Supplementary Information for

# $K_2S_2O_8$-mediated regio- and stereo-selective thiocyanation of enamides with $NH_4SCN$

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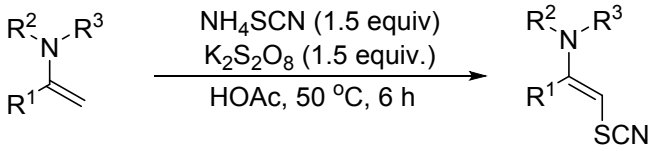
## 1. General Information

All $^{1}H$ NMR (400 MHz) and $^{13}C$ NMR (100 MHz) spectra were recorded in $CDCl_3$. TMS was used as an internal reference and *J* values are given in Hz. HR-MS were obtained on a Bruker micrOTOF-Q II spectrometer. PE is petroleum ether (60–90 $^{o}C$). All enamides (**1a-e**)[1] are known compounds. They were purchased directly or were prepared according to the reported procedures. Unless otherwise noted, materials obtained from commercial suppliers were used without further purification.

## 2. Preparation and characterizations of compounds 3aa-y, 4-9

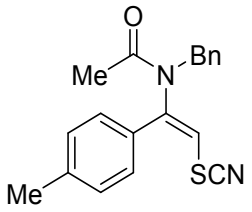
### 2.1 Preparation and characterizations of compounds 3aa-y



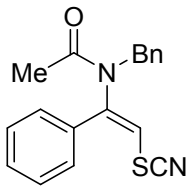

**1a-y** **3aa-y**

A mixture of enamides (**1a-y**) (0.3 mmol), $NH_4SCN$ (34.2 mg, 0.45 mmol, 1.5 equiv.) and $K_2S_2O_8$ (121.5 mg, 0.45 mmol, 1.5 equiv.) in HOAc (2 mL) was stirred at 50 °C for 6 h (monitored by TLC). After it was cooled down to room temperature, the reaction was quenched by the slow addition of a saturated solution of $Na_2CO_3$. The mixture was poured into water (15 mL) and was extracted with EtOAc (3 x 15 mL). The combined organic layers were washed with brine (2 x 15 mL) and dried over $MgSO_4$. The solvent was removed by vacuum and the residue was purified by column

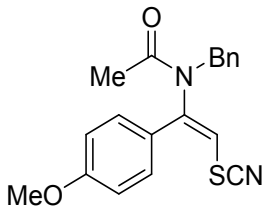
chromatography (10% EtOAc in PE) to give the corresponding products **3aa-y**.



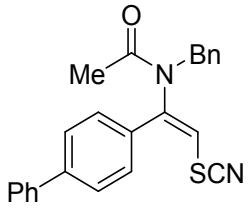

**(*E*)-*N*-benzyl-*N*-(2-thiocyanato-1-(*p*-tolyl)vinyl)acetamide** (**3aa**). 84.1 mg (87%); Yellow solid; mp 98-100 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.31-7.26 (m, 5H), 7.19-7.10 (m, 4H), 5.85 (s, 1H), 4.56 (s, 2H), 2.42 (s, 3H), 2.19 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.1, 145.7, 141.2, 136.5, 129.9, 129.3, 128.6, 128.5, 128.1, 127.7, 111.3, 109.6, 49.7, 22.4, 21.4. HRMS *m/z* (ESI) calcd. for $C_{19}H_{19}N_2OS$ $(M + H)^+$ 323.1213, found 323.1212.



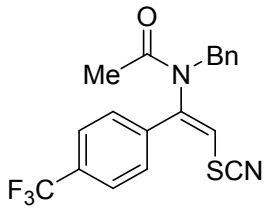

**(*E*)-*N*-benzyl-*N*-(1-phenyl-2-thiocyanatovinyl)acetamide** (**3ab**). 78.6 mg (85%); Yellow solid; mp 77-79 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.50-7.44 (m, 3H), 7.34-7.28 (m, 3H), 7.24-7.22 (m, 2H), 7.18-7.13 (m, 2H), 5.92 (s, 1H), 4.57 (s, 2H), 2.21 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.2, 145.5, 136.4, 132.2, 130.7, 129.3, 128.6, 128.5, 128.2, 127.8, 112.2, 109.4, 49.8, 22.4. HRMS *m/z* (ESI) calcd. for $C_{18}H_{17}N_2OS$ $(M + H)^+$ 309.1056, found 309.1056.



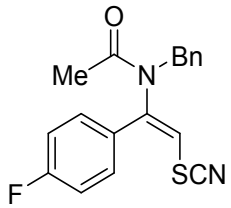

**(*E*)-*N*-benzyl-*N*-(1-(4-methoxyphenyl)-2-thiocyanatovinyl)acetamide** (**3ac**). 82.2 mg (81%); Yellow solid; mp 85-87 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.32-7.29 (m, 3H), 7.18-7.15 (m, 4H), 6.97 (d, *J* = 8.8 Hz, 2H), 5.80 (s, 1H), 4.57 (s, 2H), 3.87 (s, 3H), 2.19 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.2, 161.3, 145.7, 136.5, 129.9, 128.7, 128.6, 127.8, 124.2, 114.7, 110.1, 109.7, 55.4, 49.8, 22.4. HRMS *m/z* (ESI) calcd. for $C_{19}H_{19}N_2O_2S$ $(M + H)^+$ 339.1162, found 339.1161.



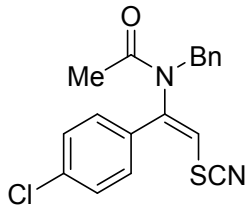

**(*E*)-*N*-(1-([1,1'-biphenyl]-4-yl)-2-thiocyanatovinyl)-*N*-benzylacetamide** (**3ad**). 88.7 mg (77%); Yellow solid; mp 119-121 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.69-7.67 (m, 2H), 7.63-7.61 (m, 2H), 7.50-7.46 (m, 2H), 7.42-7.38 (m, 1H), 7.32-7.26 (m, 5H), 7.20-7.17 (m, 2H), 5.93 (s, 1H), 4.61 (s, 2H), 2.22 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.1, 145.3, 143.5, 139.4, 136.5, 130.9, 128.9, 128.8, 128.7, 128.6, 128.1, 127.8, 127.8, 127.0, 112.1, 109.4, 49.9, 22.4. HRMS *m/z* (ESI) calcd. for $C_{24}H_{21}N_2OS$ $(M + H)^+$ 385.1369, found 385.1369.



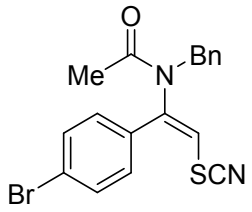

**(*E*)-*N*-benzyl-*N*-(2-thiocyanato-1-(4-(trifluoromethyl)phenyl)vinyl)acetamide** (**3ae**). 90.3 mg (80%); Yellow oil; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.73 (d, $J$ = 8.1 Hz, 2H), 7.37-7.30 (m, 5H), 7.16-7.13 (m, 2H), 6.06 (s, 1H), 4.59 (s, 2H), 2.21 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.5, 145.4, 139.1, 137.2, 131.1 (q, $J_{C-F}$ = 33 Hz), 129.0, 128.4, 127.5, 126.1 (2C), 126.0 (q, $J_{C-F}$ = 4 Hz), 123.8 (d, $J_{C-F}$ = 271 Hz), 116.7, 49.9, 22.0. HRMS *m/z* (ESI) calcd. for $C_{19}H_{16}F_3N_2OS$ $(M + H)^+$ 377.0930, found 377.0929.



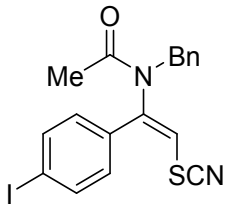

**(*E*)-*N*-benzyl-*N*-(1-(4-fluorophenyl)-2-thiocyanatovinyl)acetamide** (**3af**). 81.2 mg (83%); Yellow solid; mp 46-48 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.33-7.28 (m, 3H), 7.25-7.21 (m, 2H), 7.18-7.13 (m, 4H), 5.93 (s, 1H), 4.56 (s, 2H), 2.20 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.0, 163.6 (d, $J_{C-F}$ = 251 Hz), 144.9, 136.3, 130.4 (d, $J_{C-F}$ = 8 Hz), 128.7, 128.6, 128.3 (d, $J_{C-F}$ = 4 Hz), 127.9, 116.6 (d, $J_{C-F}$ = 22 Hz), 112.0, 109.1, 49.9, 22.4. HRMS *m/z* (ESI) calcd. for $C_{18}H_{16}FN_2OS$ $(M + H)^+$ 327.0962, found 327.0961.



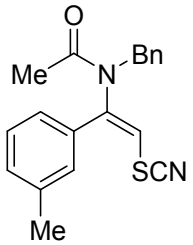

**(*E*)-*N*-benzyl-*N*-(1-(4-chlorophenyl)-2-thiocyanatovinyl)acetamide** (**3ag**). 82.1 mg (80%); Yellow solid; mp 90-92 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.45-7.43 (m, 2H), 7.32-7.29 (m, 3H), 7.18-7.13 (m, 4H), 5.95 (s, 1H), 4.57 (s, 2H), 2.19 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 167.0, 144.7, 136.8, 136.2, 130.7, 129.6, 129.5, 128.7, 128.6, 127.9, 112.6, 109.0, 49.9, 22.4. HRMS *m/z* (ESI) calcd. for $C_{18}H_{16}ClN_2OS$ $(M + H)^+$ 343.0666, found 343.0663.



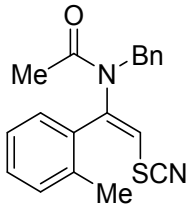

**(*E*)-*N*-benzyl-*N*-(1-(4-bromophenyl)-2-thiocyanatovinyl)acetamide** (**3ah**). 98.4 mg (85%); Yellow solid; mp 91-93 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.60 (d, $J$ = 8.3 Hz, 2H), 7.31-7.28 (m, 3H), 7.15 – 7.08 (m, 4H), 5.96 (s, 1H), 4.56 (s, 2H), 2.19 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.0, 144.6, 136.1, 132.5, 131.1, 129.7, 128.6, 128.5, 127.8, 125.0, 112.6, 108.9, 49.9, 22.4. HRMS *m/z* (ESI) calcd. for $C_{18}H_{16}BrN_2OS$ $(M + H)^+$ 387.0161, found 387.0161.



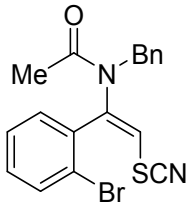

**(*E*)-*N*-benzyl-*N*-(1-(4-iodophenyl)-2-thiocyanatovinyl)acetamide** (**3ai**). 101.6 mg (78%); Yellow solid; mp 98-100 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.80 (d, *J* = 8.4 Hz, 2H), 7.33-7.28 (m, 3H), 7.15-7.13 (m, 2H), 6.96-6.94 (m, 2H), 5.95 (s, 1H), 4.56 (s, 2H), 2.18 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.0, 144.8, 138.5, 136.2, 131.7, 129.7, 128.7, 128.6, 127.9, 112.7, 109.0, 97.1, 49.9, 22.4. HRMS *m/z* (ESI) calcd. for $C_{18}H_{16}IN_2OS$ $(M + H)^+$ 435.0023, found 435.0022.



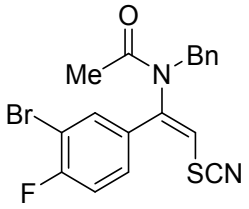

**(*E*)-*N*-benzyl-*N*-(2-thiocyanato-1-(*m*-tolyl)vinyl)acetamide** (**3aj**). 82.1 mg (85%); Yellow solid; mp 93-95 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.37-7.27 (m, 5H), 7.18-7.16 (m, 2H), 7.03-6.99 (m, 2H), 5.90 (s, 1H), 4.57 (s, 2H), 2.39 (s, 3H), 2.21 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.2, 145.6, 139.4, 136.5, 132.2, 131.5, 129.1, 128.7, 128.6, 128.5, 127.8, 125.5, 112.0, 109.6, 49.9, 22.4, 21.4. HRMS *m/z* (ESI) calcd. for $C_{19}H_{19}N_2OS$ $(M + H)^+$ 323.1213, found 323.1211.



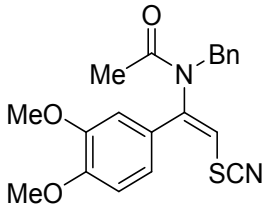

**(*E*)-*N*-benzyl-*N*-(2-thiocyanato-1-(*o*-tolyl)vinyl)acetamide** (**3ak**). 80.2 mg (83%); Yellow solid; mp 93-95 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.36 (t, *J* = 7.5 Hz, 1H), 7.32-7.22 (m, 5H), 7.09-7.02 (m, 3H), 6.13 (s, 1H), 4.50 (s, 2H), 2.35 (s, 3H), 2.18 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.3, 146.0, 137.0, 136.6, 131.4, 131.3, 130.5, 129.6, 128.6, 127.5, 127.4, 126.5, 110.7, 109.8, 49.5, 22.8, 19.4. HRMS *m/z* (ESI) calcd. for $C_{19}H_{19}N_2OS$ $(M + H)^+$ 323.1213, found 323.1216.




**(*E*)-N-benzyl-*N*-(1-(2-bromophenyl)-2-thiocyanatovinyl)acetamide** (**3al**). 77.8 mg (67%); Yellow oil; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.68-7.65 (m, 1H), 7.37-7.32 (m, 2H), 7.31-7.26 (m, 3H), 7.14-7.09 (m, 3H), 6.17 (s, 1H), 4.56 (s, 2H), 2.36 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.6, 146.2, 136.5, 134.0, 132.9, 131.9, 131.8, 128.6, 127.9, 127.7, 127.5, 122.9, 111.6, 109.6, 50.1, 22.9. HRMS *m/z* (ESI) calcd. for $C_{18}H_{16}BrN_2OS$ $(M + H)^+$ 387.0161, found 387.0165.

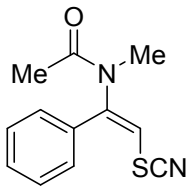



**(*E*)-*N*-benzyl-*N*-(1-(3-bromo-4-fluorophenyl)-2-thiocyanatovinyl)acetamide** (**3am**). 94.5 mg (78%); White solid; mp 144-146 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.40–7.30 (m, 4H), 7.23-7.13 (m, 4H), 5.99 (s, 1H), 4.58 (s, 2H), 2.21 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.0, 160.1 (d, $J_{C-F}$ = 253 Hz), 143.6, 136.1, 133.4, 129.9 (d, $J_{C-F}$ = 4 Hz), 129.3 (d, $J_{C-F}$ = 8 Hz), 128.8, 128.6, 128.1, 117.4 (d, $J_{C-F}$ = 23 Hz), 113.2, 110.5 (d, $J_{C-F}$ = 21 Hz), 108.7, 50.2, 22.5. HRMS *m/z* (ESI) calcd. for $C_{18}H_{15}BrFN_2OS$ $(M + H)^+$ 405.0067, found 405.0067.

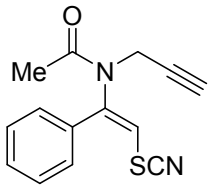



**(*E*)-*N*-benzyl-*N*-(1-(3,4-dimethoxyphenyl)-2-thiocyanatovinyl)acetamide** (**3an**). 82.8 mg (75%); Yellow solid; mp 129-131℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.32-7.27 (m, 3H), 7.20-7.18 (m, 2H), 6.92 (d, *J* = 8.3 Hz, 1H), 6.81 (dd, *J* = 8.3, 2.1 Hz, 1H), 6.57 (d, *J* = 2.1 Hz, 1H), 5.88 (s, 1H), 4.63 (s, 2H), 3.94 (s, 3H), 3.80 (s, 3H), 2.17 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.3, 150.9, 149.5, 145.8, 136.6, 128.8, 128.6 (2C), 127.8, 124.7, 121.8, 111.1, 110.3, 109.7, 56.0 (2C), 50.3, 22.6. HRMS *m/z* (ESI) calcd. for $C_{20}H_{21}N_2O_3S$ $(M + H)^+$ 369.1267,

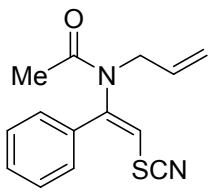
found 369.1267.



**(*E*)-*N*-methyl-*N*-(1-phenyl-2-thiocyanatovinyl)acetamide** (**3ao**). 59.2 mg (85%); Brown solid; mp 102-104 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.49-7.48 (m, 3H), 7.31-7.29 (m, 2H), 6.27 (s, 1H), 3.03 (s, 3H), 2.13 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.5, 147.6, 132.5, 130.7, 129.3, 128.1, 110.5, 109.6, 35.6, 22.2. HRMS *m/z* (ESI) calcd. for $C_{12}H_{13}N_2OS$ $(M + H)^+$ 233.0743, found 233.0743.

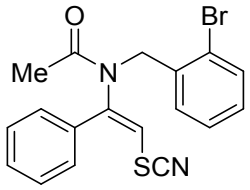


**(*E*)-*N*-(1-phenyl-2-thiocyanatovinyl)-*N*-(prop-2-yn-1-yl)acetamide** (**3ap**). 63.8 mg (83%); Yellow oil; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.49-7.47 (m, 3H), 7.34-7.32 (m, 2H), 6.43 (s, 1H), 4.25 (d, *J* = 2.4 Hz, 2H), 2.30 (t, *J* = 2.5 Hz, 1H), 2.14 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 169.7, 144.7, 132.1, 130.8, 129.3, 128.1, 112.7, 109.5, 77.9, 72.9, 36.4, 22.3. HRMS *m/z* (ESI) calcd. for $C_{14}H_{13}N_2OS$ $(M + H)^+$ 257.0743, found 257.0743.

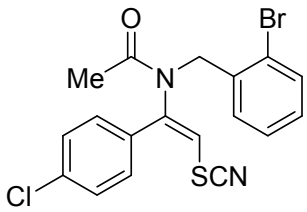


**(*E*)-*N*-allyl-*N*-(1-phenyl-2-thiocyanatovinyl)acetamide** (**3aq**). 62.7 mg

(81%); Yellow solid; mp 59-61 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.48-7.47 (m, 3H), 7.31-7.26 (m, 2H), 6.24 (s, 1H), 5.79 (ddt, *J* = 16.6, 10.1, 6.3 Hz, 1H), 5.18 (d, *J* = 10.1 Hz, 1H), 5.05 (d, *J* = 17.2 Hz, 1H), 4.02 (d, *J* = 6.2 Hz, 2H), 2.16 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 169.9, 145.9, 132.5, 132.2, 130.6, 129.2, 128.1, 118.8, 111.6, 109.6, 49.7, 22.4. HRMS *m/z* (ESI) calcd. for $C_{14}H_{15}N_2OS$ $(M + H)^+$ 259.0900, found 259.0900.

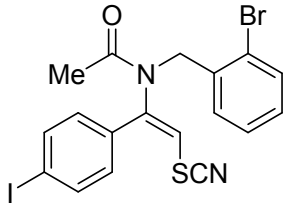



**(*E*)-*N*-(2-bromobenzyl)-*N*-(1-phenyl-2-thiocyanatovinyl)acetamide** (**3ar**). 84.5 mg (73%); Yellow solid; mp 140-142 ℃; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.54-7.44 (m, 4H), 7.27-7.25 (m, 1H), 7.21-7.14 (m, 4H), 6.09 (s, 1H), 4.77 (s, 2H), 2.23 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.4, 145.2, 135.5, 133.0, 132.2, 130.8, 130.7, 129.5, 129.2, 128.2, 127.7, 123.9, 112.8, 109.5, 49.8, 22.4. HRMS *m/z* (ESI) calcd. for $C_{18}H_{16}BrN_2OS$ $(M + H)^+$ 387.0161, found 387.0161.

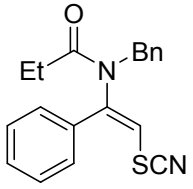



**(*E*)-*N*-(2-bromobenzyl)-*N*-(1-(4-chlorophenyl)-2-thiocyanatovinyl)acetamide** (**3as**). 84.4 mg (67%); Yellow solid; m.p. 141-143 °C; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.52 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.44-7.41 (m, 2H), 7.27-7.20 (m, 2H), 7.18-7.13 (m, 3H), 6.12 (s, 1H), 4.76

(s, 2H), 2.21 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.2, 144.2, 136.7, 135.3, 133.0, 130.8, 130.6, 129.5, 129.5, 127.7, 123.9, 113.3, 109.0, 76.7, 49.8, 22.3. HRMS *m/z* (ESI) calcd. for $C_{18}H_{15}BrClN_2OS$ $(M + H)^+$ 420.9772, found 420.9775.

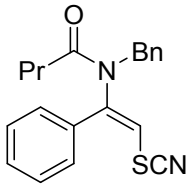



**(*E*)-*N*-(2-bromobenzyl)-*N*-(1-(4-iodophenyl)-2-thiocyanatovinyl)acetamide** (**3at**). 106.0 mg (69%); Yellow solid; m.p. 150-152 °C; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.81-7.77 (m, 2H), 7.53 (d, *J* = 7.9 Hz, 1H), 7.29-7.25 (m, 1H), 7.22-7.14 (m, 2H), 6.95-6.91 (m, 2H), 6.11 (s, 1H), 4.76 (s, 2H), 2.20 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.2, 144.3, 138.4, 135.3, 133.0, 131.7, 130.8, 129.7, 129.6, 127.7, 123.9, 113.4, 109.0, 97.1, 49.8, 22.4. HRMS *m/z* (ESI) calcd. for $C_{18}H_{15}BrIN_2OS$ $(M + H)^+$ 512.9128, found 512.9125.

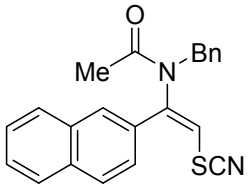



**(*E*)-*N*-benzyl-*N*-(1-phenyl-2-thiocyanatovinyl)propionamide** (**3au**). 79.2 mg (82%); Yellow oil; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.48-7.46 (m, 3H), 7.32-7.30 (m, 3H), 7.23-7.21 (m, 2H), 7.19-7.17 (m, 2H), 5.91 (s, 1H), 4.58 (s, 2H), 2.44 (q, *J* = 7.4 Hz, 2H), 1.20 (t, *J* = 7.4 Hz, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 173.8, 145.3, 136.7, 132.5, 130.8, 129.4, 128.8,

128.7, 128.3, 127.9, 112.1, 109.6, 50.2, 27.7, 10.0. HRMS *m/z* (ESI) calcd. for $C_{19}H_{19}N_2OS$ $(M + H)^+$ 323.1213, found 323.1212.

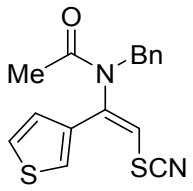



**(*E*)-*N*-benzyl-*N*-(1-phenyl-2-thiocyanatovinyl)butyramide** (**3av**). 88.7 (88%); Yellow oil; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.48-7.46 (m, 3H), 7.34-7.28 (m, 3H), 7.24-7.21 (m, 2H), 7.18-7.16 (m, 2H), 5.88 (s, 1H), 4.58 (s, 2H), 2.40 (t, *J* = 7.4 Hz, 2H), 1.74 (q, *J* = 7.3 Hz, 2H), 0.96 (t, *J* = 7.4 Hz, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 172.9, 145.3, 136.7, 132.4, 130.7, 129.3, 128.7, 128.6, 128.2, 127.8, 111.9, 109.5, 50.0, 36.1, 19.1, 13.9. HRMS *m/z* (ESI) calcd. for $C_{20}H_{21}N_2OS$ $(M + H)^+$ 337.1369, found 337.1369.

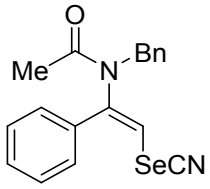



**(*E*)-*N*-benzyl-*N*-(1-(naphthalen-2-yl)-2-thiocyanatovinyl)acetamide** (**3aw**). 82.7 mg (77%); Yellow oil; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.94 (d, *J* = 8.6 Hz, 1H), 7.91-7.85 (m, 2H), 7.67 (d, *J* = 1.8 Hz, 1H), 7.63-7.58 (m, 2H), 7.34-7.29 (m, 4H), 7.20-7.17 (m, 2H), 6.01 (s, 1H), 4.62 (s, 2H), 2.26 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.3, 145.6, 136.5, 133.9, 132.8, 129.6, 129.5, 128.6, 128.7 (2C), 128.4, 127.9, 127.8 (2C), 127.3, 124.2, 112.5, 109.5, 50.0, 22.6. HRMS *m/z* (ESI) calcd. for $C_{22}H_{19}N_2OS$ $(M + H)^+$

359.1213, found 359.1212.

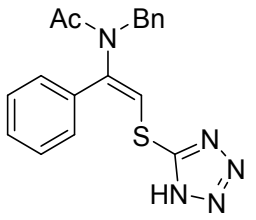



**(*E*)-*N*-benzyl-*N*-(2-thiocyanato-1-(thiophen-3-yl)vinyl)acetamide** (**3ax**). 78.2 mg (83%); Yellow solid; m.p. 60-62 °C; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.45 (dd, *J* = 5.1, 2.9 Hz, 1H), 7.37-7.36 (m, 1H), 7.34-7.29 (m, 3H), 7.21-7.19 (m, 2H), 7.07 (d, *J* = 5.0 Hz, 1H), 5.84 (s, 1H), 4.64 (s, 2H), 2.13 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 169.9, 140.4, 136.5, 134.1, 128.8, 128.6, 127.9, 127.8, 127.7, 126.3, 112.0, 109.1, 50.3, 22.2. HRMS *m/z* (ESI) calcd. for $C_{16}H_{15}N_2OS_2$ $(M + H)^+$ 315.0620, found 315.0620.




**(*E*)-*N*-benzyl-*N*-(1-phenyl-2-selenocyanatovinyl)acetamide** (**3ay**). 91.9 mg (86%); Yellow solid; m.p. 68-70 °C; **$^1$H NMR (400MHz, $CDCl_3$)** δ 7.50-7.46 (m, 3H), 7.34-7.28 (m, 3H), 7.18-7.14 (m, 4H), 6.26 (s, 1H), 4.58 (s, 2H), 2.21 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$)** δ 170.2, 145.4, 136.5, 133.7, 130.8, 129.6, 128.6 (2C), 127.8, 127.5, 111.0, 100.2, 49.9, 22.4. HRMS *m/z* (ESI) calcd. for $C_{18}H_{17}N_2OSe$ $(M + H)^+$ 357.0501, found 357.0500.

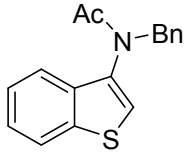
**2.2 Preparation and characterizations of compounds 4-9**




**4**

Preparation of product **4** from **3ab**: Compound **3ab** (154.2 mg, 0.5 mmol), $ZnBr_2$ (112.6 mg, 0.5 mmol, 1 equiv.) and $NaN_3$ (81.3 mg, 1.25 mmol, 2.5 equiv.) were combined in a mixed solvent [$H_2O$/*i*PrOH (1:1, 3 mL)] and refluxed for 12 h. Upon completion of the reaction, the mixture was diluted with EtOAc. The solvent was then removed under vacuo. Column chromatography of the residue (petroleum ether/EtOAc, 1:1) provided tetrazole **4** as yellow solid in 133.4 mg (76%); m.p. 141-143 $^oC$;

***E*-*N*-(2-((1*H*-tetrazol-5-yl)thio)-1-phenylvinyl)-*N*-benzylacetamide (4)**. **$^1$H NMR (400MHz, DMSO-$d_6$) δ** 7.58-7.54 (m, 2H), 7.49-7.42 (m, 3H), 7.35-7.21 (m, 3H), 7.22-7.21 (m, 2H), 6.83 (s, 1H), 4.51 (s, 2H), 2.21 (s, 3H). **$^{13}$C NMR (100 MHz, DMSO-$d_6$) δ** 170.5, 154.1, 137.5, 134.6, 134.3, 129.1, 129.0, 128.5, 128.4, 127.8, 127.3, 126.0, 49.2, 22.2. HRMS m/z (ESI) calcd. for $C_{18}H_{18}N_5OS$ $(M + H)^+$ 352.1227, found 352.1225.

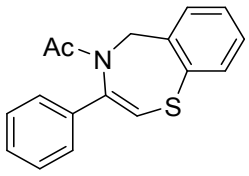



**5**

Preparation of product **5** from **3al**: To a mixture of $Pd(OAc)_2$ (5.6 mg, 0.025 mmol, 5 mol%), $PPh_3$ (13.1 mg, 0.05 mmol, 10 mol%), and $Cs_2CO_3$ (325.8 mg, 1 mmol, 2 equiv.) was added a solution of **3al** (193.6 mg, 0.5

mmol) in 2 mL DMF under nitrogen atmosphere. After stirring at 100 °C overnight, the reaction mixture was quenched with water, extracted with EtOAc, washed with brine. The combined organic layers were dried over anhydrous $Na_2SO_4$ and evaporated in vacuo. The residue was purified by column chromatography over silica gel (petroleum ether/EtOAc, 10:1). The product of **5** was isolated as yellow oil in 45% yield (63.2 mg);

***N*-(benzo[*b*]thiophen-3-yl)-*N*-benzylacetamide** (**5**). **$^1$H NMR (400MHz, $CDCl_3$) δ** 7.87-7.81 (m, 1H), 7.54-7.48 (m, 1H), 7.43-7.37 (m, 2H), 7.27-7.20 (m, 5H), 6.93 (s, 1H), 5.51 (d, *J* = 14.1 Hz, 1H), 4.27 (d, *J* = 14.1 Hz, 1H), 1.89 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$) δ** 171.1, 138.6, 137.6, 135.1, 134.9, 128.9, 128.4, 127.5, 125.2, 124.9, 124.2, 123.3, 120.7, 51.4, 22.0. HRMS m/z (ESI) calcd. for $C_{17}H_{16}NOS$ $(M + H)^+$ 282.0947, found 282.0945.

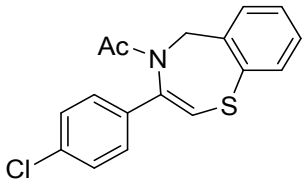



**6**

Preparation of product **6** from **3ar**: To a mixture of $Pd(OAc)_2$ (5.6 mg, 0.025 mmol, 5 mol%), $PPh_3$ (13.1 mg, 0.05 mmol, 10 mol%), and $Cs_2CO_3$ (325.8 mg, 1 mmol, 2 equiv.) was added a solution of **3ar** (193 mg, 0.5 mmol) in 2 mL DMF under nitrogen atmosphere. After stirring at 100 °C overnight, the reaction mixture was quenched with water, extracted with EtOAc, washed with brine. The combined organic layers were dried over

anhydrous $Na_2SO_4$ and evaporated in vacuo. The residue was purified by column chromatography over silica gel (petroleum ether/EtOAc, 10:1). The product of **6** was isolated as yellow solid in 36% yield (50.6 mg); m.p. 86-88 $^oC$;

**1-(3-phenylbenzo[*f*][1,4]thiazepin-4(5*H*)-yl)ethan-1-one (6)**. **$^1$H NMR (400MHz, $CDCl_3$) δ** 7.49-7.46 (m, 1H), 7.39-7.33 (m, 4H), 7.31-7.26 (m, 2H), 7.20-7.15 (m, 2H), 6.07 (s, 1H), 4.84 (s, 2H), 1.64 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$) δ** 170.9, 141.6, 139.0, 138.5, 132.6, 131.4, 129.1, 128.0, 127.7 (2C), 126.1, 124.5, 113.8, 53.1, 23.9. HRMS m/z (ESI) calcd. for $C_{17}H_{16}NOS$ $(M + H)^+$ 282.0947, found 282.0943.

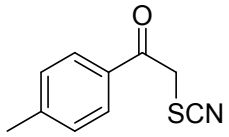



**7**

Preparation of product **7** from **3as**: To a mixture of $Pd(OAc)_2$ (5.6 mg, 0.025 mmol, 5 mol%), $PPh_3$ (13.1 mg, 0.05 mmol, 10 mol%), and $Cs_2CO_3$ (325.8 mg, 1 mmol, 2 equiv.) was added a solution of **3as** (210.0 mg, 0.5 mmol) in 2 mL DMF under nitrogen atmosphere. After stirring at 100 °C overnight, the reaction mixture was quenched with water, extracted with EtOAc, washed with brine. The combined organic layers were dried over anhydrous $Na_2SO_4$ and evaporated in vacuo. The residue was purified by column chromatography over silica gel (petroleum ether/EtOAc, 10:1). The product of **7** was isolated as yellow solid in 33% yield (52.0 mg); m.p.

90-92 °C;

**1-(3-(4-chlorophenyl)benzo[*f*][1,4]thiazepin-4(5*H*)-yl)ethan-1-one (7)**. **$^1$H NMR (400MHz, $CDCl_3$) δ** 7.49-7.45 (m, 1H), 7.36-7.31 (m, 2H), 7.30-7.25 (m, 3H), 7.21-7.16 (m, 2H), 6.06 (s, 1H), 4.82 (s, 2H), 1.64 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$) δ** 170.7, 140.3, 138.4, 137.6, 133.7, 132.3, 131.4, 129.3, 127.8, 127.7, 126.2, 125.7, 114.5, 53.1, 23.9. HRMS m/z (ESI) calcd. for $C_{17}H_{15}ClNOS$ $(M + H)^+$ 316.0557, found 316.0554.

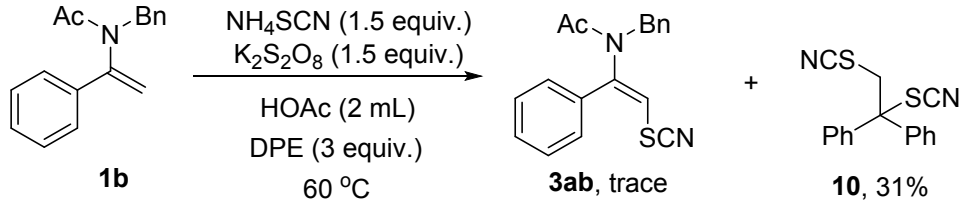



**9**

Preparation of product **9** from **3aa**: To a solution of **3aa** (161.0 mg, 0.5 mmol) in a mixed solvent of THF/$H_2O$ (1:1, 2.0 mL) was added concentrated hydrochloric acid (1 mL), and the vial was heated at 50 °C for 24 h. Upon completion of the reaction, the mixture was diluted with EtOAc. The solvent was then removed under vacuo. The residue was purified by column chromatography over silica gel (petroleum ether/EtOAc, 20:1). The product of **9** was isolated as yellow solid in 81% yield (77.4 mg);

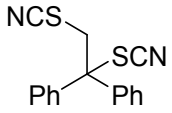
**2-thiocyanato-1-(*p*-tolyl)ethan-1-one (9)**.[2] **$^1$H NMR (400MHz, $CDCl_3$) δ** 7.84 (d, $J$ = 8.2 Hz, 2H), 7.32 (d, $J$ = 8.0 Hz, 2H), 4.73 (s, 2H), 2.45 (s, 3H). **$^{13}$C NMR (100 MHz, $CDCl_3$) δ** 190.4, 146.0, 131.4, 129.8, 128.5, 112.0, 43.0, 21.8.

## 3. Preliminary Mechanistic Studies




**1b** **3ab**, trace **10**, 31%

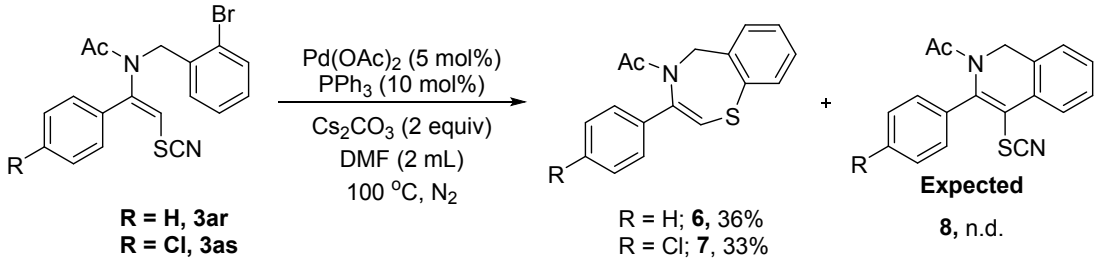
To a solution of enamides **1b** (75.4 mg, 0.30 mmol), $NH_4SCN$ (34.3 mg, 0.45 mmol, 1.5 equiv.), $K_2S_2O_8$ (121.6 mg, 0.45 mmol, 1.5 equiv.) in HOAc (2 mL) was added DPE (162.2 mg, 0.6 mmol, 3 equiv.). The vial was sealed with a septum and allowed to stir at 50 °C for 6 h. Upon completion of the reaction, the mixture was diluted with EtOAc. The solvent was then removed under vacuo. The residue was purified by column chromatography over silica gel (petroleum ether/EtOAc, 3:1). The adduct product **10** of DPE and SCN radical was isolated as yellow oil in 31% yield (55.1 mg). Trace amount of corresponding **3ab** was detected.



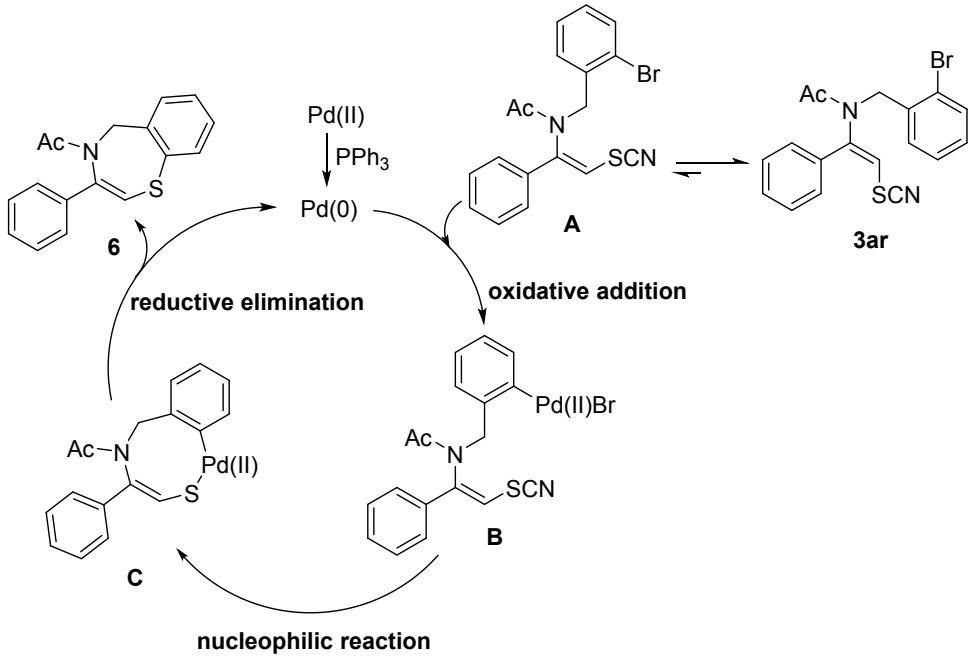

**10**

**(1,2-dithiocyanatoethane-1,1-diyl)dibenzene(10).**[3] **$^1$H NMR (400MHz, $CDCl_3$) δ** 7.44-7.37 (m, 6H), 7.34-7.29 (m, 4H), 4.01 (s, 2H). **$^{13}$C NMR (100 MHz, $CDCl_3$) δ** 139.9, 129.1, 129.0, 126.1, 111.2, 72.0, 46.5.

## 4. Plausible mechanism for Scheme 3c




Scheme 3c. Preparation of seven-membered S-containing heterocycles



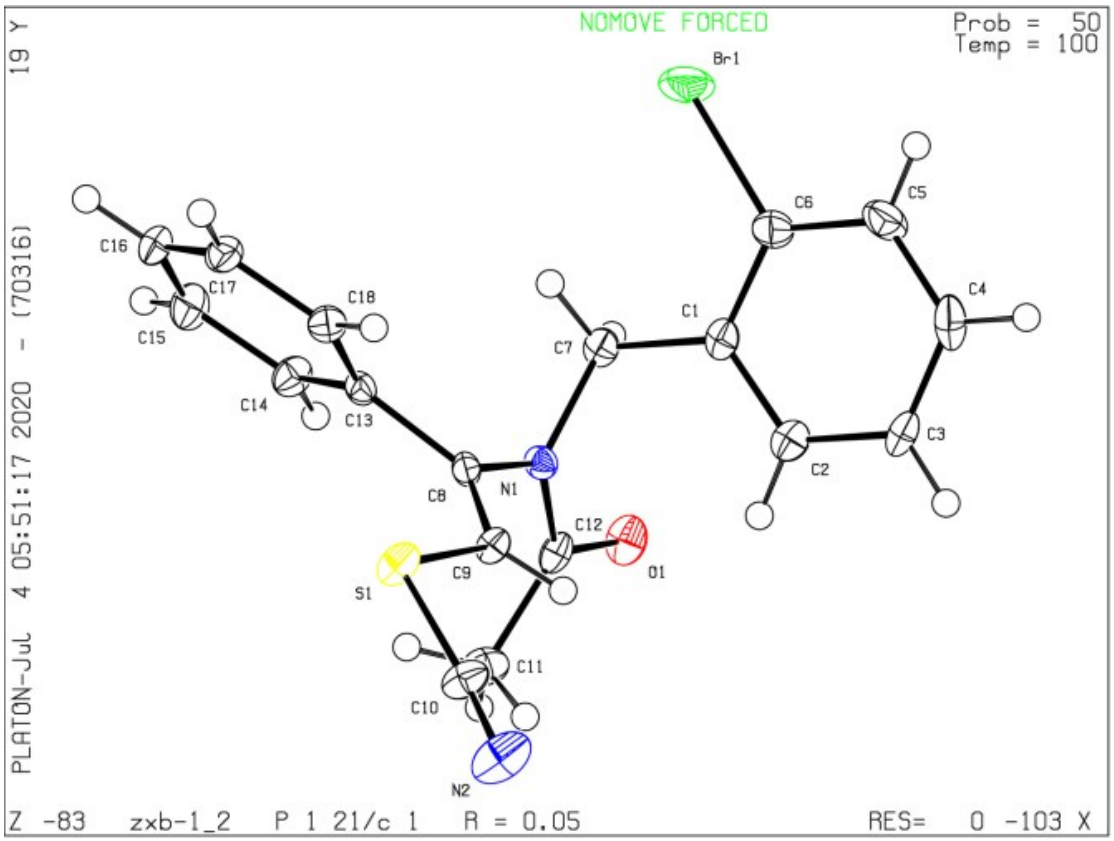

Based on the results obtained and previous reports,[4] a plausible reaction mechanism is proposed. Initially, transition-metal catalyst Pd(II) is reduced to Pd(0) species in the presence of $PPh_3$. Meanwhile, intermediate **A** is probably generated from **3ar** through isomerization reaction under heating conditions. The active Pd(0) species then undergoes oxidative addition with intermediate **A** to afford intermediates **B**. Intramolecular nucleophilic reaction of thiolate with the metal complex furnishes intermediates **C**, followed by reductive elimination reaction to provide seven-membered

ring product **6** and Pd(0) species.

## 5. X-ray Crystallographic Data of 3ar

Sample preparation: Single crystals of **3ar** for X-ray diffraction experiment was obtained by slow evaporation of DCM/*n*-hexane (1:10, *v*/*v*) solution containing **3ar**. CCDC 2014798 contain the supplementary crystallographic data for this paper, these data can be obtained free of charge from the Cambridge Crystallographic Data Center.

**Figure S1**. *ORTEP* Structure of **3ar** (CCDC 2014798)



## Table S1 Crystal data and structure refinement for 3ar (CCDC 2014798).

| | |
|---|---|
| Identification code | **3ar** |
| Empirical formula | $C_{18}H_{15}BrN_2OS$ |
| Formula weight | 387.29 |
| Temperature/K | 99.9(4) |
| Crystal system | monoclinic |
| Space group | $P2_1/c$ |
| a/Å | 10.6922(6) |
| b/Å | 8.9341(8) |
| c/Å | 17.5905(13) |
| α/° | 90 |
| β/° | 98.505(6) |
| γ/° | 90 |
| Volume/Å$^3$ | 1661.9(2) |
| Z | 4 |
| $\rho_{calc}$g/cm$^3$ | 1.548 |
| μ/mm$^{-1}$ | 2.604 |
| F(000) | 784.0 |
| Crystal size/mm$^3$ | 0.13 × 0.12 × 0.1 |
| Radiation | Mo Kα (λ = 0.71073) |
| 2Θ range for data collection/° | 3.852 to 49.996 |
| Index ranges | $-12 \le h \le 12$, $-10 \le k \le 6$, $-20 \le l \le 20$ |
| Reflections collected | 7414 |
| Independent reflections | 2931 [$R_{int}$ = 0.0508, $R_{sigma}$ = 0.0641] |
| Data/restraints/parameters | 2931/0/209 |
| Goodness-of-fit on $F^2$ | 1.072 |
| Final R indexes [I>=2σ (I)] | $R_1$ = 0.0482, $wR_2$ = 0.1103 |
| Final R indexes [all data] | $R_1$ = 0.0607, $wR_2$ = 0.1207 |
| Largest diff. peak/hole / e Å$^{-3}$ | 1.04/-1.61 |

## Table S2 Bond Lengths for 3ar (CCDC 2014798).

| Atom | Atom | Length/Å | Atom | Atom | Length/Å |
|---|---|---|---|---|---|
| Br1 | C6 | 1.905(4) | C3 | C4 | 1.392(5) |
| S1 | C9 | 1.766(4) | C4 | C5 | 1.373(6) |
| S1 | C10 | 1.684(4) | C5 | C6 | 1.380(5) |
| O1 | C12 | 1.223(4) | C8 | C9 | 1.325(5) |
| N1 | C7 | 1.468(4) | C8 | C13 | 1.486(5) |
| N1 | C8 | 1.430(5) | C11 | C12 | 1.505(5) |
| N1 | C12 | 1.370(4) | C13 | C14 | 1.392(5) |
| N2 | C10 | 1.149(5) | C13 | C18 | 1.391(5) |
| C1 | C2 | 1.392(5) | C14 | C15 | 1.385(5) |
| C1 | C6 | 1.400(5) | C15 | C16 | 1.389(6) |
| C1 | C7 | 1.516(5) | C16 | C17 | 1.375(6) |
| C2 | C3 | 1.380(5) | C17 | C18 | 1.391(5) |

## Table S3 Bond Angles for 3ar (CCDC 2014798).

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| C10 | S1 | C9 | 101.08(18) | C9 | C8 | N1 | 119.6(3) |
| C8 | N1 | C7 | 115.6(3) | C9 | C8 | C13 | 124.8(3) |
| C12 | N1 | C7 | 119.1(3) | C8 | C9 | S1 | 121.2(3) |
| C12 | N1 | C8 | 125.3(3) | N2 | C10 | S1 | 172.8(4) |
| C2 | C1 | C6 | 116.2(3) | O1 | C12 | N1 | 120.1(3) |
| C2 | C1 | C7 | 121.5(3) | O1 | C12 | C11 | 121.8(3) |
| C6 | C1 | C7 | 122.2(3) | N1 | C12 | C11 | 118.0(3) |
| C3 | C2 | C1 | 121.9(3) | C14 | C13 | C8 | 119.5(3) |
| C2 | C3 | C4 | 120.0(3) | C18 | C13 | C8 | 121.8(3) |
| C5 | C4 | C3 | 119.6(4) | C18 | C13 | C14 | 118.7(3) |
| C4 | C5 | C6 | 119.5(3) | C15 | C14 | C13 | 120.7(4) |
| C1 | C6 | Br1 | 119.6(3) | C16 | C15 | C14 | 120.1(4) |
| C5 | C6 | Br1 | 117.7(3) | C17 | C16 | C15 | 119.6(4) |
| C5 | C6 | C1 | 122.7(3) | C16 | C17 | C18 | 120.6(4) |

**Table S3 Bond Angles for 3ar (CCDC 2014798).**

| Atom | Atom | Atom | Angle/° | Atom | Atom | Atom | Angle/° |
|---|---|---|---|---|---|---|---|
| N1 | C7 | C1 | 113.3(3) | C17 | C18 | C13 | 120.3(4) |
| N1 | C8 | C13 | 115.6(3) | | | | |

## 6. Reference


[1]. (a) Van den Berg, M.; Haak, R. M.; Minnaard, A. J.; de Vries, A. H. M.; de Vries, J. G.; Feringa, B. L. Rhodium/MonoPhos-Catalysed Asymmetric Hydrogenation of Enamides. *Adv. Synth. Catal.* **2002**, *344*, 1003-1007; (b) Pankajakshan, S.; Xu, Y.-H.; Cheng, J. K.; Low, M. T.; Loh, T.-P. Palladium Catalyzed Direct C-H Arylation of Enamides with Simple Arenes. *Angew. Chem. Int. Ed.* **2012**, *51*, 5701-5705; (c) Shen, Z.-Y.; Cheng, J.-K.; Wang, C.; Yuan, C.; Loh, T.-P.; Hu, X.-H. Iron-Catalyzed Carbamoylation of Enamides with Formamides as a Direct Approach to N-Acyl Enamine Amides. *ACS Catal.* **2019**, *9*, 8128–8135.

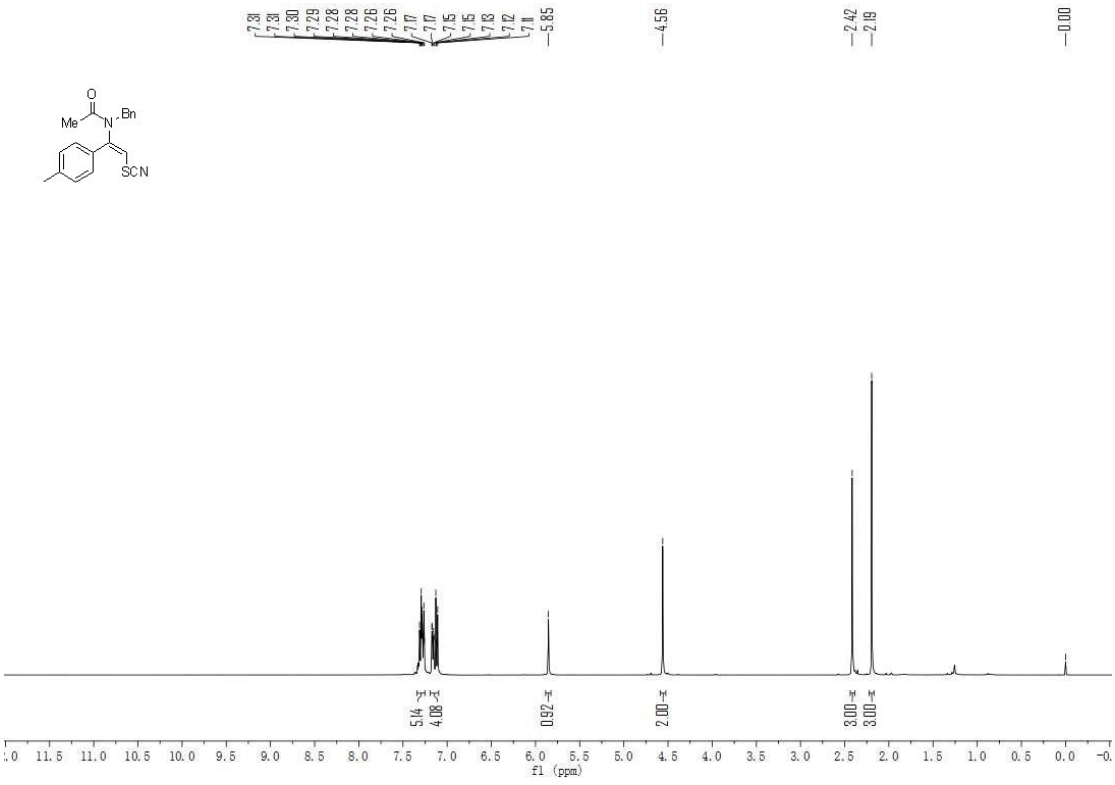
[2]. Kumaraswamy, G.; Vijaykumar, S. Photo-sensitized oxy-thiocynation of terminal alkynes/1,3-aryldienes and their one-pot conversion to 2-hydroxy 4-substitutedaryl thiazoles. *Org. Biomol. Chem.* **2019**, *17*, 2232-2241.

[3]. Amrita, D.; Alakananda, H. Potassium Persulfate-Mediated Thiocyanation of 2*H*-Indazole under Iron-Catalysis. *Adv. Synth. Catal.* **2019**, *361*, 842-849.

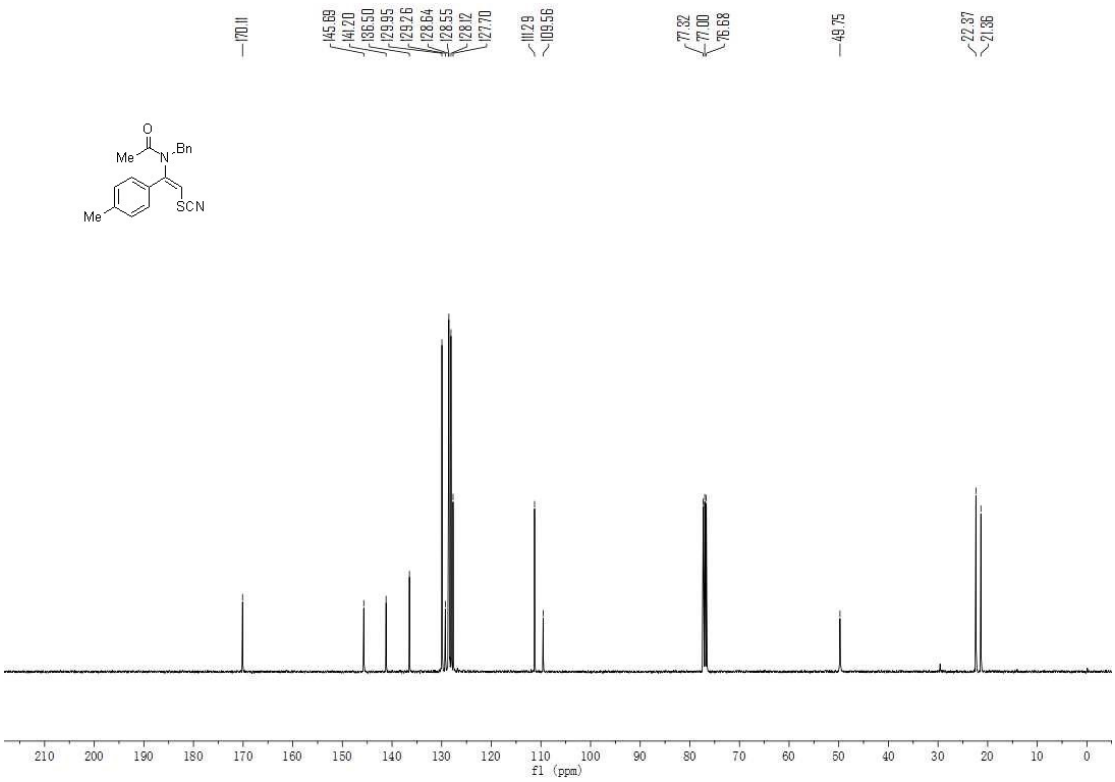
[4]. (a) Still, I. W. J.; Toste, F. D. Reduction of Aryl Thiocyanates with SmI2 and Pd-Catalyzed Coupling with Aryl Halides as a Route to Mixed Aryl Sulfides. *J. Org. Chem.* **1996**, *61*, 7677-7680; (b) Ke, F.; Qu, Y.; Jiang, Z.; Li, Z.; Wu, D.; Zhou, X. An Efficient Copper-Catalyzed Carbon-Sulfur Bond Formation Protocol in Water. *Org. Lett.* **2011**, *13*, 454–457.

## 7. $^{1}$H NMR and $^{13}$C NMR spectra of compounds 3aa-y, 4-10

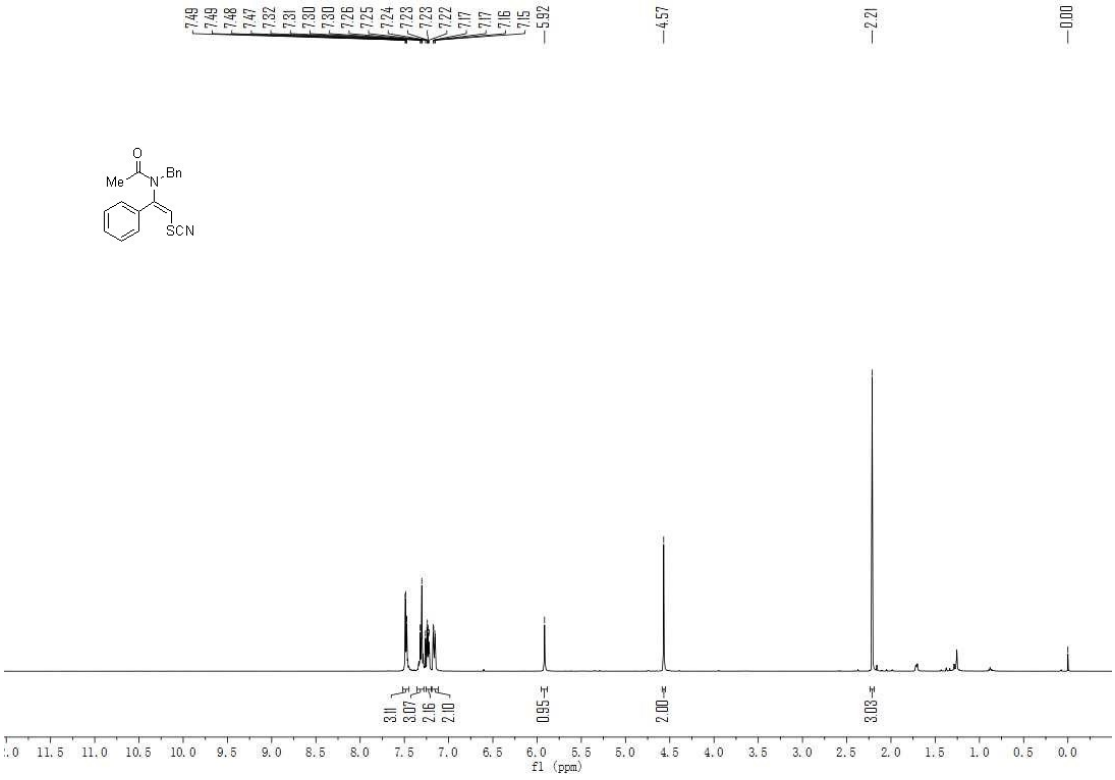
**$^{1}$H NMR spectrum of 3aa**



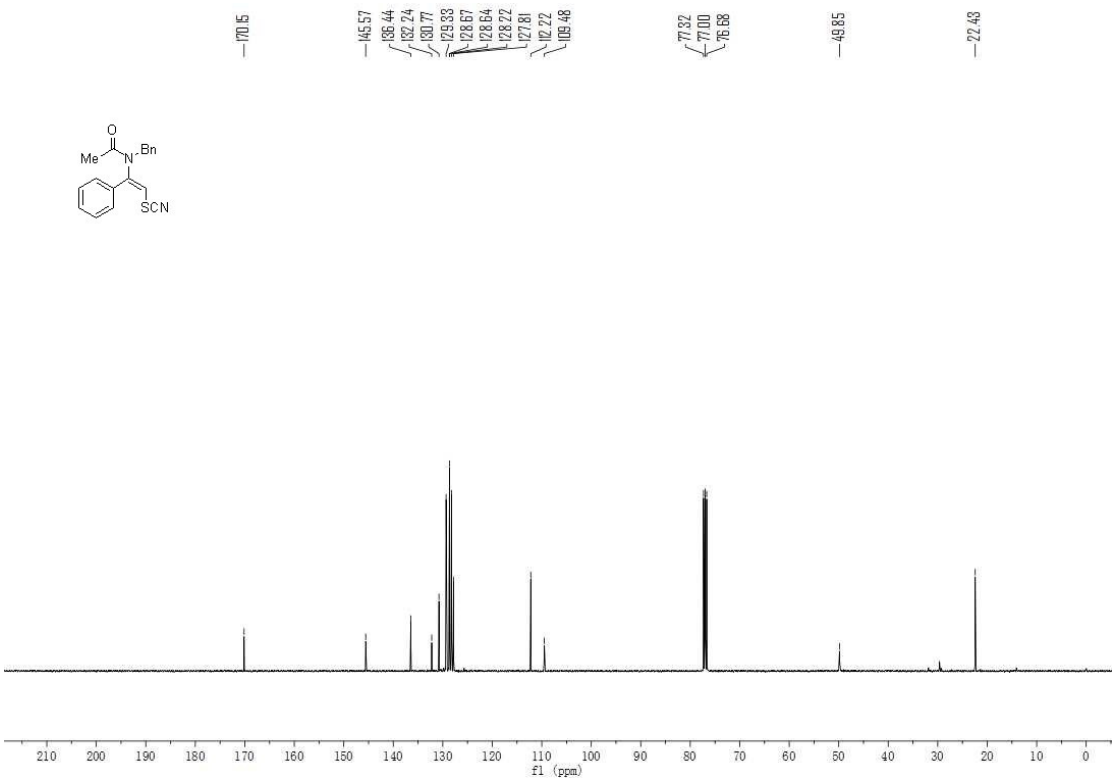

**$^{13}$C NMR spectrum of 3aa**



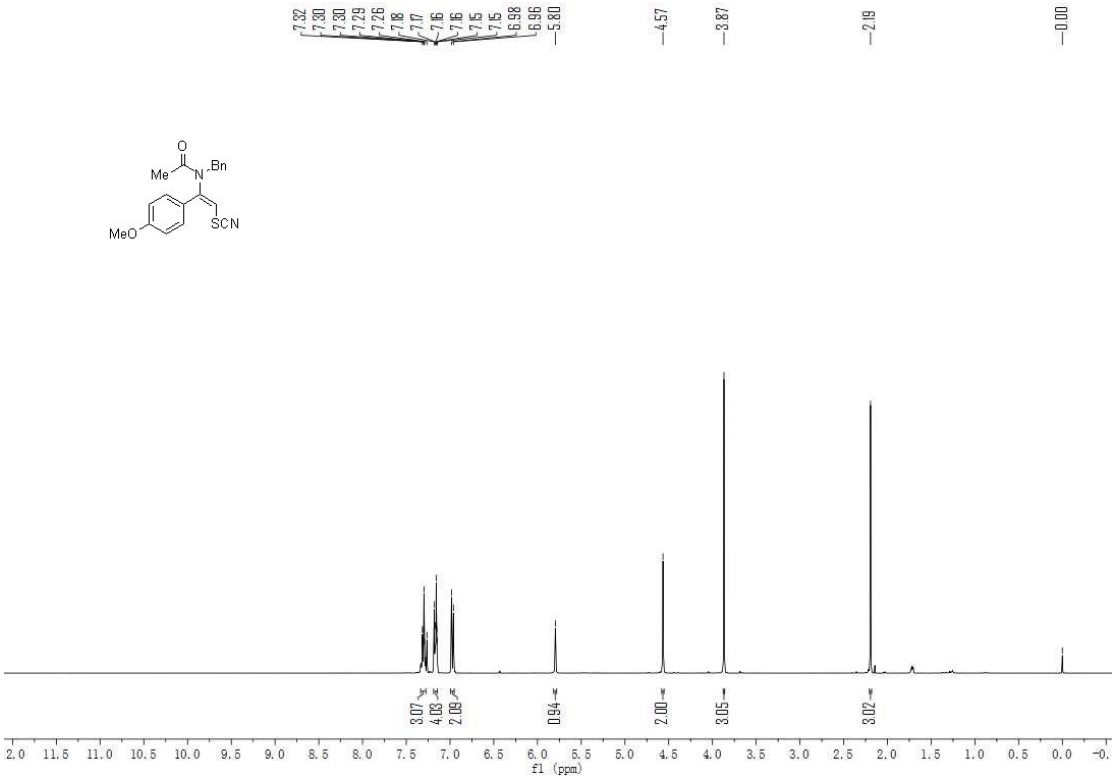

**$^{1}$H NMR spectrum of 3ab**



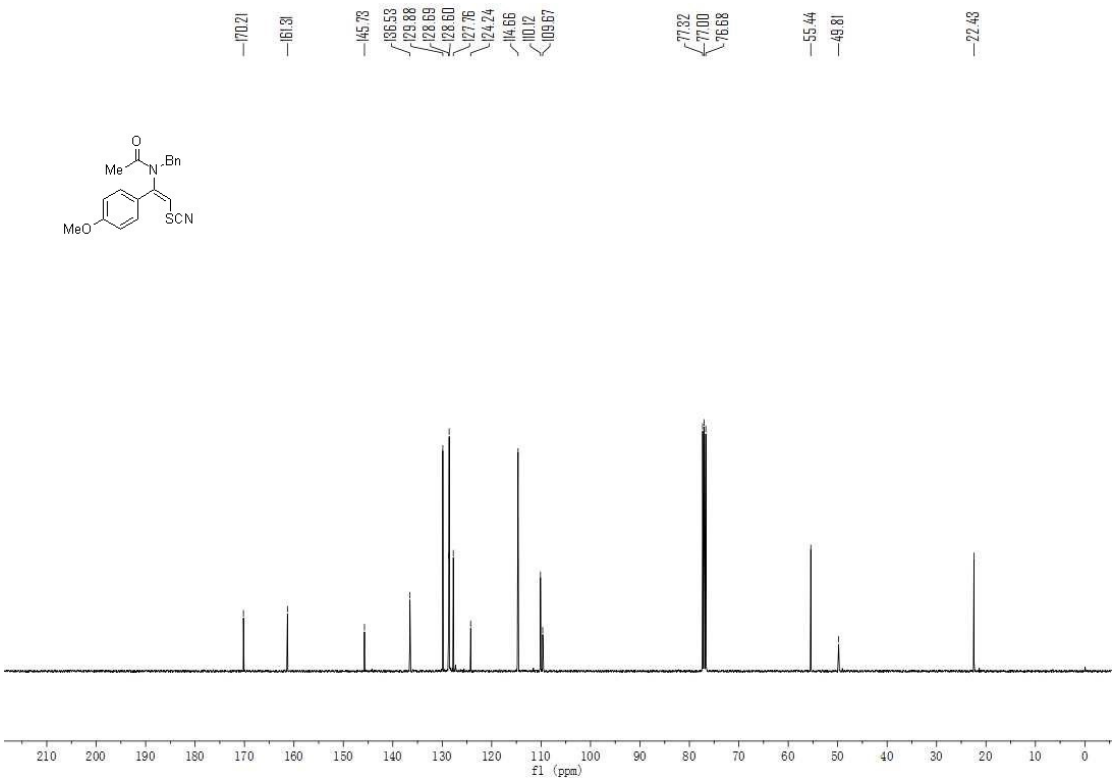

**$^{13}$C NMR spectrum of 3ab**



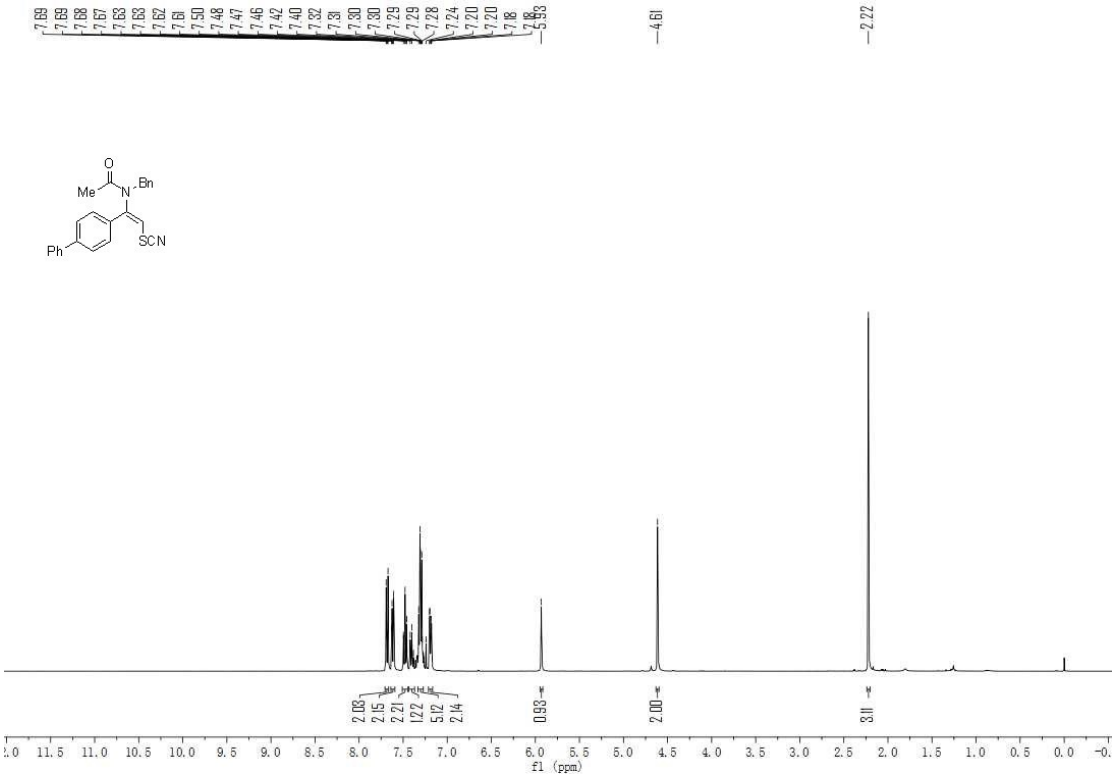

**$^{1}$H NMR spectrum of 3ac**



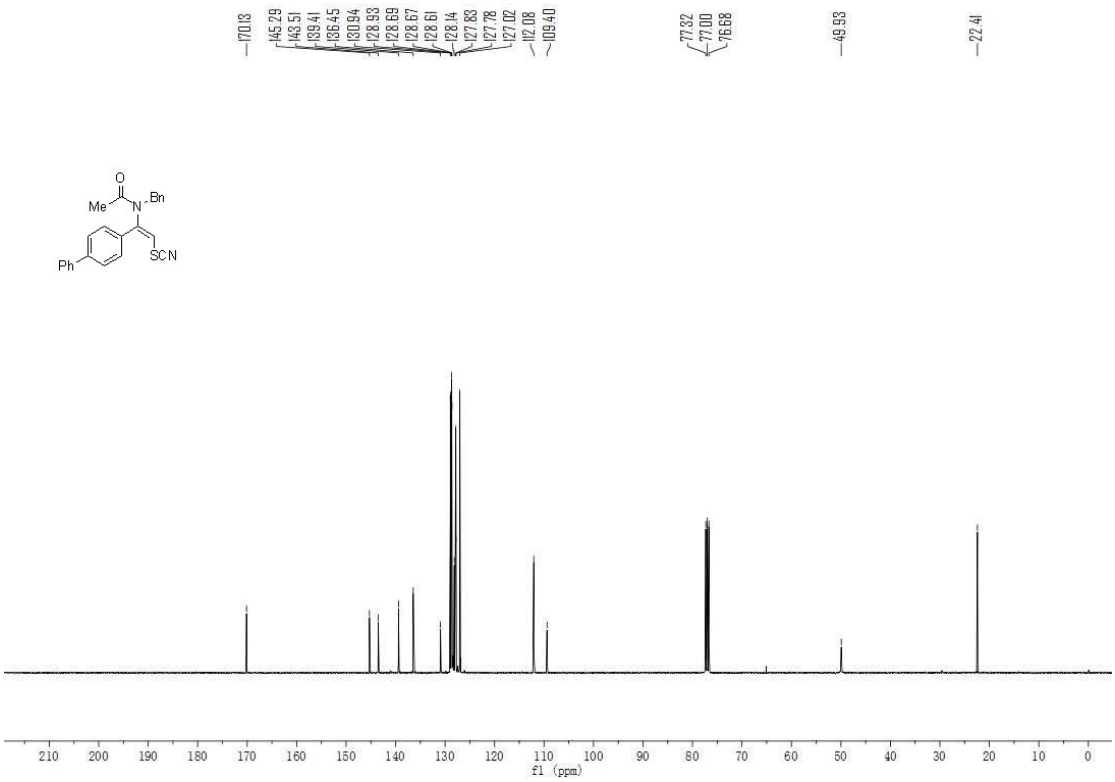

**$^{13}$C NMR spectrum of 3ac**



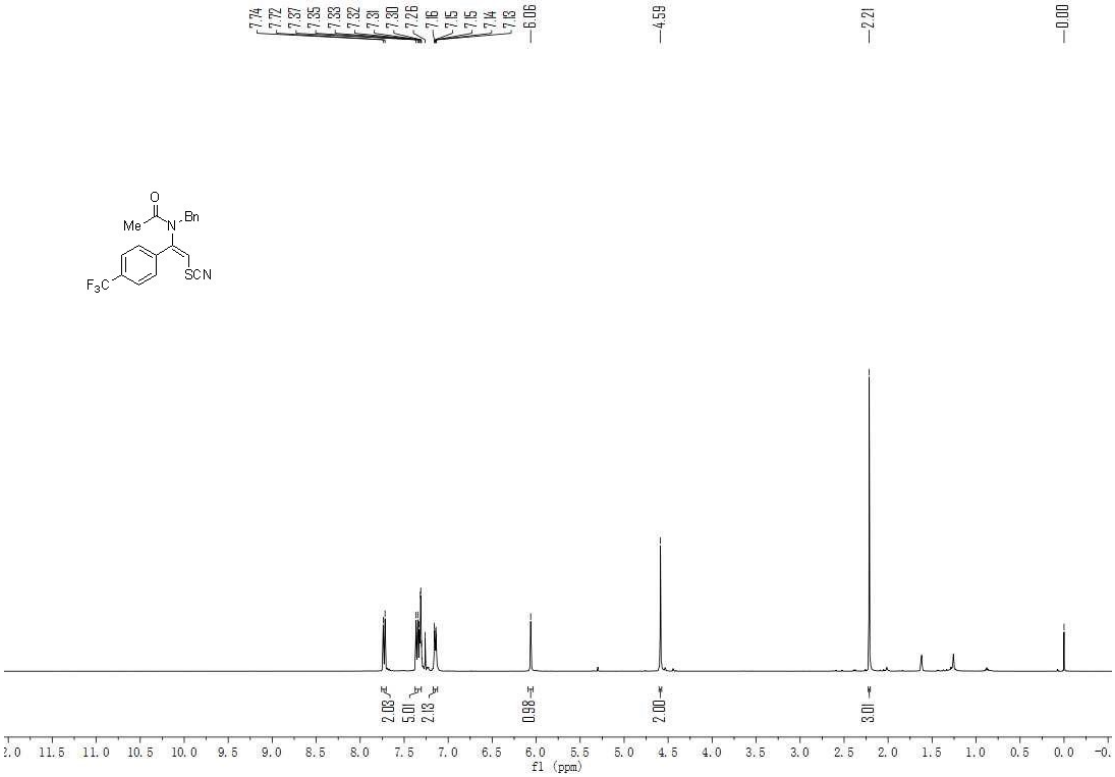

**$^{1}$H NMR spectrum of 3ad**



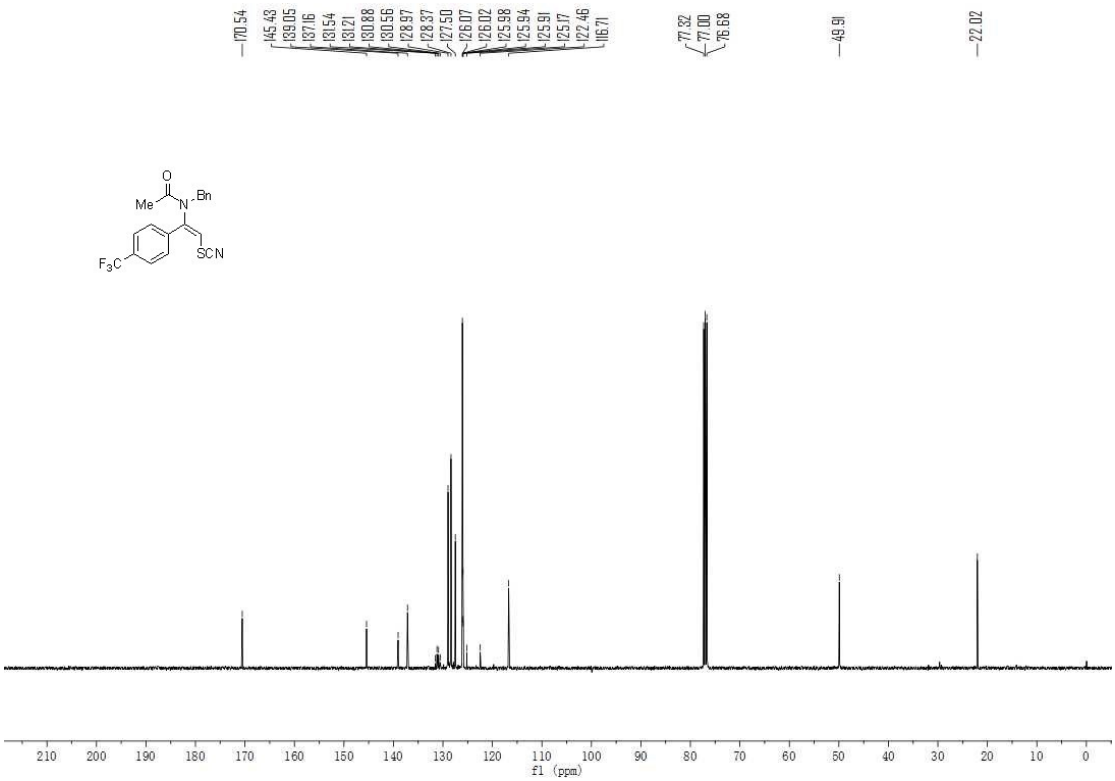

**$^{13}$C NMR spectrum of 3ad**



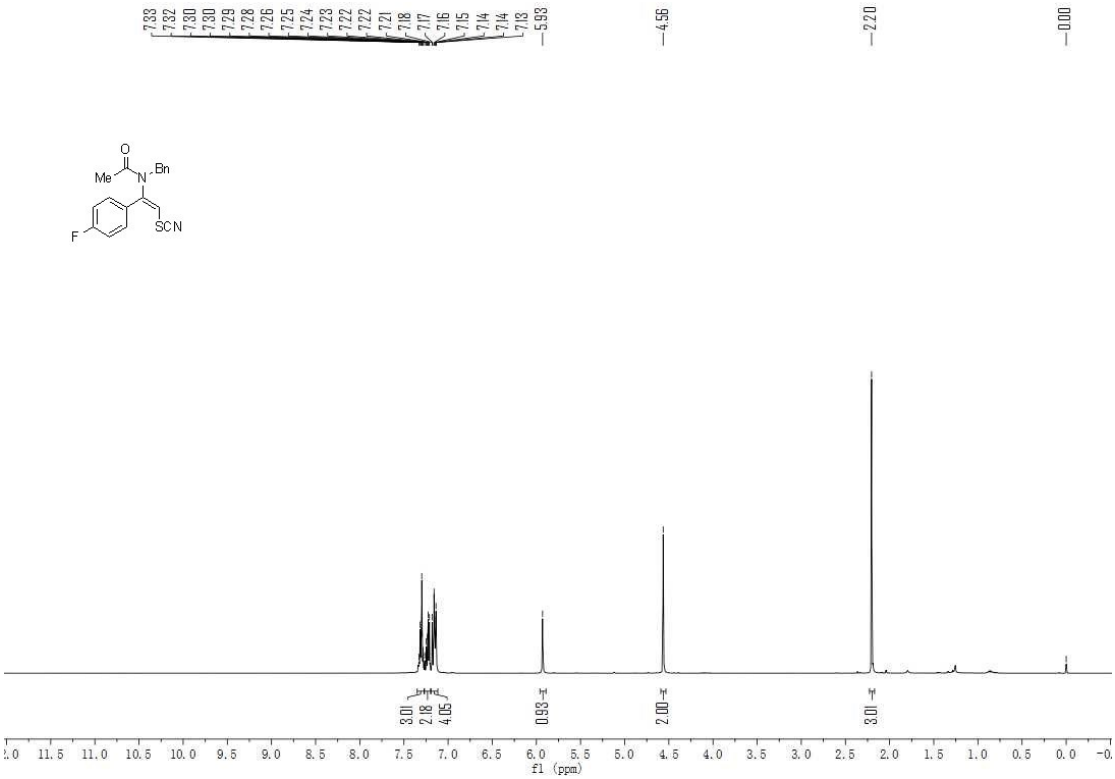

**$^{1}$H NMR spectrum of 3ae**



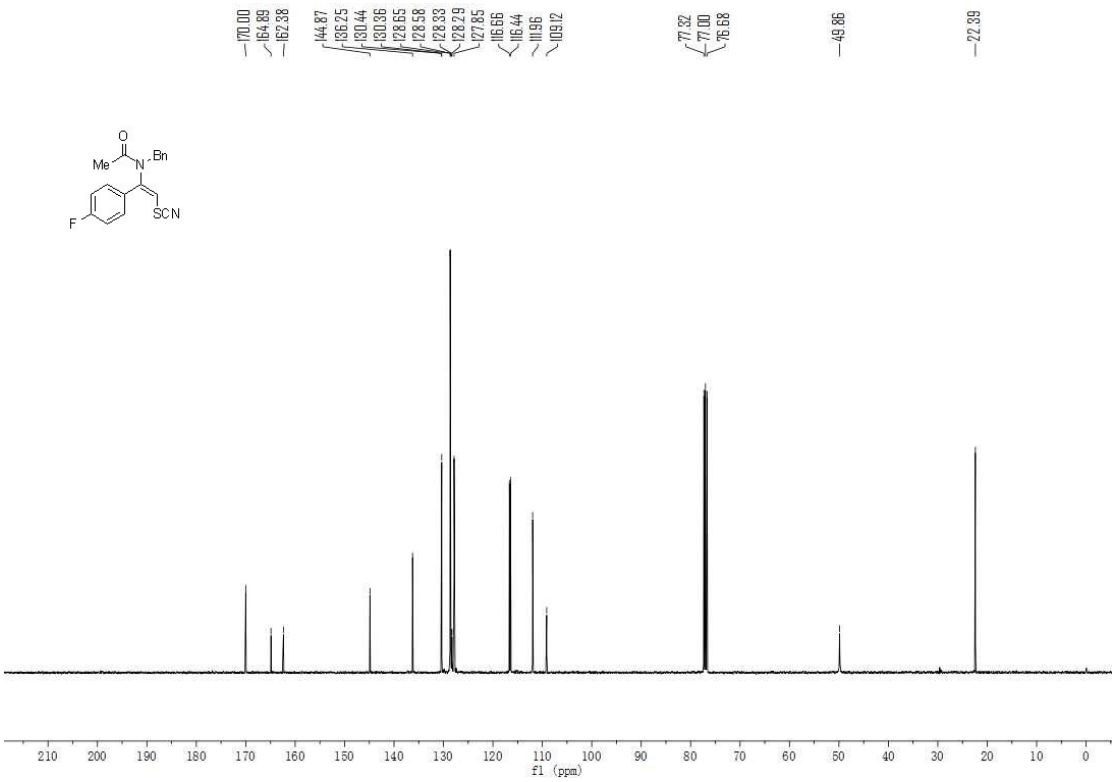

**$^{13}$C NMR spectrum of 3ae**



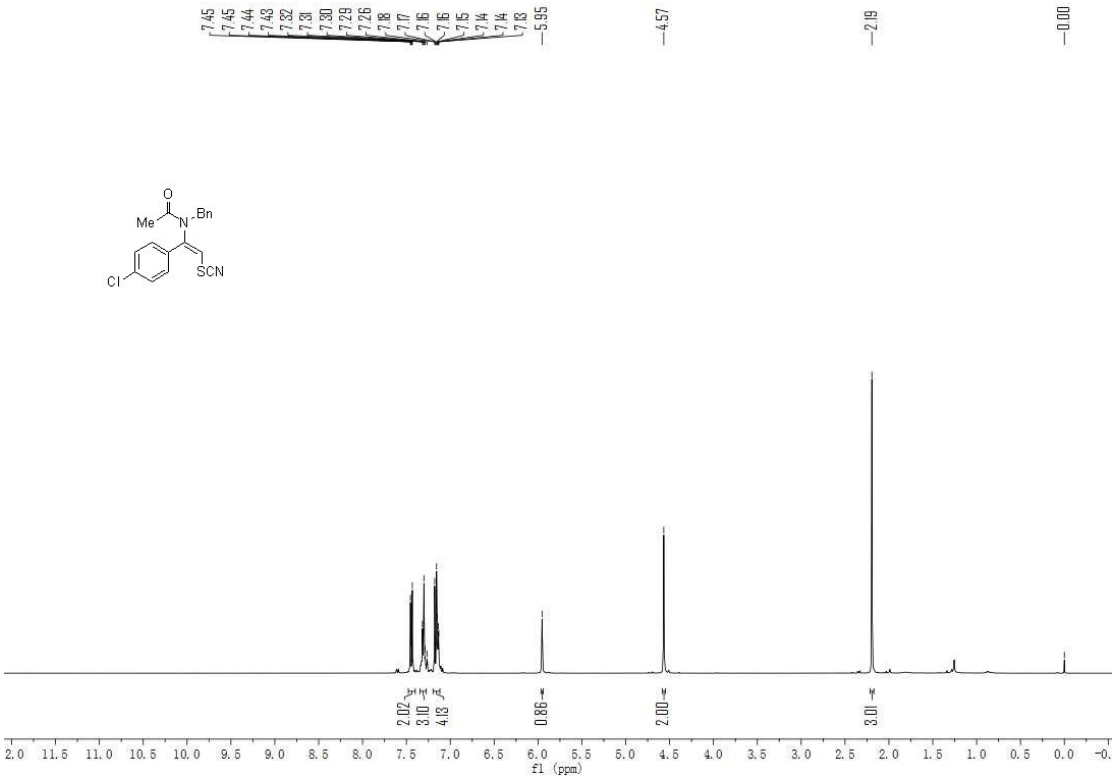

**$^{1}$H NMR spectrum of 3af**



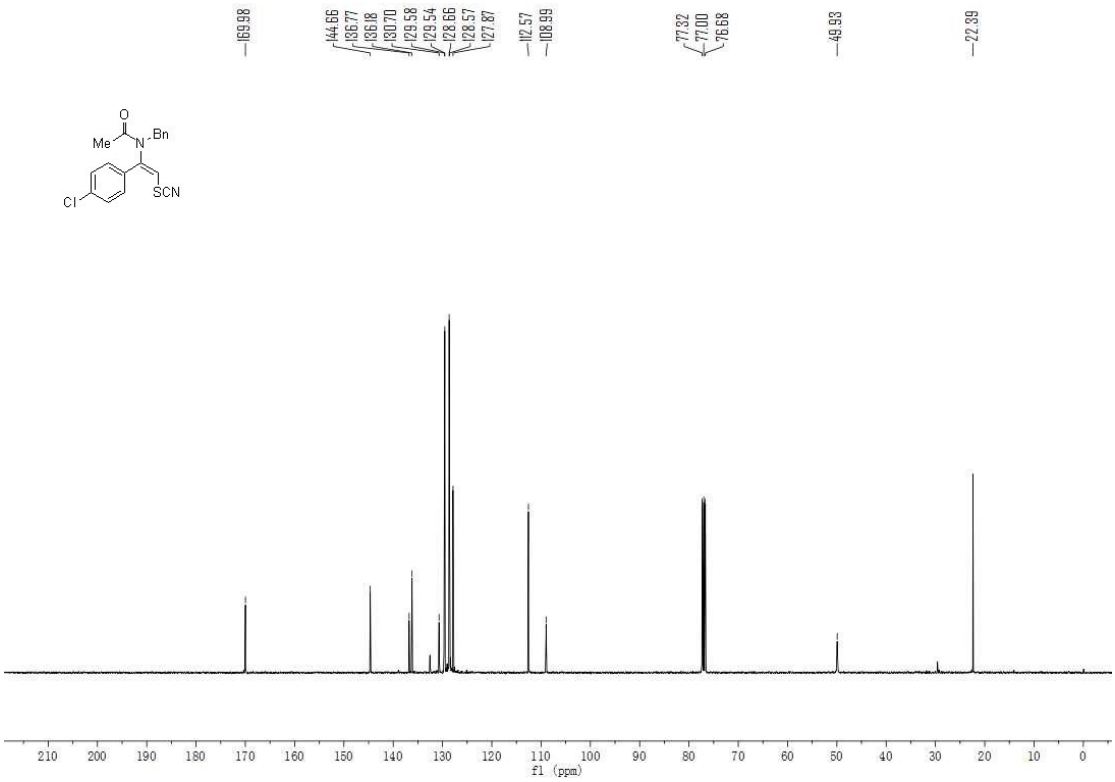

**$^{13}$C NMR spectrum of 3af**



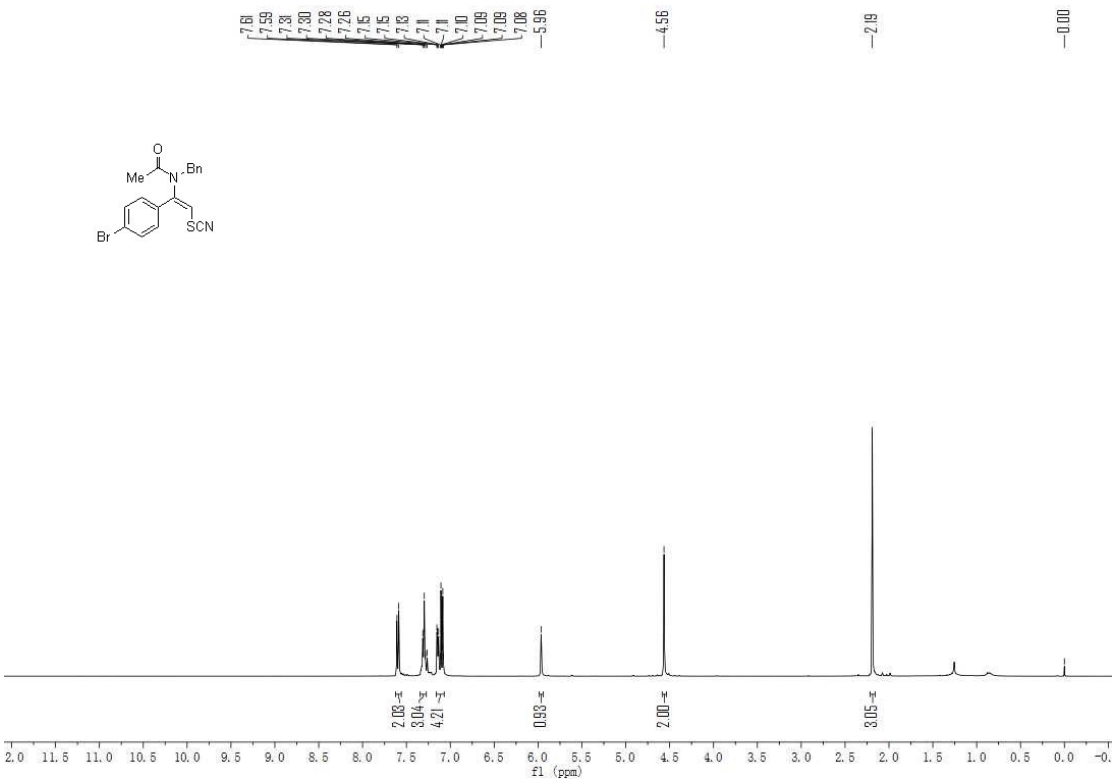

**$^{1}$H NMR spectrum of 3ag**



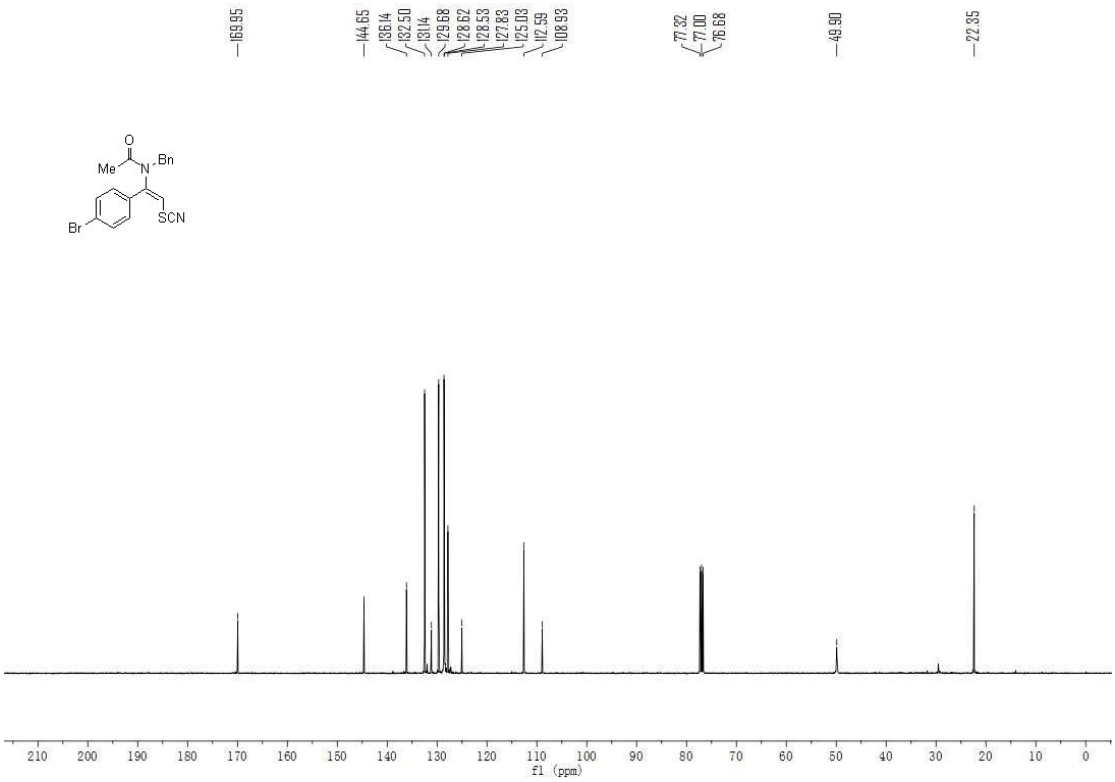

**$^{13}$C NMR spectrum of 3ag**



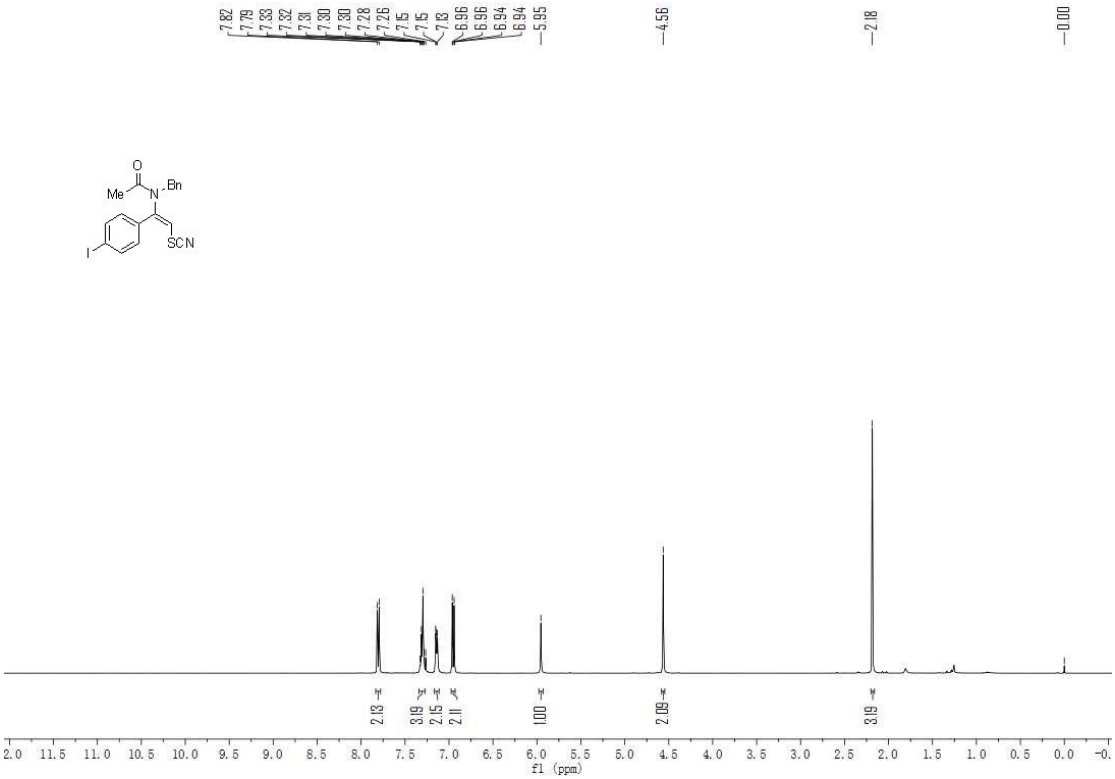

**$^{1}$H NMR spectrum of 3ah**



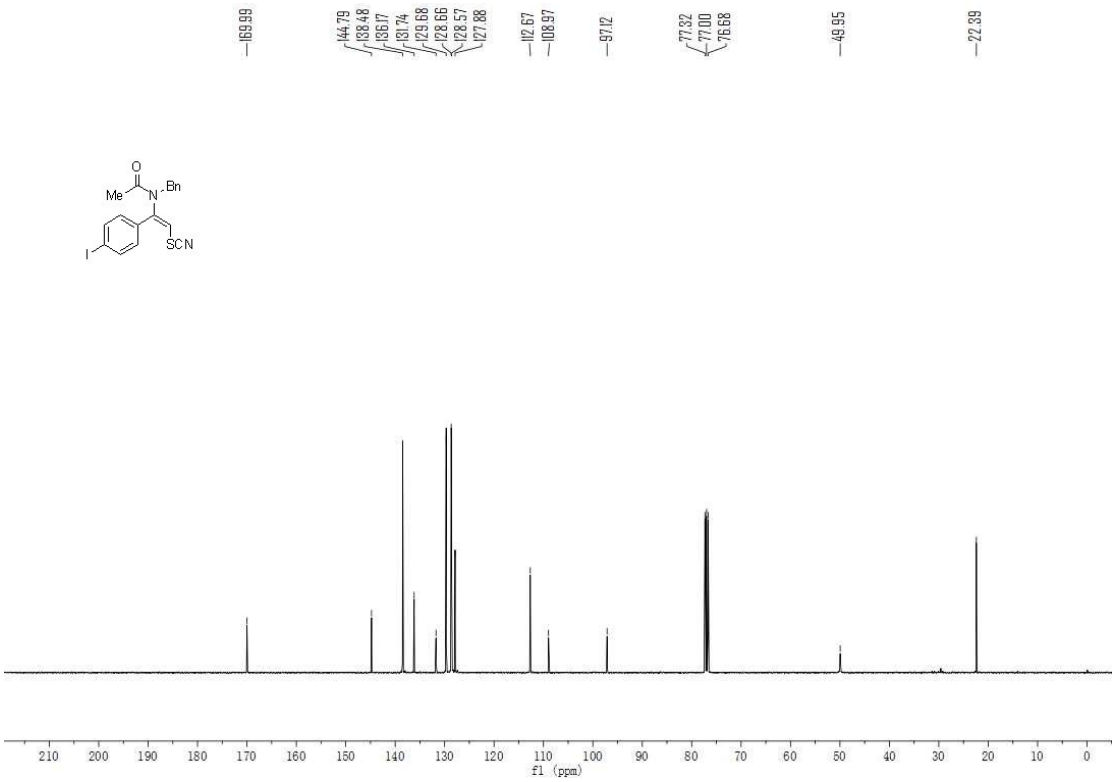

**$^{13}$C NMR spectrum of 3ah**



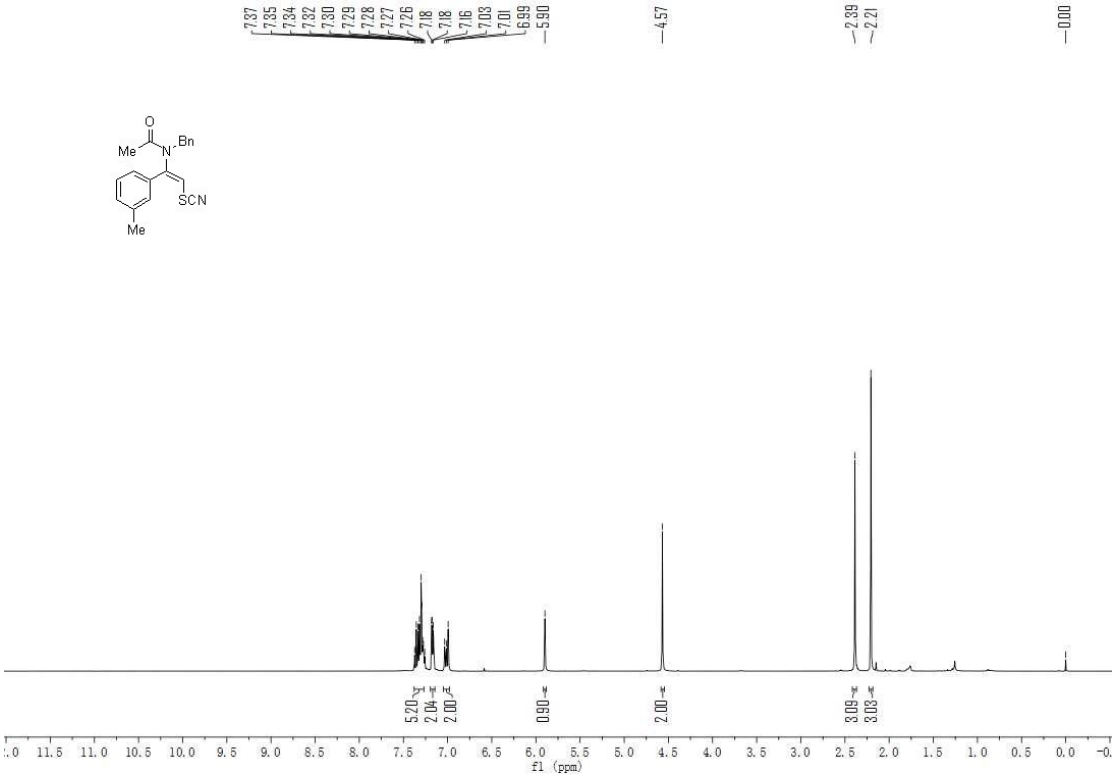

**$^{1}$H NMR spectrum of 3ai**



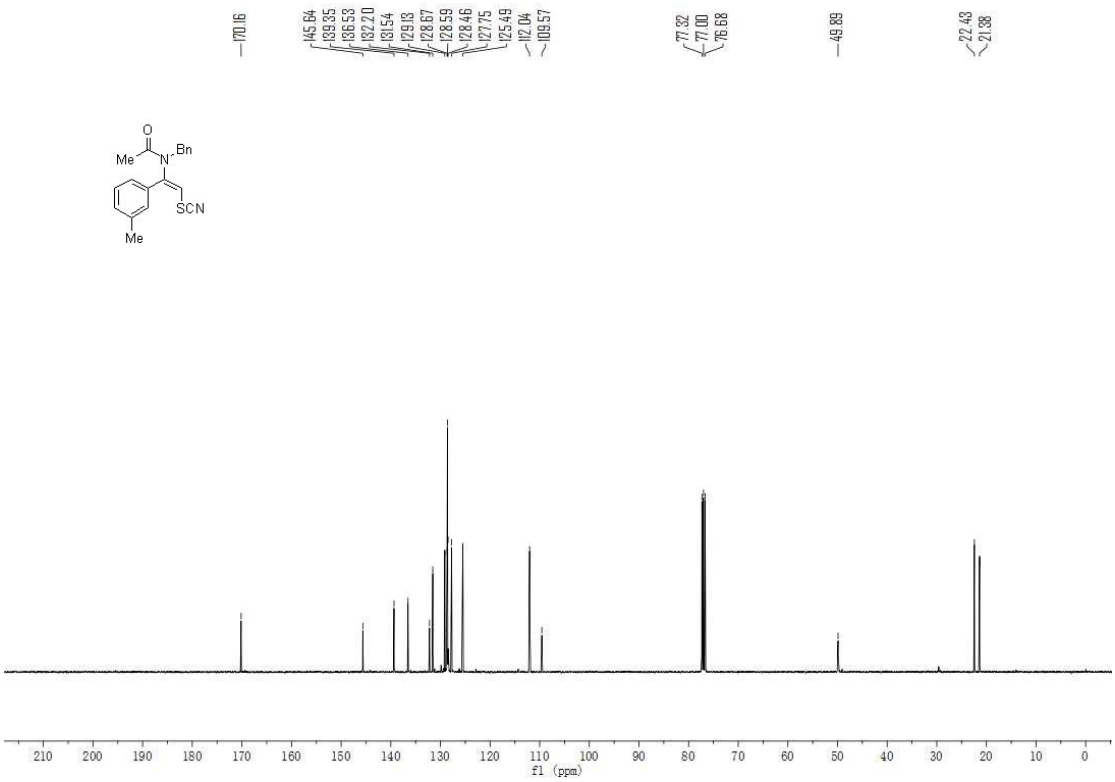

**$^{13}$C NMR spectrum of 3ai**



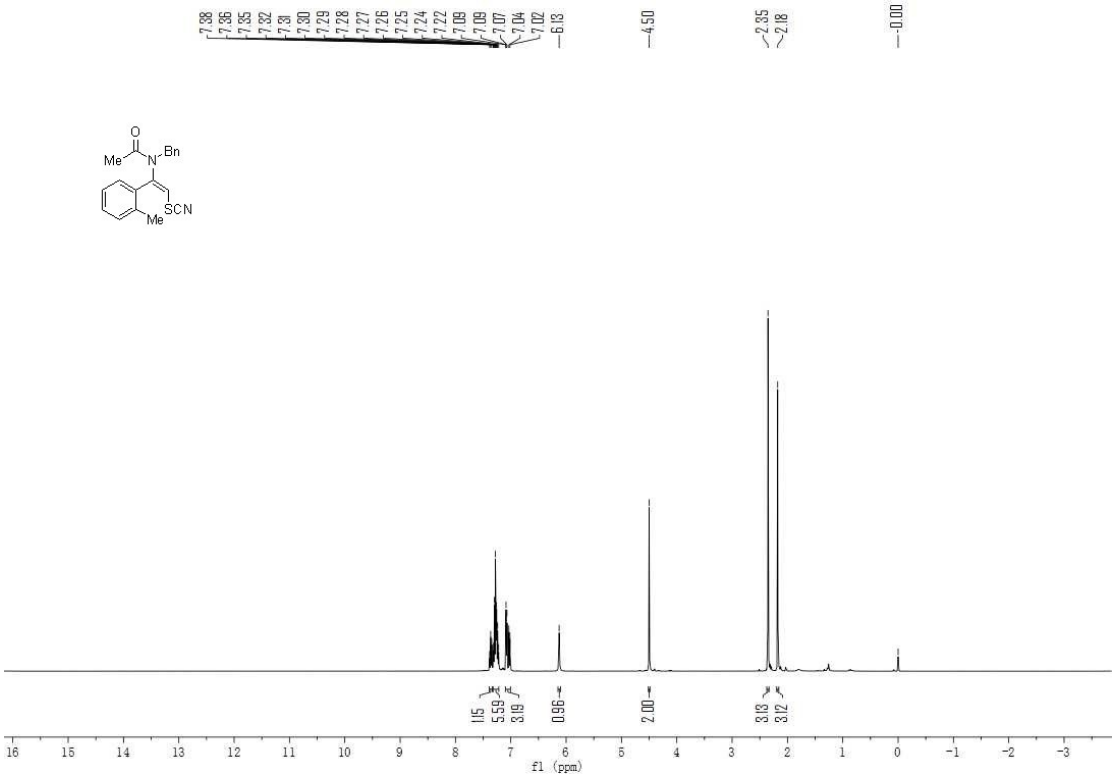

**$^{1}$H NMR spectrum of 3aj**



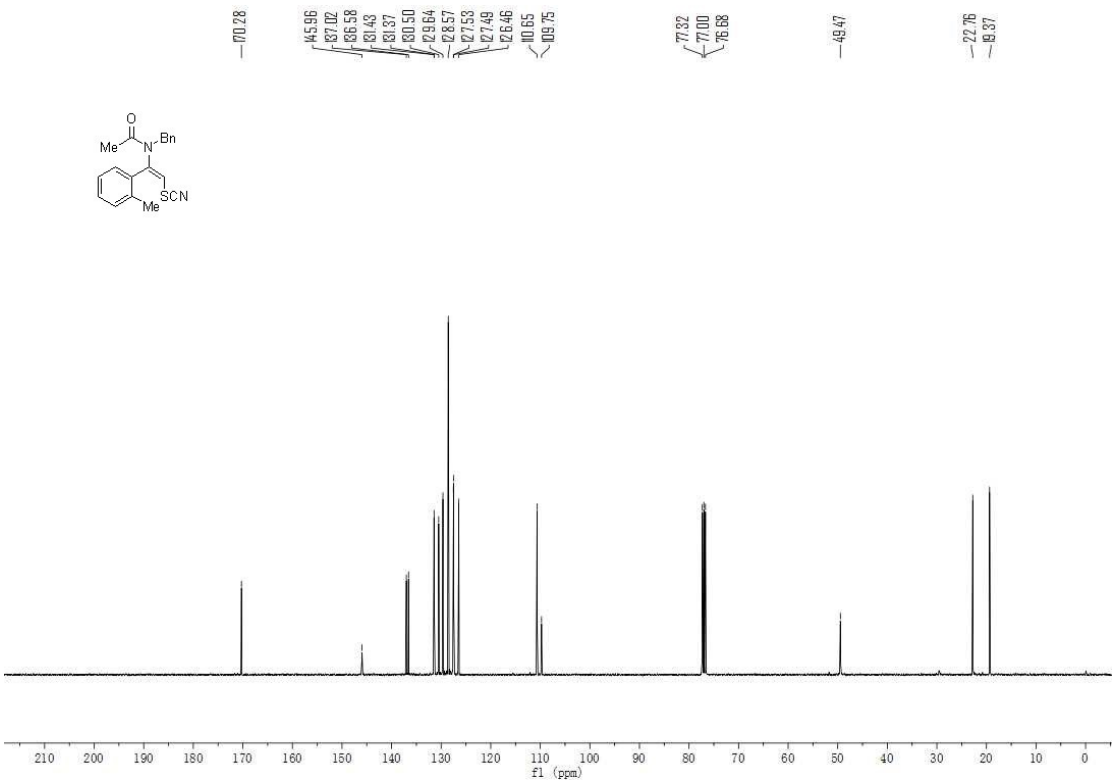

**$^{13}$C NMR spectrum of 3aj**



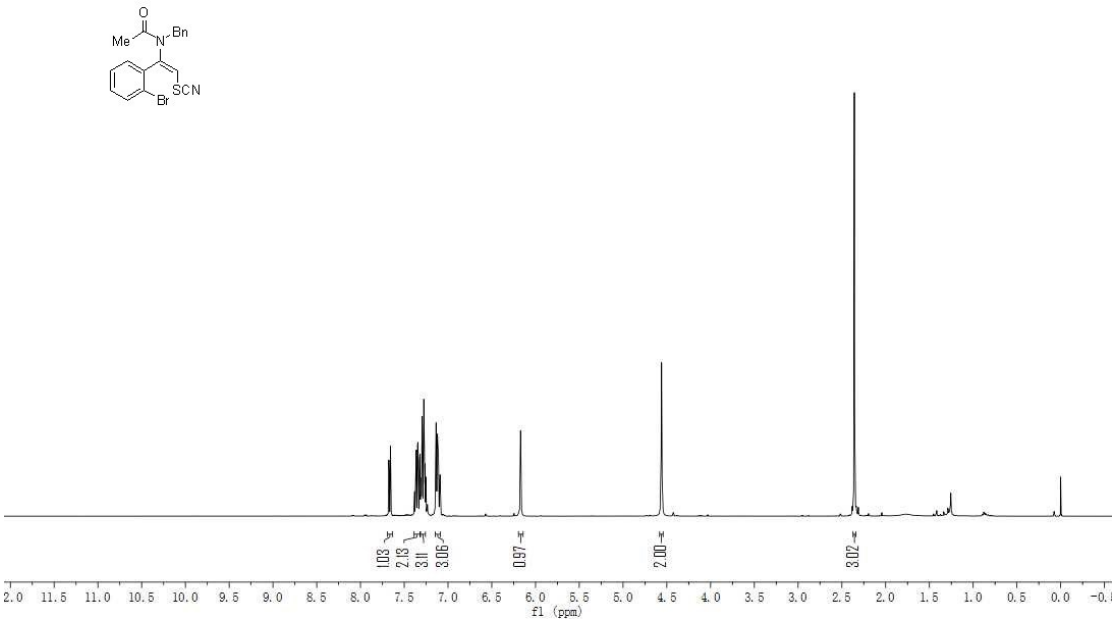

**$^{1}$H NMR spectrum of 3ak**



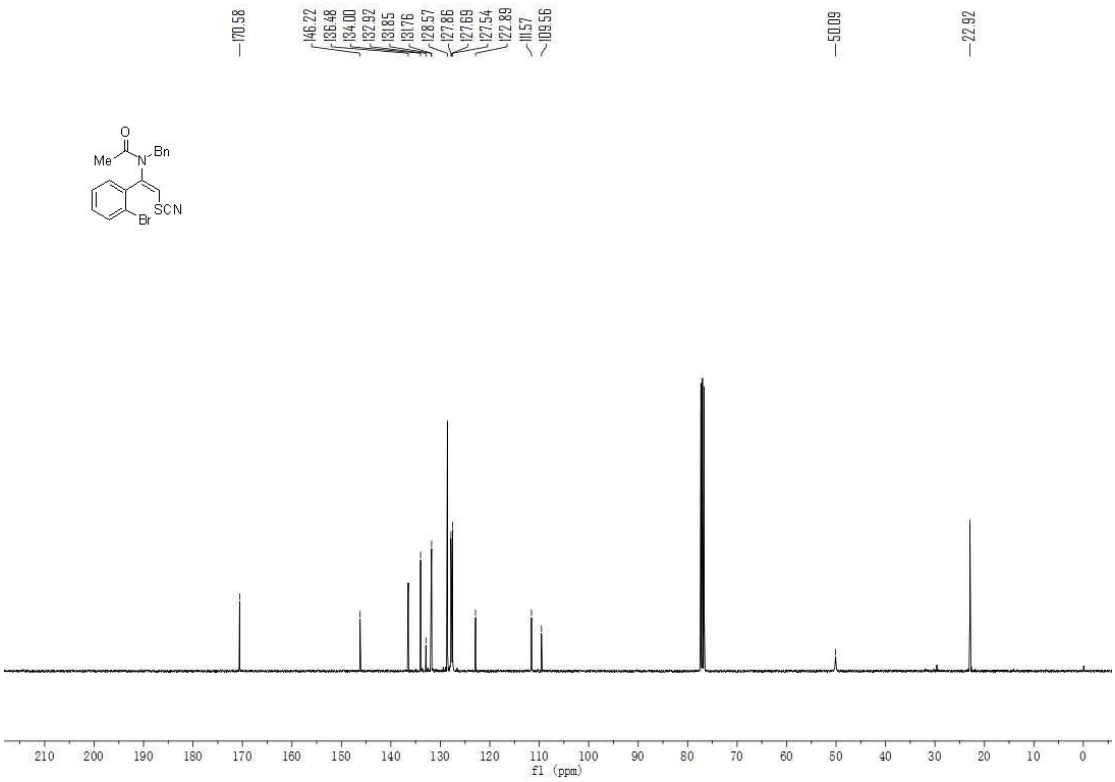

**$^{13}$C NMR spectrum of 3ak**



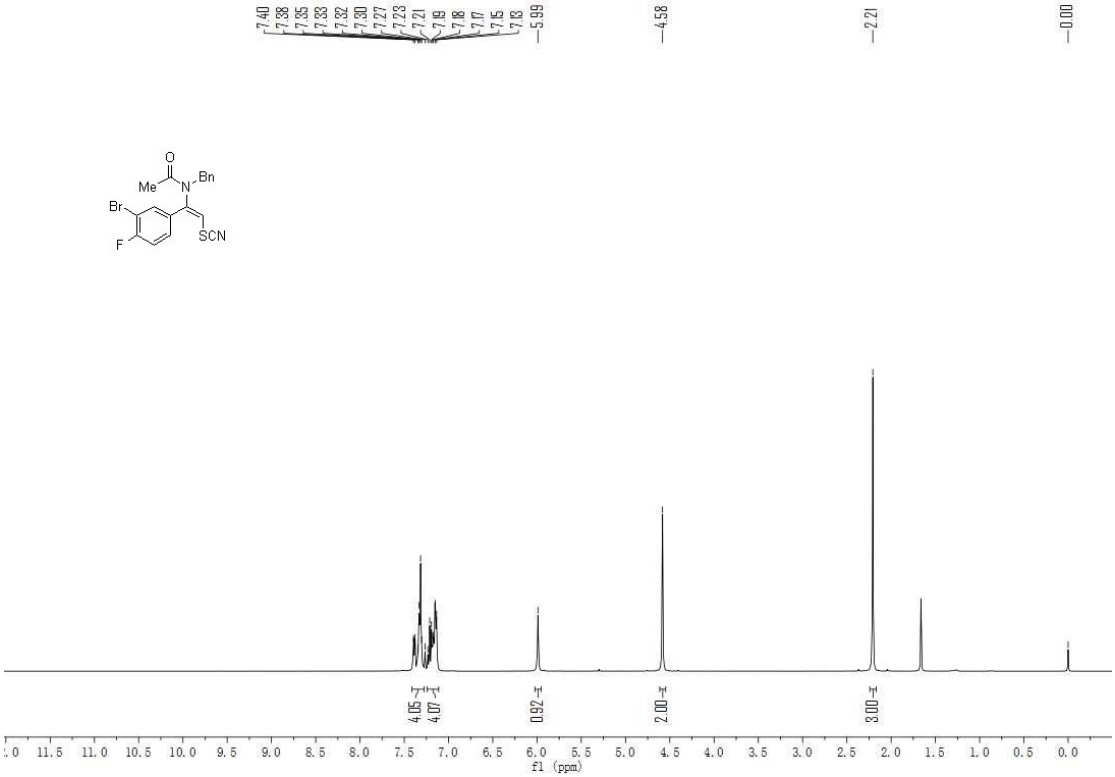

**$^{1}$H NMR spectrum of 3al**



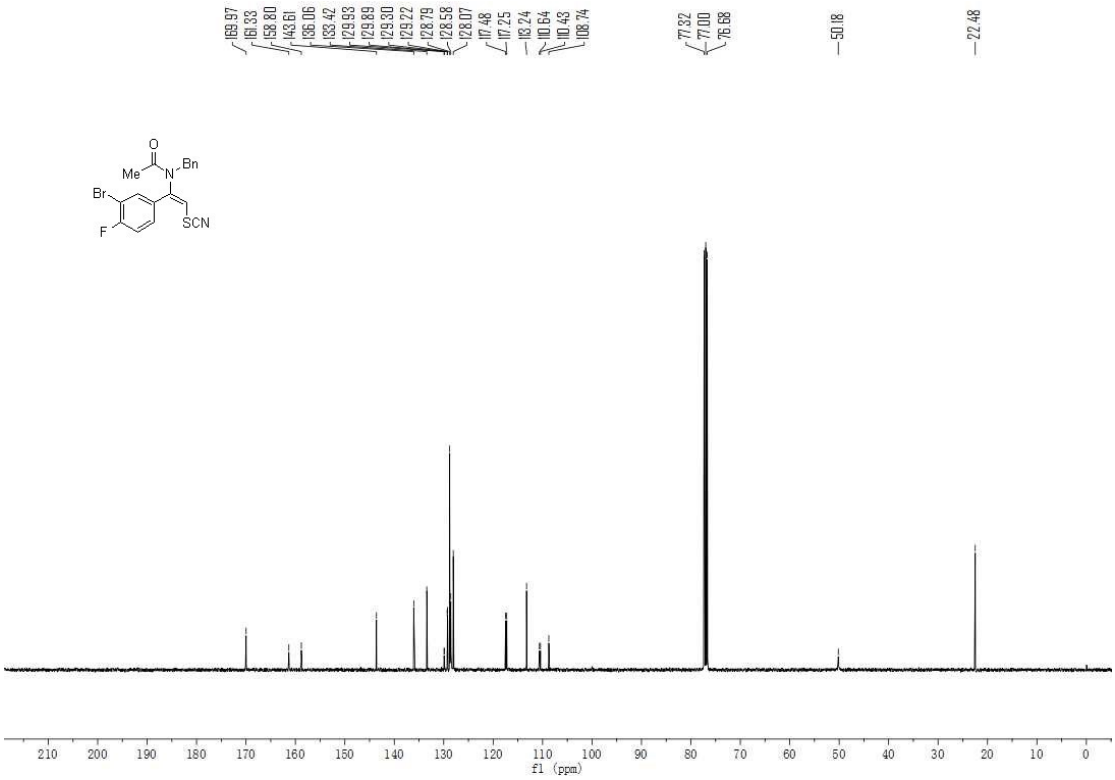

**$^{13}$C NMR spectrum of 3al**



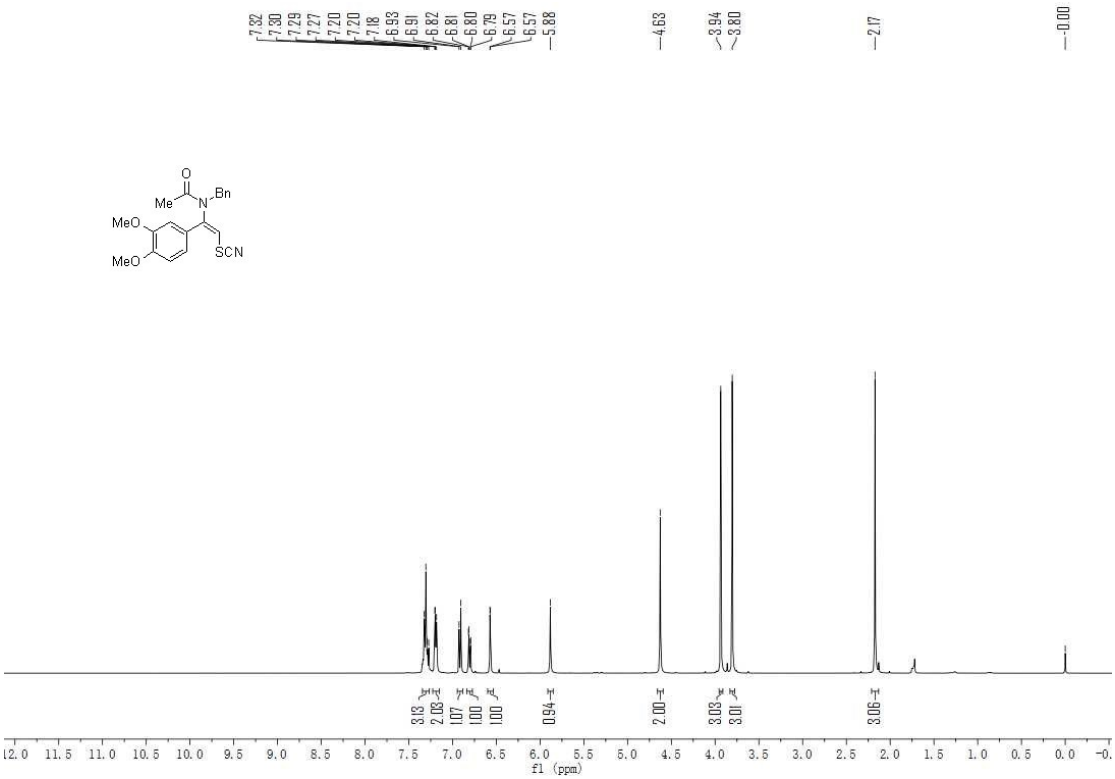

**$^{1}$H NMR spectrum of 3am**



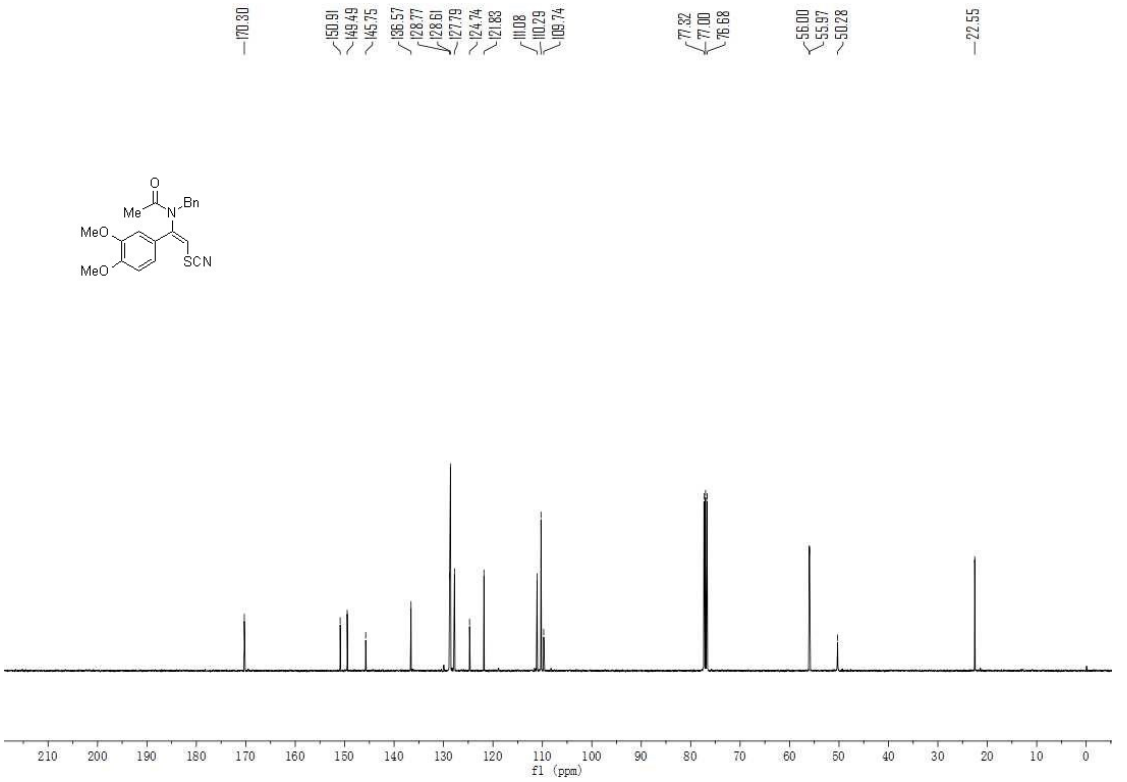

**$^{13}$C NMR spectrum of 3am**



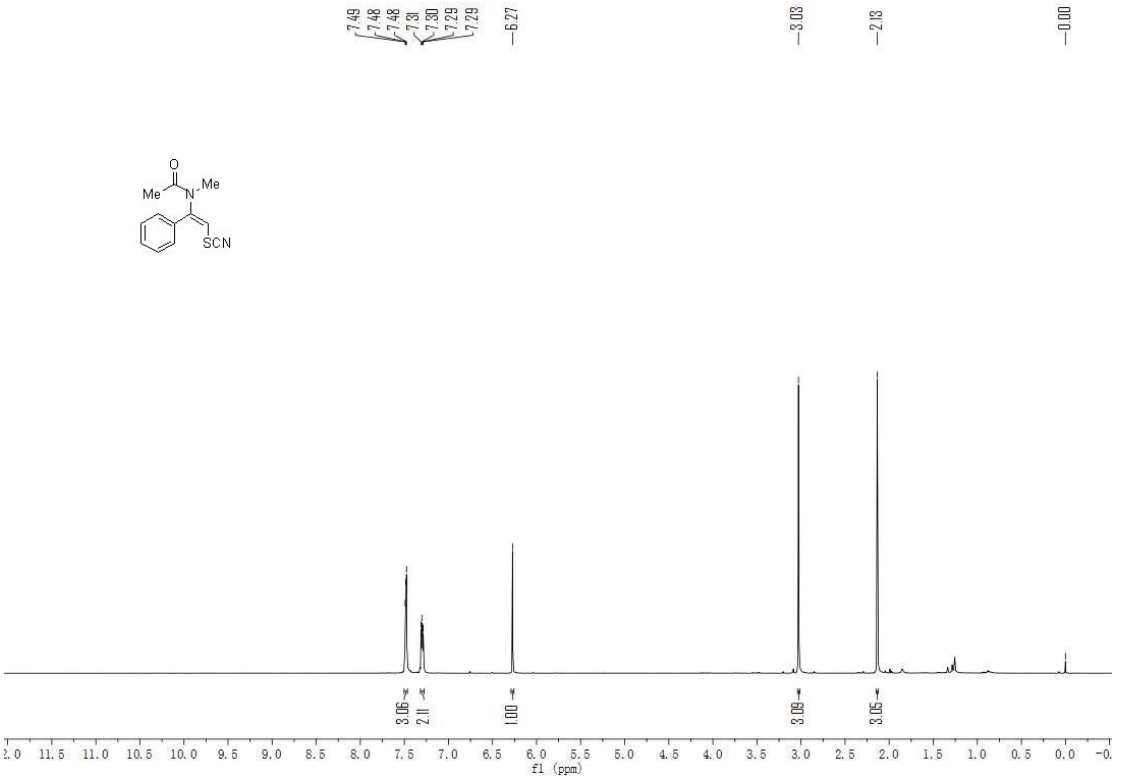

**$^{1}$H NMR spectrum of 3an**



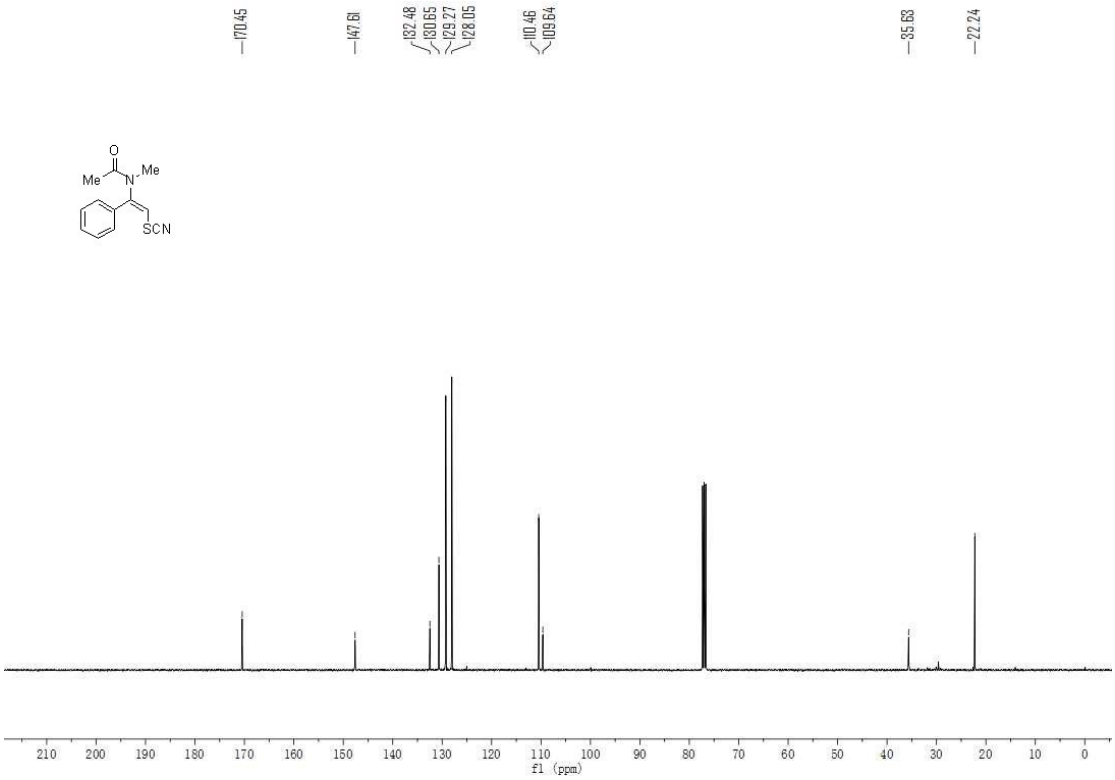

**$^{13}$C NMR spectrum of 3an**



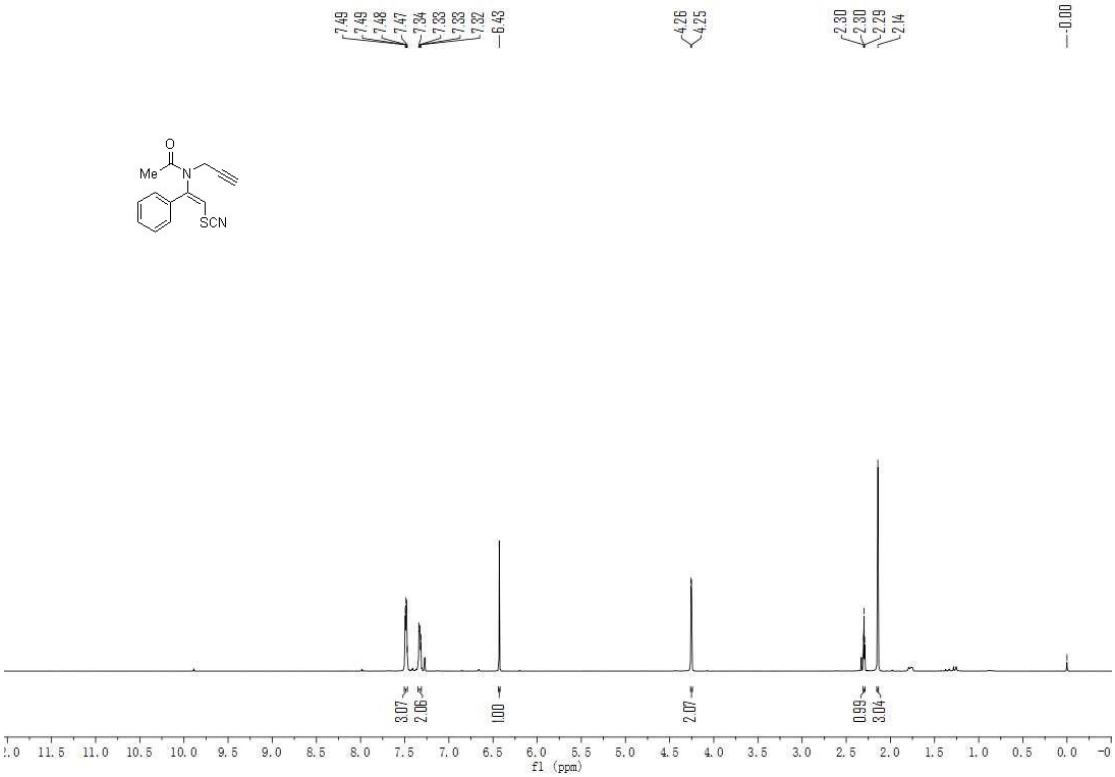

**$^{1}$H NMR spectrum of 3ao**



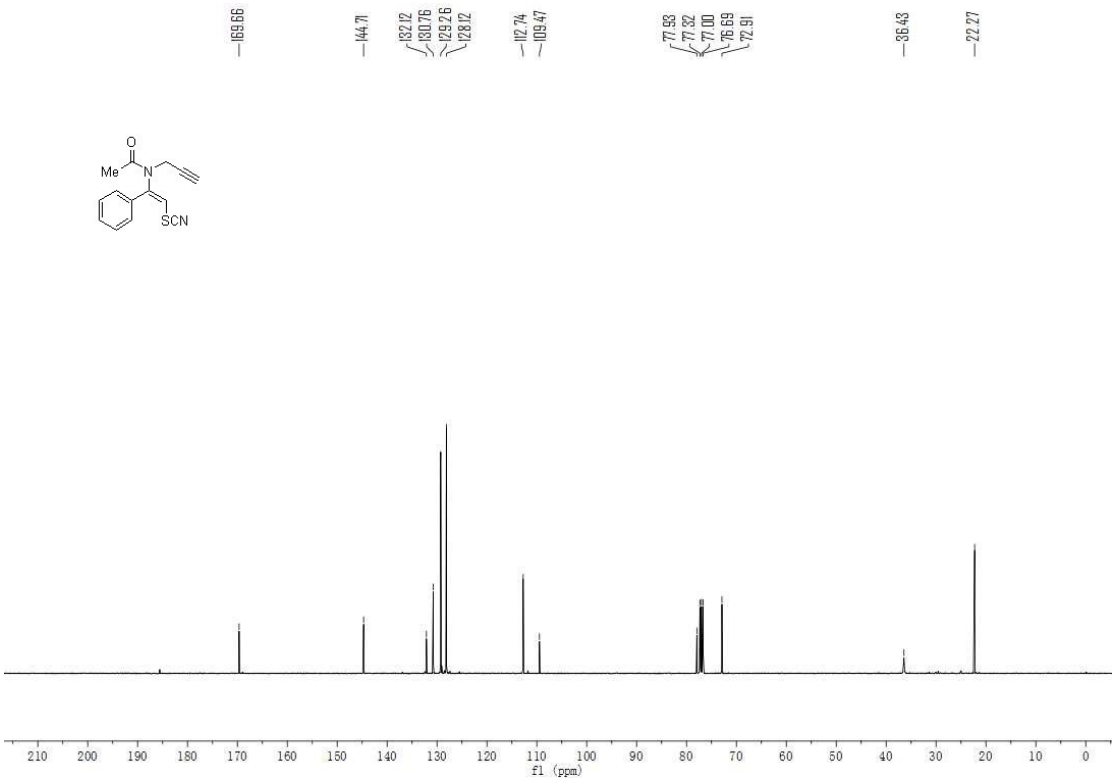

**$^{13}$C NMR spectrum of 3ao**



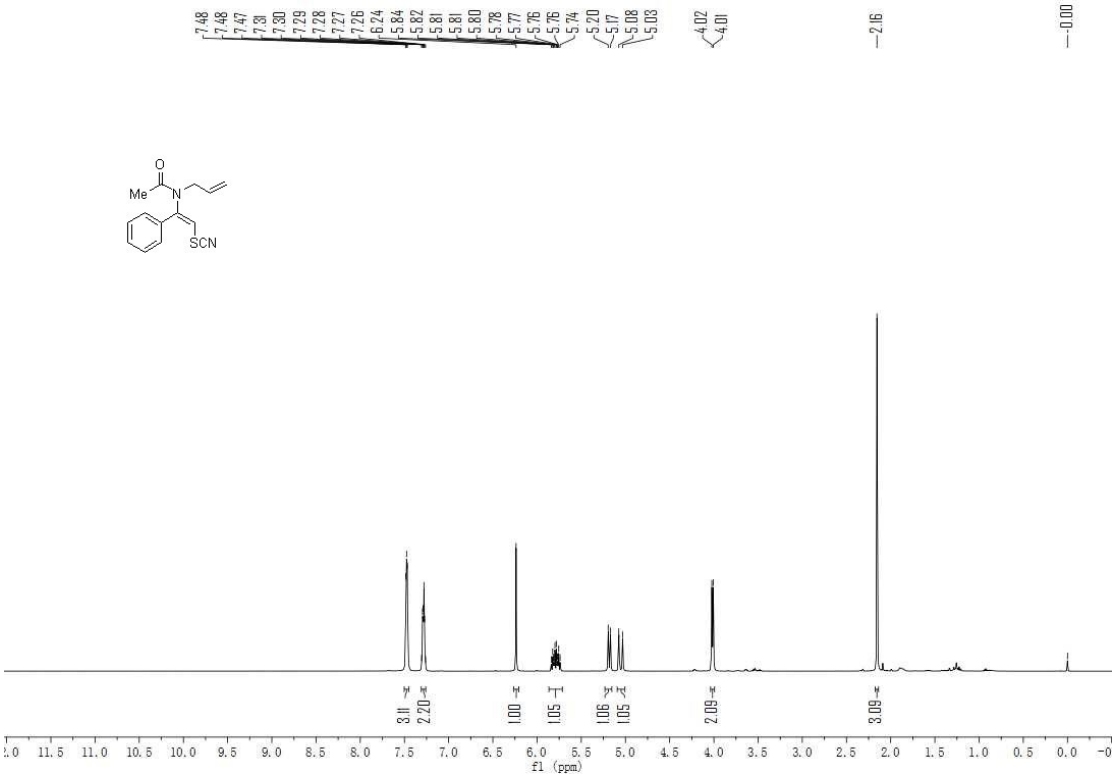

**$^{1}$H NMR spectrum of 3ap**



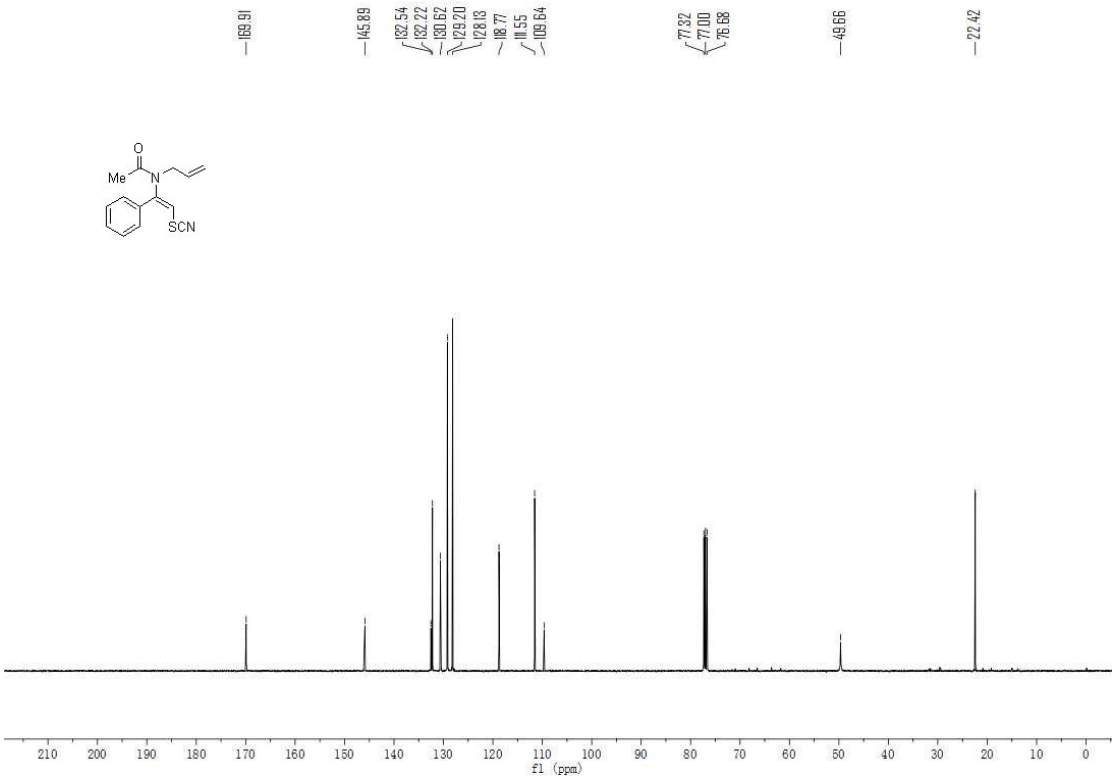

**$^{13}$C NMR spectrum of 3ap**



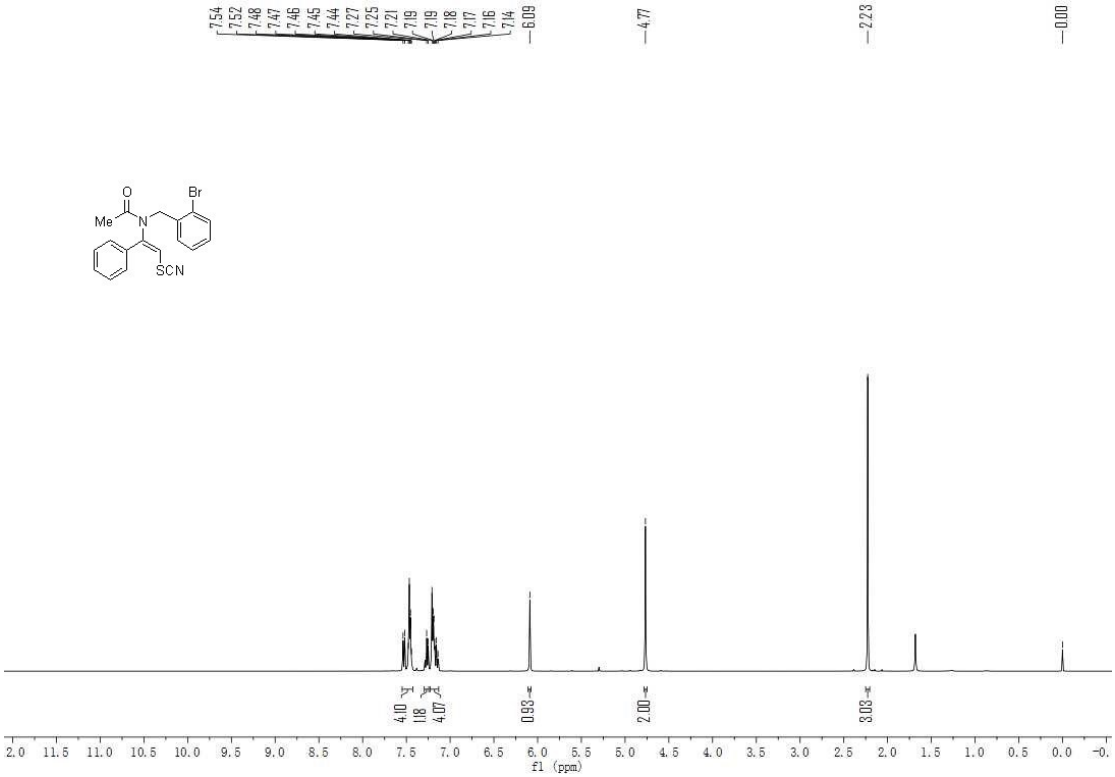

**$^{1}$H NMR spectrum of 3aq**



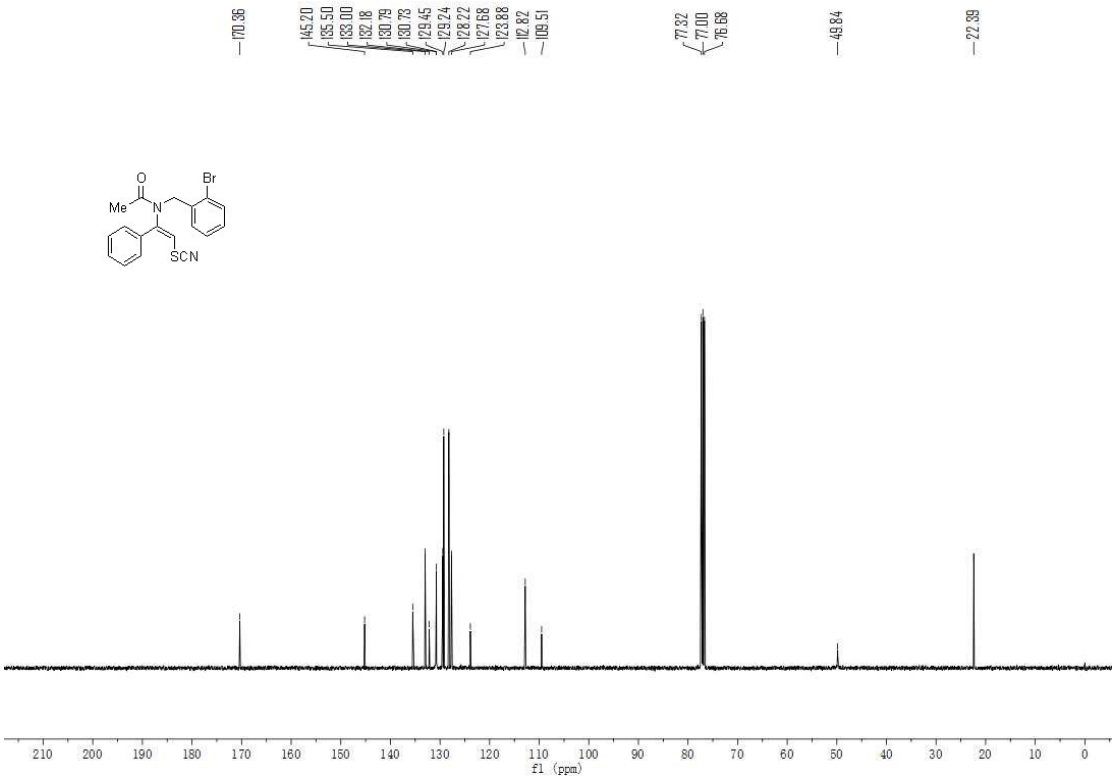

**$^{13}$C NMR spectrum of 3aq**



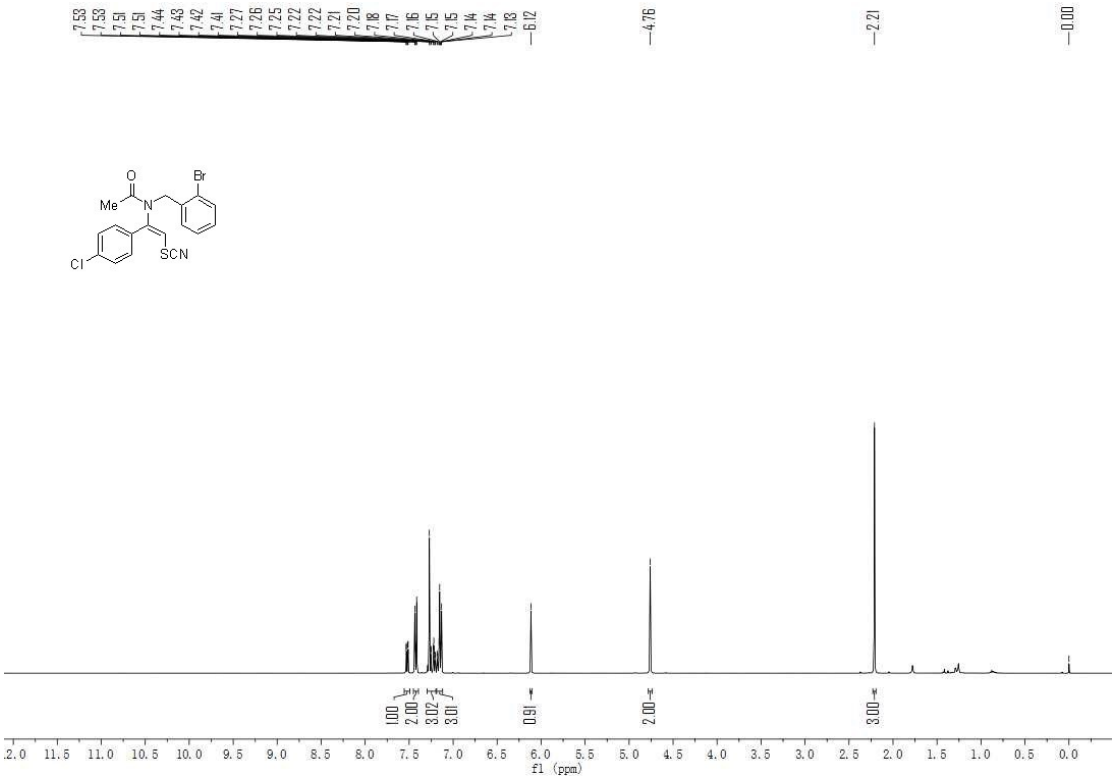

**$^{1}$H NMR spectrum of 3ar**



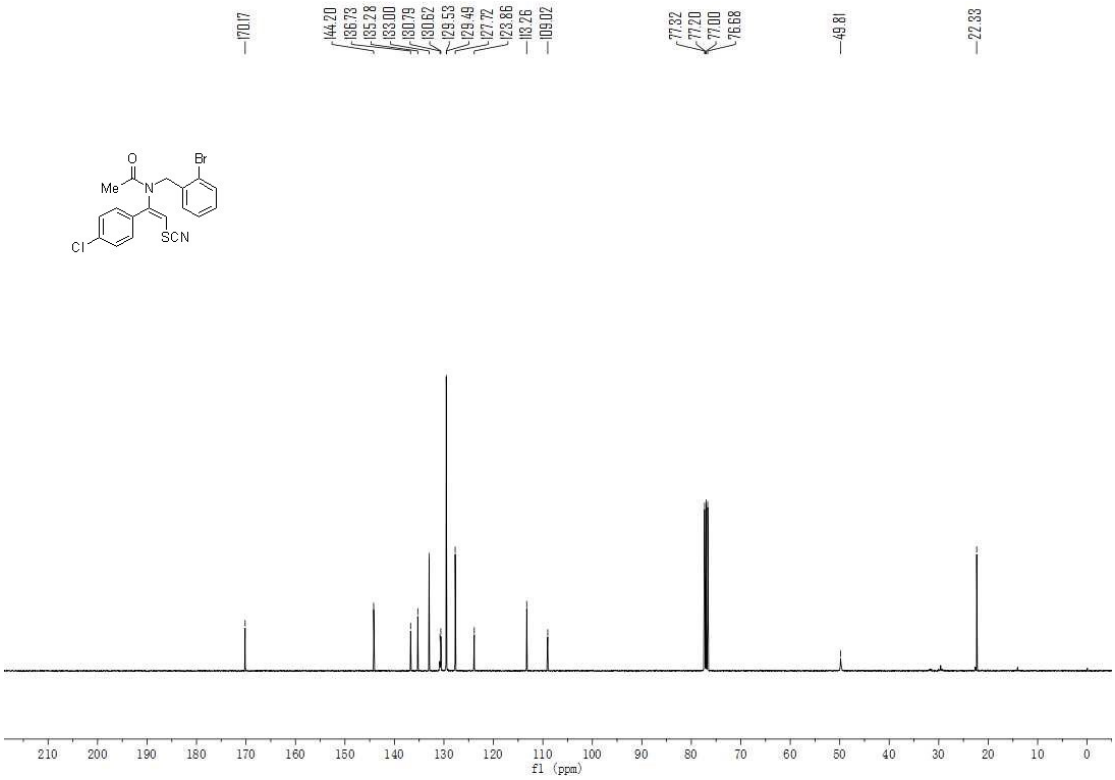

**$^{13}$C NMR spectrum of 3ar**



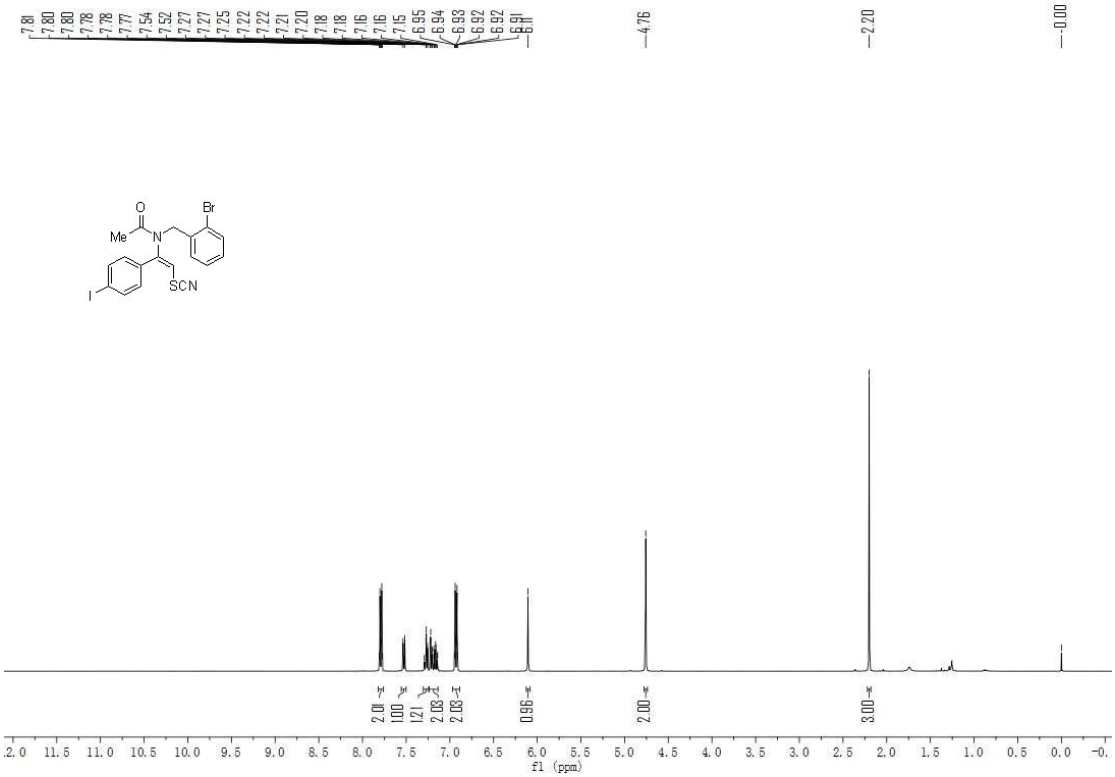

**$^{1}$H NMR spectrum of 3as**



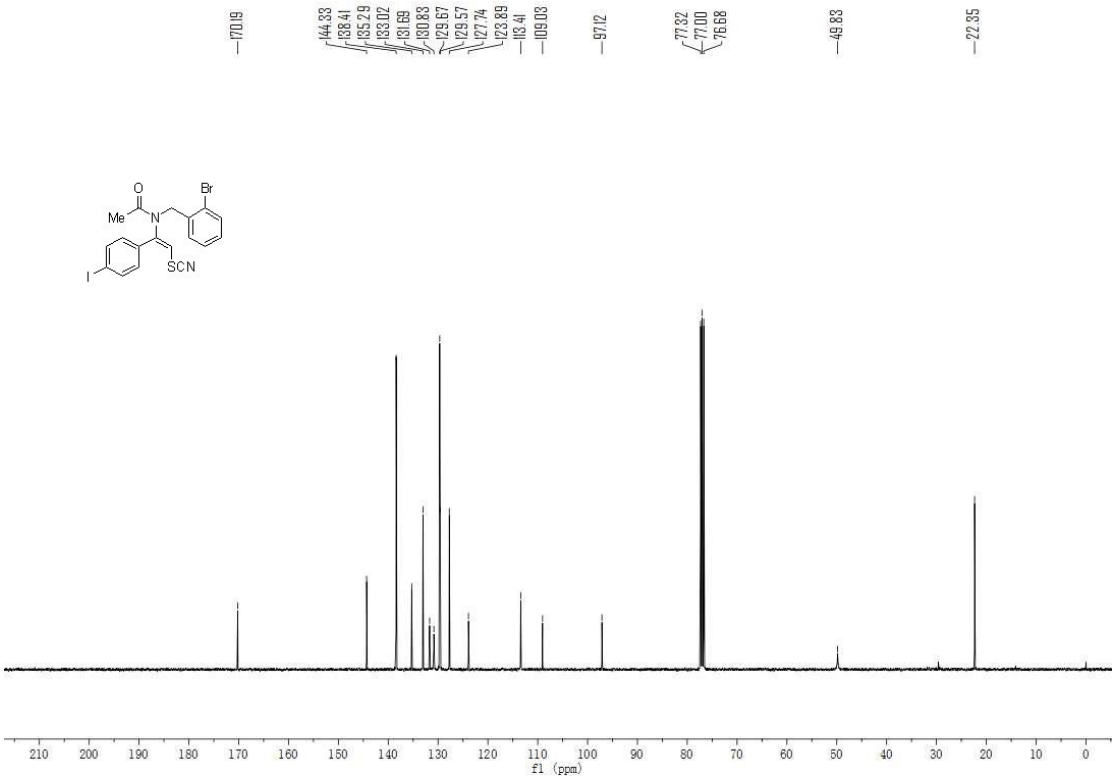

**$^{13}$C NMR spectrum of 3as**



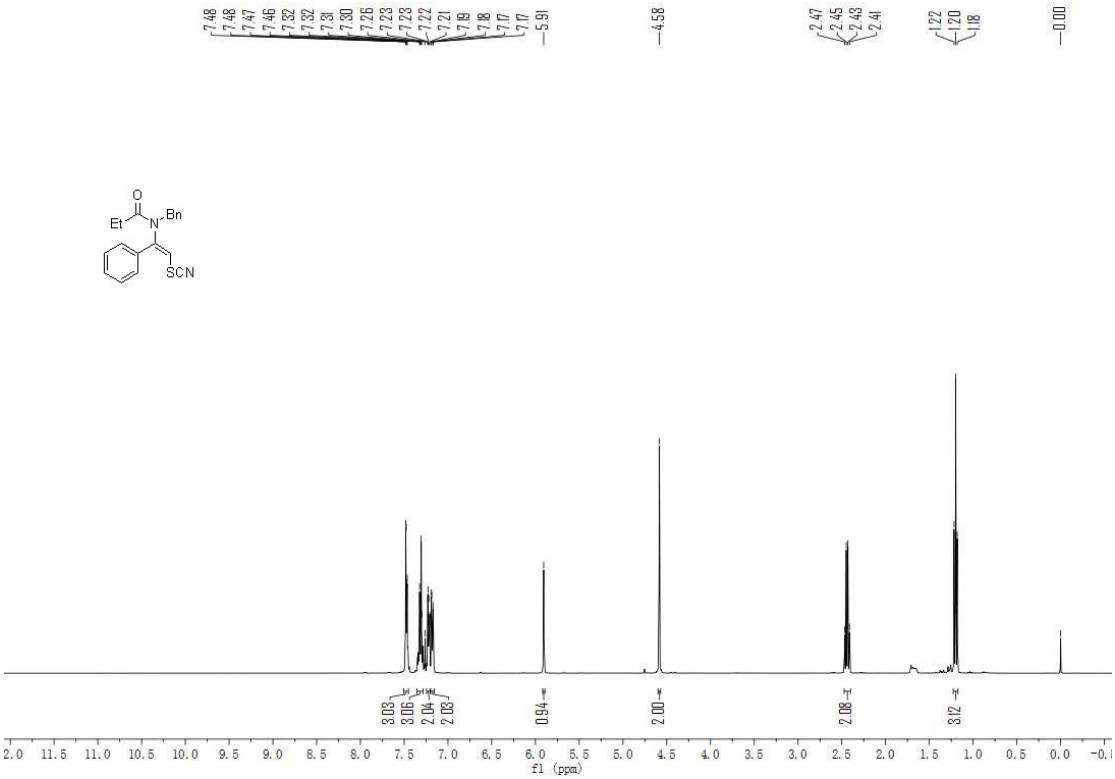

**$^{1}$H NMR spectrum of 3at**



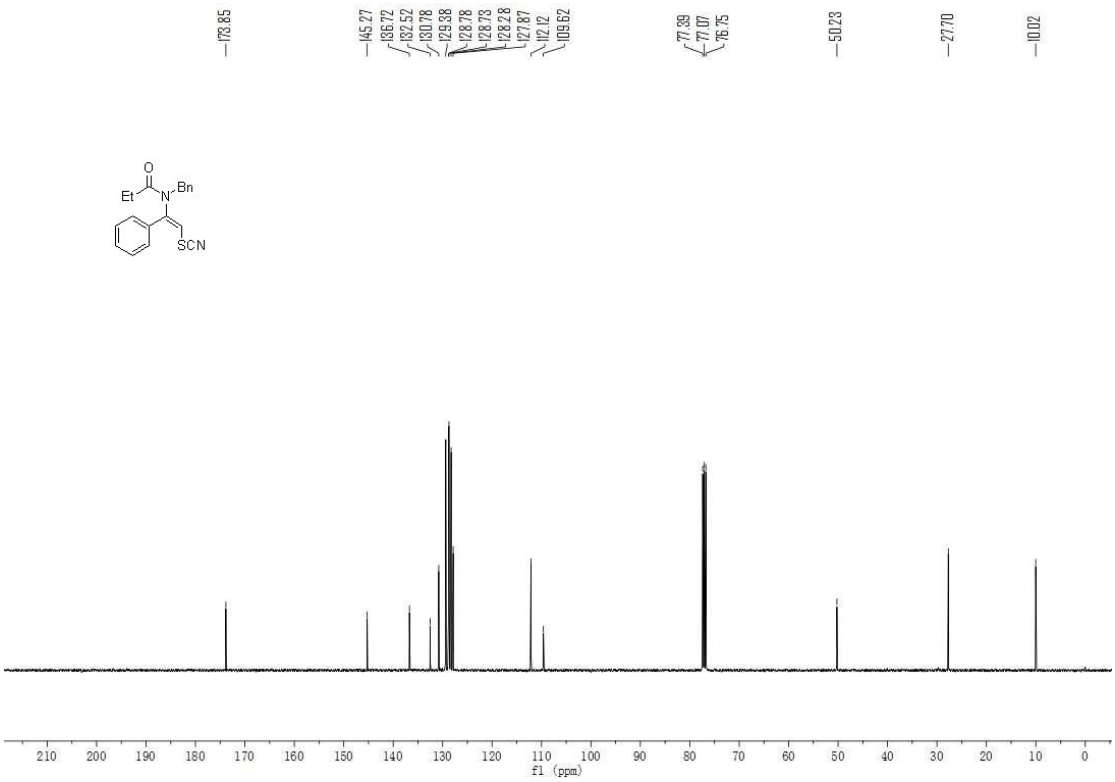

**$^{13}$C NMR spectrum of 3at**



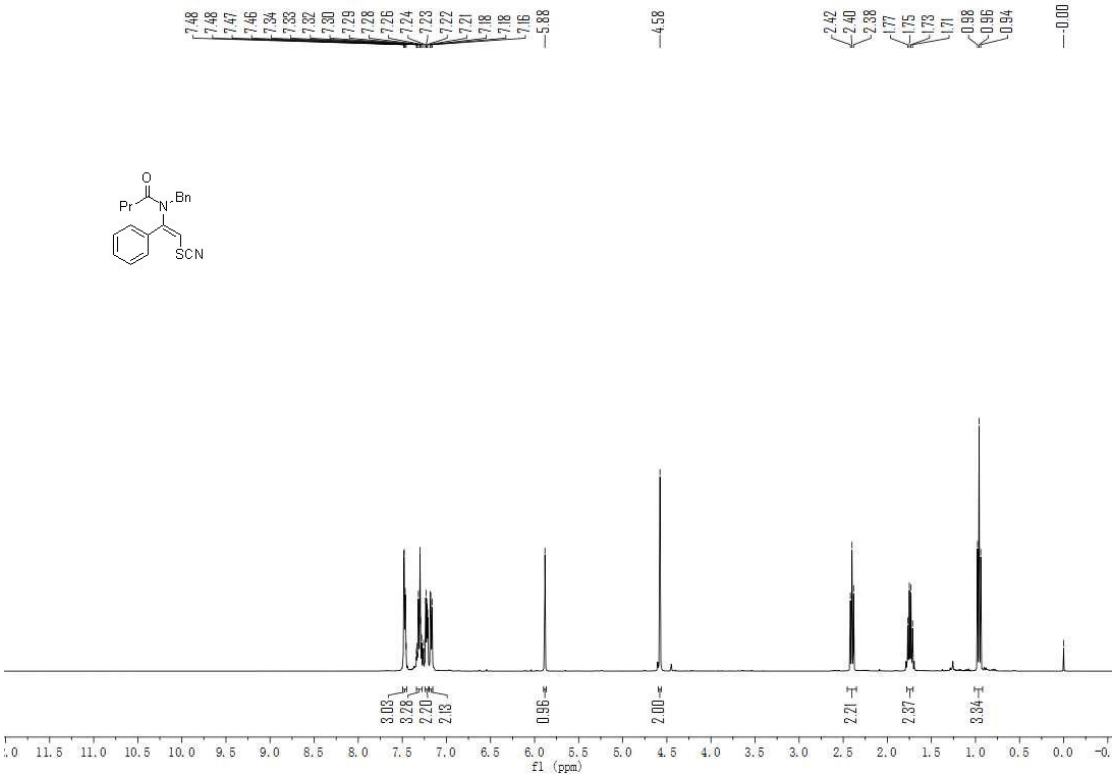

**$^{1}$H NMR spectrum of 3au**



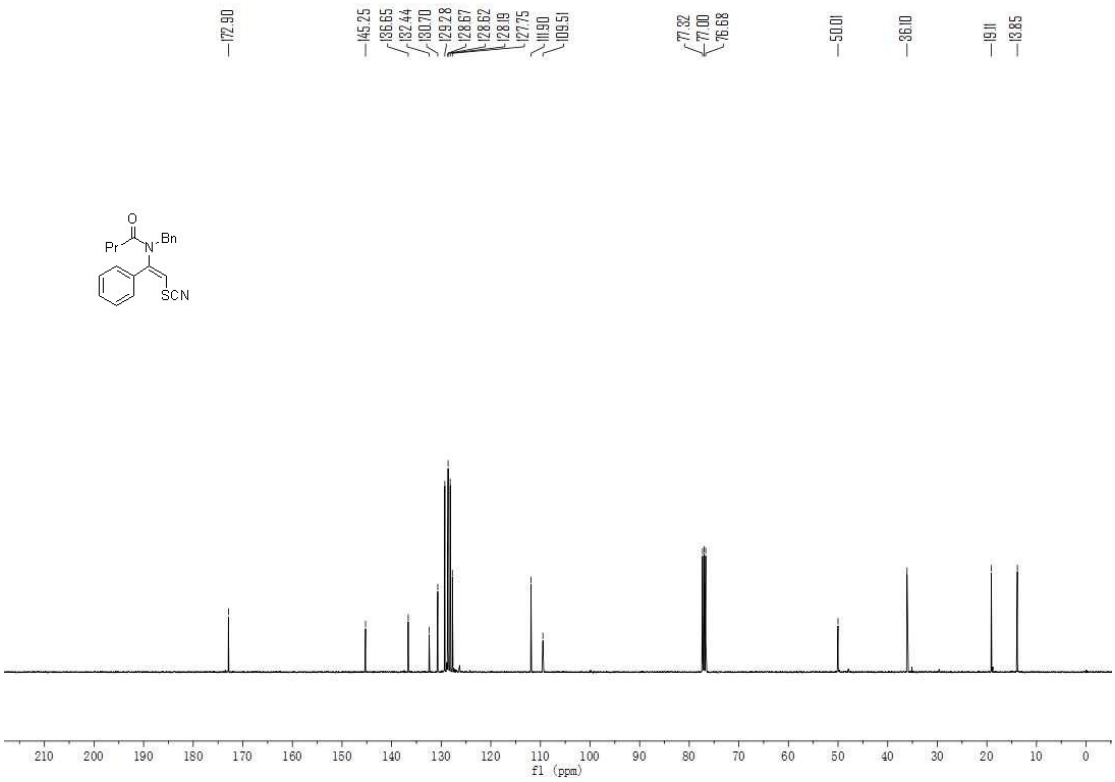

**$^{13}$C NMR spectrum of 3au**



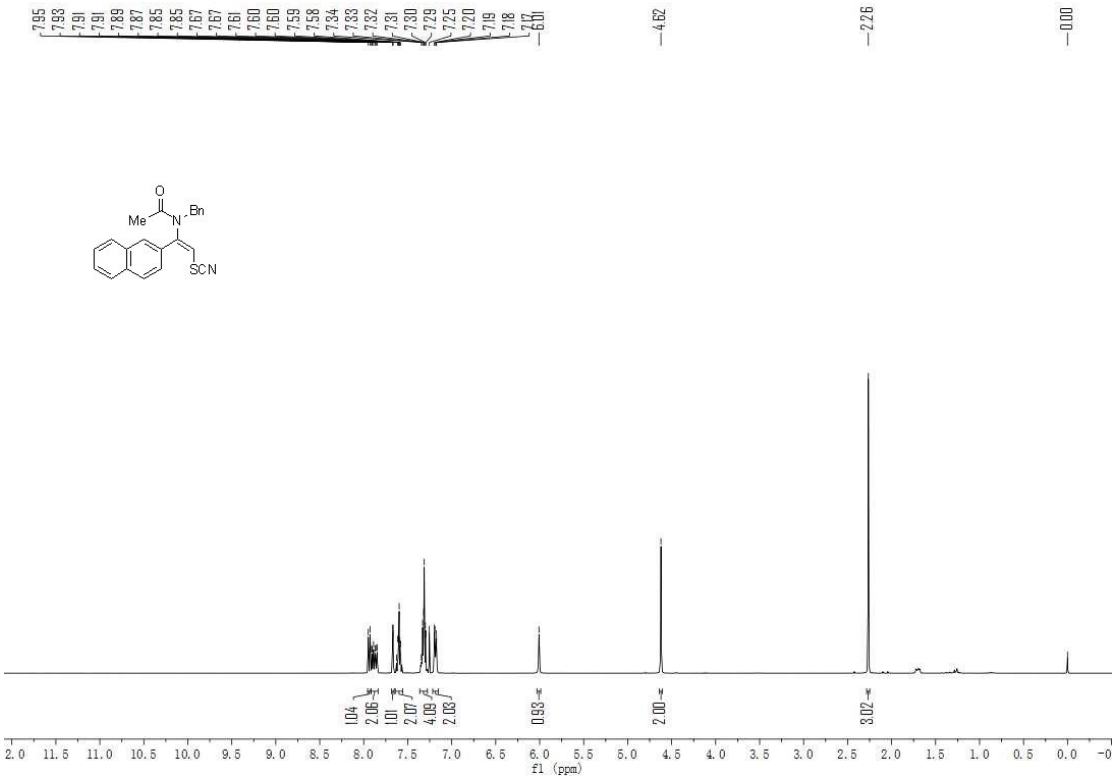

**$^{1}$H NMR spectrum of 3av**



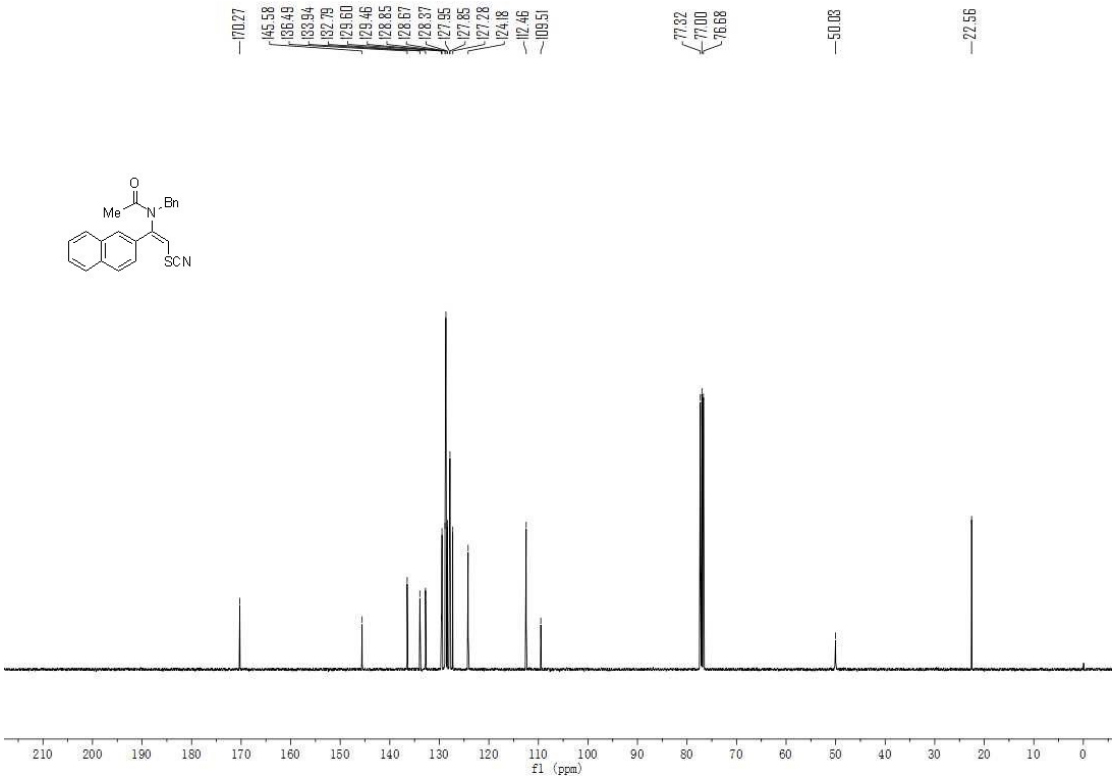

**$^{13}$C NMR spectrum of 3av**



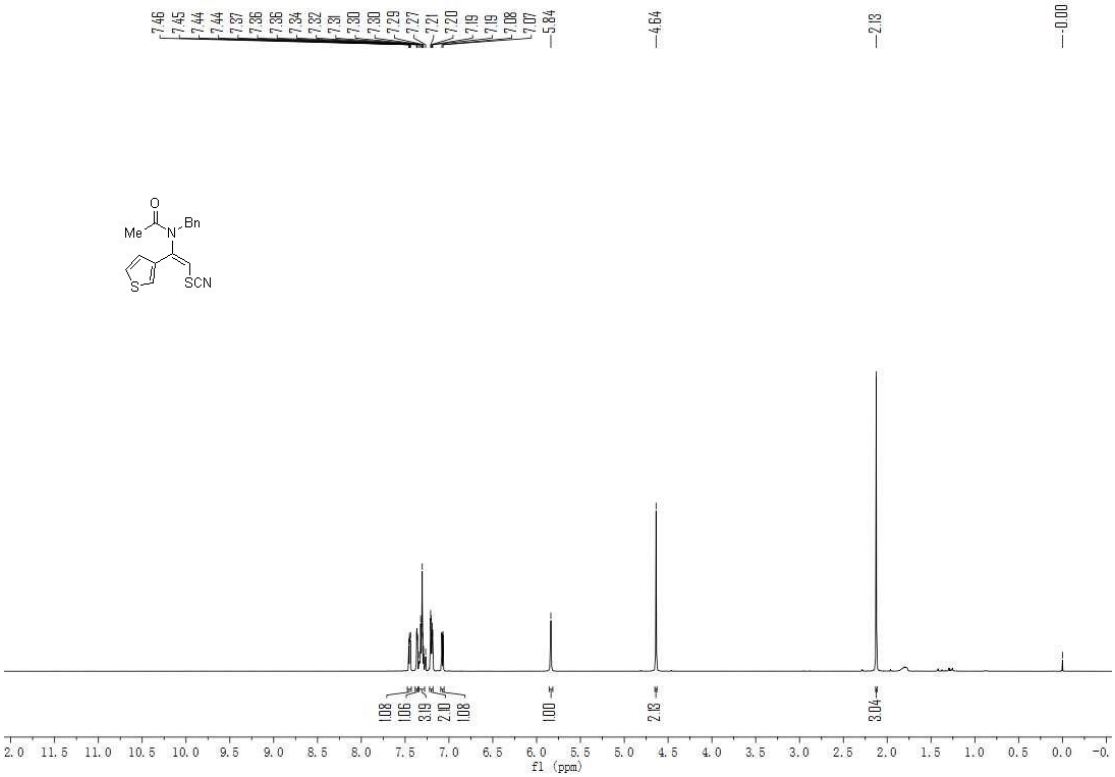

**$^{1}$H NMR spectrum of 3aw**



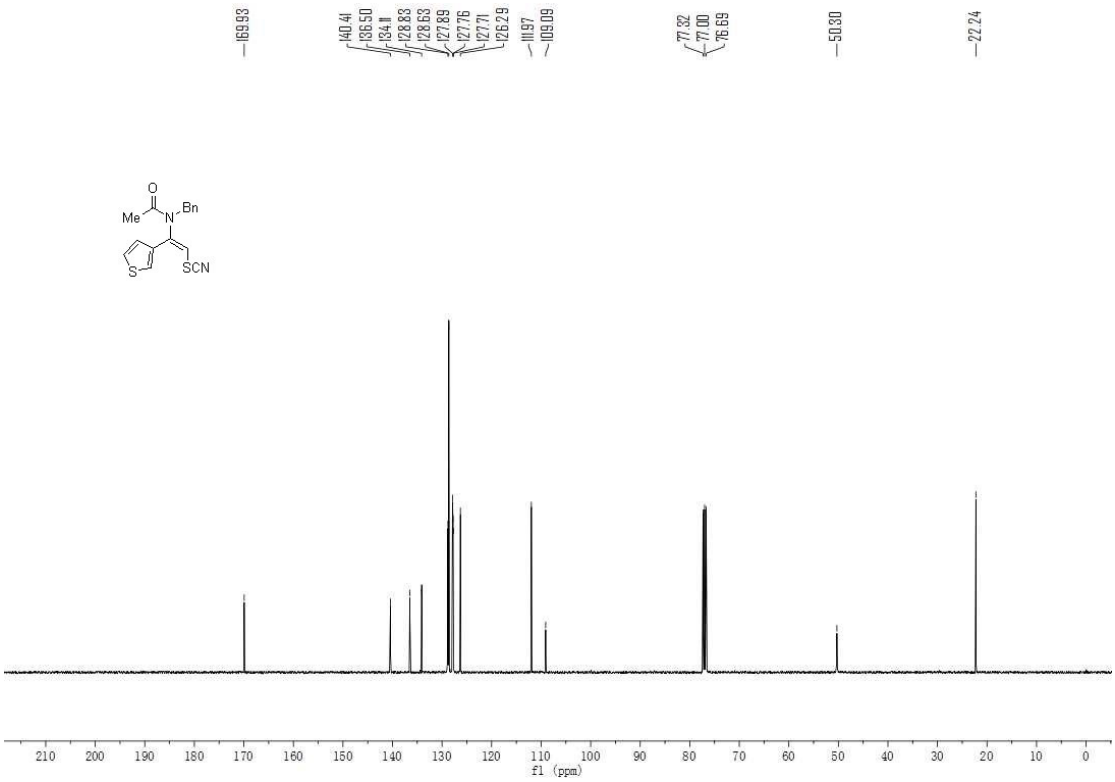

**$^{13}$C NMR spectrum of 3aw**



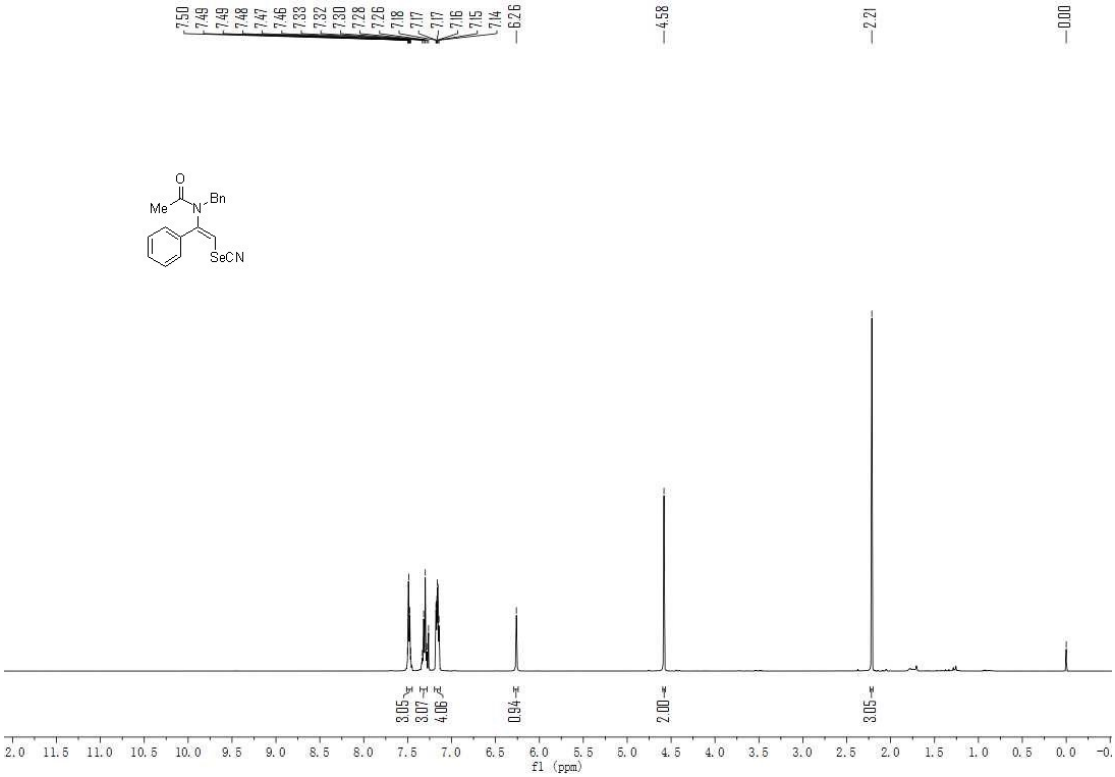

**$^{1}$H NMR spectrum of 3ax**



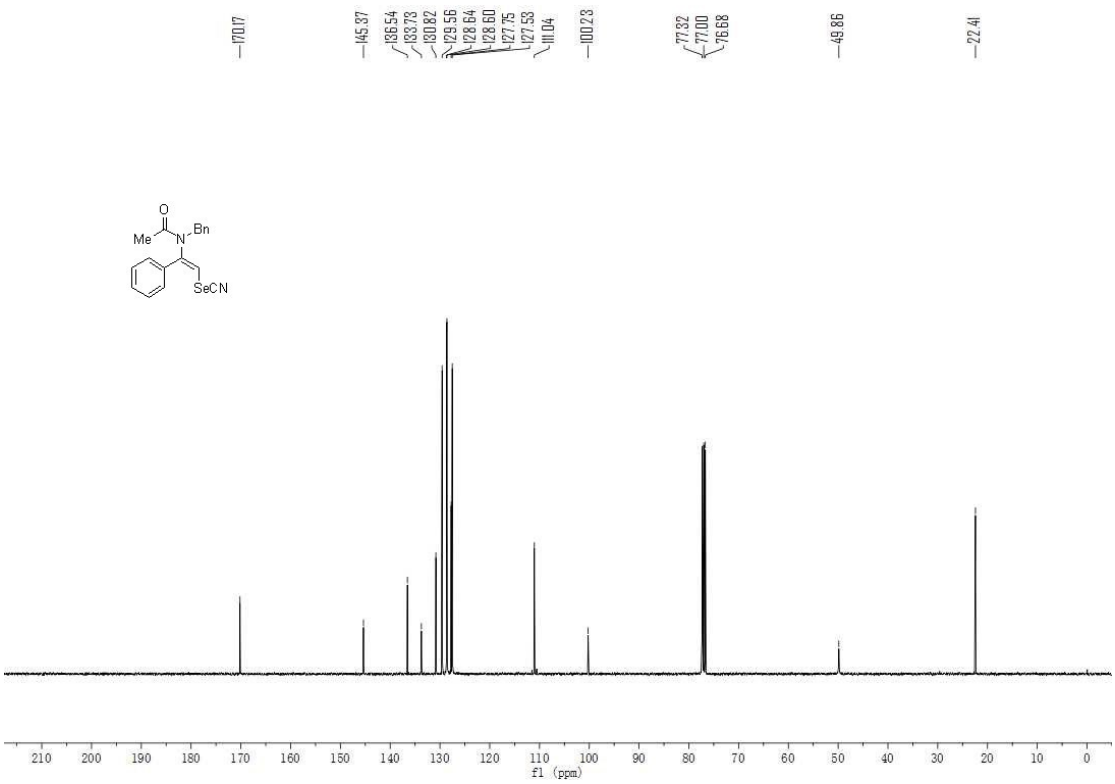

**$^{13}$C NMR spectrum of 3ax**



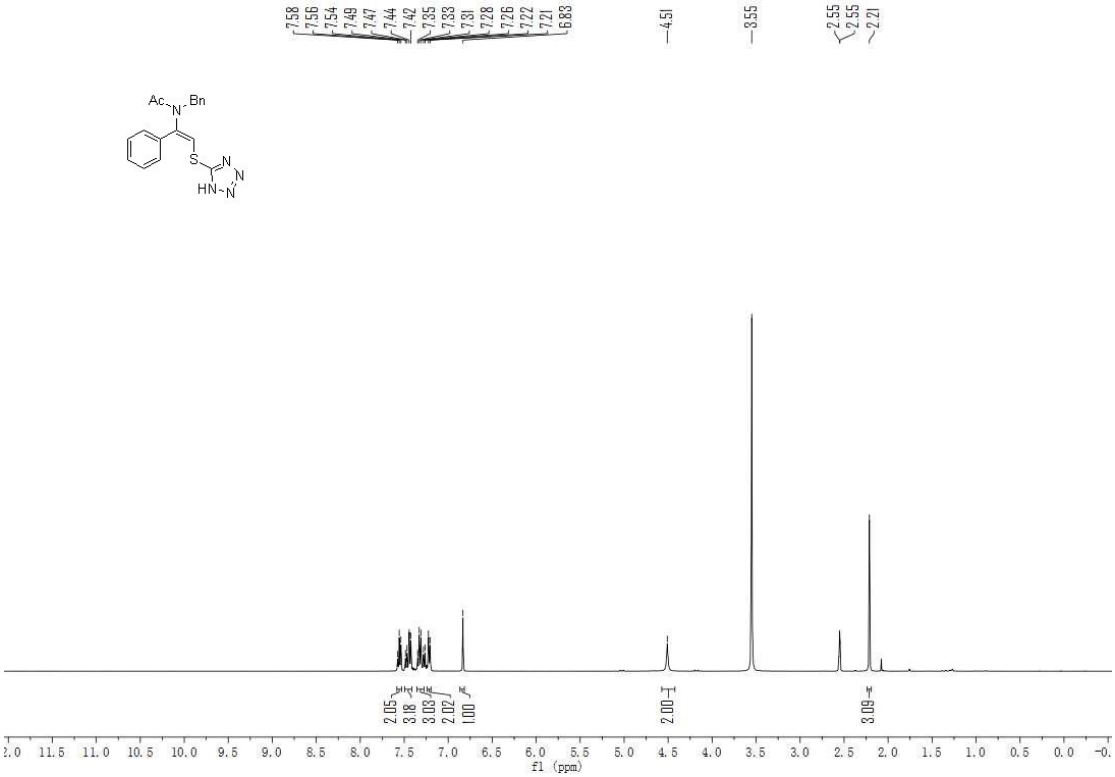

**$^{1}$H NMR spectrum of 3ay**



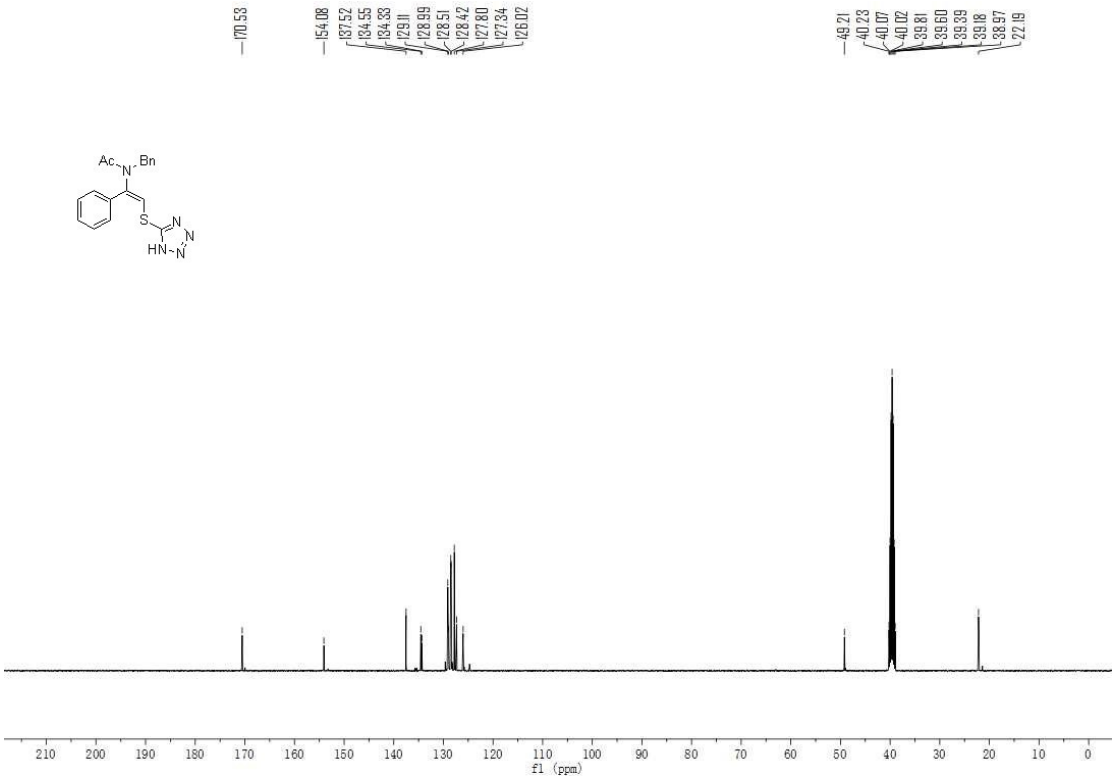

**$^{13}$C NMR spectrum of 3ay**



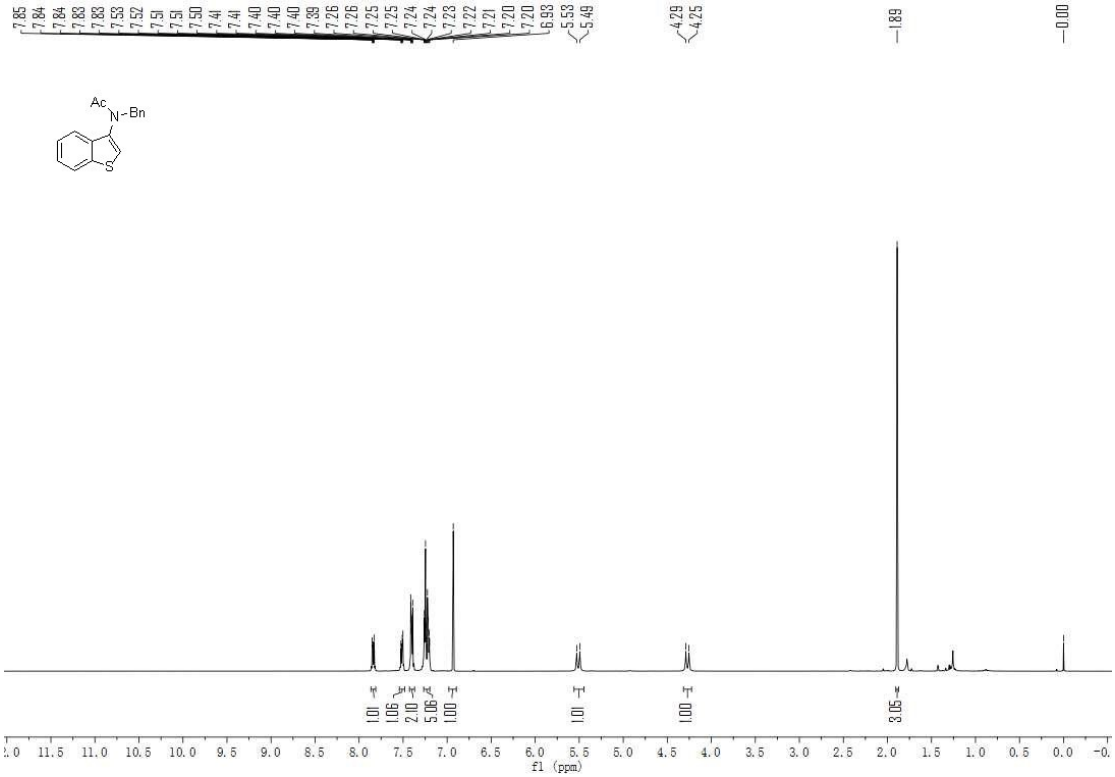

**$^{1}$H NMR spectrum of 4**



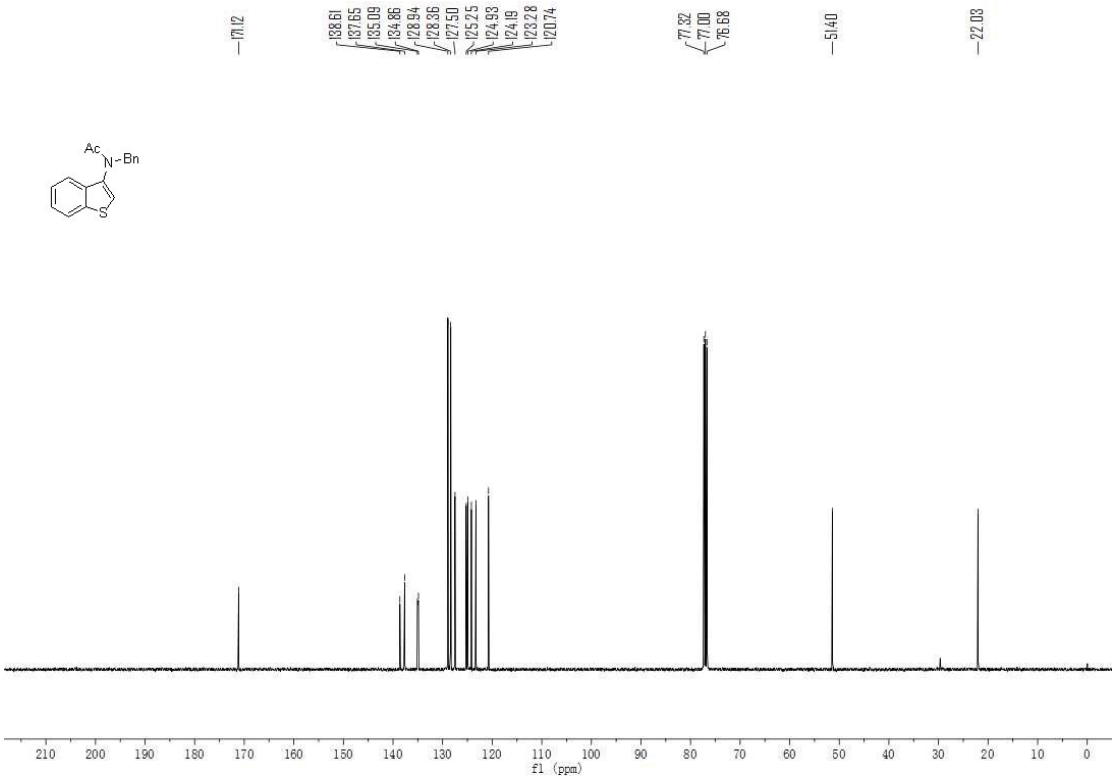

**$^{13}$C NMR spectrum of 4**



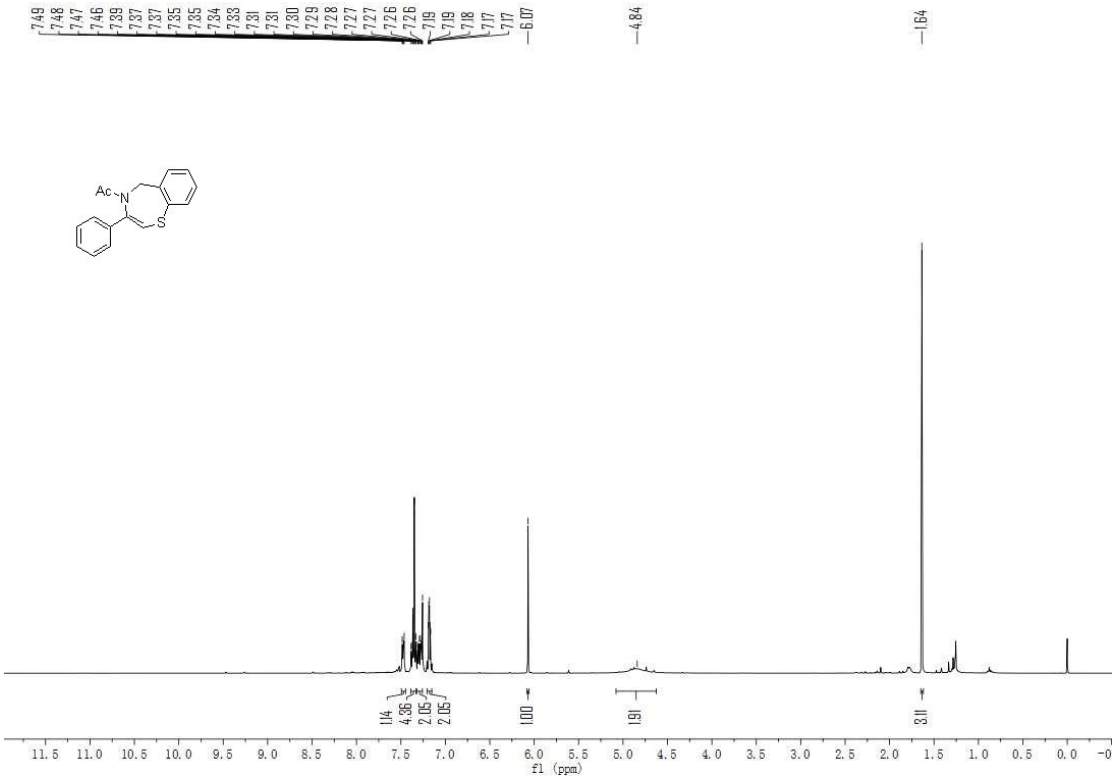

**$^{1}$H NMR spectrum of 5**



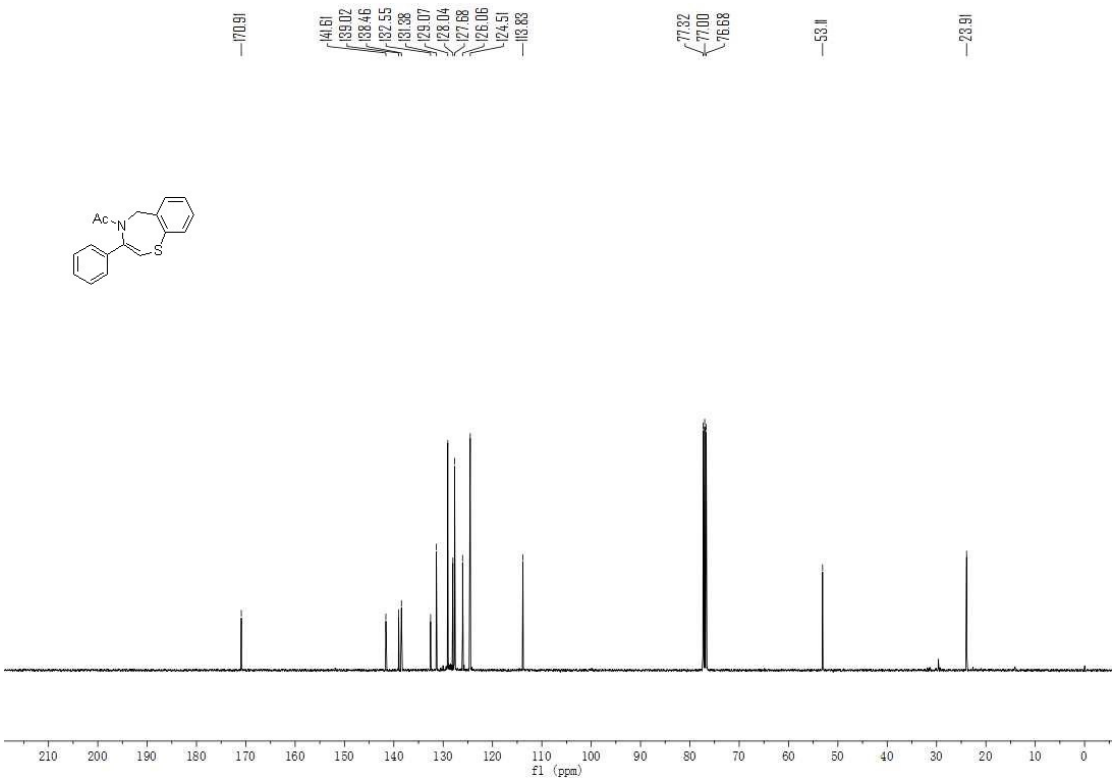

**$^{13}$C NMR spectrum of 5**



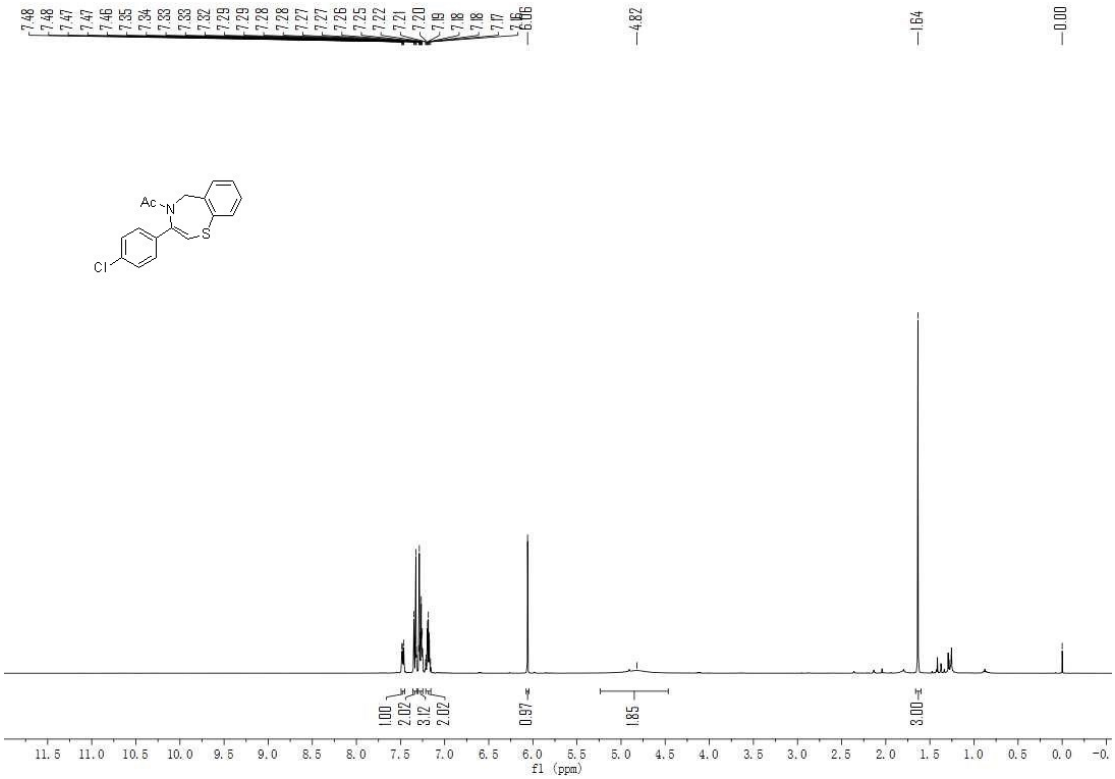

**$^{1}$H NMR spectrum of 6**



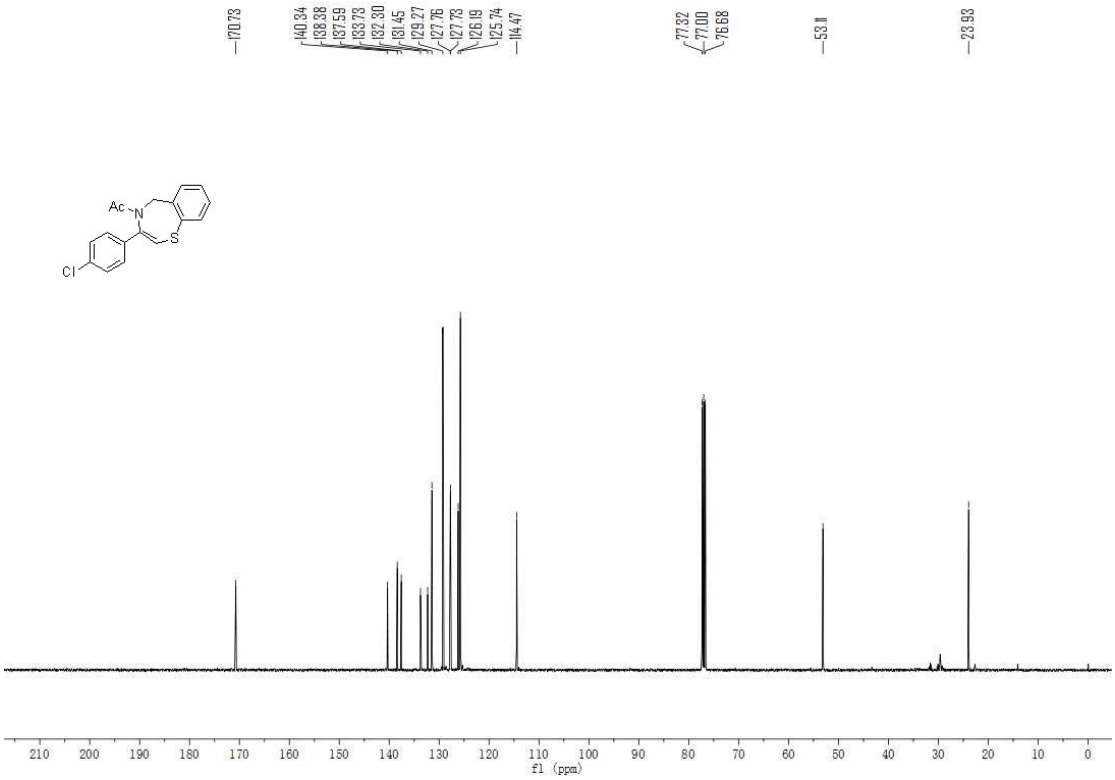

**$^{13}$C NMR spectrum of 6**



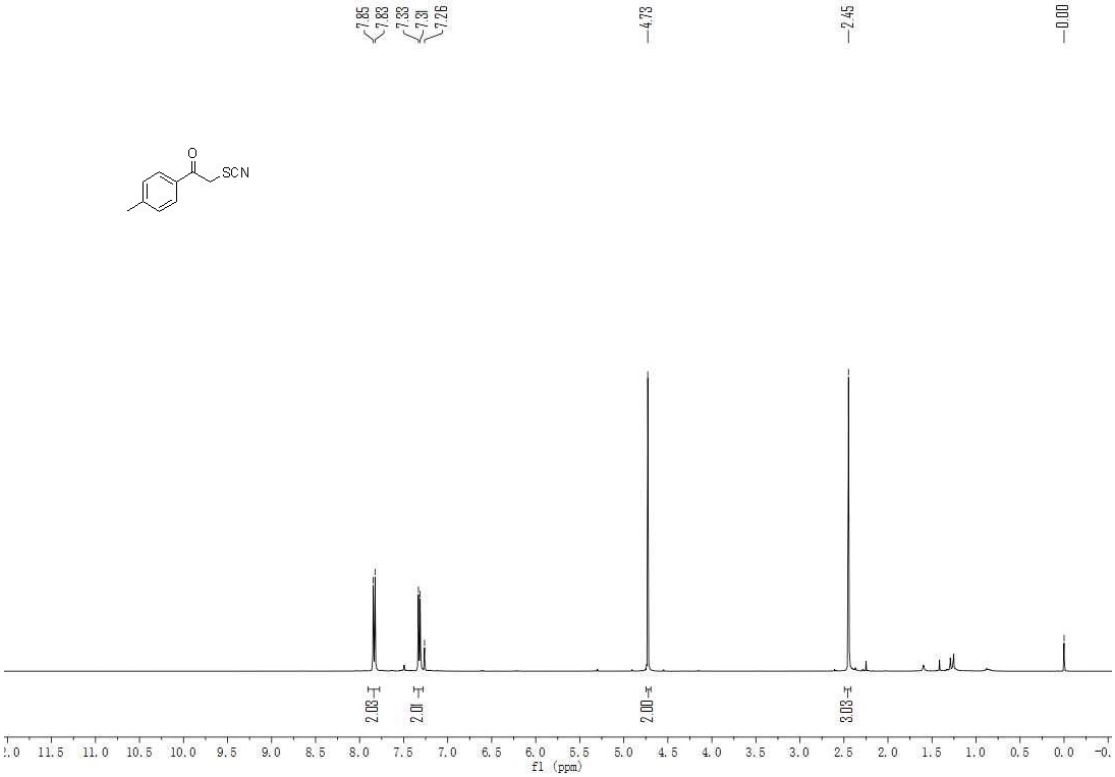

**$^{1}$H NMR spectrum of 7**



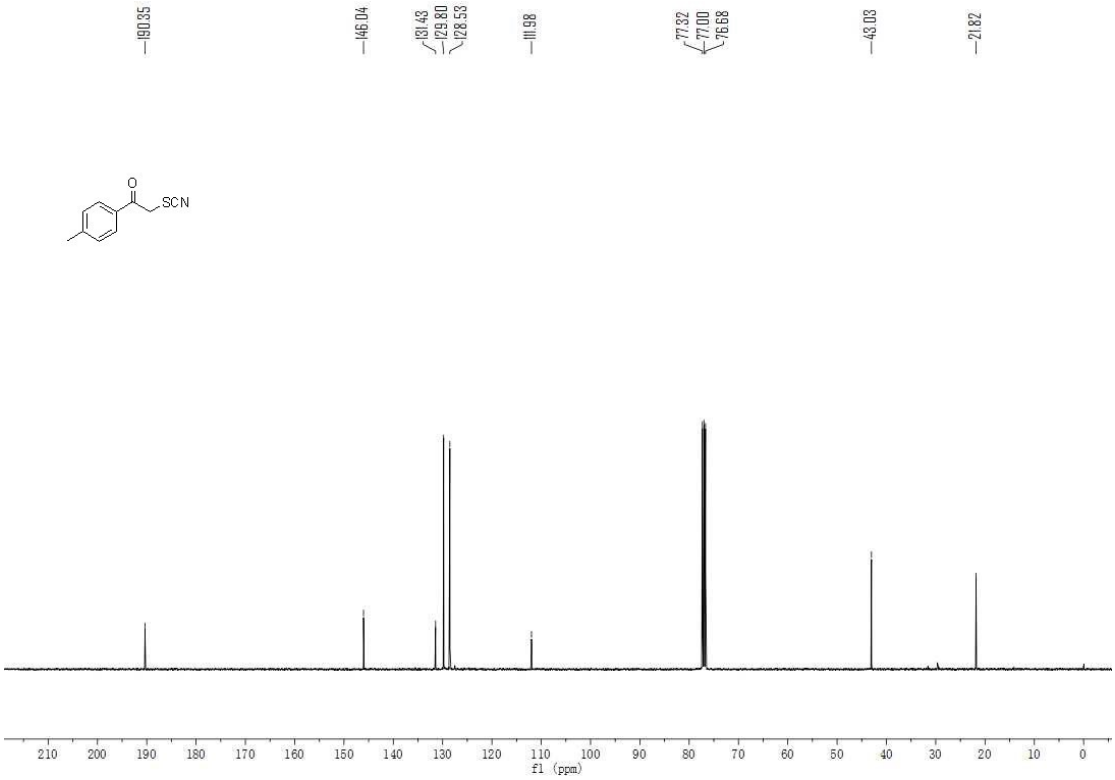

**$^{13}$C NMR spectrum of 7**



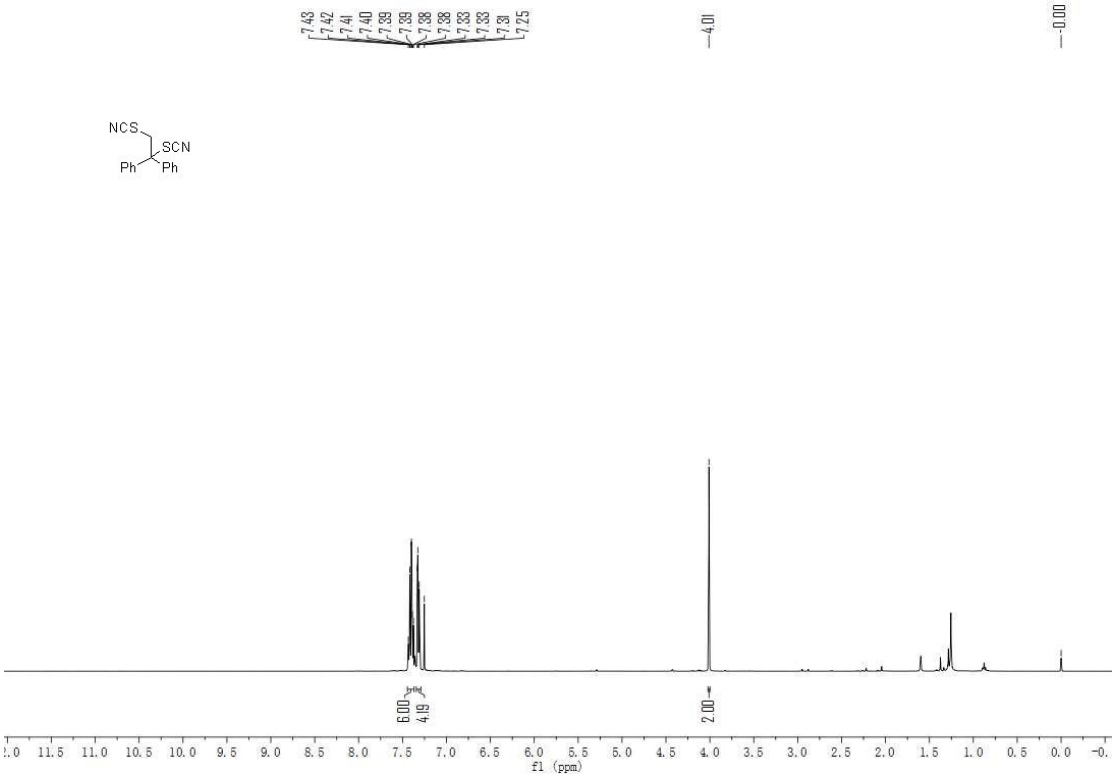

**$^{1}$H NMR spectrum of 9**



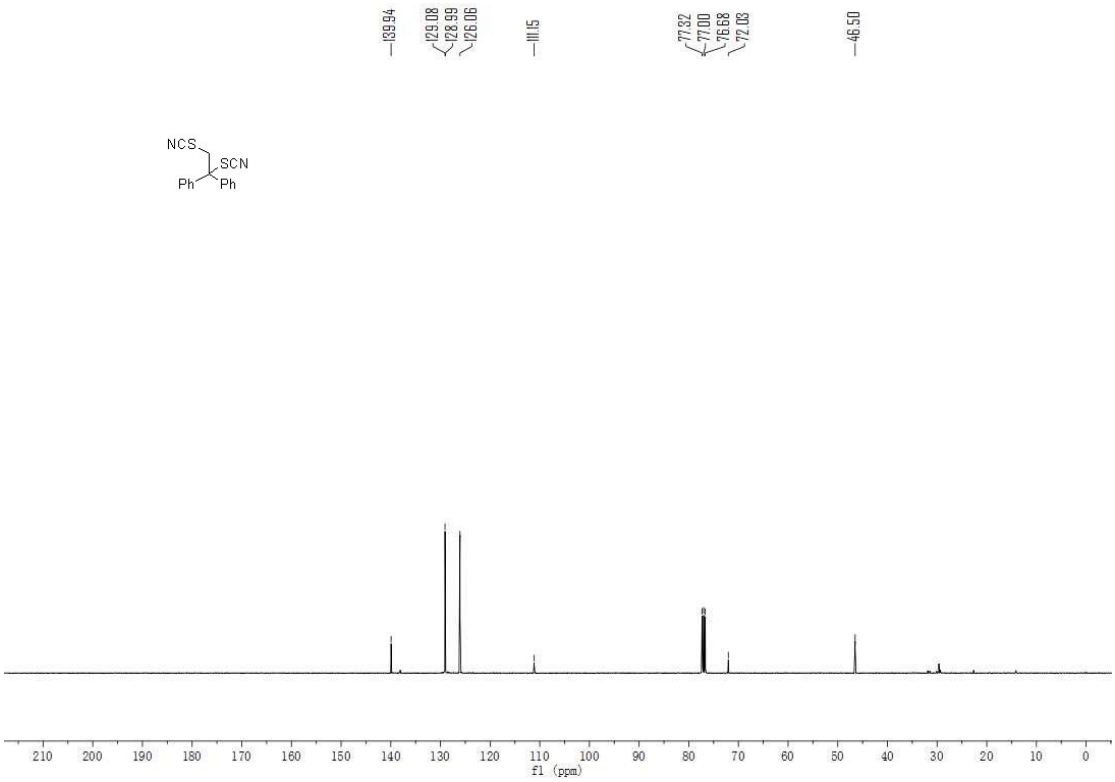

**$^{13}$C NMR spectrum of 9**




**$^{1}$H NMR spectrum of 10**




**$^{13}$C NMR spectrum of 10**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77.00
76.68
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46.50
NCS
SCN
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200
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180
170
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150
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70
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50
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30
20
10
0
f1 (ppm)