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Cyanation of α,β-unsaturated enones by malononitrile in open air with metal-catalyst-free

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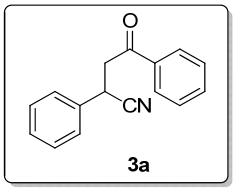
I. General

All reagents were purchased from commercial sources and used without treatment, unless otherwise indicated. The products were purified by column chromatography over silica gel. ^{1}H NMR and ^{13}C NMR spectra were recorded at 25 ºC on a Varian 500 MHz and 125 MHz, respectively, and TMS as internal standard. IR spectra (KBr) were recorded on a Magna-560 FTIR spectrophotometer in the range of 400~4000 cm-1. Elemental analyses were measured on an E-2400 analyzer (Perkin-Elmer). Mass spectra were recorded on Agilient 1100 LCMsD mass spectrometer.

II. Synthesis and analytical data of 3.

General procedure for the preparation of **3** (**3a** as an example): To a solution of (*E*)-chalcone **1a** (208 mg, 1.0 mmol) in DMF (4 mL) was added malononitrile (73 mg, 1.1 mmol) and K_2CO_3 (152 mg, 1.1 mmol). The reaction mixture was stirred at room temperature for 12 h. After completion of the reaction, the solution poured into water and then extracted with CH_2Cl_2 (3 × 10 mL). The combined organic phase was washed with water (3 × 10 mL), dried over anhydrous $MgSO_4$, filtered and concentrated under reduced pressure. The crude product was purified by flash chromatography (silica gel, petroleum ether: diethyl ether = 9: 1) to give **3a** (223 mg, 95%) as a white solid.

4-oxo-2, 4-diphenylbutanenitrile (3a)



3a

White solid. m.p. 120-122 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.49-3.54 (m, 1H), 3.71-3.77 (m, 1H), 4.56-4.59 (m, 1H), 7.34-7.36 (d, J = 7.0 Hz, 1H), 7.38-7.44 (m, 2H), 7.45-7.49 (m, 4H), 7.59-7.60 (d, J = 7.5 Hz, 1H), 7.92-7.94 (t, J = 7.0 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.8, 44.5, 120.6, 127.5, 128.1, 128.4, 128.8, 129.3, 133.9, 135.2, 135.6, 194.6. MS calcd m/z 235.1, found 236.1 $[(M + 1)]^+$. Anal. Calcd for $C_{16}H_{13}NO$: C, 81.68; H, 5.57; N, 5.95; Found: C, 81.75; H, 5.59; N, 6.01.

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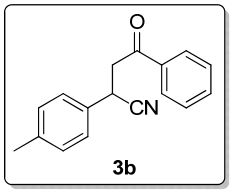
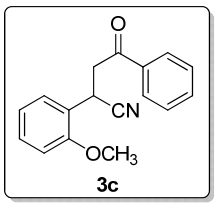
4-oxo-4-phenyl-2-(*p*-tolyl)butanenitrile (3b)



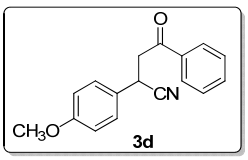
White solid. m.p. 65-67 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 2.35 (s, 3H), 3.47-3.52 (m, 1H), 3.69-3.74 (m, 1H), 4.52-4.55 (m, 1H), 7.19-7.20 (d, J = 8.0 Hz, 2H), 7.31-7.33 (d, J = 8.5 Hz, 2H), 7.46-7.49 (t, J =7.5 Hz, 2H), 7.58-7.61 (t, J = 7.5 Hz, 1H), 7.92-7.93 (d, J = 7.5 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 21.1, 31.5, 44.5, 120.8, 127.3, 128.1, 128.8, 129.9, 132.2, 133.9, 135.6, 138.2, 194.7. MS calcd m/z 249.1, found 250.1 $[(M + 1)]^+$. Anal. Calcd for $C_{17}H_{15}NO$: C, 81.90; H, 6.06; N, 5.62; Found: C, 81.78; H, 6.01; N, 5.57.

2-(2-methoxyphenyl)-4-oxo-4-phenylbutanenitrile (3c)



White solid. m.p. 72-74 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.48-3.53 (m, 1H), 3.63-3.68 (m, 1H), 3.82 (s, 3H), 4.77-4.79 (m, 1H), 6.91-6.93 (d, J = 8.5 Hz, 1H), 6.99-7.02 (m, 1H), 7.32-7.35 (m, 1H), 7.45-7.47 (d, J = 7.5 Hz, 2H), 7.48-7.52 (m, 1H), 7.57-7.60 (m, 1H), 7.93-7.95 (m, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 27.4, 42.1, 55.5, 110.9, 120.6, 121.0, 123.0, 128.0, 128.7, 128.9, 129.7, 133.7, 135.8, 156.2, 195.3. MS calcd m/z 265.1, found 266.1 $[(M + 1)]^+$. Anal. Calcd for $C_{17}H_{15}NO_2$: C, 76.96; H, 5.70; N, 5.28; Found: C, 77.04; H, 5.68; N, 5.21.

2-(4-methoxyphenyl)-4-oxo-4-phenylbutanenitrile (3d)



White solid. m.p. 107-109 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.47-3.52 (m, 1H), 3.67-3.72 (m, 1H), 3.80 (s, 3H), 4.51-4.54 (t, J = 7.0 Hz, 1H), 6.90-6.91 (d, J = 7.0 Hz,

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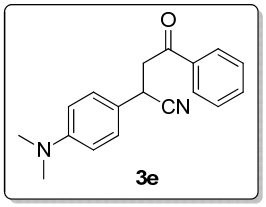
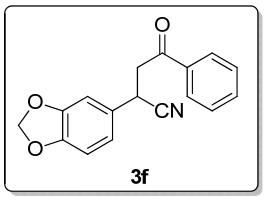
2H), 7.34-7.36 (d, J = 9.0 Hz, 2H), 7.45-7.49 (t, J = 8.0 Hz, 2H), 7.58-7.61 (t, J = 7.0 Hz, 1H), 7.92-7.93 (d, J = 8.0 Hz, 2H); ^{13}C NMR (CDCl3, 125 MHz): δ = 31.1, 44.6, 55.4, 114.6, 120.9, 127.2, 128.1, 128.2, 128.9, 132.9, 135.8, 159.6, 194.8. MS calcd m/z 265.1, found 266.1 $[(M + 1)]^+$. Anal. Calcd for $C_{17}H_{15}NO_2$: C, 76.96; H, 5.70; N, 5.28; Found: C, 77.08; H, 5.67; N, 5.20.

2-(4-(dimethylamino)phenyl)-4-oxo-4-phenylbutanenitrile (3e)



Yellow solid. m.p. 87-89 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 2.95 (s, 6H), 3.45-3.49 (m, 1H), 3.65-3.71 (m, 1H), 4.45-4.48 (m, 1H), 6.69-6.71 (d, J = 8.0 Hz, 2H), 7.26-7.28 (t, J = 9.0 Hz, 2H), 7.45-7.48 (t, J = 8.0 Hz, 2H), 7.57-7.59 (d, J = 7.5 Hz, 1H), 7.91-7.93 (t, J = 7.05 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.1, 40.5, 44.7, 112.8, 121.3, 128.1, 128.3, 128.8, 133.8, 135.9, 150.3, 195.1. MS calcd m/z 278.1, found 279.1 $[(M + 1)]^+$. Anal. Calcd for $C_{18}H_{18}N_2O$: C, 77.67; H, 6.52; N, 10.06; Found: C, 77.76; H, 6.55; N, 10.13.

2-(benzo[d][1,3]dioxol-5-yl)-4-oxo-4-phenylbutanenitrile (3f)



White solid. m.p. 126-128 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.48-3.52 (m, 1H), 3.66-3.72 (m, 1H), 4.48-4.50 (t, J = 7.5 Hz, 1H), 5.99 (s, 2H), 6.79-6.81 (d, J = 8.0 Hz, 1H), 6.89-6.91 (t, J = 7.5 Hz, 2H), 7.47-7.50 (t, J = 8.0 Hz, 2H), 7.59-7.62 (t, J = 7.5 Hz, 1H), 7.92-7.94 (d, J = 7.5 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.5, 44.5, 101.5, 107.9, 108.7, 120.7, 121.0, 128.1, 128.7, 128.8, 133.9, 135.6, 147.6, 148.3, 194.6. MS calcd m/z 279.1, found 280.1 $[(M + 1)]^+$. Anal. Calcd for $C_{17}H_{13}NO_3$: C, 73.11; H, 4.69; N, 5.02; Found: C, 73.02; H, 4.66; N, 4.95.

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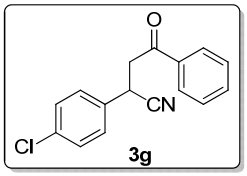
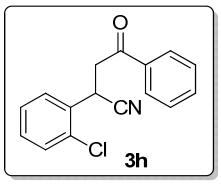
2-(4-chlorophenyl)-4-oxo-4-phenylbutanenitrile (3g)



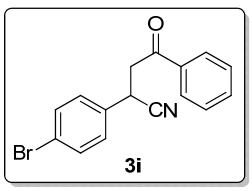
White solid. m.p. 112-114 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.49-3.54 (m, 1H), 3.69-3.74 (m, 1H), 4.55-4.58 (t, J = 7.0 Hz, 1H), 7.36-7.40 (m, 4H), 7.47-7.50 (m, 2H), 7.59-7.63 (m, 1H), 7.91-7.93 (m, 2H); ^{13}C NMR (CDCl3, 125 MHz): δ = 31.2, 44.3, 120.3, 128.5, 128.9, 128.9, 129.4, 133.7, 134.0, 134.4, 135.4, 194.3. MS calcd m/z 269.0, found 270.0 $[(M + 1)]^{+}$. Anal. Calcd for $C_{16}H_{12}ClNO$: C, 71.25; H, 4.48; N, 5.19; Found: C, 71.35; H, 4.50; N, 5.24.

2-(2-chlorophenyl)-4-oxo-4-phenylbutanenitrile (3h)



White solid. m.p. 91-93 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.52-3.56 (m, 1H), 3.65-3.71 (m, 1H), 4.92-4.95 (m, 1H), 7.31-7.38 (m, 2H), 7.43-7.45 (m, 1H), 7.47-7.50 (m, 2H), 7.59-7.63 (m, 1H), 7.68-7.70 (m, 1H), 7.95-7.97 (m, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 30.1, 42.4, 119.7, 127.8, 128.1, 128.9, 129.5, 129.9, 130.3, 132.7, 133.9, 135.6, 194.4. MS calcd m/z 269.0, found 270.0 $[(M + 1)]^{+}$. Anal. Calcd for $C_{16}H_{12}ClNO$: C, 71.25; H, 4.48; N, 5.19; Found: C, 71.16; H, 4.45; N, 5.13.

2-(4-bromophenyl)-4-oxo-4-phenylbutanenitrile (3i)



White solid. m.p. 126-128 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.49-3.53 (m, 1H),

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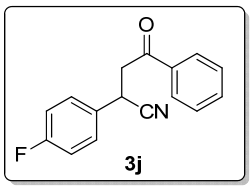
3.69-3.74 (m, 1H), 4.53-4.56 (t, J = 7.0 Hz, 1H), 7.31-7.32 (d, J = 8.5 Hz, 2H), 7.46-7.53 (m, 4H), 7.59-7.62 (t, J = 7.5 Hz, 1H), 7.91-7.92 (t, J = 7.5 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.4, 44.2, 120.2, 122.5, 128.1, 128.9, 129.3, 132.4, 134.1, 134.3, 135.5, 194.3. MS calcd m/z 313.0, found 314.0 $[(M + 1)]^+$. Anal. Calcd for $C_{16}H_{12}BrNO$: C, 61.17; H, 3.85; N, 4.46; Found: C, 61.28; H, 3.87; N, 4.51.

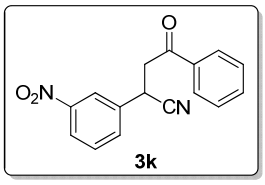
2-(4-fluorophenyl)-4-oxo-4-phenylbutanenitrile (3j)



3j

White solid. m.p. 105-107 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.49-3.54 (m, 1H), 3.69-3.74 (m, 1H), 4.56-4.59 (t, J = 7.0 Hz, 1H), 7.07-7.10 (t, J = 8.5 Hz, 2H), 7.41-7.44 (m, 2H), 7.46-7.50 (t, J = 7.5 Hz, 2H), 7.59-7.62 (t, J = 7.0 Hz, 1H), 7.91-7.92 (d, J = 8.0 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.2, 44.4, 116.2, 116.4, 120.5, 128.1, 128.9, 129.3, 129.4, 134.0, 135.6, 161.6, 163.5, 194.4. MS calcd m/z 253.1, found 254.1 $[(M + 1)]^+$. Anal. Calcd for $C_{16}H_{12}FNO$: C, 75.88; H, 4.78; N, 5.53; Found: C, 75.99; H, 4.81; N, 5.58.

2-(3-nitrophenyl)-4-oxo-4-phenylbutanenitrile (3k)



3k

White solid. m.p. 128-130 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.59-3.64 (m, 1H), 3.78-3.83 (m, 1H), 4.71-4.74 (t, J = 7.0 Hz, 1H), 7.47-7.50 (t, J = 7.5 Hz, 2H), 7.59-7.63 (m, 2H), 7.84-7.85 (d, J = 8.0 Hz, 1H), 7.92-7.94 (d, J = 7.5 Hz, 2H), 8.21-8.23 (d, J = 8.5 Hz, 1H), 8.34 (s, 1H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.6, 43.9, 119.6, 122.8, 123.6, 128.1, 130.0, 130.4, 133.9, 134.3, 135.3, 137.3, 193.8. MS calcd m/z 280.1, found 281.1 $[(M + 1)]^+$. Anal. Calcd for $C_{16}H_{12}N_2O_3$: C, 68.56; H, 4.32; N, 9.99; Found: C, 68.66; H, 4.36; N, 10.06.

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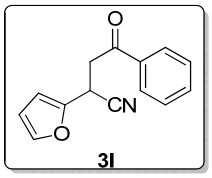
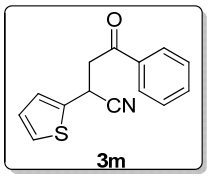
2-(furan-2-yl)-4-oxo-4-phenylbutanenitrile (3l)



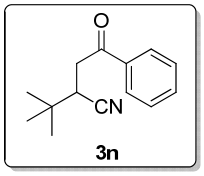
White solid. m.p. 66-68 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.66-3.74 (m, 2H), 4.67-4.70 (t, J = 6.5 Hz, 1H), 6.36-6.40 (m, 2H), 7.39-7.40 (d, J = 1.0 Hz, 1H), 7.48-7.52 (t, J = 8.0 Hz, 2H), 7.61-7.64 (t, J = 7.0 Hz, 1H), 7.96-7.98 (d, J = 8.0 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 25.9, 40.6, 108.2, 110.8, 118.3, 128.1, 128.8, 134.0, 135.5, 143.1, 146.8, 194.2. MS calcd m/z 225.0, found 226.0 $[(M + 1)]^+$. Anal. Calcd for $C_{14}H_{11}NO_2$: C, 74.65; H, 4.92; N, 6.22; Found: C, 74.54; H, 4.89; N, 6.16.

4-oxo-4-phenyl-2-(thiophen-2-yl)butanenitrile (3m)



White solid. m.p. 111-113 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.61-3.66 (m, 1H), 3.75-3.80 (m, 1H), 4.85-4.88 (t, J = 6.5 Hz, 1H), 6.98-6.99 (m, 1H), 7.16-7.17 (m, 1H), 7.27-7.29 (m, 1H), 7.48-7.51 (m, 2H), 7.60-7.64 (m, 1H), 7.95-7.96 (m, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 27.3, 44.6, 119.8, 125.9, 126.7, 127.2, 127.6, 128.2, 128.9, 134.1, 135.6, 137.0, 194.3. MS calcd m/z 241.0, found 242.0 $[(M + 1)]^+$. Anal. Calcd for $C_{14}H_{11}NOS$: C, 69.68; H, 4.59; N, 5.80; Found: C, 69.59; H, 4.56; N, 5.74.

2-(tert-butyl)-4-oxo-4-phenylbutanenitrile (3n)



White solid. m.p. 106-108 ºC. ^{1}H NMR (500 MHz, CDCl3): δ = 1.13 (s, 9H), 3.16-3.21 (m, 2H), 3.34-3.40 (m, 1H), 7.49-7.52 (t, J = 8.0 Hz, 2H), 7.60-7.61 (d, J =

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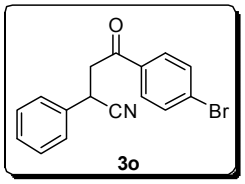
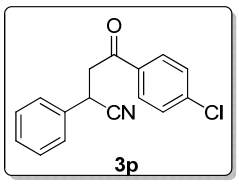
7.0 Hz, 1H), 7.97-7.98 (t, J = 7.0 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 27.4, 32.8, 36.9, 37.8, 121.1, 128.1, 128.8, 133.8, 136.1, 195.8. MS calcd m/z 215.1, found 216.1 [(M + 1)]+. Anal. Calcd for $C_{14}H_{17}NO$: C, 78.10; H, 7.96; N, 6.51; Found: C, 78.18; H, 7.98; N, 6.56.

4-(4-bromophenyl)-4-oxo-2-phenylbutanenitrile (3o)



White solid. m.p. 120-122 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.44-3.49 (m, 1H), 3.67-3.72 (m, 1H), 4.53-4.56 (m, 1H), 7.33-7.36 (t, J = 6.5 Hz, 1H), 7.39-7.44 (m, 4H), 7.61-7.63 (d, J = 8.5 Hz, 2H), 7.78-7.80 (d, J = 8.5 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.8, 44.4, 120.4, 127.4, 128.3, 128.4, 129.0, 129.3, 129.5, 132.5, 134.2, 134.9, 193.7. MS calcd m/z 313.0, found 314.0 $[(M + 1)]^+$. Anal. Calcd for $C_{16}H_{12}BrNO$: C, 61.17; H, 3.85; N, 4.46; Found: C, 61.28; H, 3.87; N, 4.52.

4-(4-chlorophenyl)-4-oxo-2-phenylbutanenitrile (3p)



White solid. m.p. 111-113 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.44-3.49 (m, 1H), 3.67-3.72 (m, 1H), 4.53-4.55 (m, 1H), 7.32-7.22 (d, J = 4.5 Hz, 1H), 7.34-7.36 (m, 2H), 7.38-7.43 (m, 4H), 7.85-7.87 (d, J = 8.5 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.9, 44.5, 120.5, 127.5, 128.5, 129.2, 134.0, 135.1, 140.5, 193.5. MS calcd m/z 269.0, found 270.0 $[(M + 1)]^+$. Anal. Calcd for $C_{16}H_{12}ClNO$: C, 71.25; H, 4.48; N, 5.19; Found: C, 71.36; H, 4.51; N, 5.24.

4-oxo-2-phenyl-4-(*p*-tolyl)butanenitrile (3q)

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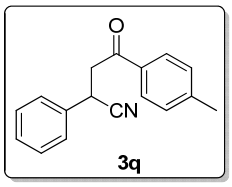
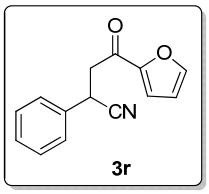


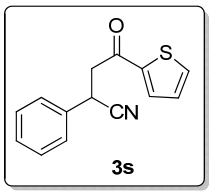
White solid. m.p. 64-66 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 2.41 (s, 3H), 3.46-3.51 (m, 1H), 3.68-4.703 (m, 1H), 4.55-4.58 (m, 1H), 7.25-7.27 (t, J = 8.0 Hz, 2H), 7.33-7.35 (d, J = 7.5 Hz, 1H), 7.38-7.41 (t, J = 7.0 Hz, 2H), 7.43-7.44 (d, J = 7.0 Hz, 2H), 7.82-7.83 (d, J = 8.5 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 21.7, 31.9, 44.4, 120.7, 127.5, 128.2, 129.5, 133.3, 135.4, 144.9, 194.2. MS calcd m/z 249.10, found 250.1 $[(M + 1)]^{+}$. Anal. Calcd for $C_{17}H_{15}NO$: C, 81.90; H, 6.06; N, 5.62; Found: C, 81.99; H, 6.09; N, 5.68.

4-(furan-2-yl)-4-oxo-2-phenylbutanenitrile (3r)



White solid. m.p. 78-80 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.35-3.40 (m, 1H), 3.56-3.61 (m, 1H), 4.52-4.54 (t, J = 7.5 Hz, 1H), 6.55-6.56 (m, 1H), 7.23-7.26 (d, J = 3.5 Hz, 1H), 7.31-7.34 (t, J = 7.5 Hz, 1H), 7.36-7.42 (m, 4H), 7.58 (s, 1H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.5, 43.9, 112.7, 118.1, 120.4, 127.5, 128.4, 129.3, 135.0, 147.0, 151.8, 183.7. MS calcd m/z 225.1 found 226.1 $[(M + 1)]^{+}$. Anal. Calcd for $C_{14}H_{11}NO_2$: C, 74.65; H, 4.92; N, 6.22; Found: C, 74.76; H, 4.94; N, 6.27.

4-oxo-2-phenyl-4-(thiophen-2-yl)butanenitrile (3s)



White solid. m.p. 91-93 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.42-3.47 (m, 1H), 3.63-3.68 (m, 1H), 4.55-4.58 (m, 1H), 7.13-7.14 (t, J = 4.0 Hz, 1H), 7.32-7.35 (m,

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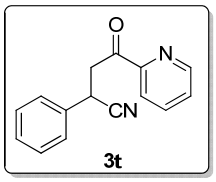
1H), 7.35-7.41 (m, 2H), 7.42-7.44 (m, 2H), 7.68-7.69 (d, J = 4.0 Hz, 2H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 32.0, 44.9, 120.4, 127.5, 127.5, 129.3, 132.6, 134.8, 135.0, 142.7, 187.4. MS calcd m/z 241.0, found 242.0 $[(M + 1)]^+$. Anal. Calcd for $C_{14}H_{11}NOS$: C, 69.68; H, 4.59; N, 5.80; Found: C, 69.58; H, 4.57; N, 5.72.

4-oxo-2-phenyl-4-(pyridin-2-yl)butanenitrile (3t)



3t

White solid. m.p. 88-90 ºC. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 3.78-3.83 (m, 1H), 3.98-4.03 (m, 1H), 4.51-4.54 (m, 1H), 7.30-7.34 (m, 1H), 7.37-7.40 (m, 2H), 7.44-7.45 (m, 2H), 7.49-7.51 (m, 1H), 7.84-7.87 (m, 1H), 8.06-8.08 (m, 1H), 8.64-8.66 (m, 1H); ^{13}C NMR ($CDCl_3$, 125 MHz): δ = 31.9, 44.5, 120.5, 127.5, 128.5, 129.2, 134.0, 135.1, 140.5, 193.5. MS calcd m/z 236.0, found 237.0 $[(M + 1)]^+$. Anal. Calcd for $C_{15}H_{12}N_2O$: C, 76.25; H, 5.12; N, 11.86; Found: C, 76.36; H, 5.15; N, 11.94.

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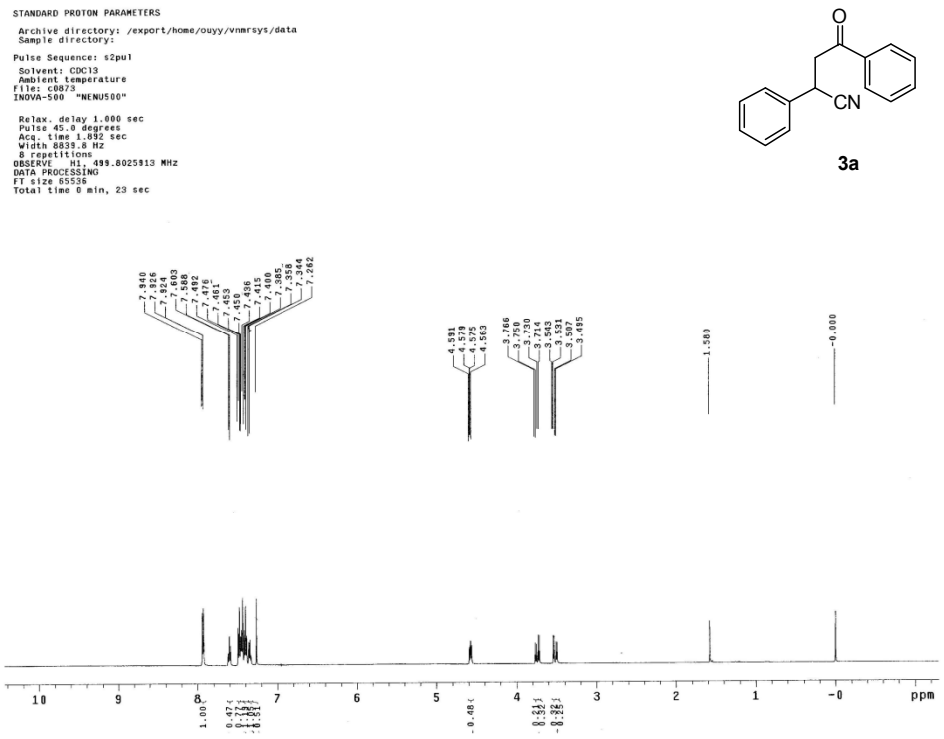

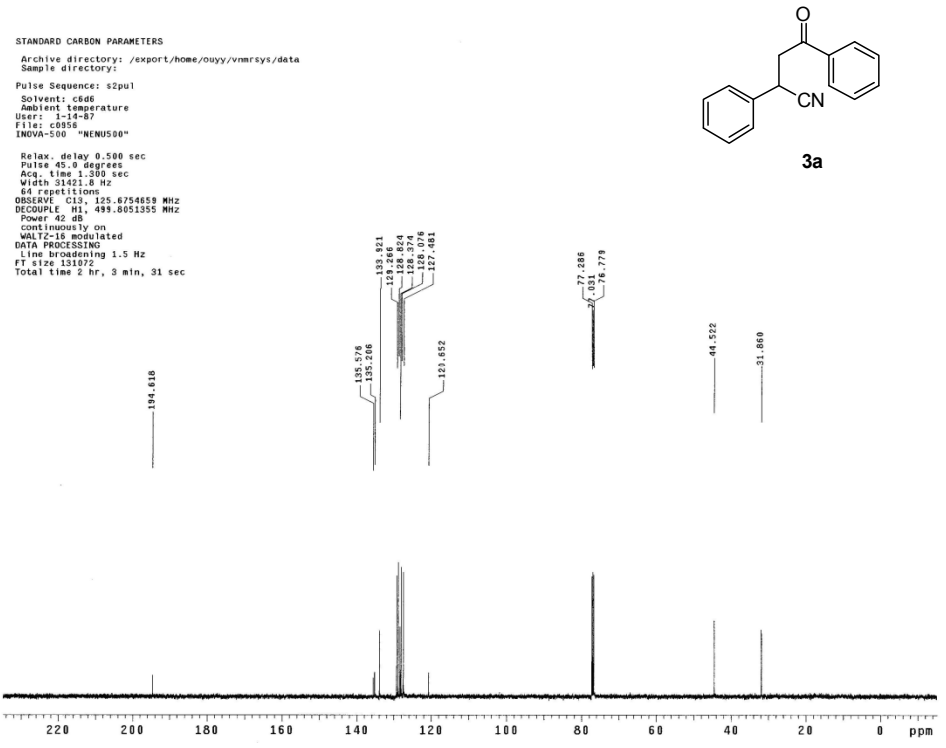

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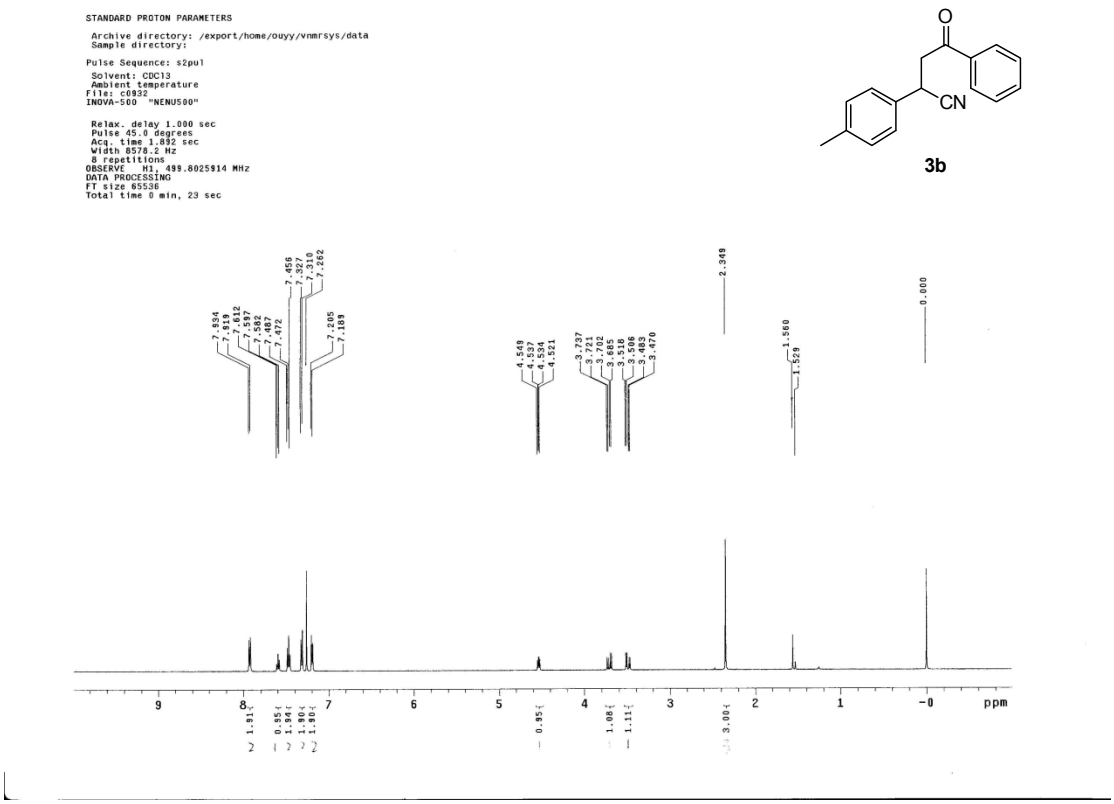

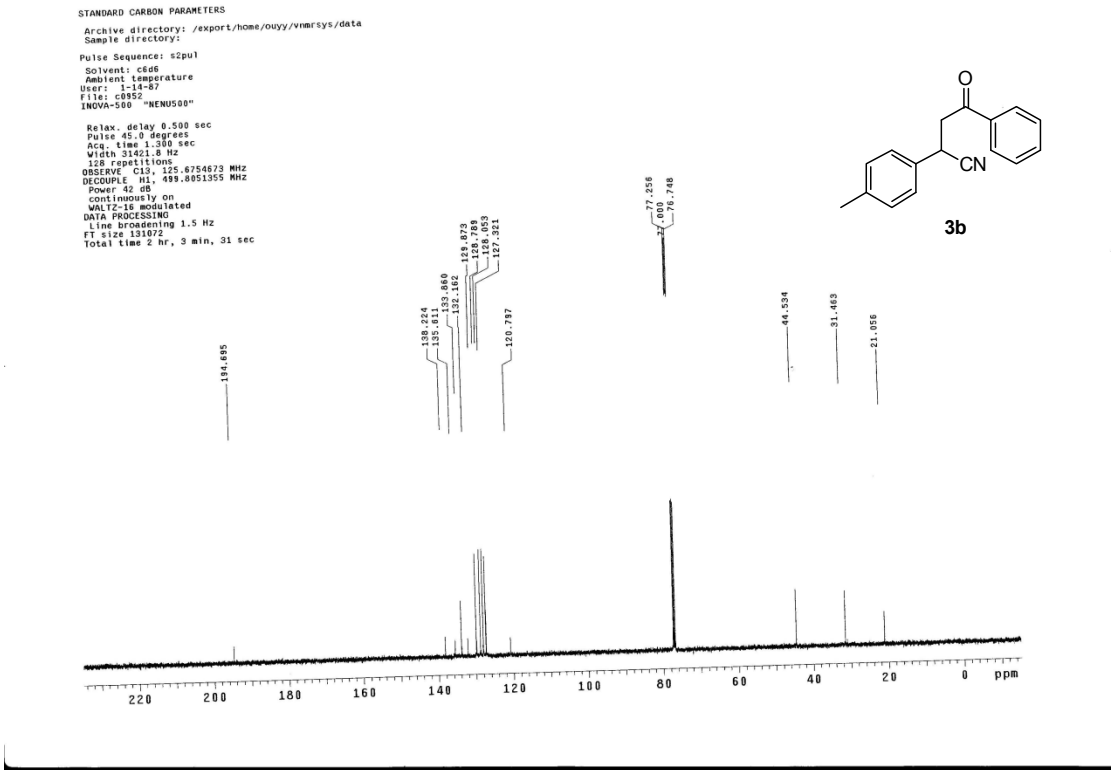

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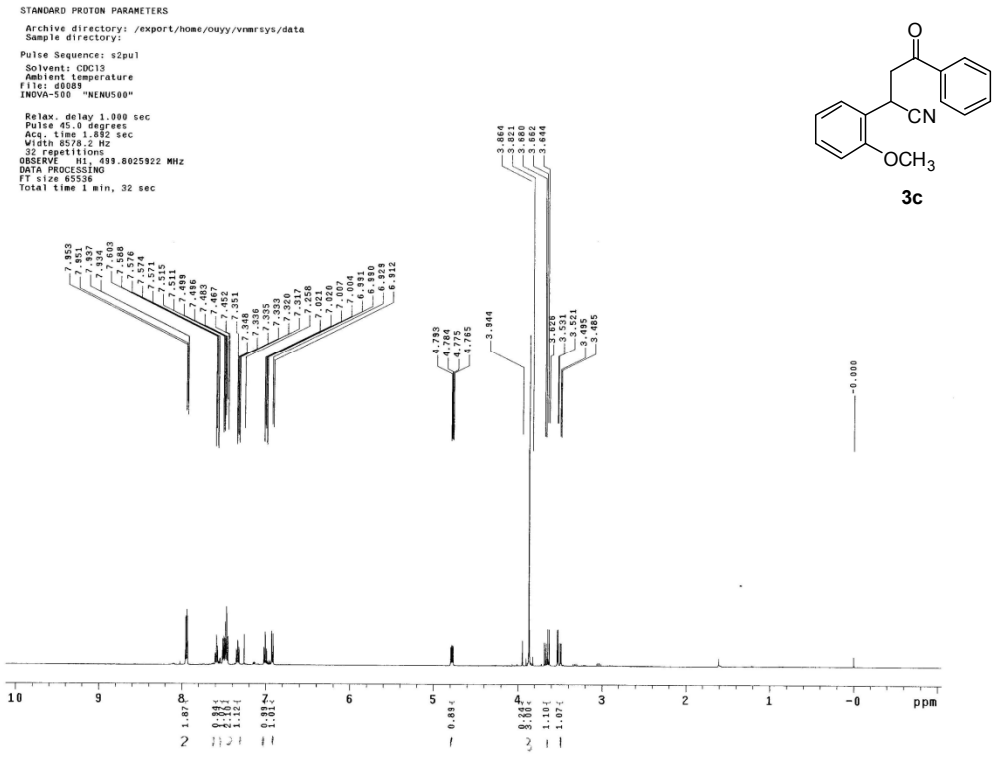

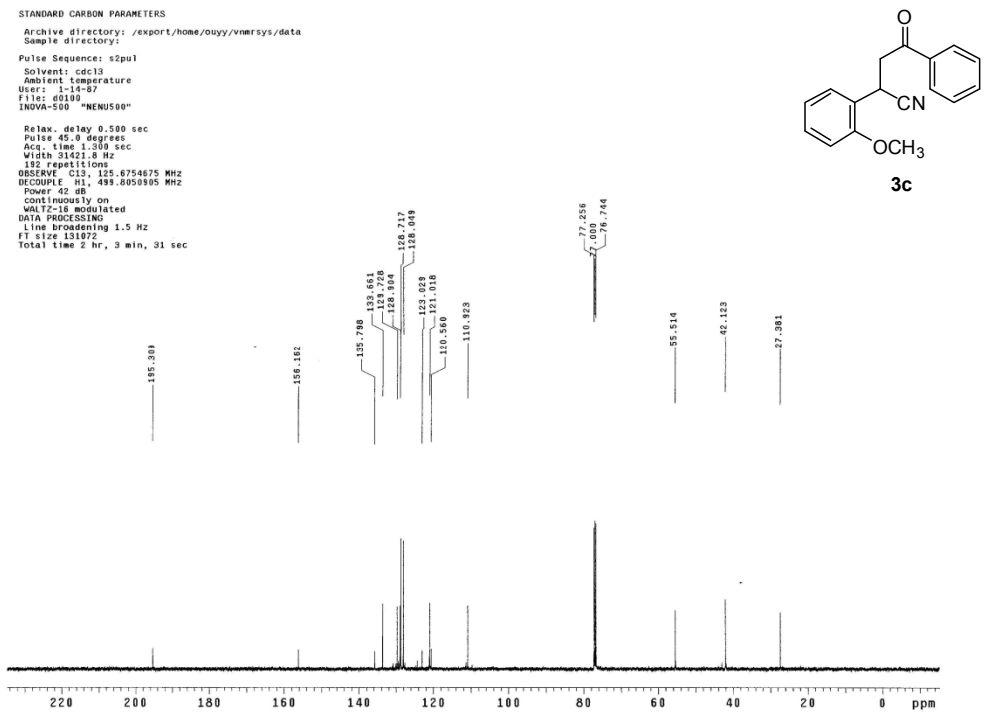

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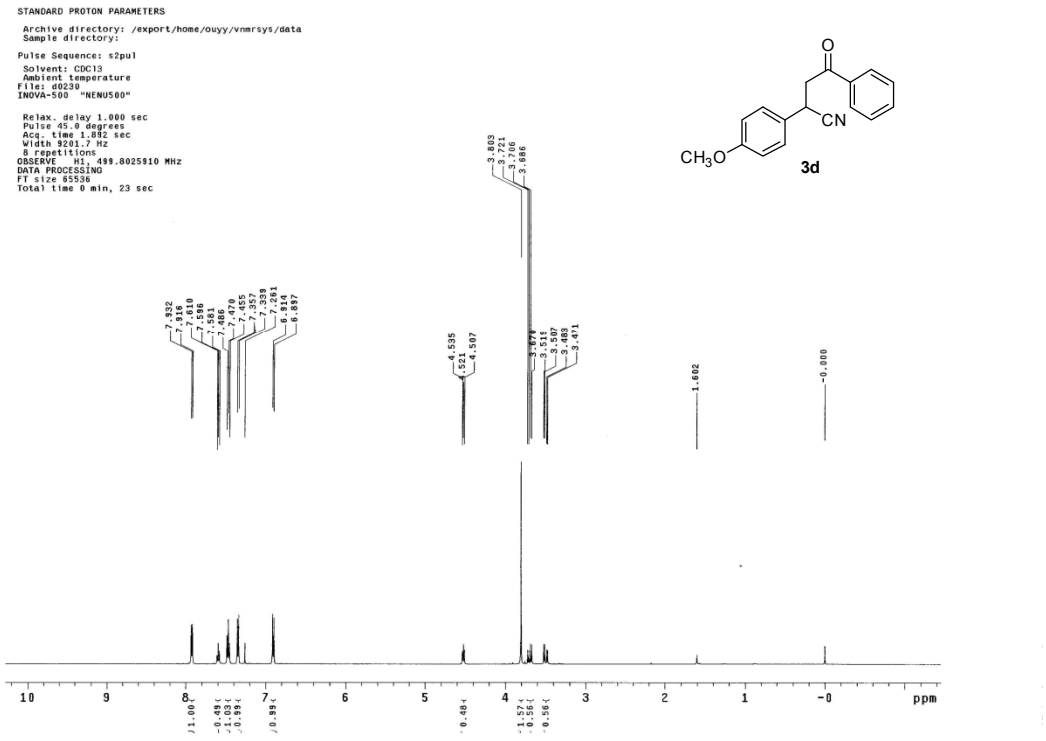

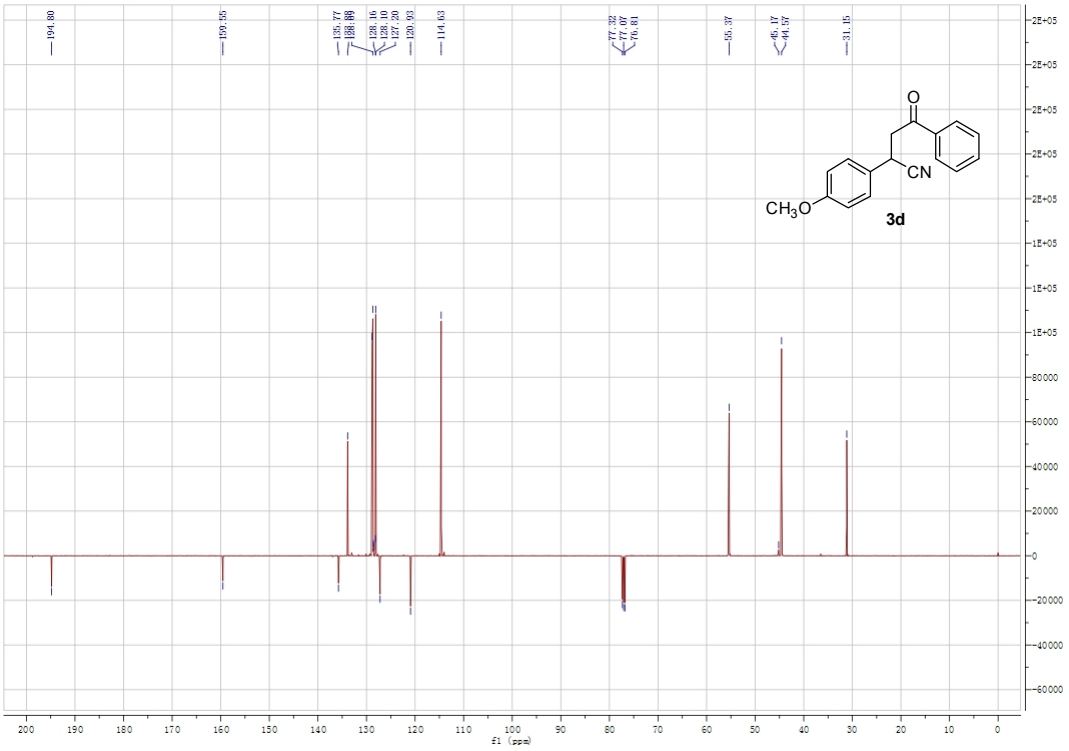

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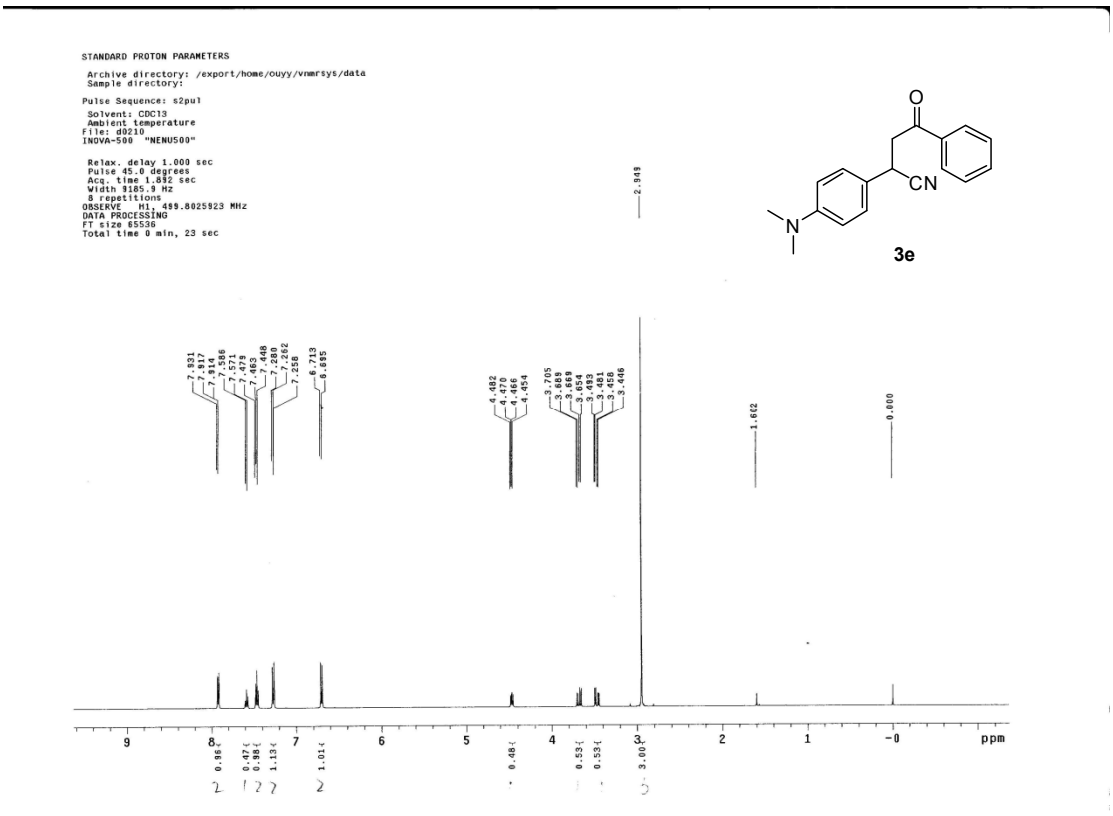

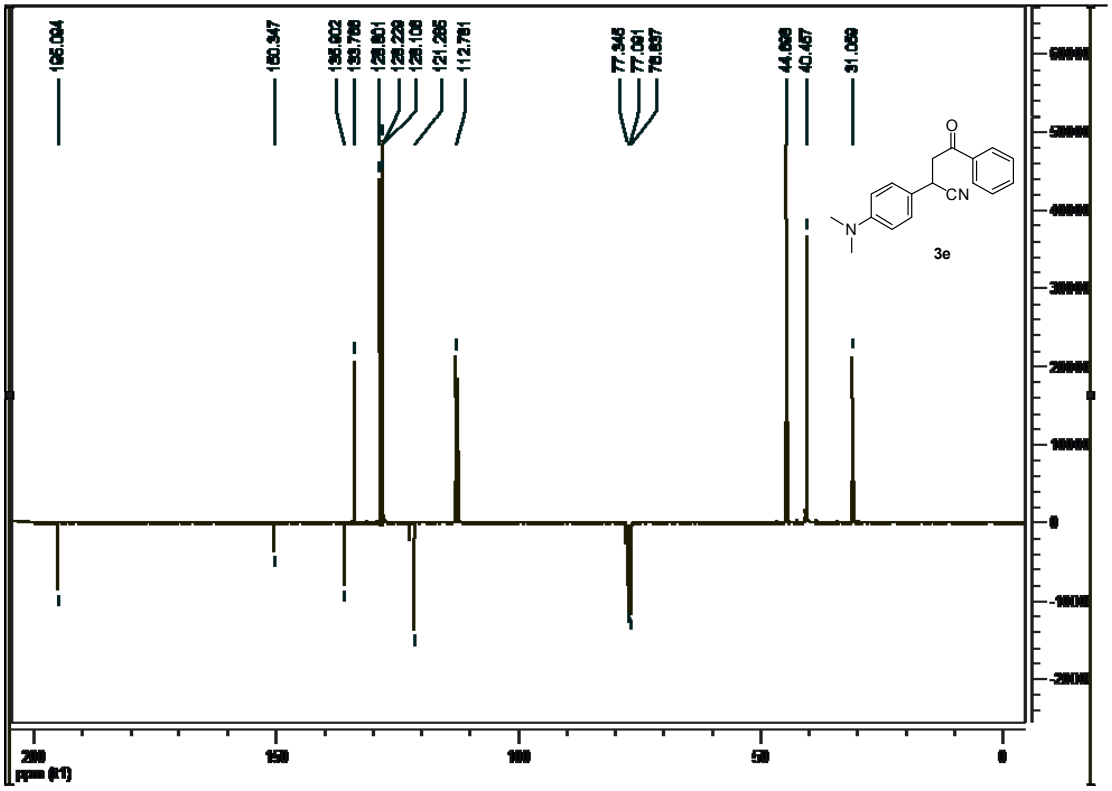

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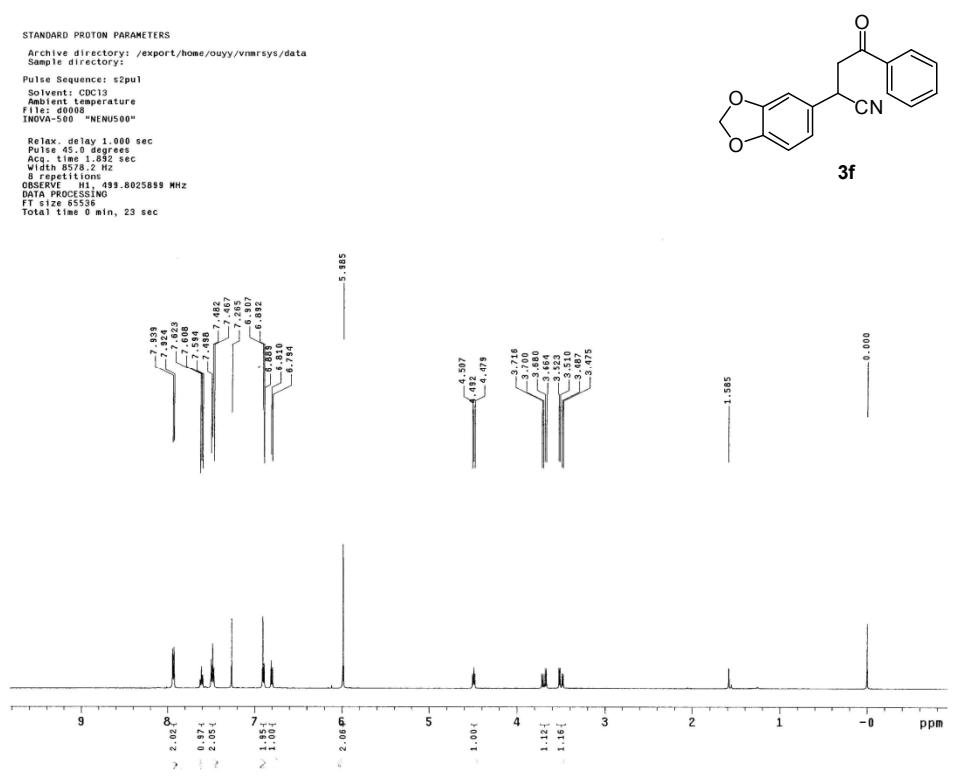

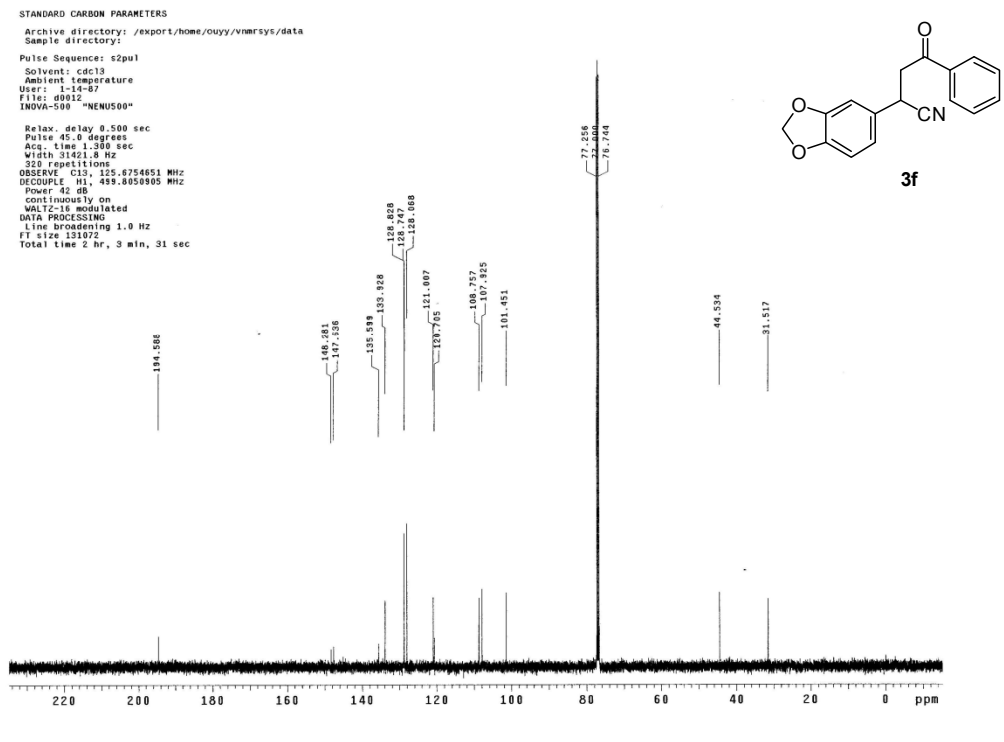

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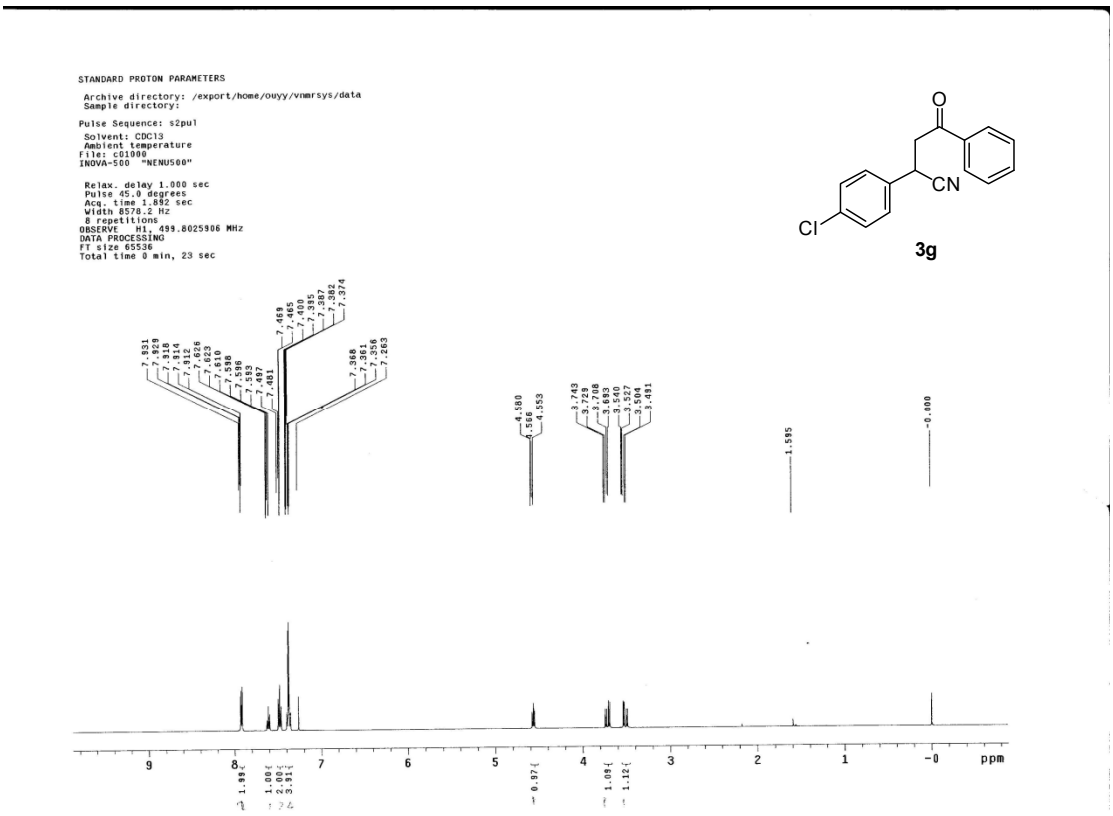

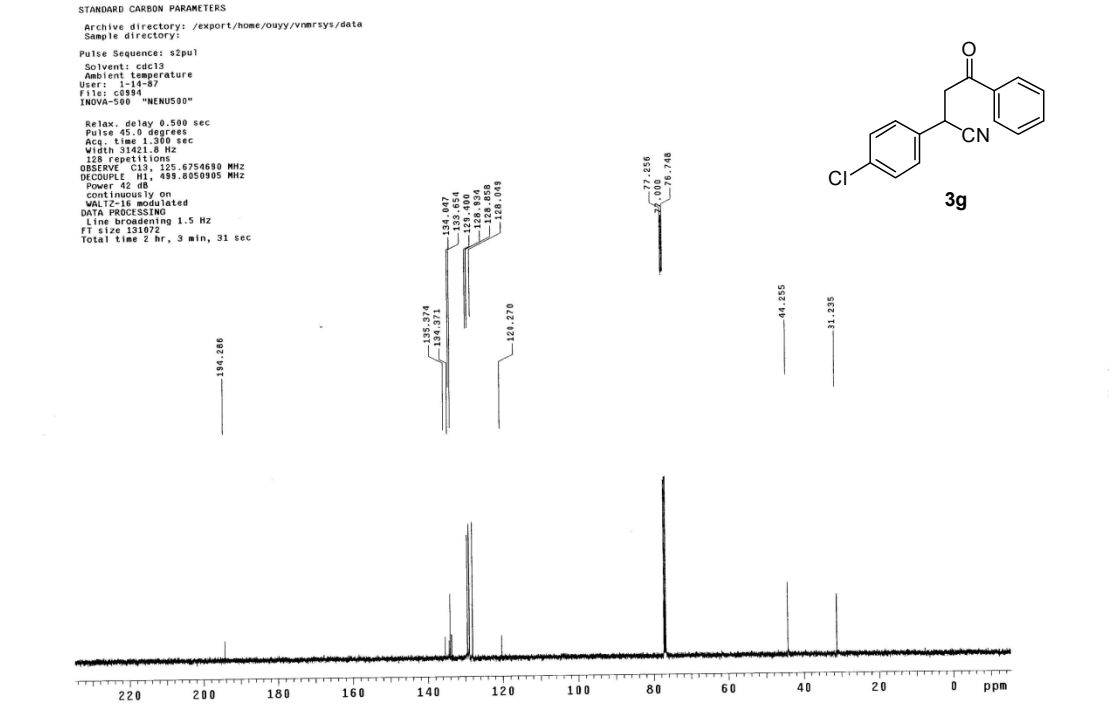

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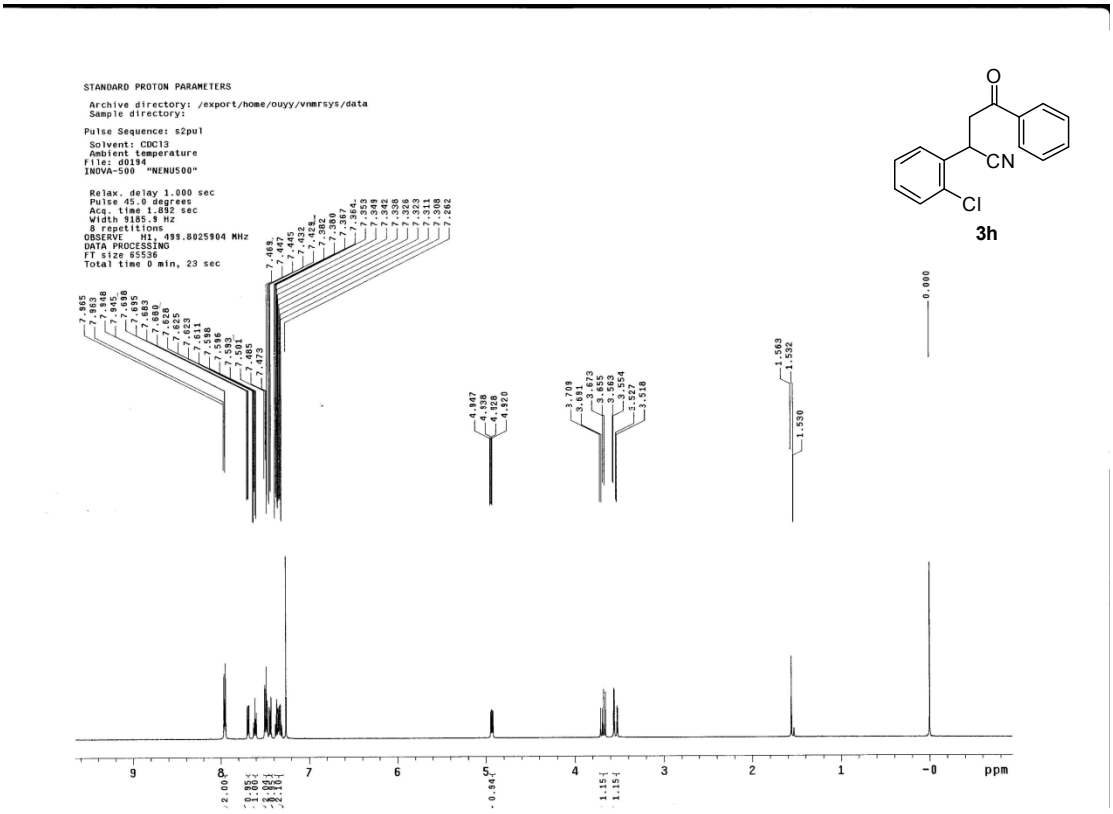

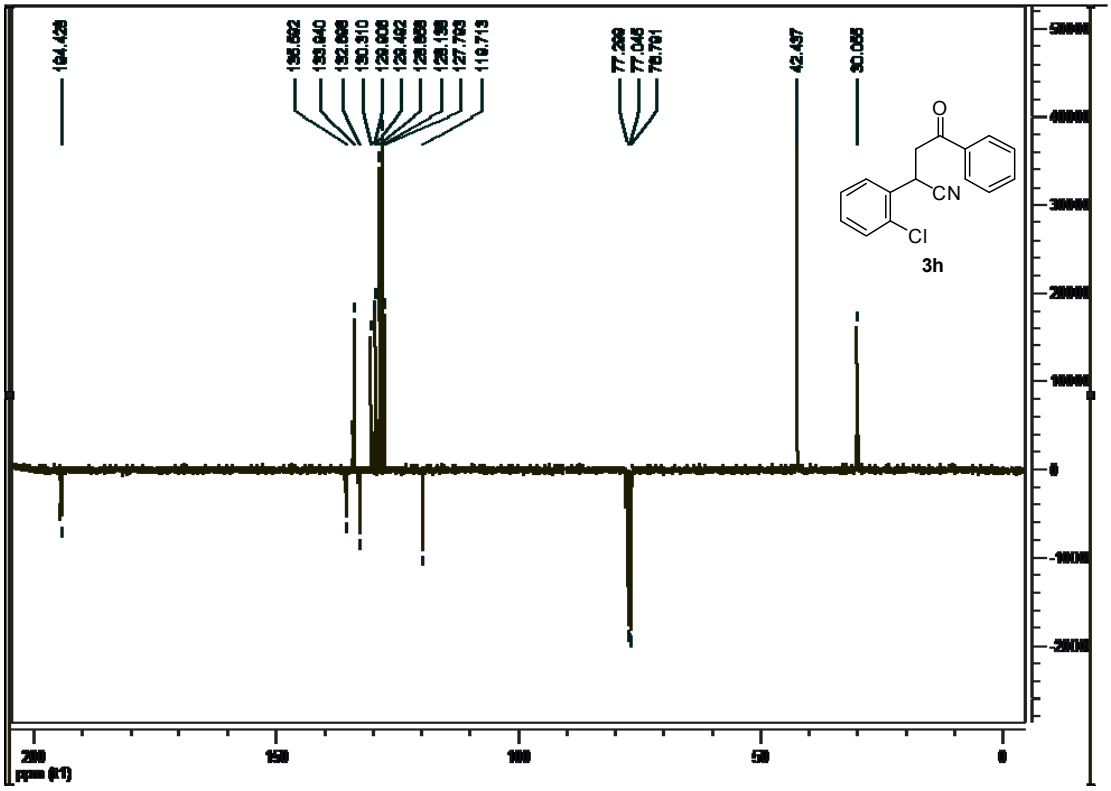

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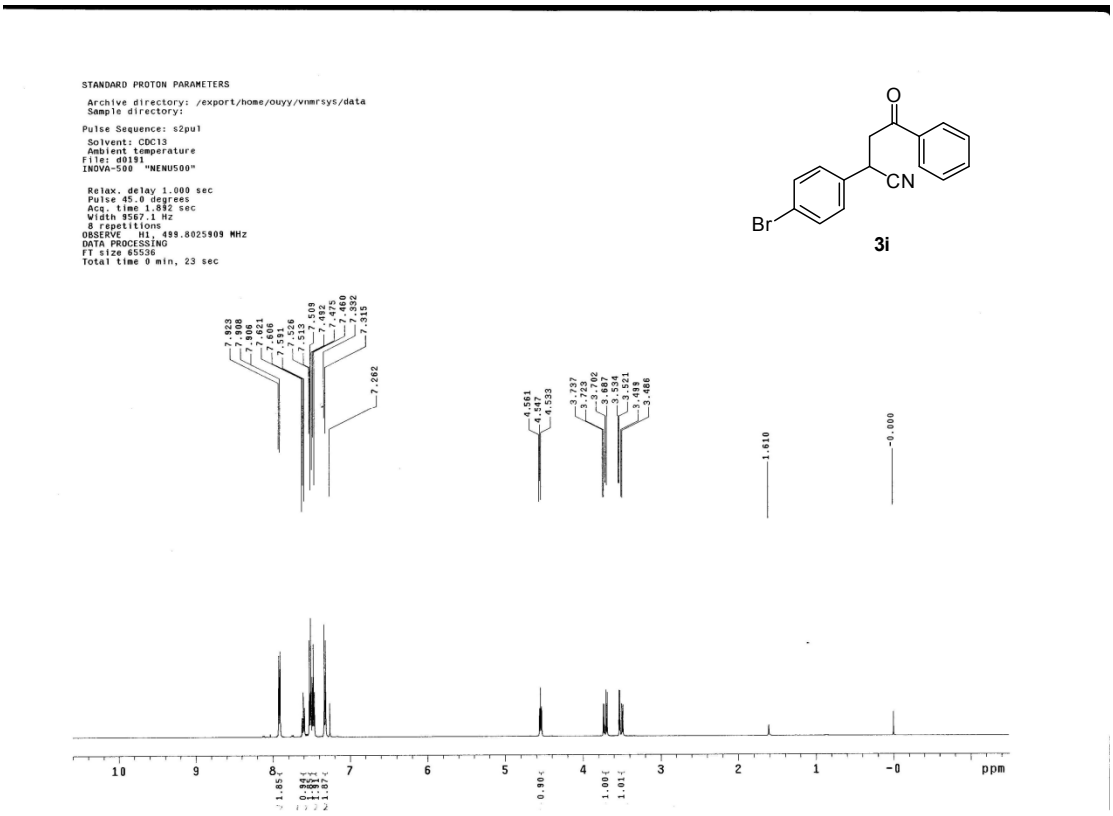

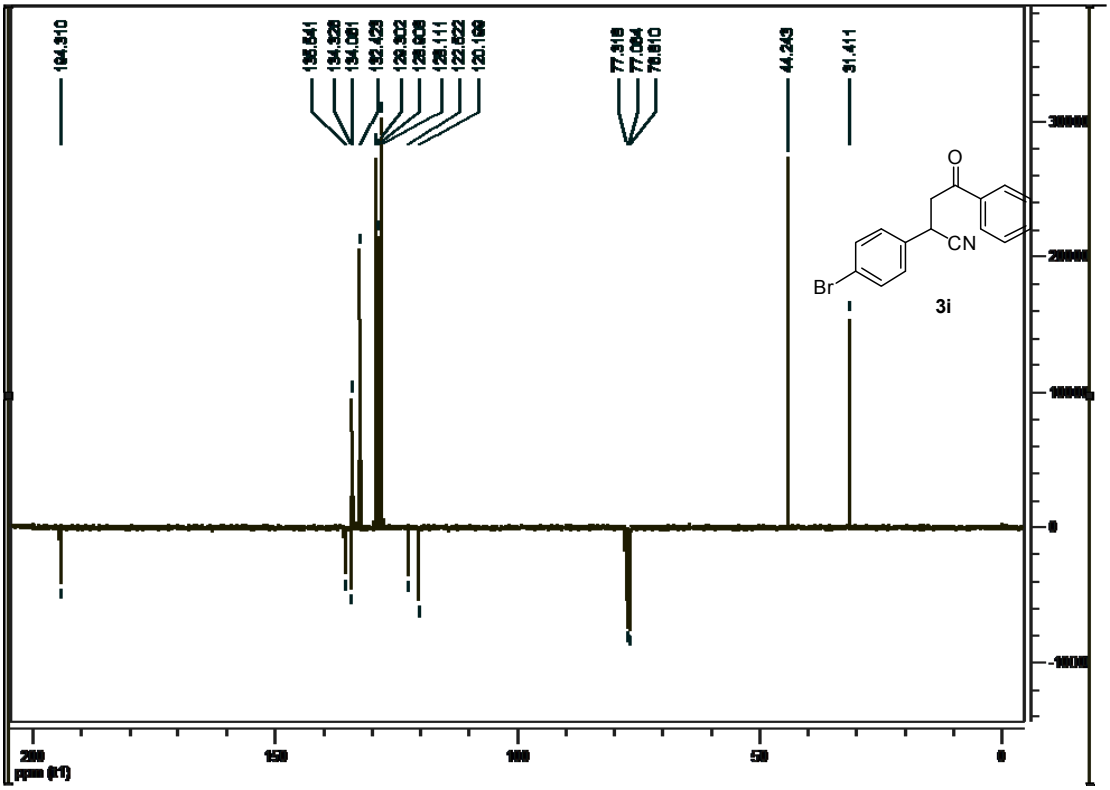

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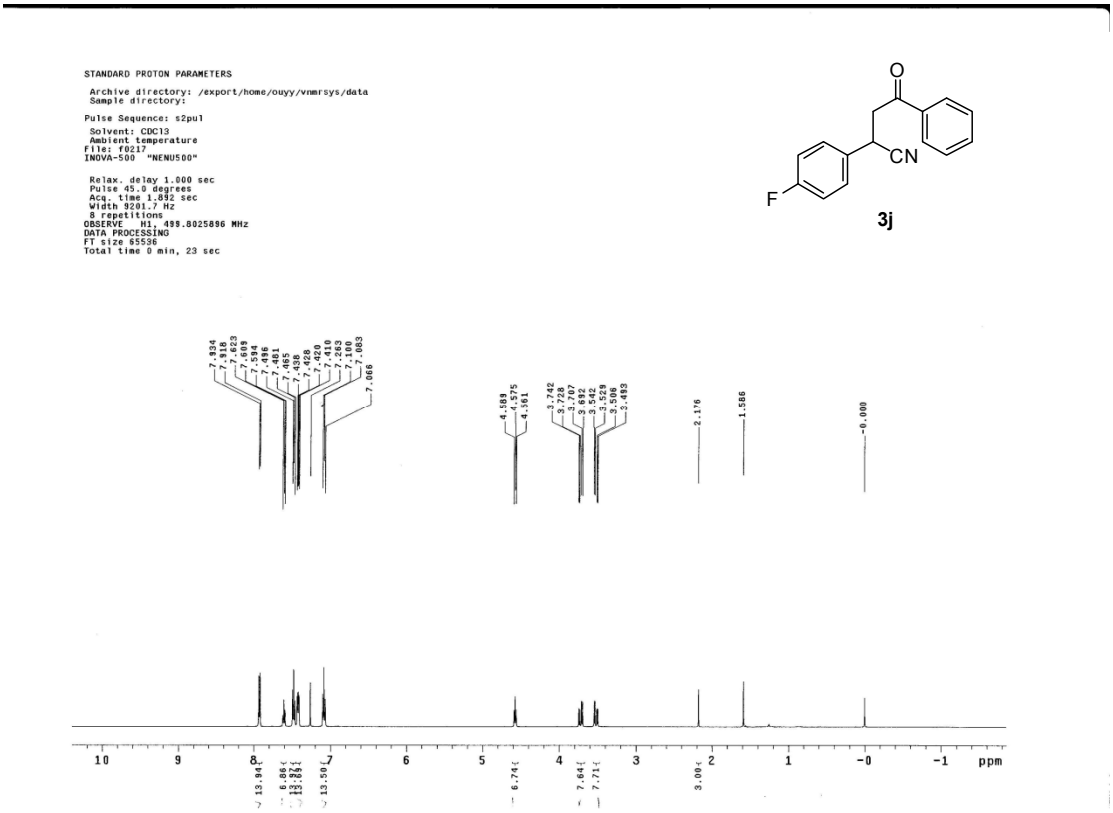

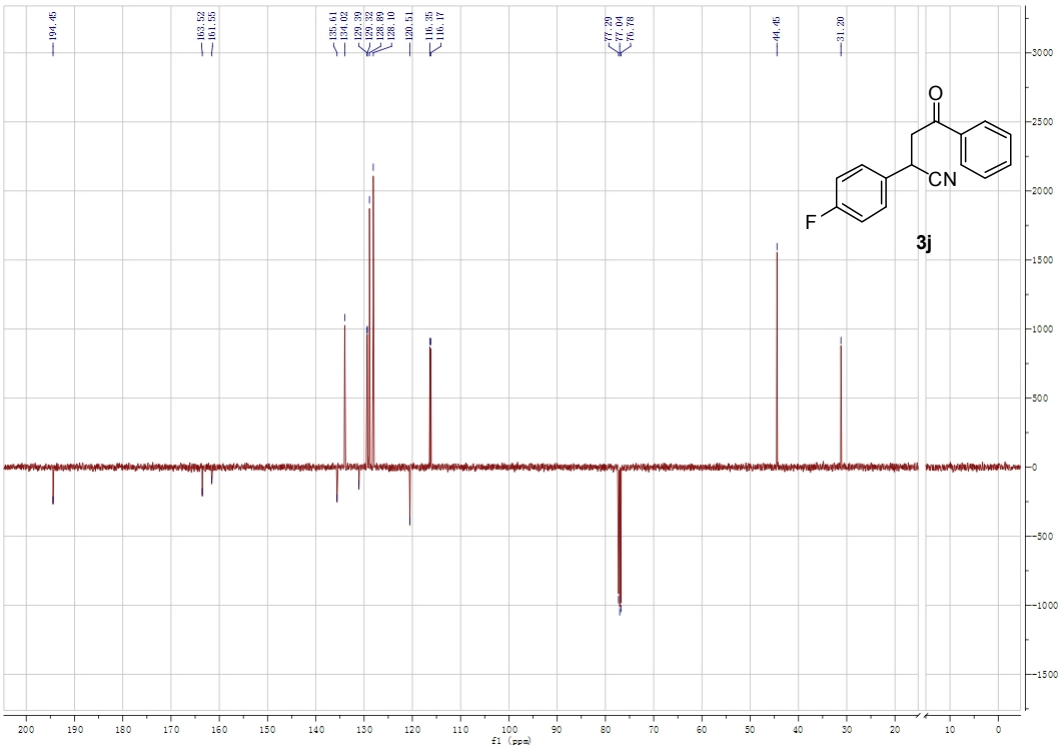

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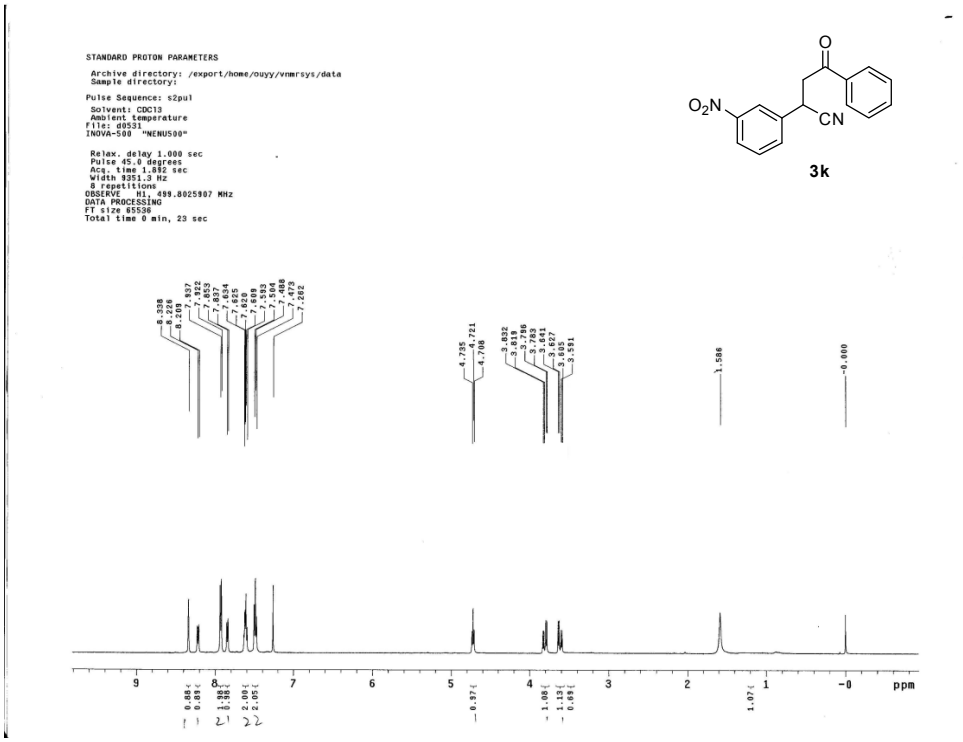

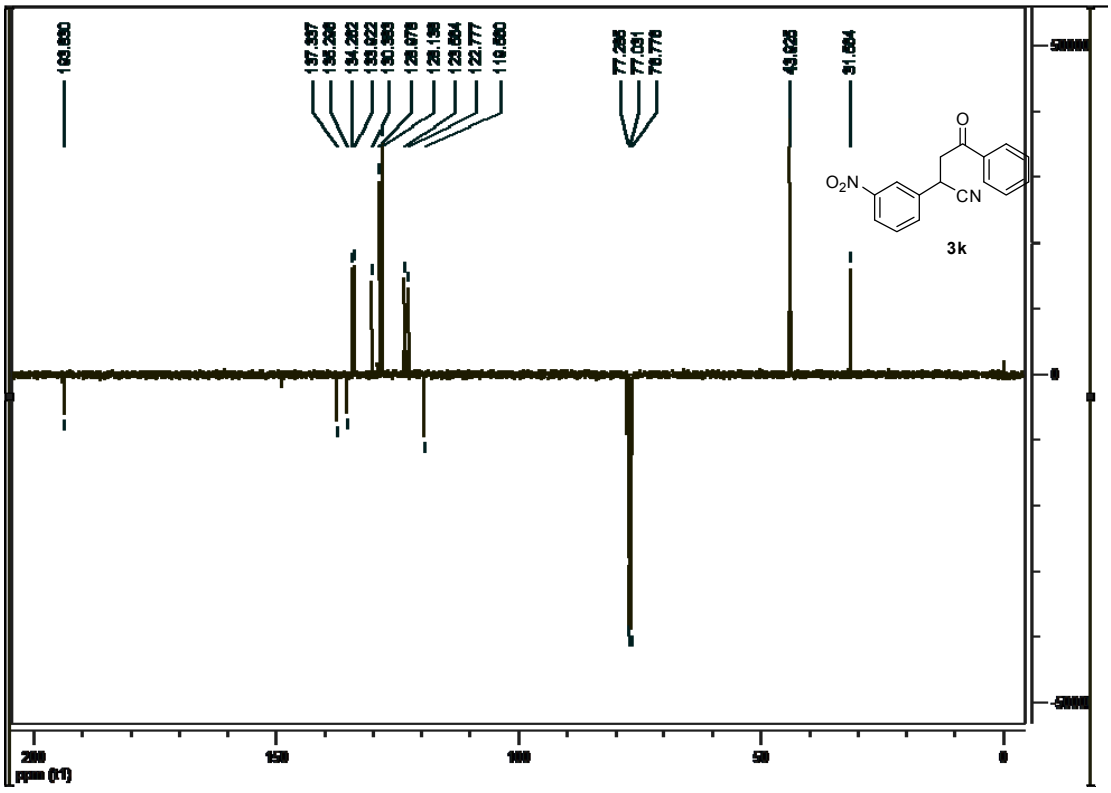

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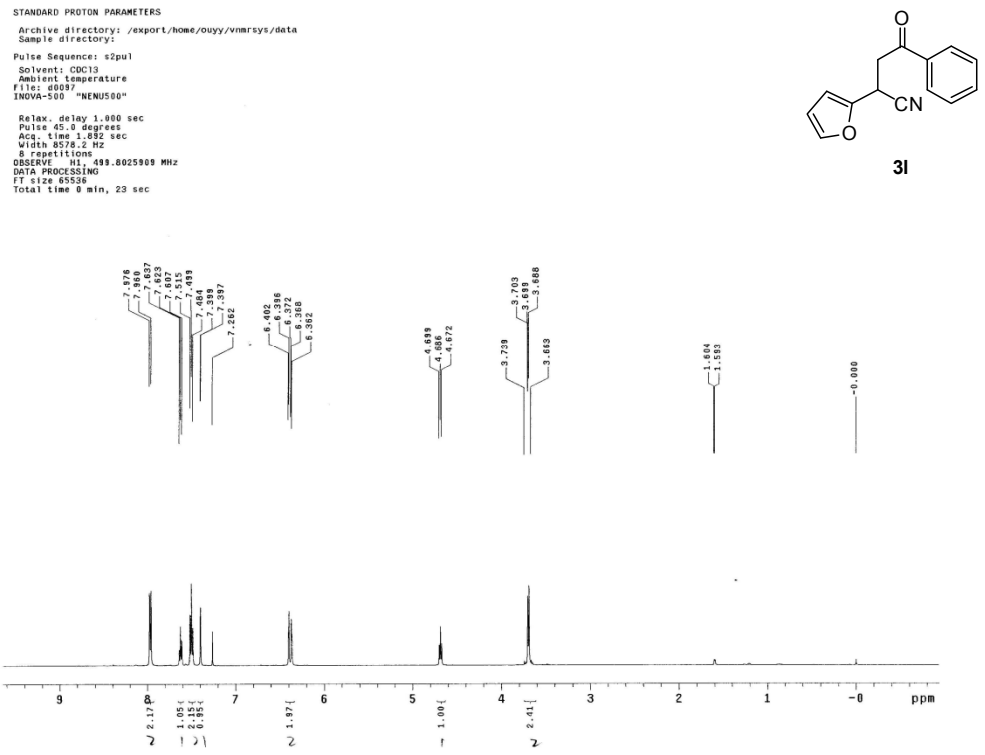

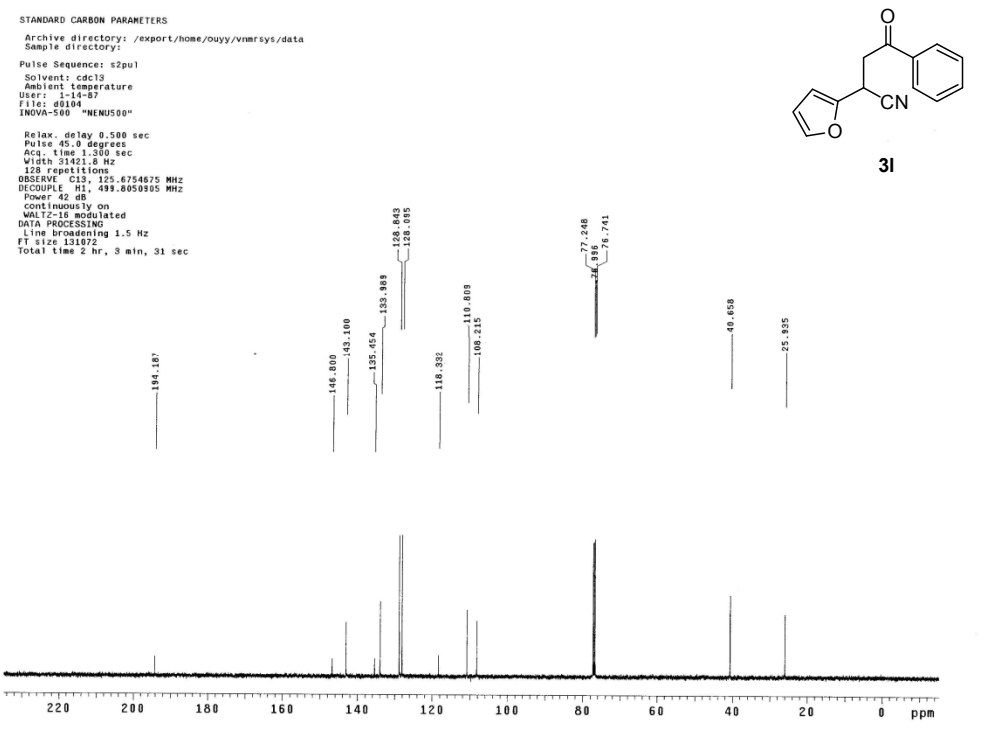

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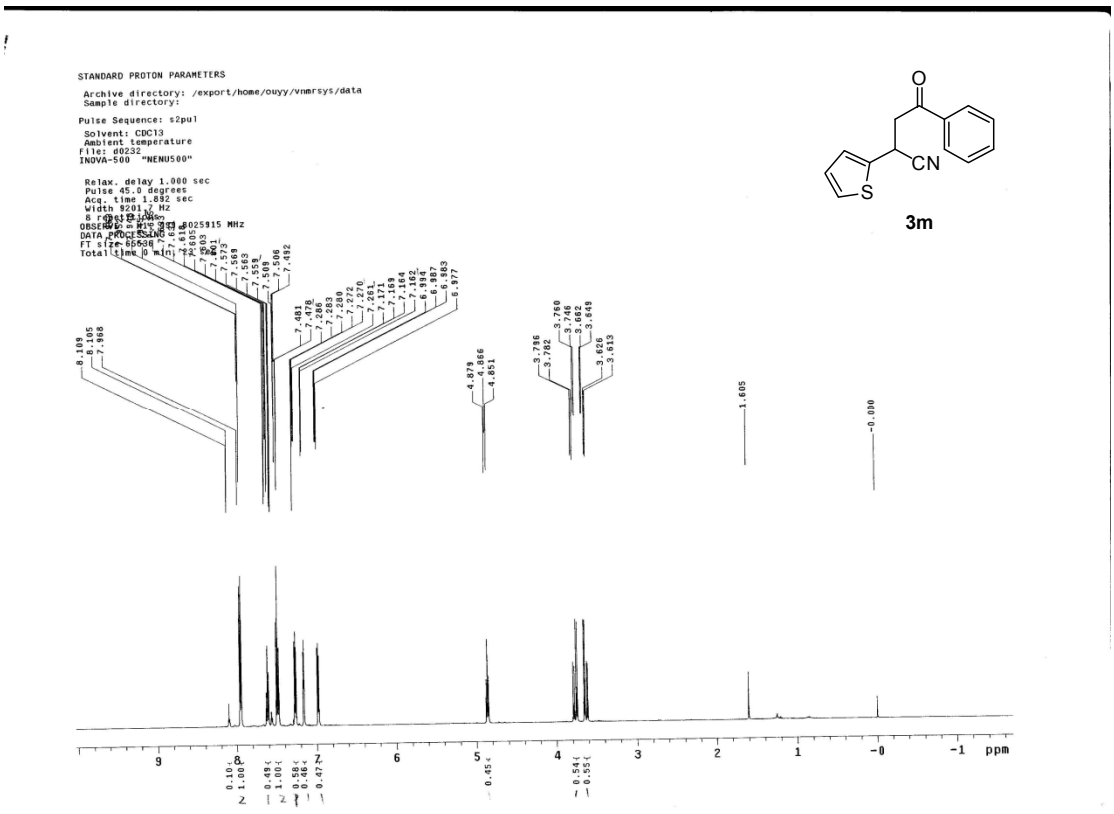

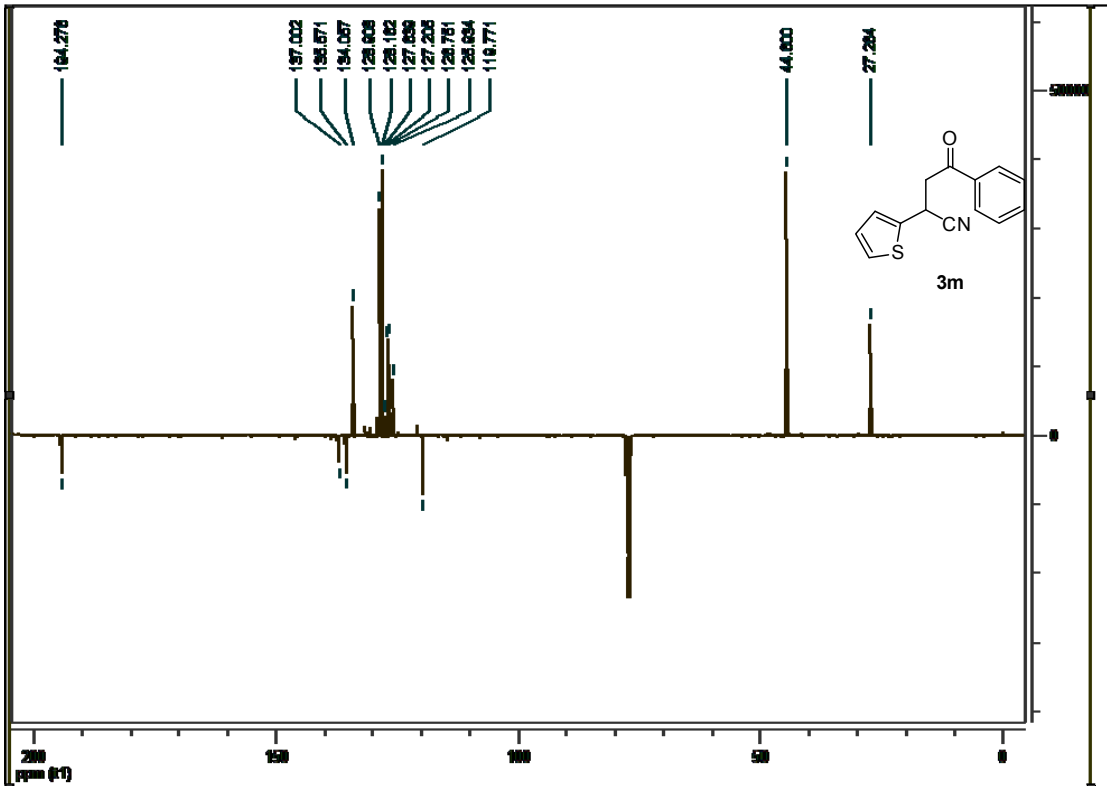

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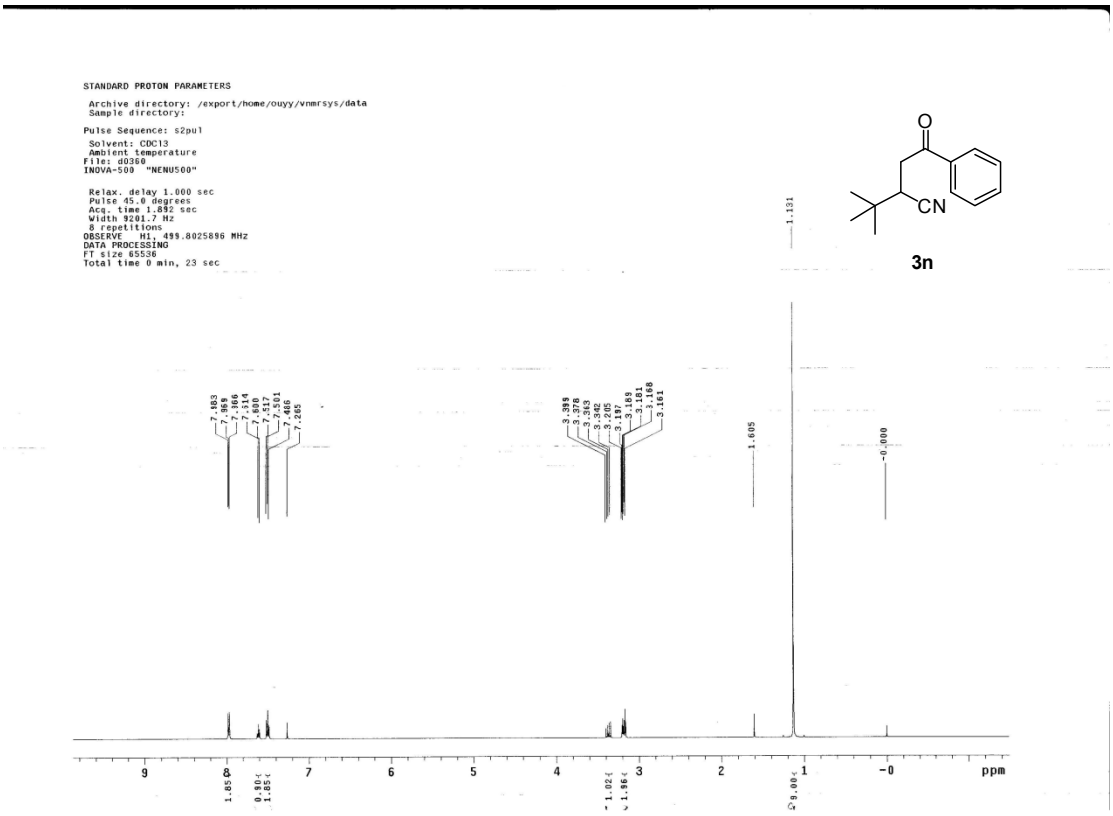

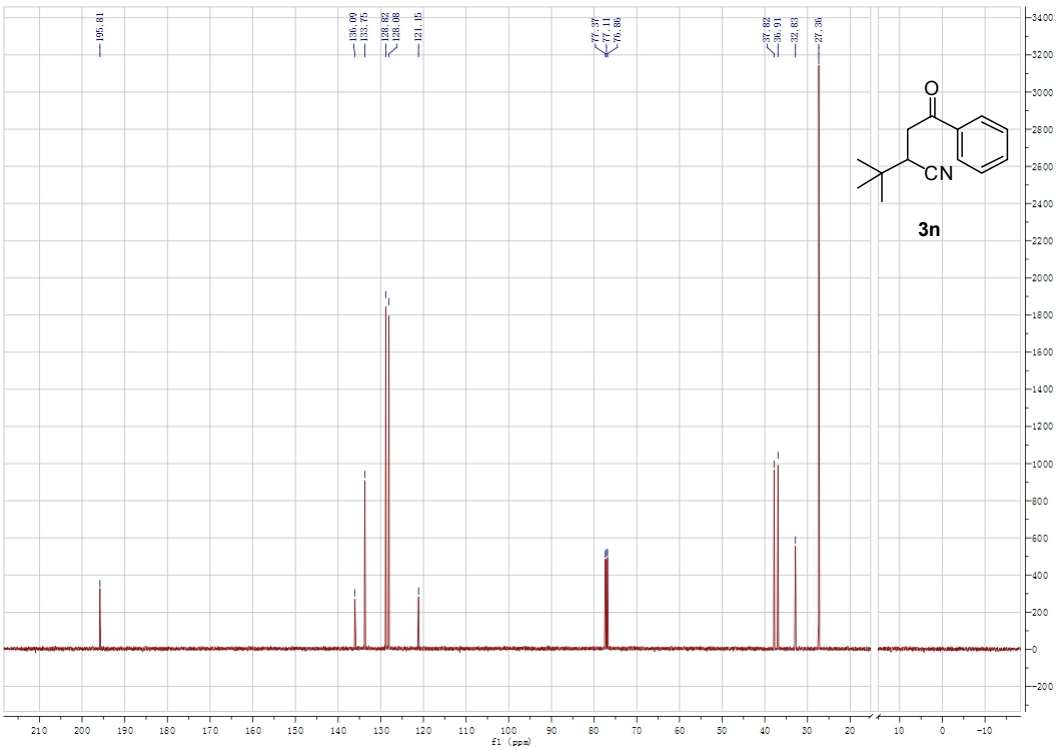

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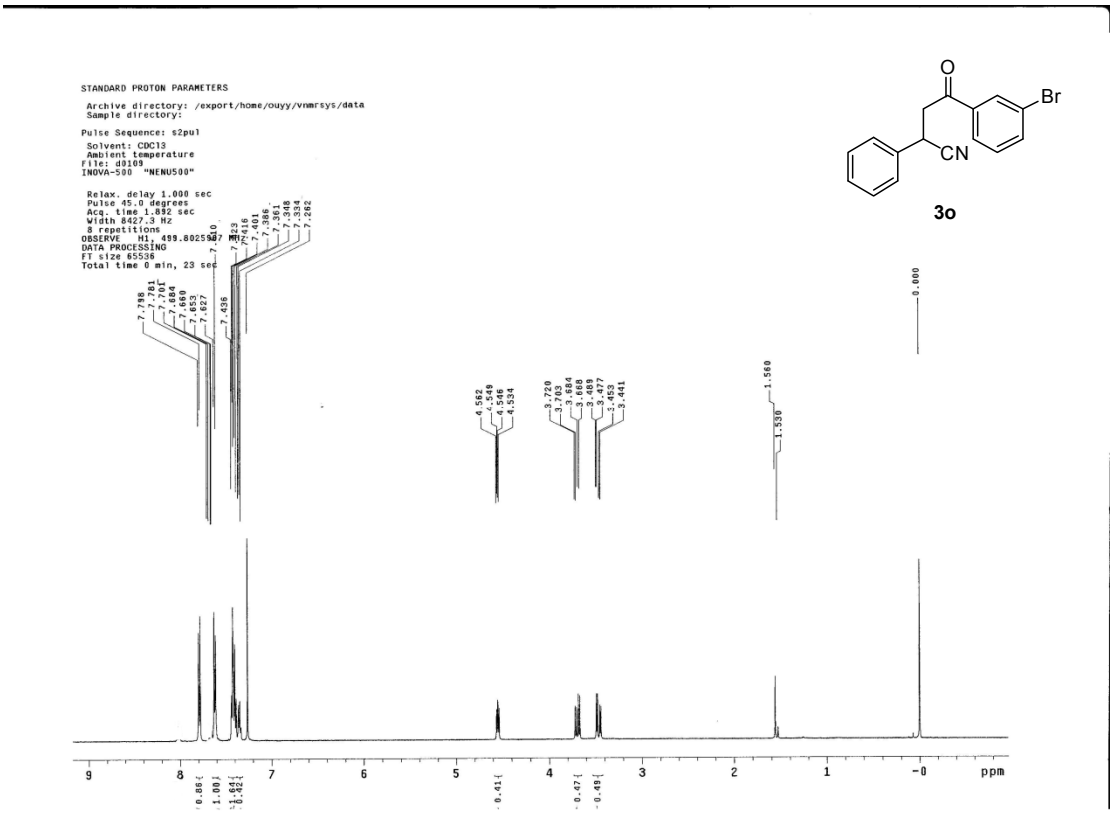

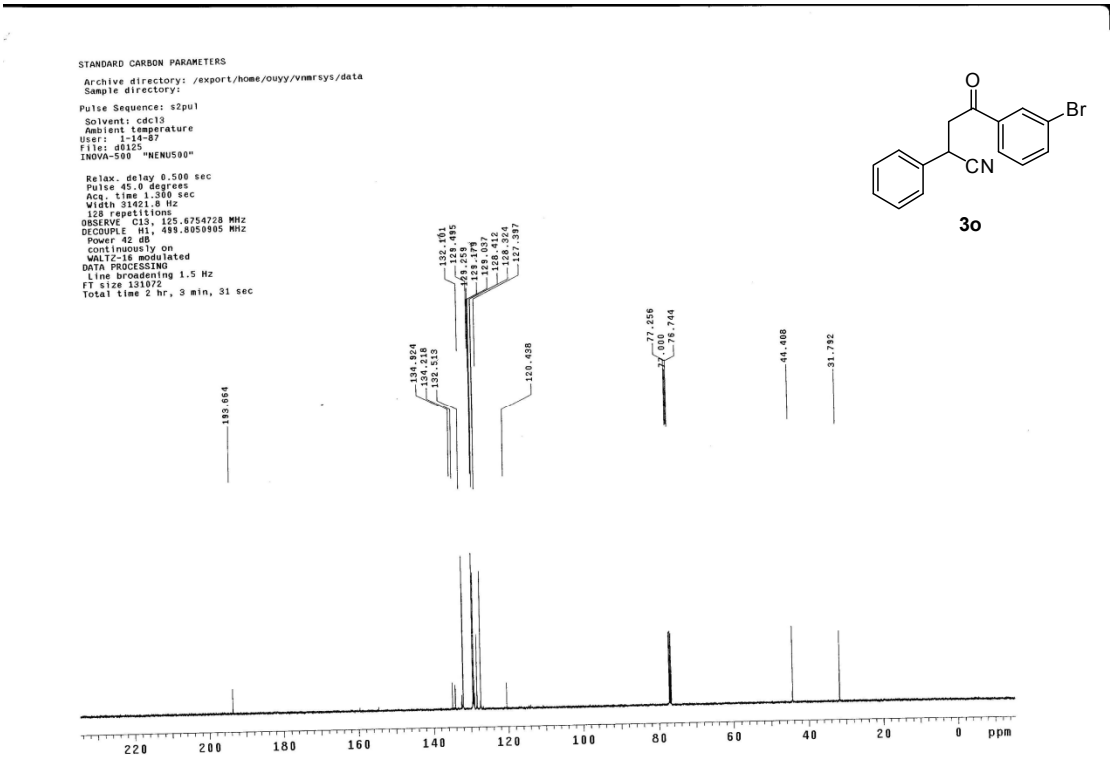

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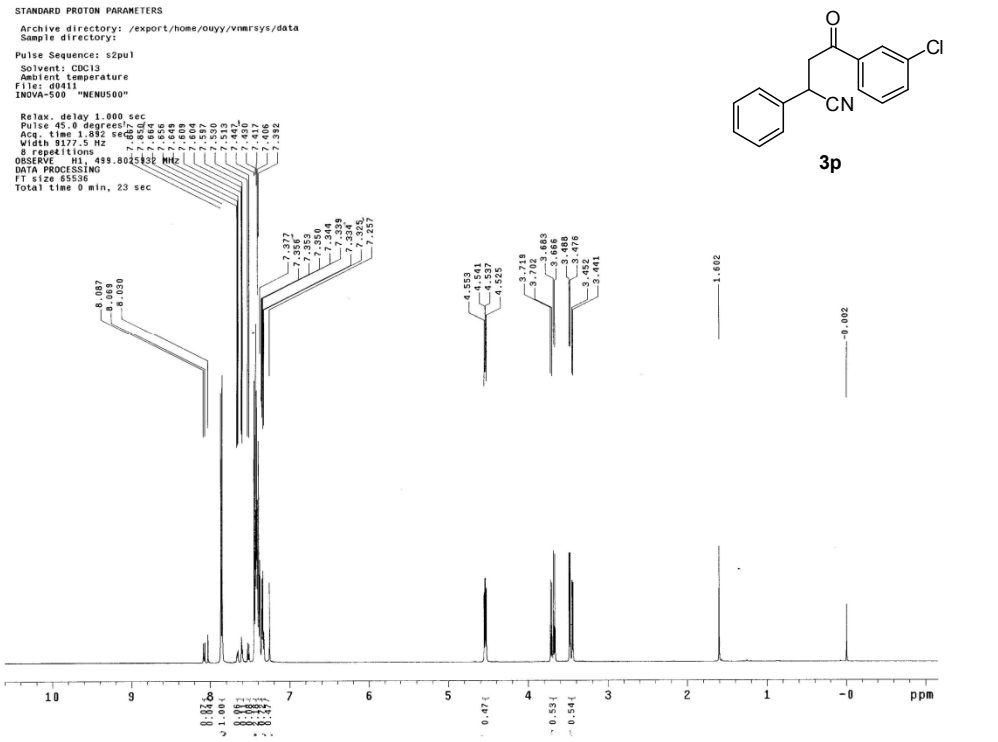

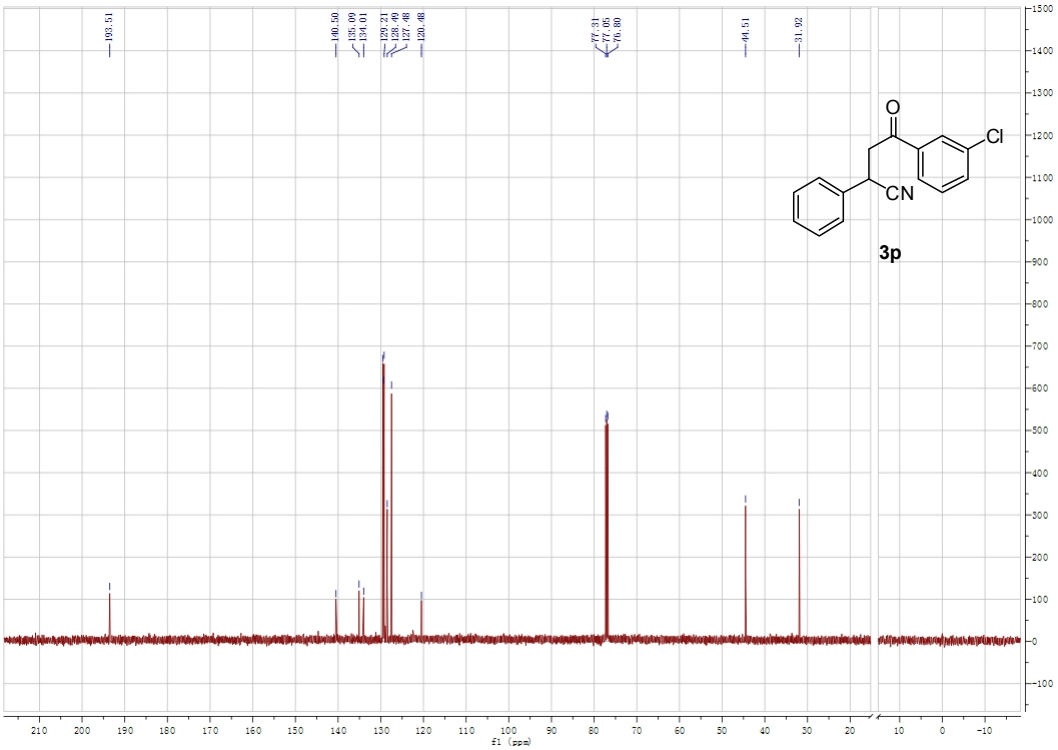

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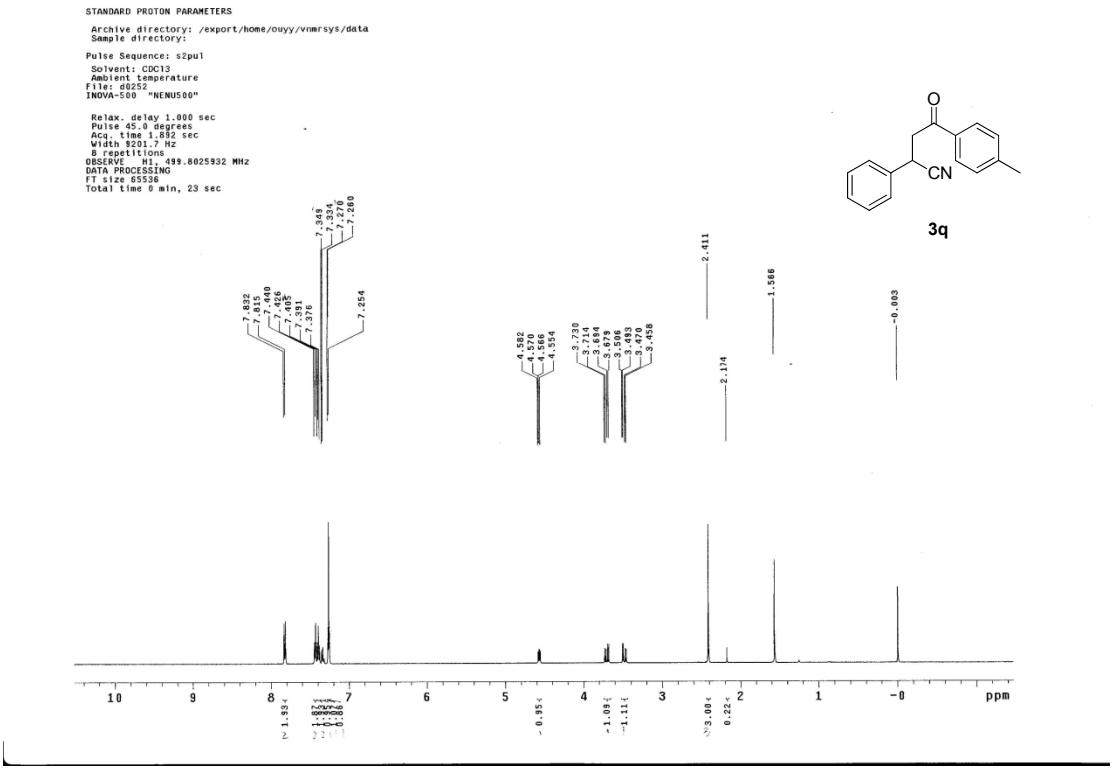

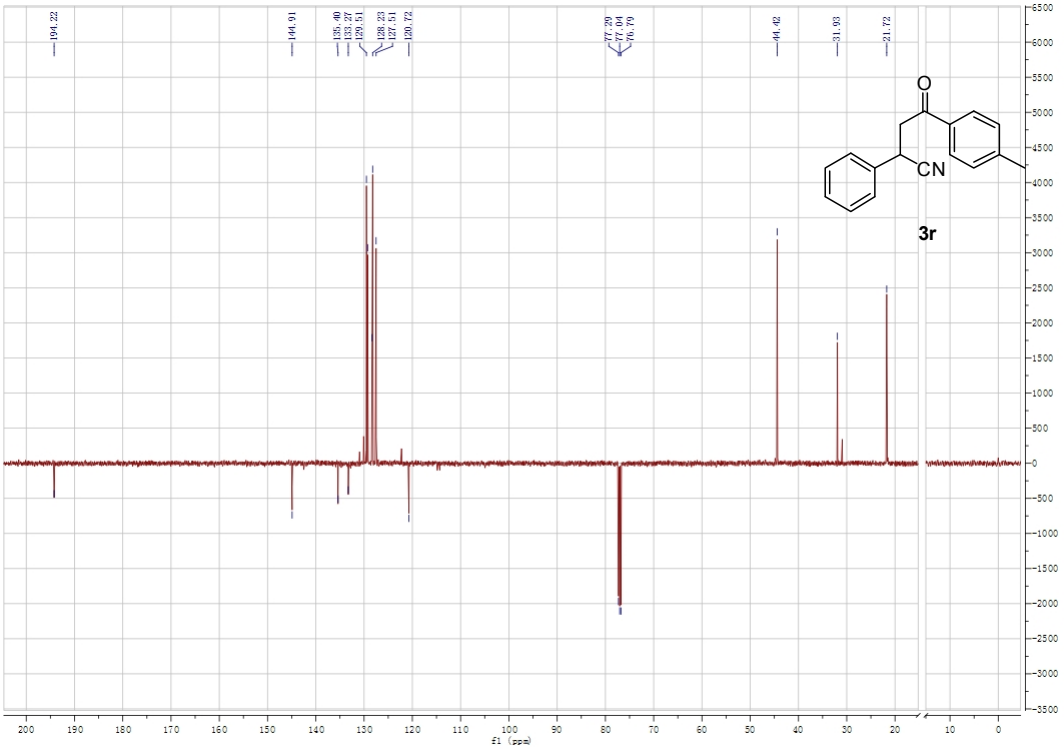

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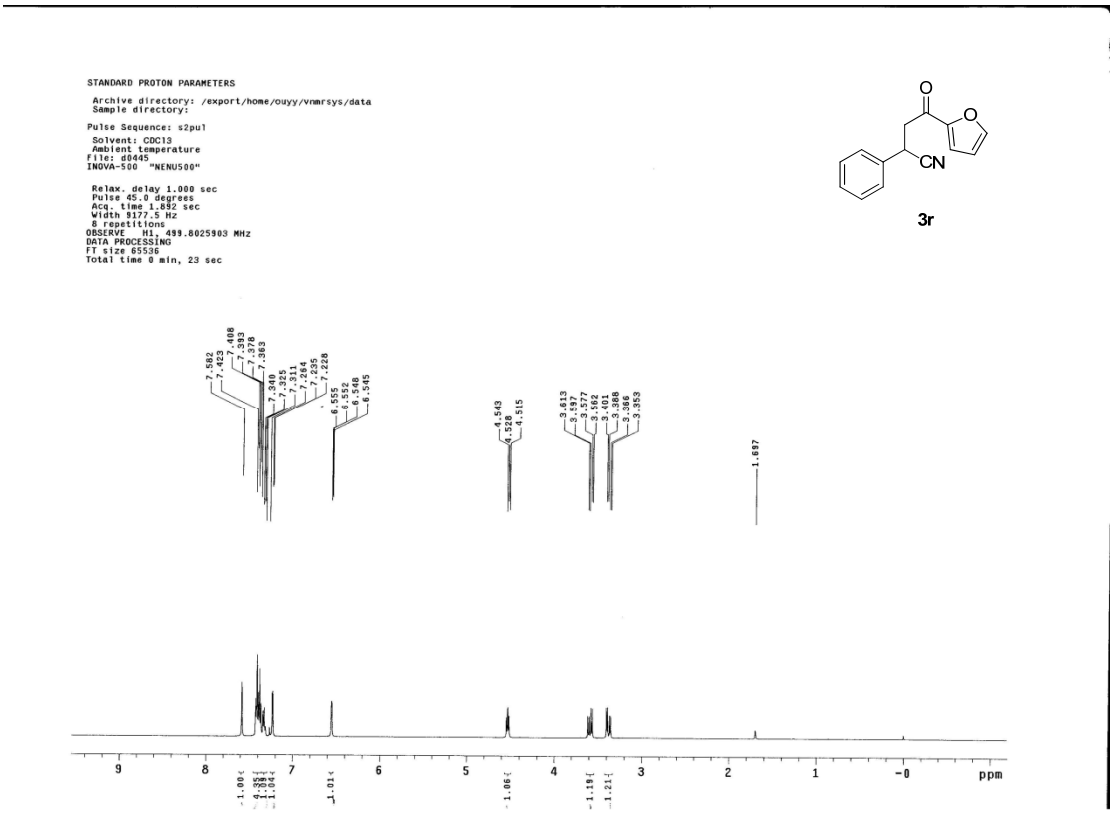

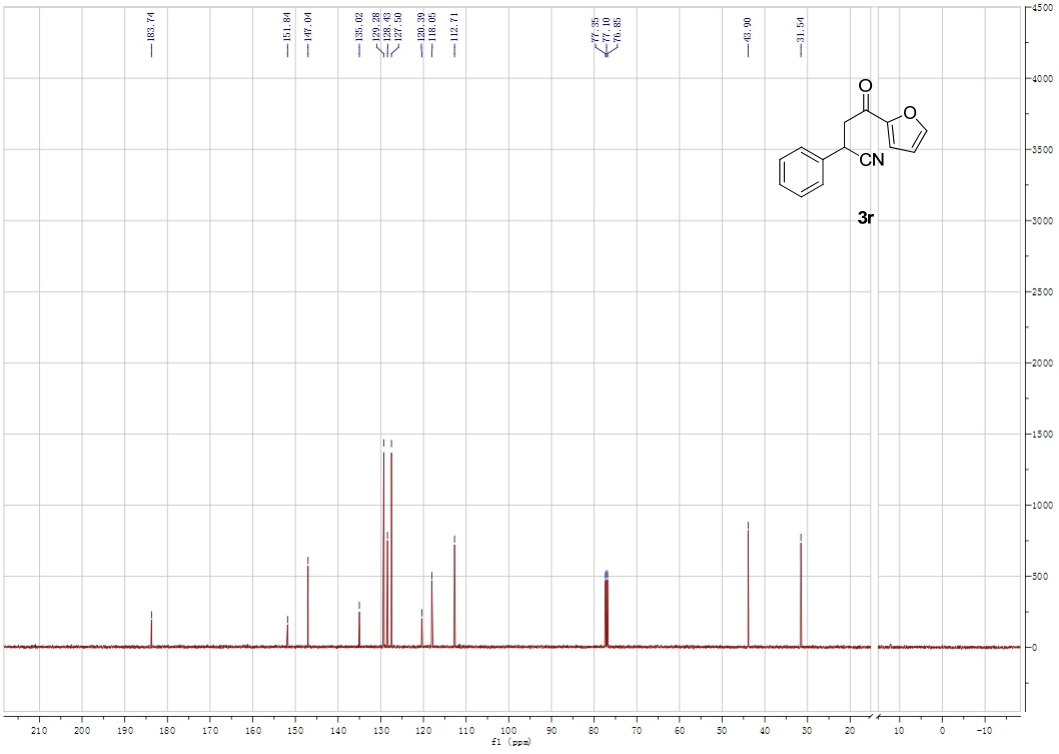

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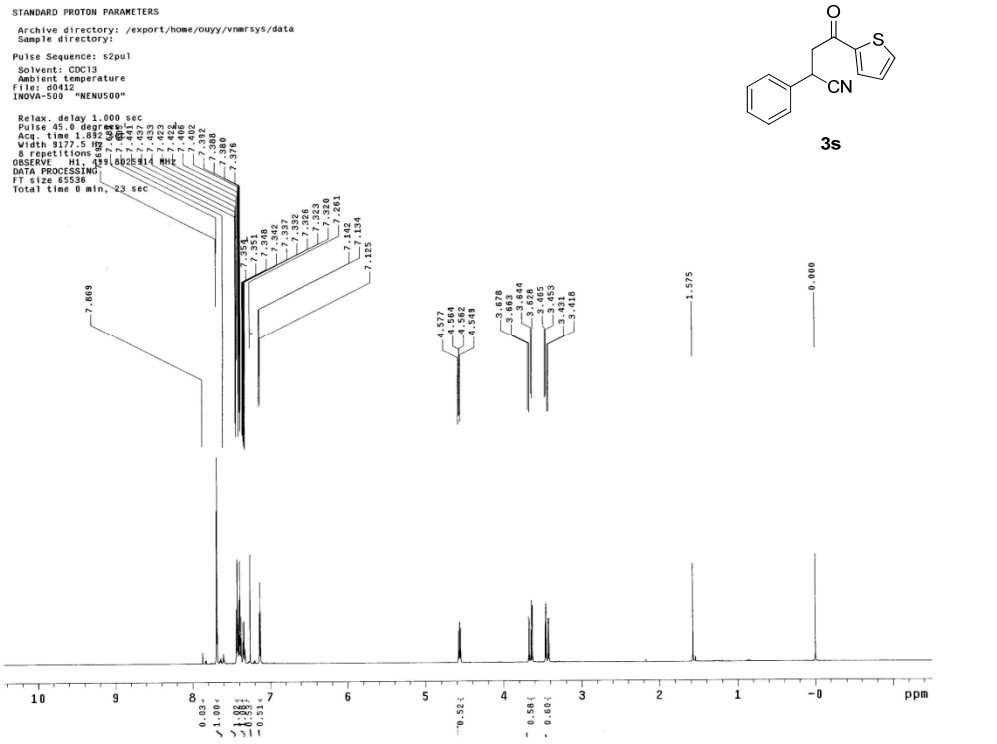

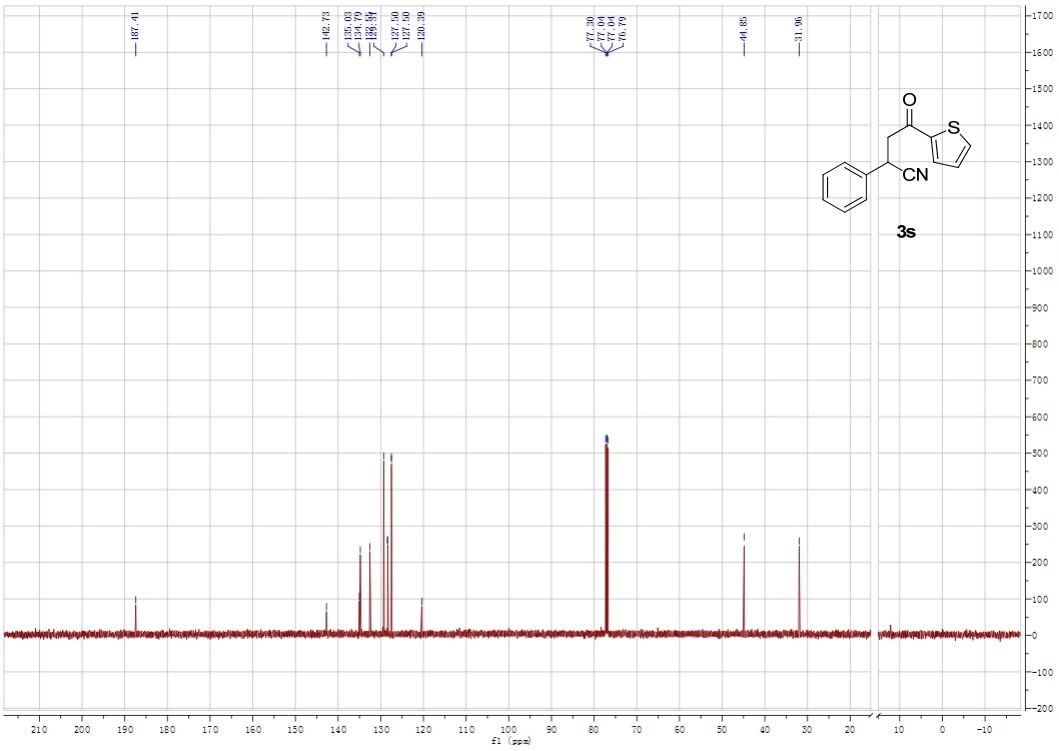

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