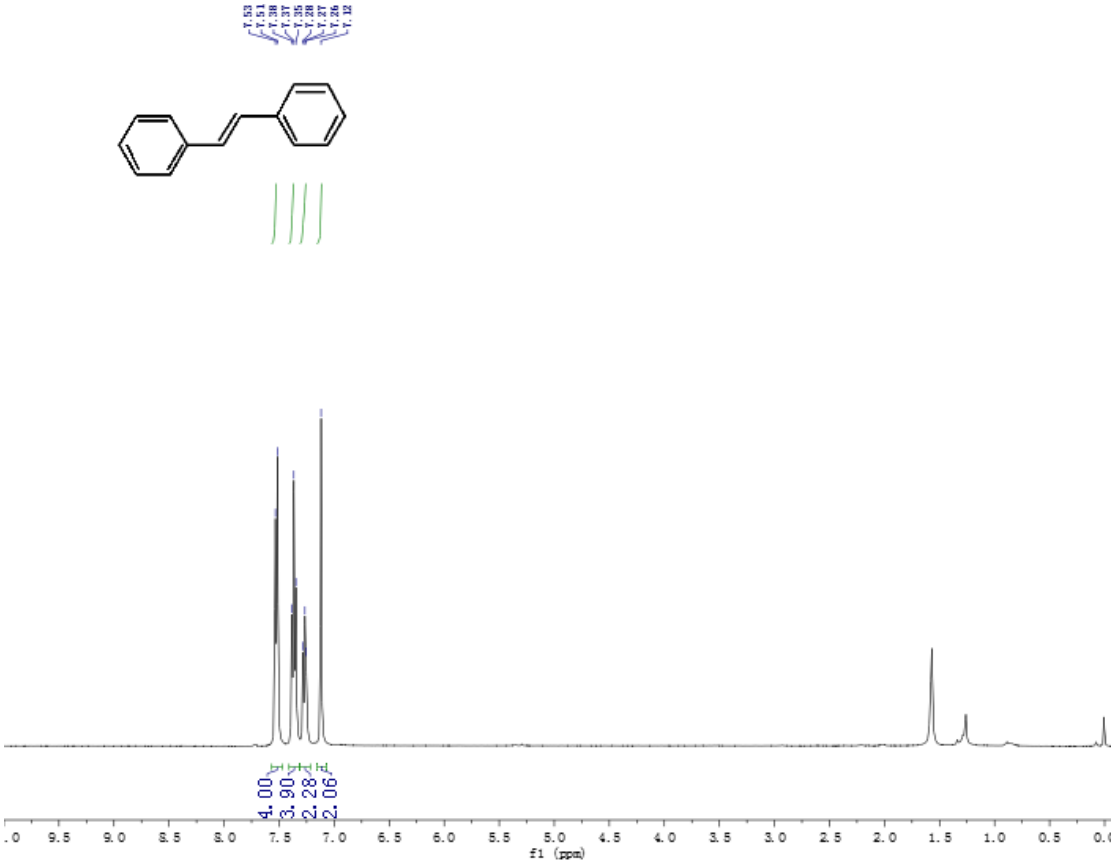
^{1}H NMR of **2m**



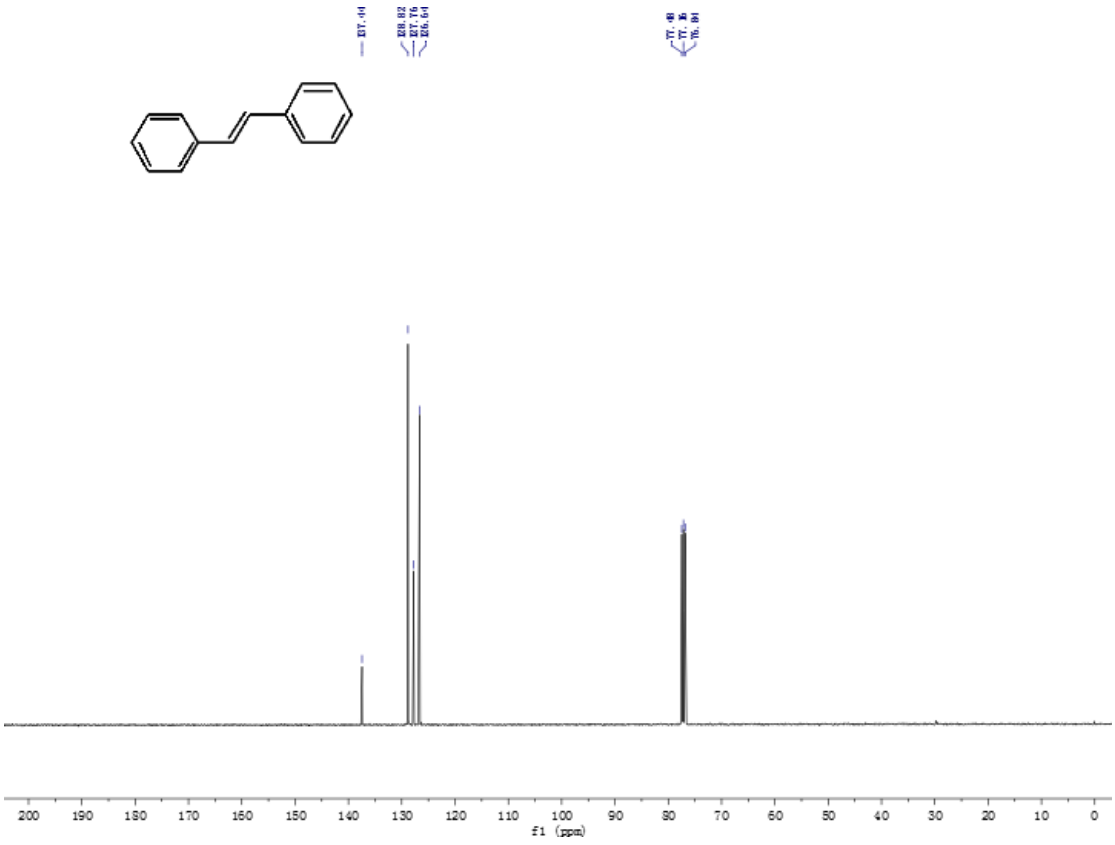
^{13}C NMR of **2m**



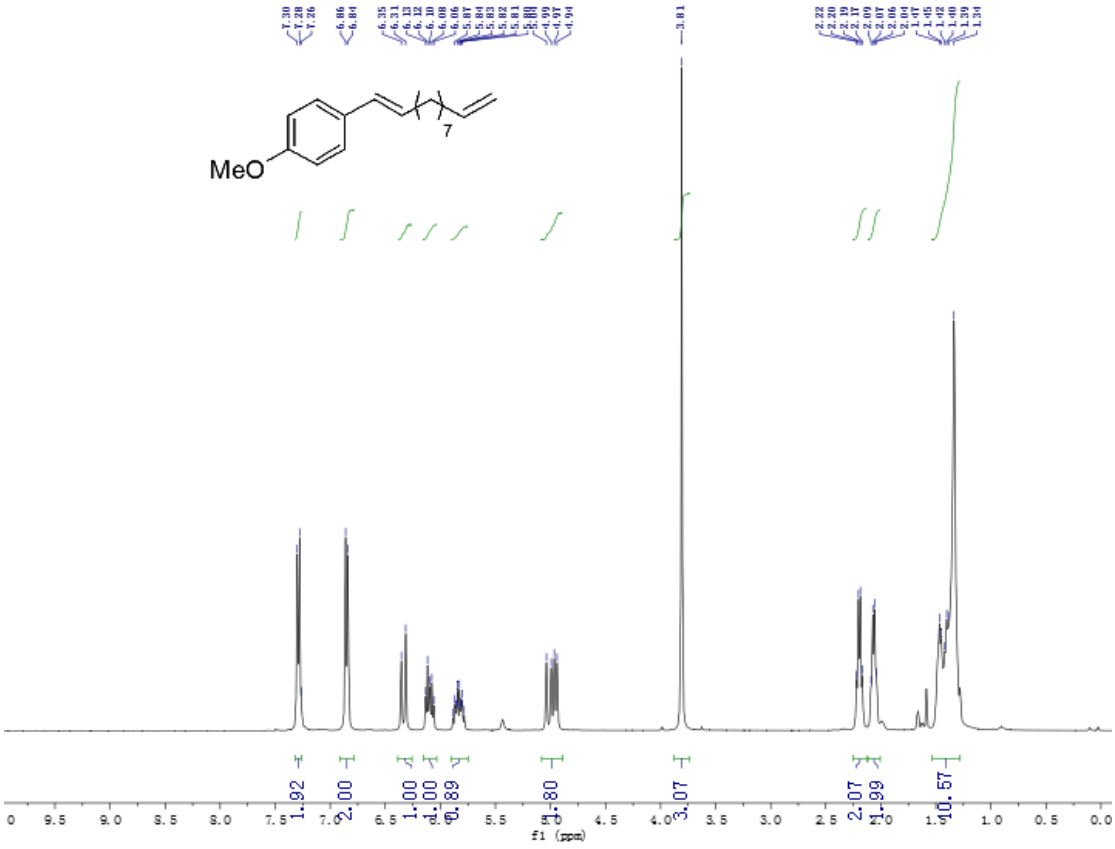
^{1}H NMR of **2n**



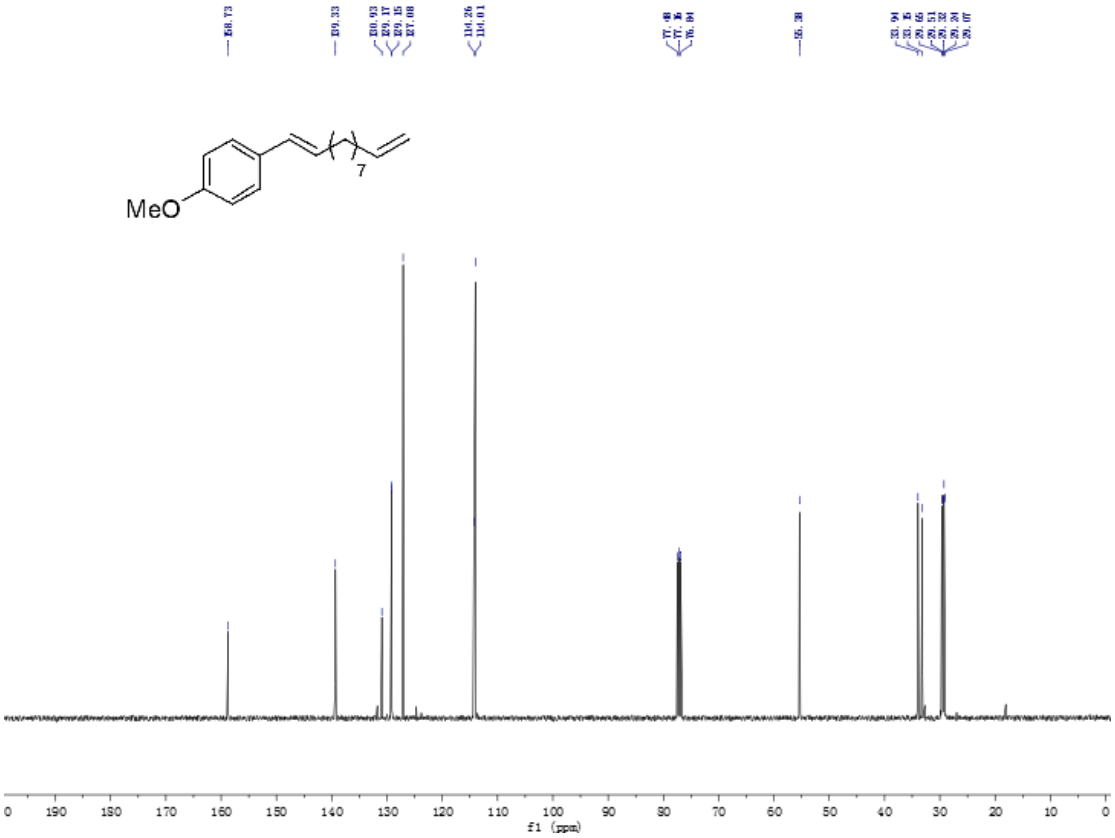
^{13}C NMR of **2n**



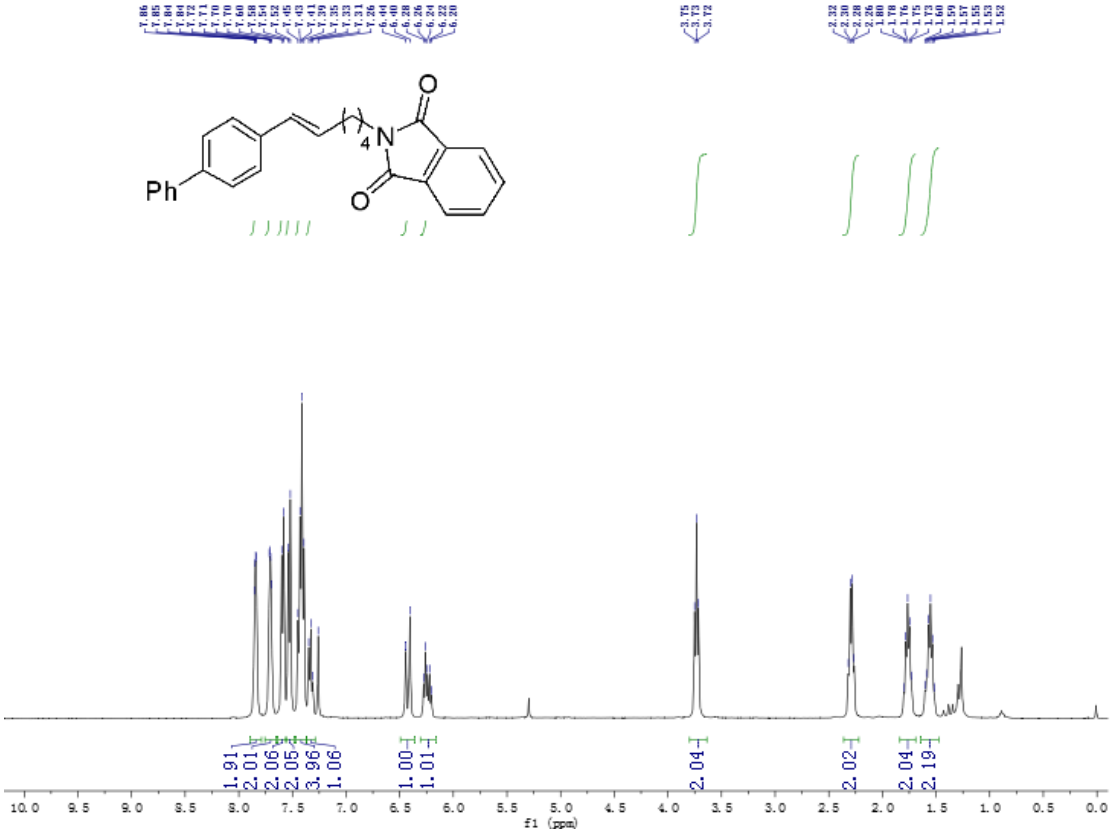
^{1}H NMR of **2o**



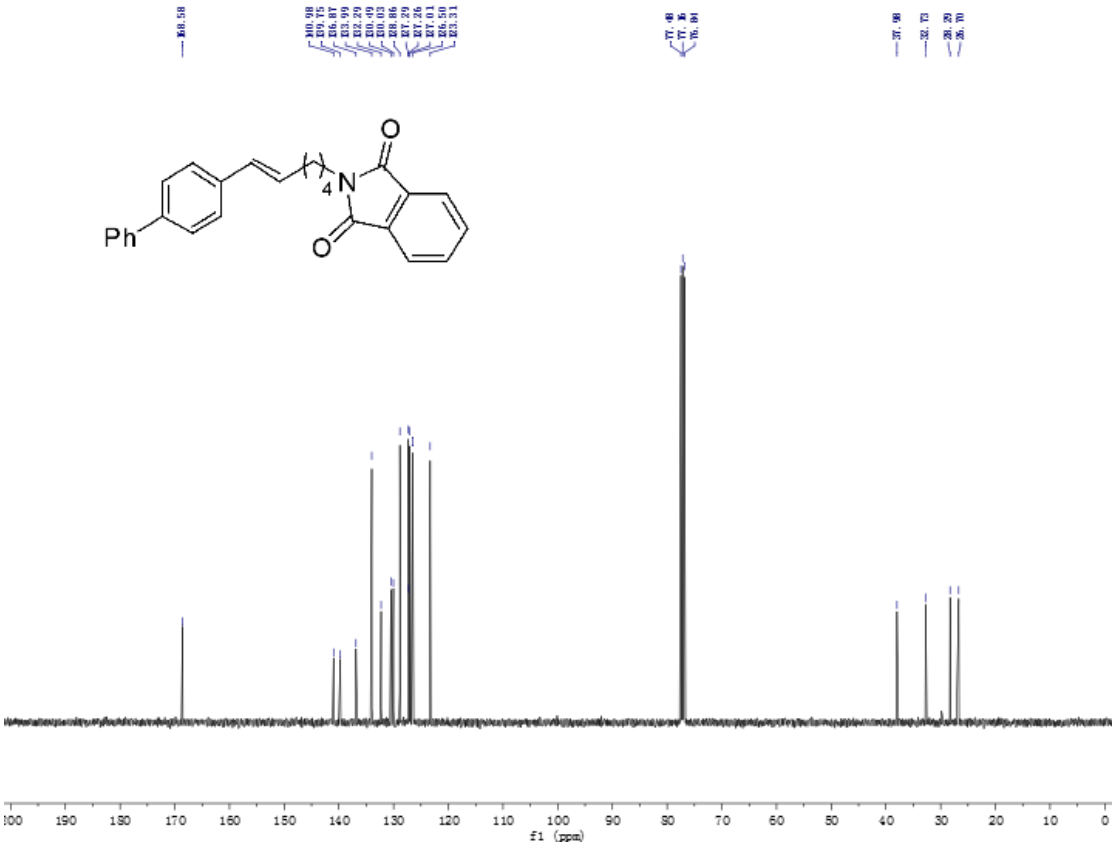
^{13}C NMR of **2o**



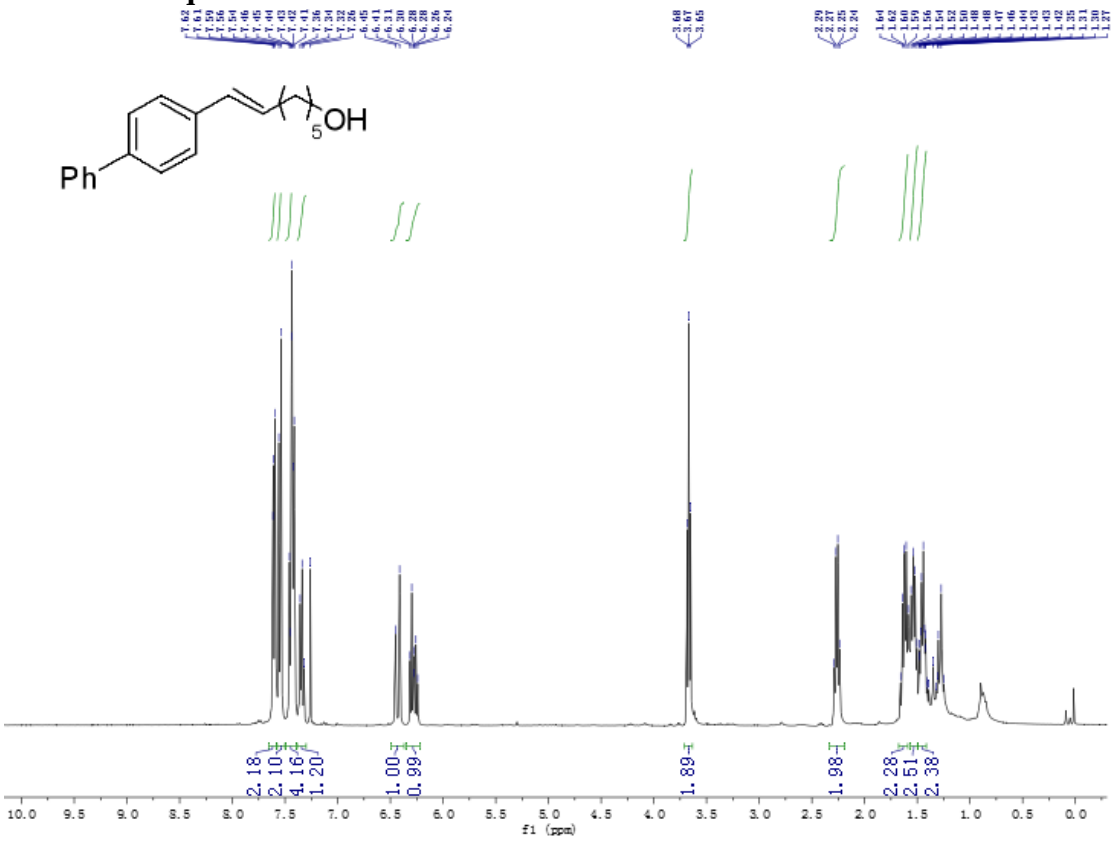
^{1}H NMR of **2p**



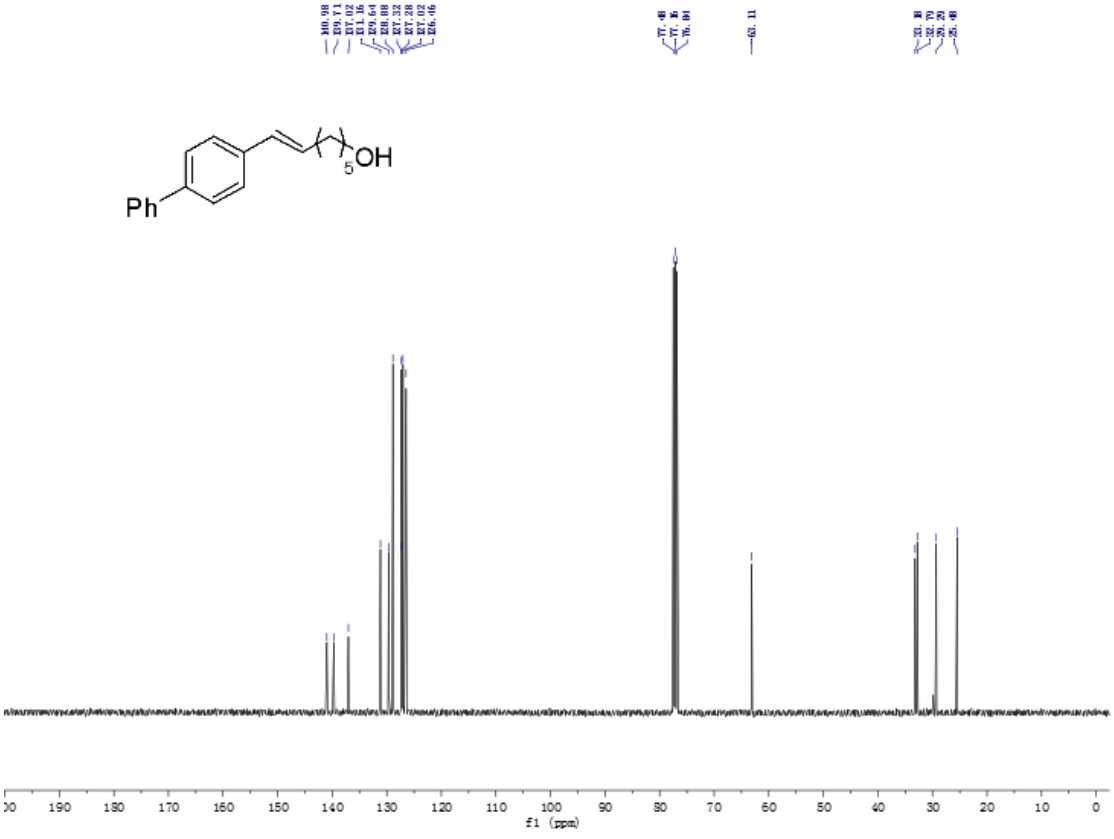
^{13}C NMR of **2p**



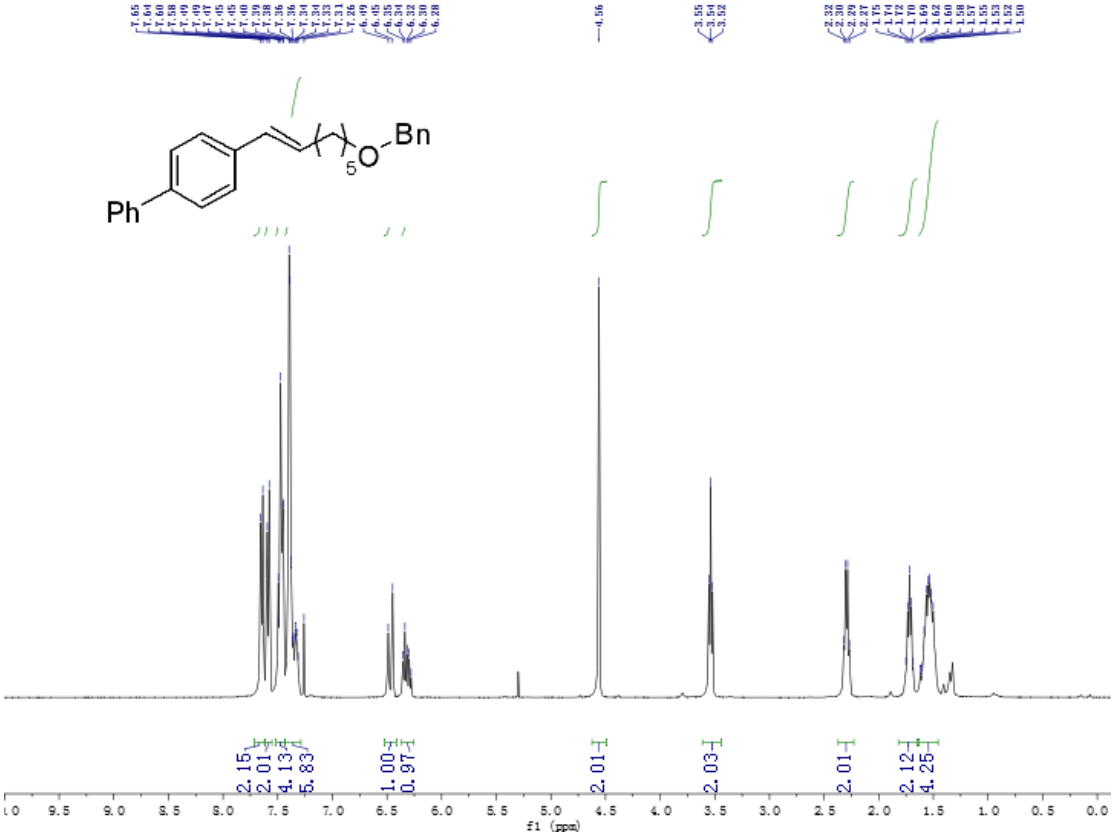
^{1}H NMR of **2q**



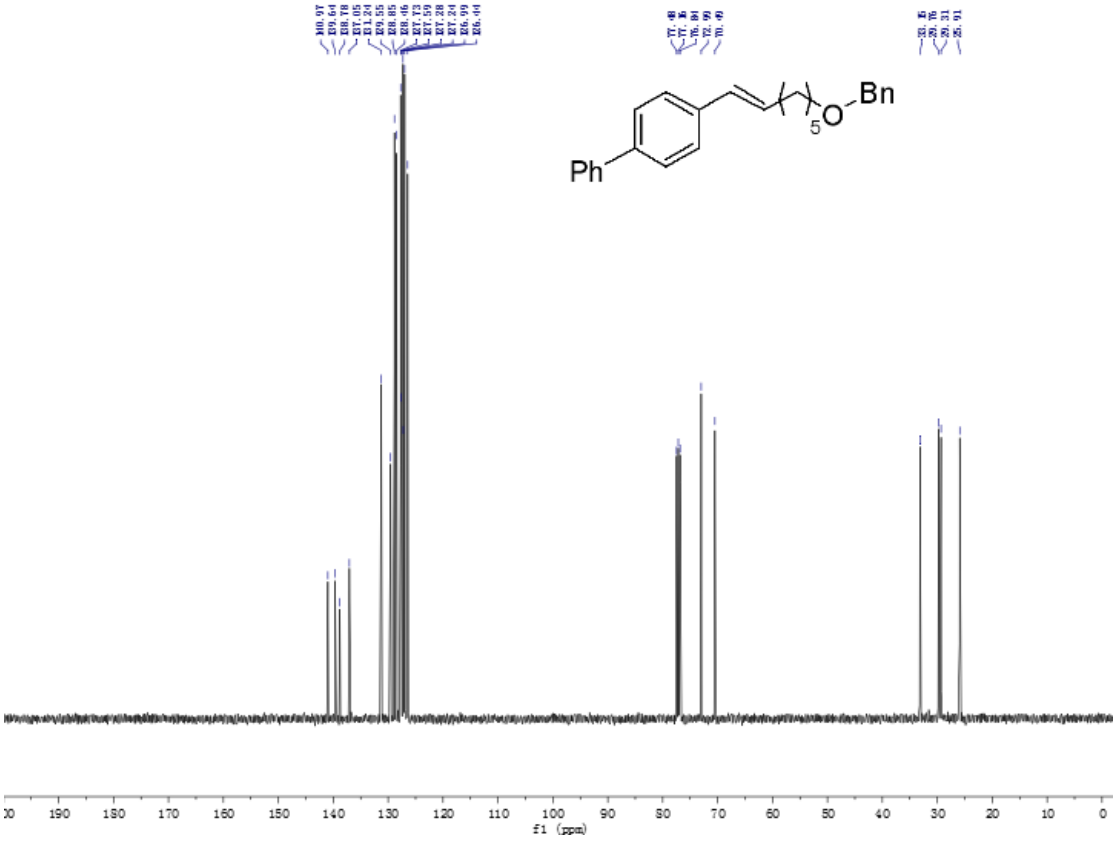
^{13}C NMR of **2q**



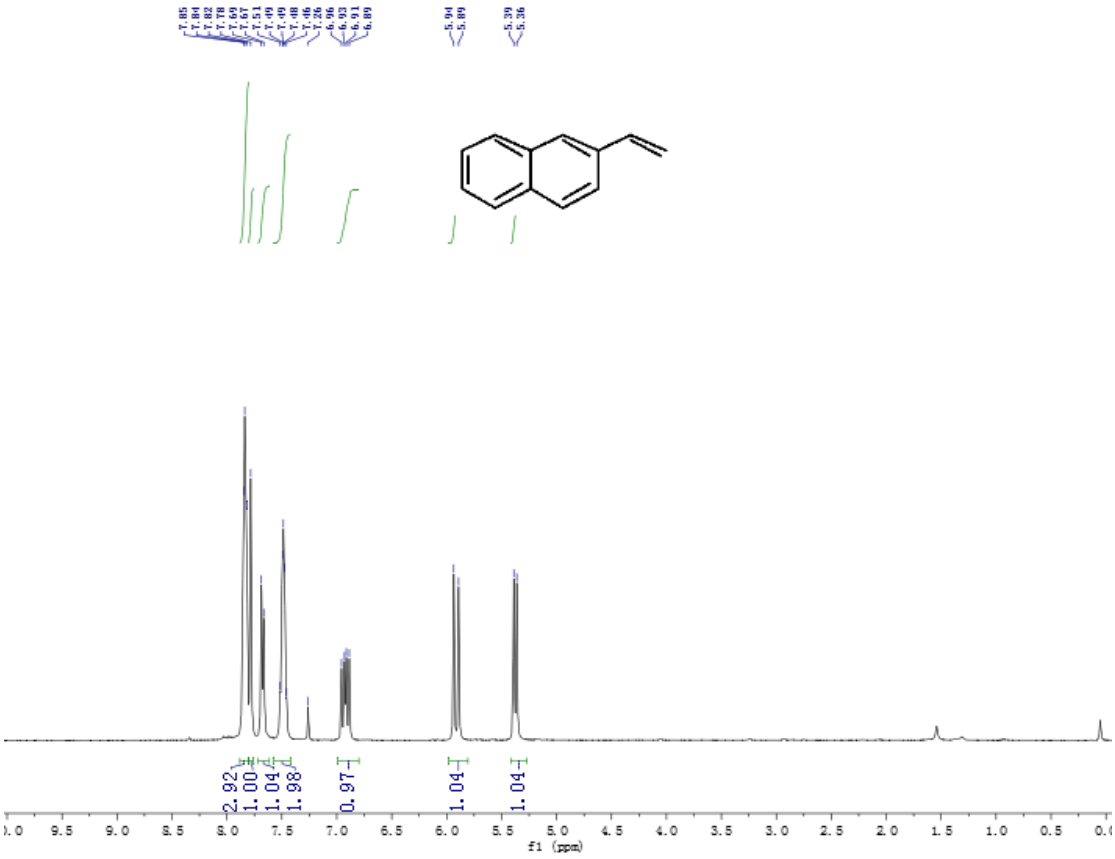
^{1}H NMR of **2r**



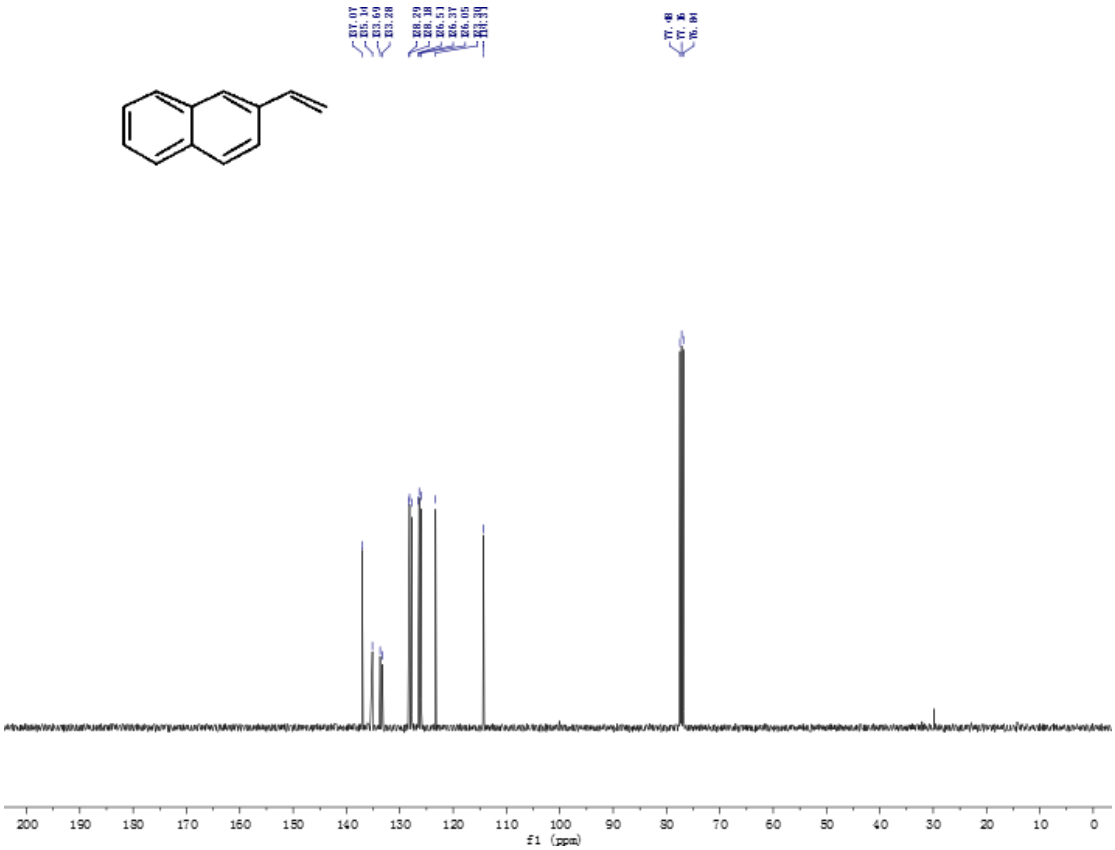
^{13}C NMR of **2r**



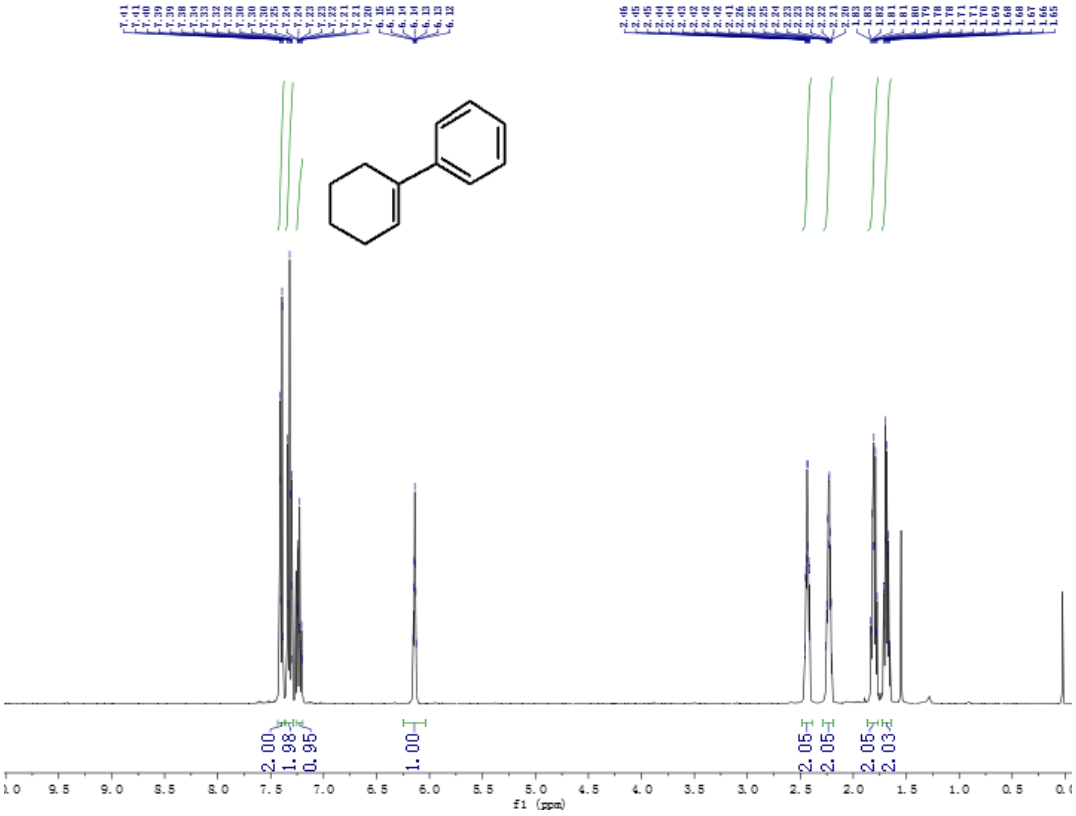
^{1}H NMR of **2s**



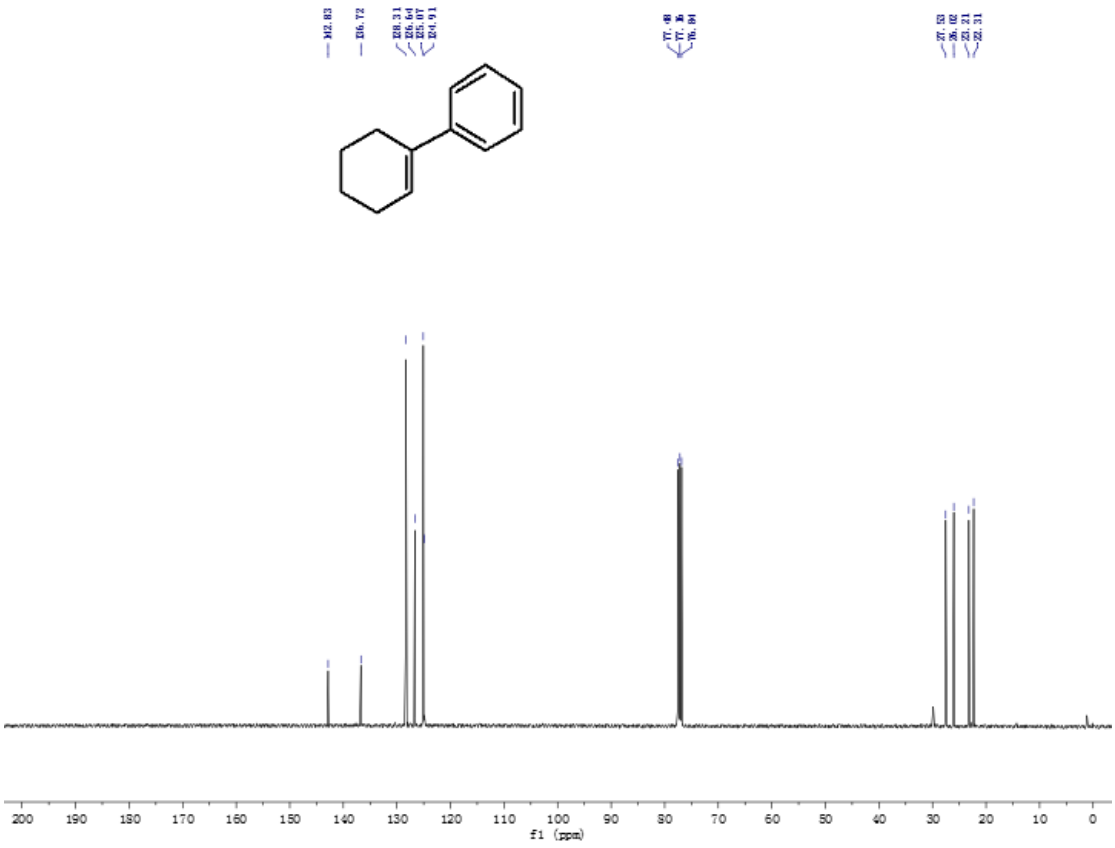
^{13}C NMR of **2s**



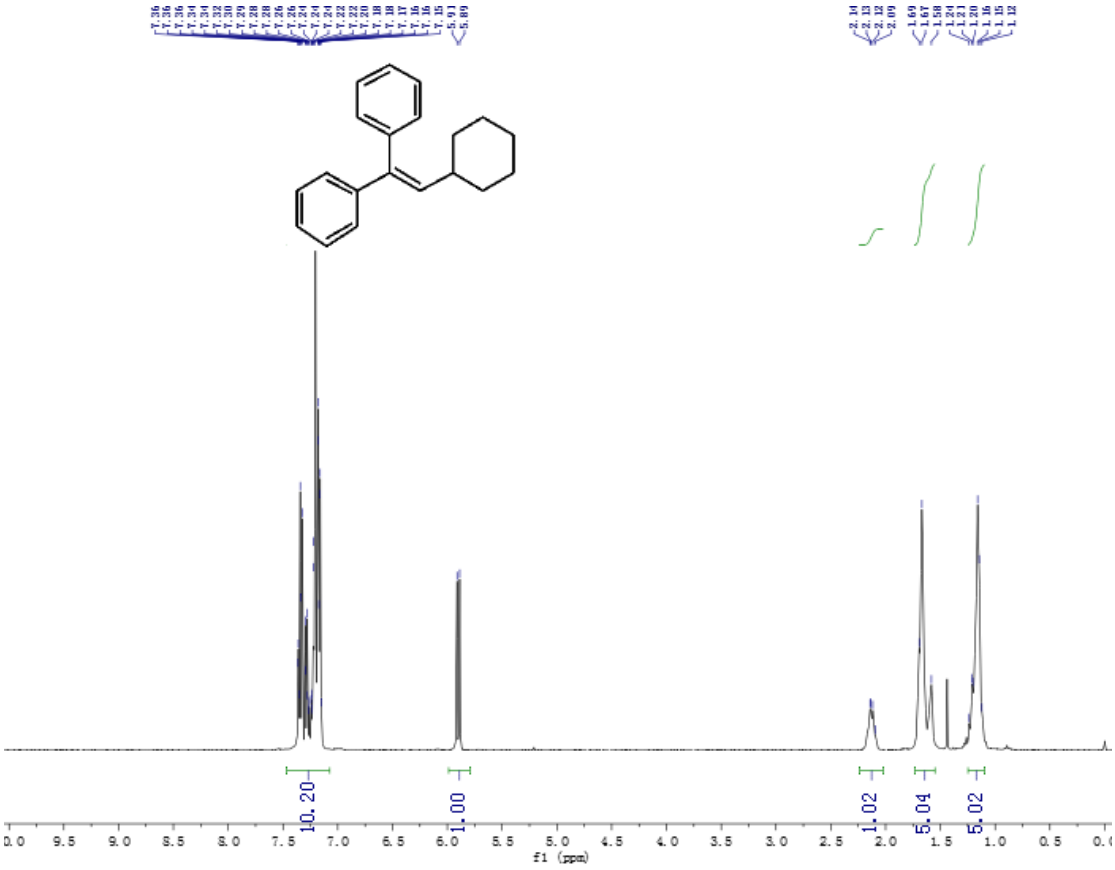
^{1}H NMR of **2t**



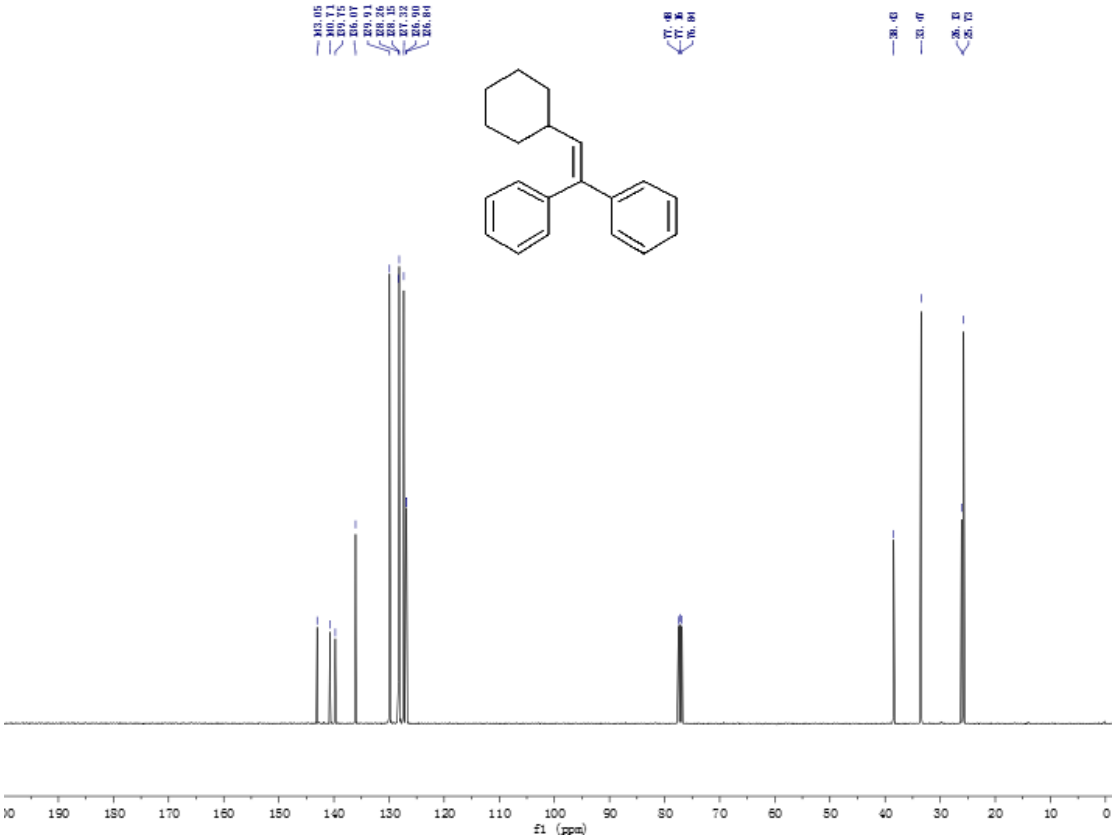
^{13}C NMR of **2t**



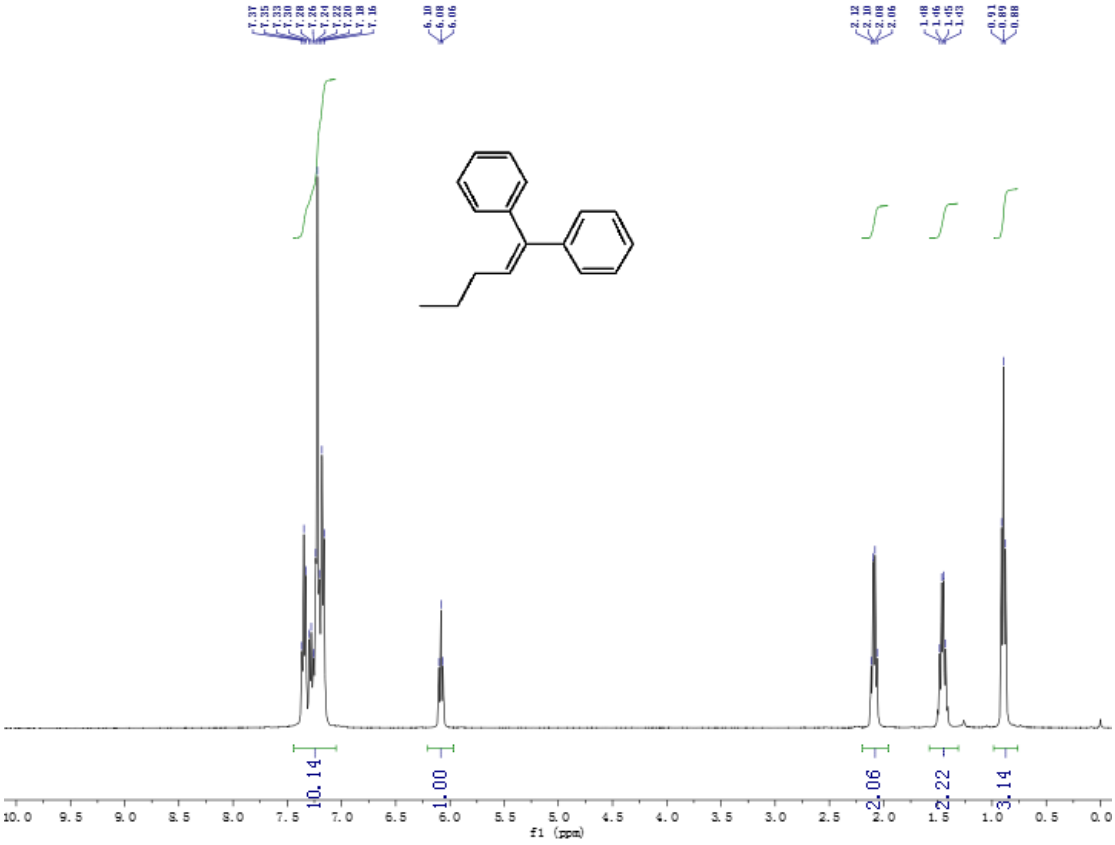
^{1}H NMR of **2u**



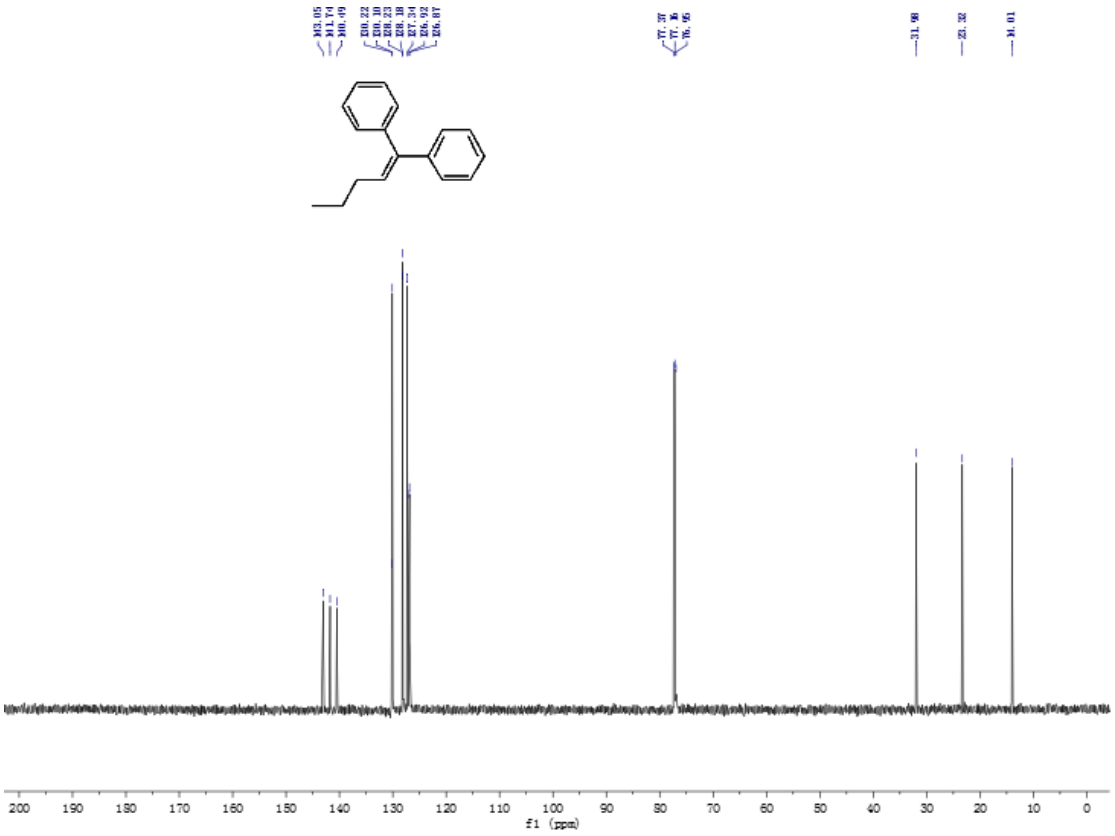
^{13}C NMR of **2u**



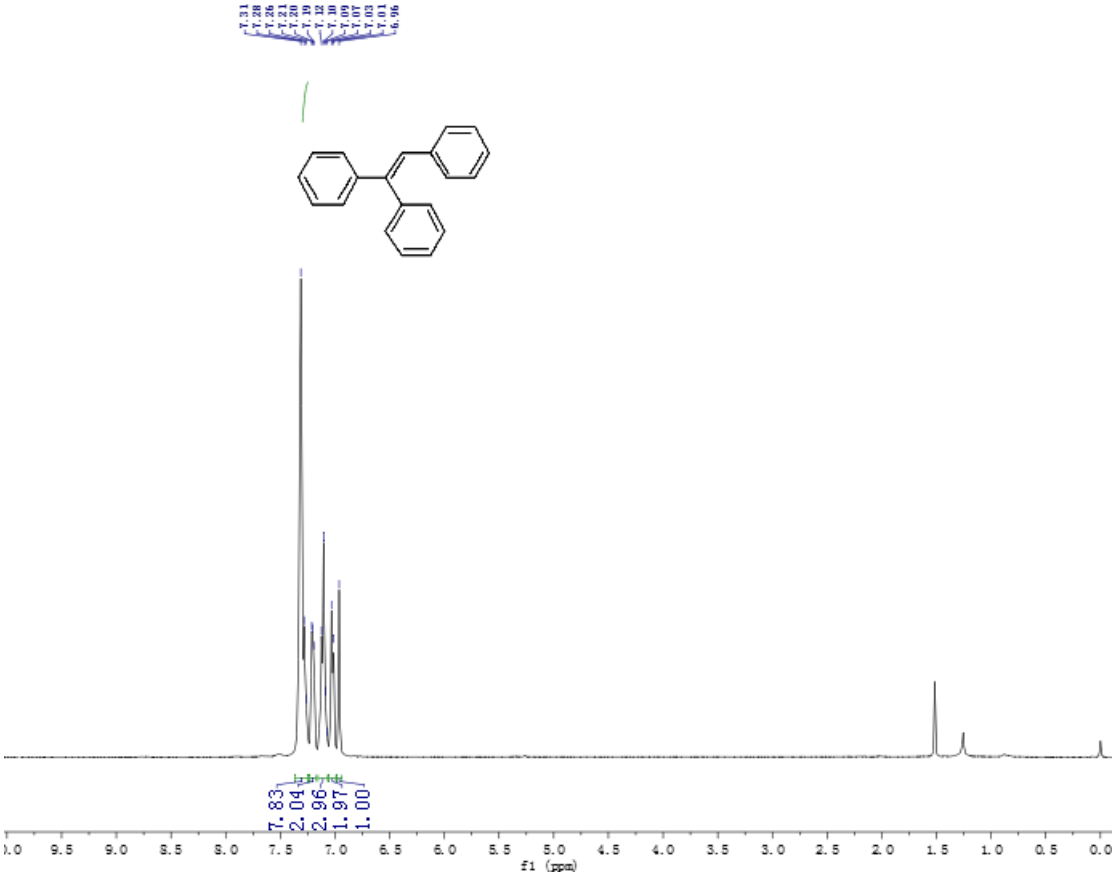
^{1}H NMR of **2v**



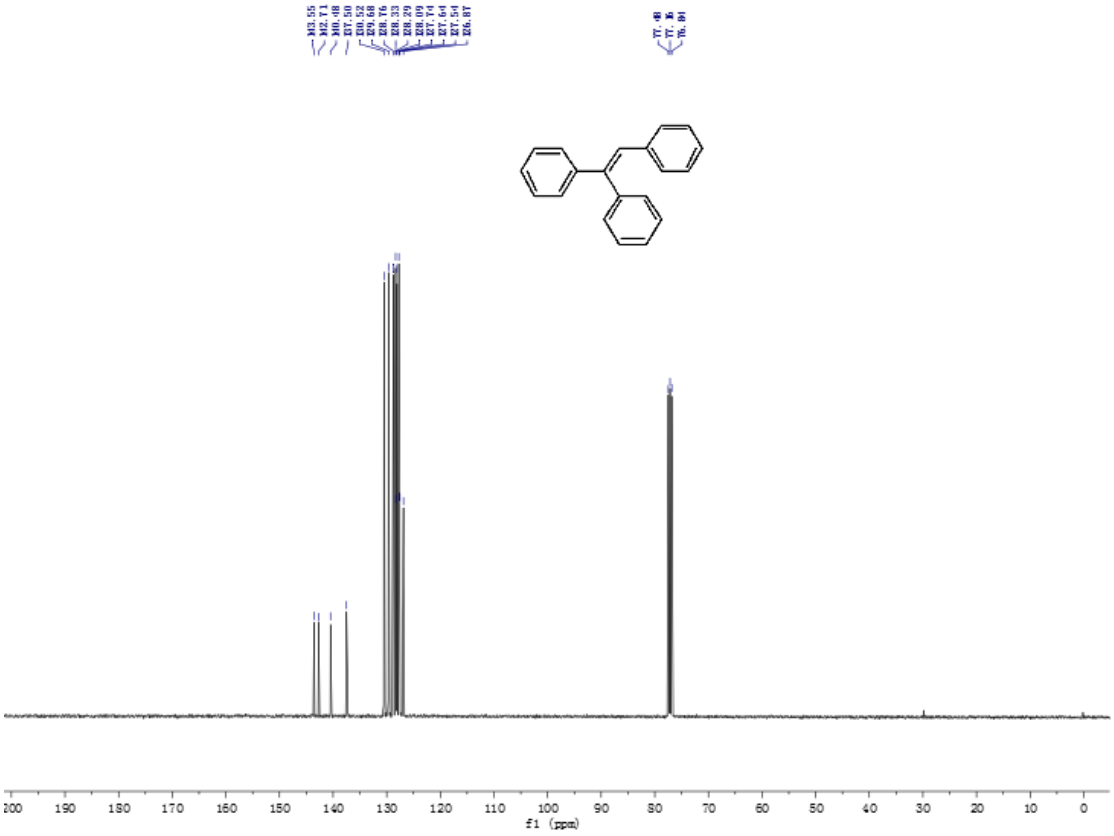
^{13}C NMR of **2v**



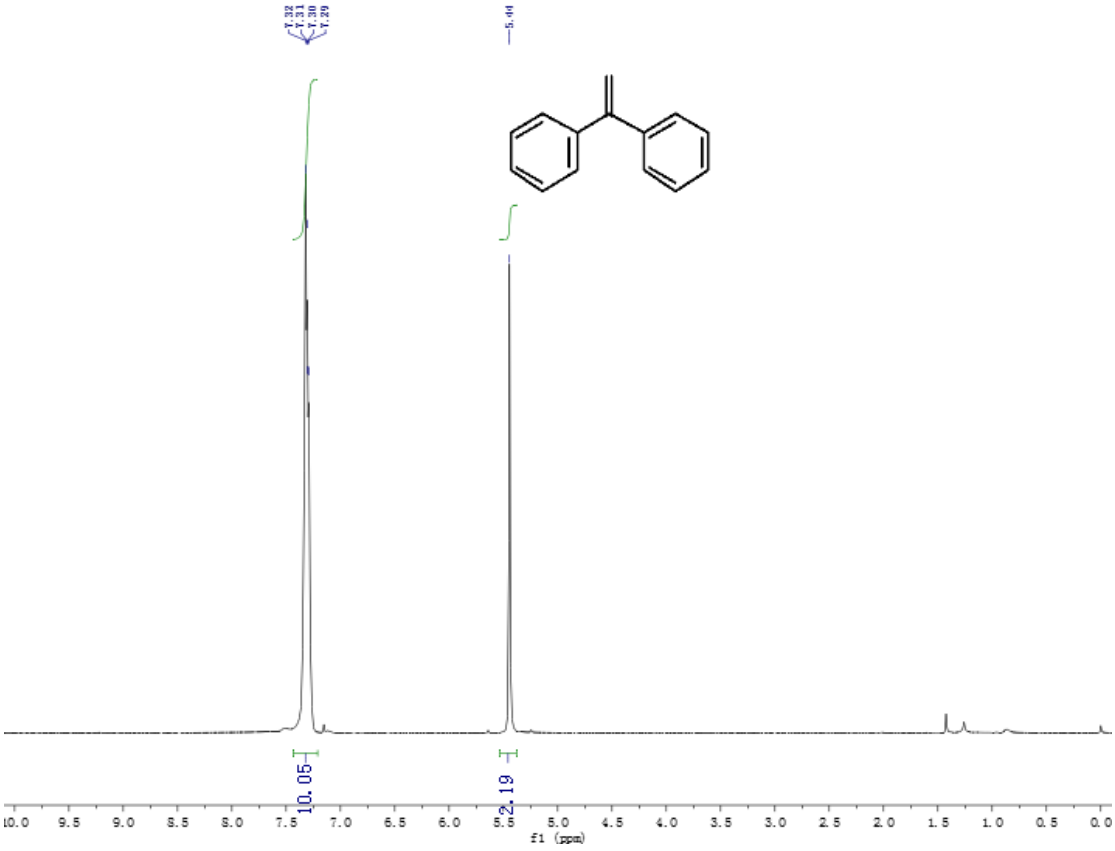
^{1}H NMR of **2w**



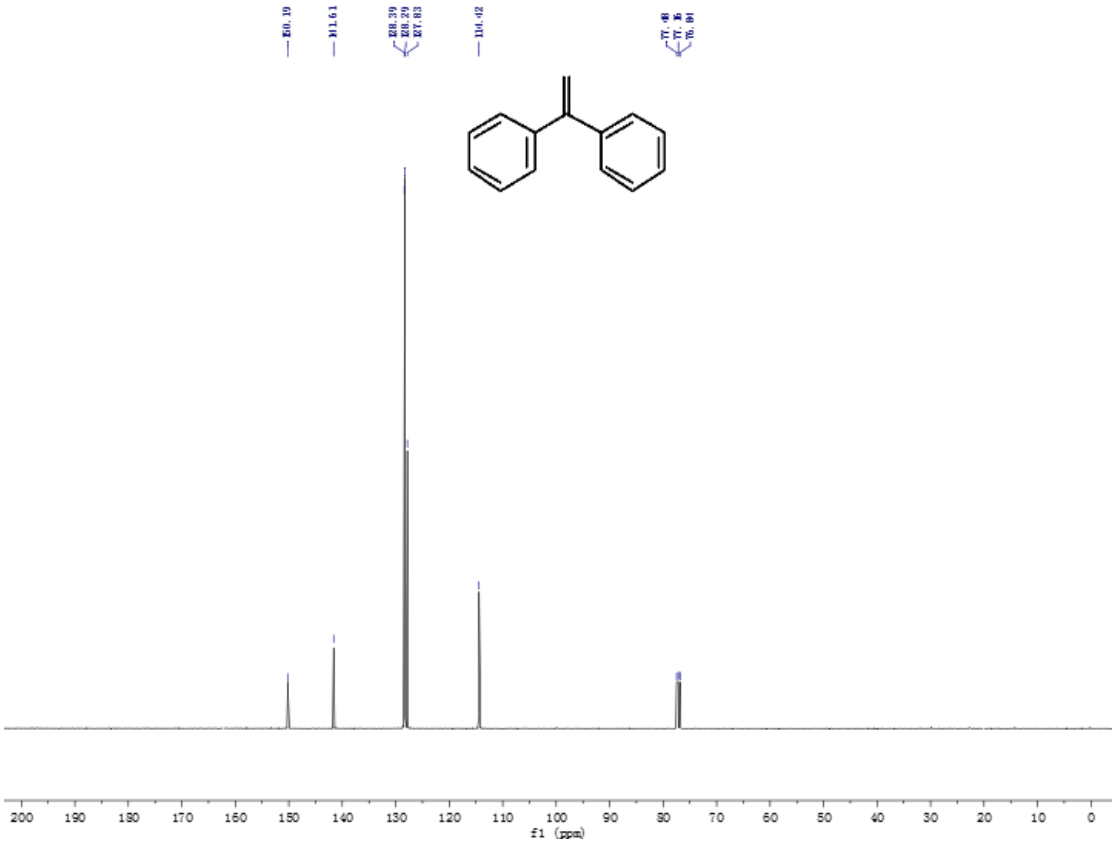
^{13}C NMR of **2w**



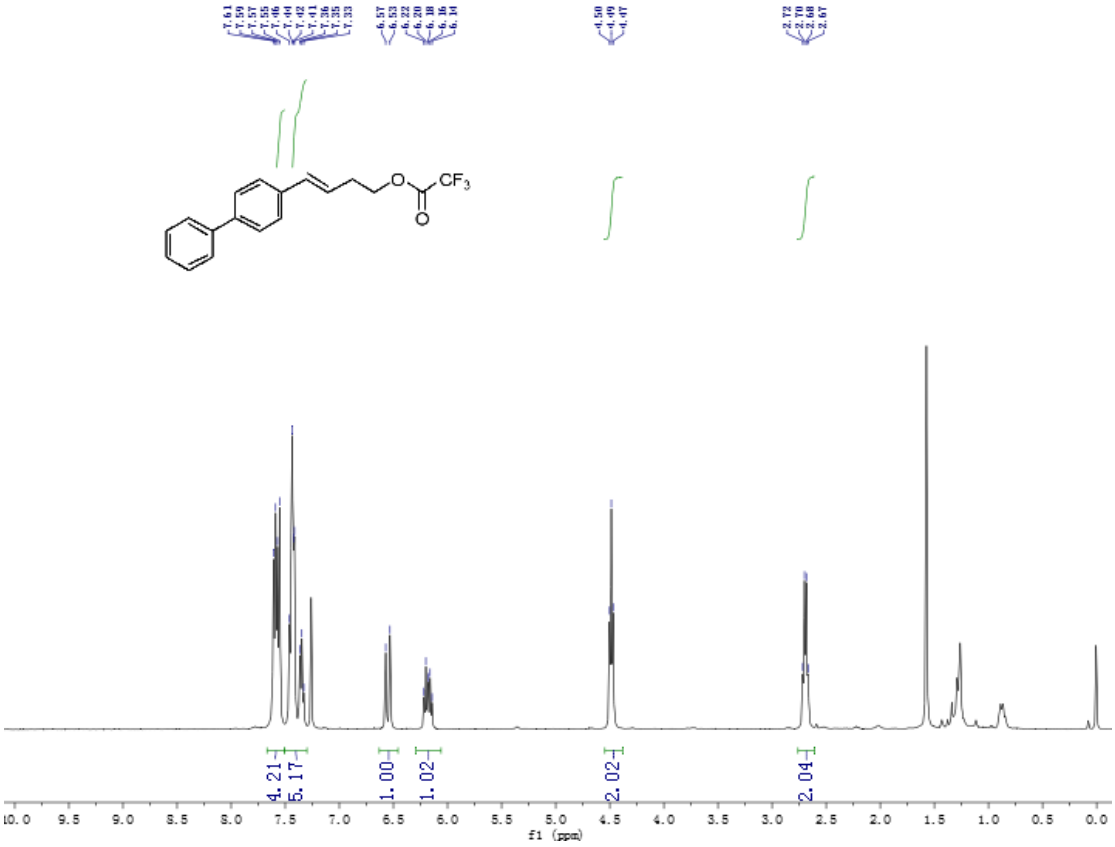
^{1}H NMR of **2x**



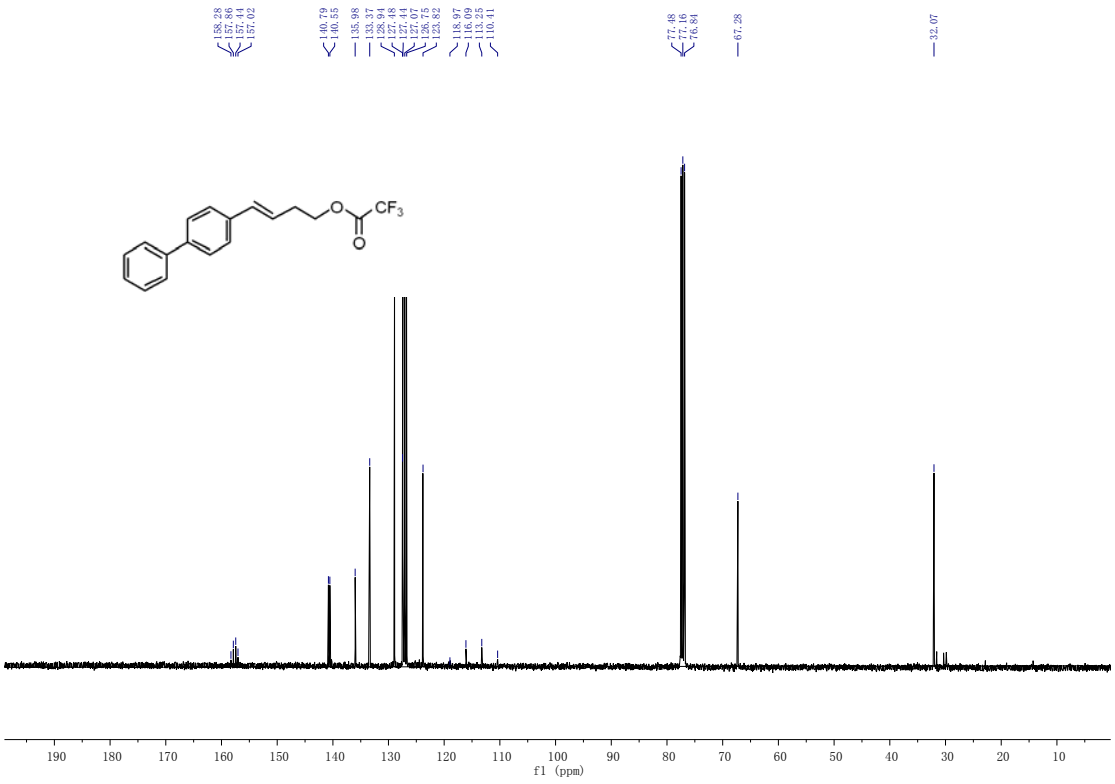
^{13}C NMR of **2x**



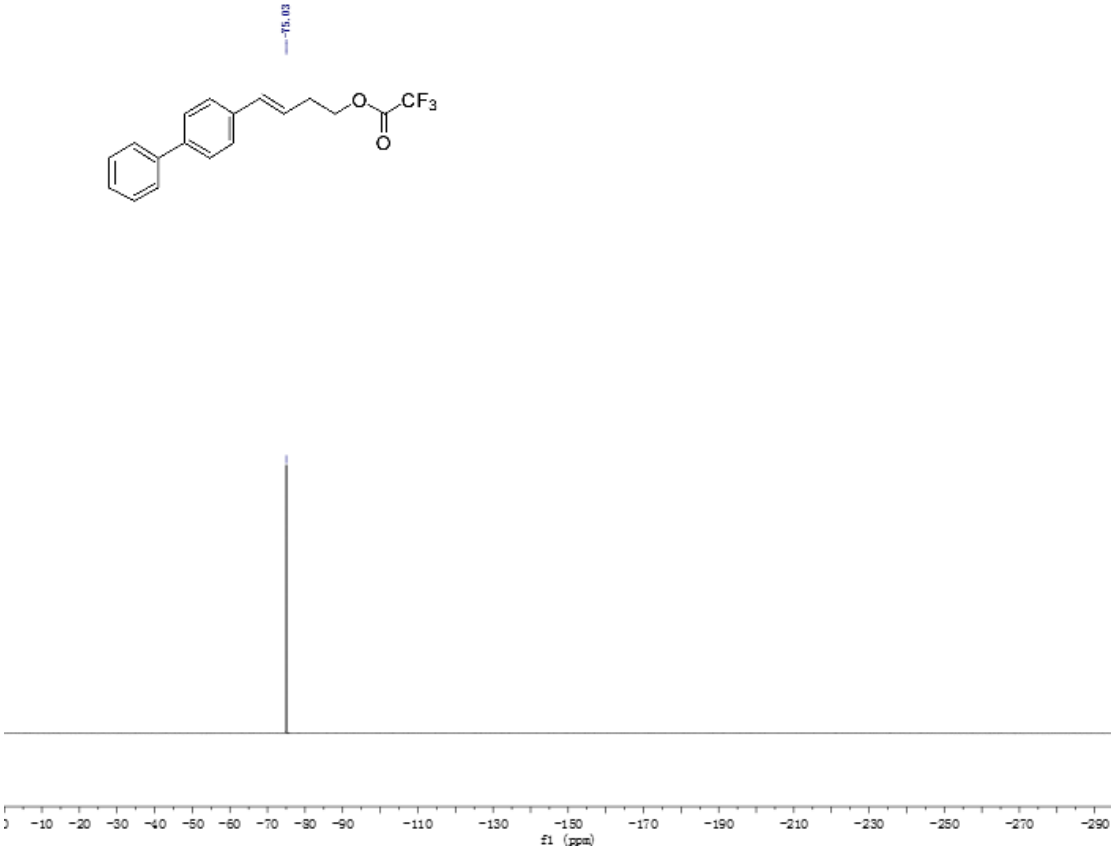
^{1}H NMR of **4**



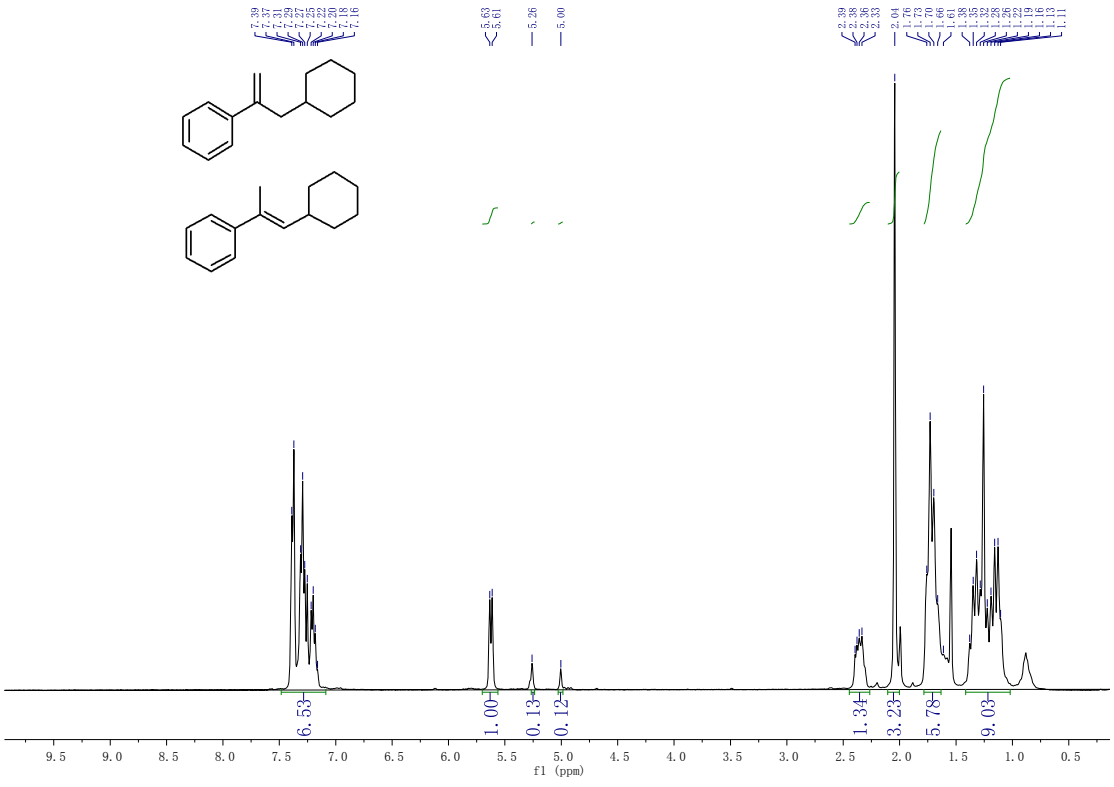
^{13}C NMR of **4**



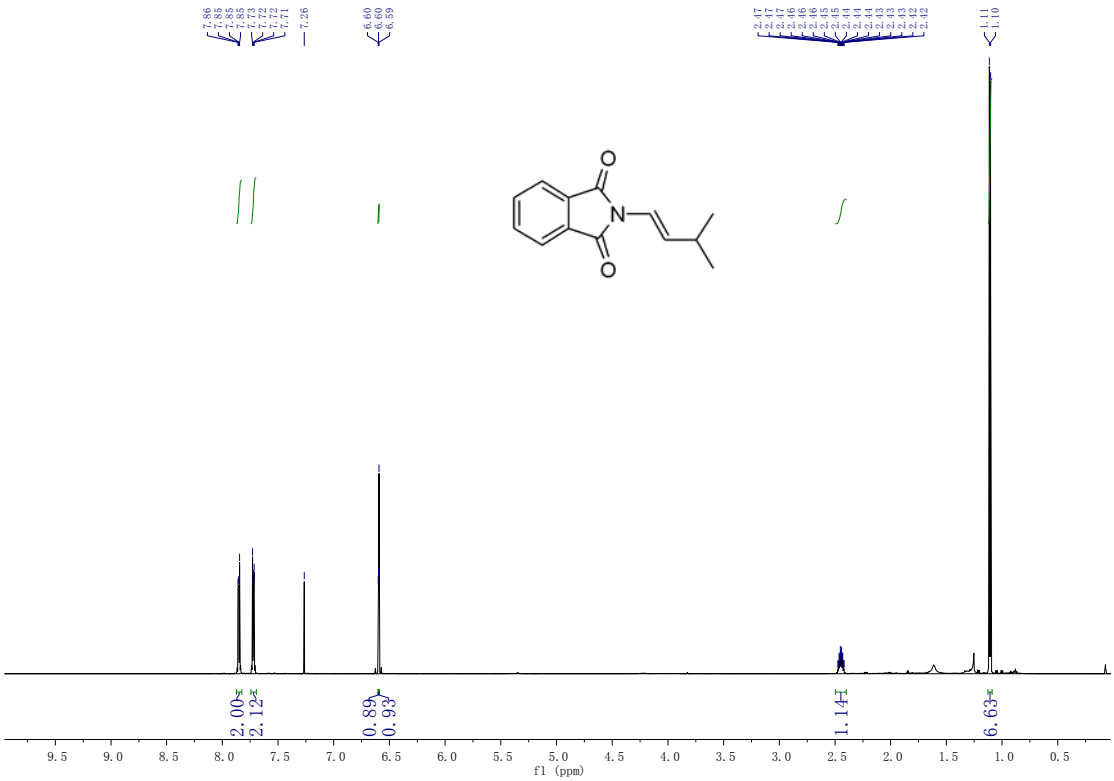
^{19}F NMR of **4**



^{1}H NMR of **6a/6b**



^{1}H NMR of **8**



^{13}C NMR of **8**