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Supporting Information

For

Cascade Synthesis of 2-Pyridones Using Acrylamides and Ketones

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Content

1. Experimental section

General Considerations. Microwave reactions were performed in a CEM Discover BenchMate single-mode microwave reactor with a new sealed pressure regulation 10-mL pressurized vial with ‘‘snap-on’’ cap and teflon-coated magnetic stir bar. The standard temperature control system for the Discover System consists of a non-contact calibrated infrared sensor which monitors and controls the temperature conditions of the reaction vessel located in the instrument cavity. The glassware used in the experiments was carefully cleaned and oven dried. Completion of reaction was checked by commercially available thin layer chromatography (TLC) from Merck, made up of silica gel 60/Kieselguhr F_{254} precoated on Aluminum sheets (thickness 0.2 mm). Column chromatography was performed using Merck silica gel (100-200 mesh). Visualization of spots on TLC plate was accomplished with UV light. Unless otherwise noted, all reagents were obtained from commercial suppliers and used without further purification. Products yield refer to either crude or isolated yield after column chromatography.

Synthetic procedure for Acrylamides (1-6):

Method A. (Conventional): Aldehyde (20 mmol) and cyanoacetamide (20 mmol) were taken in a round bottomed flask in equimolar amount. Distilled water was added to facilitate the stirring and reaction mixture was refluxed with stirring on oil bath for specified time. Completion of reaction was confirmed by TLC. After completion of reaction, mixture was cooled at room temperature to form precipitate. Precipitate formed was filtered and dried in air.

Method B. (Micro Wave): In a sealed pressure regulation 10-mL pressurized vial were placed aldehyde (1 mmol), Cyanoacetamide (1 mmol), 1.0 mL distilled water and a teflon coated magnetic stir bar. The vessel was closed with a snap-on cap, stirred at room temperature for 2-5 min and then placed into the MW cavity. Microwave irradiation of 60 W at a set temperature of 120°C was used and the reaction mixture was held under these conditions for the specified time. Completion of

reaction was confirmed by TLC. After completion of reaction, mixture was cooled at room temperature to form precipitate. Precipitate formed was filtered and dried in air.

Physical and spectral data of products:

2-cyano-3-phenylacrylamide (1);

Crystalline white solid; yield: 99% (MW), 98% (thermal), m.p. 102-105 °C; IR (ν_{max}/cm^{-1}) 3401, 3163, 2219, 1693, 1597; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H 8.34 (s, 1H, Vinylic-**H**), 7.96 (d, 2H, J = 9, Ar-**H**), 7.55 (t, 3H, J = 6, Ar–**H**), 6.36 (s, 1H, N**H$_2$**), 6.06 (s, 1H, N**H$_2$**); ^{13}C NMR (75 MHz, $CDCl_3$) 162.2, 153.9, 132.9, 131.5, 130.7, 129.2, 116.9, 103.1. **Chemical Formula:** $C_{10}H_8N_2O$, **Elemental Analysis:** Calculated; C, 69.76; H, 4.68; N, 16.27; Found; C, 69.53; H, 4.70; N, 16.30.

3-(4-chlorophenyl)-2-cyanoacrylamide (2):

White solid; yield: 98% (MW), 92% (thermal), m.p. 183-185 °C; IR (ν_{max}/cm^{-1}) 3455, 3154, 2212, 1703, 1587; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H 8.14 (s, 1H, Vinylic-**H**), 7.93 (d, 2H, J = 9, Ar-**H**), 7.78 (s, 2H, N**H$_2$**), 7.64 (d, 2H, J = 9, Ar–**H**); ^{13}C NMR (75 MHz, $CDCl_3$) 162.6, 149.3, 137.0, 131.7, 130.8, 129.4, 116.3, 107.3 **Chemical Formula:** $C_{10}H_7N_2OCl$, **Elemental Analysis:** Calculated; C, 58.13; H, 3.41; N, 13.56; Found; C, 58.05; H, 3.50; N, 13.50.

2-cyano-3-(3, 4-dimethoxyphenyl)acrylamide (3):

Green yellow solid; yield: 98% (MW), 91% (thermal), m.p. 185-188 °C; IR (ν_{max}/cm^{-1}) 3394, 3165, 2214, 1694, 1584; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H 8.08 (s, 1H, Vinylic-**H**), 7.77 (s, 2H, N**H$_2$**), 7.63 (s, 1H, Ar-**H**), 7.54 (d, 1H, J = 9, Ar–**H**), 7.11 (d, 1H, J = 6, Ar–**H**), 3.83 (s, 3H, OC**H$_3$**), 3.78 (s, 3H, OC**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 163.1, 152.5, 150.6, 148.6, 125.6, 124.4, 117.2, 112.1, 111.7, 102.7; **Chemical Formula:** $C_{12}H_{12}N_2O_3$, **Elemental Analysis:** Calculated; C, 62.06; H, 5.21; N, 12.06;. Found; C, 62.0; H, 5.18; N, 12.10.

2-cyano-3-(4-methoxyphenyl)acrylamide (4):

White solid; yield: 97% (MW), 93% (thermal), m.p. 197-199 °C; IR (ν_{max}/cm^{-1}) 3447, 3176, 2208, 1698, 1583; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H 8.26 (s, 1H, Vinylic-**H**), 7.97 (d, 2H, J = 9, Ar-**H**), 7.01 (d, 2H, J = 9, Ar-**H**), 6.26 (br s, 1H N**H$_2$**), 5.65 (br s, 1H N**H$_2$**), 3.89 (s, 3H, OC**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 163.2, 162.4, 152.3, 132.8, 124.46, 117.3, 114.2, 100.3, 55.3; **Chemical Formula:** $C_{11}H_{10}N_2O_2$, **Elemental Analysis:** Calculated; C, 65.34; H, 4.98; N, 13.85;. Found; C, 65.30; H, 5.00; N, 13.80.

2-cyano-3-(p-tolyl)acrylamide (5):

Crystalline white solid; yield: 99% (MW), 94% (thermal), m.p. 147-149 °C; IR (ν_{max}/cm^{-1}) 3416, 3116, 2224, 1704, 1605, 1379, 1350; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H 8.29 (s, 1H, Vinylic-**H**), 7.87 (d, 2H, J = 9, Ar-**H**), 7.31 (d, 2H, J = 9, Ar-**H**), 6.4 (br s, 2H N**H$_2$**), 2.43 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 162.4, 153.9, 153.8, 144.3, 130.9, 130.8, 129.9, 128.9, 117.2, 101.6, 21.8; **Chemical Formula:** $C_{11}H_{10}N_2O$, **Elemental Analysis:** Calculated; C, 70.95; H, 5.41; N, 15.04;. Found; C, 71.90; H, 5.38; N, 15.09.

2-cyano-3-(3-nitrophenyl)acrylamide (6):

White solid; yield: 96% (MW), 85% (thermal), m.p. 173-175 °C; IR (ν_{max}/cm^{-1}) 3416.40, 3116.34, 2224.57, 1704.25, 1605.05, 1526.42; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H 8.74 (s, 1H, Vinylic-**H**), 8.37 (d, 1H, J = 7.8, Ar-**H**), 8.30 (d, 2H, J = 9, Ar-**H**), 7.98 (br s, 2H, N-**H**), 7.86 (m, 3H, Ar-**H**); ^{13}C NMR (75 MHz, $CDCl_3$) 162.1, 148.3, 148.0, 135.9, 133.4, 130.8, 126.2, 124.1, 115.8, 109.5; **Chemical Formula:** $C_{10}H_7N_3O_3$, **Elemental Analysis:** Calculated; C, 55.30; H, 3.25; N, 19.35;. Found; C, 55.28; H, 3.21; N, 19.37.

2-cyano-3-(2-nitrophenyl)acrylamide (7):

White solid; yield: 92% (MW), 75% (thermal), m.p. 170-172 °C; IR (ν_{max}/cm^{-1}) 3393.54, 3179.31, 2234.58, 1718.96, 1613.77, 1524.39, 1387.90, 1352.98; ^{1}H NMR (300 MHz, $CDCl_3$ + few drop of $DMSO_{d6}$) δ_H 8.68 (s, 1H, Vinylic-**H**), 8.26 (d, 1H, J = 8.4, Ar-**H**), 7.83 (d, 2H, J = 3.6, Ar-**H**), 7.73 (m, 2H, Ar-**H**), 7.24 (s, 1H, N**H$_2$**), 7.18 (s, 1H, N**H$_2$**); ^{13}C NMR (75 MHz, $CDCl_3$) 160.4, 150.0, 133.8, 131.2, 129.9, 128.1, 124.7, 120.3, 114.6; **Chemical Formula:** $C_{10}H_7N_3O_3$, **Elemental Analysis:** Calculated; C, 55.30; H, 3.25; N, 19.35;. Found; C, 55.29; H, 3.24; N, 19.35.

2-cyano-3-(4-nitrophenyl)acrylamide (8):

Dirty white solid; yield: 95% (MW), 80% (thermal), m.p. 234-235 °C; IR (ν_{max}/cm^{-1}) 3441.73, 3346.68, 2244.68, 1693.36, 1602.13, 1509.82, 1344.97; ^{1}H NMR (400 MHz, $DMSO_{d6}$) δ_H 8.37 (s, 2H, J = 8.8, Ar-**H**), 8.28 (d, 1H, Vinylic-**H**), 8.16 (d, 2H, J = 8.8, Ar-**H**), 8.05 (s, 1H, N**H$_2$**), 7.89 (s, 1H, N**H$_2$**); ^{13}C NMR (100 MHz, $DMSO_{d6}$) 162.5, 149.2, 148.7, 138.4, 131.4, 124.5, 116.1, 111.0; **Chemical Formula:** $C_{10}H_7N_3O_3$, **Elemental Analysis:** Calculated; C, 55.30; H, 3.25; N, 19.35;. Found; C, 55.28; H, 3.26; N, 19.36.

Synthetic procedure for 2-pyridones:

Clean and freshly cut sodium metal (1.2 equivalents) was completely dissolved in dried ethanol then ketone (1.0 equivalent) was added and stirred for 30 minutes. After that acrylamide (1.0 equivalent) was added and stirring was continued for specified time. Completion of reaction was checked by TLC. After completion of the reaction water was added (to make 1:1, ethanol:water mixture) and stand at 0-5 °C for precipitate formation. Then filtered and dried in air. For isomeric mixture column chromatography was performed to isolate the isomers. Elutent ratio for separation of each isomer has been shown in table 6.

Table 6. Separation of isomeric mixtures by column chromatography.

Compound Name	Eluent ratio (Ethyl acetate:Hexane)
1b	80:20
1h	40:60
1d	60:40
1e	20:80
1f	25:75
1g	10:90
1i	05:95
2d	40:60
2e	20:80
2f	25:75
2g	10:90
4d	35:65
4e	20:80
5d	50:50
5e	20:80

Physical and spectral data of products:

6-methyl-2-oxo-4-phenyl-1,2-dihydropyridine-3-carbonitrile (1a):

Green yellow solid; yield: 85%: mp. 265-270 °C; IR (ν_{max}/cm^{-1}): 2221.65, 1660.71, 1625.53; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.59 (br s, 1H, N**H**), 7.56 (m, 5H, Ar-**H**), 6.29 (s, 1H, Pyridone-Ring-**H**), 2.28 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.4, 160.0, 152.1, 136.0, 130.2, 128.7, 127.9, 116.6, 106.5, 97.2, 19.1; **Chemical Formula:** $C_{13}H_{10}N_2O$, **Elemental Analysis:** Calculated; C, 74.27; H, 4.79; N, 13.33;. Found; C, 74.26; H, 4.78; N, 13.34.

2-oxo-4,6-diphenyl-1,2-dihydropyridine-3-carbonitrile (1b):

Light green yellow solid; yield: 96%: mp. 298-300 °C; IR (ν_{max}/cm^{-1}): 2218.87, 1645, 1608.16; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.82 (br s, 1H N**H**), 7.89 (d, 2H, J = 6, Ar-**H**), 7.72 (d, 2H, J = 6, Ar-**H**), 7.55 (m, 6H, Ar-**H**), 6.82 (s, 1H Pyridone-Ring-**H**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 162.0, 159.8, 151.4, 136.0, 132.2, 131.1, 130.4, 128.9, 128.7, 128.5, 128.2, 127.7, 116.5, 106.1; **Chemical Formula:** $C_{18}H_{12}N_2O$, **Elemental Analysis:** Calculated; C, 79.39; H, 4.44; N, 10.29;. Found; C, 79.40; H, 4.44; N, 10.28.

6-(4-chlorophenyl)-2-oxo-4-phenyl-1,2-dihydropyridine-3-carbonitrile (1c):

White solid; yield: 95%: mp. 270 °C; IR (ν_{max}/cm^{-1}): 2222.06, 1662.48, 1613.45; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.85 (br s, 1H, N**H**), 7.94 (d, 2H, J = 9, Ar-**H**), 7.73 (dd, 2H, J = 9, Ar-**H**), 7.59 (m, 5H, Ar-**H**), 6.88 (s, 1H, Pyridone-Ring-**H**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 166.7, 162.1, 159.5, 150.5, 135.9, 131.3, 130.4, 129.6, 128.8, 128.7, 128.2, 116.3, 106.8, 98.3; **Chemical Formula:** $C_{18}H_{11}N_2OCl$, **Elemental Analysis:** Calculated; C, 70.48; H, 3.61; N, 9.13;. Found; C, 70.50; H, 3.60; N, 9.10.

5,6-dimethyl-2-oxo-4-phenyl-1,2-dihydropyridine-3-carbonitrile (1d):

Yellow green solid; yield: 89%: mp. 270-272 °C; IR (ν_{max}/cm^{-1}): 2224.60, 1648.31, 1595.18; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 12.89 (br s, 1H, N**H**), 7.51 (m, 3H, Ar-**H**), 7.25 (d, 2H, J = 6, Ar-**H**), 2.40 (s, 3H, C**H$_3$**), 1.81 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 163.0, 162.6, 149.6, 136.0, 129.3, 128.8, 128.0, 127.6, 115.3, 106.6, 101.2, 18.7, 14.4; **Chemical Formula:** $C_{14}H_{12}N_2O$, **Elemental Analysis:** Calculated; C, 74.98; H, 5.39; N, 12.49;. Found; C, 74.95; H, 5.40; N, 12.50.

6-ethyl-2-oxo-4-phenyl-1,2-dihydropyridine-3-carbonitrile (1e):

Yellow green solid; yield: 11%: mp. 257-260 °C; IR (ν_{max}/cm^{-1}): 2224.42, 1647.95, 1605.11; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.57 (br s, 1H, N**H**), 7.60 (d, 1H, J = 2.4, Ar-**H**), 7.58 (d, 1H, J = 3.0, Ar-**H**), 7.52 (t, 3H, J = 2.7, Ar-**H**), 6.31 (s, 1H, Pyridone-Ring-**H**), 2.60 (q, 2H, J = 7.2, 7.5, 7.8 -C**H$_2$**-), 1.19 (t, 3H, J = 7.5, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.9, 160.8, 157.7, 136.5, 130.8, 129.2, 129.1, 128.4, 117.0, 105.5, 26.3, 12.9; **Chemical Formula:** $C_{14}H_{12}N_2O$, **Elemental Analysis:** Calculated; C, 74.98; H, 5.39; N, 12.49;. Found; C, 74.96; H, 5.35; N, 12.52.

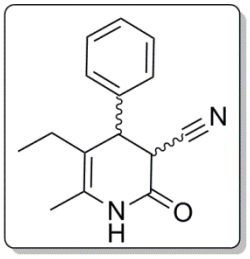
5-ethyl-6-methyl-2-oxo-4-phenyl-1,2-dihydropyridine-3-carbonitrile (1f):

White solid; yield: 27%: mp. 272-275 °C; IR (ν_{max}/cm^{-1}): 2225.40, 1644.93, 1594.03; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 13.82 (br s, 1H, N**H**), 7.50 (d, 2H, J = 5.1, Ar-**H**), 7.27 (m, 3H, J = 2.7, 4.8, Ar-**H**), 2.48 (s, 3H, C**H$_3$**), 2.31 (q, 2H, J = 4.8, 7.2, -C**H$_2$**-), 0.90 (t, 3H, J = 7.5, 7.2, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 163.1, 162.4, 149.5, 135.8, 129.1, 128.9, 128.7, 127.2, 120.2, 115.2, 101.5, 21.4, 17.8, 14.2; **Chemical Formula:** $C_{15}H_{14}N_2O$, **Elemental Analysis:** Calculated; C, 75.61; H, 5.92; N, 11.76;. Found; C, 75.59; H, 5.90; N, 11.78.

2-oxo-4-phenyl-6-propyl-1,2-dihydropyridine-3-carbonitrile (1g):

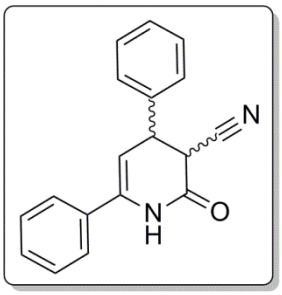
Light green yellow solid; yield: 73%: mp. 195-197 °C; IR (ν_{max}/cm^{-1}): 2221.24, 1649.41, 1617.68; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 13.60 (br s, 1H, N**H**), 7.61- 7.49 (m, 5H, Ar-**H**), 6.29 (s, 1H, Pyridone-Ring-**H**), 2.76 (t, 2H, J = 7.2, 7.5, -C**H$_2$**-), 1.88 (sext, 2H, J = 7.2, 7.5, -C**H$_2$**-), 1.19 (t, 3H, J = 7.5, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.9, 160.8, 157.7, 136.5, 130.8, 129.2, 129.1, 128.4, 117.0, 105.5, 26.3, 12.9; **Chemical Formula:** $C_{14}H_{12}N_2O$, **Elemental Analysis:** Calculated; C, 74.98; H, 5.39; N, 12.49;. Found; C, 74.97; H, 5.38; N, 12.52.

5-ethyl-6-methyl-2-oxo-4-phenyl-1,2,3,4-tetrahydropyridine-3-carbonitrile (1h):



White solid; yield: 3%: mp 211-213 °C; IR (ν_{max}/cm^{-1}): 3219.66, 3107.79, 2253.32, 1698.85, 1677.36; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 8.51 (br s, 1H, N**H**), 7.33 – 7.15 (m, 5H, Ar-**H**), 4.09 (d, 0.81 x 1H, J = 6.9), 3.81 (d, 0.18 x 1H, J = 2.1), 3.68 (d, 0.82 x 1H, J = 6.9), 3.59 (d, 0.18 x 1H, J = 2.7), 2.28 – 2.12 (m, 2H, -C**H$_2$**-), 1.90 (s, 3H, C**H$_3$**), 0.91 (t, 3H, J = 7.2, 7.5, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 162.2, 135.8, 129.1, 128.9, 128.3, 128.2, 12.4, 116.8, 114.9, 44.5, 41.8, 23.6, 15.3, 134; **Chemical Formula:** $C_{15}H_{16}N_2O$, **Elemental Analysis:** Calculated; C, 74.97; H, 6.71; N, 11.66;. Found; C, 74.95; H, 6.70; N, 11.68.

2-oxo-4,6-diphenyl-1,2,3,4-tetrahydropyridine-3-carbonitrile (1i):



White solid; yield: 92%: mp 218-220 °C; IR (ν_{max}/cm^{-1}): 3475.32, 3373.49, 3351.02, 2258.57, 1698.36, 1595.78; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 8.88 (s, 1H, N**H**), 7.57 – 7.33 (m, 10H, Ar-**H**), 5.30 (s, 1H, =C**H**-), 4.94 (d, 1H, J = 12.9), 4.39 (d, 1H, J = 12.9); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 163.7, 162.9, 135.1, 134.5, 129.1, 128.6, 128.2, 127.8, 116.7, 115.3, 60.4, 46.4; **Chemical Formula:** $C_{18}H_{14}N_2O$, **Elemental Analysis:** Calculated; C, 78.81; H, 5.14; N, 10.21;. Found; C, 78.80; H, 5.12; N, 10.24.

4-(4-chlorophenyl)-6-methyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (2a):

Chartreuse yellow solid; yield: 83%: mp (d) > 300 °C; IR (ν_{max}/cm^{-1}): 2220.95, 1661.29, 1626.27; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.64 (br s, 1H, N**H**), 7.63 (m, 4H, Ar-**H**), 6.32 (s, 1H Pyridone-Ring-**H**), 2.29 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.2, 158.8, 152.4, 135.1, 134.8, 129.8, 128.8, 116.4, 106.3, 97.3, 19.1; **Chemical Formula:** $C_{13}H_9N_2OCl$, **Elemental Analysis:** Calculated; C, 63.81; H, 3.71; N, 11.45;. Found; C, 63.79; H, 3.75; N, 11.41.

4-(4-chlorophenyl)-2-oxo-6-phenyl-1,2-dihydropyridine-3-carbonitrile (2b):

White solid; yield: 94%: mp (d) > 290 °C; IR (ν_{max}/cm^{-1}): 2219.11, 1642.89, 1607.59; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 7.90 (d, 2H, J = 9, Ar-**H**),7.76 (d, 2H, J = 9, Ar-**H**), 7.64 (d, 2H, J = 9, Ar-**H**), 7.53 (d, 3H, J = 6, Ar-**H**), 6.82 (s, 1H, Pyridone-Ring-**H**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 162.5, 158.3, 152.1, 135.2, 135.0, 132.7, 131.1, 130.2, 12., 128.8, 127.7, 116.6, 105.9; **Chemical Formula:** $C_{18}H_{11}N_2OCl$, **Elemental Analysis:** Calculated; C, 70.48; H, 3.61; N, 9.13;. Found; C, 70.52; H, 3.65; N, 9.05.

4,6-bis(4-chlorophenyl)-2-oxo-1,2-dihydropyridine-3-carbonitrile (2c):

Light yellow solid; yield: 97%: mp (d) 240 °C; IR (ν_{max}/cm^{-1}): 2201.47, 1657.94, 1595.73; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 7.99 (d, 2H, J = 9, Ar-**H**), 7.64 (d, 2H, J = 9, Ar-**H**), 7.56 (d, 2H, J = 9, Ar-**H**), 7.48 (d, 2H, J = 9, Ar-**H**), 6.66 (s, 1H, Pyridone-Ring-**H**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 155.5, 154.9, 136.8, 134.1, 133.8, 1331, 132.9, 130.0, 128.9, 128.5, 128.3, 119.5, 103.3; **Chemical Formula:** $C_{18}H_{10}N_2OCl_2$, **Elemental Analysis:** Calculated; C, 63.36; H, 2.95; N, 8.21;. Found; C, 63.30; H, 3.00; N, 8.20.

4-(4-chlorophenyl)-5,6-dimethyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (2d):

Light green yellow solid; yield: 91%: mp (d) 270 °C; IR (ν_{max}/cm^{-1}): 2223.25, 1645.16, 1606.48; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.61 (br s, 1H, N**H**), 7.58 (d, 2H, J = 8.4, Ar-**H**), 7.33

(d, 2H, J = 8.4, Ar-**H**), 2.30 (s, 3H, C**H$_3$**), 1.68 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 160.5, 159.9, 150.7, 135.2, 135.1, 134.9, 133.8, 129.9, 129.6, 128.8, 116.3, 116.2, 111.2, 99.7, 1.0, 13.9; **Chemical Formula:** $C_{14}H_{11}N_2OCl$, **Elemental Analysis:** Calculated; C, 65.00; H, 4.29; N, 10.83;. Found; C, 65.02; H, 4.30; N, 10.85.

4-(4-chlorophenyl)-6-ethyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (2e):

Yellow green solid; yield: 9%: mp 257-260 °C ; IR (ν_{max}/cm^{-1}): 2219.88, 1645.77, 1613.96; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.56 (br s, 1H, N**H**), 7.56 (d, 2H, J = 9, Ar-**H**), 7.52 (d, 2H, J = 8.7, Ar-**H**), 6.25 (s, 1H, Pyridone-Ring-**H**), 2.50 (q, 2H, J = 7.5, -C**H$_2$**-), 1.11 (t, 3H, J = 7.5, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.4, 159.1, 157.5, 135.2, 134.9, 128.9, 116.4, 105.1, 105.0, 104.9, 97.7, 26.1, 12.7; **Chemical Formula:** $C_{14}H_{11}N_2OCl$, **Elemental Analysis:** Calculated; C, 65.00; H, 4.29; N, 10.83;. Found; C, 65.07; H, 4.31; N, 10.80.

4-(4-chlorophenyl)-5-ethyl-6-methyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (2f):

Green yellow solid; yield: 30%: mp 270 °C; IR (ν_{max}/cm^{-1}): 2226.47, 1650.69, 1599.76; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.61 (br s, 1H, N**H**), 7.58 (d, 2H, J = 8.1, Ar-**H**), 7.35 (d, 2H, J = 8.4, Ar-**H**), 2.34 (s, 3H, C**H$_3$**), 2.11 (q, 2H, J = 6.9, 7.5, 6.9, -C**H$_2$**-), 0.77 (t, 3H, J = 7.5, 7.2, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 160.8, 159.7, 150.5, 135.0, 133.7, 129.4, 128.7, 117.5, 116.0, 100.3, 20.4, 17.2, 13.9; **Chemical Formula:** $C_{15}H_{13}N_2OCl$, **Elemental Analysis:** Calculated; C, 66.06; H, 4.80; N, 10.27;. Found; C, 66.03; H, 4.82; N, 10.30.

4-(4-chlorophenyl)-2-oxo-6-propyl-1,2-dihydropyridine-3-carbonitrile (2g):

Green yellow solid; yield: 70%: mp 225-228 °C ; IR (ν_{max}/cm^{-1}): 2221.03, 1649.66, 1614.20; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 13.52 (br s, 1H, N**H**), 7.54 (d, 2H, J = 8.4, Ar-**H**), 7.47 (d, 2H, J = 8.1, Ar-**H**), 6.25 (s, 1H, Pyridone-Ring-**H**), 2.72 (t, 2H, J = 7.2, 7.5, -C**H$_2$**-), 1.81 (sext,

2H, J = 7.5, -C**H$_2$**-), 1.04 (t, 3H, J = 7.5, 7.2, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 164.0, 159.9, 155.7, 136.9, 134.2, 129.4, 129.2, 115.4, 107.2, 98.6, 35.5, 21.8, 13.5; **Chemical Formula:** $C_{15}H_{13}N_2OCl$, **Elemental Analysis:** Calculated; C, 66.06; H, 4.80; N, 10.27;. Found; C, 66.02; H, 4.79; N, 10.27

4-(3,4-dimethoxyphenyl)-6-methyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (3a):

White solid; yield: 81%: mp (d) > 280 °C ; IR (ν_{max}/cm^{-1}): 2214.76, 1667.34, 1627.43, 160.34; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 7.22 (d, 2H, J = 9, Ar-**H**),7.10 (d, 1H, J = 9, Ar-**H**), 6.36 (s, 1H, Pyridone-Ring-**H**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.7, 159.7, 151.6, 150.6, 148.5, 128.0, 121.2, 117.1, 111.5, 106.4, 96.5, 55.6, 19.2; **Chemical Formula:** $C_{15}H_{14}N_2O_3$, **Elemental Analysis:** Calculated; C, 66.66; H, 5.22; N, 10.36;. Found; C, 66.64; H, 5.25; N, 10.33.

4-(3,4-dimethoxyphenyl)-2-oxo-6-phenyl-1,2-dihydropyridine-3-carbonitrile (3b):

White solid; yield: 91%: mp (d) 248 °C; IR (ν_{max}/cm^{-1}): 2202.27, 1666.14, 1606.06; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 7.98 (d, 2H, J = 9, Ar-**H**), 7.40 (m, 4H, Ar-**H**), 7.18 (d, 2H, J = 9, Ar-**H**), 7.05 (s, 1H, Ar-**H**), 6.61 (s, 1H Pyridone-Ring-**H**) 3.81 (s, 3H, OC**H$_3$**) 3.80 (s, 3H, O**CH$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 157.9, 155.1, 149.2, 148.3, 139.3, 136.5, 133.1, 131.0, 128.8, 128.2, 127.0, 120.6, 111.5, 102.8, 91.9, 55.5; **Chemical Formula:** $C_{20}H_{16}N_2O_3$, **Elemental Analysis:** Calculated; C, 72.28; H, 4.85; N, 8.43;. Found; C, 72.20; H, 4.87; N, 8.40.

6-(4-chlorophenyl)-4-(3,4-dimethoxyphenyl)-2-oxo-1,2-dihydropyridine-3-carbonitrile (3c):

White solid; yield: 94%: mp (d) 280 °C; IR (ν_{max}/cm^{-1}): 2203.79, 1680.65, 1595.41; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 8.26 (s, 1H, N**H**), 8.02 (d, 2H, J = 9, Ar-**H**), 7.44 (d, 2H, J = 9, Ar-**H**), 7.16 (d, 2H, J = 9, Ar-**H**), 7.04 (s, 1H, Ar-**H**), 6.63 (s, 1H, Pyridone-Ring-**H**), 3.80 (s, 6H, O**CH$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 157.3, 155.0, 149.3, 148.4, 138.7, 133.5, 131.2, 128.8, 128.3,

121.2, 120.7, 111.9, 91.9, 55.7, 55.6; **Chemical Formula:** $C_{20}H_{15}N_2O_3Cl$, **Elemental Analysis:** Calculated; C, 65.49; H, 4.12; N, 7.64;. Found; C, 65.5; H, 4.15; N, 7.61.

4-(4-methoxyphenyl)-6-methyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (4a):

White solid; yield: 78%: mp (d) 242 °C; IR (ν_{max}/cm^{-1}): 2219.10, 1661.89, 1608.48; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 7.60 (d, 2H, J = 9, Ar-**H**), 7.01 (d, 2H, J = 9, Ar-**H**), 6.26 (s, 1H, Pyridone-Ring-**H**), 3.86 (s, 3H, OC**H$_3$**), 2.29 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 164.3, 161.6, 160.7, 150.5, 129.7, 127.9, 116.1, 114.3, 108.1, 97.7, 55.4, 19.7; **Chemical Formula:** $C_{14}H_{12}N_2O_2$, **Elemental Analysis:** Calculated; C, 69.99; H, 5.03; N, 11.66;. Found; C, 69.95; H, 5.11; N, 11.71.

4-(4-methoxyphenyl)-2-oxo-6-phenyl-1,2-dihydropyridine-3-carbonitrile (4b):

White solid; yield: 85%: mp (d) 198-200 °C; IR (ν_{max}/cm^{-1}): 2208.92, 1662.33, 1608.16; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 7.99 (d, 2H, J = 6, Ar-**H**), 7.59 (d, 2H, J = 9, Ar-**H**), 7.39 (d, 2H, J = 6, Ar-**H**), 7.05 (d, 2H, J = 9, Ar-**H**), 6.66 (s, 1H, Pyridone-Ring-**H**), 3.81 (s, 3H, OC**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 159.8, 157.7, 155.1, 138.8, 136.5, 131.7, 130.5, 129.4, 128.2, 17.1, 120.3, 113.8, 112.4, 103.7, 55.2; **Chemical Formula:** $C_{19}H_{14}N_2O_2$, **Elemental Analysis:** Calculated; C, 75.48; H, 4.67; N, 9.27;. Found; C, 75.45; H, 4.65; N, 9.30.

6-(4-chlorophenyl)-4-(4-methoxyphenyl)-2-oxo-1,2-dihydropyridine-3-carbonitrile (4c):

White solid; yield: 91%: mp (d) 190-195 °C; IR (ν_{max}/cm^{-1}): 2208.92, 1667.69, 1610.39; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 8.00 (d, 2H, J = 9, Ar-**H**), 7.58 (d, 2H, J = 6, Ar-**H**), 7.43 (d, 2H, J = 9, Ar-**H**), 7.05 (d, 2H, J = 9, Ar-**H**), 6.69 (s, 1H, Pyridone-Ring-**H**), 3.80 (s, 3H, OC**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 159.9, 156.3, 155.4, 137.5, 133.8, 130.3, 129.5, 129.1, 128.9, 128.7, 128.5, 128.3, 120.1, 113.9, 55.2; **Chemical Formula:** $C_{19}H_{13}N_2O_2Cl$, **Elemental Analysis:** Calculated; C, 67.76; H, 3.89; N, 8.32;. Found; C, 67.75; H, 3.90; N, 8.30.

5-ethyl-4-(4-methoxyphenyl)-6-methyl-2-oxo-1,2-dihydropyridine-3-carbonitrile (4d):

Light green yellow solid; yield: 29%: mp 280-282 °C; IR (ν_{max}/cm^{-1}): 2223.20, 1651.52, 1606.64; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 13.75 (br s, 1H, N**H**), 7.19 (d, 2H, J = 8.4, Ar-**H**), 7.01(d, 2H, J = 8.7, Ar-**H**), 3.86 (s, 1H, OC**H$_3$**), 2.51 (s, 3H, C**H$_3$**), 2.31 (quint, 2H, J = 7.2, -C**H$_2$**-) 0.88 (t, 3H, J = 7.2, 7.5, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 163.1, 162.5, 160.3, 149.0, 128.8, 128.1, 120.5, 115.4, 114.3, 55.2, 21.0, 17.9, 14.2; **Chemical Formula:** $C_{16}H_{16}N_2O_2$, **Elemental Analysis:** Calculated; C, 71.62; H, 6.01; N, 10.44;. Found; C, 71.60; H, 6.00; N, 10.45.

4-(4-methoxyphenyl)-2-oxo-6-propyl-1,2-dihydropyridine-3-carbonitrile (4e):

Green yellow solid; yield: 71%: mp 180-182 °C; IR (ν_{max}/cm^{-1}): 2222.77, 1654.40, 1604.79; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 7.60 (d, 2H, J = 7.8, Ar-**H**), 7.01(d, 2H, J = 8.1, Ar-**H**), 6.26 (s, 1H, Pyridone-Ring-**H**), 5.99 (br s, 1H, N**H**), 3.87 (s, 1H, OC**H$_3$**), 2.69 (t, 2H, -C**H$_2$**-), 1.80 (sext, 2H, J = 4.8, 7.5, 7.2, -C**H$_2$**-) 1.03 (t, 3H, J = 6.6, 7.2, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 164.4, 161.6, 160.7, 154.8, 129.7, 128.0, 116.1, 114.3, 107.2, 97.8, 55.4, 35.5, 21.5, 13.4; **Chemical Formula:** $C_{16}H_{16}N_2O_2$, **Elemental Analysis:** Calculated; C, 71.62; H, 6.01; N, 10.44;. Found; C, 71.63; H, 6.05; N, 10.40.

6-methyl-2-oxo-4-(p-tolyl)-1,2-dihydropyridine-3-carbonitrile (5a):

White solid; yield: 80%: mp 220-222 °C; IR (ν_{max}/cm^{-1}): 2216.91, 1651.27, 1614.82; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 7.50 (d, 2H, J = 9, Ar-**H**), 7.29 (d, 2H, J = 9, Ar-**H**), 6.28 (s, 1H Pyridone-Ring-**H**), 5.70 (br s, 1H, N**H**), 2.50 (s, 3H, C**H$_3$**), 2.41 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 164.2, 161.2, 150.9, 141.1, 132.8, 129.5, 127.9, 115.9, 108.3, 108.2, 98.0, 21.3, 19.7; **Chemical Formula:** $C_{14}H_{12}N_2O$, **Elemental Analysis:** Calculated; C, 74.98; H, 5.39; N, 12.49;. Found; C, 75.03; H, 5.40; N, 12.45.

2-oxo-6-phenyl-4-(p-tolyl)-1,2-dihydropyridine-3-carbonitrile (5b):

White solid; yield: 90%: mp 215-216 °C; IR (ν_{max}/cm^{-1}): 2210.42, 1672.80, 1613.78; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 8.01 (d, 2H, J = 6, Ar-**H**), 7.50 (d, 2H, J = 9, Ar-**H**), 7.38 (m, 3H, Ar-**H**), 7.29 (d, 2H, J = 6, Ar-**H**), 6.68 (s, 1H, Pyridone-Ring-**H**), 2.36 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 158.6, 155.0, 139.5, 138.1, 135.7, 128.9, 128.8, 128.1, 127.9, 127.6, 127.0, 126.4, 103.8, 91.4, 68.8, 20.8; **Chemical Formula:** $C_{19}H_{14}N_2O$, **Elemental Analysis:** Calculated; C, 79.70; H, 4.93; N, 9.78;. Found; C, 79.72; H, 4.90; N, 9.80.

6-(4-chlorophenyl)-2-oxo-4-(p-tolyl)-1,2-dihydropyridine-3-carbonitrile (5c):

White solid; yield: 88%: mp 223-224 °C; IR (ν_{max}/cm^{-1}): 2209.89, 1659.07, 1609.22; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 8.02 (d, 2H, J = 9, Ar-**H**), 7.50 (d, 2H, J = 6, Ar-**H**), 7.43 (d, 2H, J = 9, Ar-**H**), 7.29 (d, 2H, J = 6, Ar-**H**), 6.68 (s, 1H, Pyridone-Ring-**H**), 2.35 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 171.1, 156.5, 155.6, 138.4, 137.6, 135.4, 133.8, 129.0, 128.2, 128.0, 120.1, 103.7, 92.5, 20.8; **Chemical Formula:** $C_{19}H_{13}N_2OCl$, **Elemental Analysis:** Calculated; C, 71.14; H, 4.08; N, 8.73;. Found; C, 71.10; H, 4.10; N, 8.75.

5,6-dimethyl-2-oxo-4-(p-tolyl)-1,2-dihydropyridine-3-carbonitrile (5d):

Green yellow solid; yield: 90%: mp(d) > 290 °C; IR (ν_{max}/cm^{-1}): 2225.72, 1647.27, 1599.70; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.53 (br s, 1H, N**H**), 7.31 (d, 2H, J = 7.2, Ar-**H**), 7.17(d, 2H, J = 7.2, Ar-**H**), 2.36 (s, 3H, C**H$_3$**), 2.29 (s, 3H, C**H$_3$**), 1.69 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.9, 160.0, 150.2, 138.5, 133.3, 129.1, 127.5, 116.4, 111.3, 99.7, 20.8, 17.9, 13.9; **Chemical Formula:** $C_{15}H_{14}N_2O$, **Elemental Analysis:** Calculated; C, 75.61; H, 5.92; N, 11.76;. Found; C, 75.60; H, 5.90; N, 11.78.

6-ethyl-2-oxo-4-(p-tolyl)-1,2-dihydropyridine-3-carbonitrile (5e):

Green yellow solid; yield: 10%: mp 230 °C ; IR (ν_{max}/cm^{-1}): 2217.95, 1644.75, 169.86; ^{1}H NMR (300 MHz, $CDCl_3$, 298 K, TMS): δ_H 13.51 (br s, 1H, N**H**), 7.51 (d, 2H, J = 7.5, Ar-**H**), 7.29 (d, 2H, J = 7.5, Ar-**H**), 6.28 (s, 1H, Pyridone-Ring-**H**), 2.79 (q, 2H, -C**H$_2$**-), 2.42 (s, 3H, C**H$_3$**), 1.37 (t, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $CDCl_3$) 164.3, 161.4, 156.4, 141.0, 1331, 129.5, 127.9, 115.9, 106.5, 98.3, 26.9, 21.3, 12.3; **Chemical Formula:** $C_{15}H_{14}N_2O$, **Elemental Analysis:** Calculated; C, 75.61; H, 5.92; N, 11.76;. Found; C, 75.64; H, 5.95; N, 11.72.

6-methyl-4-(3-nitrophenyl)-2-oxo-1,2-dihydropyridine-3-carbonitrile (6a):

White solid; yield: 88%: mp (d) > 300 °C; IR (ν_{max}/cm^{-1}): 2221.75, 1663.75, 1624.77; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.74 (br s, 1H, N**H**), 8.39(d, 2H, J = 9, Ar-**H**), 8.07 (d, 1H, J = 6, Ar-**H**), 7.86 (t, 1H, J = 9, 6, Ar-**H**), 6.44 (s, 1H, Pyridone-Ring-**H**), 2.32 (s, 3H, C**H$_3$**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.1, 157.6, 152.9, 147.7, 137.4, 134.5, 130.5, 124.9, 122.7, 16.2, 1064, 97.8, 19.2; **Chemical Formula:** $C_{13}H_9N_3O_3$, **Elemental Analysis:** Calculated; C, 61.18; H, 3.55; N, 16.46; Found; C, 61.15; H, 3.52; N, 16.50.

4-(3-nitrophenyl)-2-oxo-6-phenyl-1,2-dihydropyridine-3-carbonitrile (6b):

White solid; yield: 88%: mp (d) > 300 °C ; IR (ν_{max}/cm^{-1}): 2222.55, 1651.66, 1604.35; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.95 (br s, 1H, N**H**), 8.55(s, 1H, Ar-**H**), 8.41 (d, 1H, J = 6, Ar-**H**), 8.20 (d, 1H, J = 9, Ar-**H**), 7.92 (m, 3H, Ar-**H**), 7.56 (t, 3H, J = 4.5, 6.9, Ar-**H**) 6.98 (s, 1H, Pyridone-Ring-**H**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.8, 157.4, 151.3, 147.8, 139.3, 138.3, 137.4, 134.9, 131.3, 130.4, 128.9, 127.8, 124.9, 123.2, 116.1, 106.0; **Chemical Formula:** $C_{18}H_{11}N_3O_3$, **Elemental Analysis:** Calculated; C, 68.14; H, 3.49; N, 13.24; Found; C, 68.12; H, 3.50; N, 13.24.

6-(4-chlorophenyl)-4-(3-nitrophenyl)-2-oxo-1,2-dihydropyridine-3-carbonitrile (6c):

White solid; yield: 88%: mp (d) > 300 °C; IR (ν_{max}/cm^{-1}): 2226.48, 1632.65, 1603.72; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.97 (br s, 1H, N**H**), 8.54(s, 1H, Ar-**H**), 8.41 (d, 1H, J = 9, Ar-**H**), 8.19 (d, 1H, J = 9, Ar-**H**), 7.96 (d, 2H, J = 6, Ar-**H**), 7.88 (t, 1H, J = 7.8, 8.1, Ar-**H**) 7.60 (d, 2H, J = 7.8, Ar-**H**), 7.05 (s, 1H, Pyridone-Ring-**H**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 161.0, 157.1, 147.8, 137.3, 136.1, 134.9, 133.6, 132.7, 130.4, 129.6, 128.9, 124.9, 123.2, 115.9, 105.7; **Chemical Formula:** $C_{18}H_{10}ClN_3O_3$, **Elemental Analysis:** Calculated; C, 61.46; H, 2.87; N, 11.95; Found; C, 61.48; H, 2.88; N, 11.92.

4-(2-nitrophenyl)-2-oxo-6-phenyl-1,2-dihydropyridine-3-carbonitrile (7a):

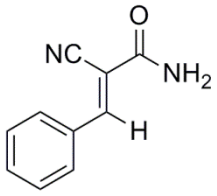
Yellow crystalline solid; yield: 60%: mp 275-277 °C ; IR (ν_{max}/cm^{-1}): 2218.22, 1651.03, 1528.05, 1502.88, 1353.39; ^{1}H NMR (400 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 8.29(d, 1H, J = 1.0, Ar-**H**), 7.97-7.87 (m, 1H, Ar-**H**), 7.85 (t, 3H, J = 7.0, Ar-**H**), 7.73-7.70 (m, 1H, Ar-**H**), 7.57-7.50 (m, 3H, Ar-**H**) 6.90 (s, 1H, Pyridone-Ring-**H**); ^{13}C NMR (100 MHz, $DMSO_{d6}$) 161.8, 158.8, 152.5, 146.9, 135.0, 132.4, 131.9, 131.7, 131.7, 131.4, 129.5, 128.1, 125.6, 115.9, 106.3; **Chemical Formula:** $C_{18}H_{11}N_3O_3$, **Elemental Analysis:** Calculated; C, 68.14; H, 3.49; N, 13.24; Found; C, 68.13; H, 3.49; N, 13.23.

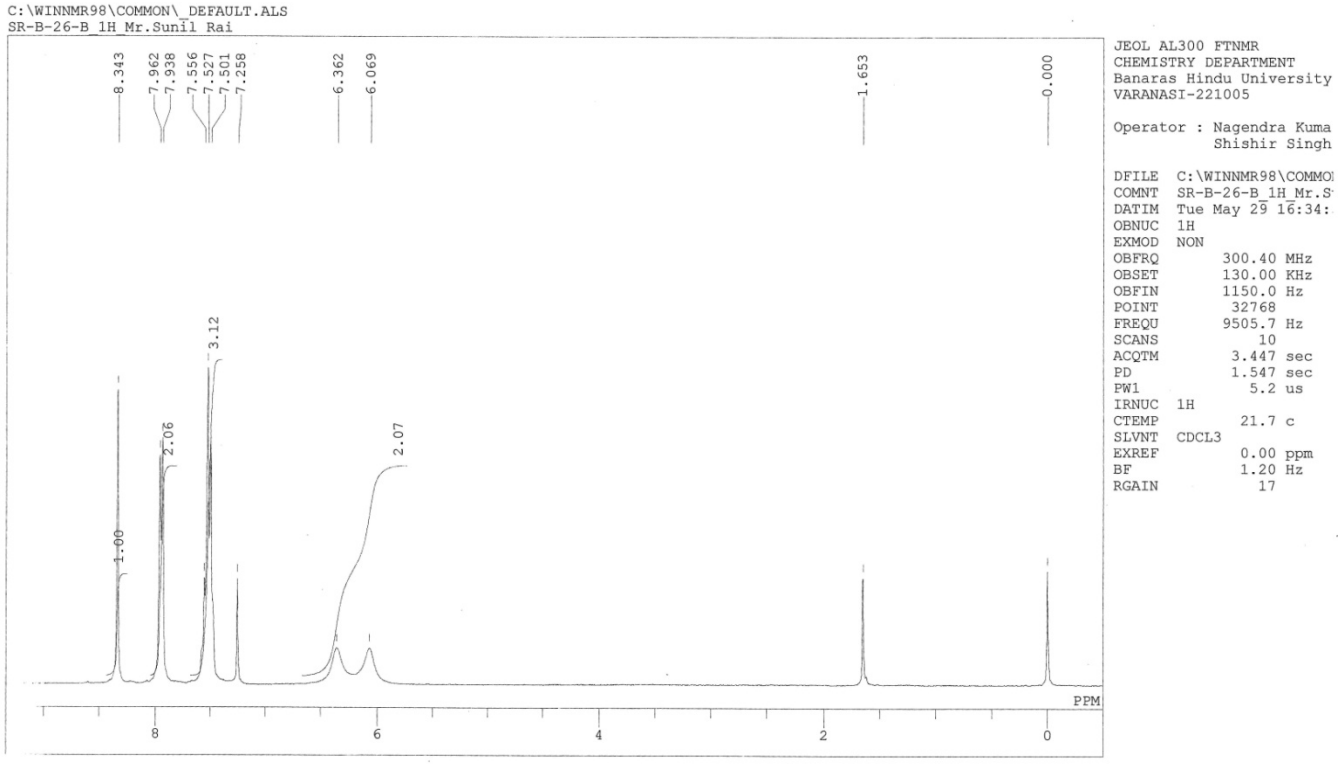
4-(4-nitrophenyl)-2-oxo-6-phenyl-1,2-dihydropyridine-3-carbonitrile (8a):

Green solid; yield: 87%: mp (d) > 300 °C ; IR (ν_{max}/cm^{-1}): 2219.64, 1658.52, 1607.07, 1515.58, 1352.46; ^{1}H NMR (300 MHz, $DMSO_{d6}$, 298 K, TMS): δ_H 12.97 (br s, 1H, N**H**), 8.38(d, 2H, J = 8.1, Ar-**H**), 8.01-7.89 (m, 4H, Ar-**H**), 7.56-7.53 (m, 3H, Ar-**H**), 6.92 (s, 1H, Pyridone-Ring-**H**); ^{13}C NMR (75 MHz, $DMSO_{d6}$) 148.3, 142.2, 131.3, 129.8, 128.9, 127.8, 123.7, 115.9; **Chemical Formula:** $C_{18}H_{11}N_3O_3$, **Elemental Analysis:** Calculated; C, 68.14; H, 3.49; N, 13.24; Found; C, 68.15; H, 3.48; N, 13.22.

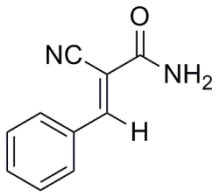
2. Copies of ^{1}H and ^{13}C NMR spectra:

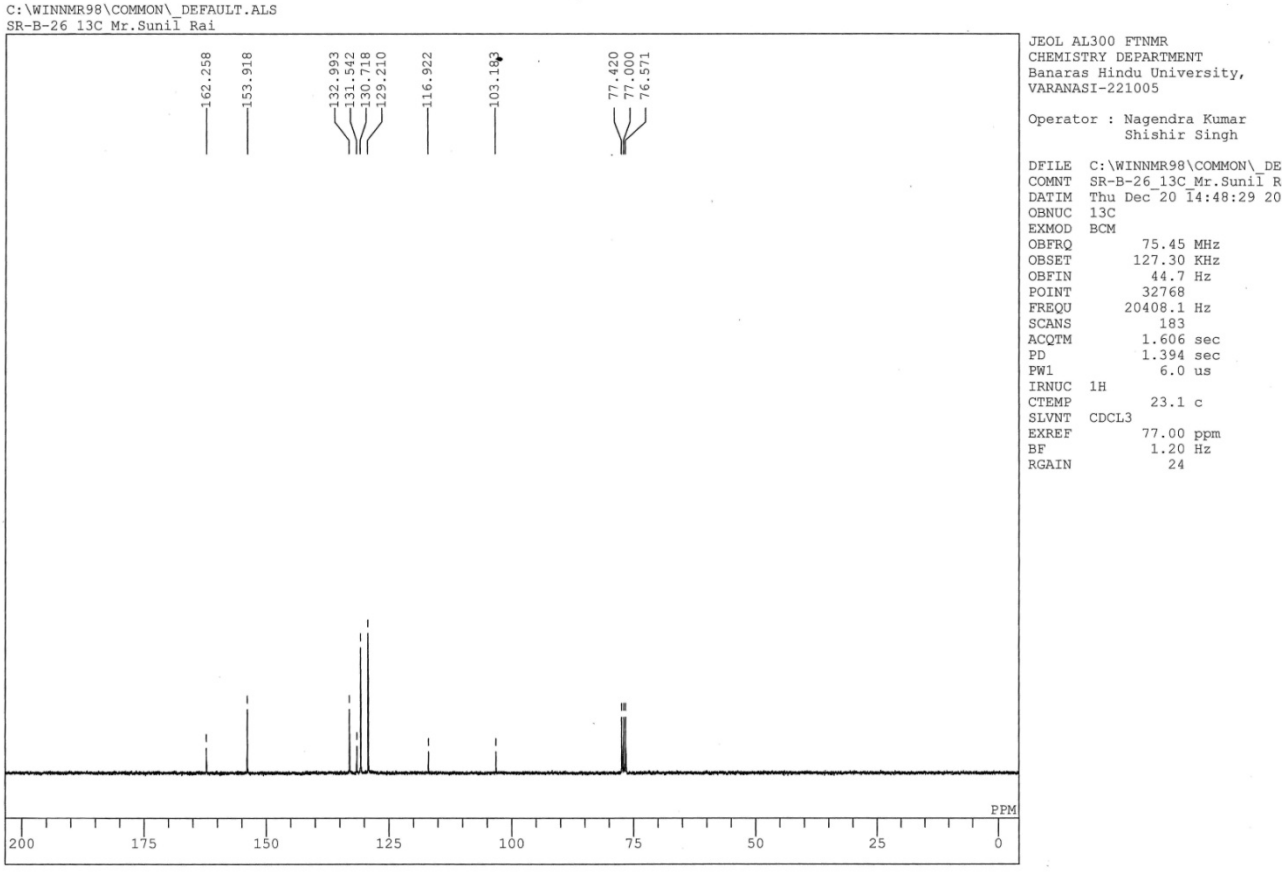
Compound (1): ^{1}H NMR



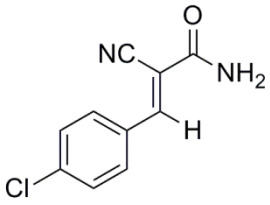


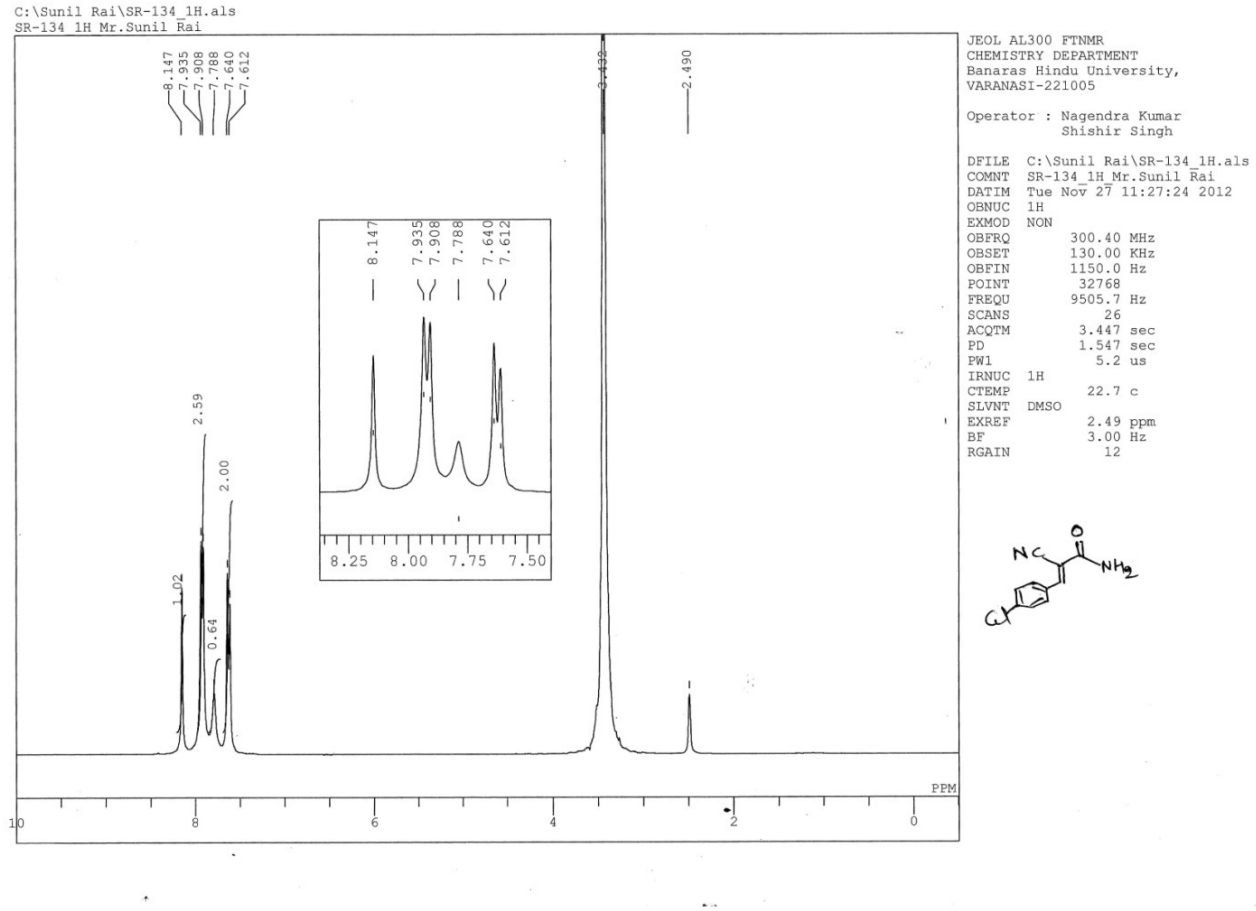
Compound (1): ^{13}C NMR



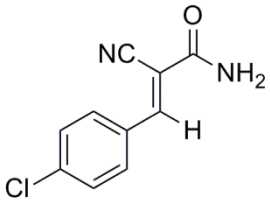


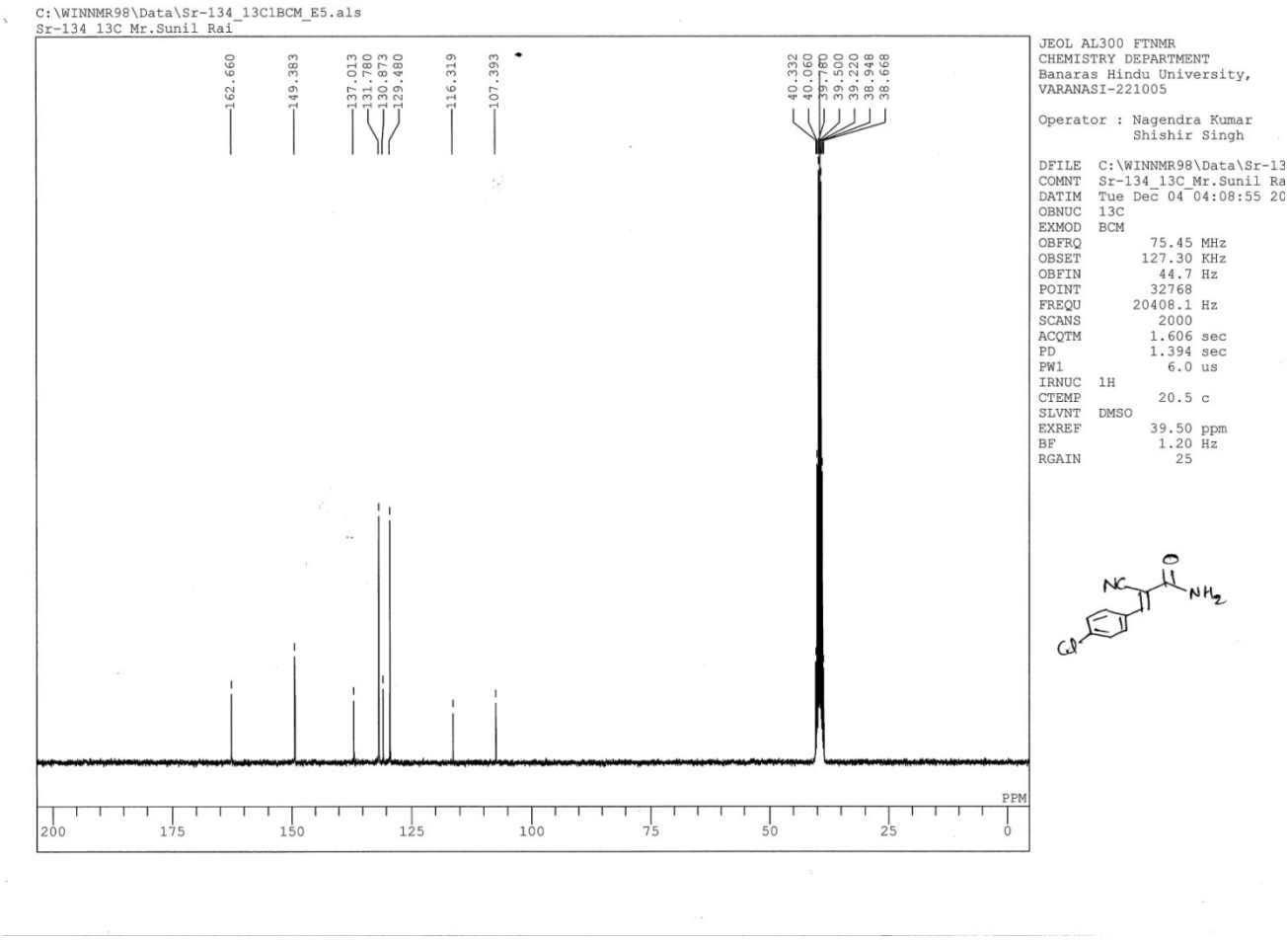
Compound (2): ^{1}H NMR



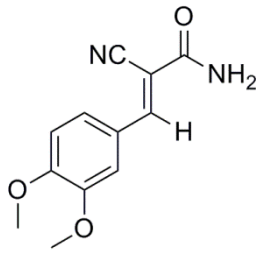


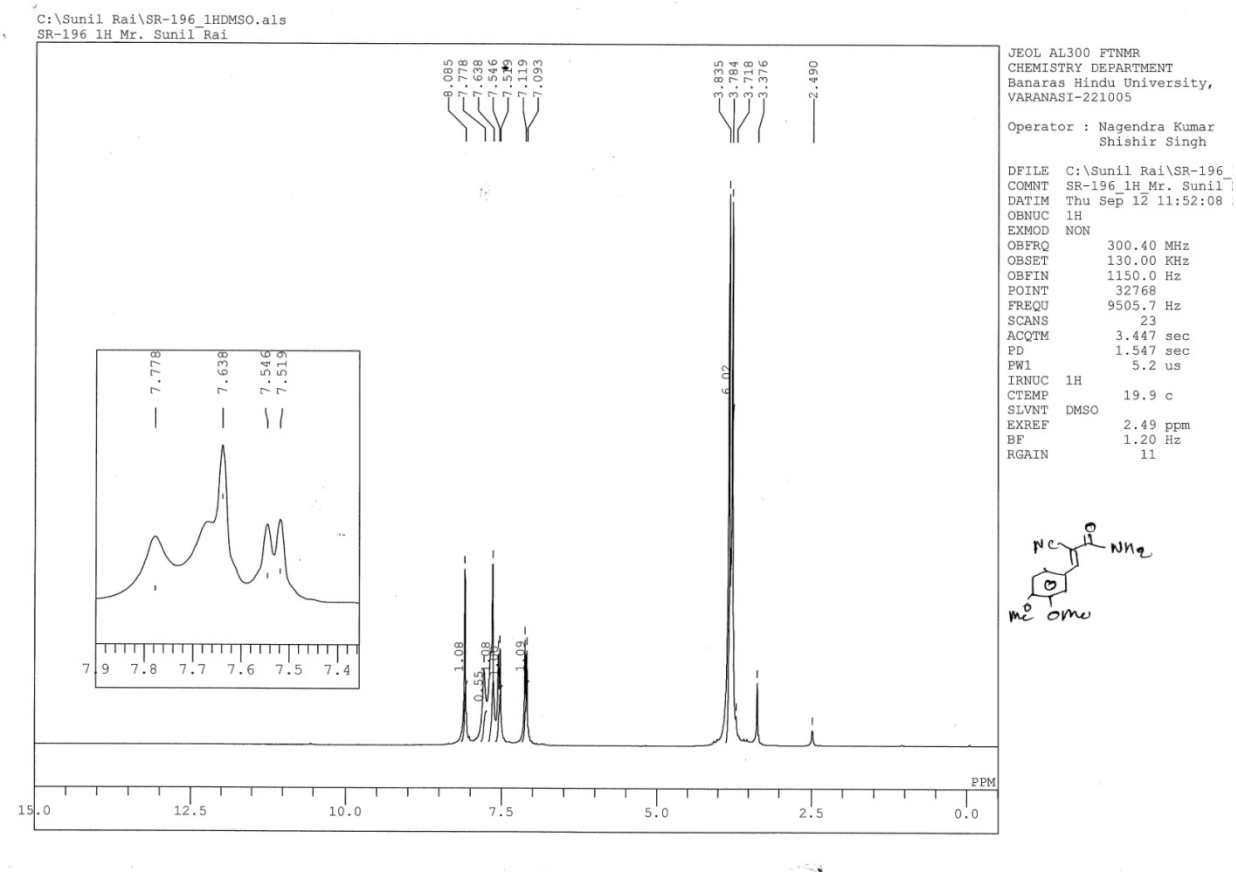
Compound (2): ^{13}C NMR



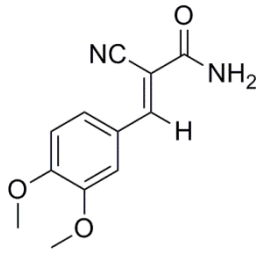


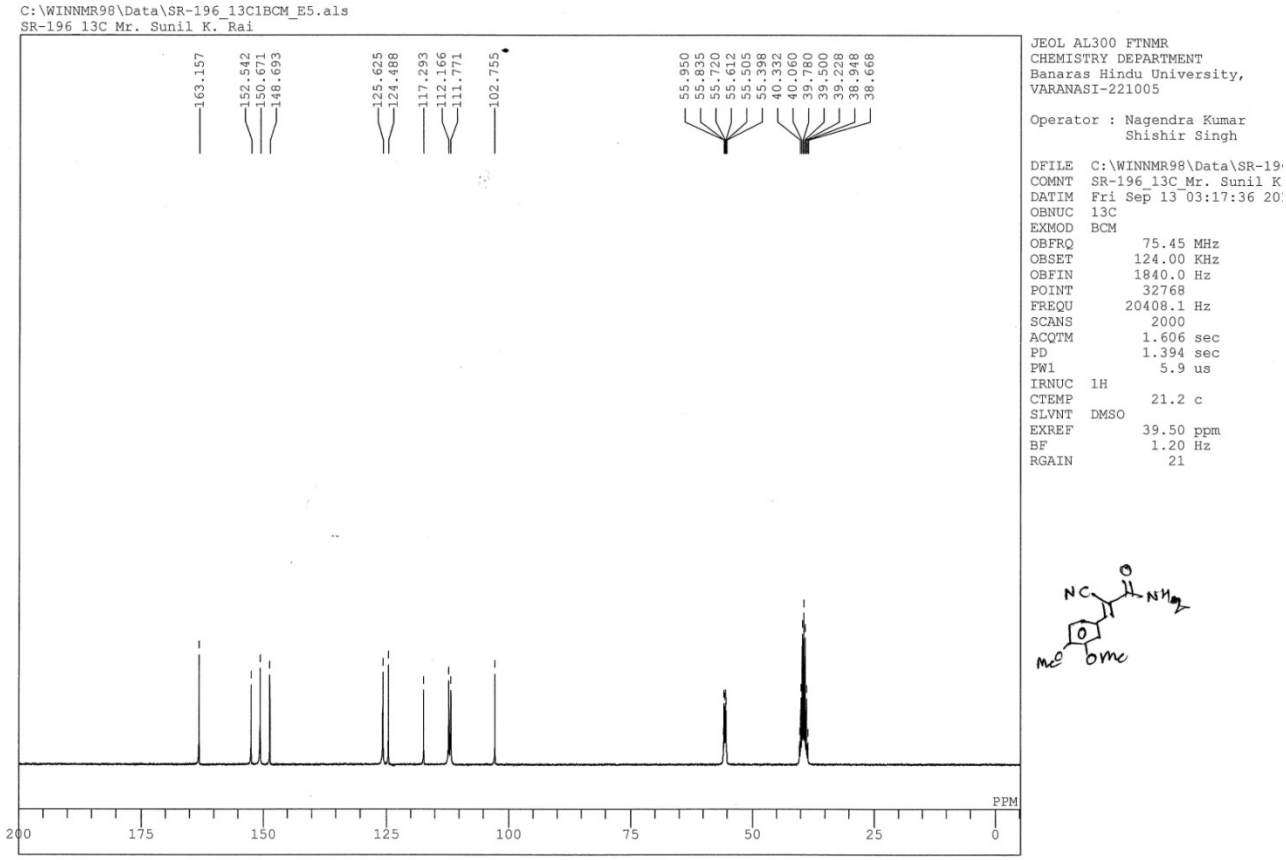
Compound (3): ^{1}H NMR



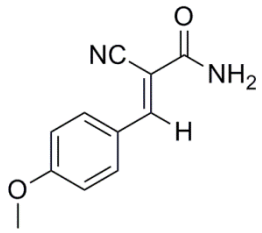


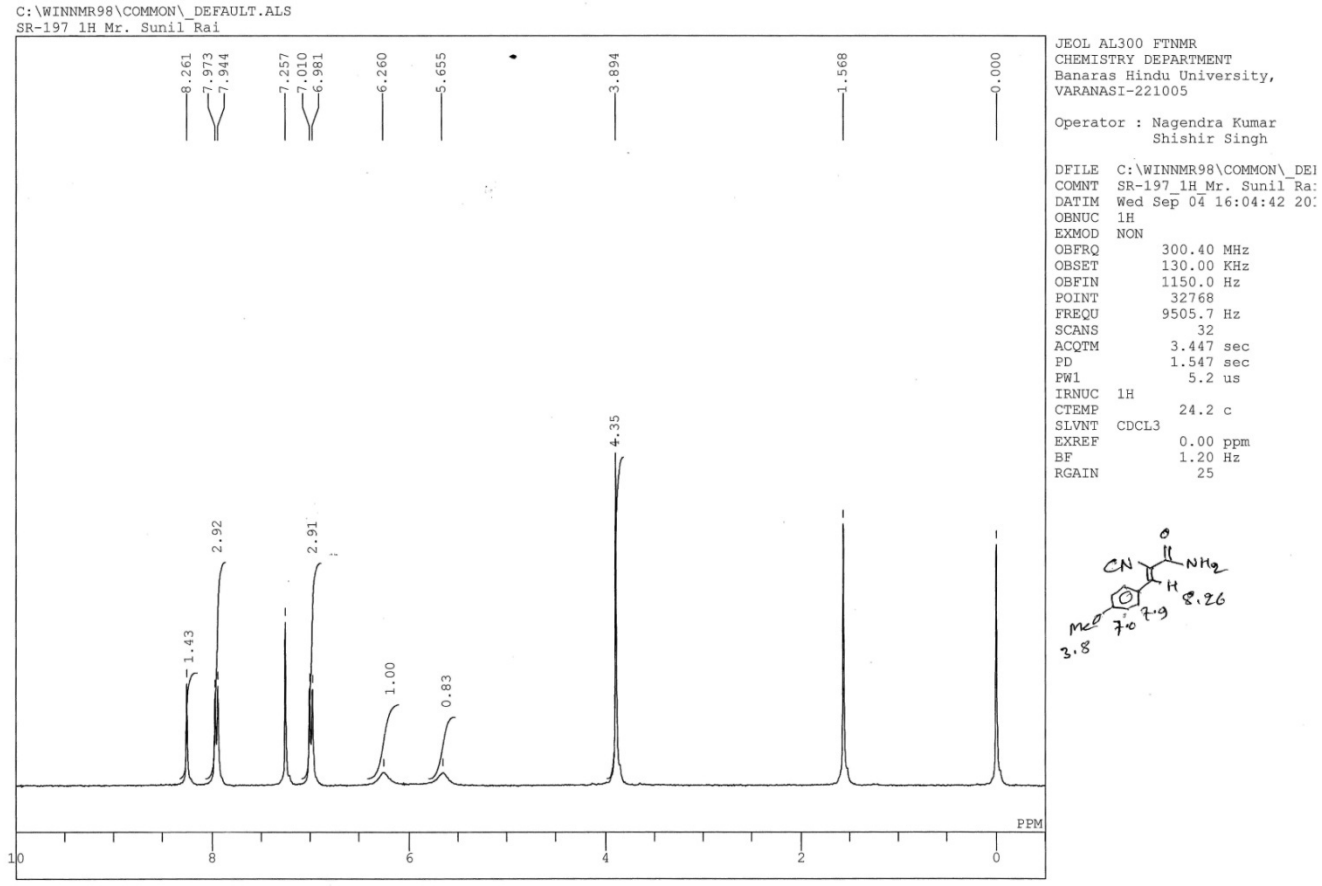
Compound (3): ^{13}C NMR



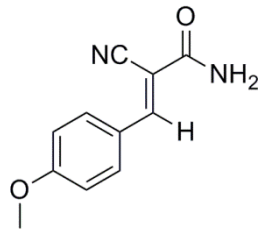


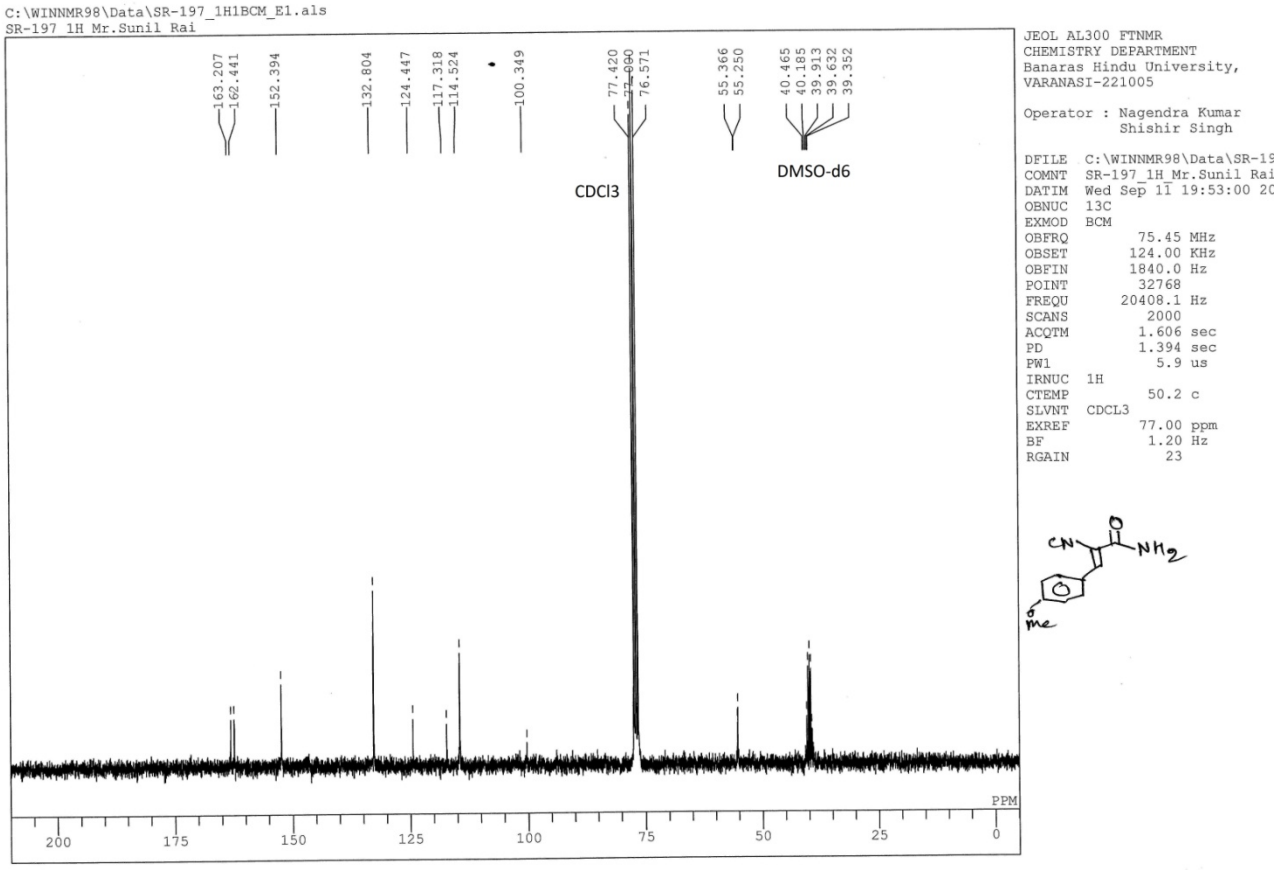
Compound (4): ^{1}H NMR



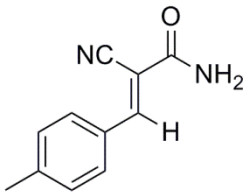


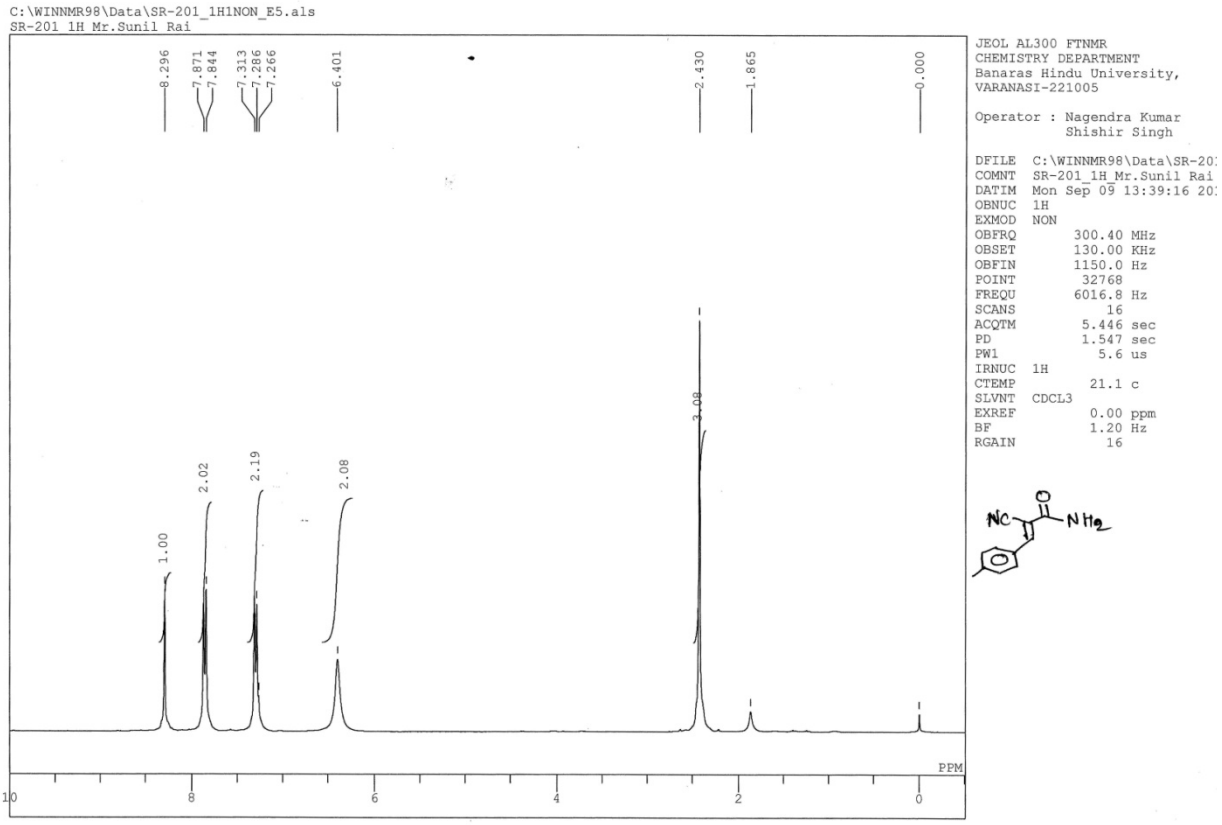
Compound (4): ^{13}C NMR



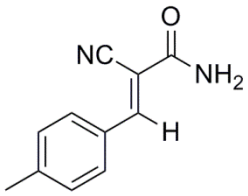


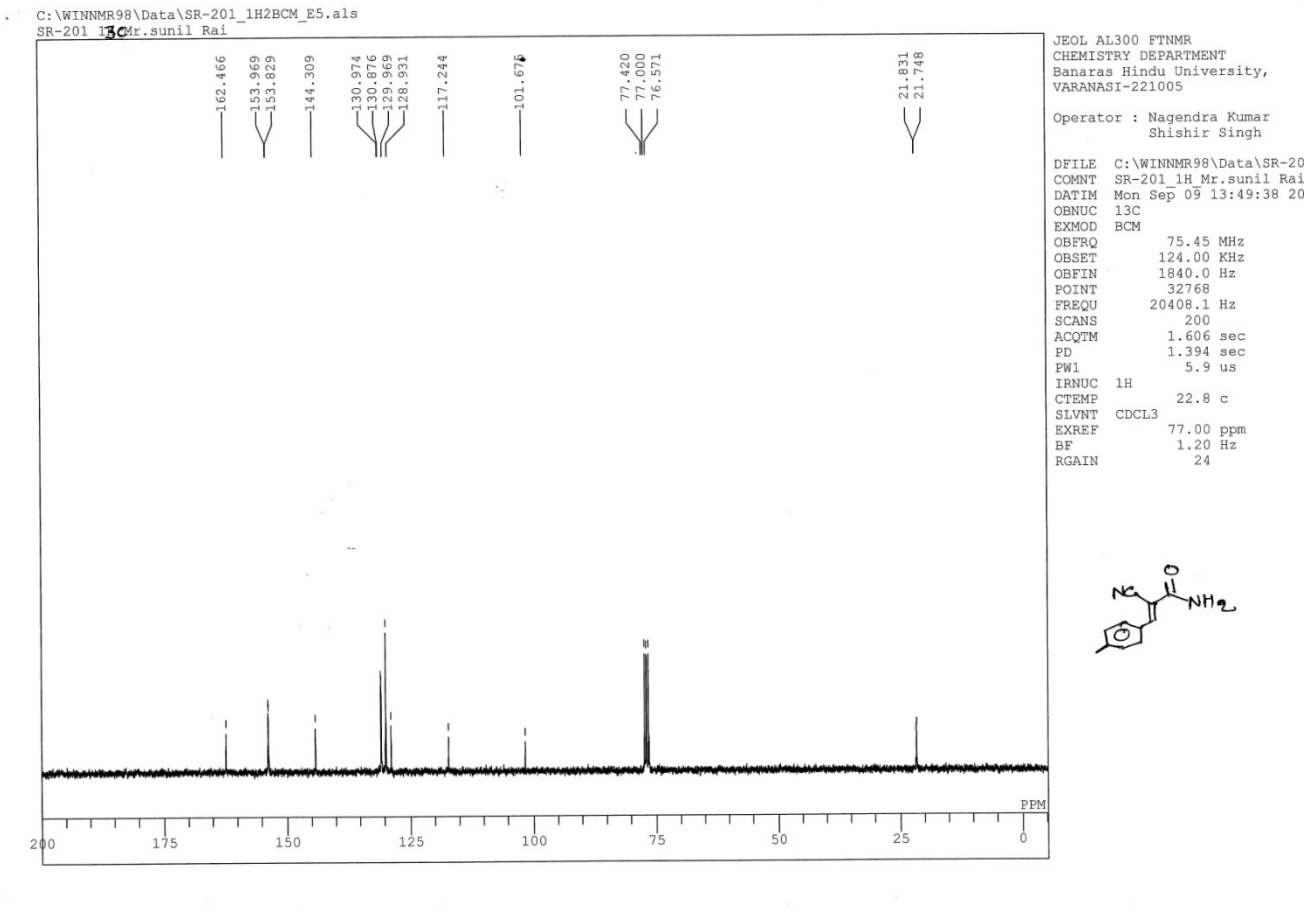
Compound (5): ^{1}H NMR



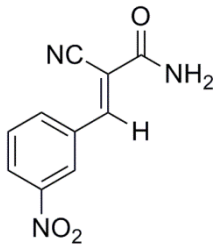


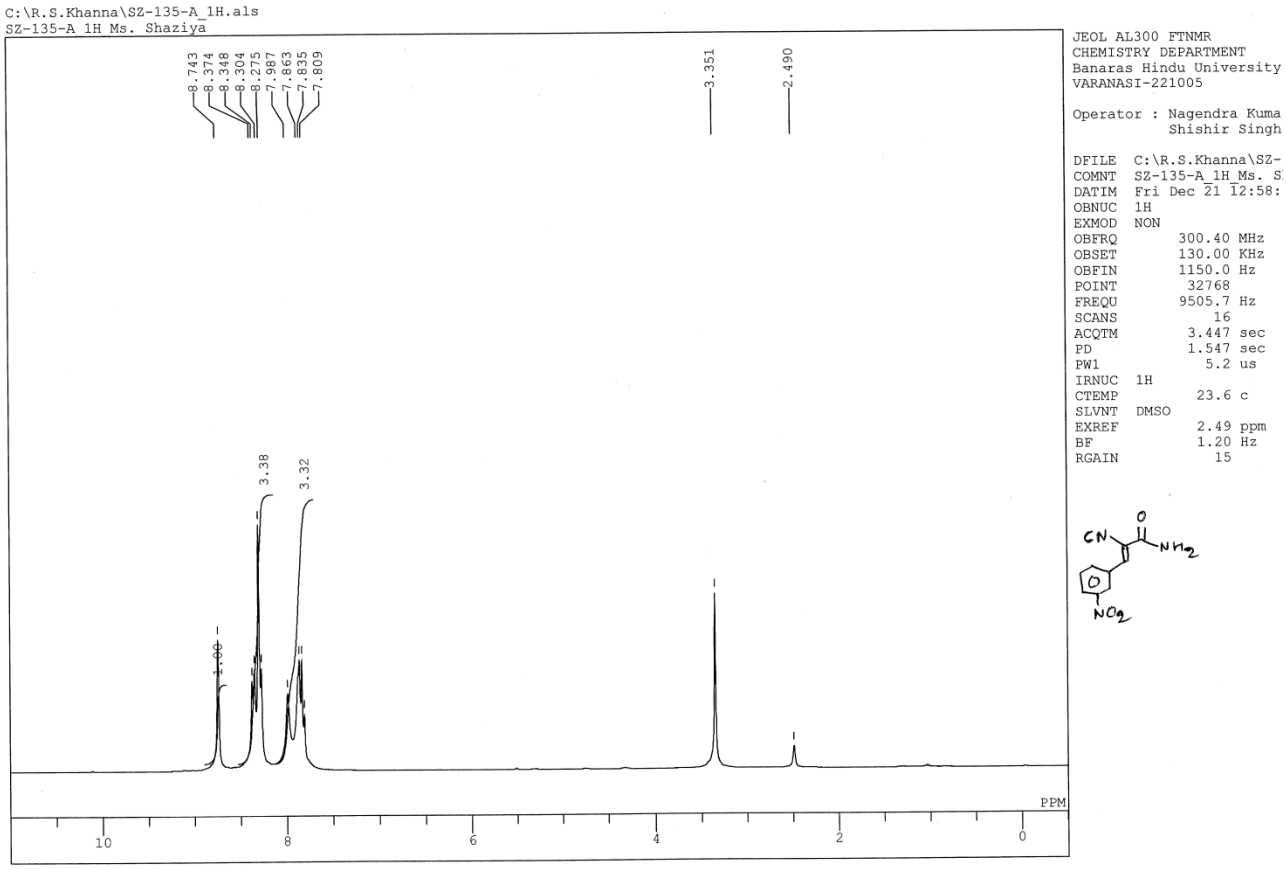
Compound (5): ^{13}C NMR



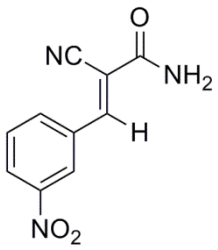


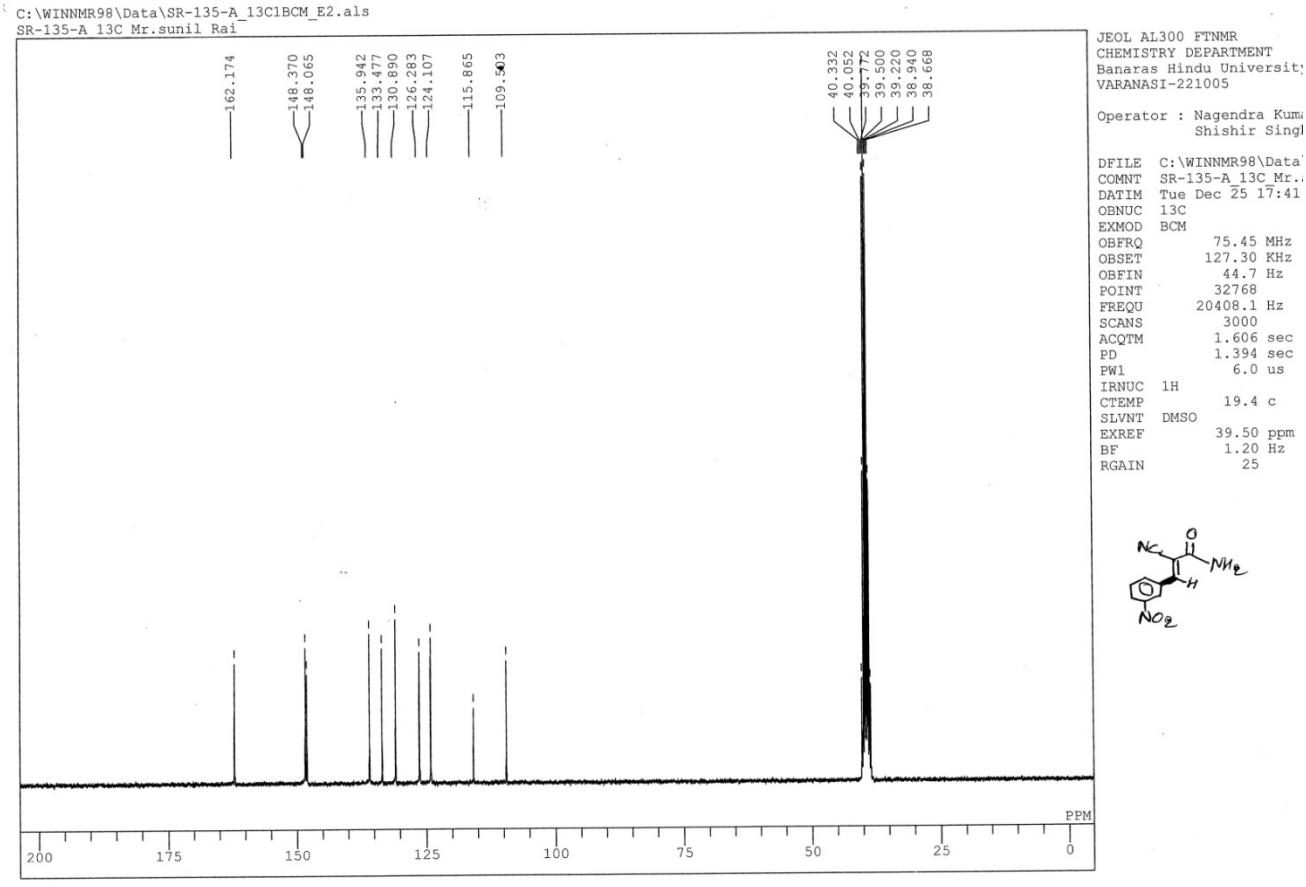
Compound (6): ^{1}H NMR



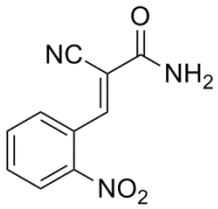


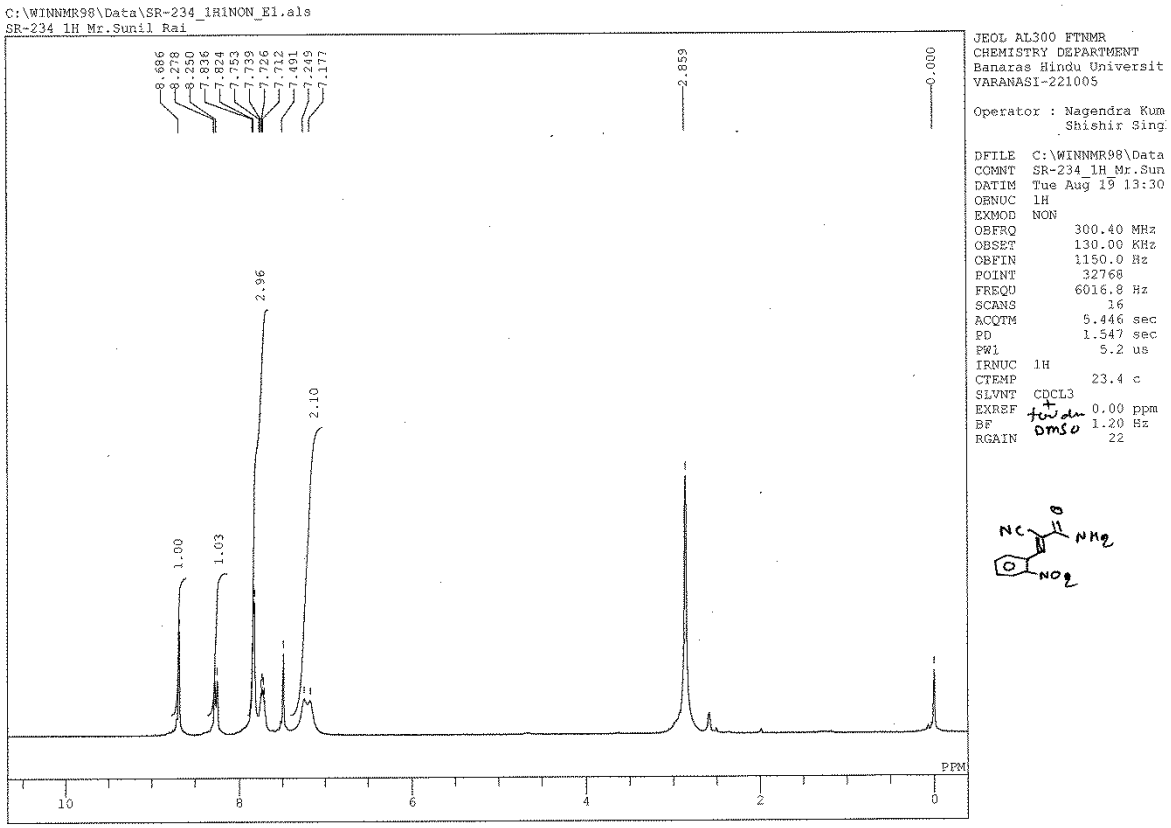
Compound (6): ^{13}C NMR



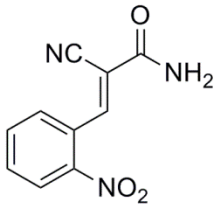


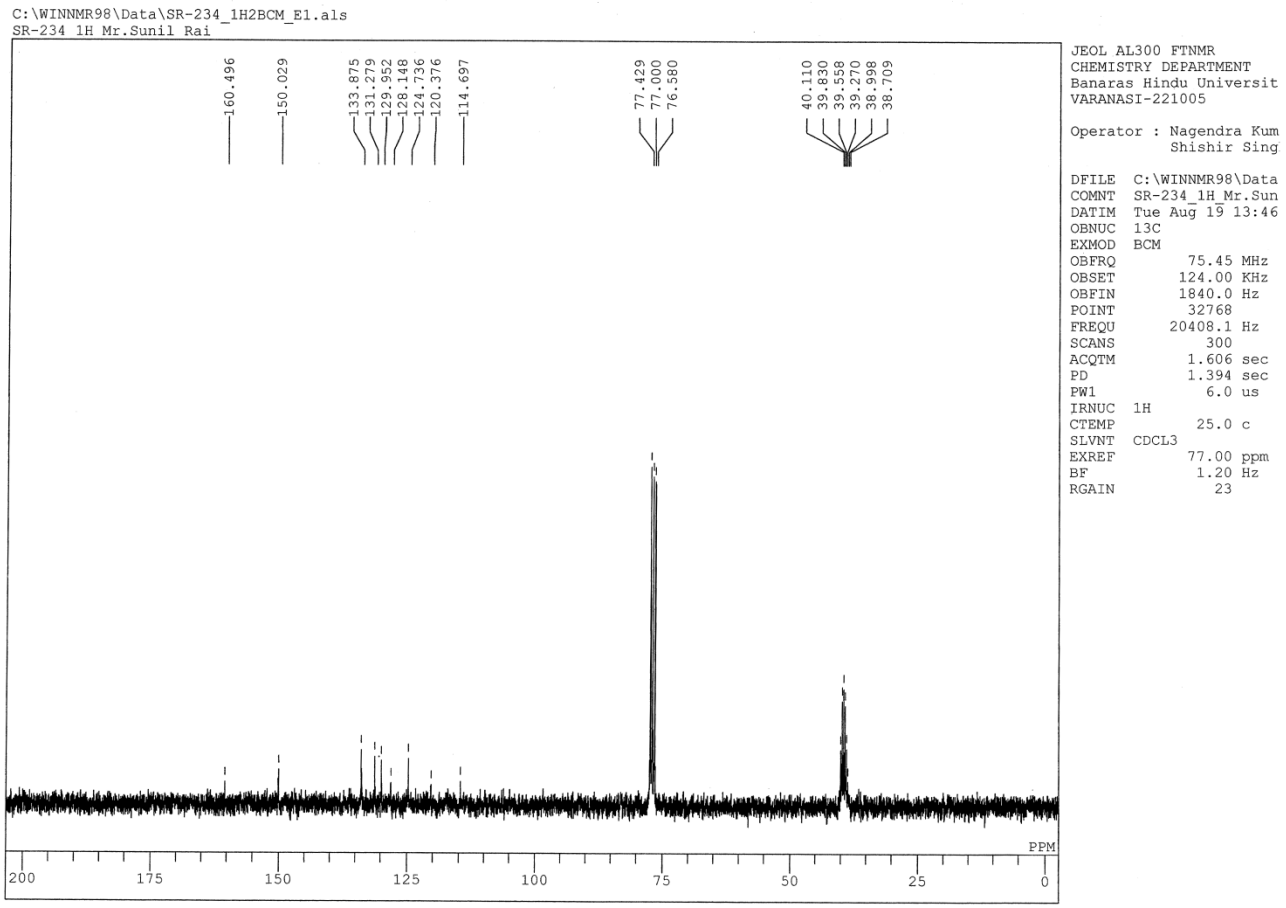
Compound (7): ^{1}H NMR



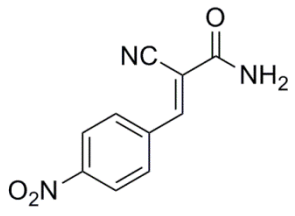


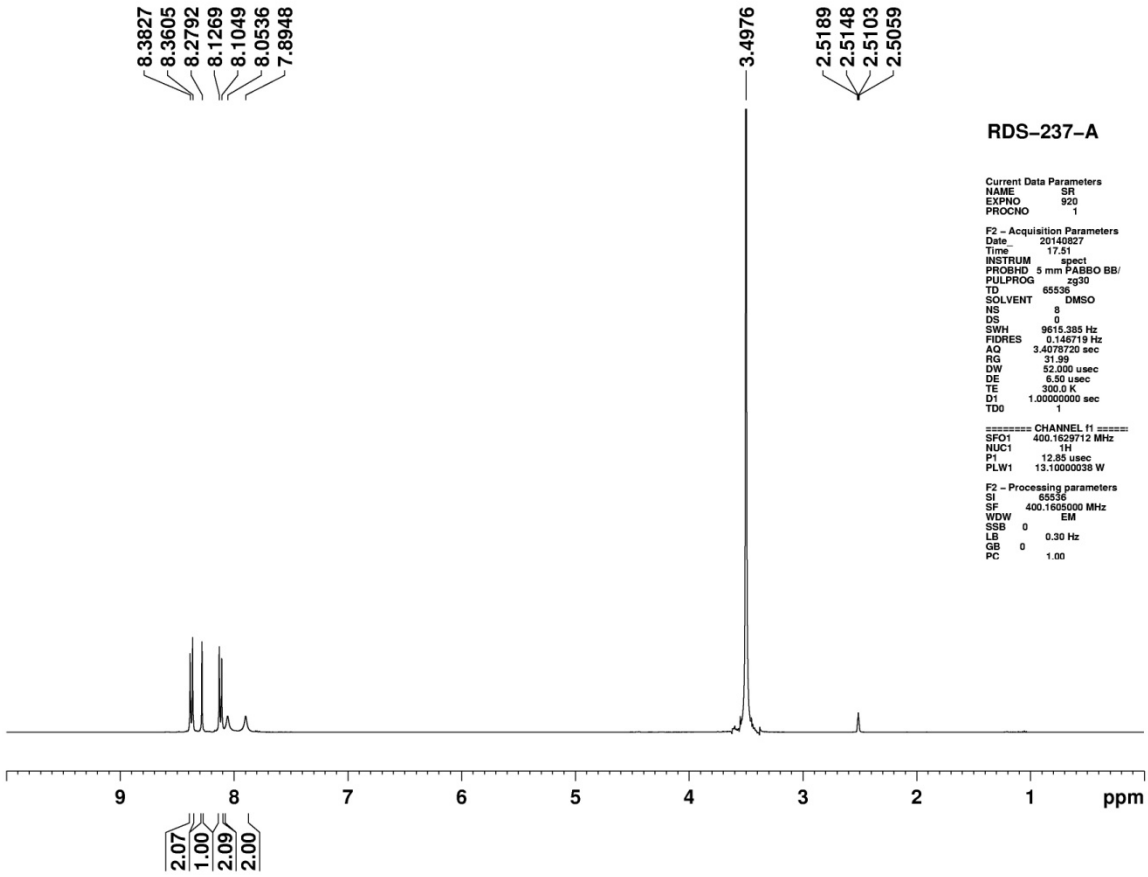
Compound (7): ^{13}C NMR



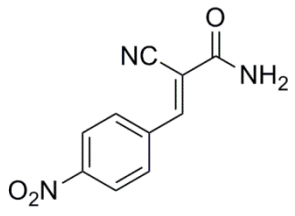


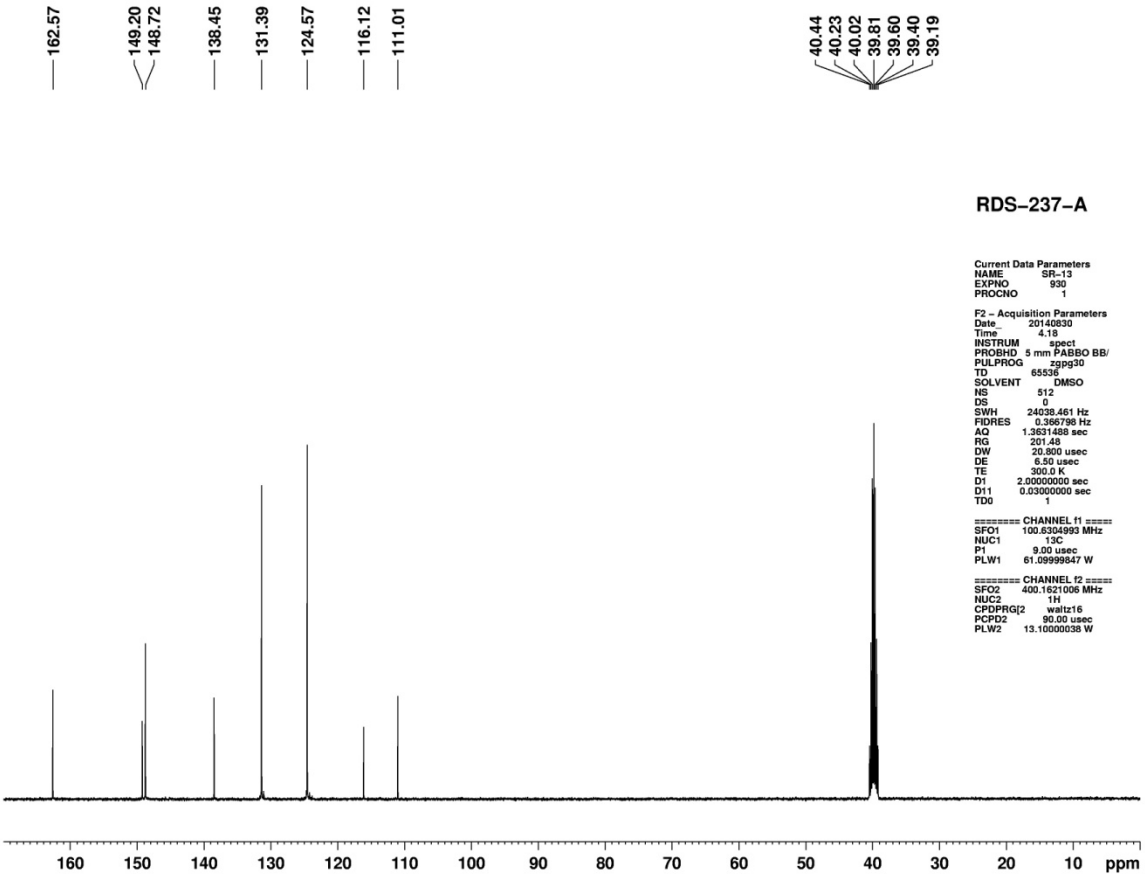
Compound (8): ^{1}H NMR



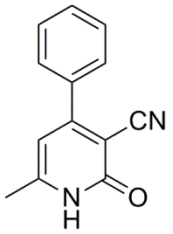


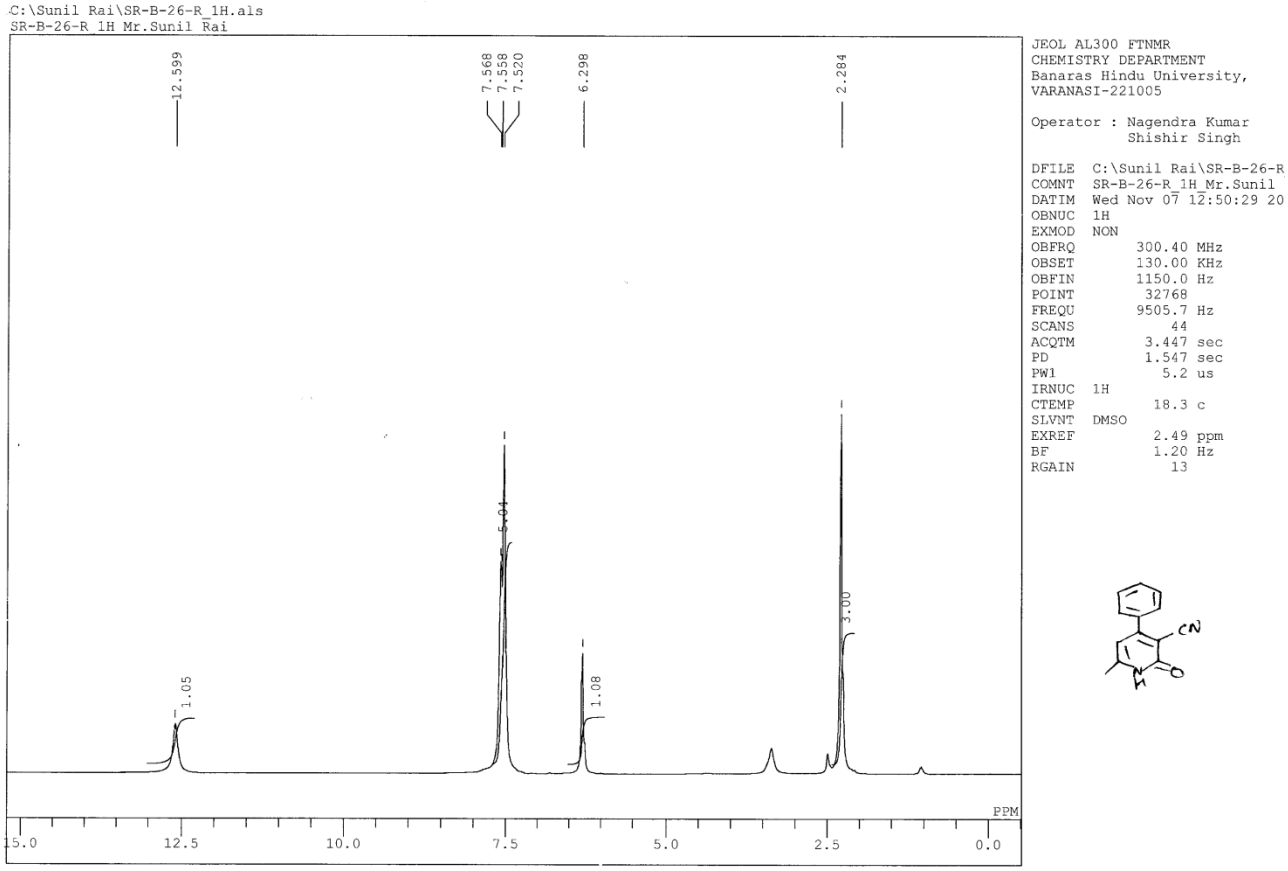
Compound (8): ^{13}C NMR



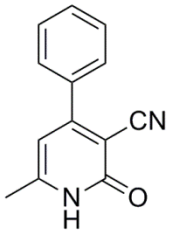


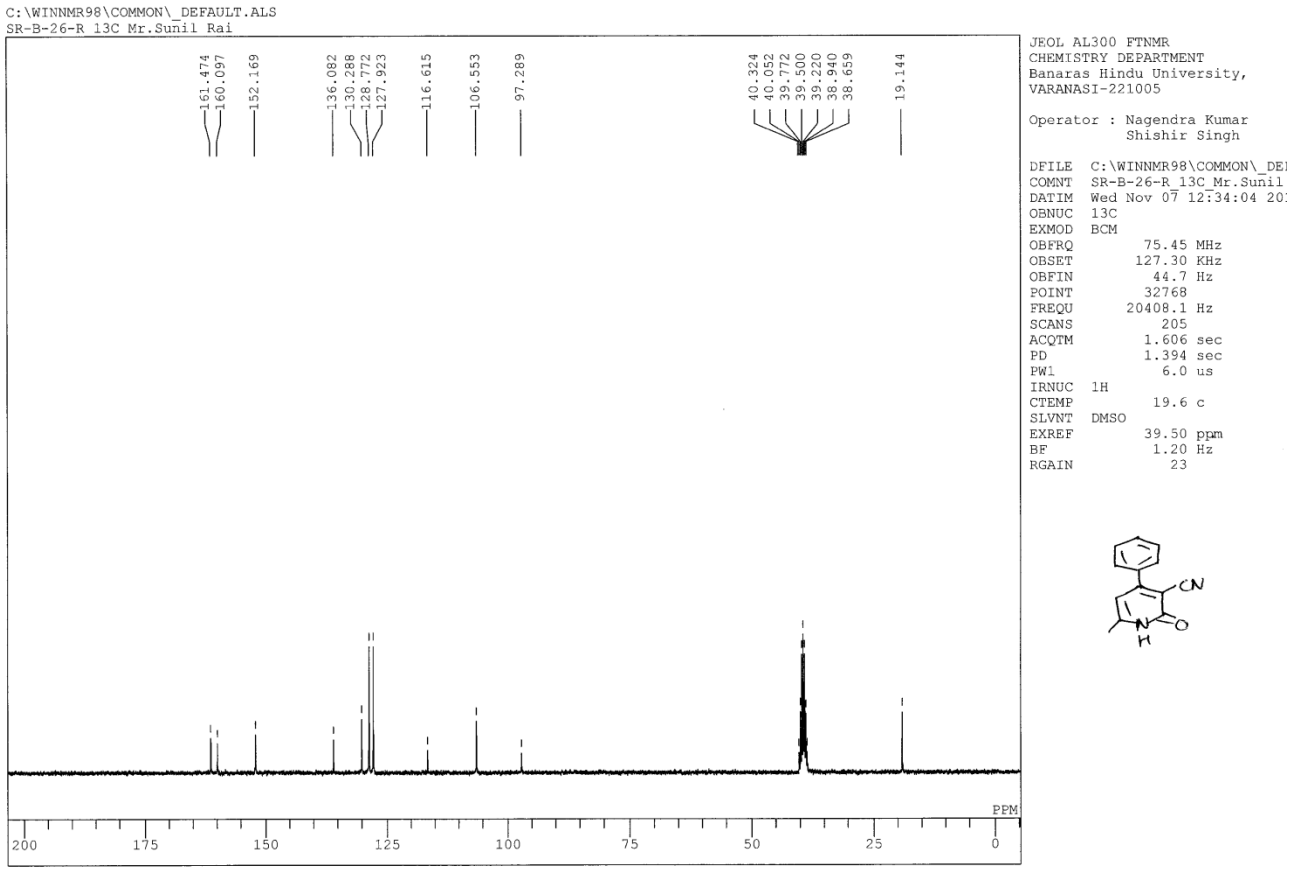
Compound (1a): ^{1}H NMR



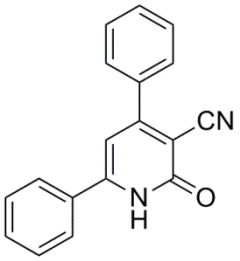


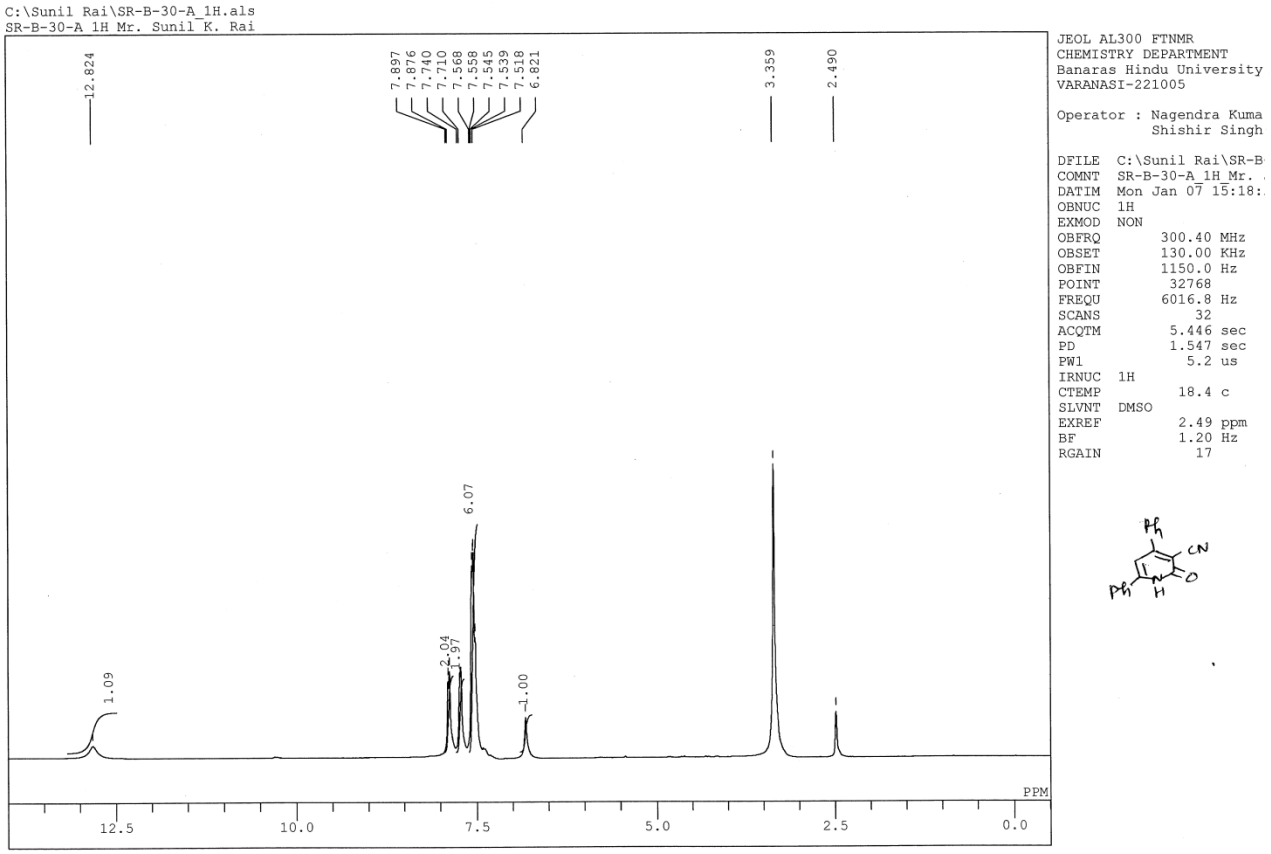
Compound (1a):^{13}C NMR



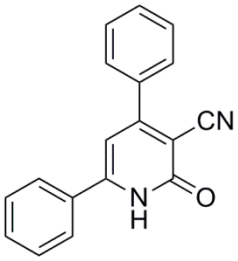


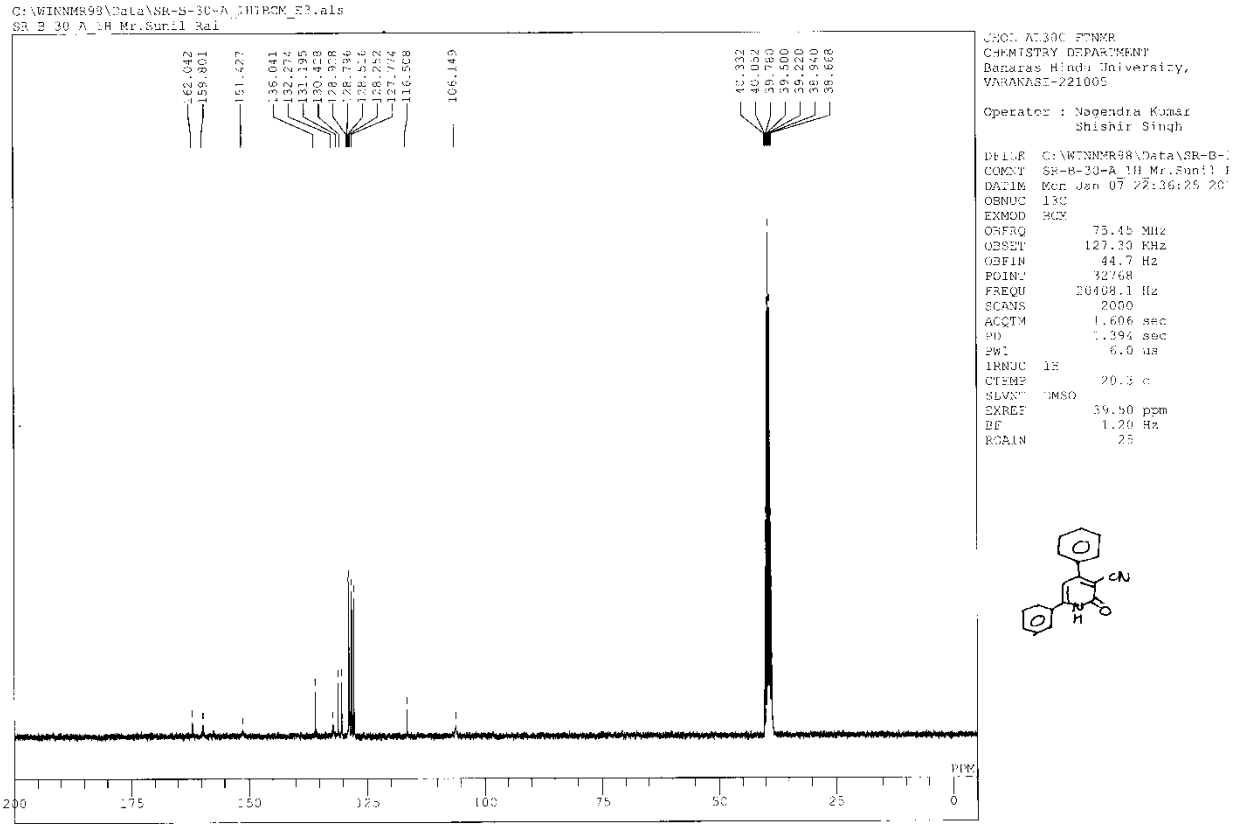
Compound (1b): ^{1}H NMR



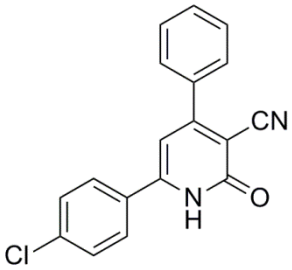


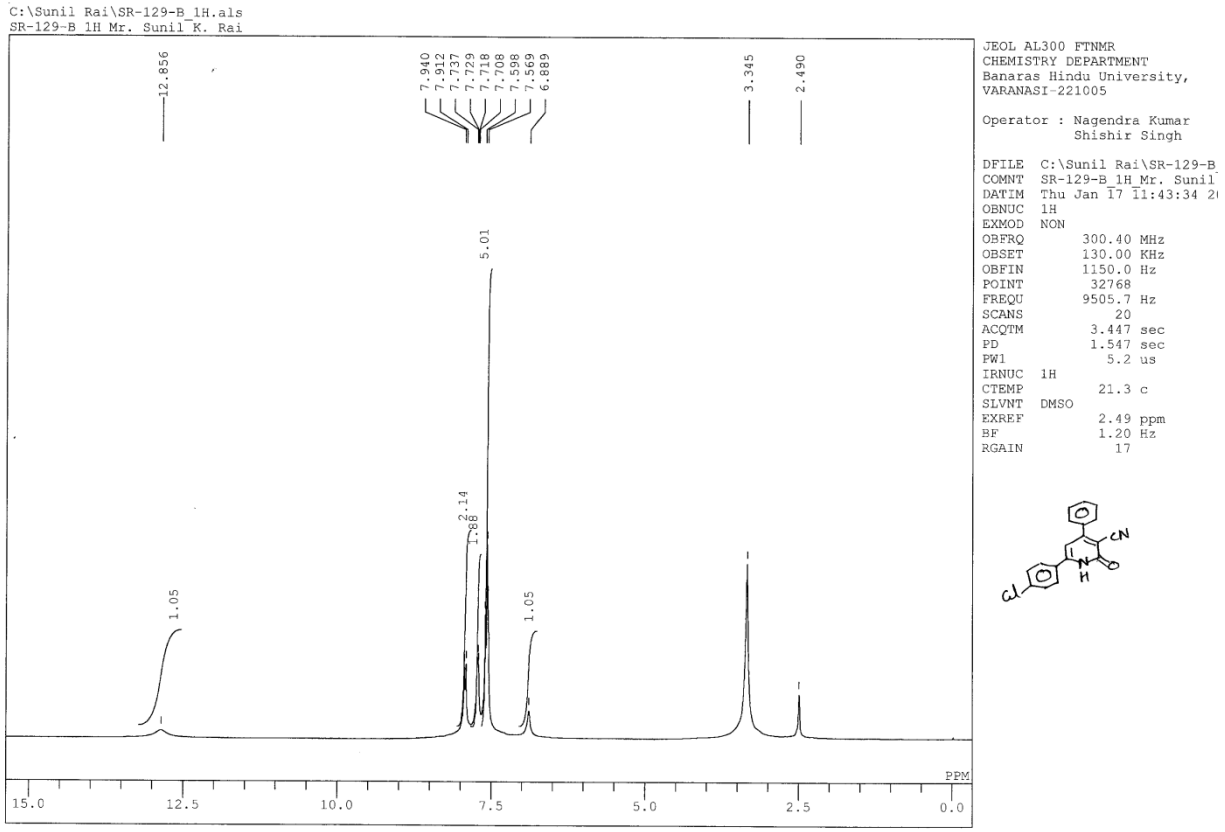
Compound (1b): ^{13}NMR



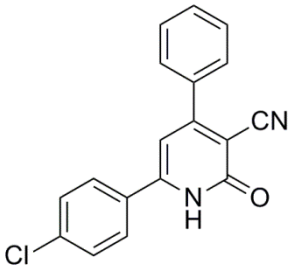


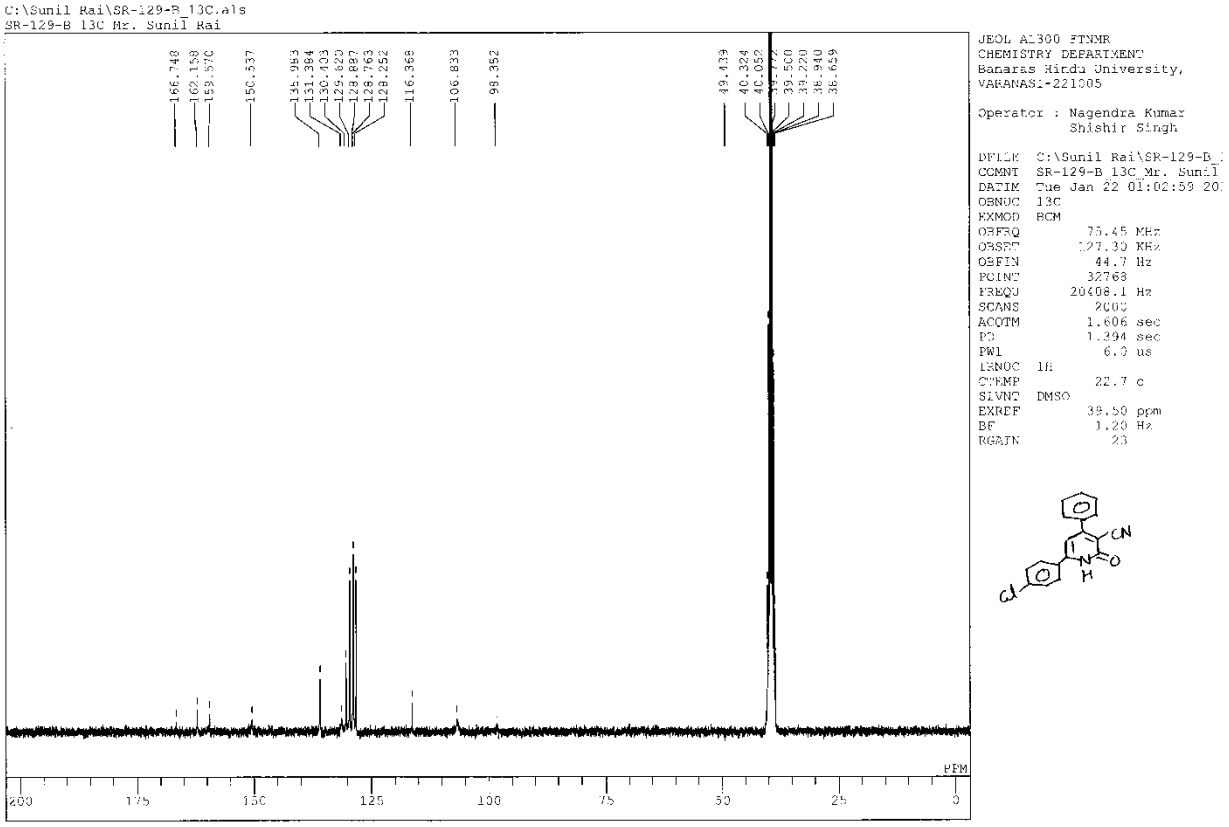
Compound (1c): 1H NMR



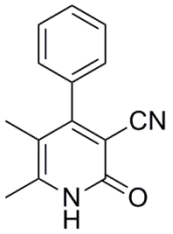


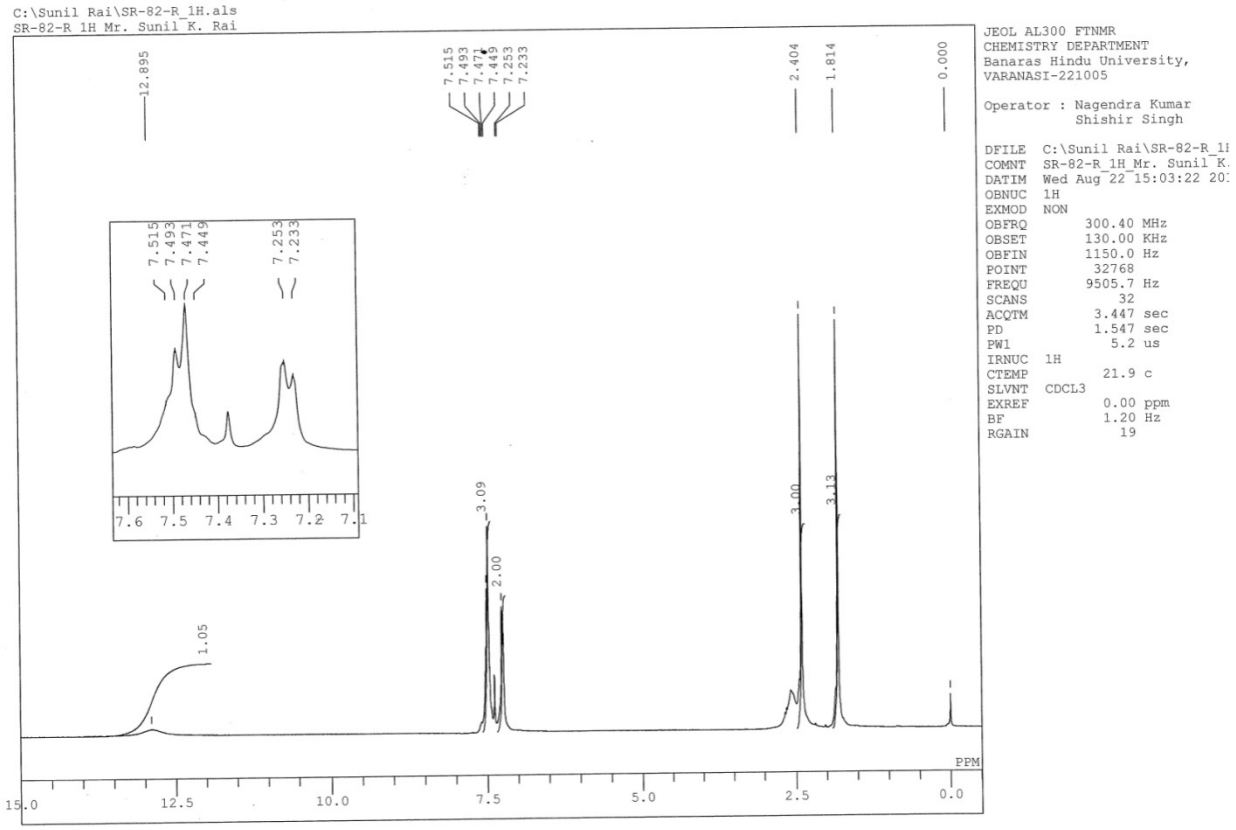
Compound (1c): 13C NMR



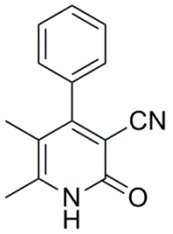


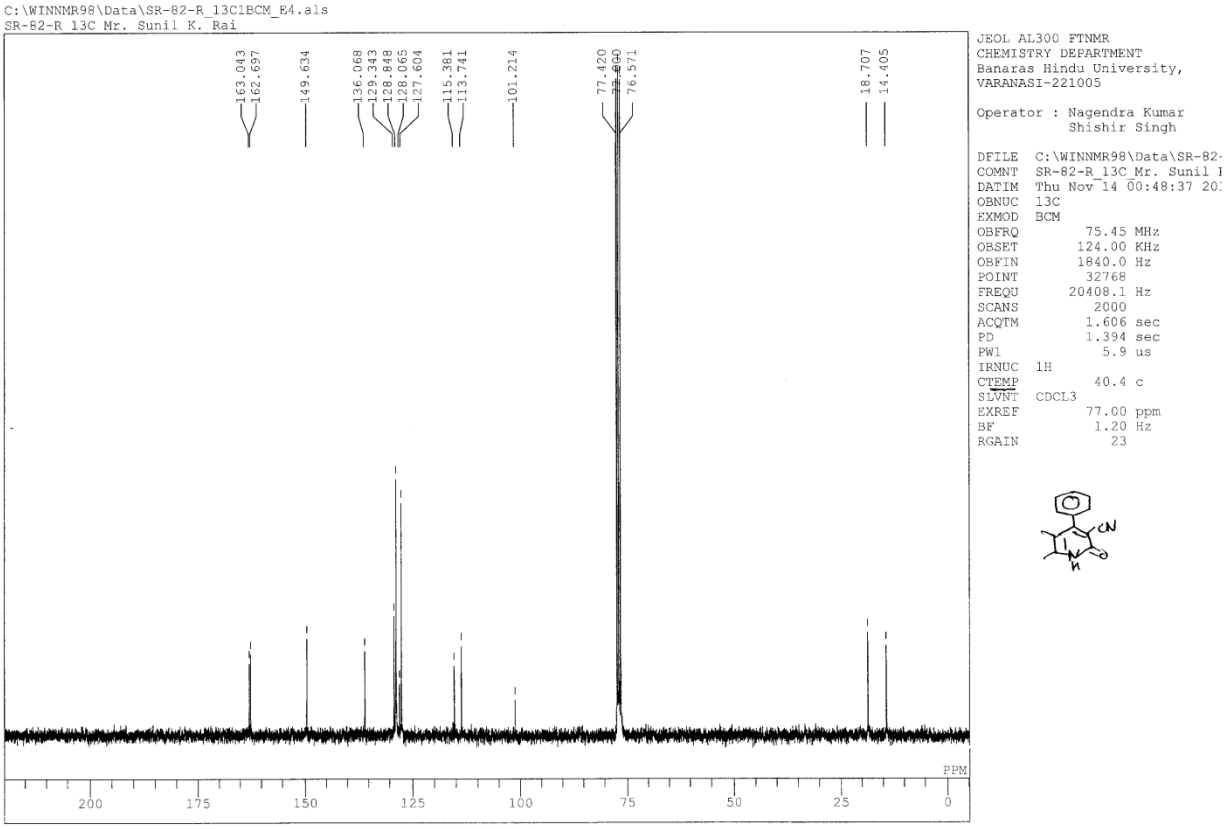
Compound (1d): ^{1}H NMR



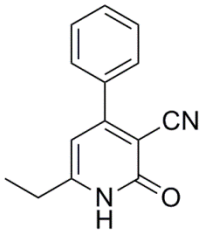


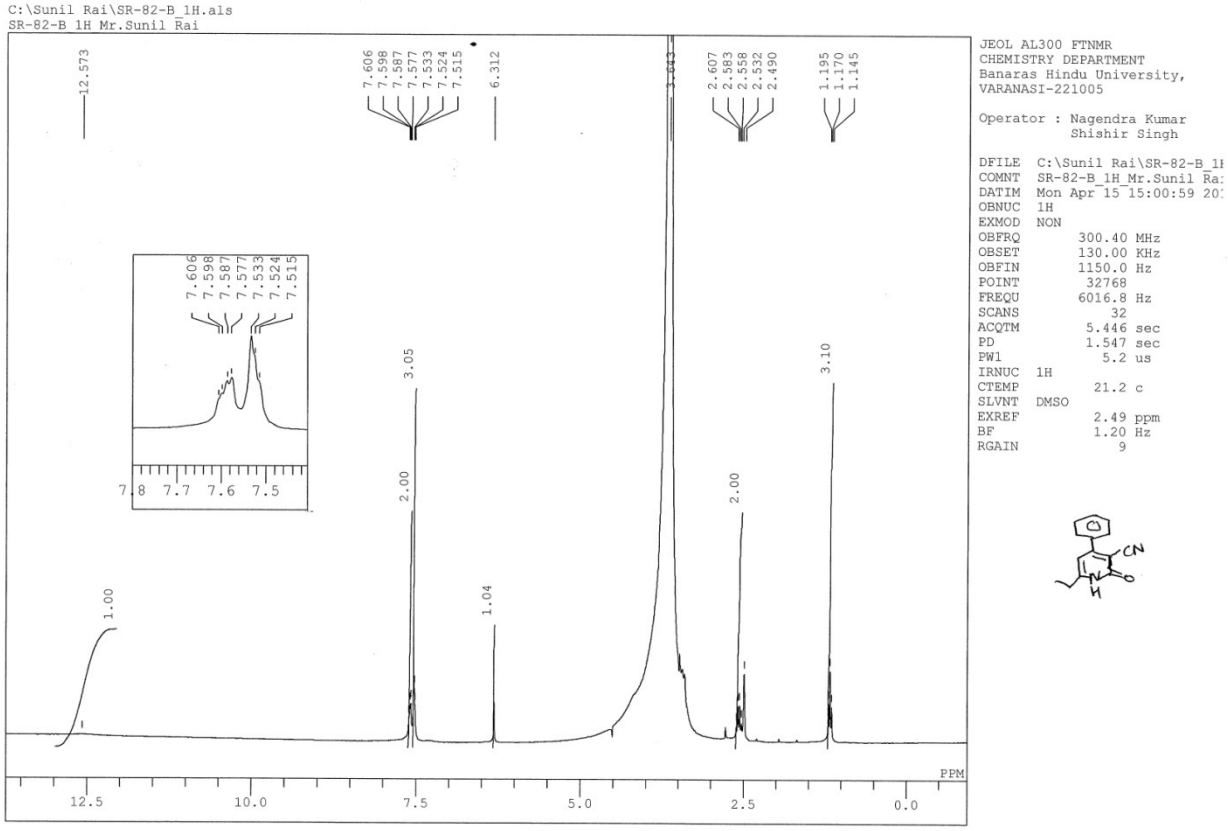
Compound (1d): ^{13}C NMR



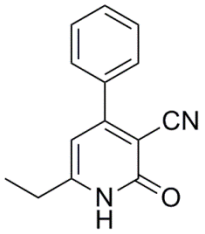


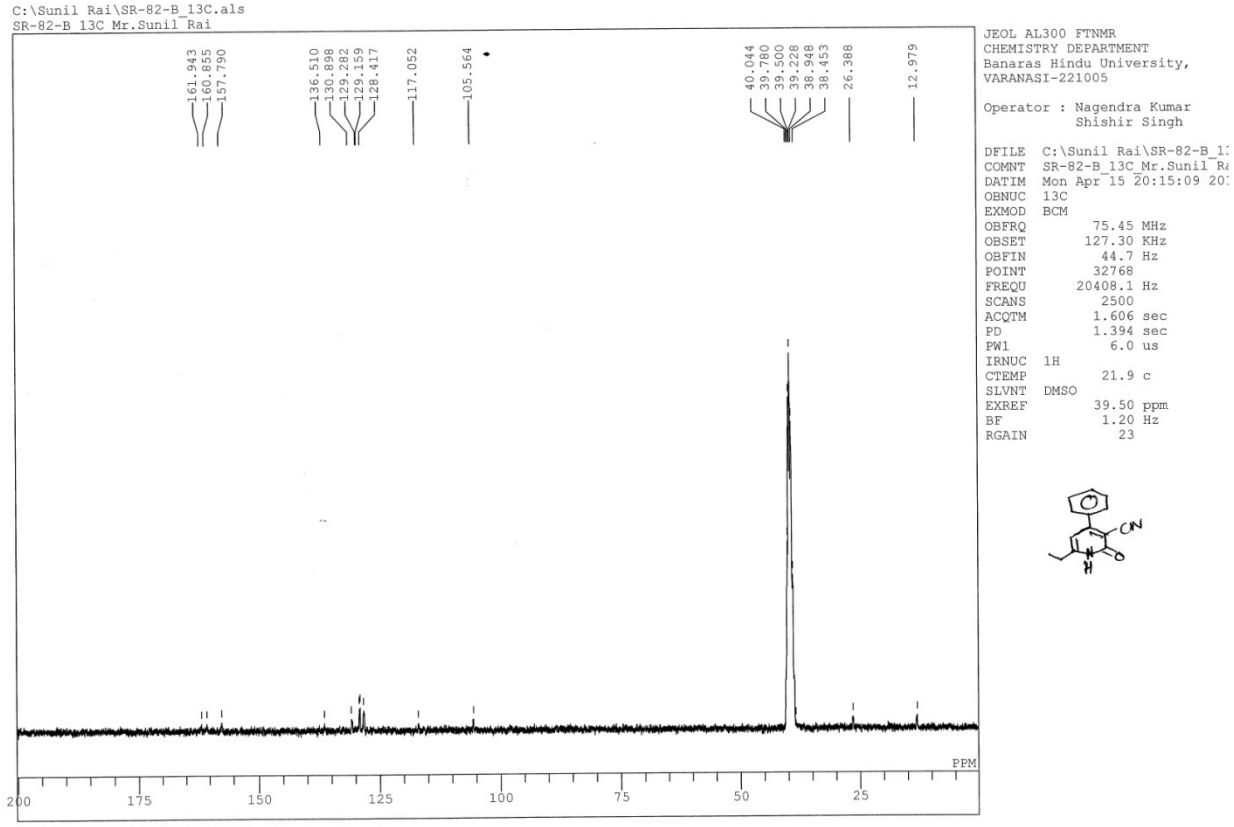
Compound (1e): ^{1}H NMR



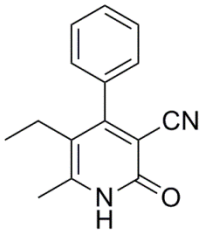


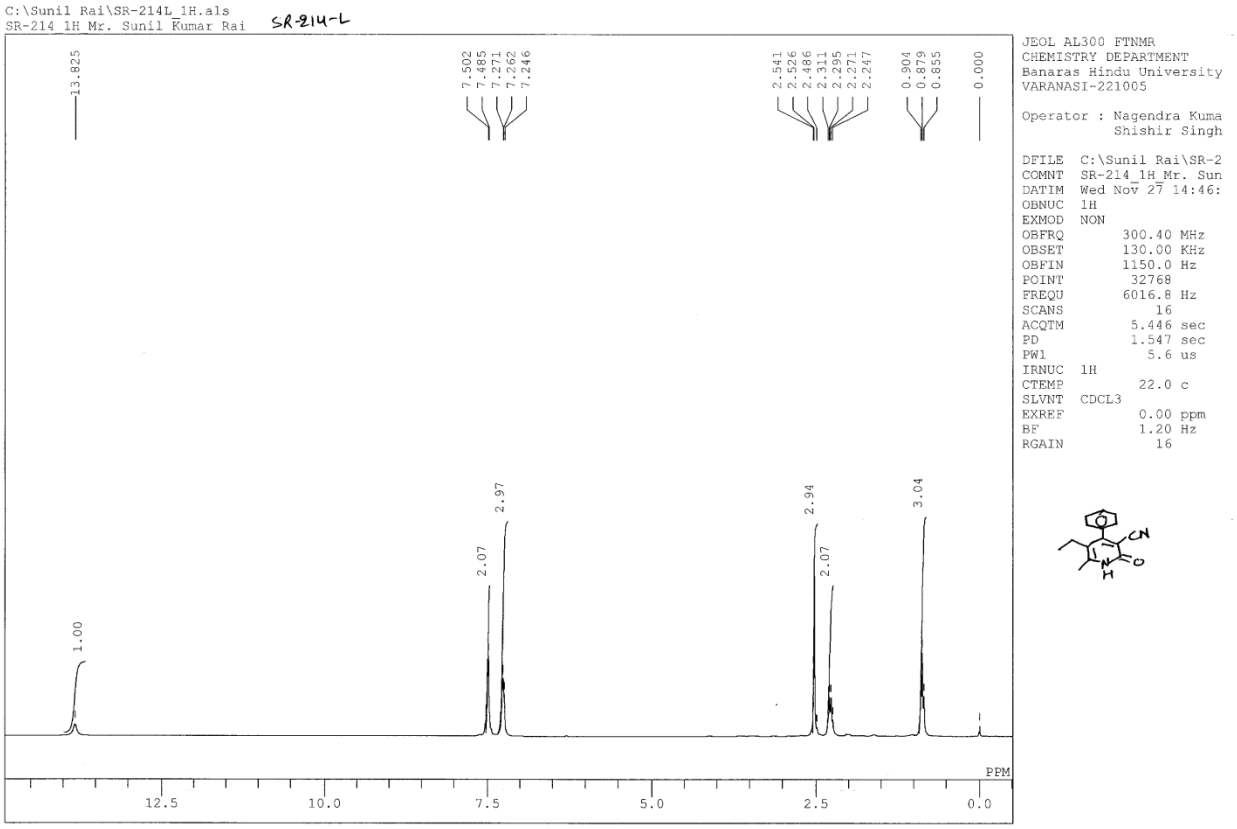
Compound (1e): ^{13}C NMR



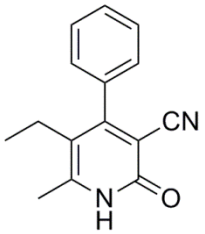


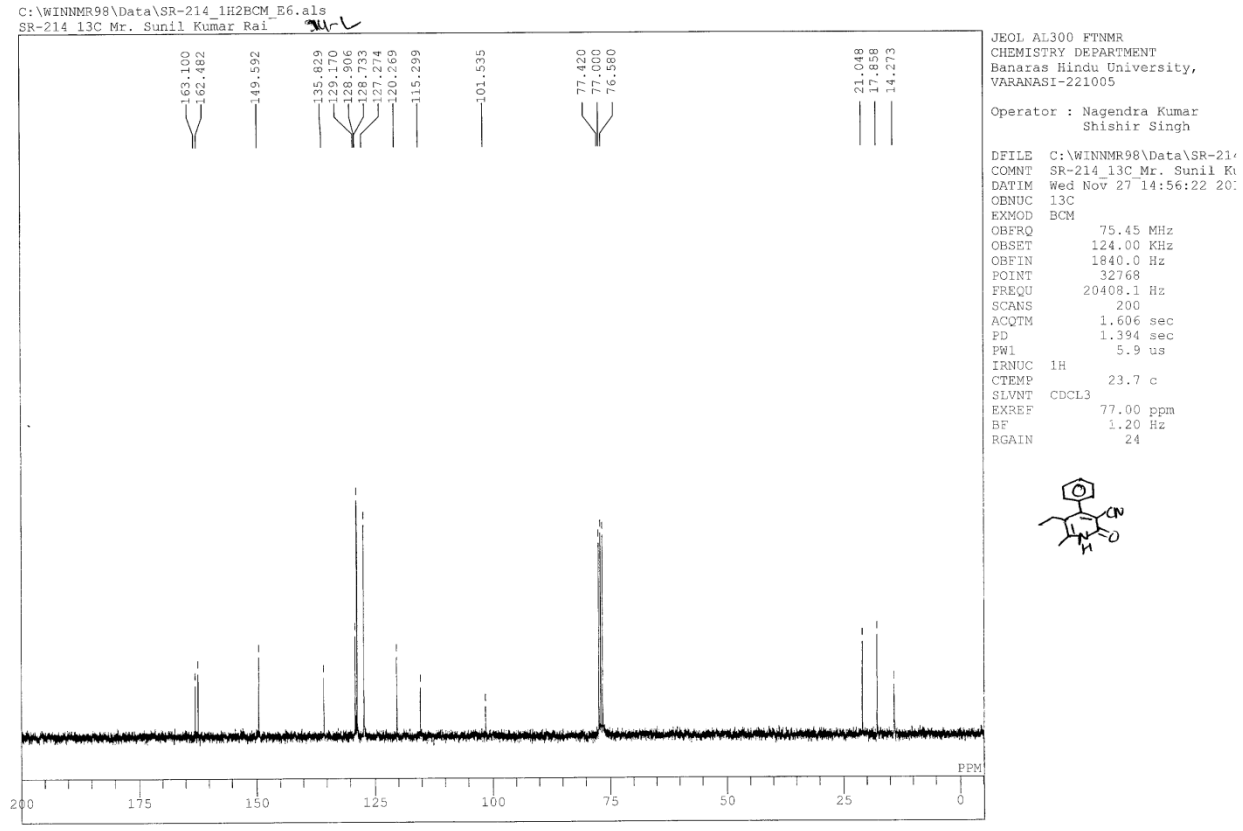
Compound (1f): ^{1}H NMR



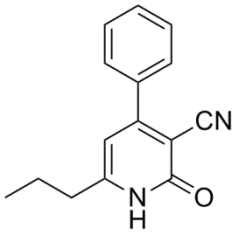


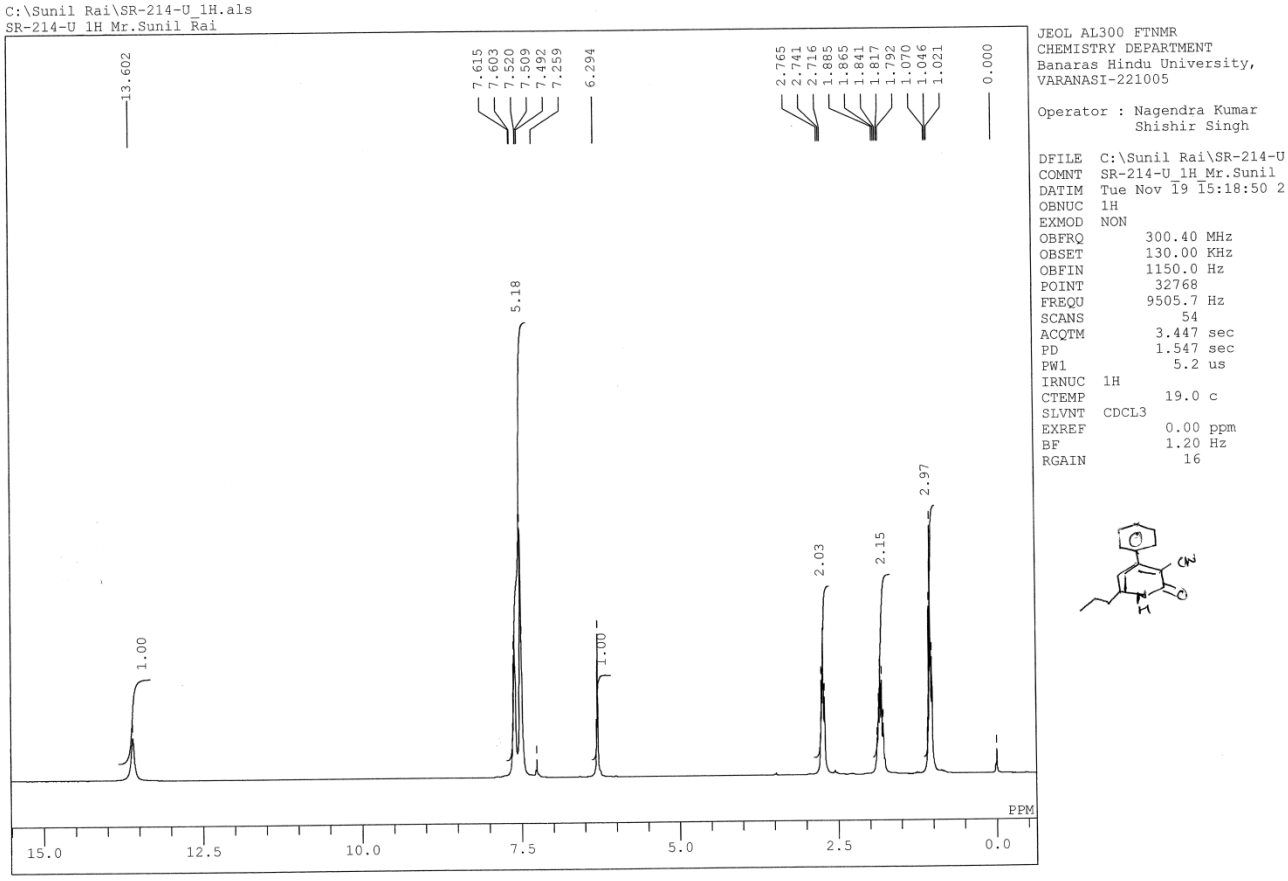
Compound (1f): ^{13}C NMR



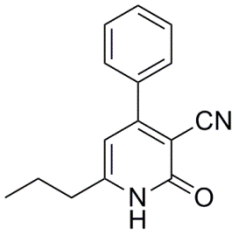


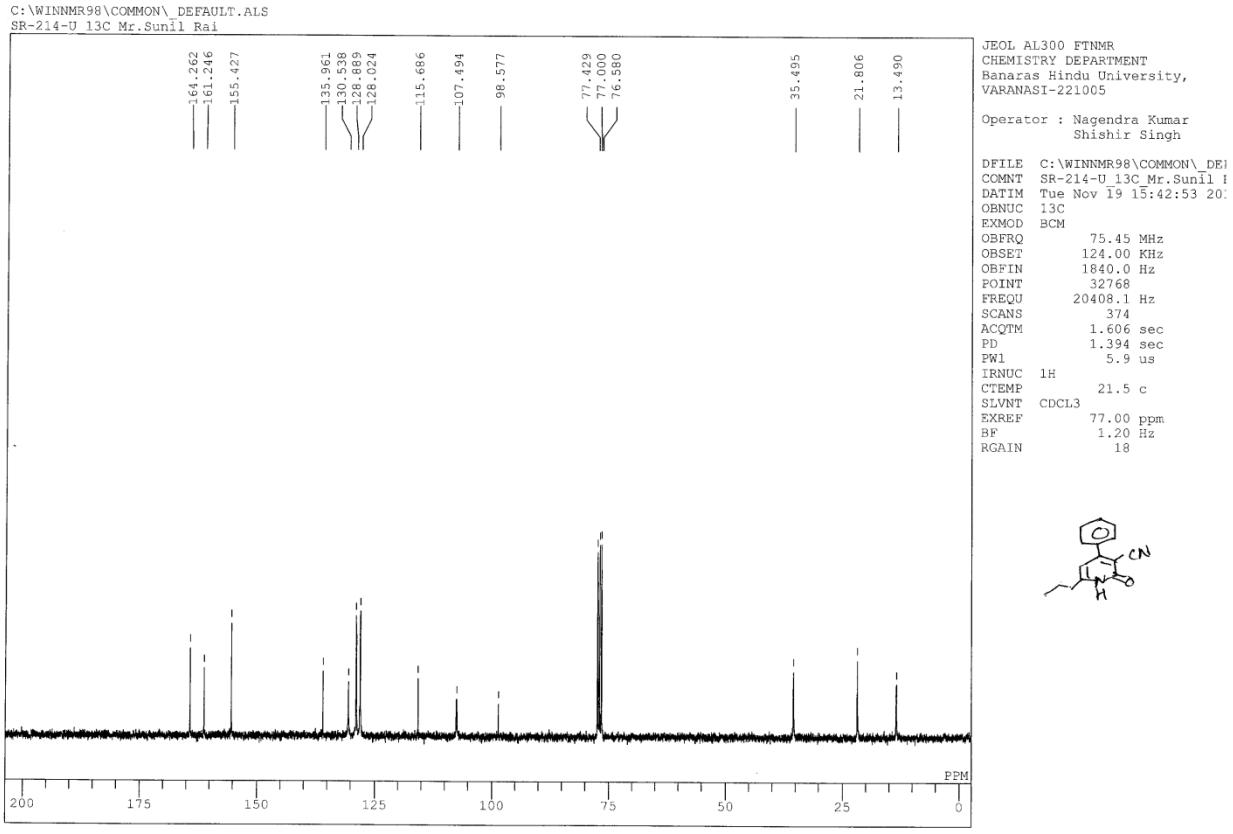
Compound (1g): ^{1}H NMR



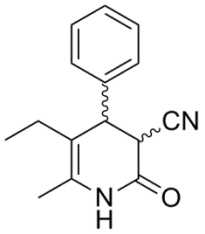


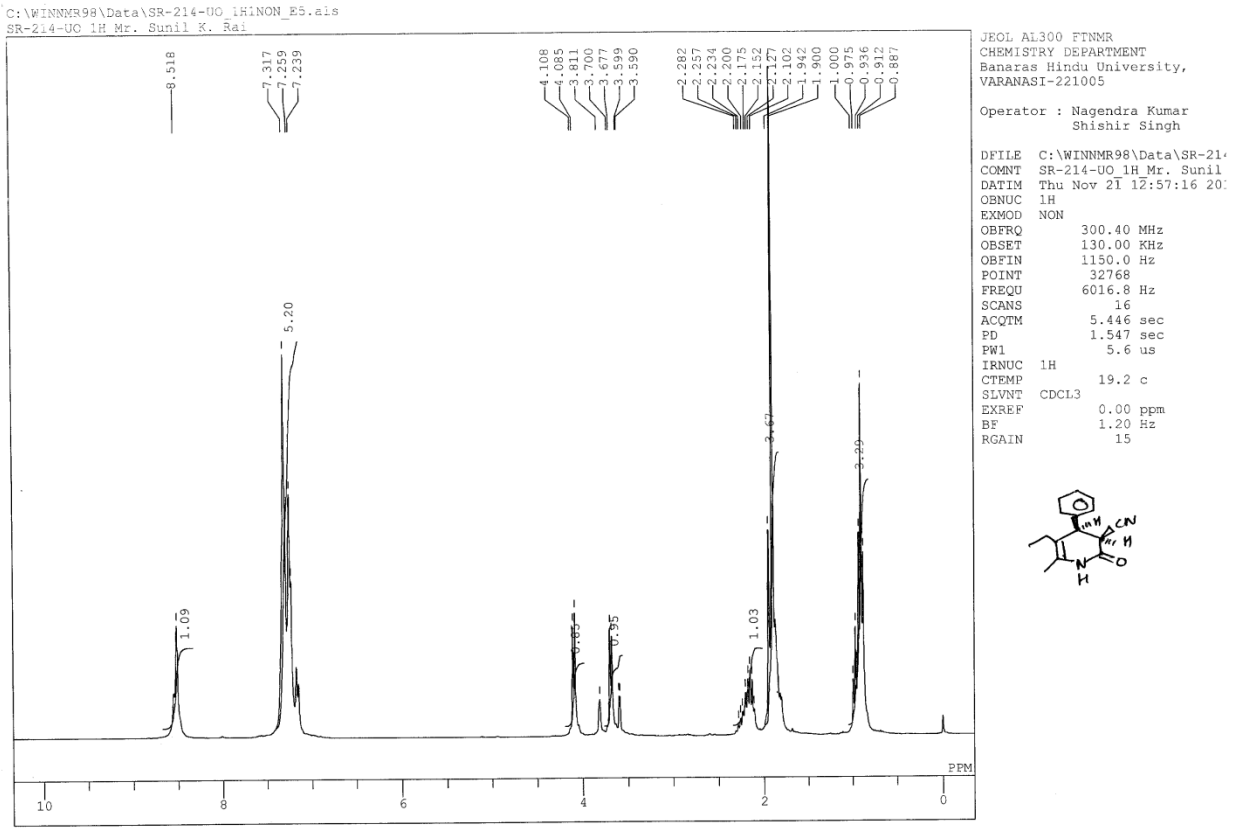
Compound (1g): ^{13}C NMR



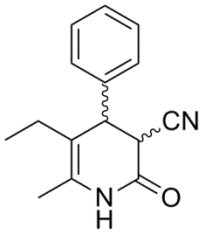


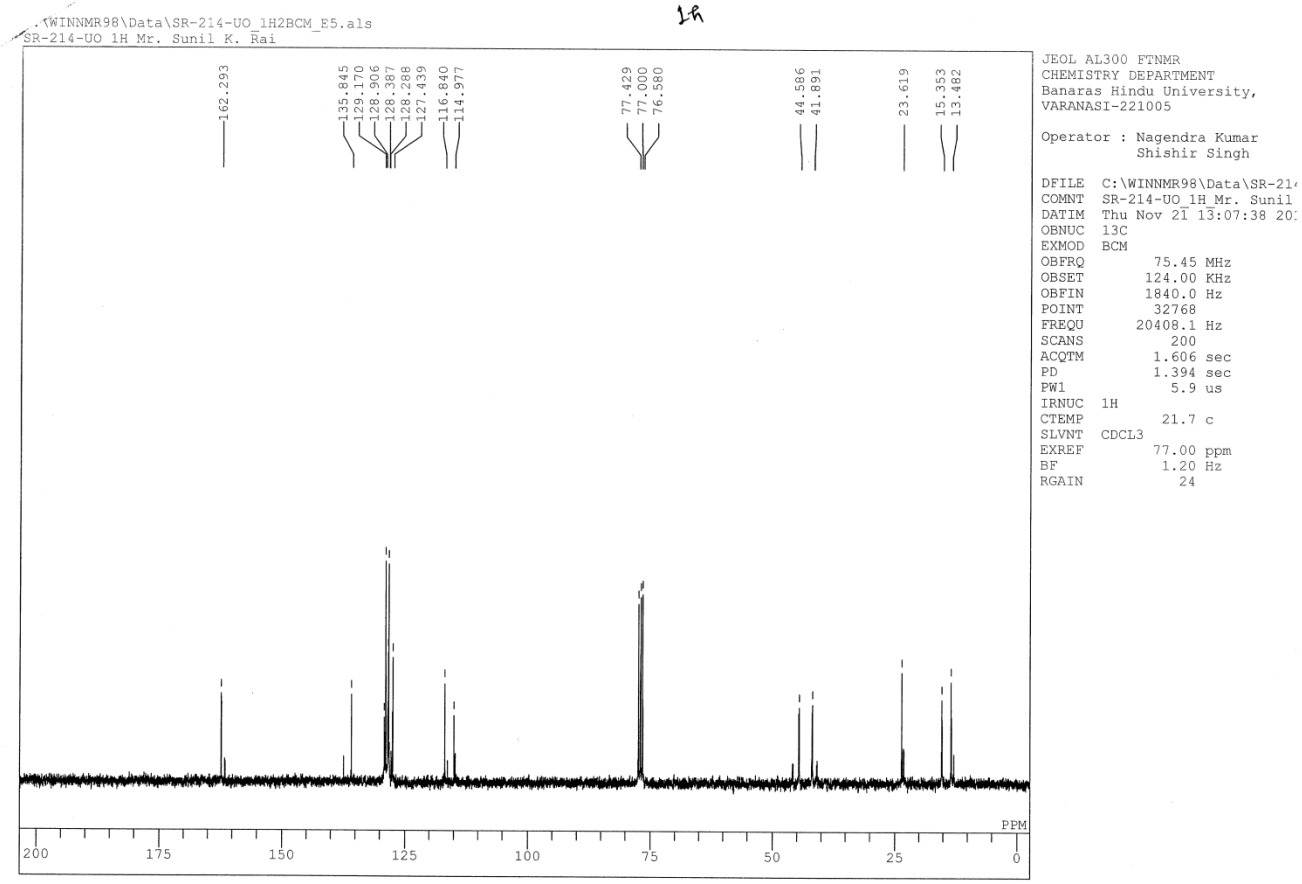
Compound (1h): ^{1}H NMR



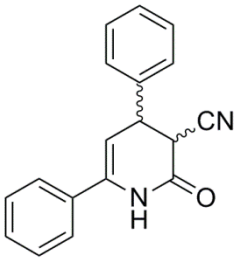


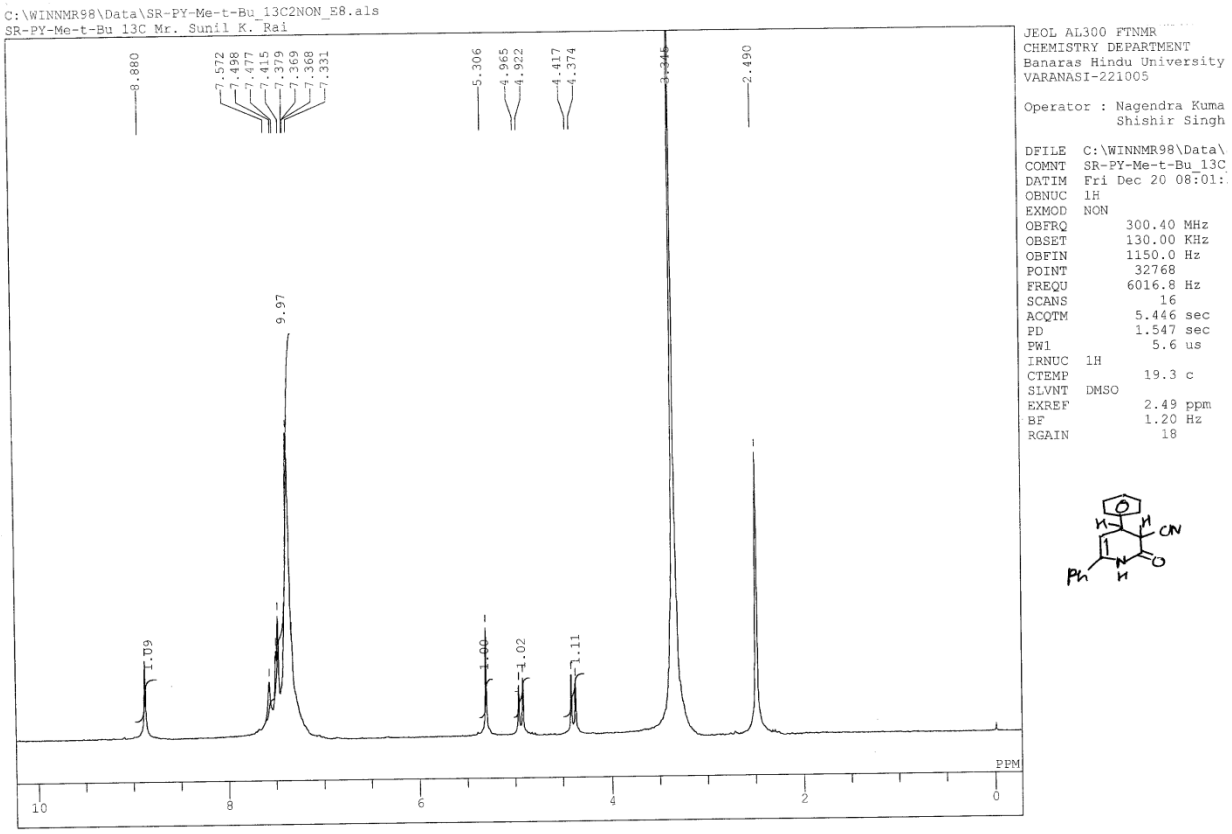
Compound (1h): ^{13}C NMR



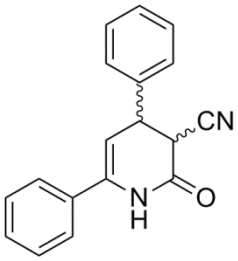


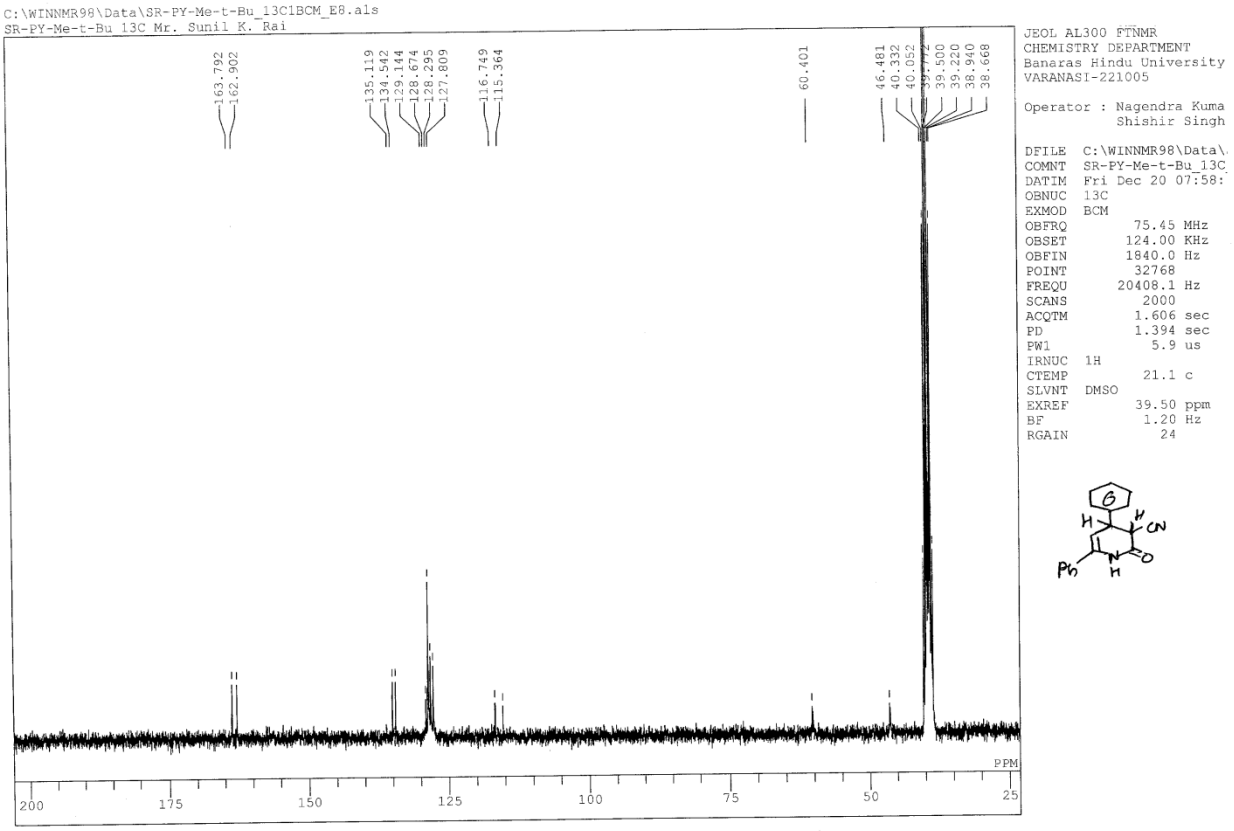
Compound (1i): ^{1}H NMR



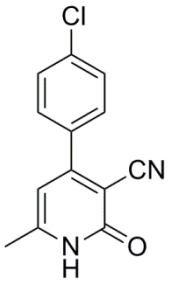


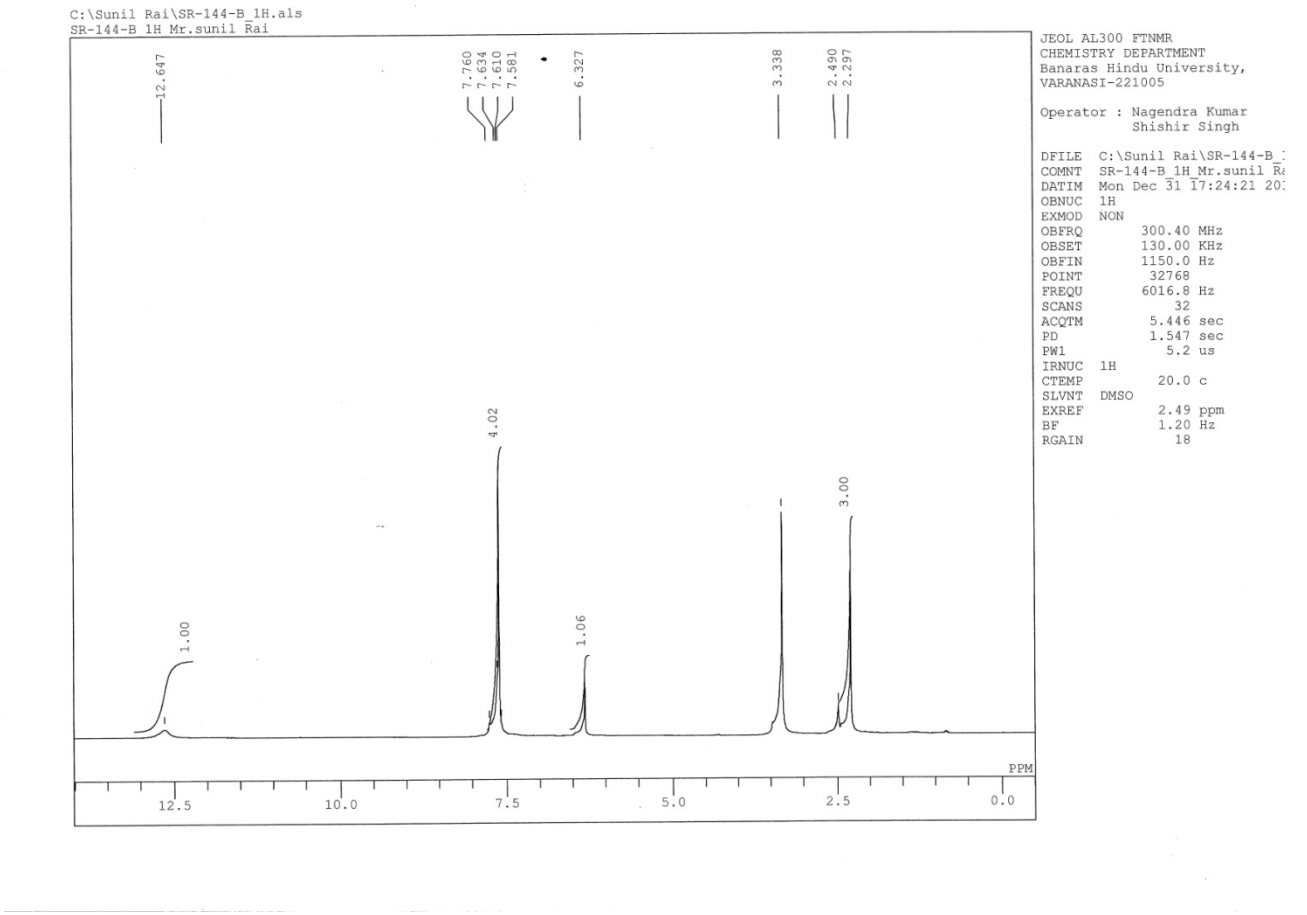
Compound (1i): ^{13}C NMR



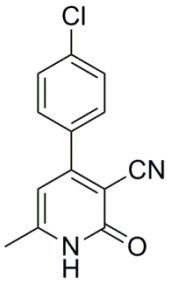


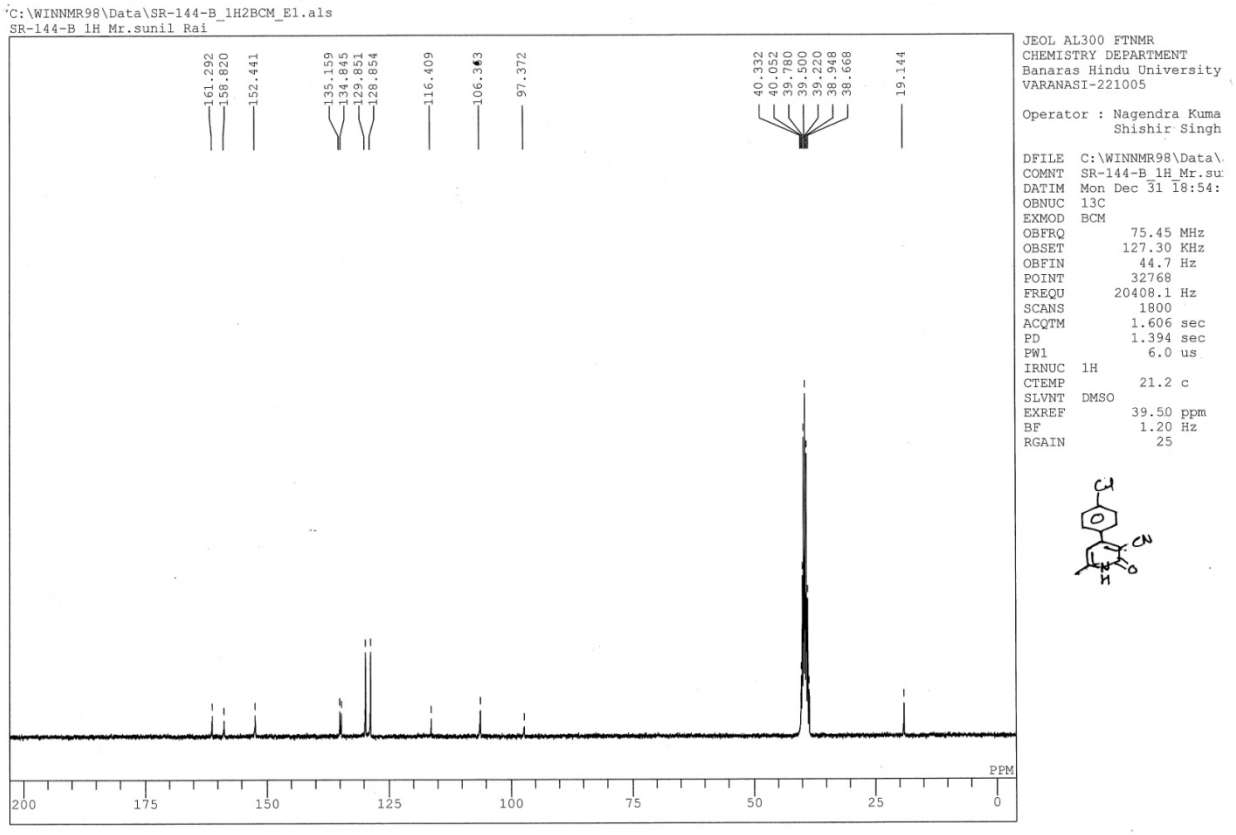
Compound (2a): ^{1}H NMR



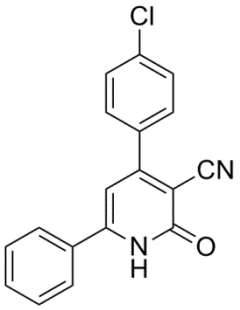


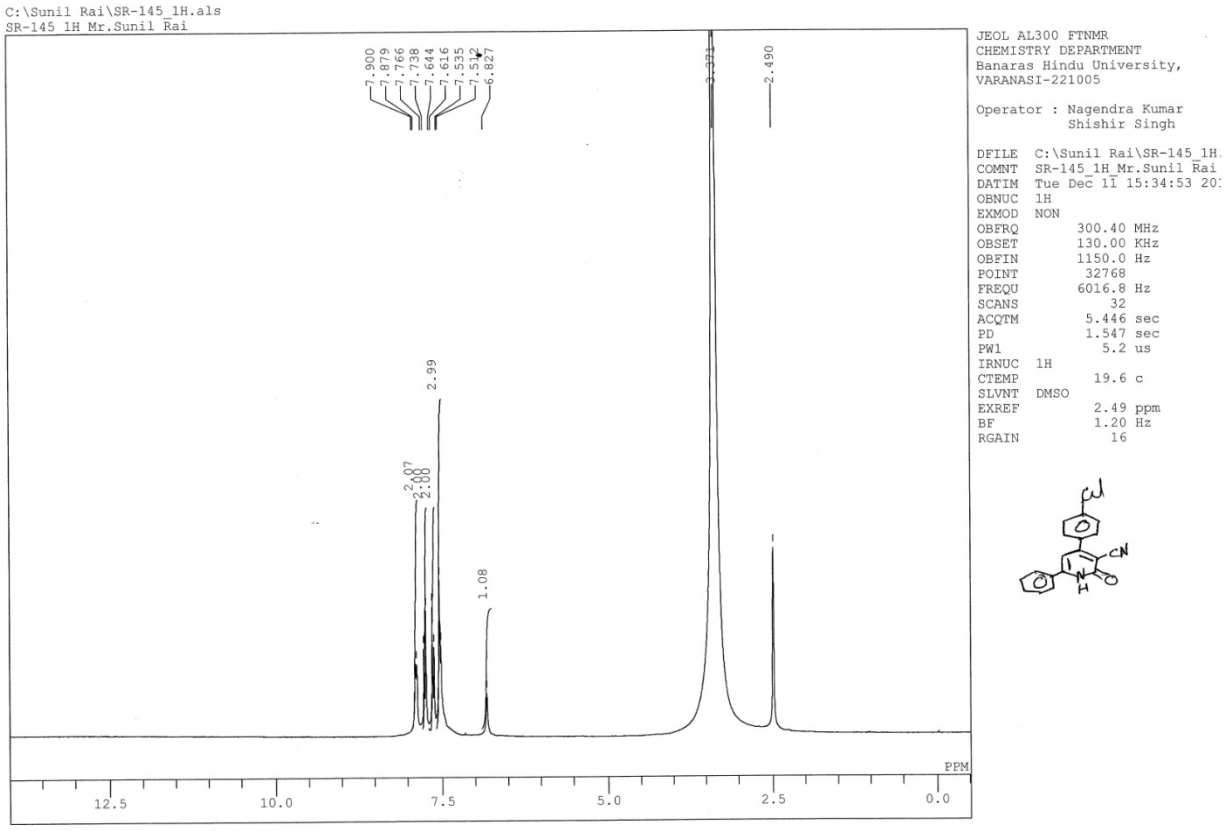
Compound (2a): ^{13}C NMR



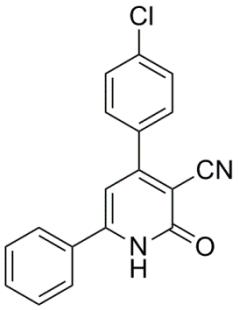


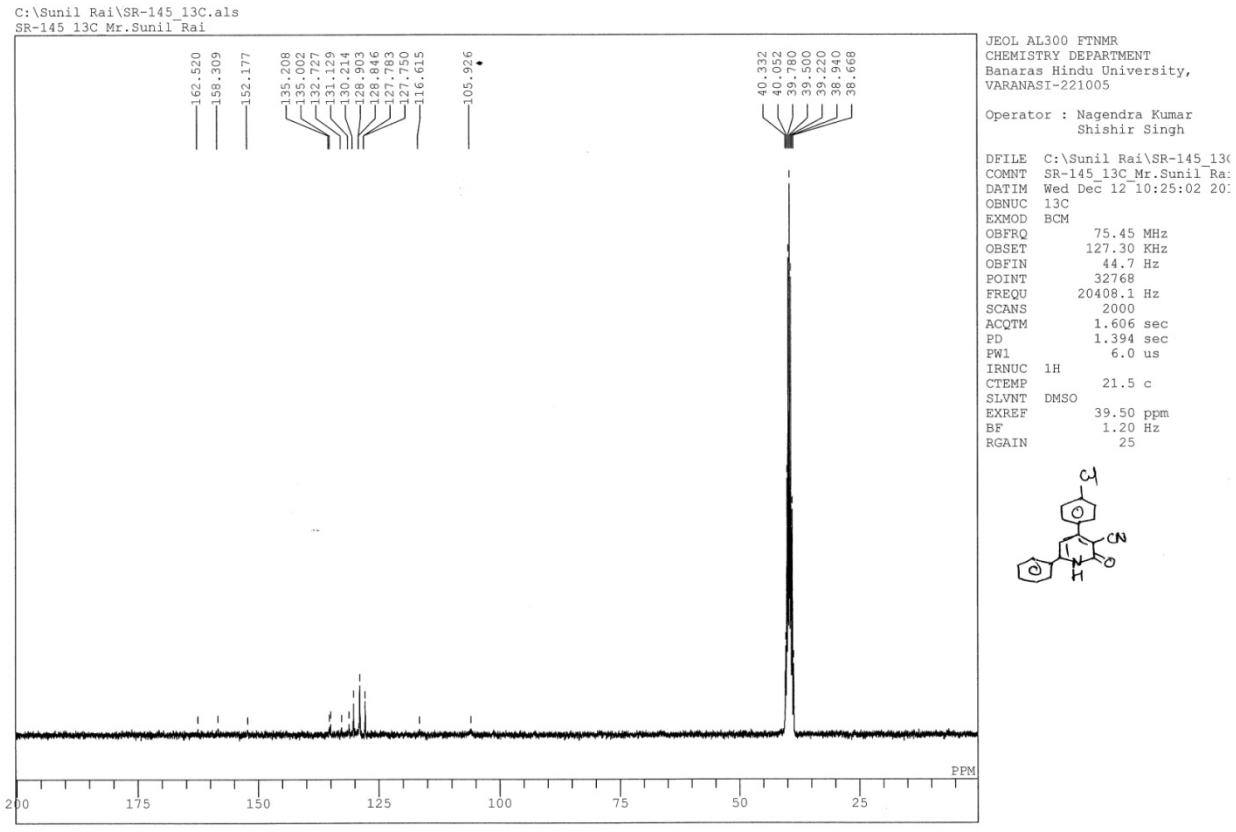
Compound (2b): ^{1}H NMR



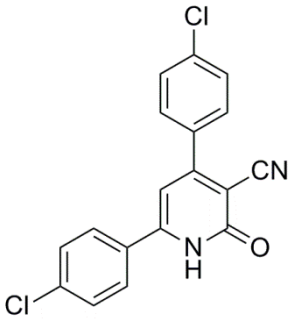


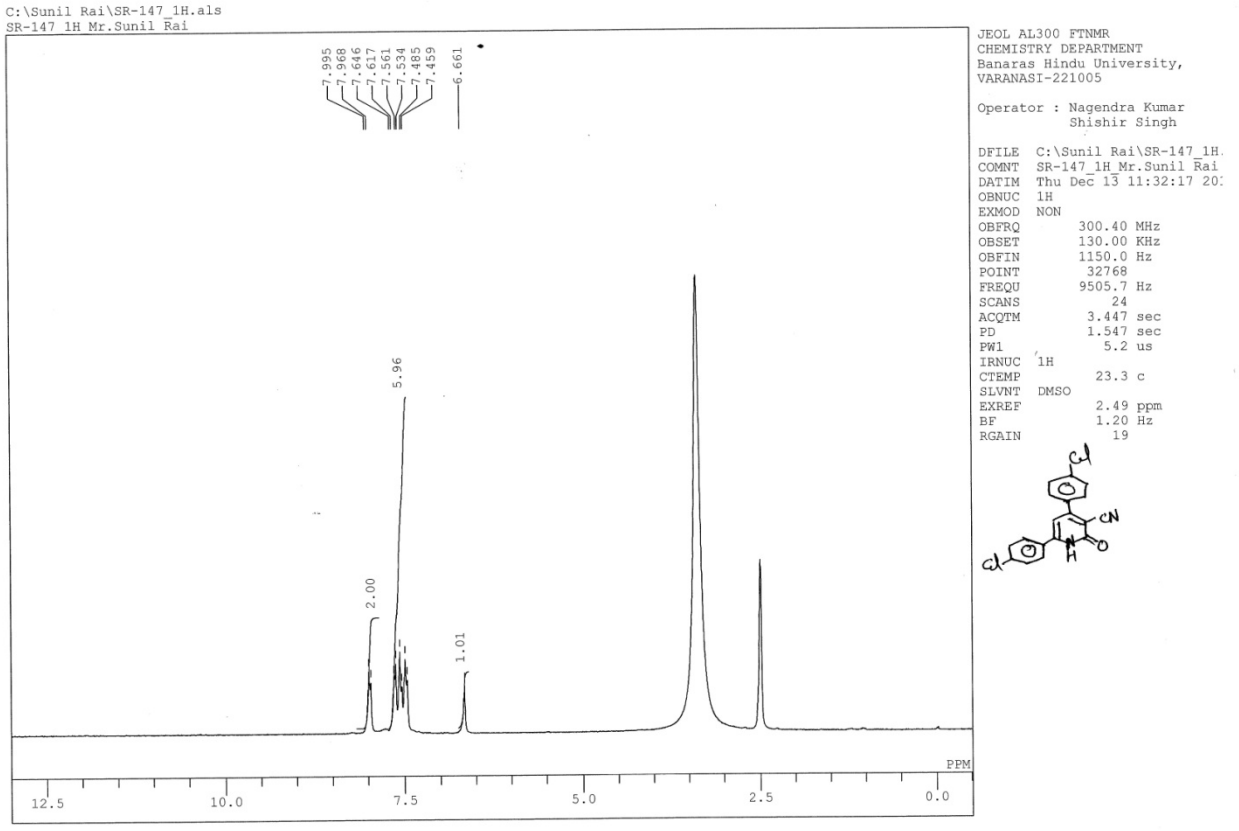
Compound (2b): ^{13}C NMR



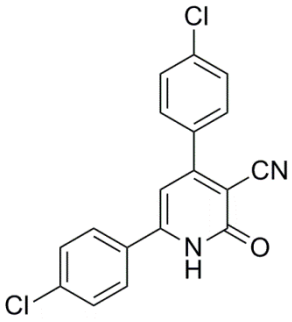


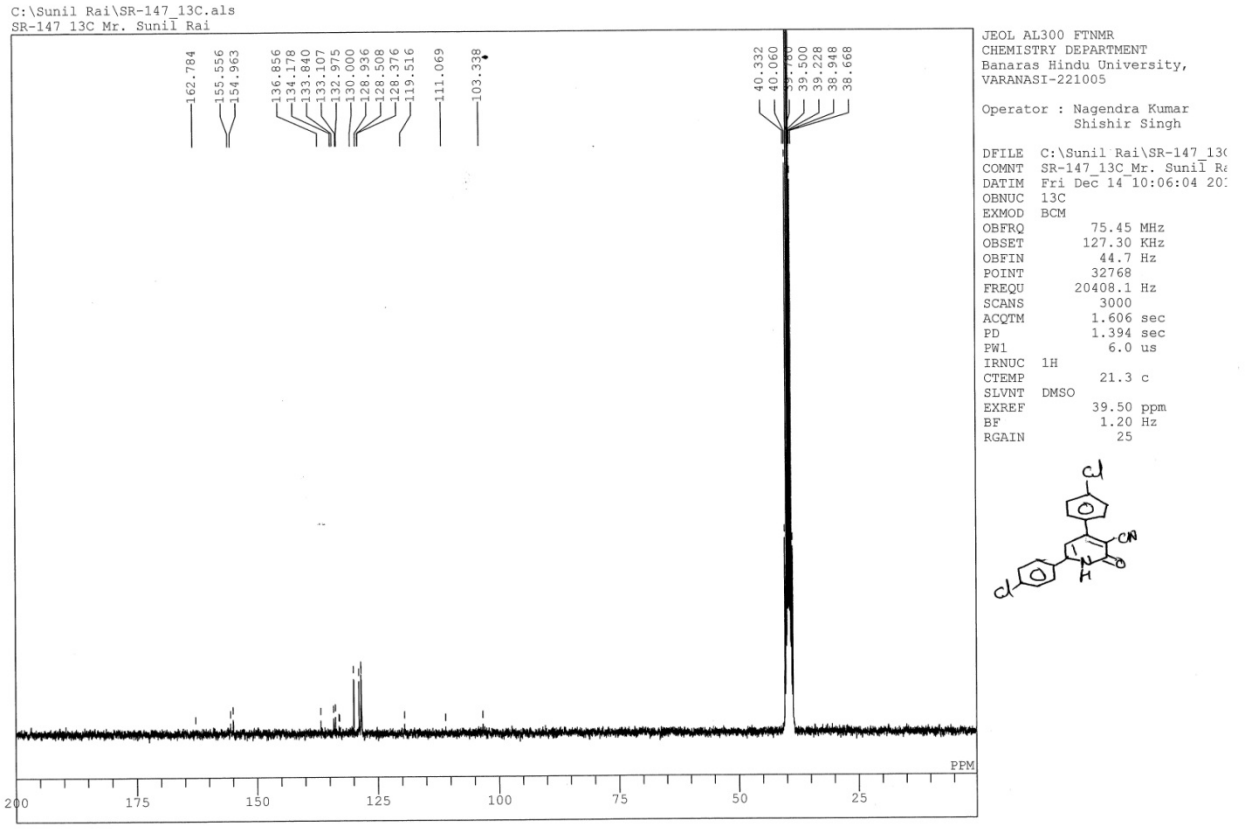
Compound (2c): ^{1}H NMR



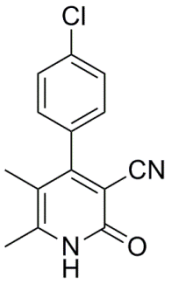


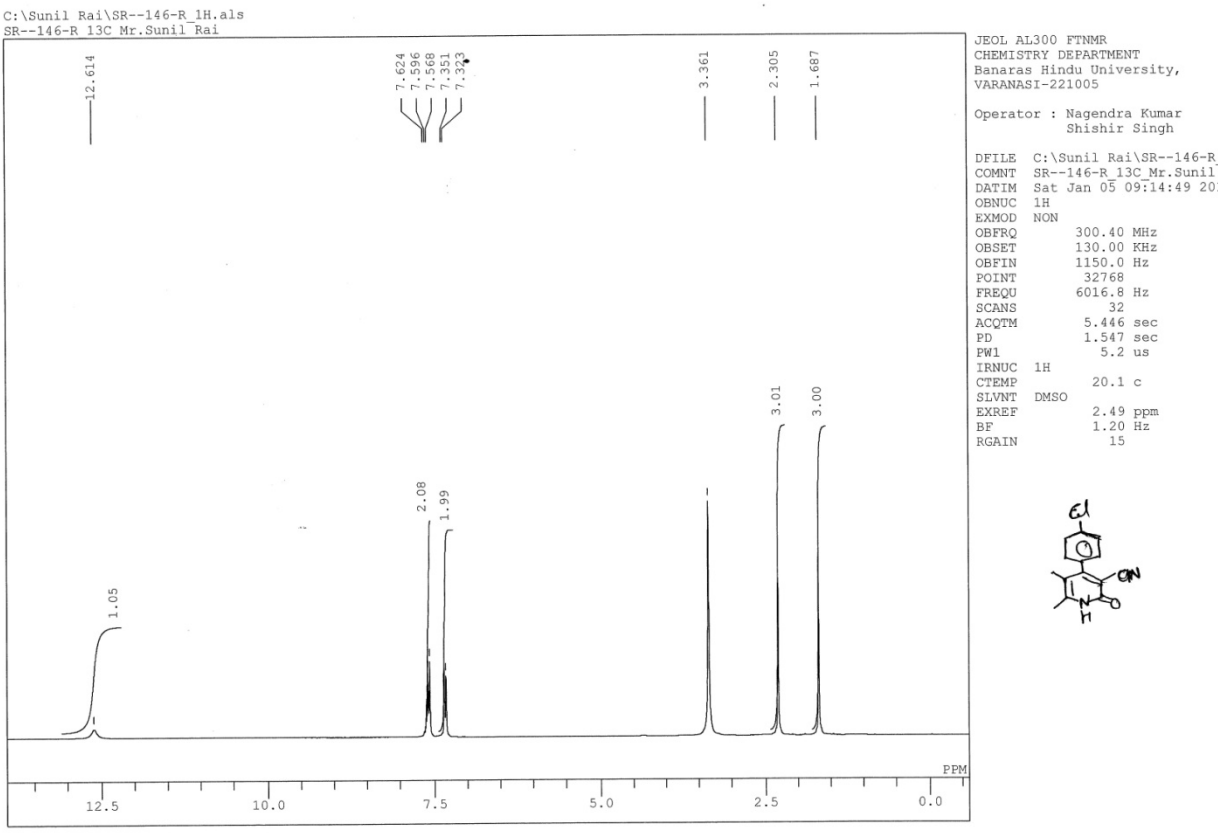
Compound (2c): ^{13}C NMR



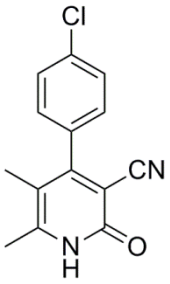


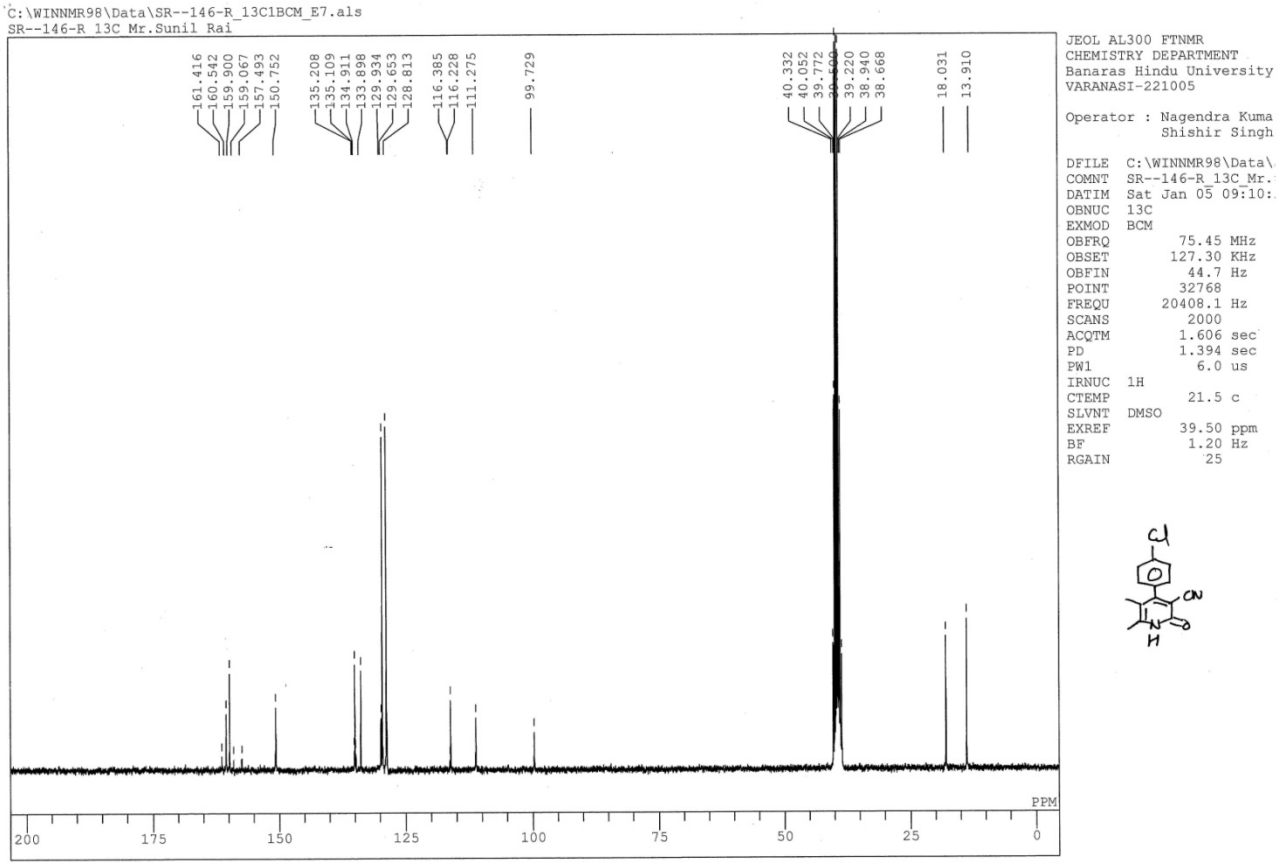
Compound (2d): 1H NMR



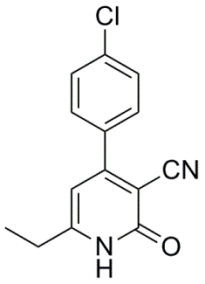


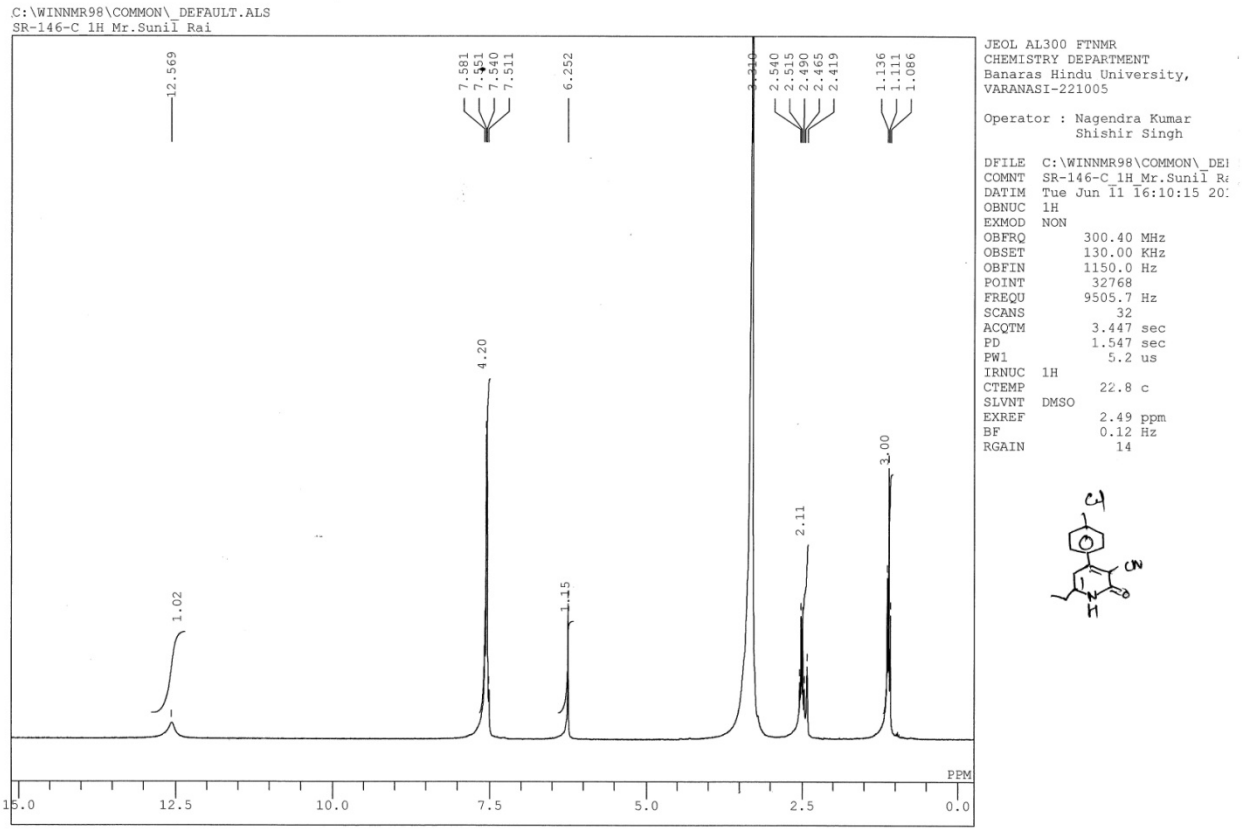
Compound (2d): ^{13}C NMR



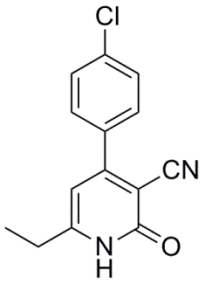


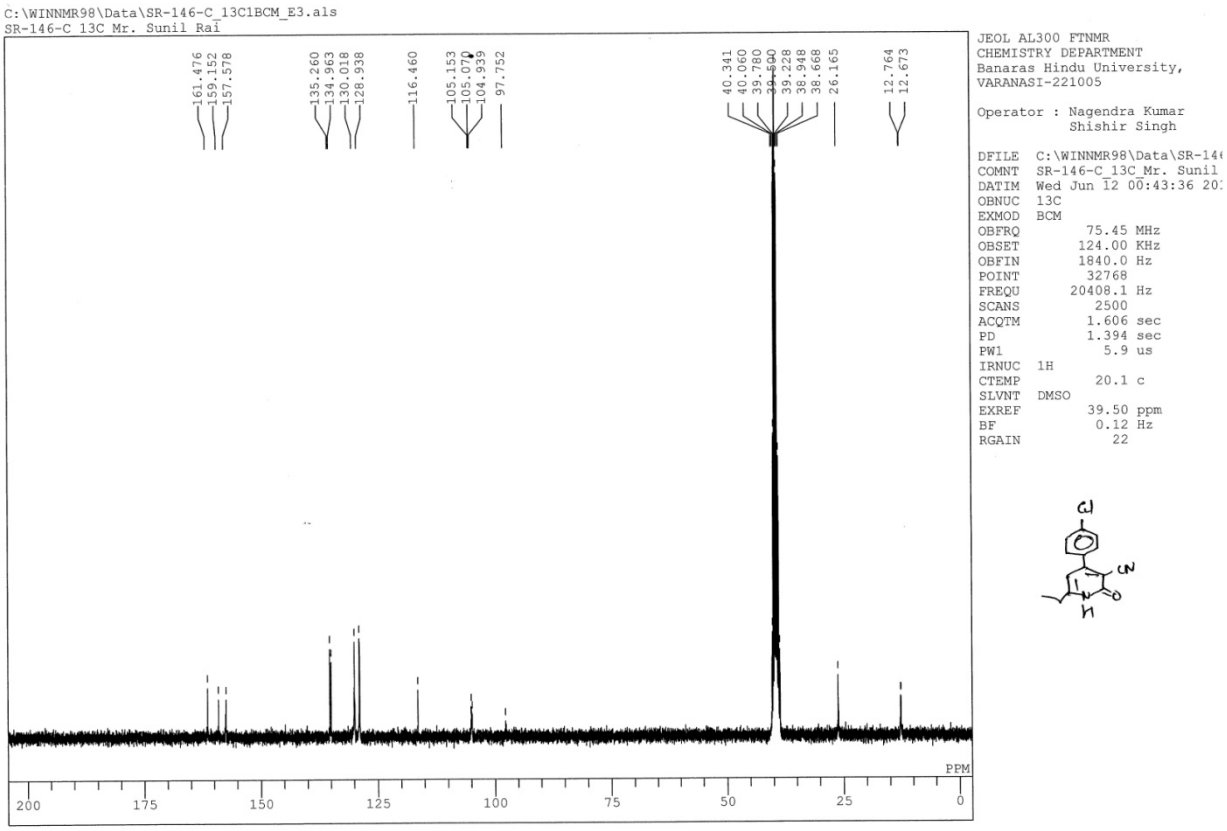
Compound (2e): 1H NMR



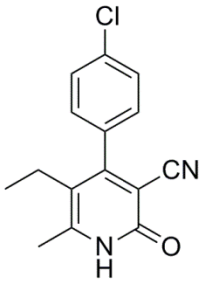


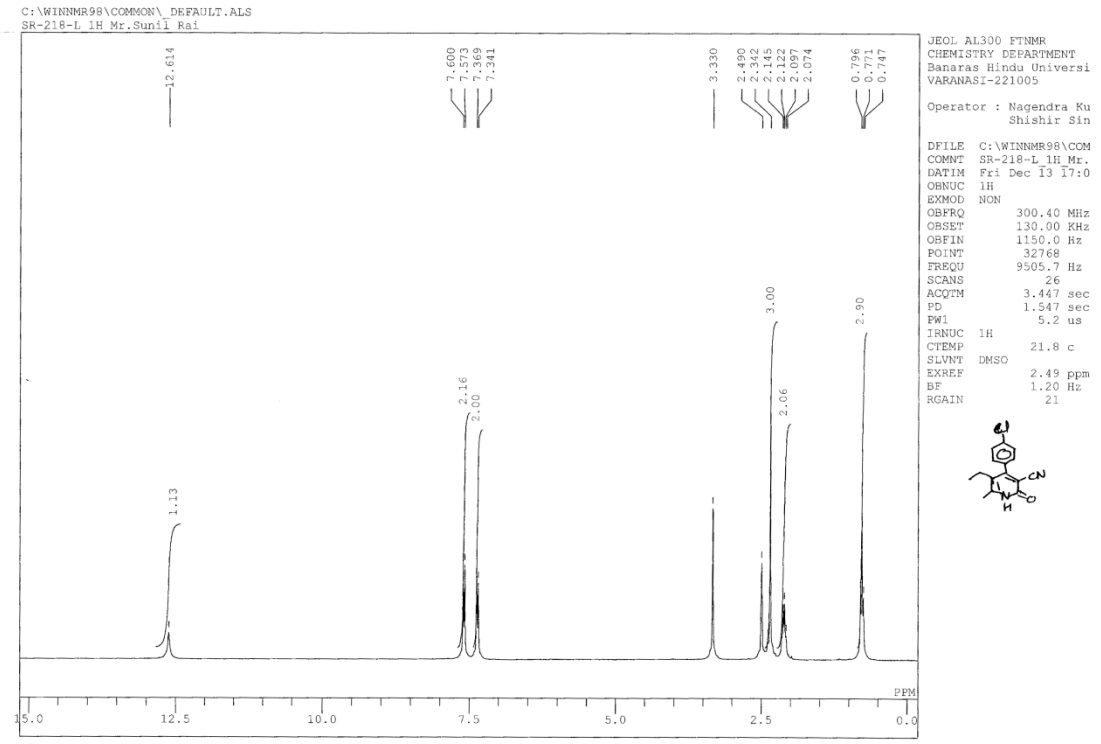
Compound (2e): ^{13}C NMR



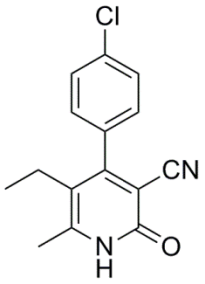


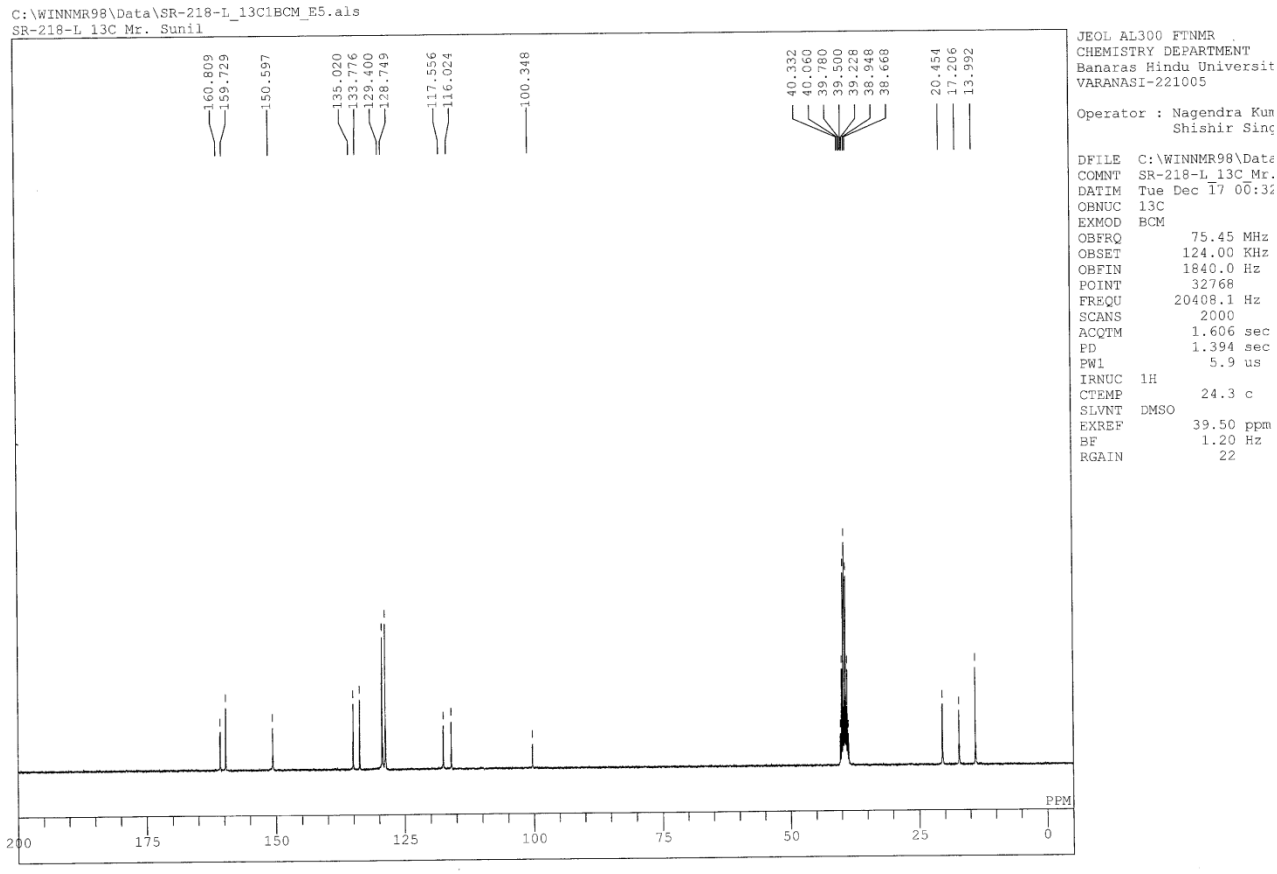
Compound (2f): 1H NMR



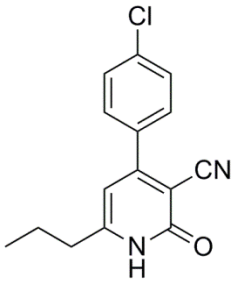


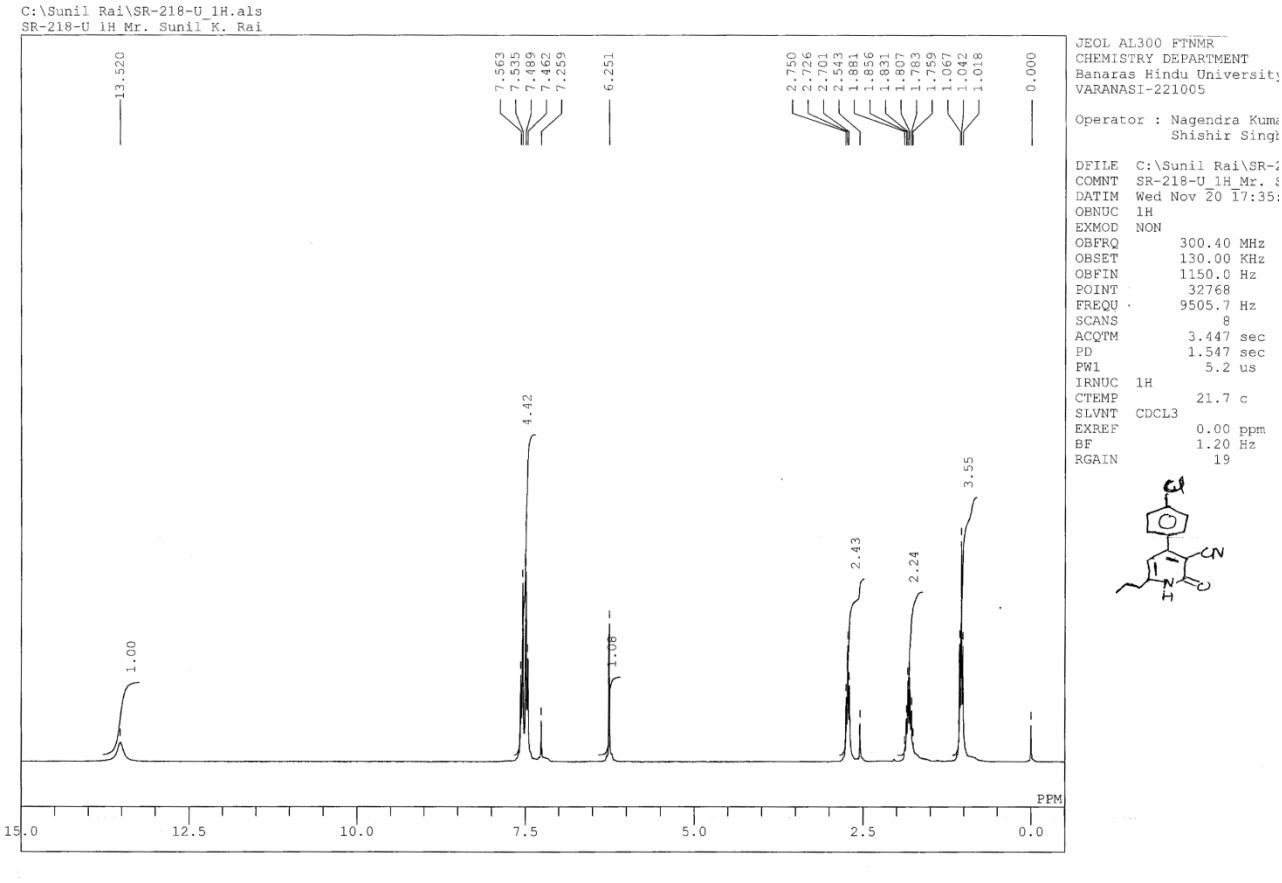
Compound (2f): 13C NMR



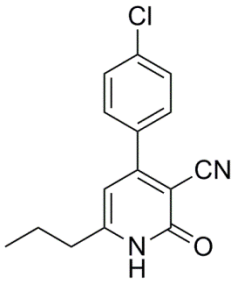


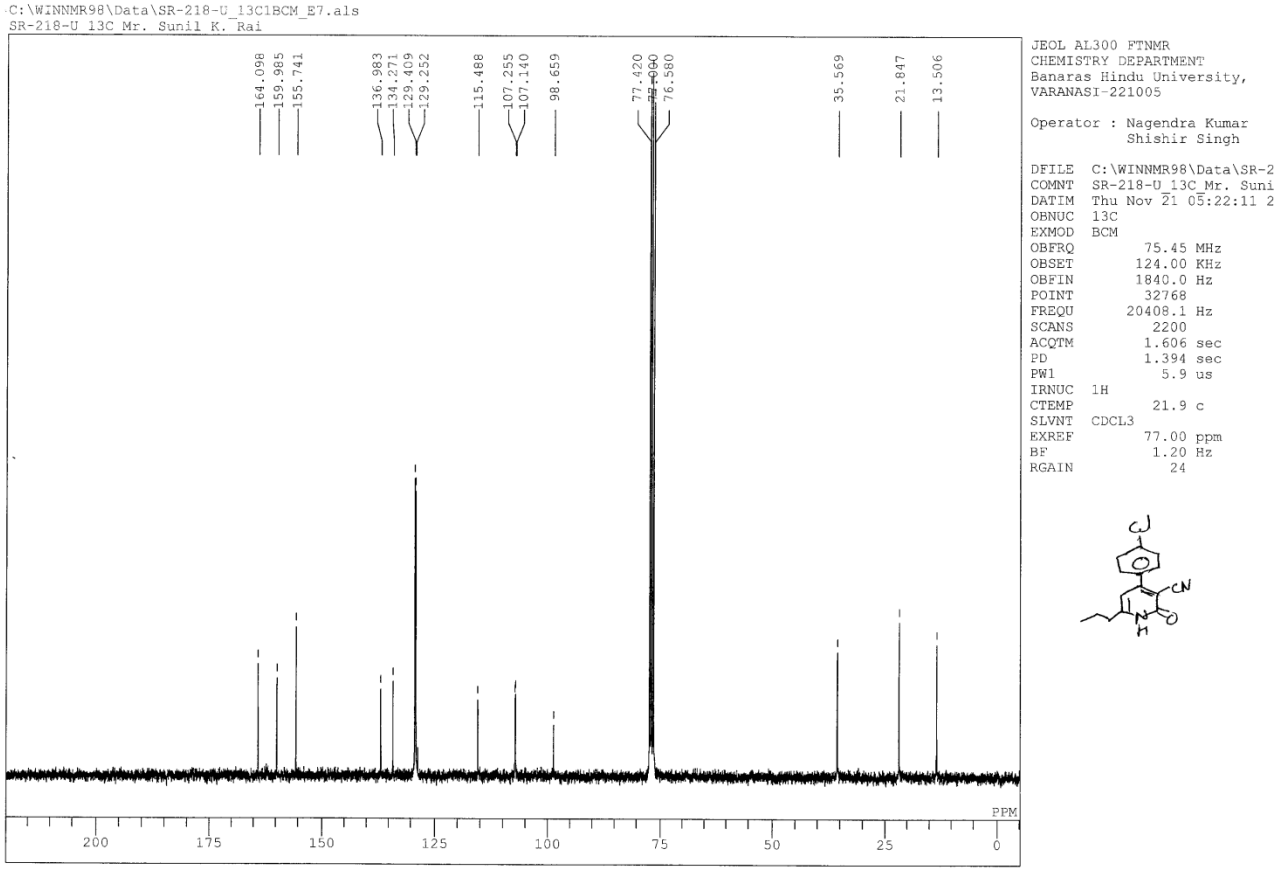
Compound (2g): ^{1}H NMR



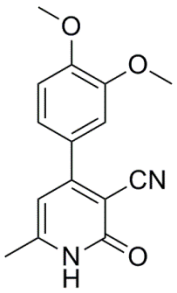


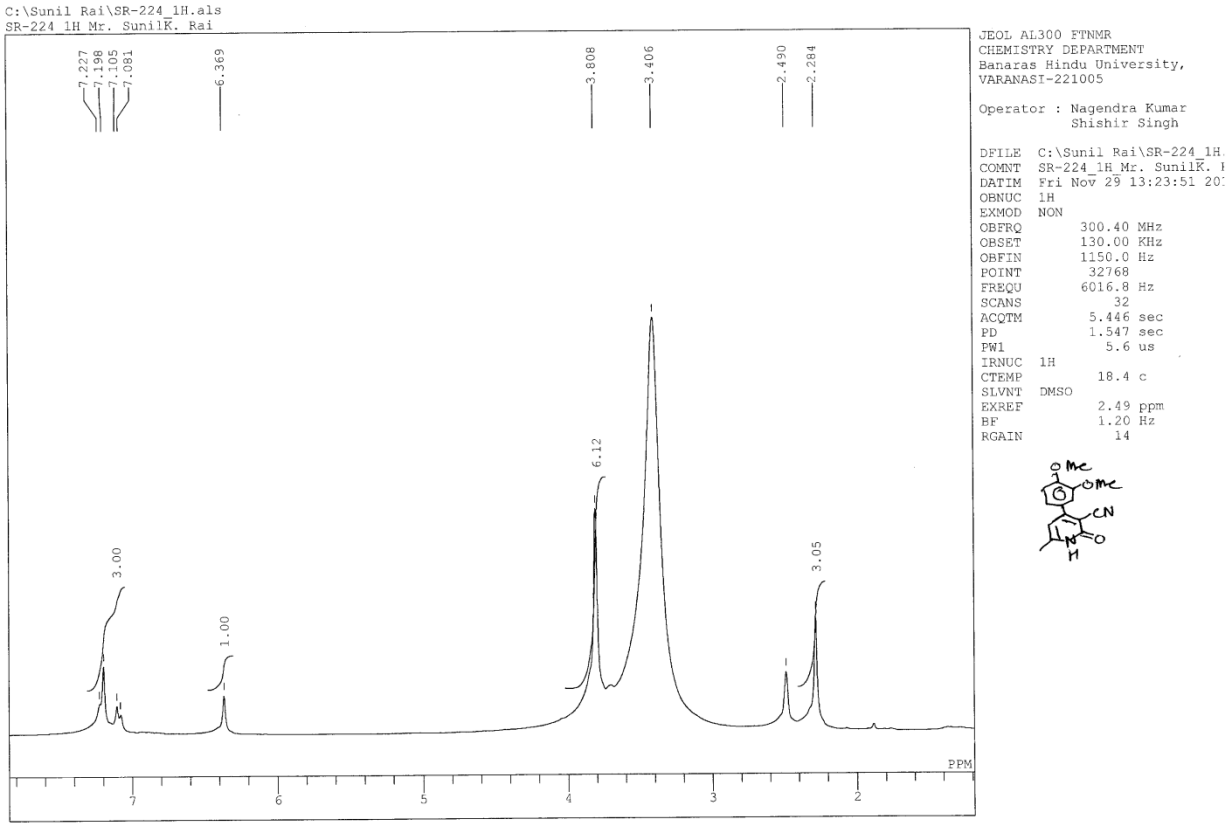
Compound (2g): ^{13}C NMR



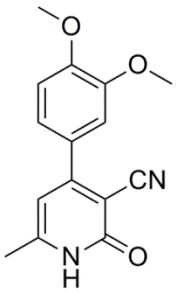


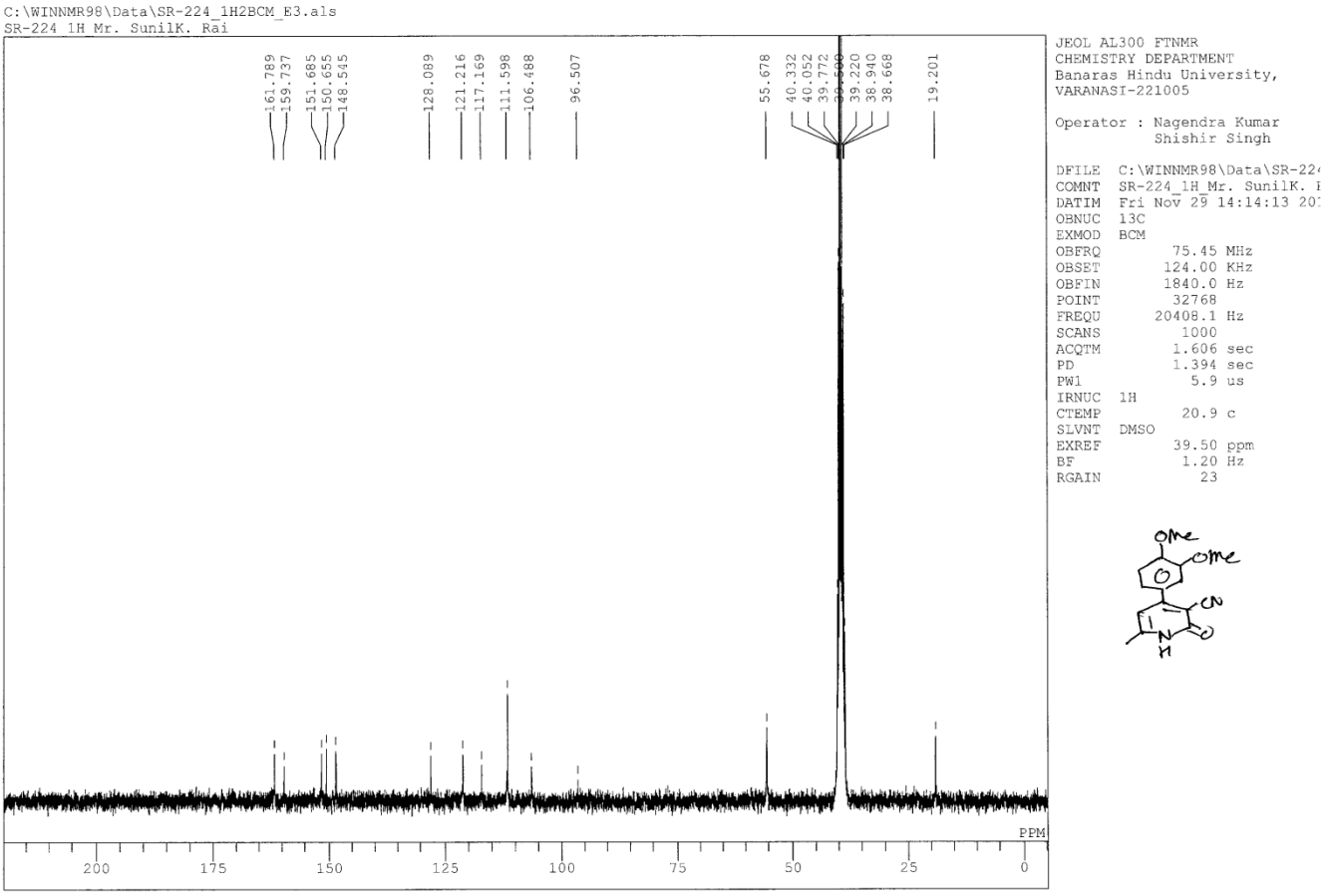
Compound (3a): ^{1}H NMR



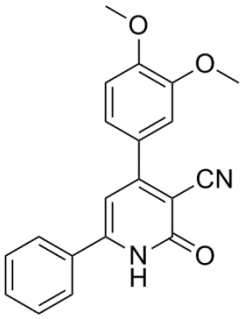


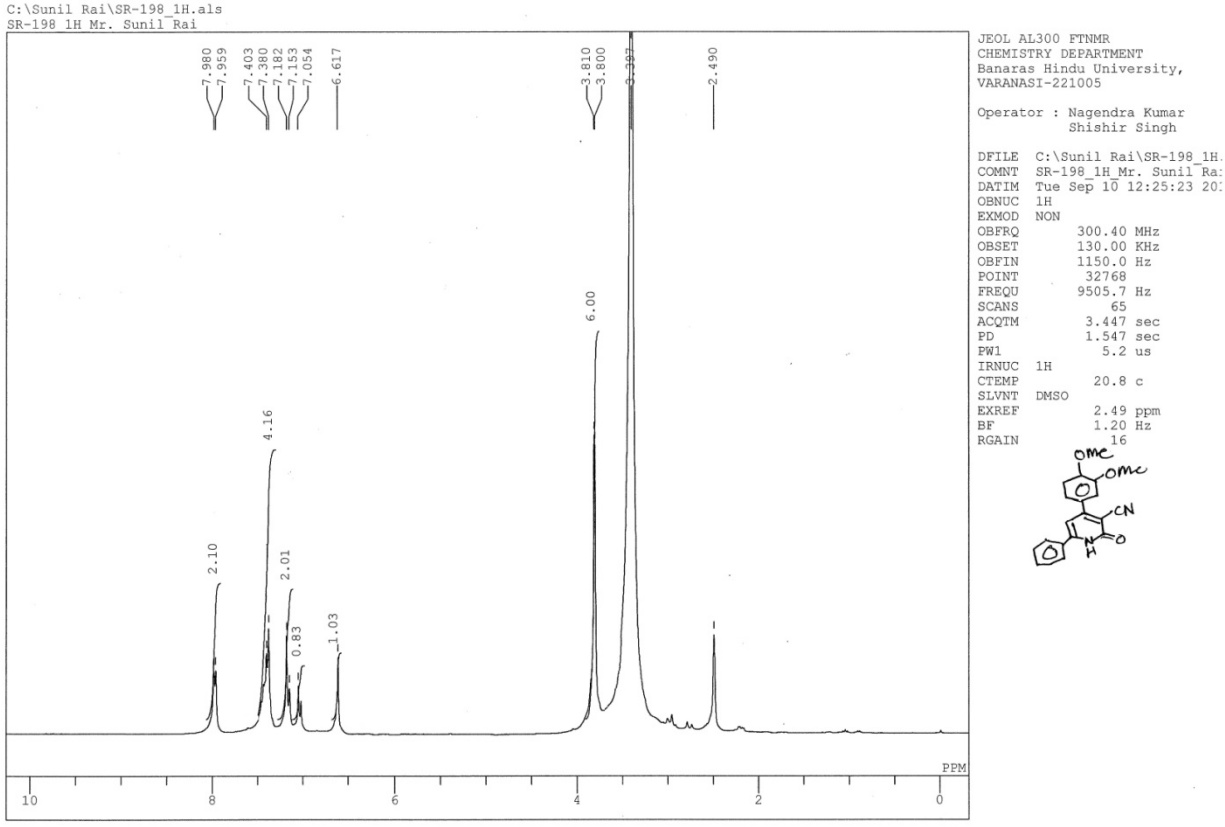
Compound (3a): ^{13}C NMR



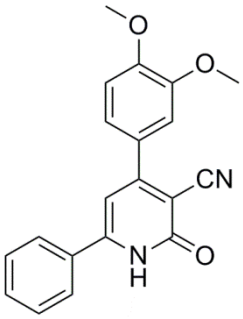


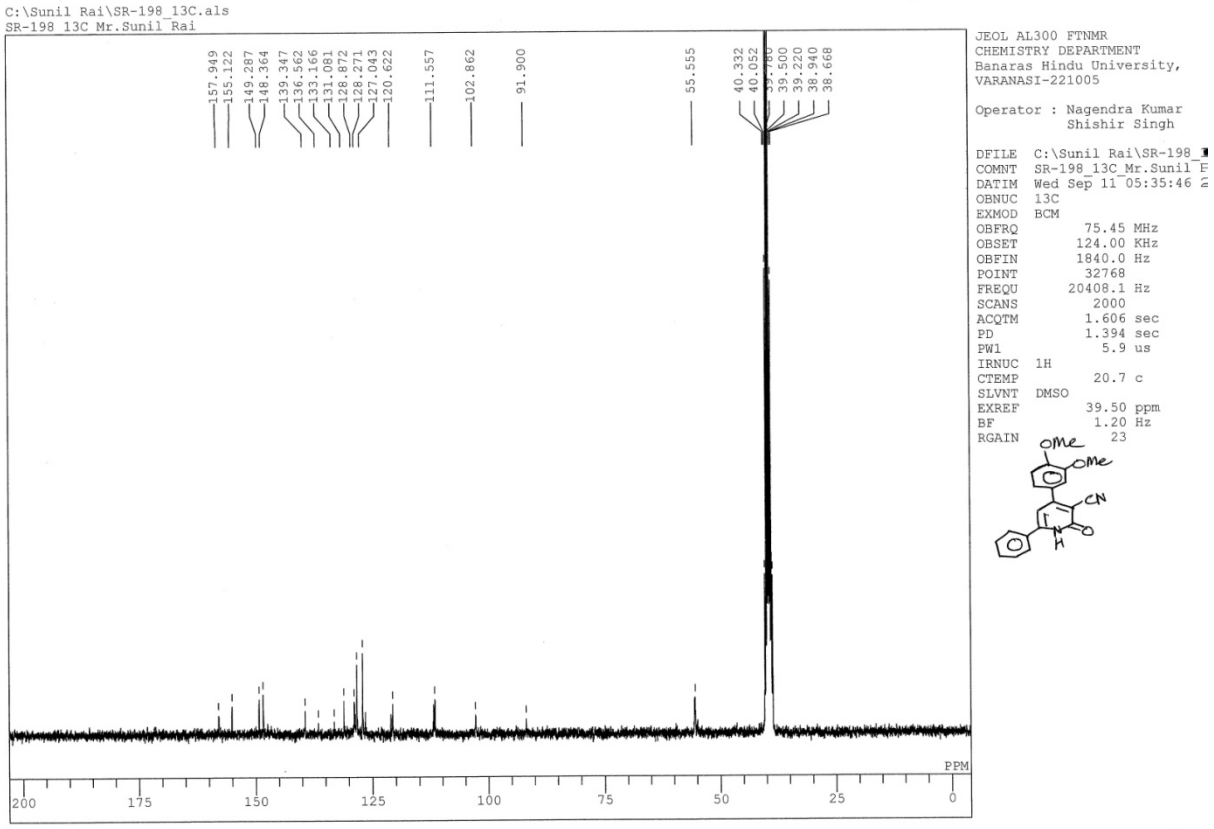
Compound (3b): ^{1}H NMR



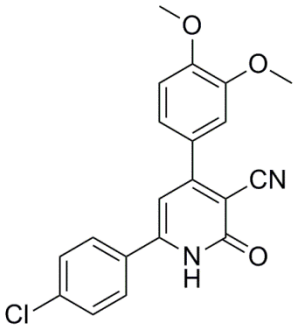


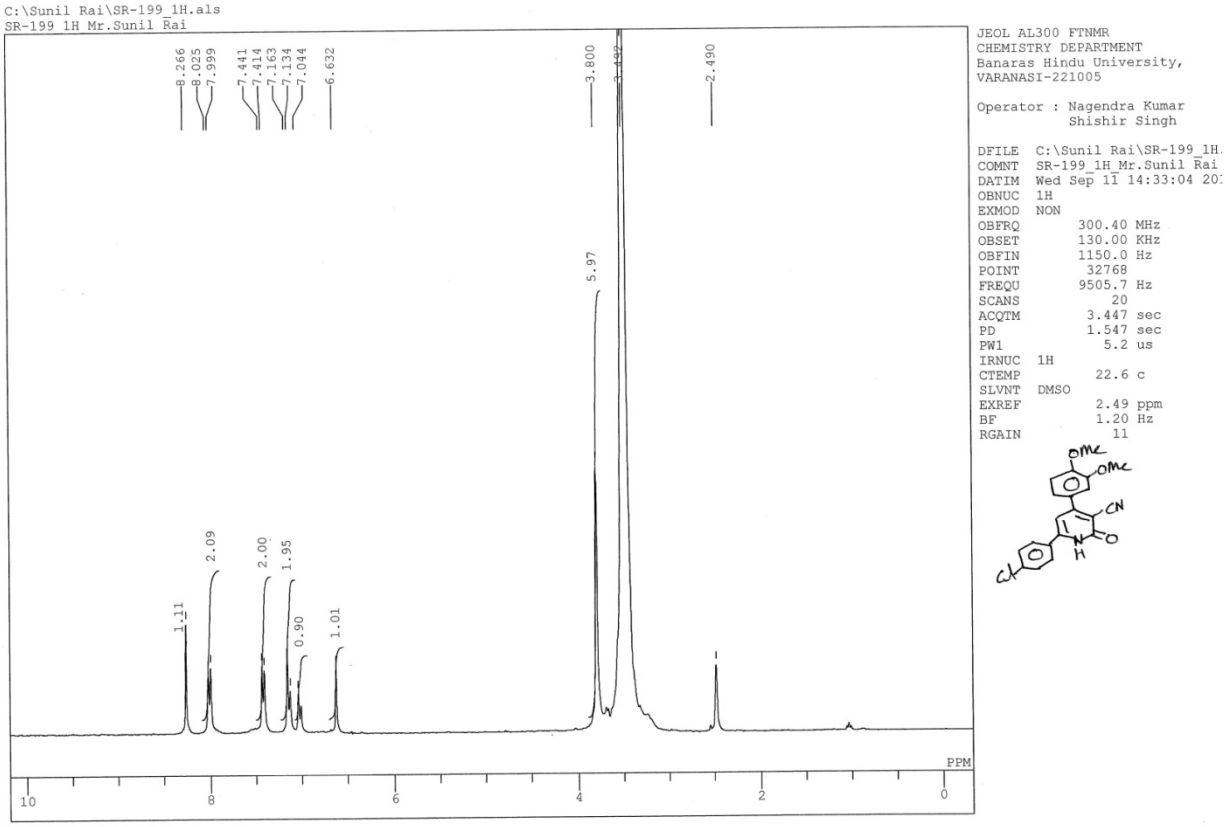
Compound (3b): ^{13}C NMR



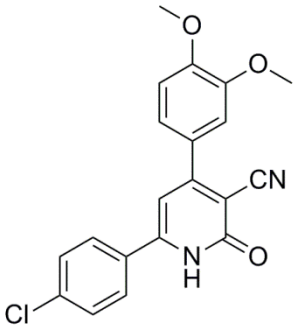


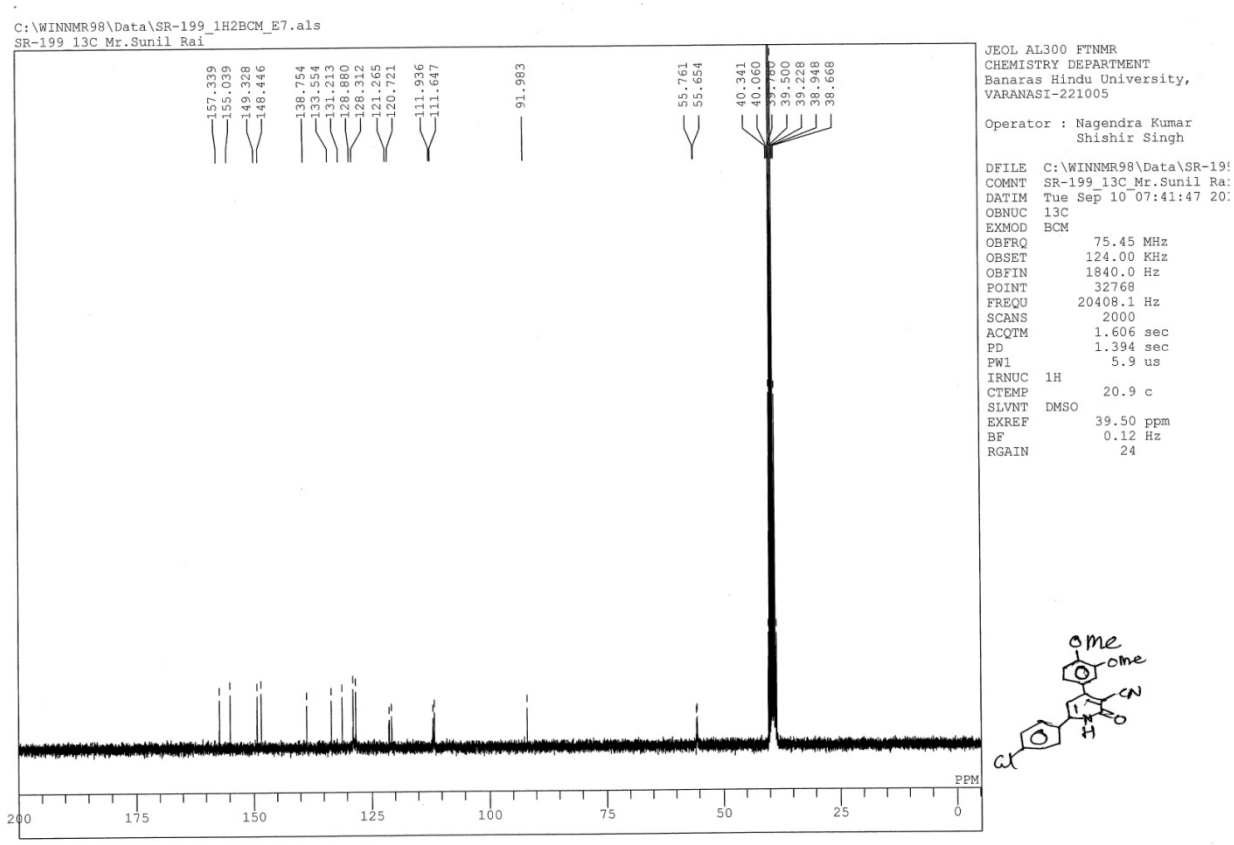
Compound (3c): ^{1}H NMR



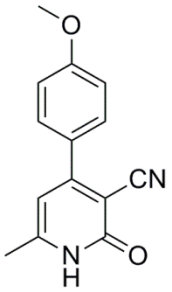


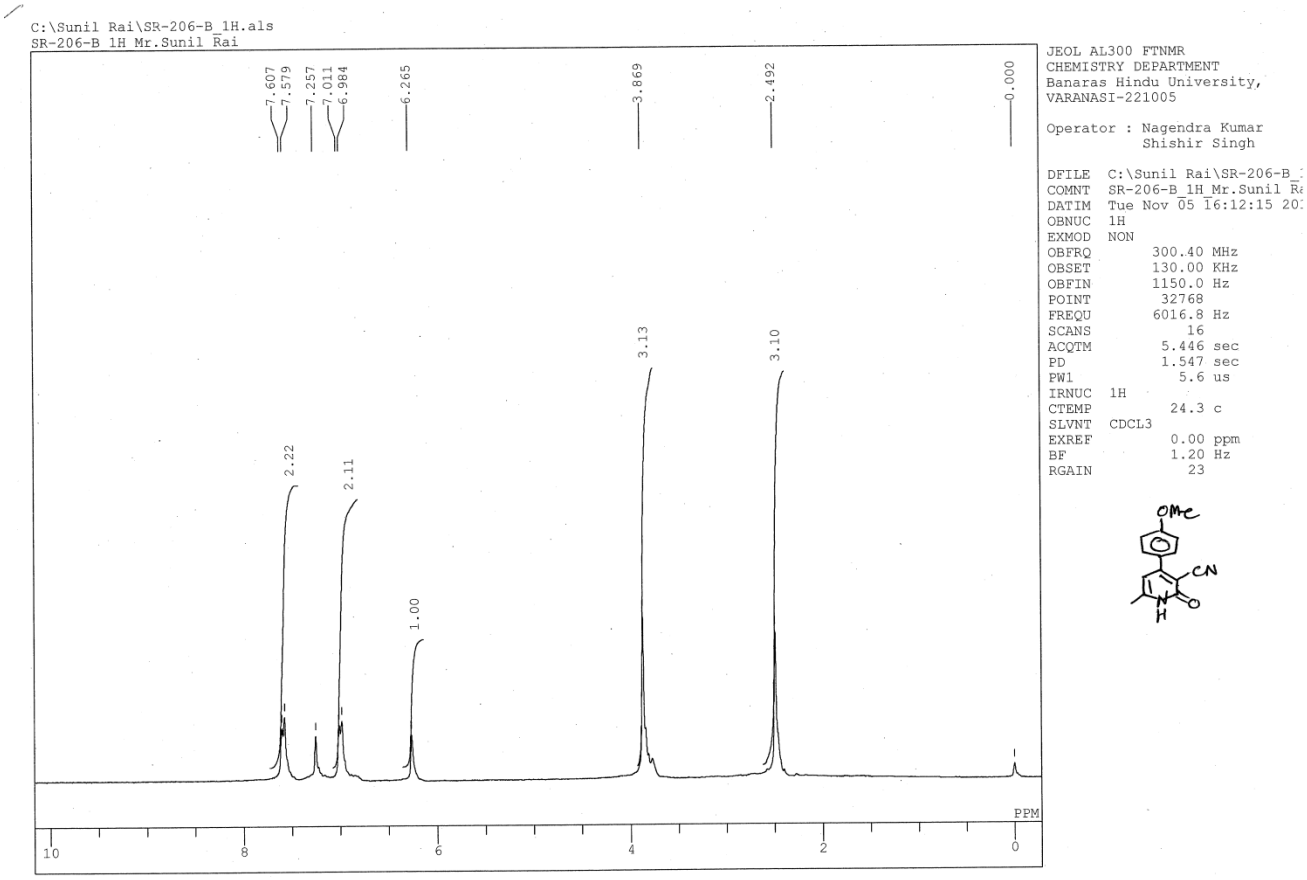
Compound (3c): ^{13}C NMR



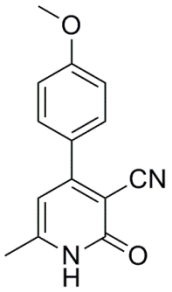


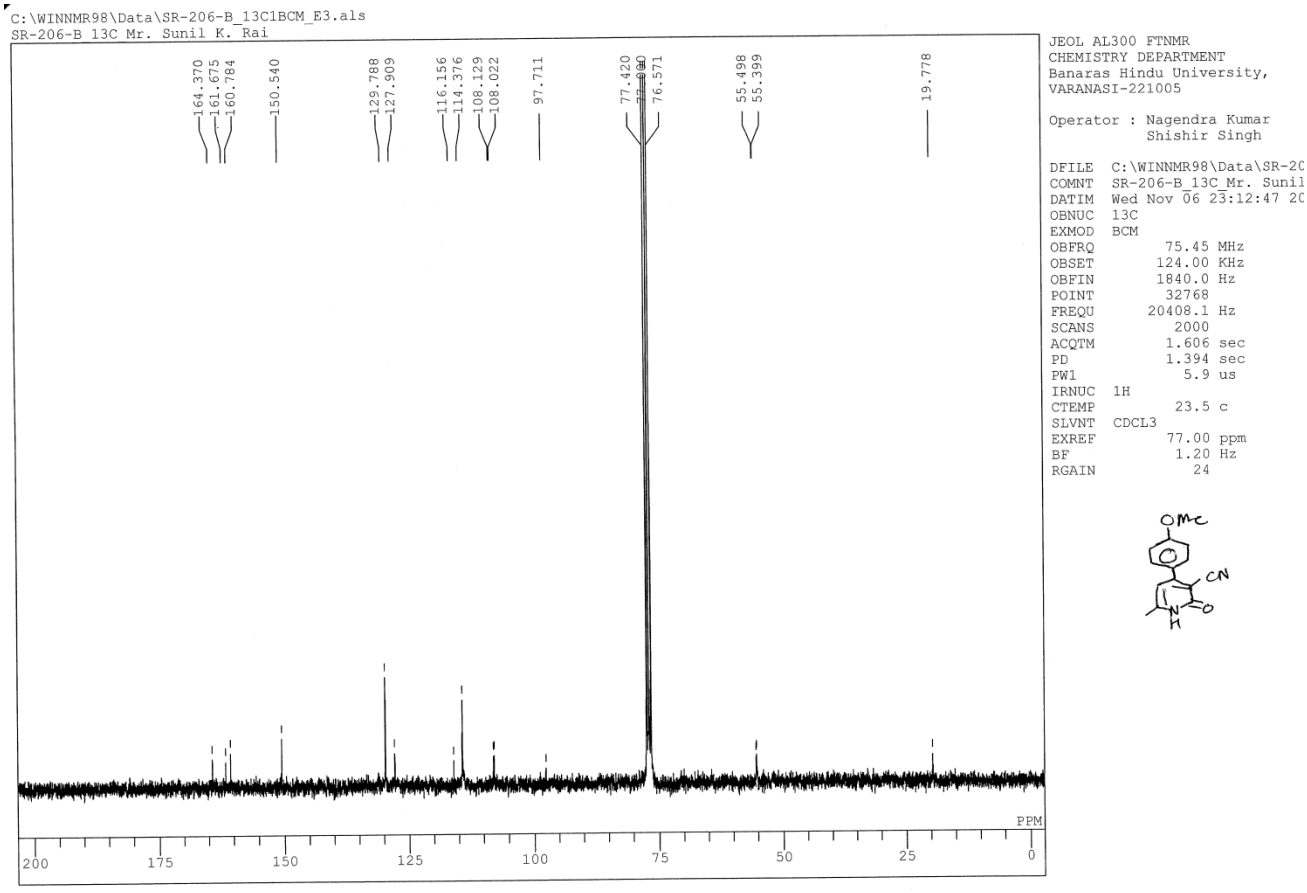
Compound (4a): ^{1}H NMR



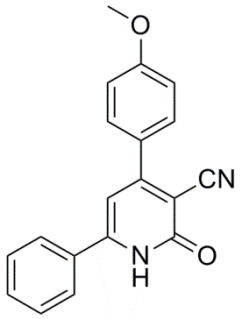


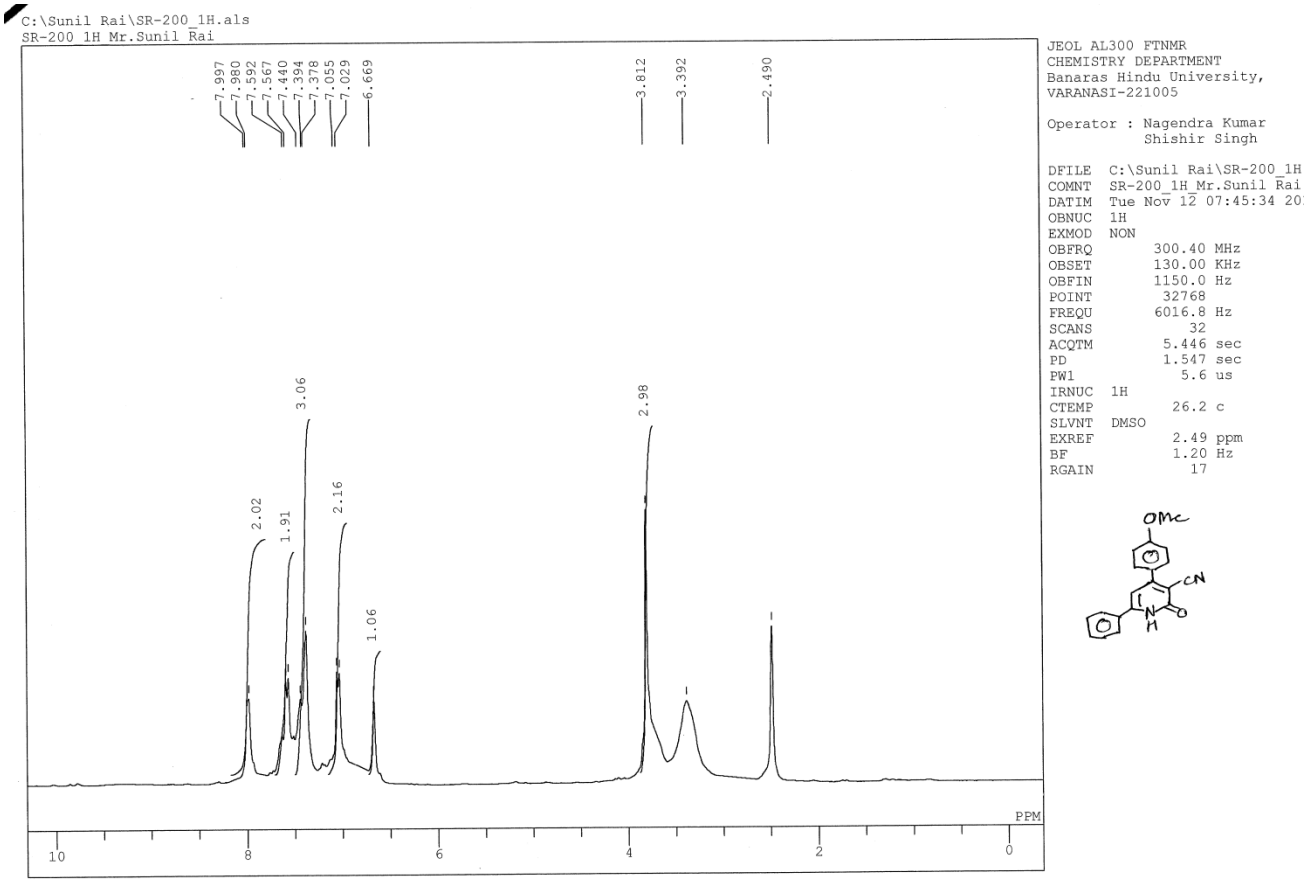
Compound (4a): ^{13}C NMR



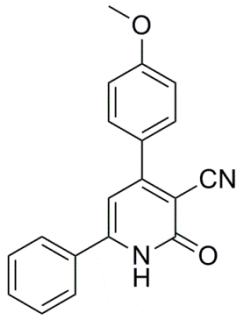


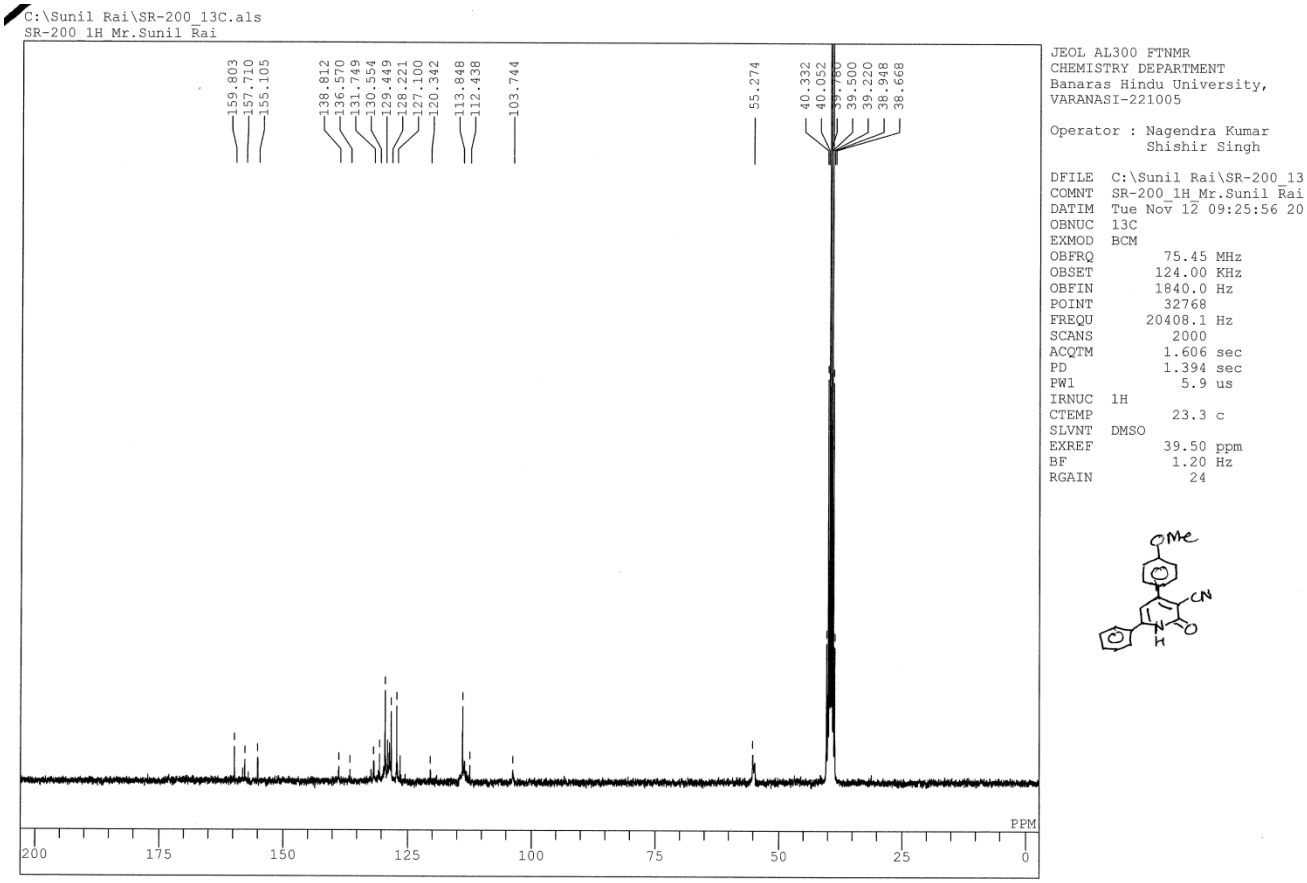
Compound (4b): ^{1}H NMR



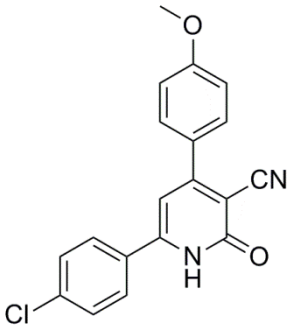


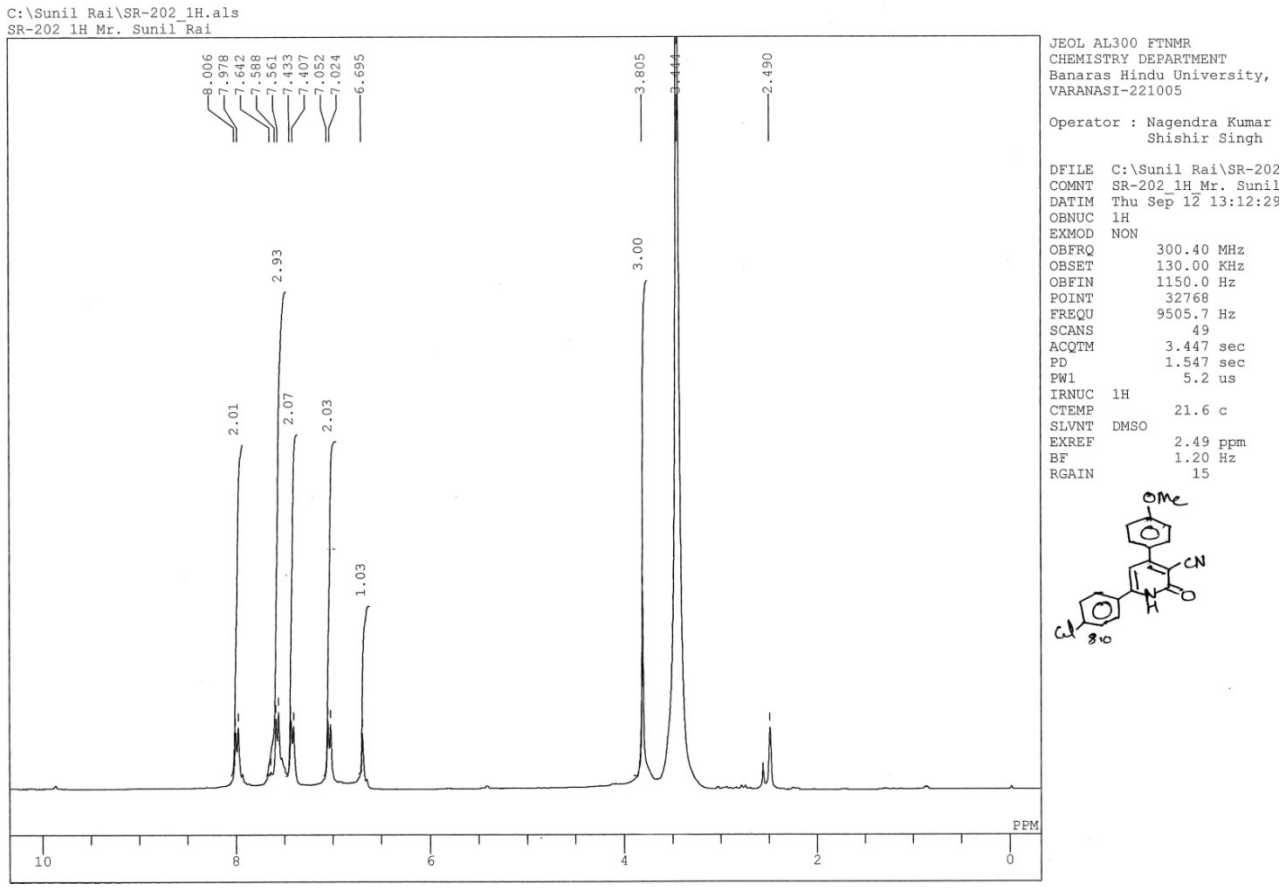
Compound (4b): ^{13}C NMR



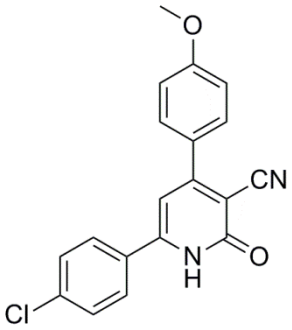


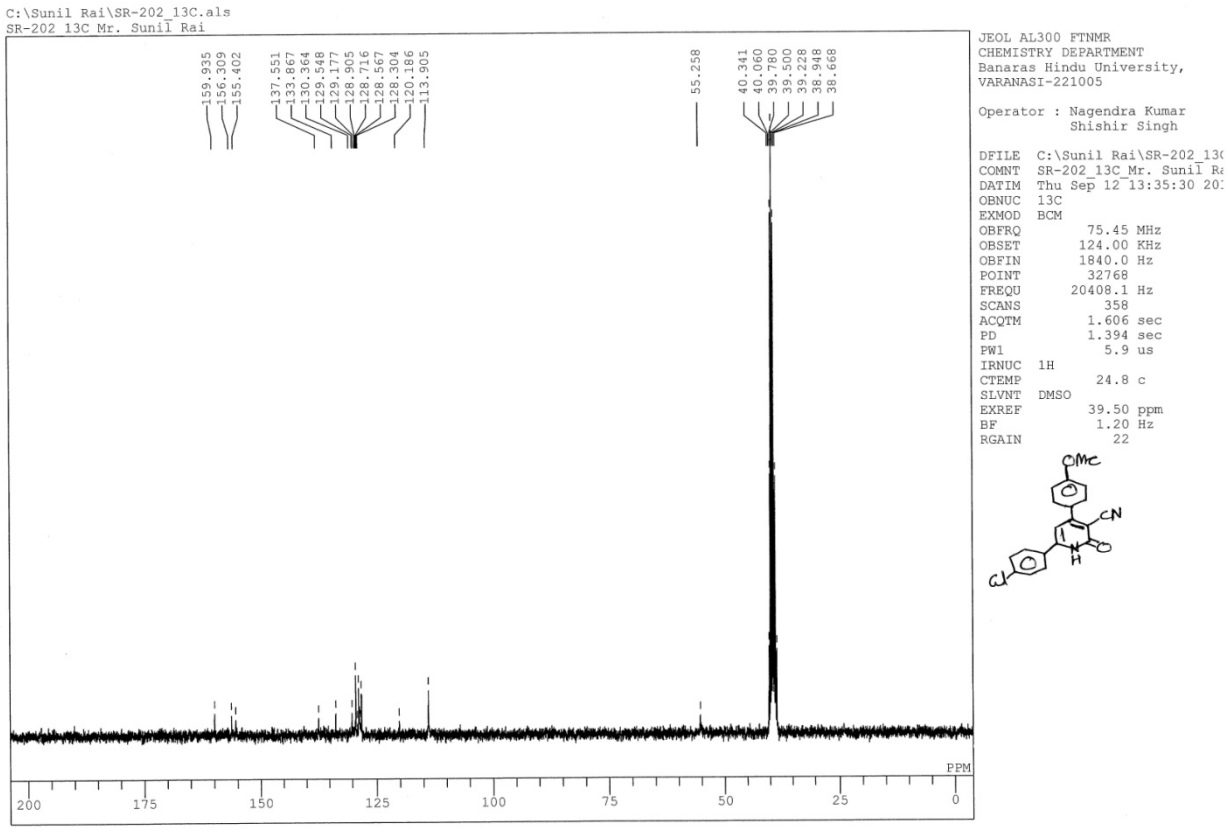
Compound (4c): ^{1}H NMR



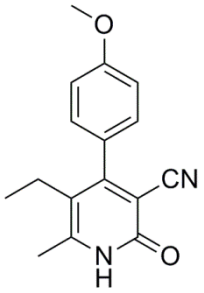


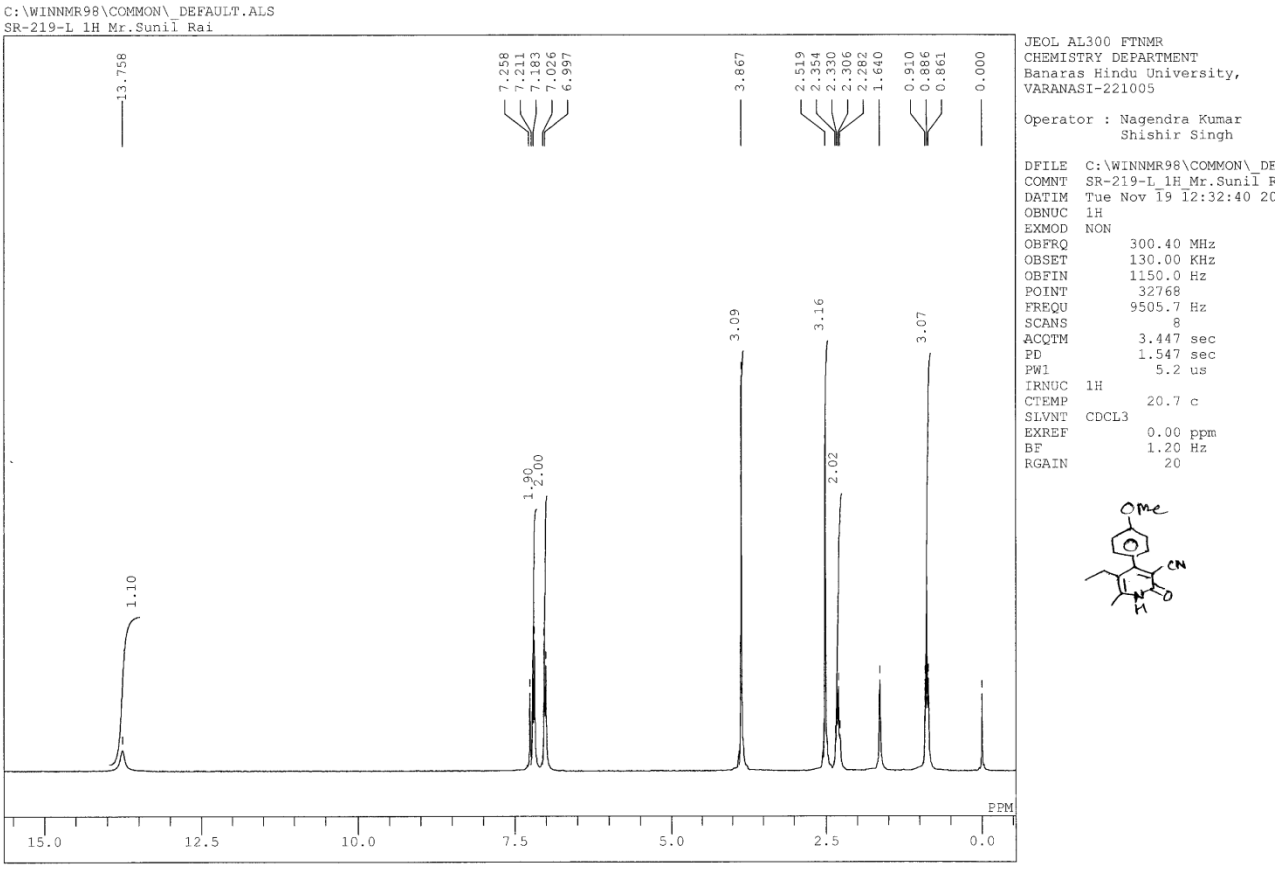
Compound (4c): ^{13}C NMR



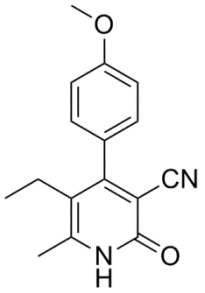


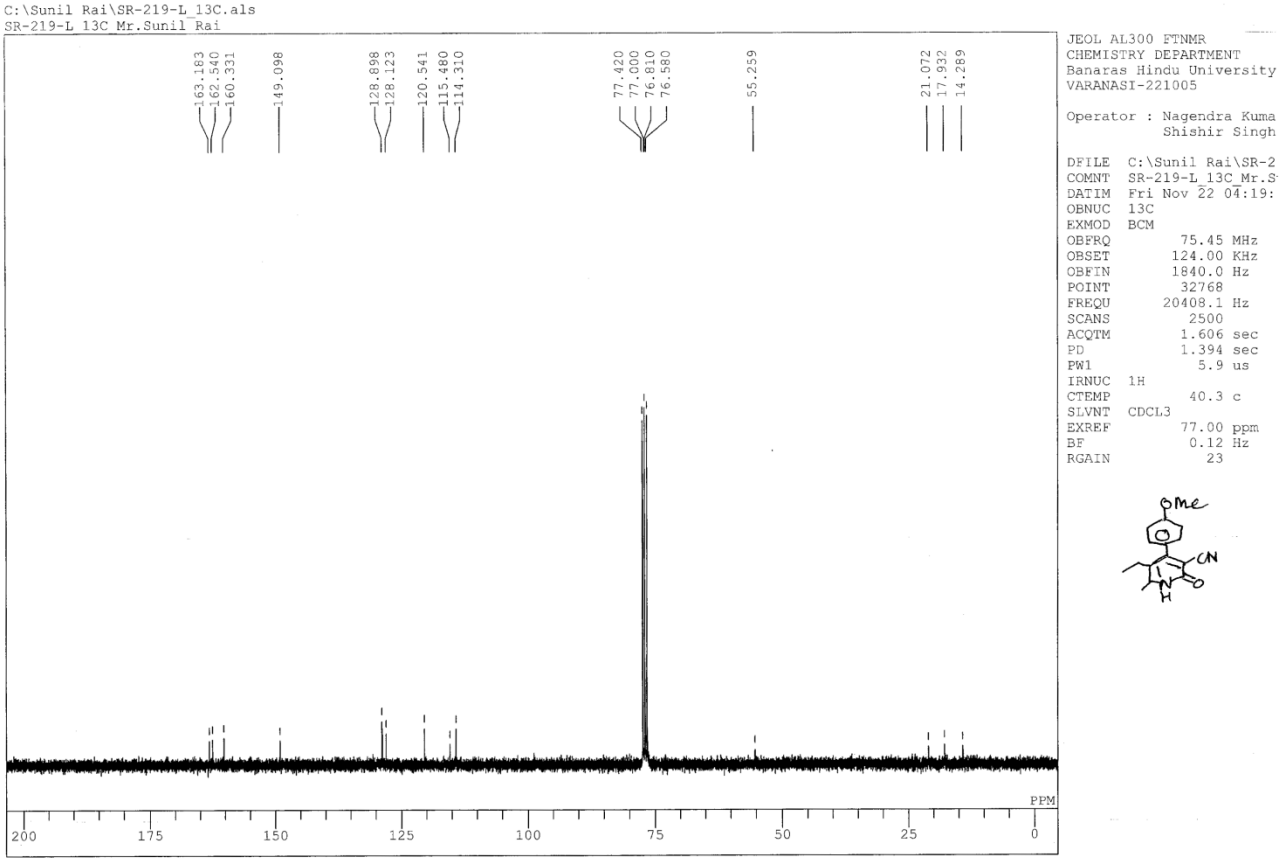
Compound (4d): ^{1}H NMR



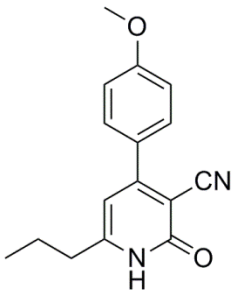


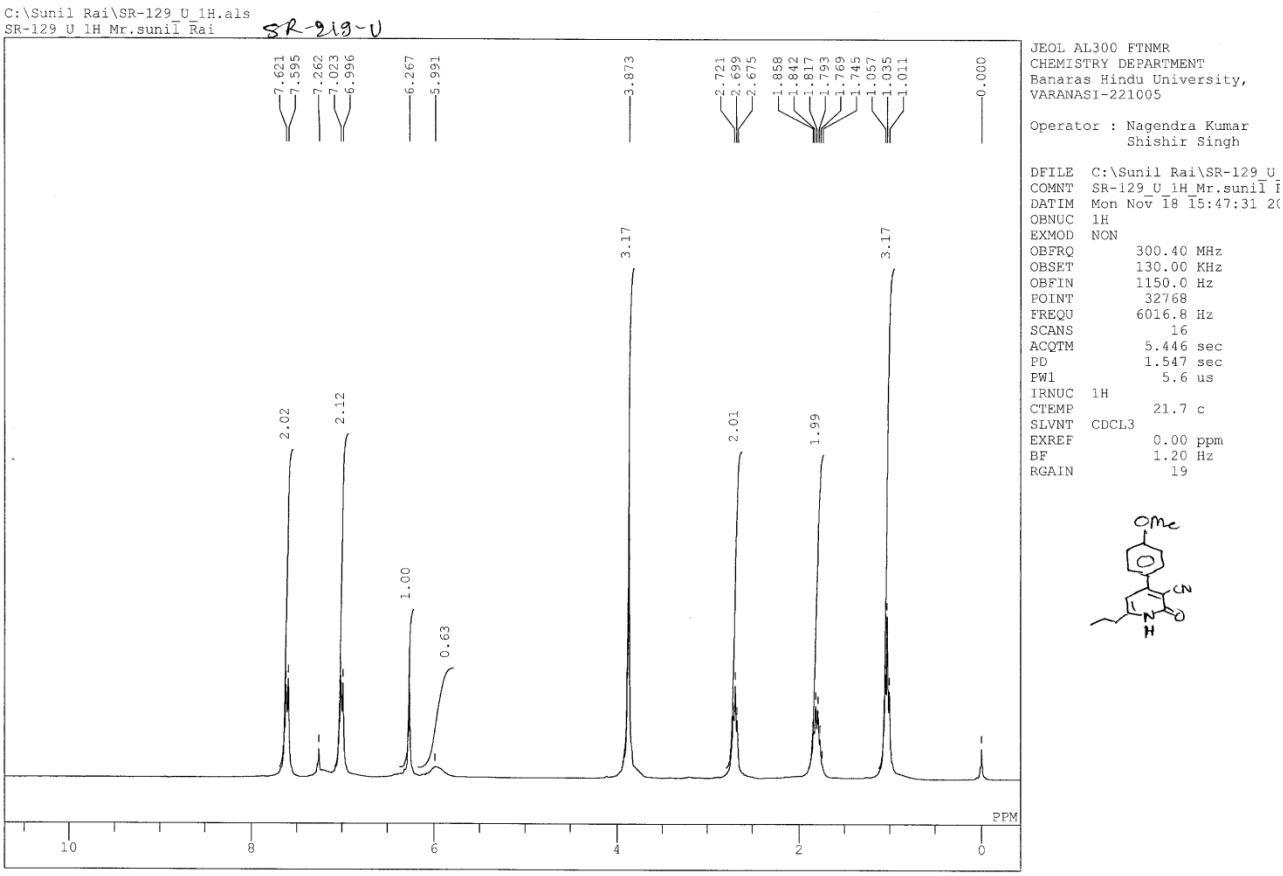
Compound (4d): ^{13}C NMR



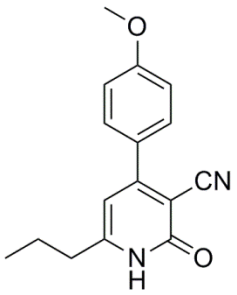


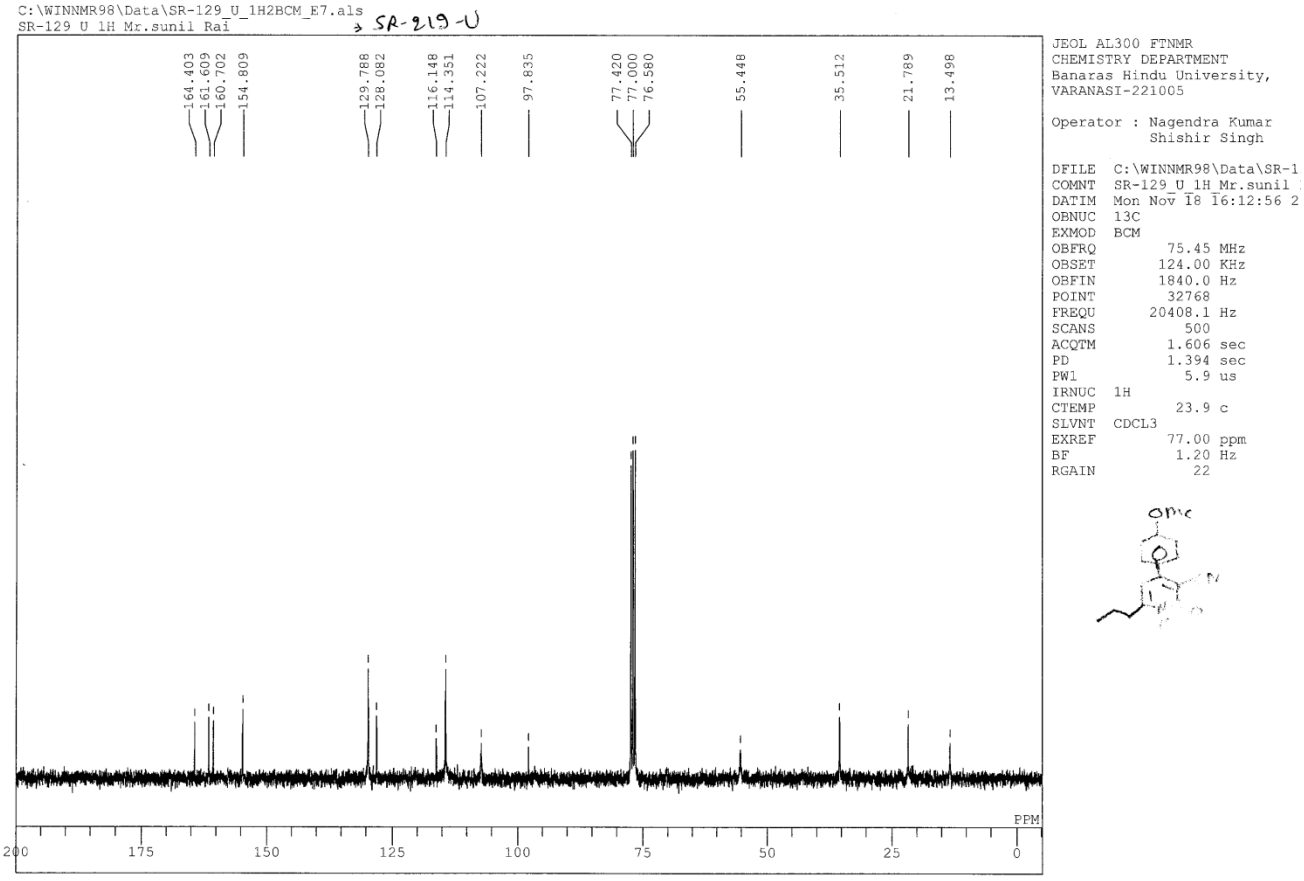
Compound (4e): ^{1}H NMR



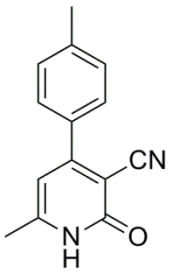


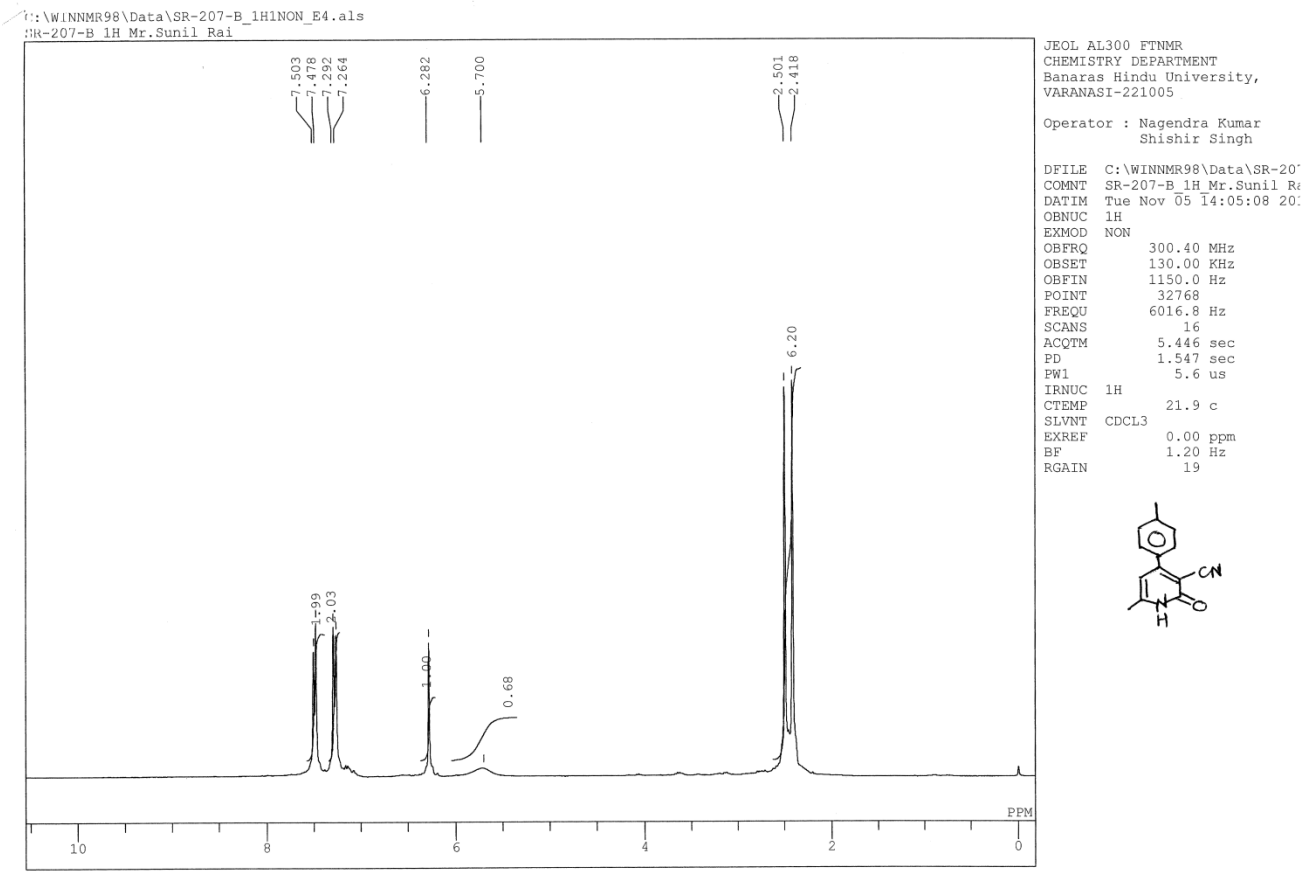
Compound (4e): ^{13}C NMR



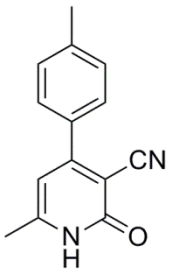


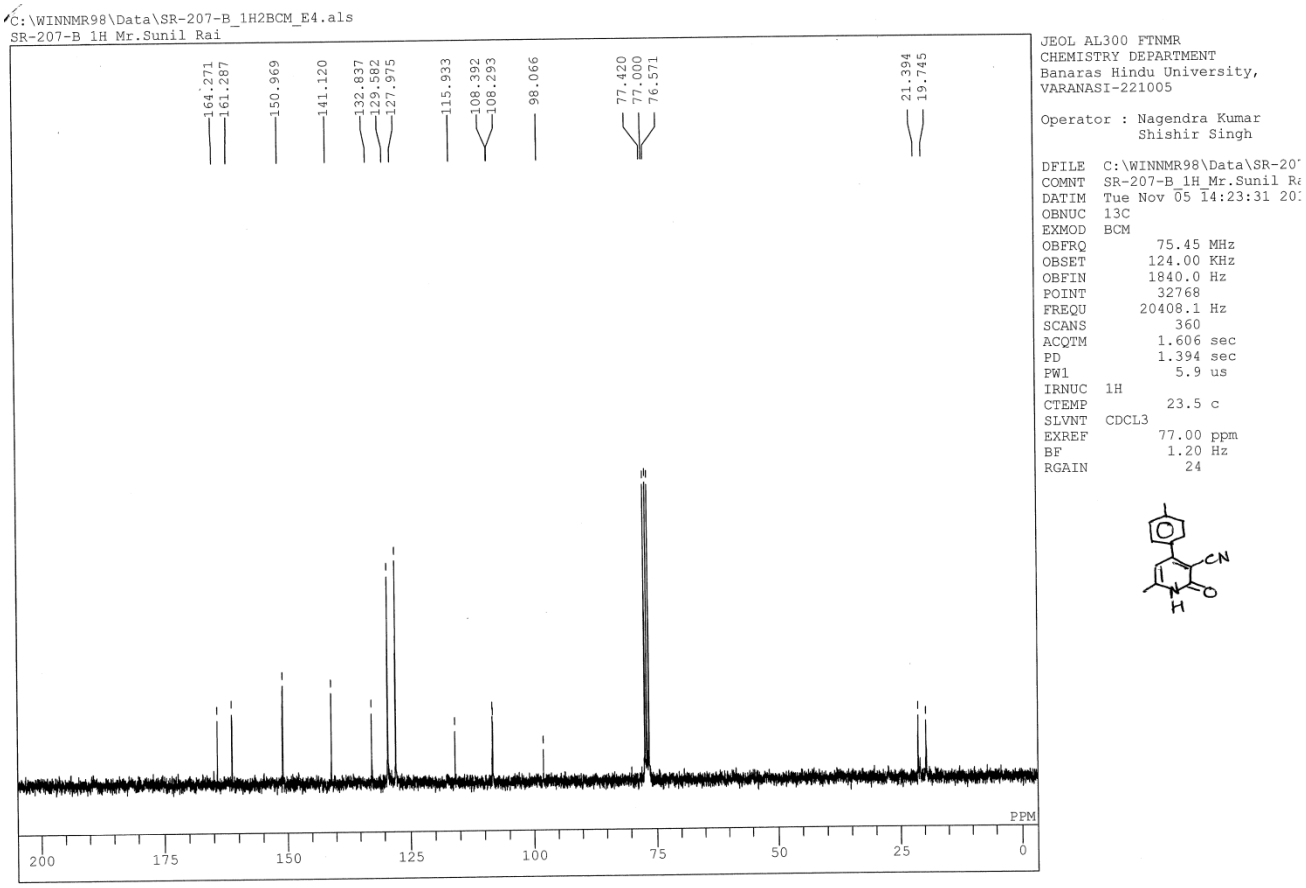
Compound (5a): ^{1}H NMR



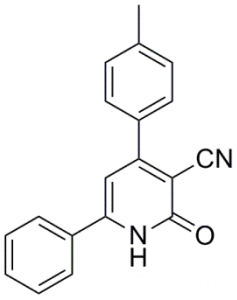


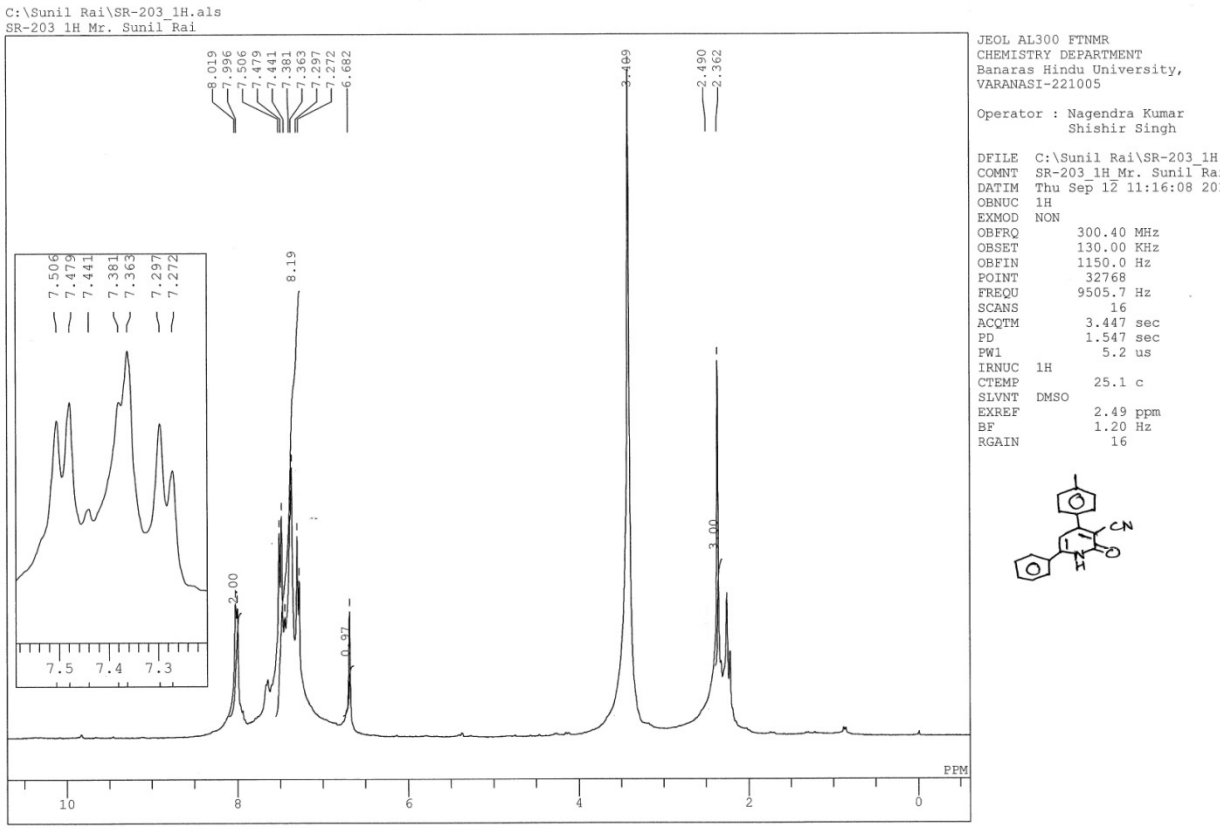
Compound (5a): ^{13}C NMR



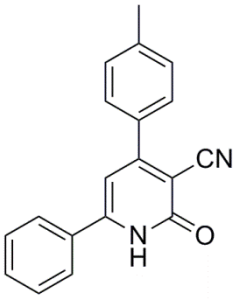


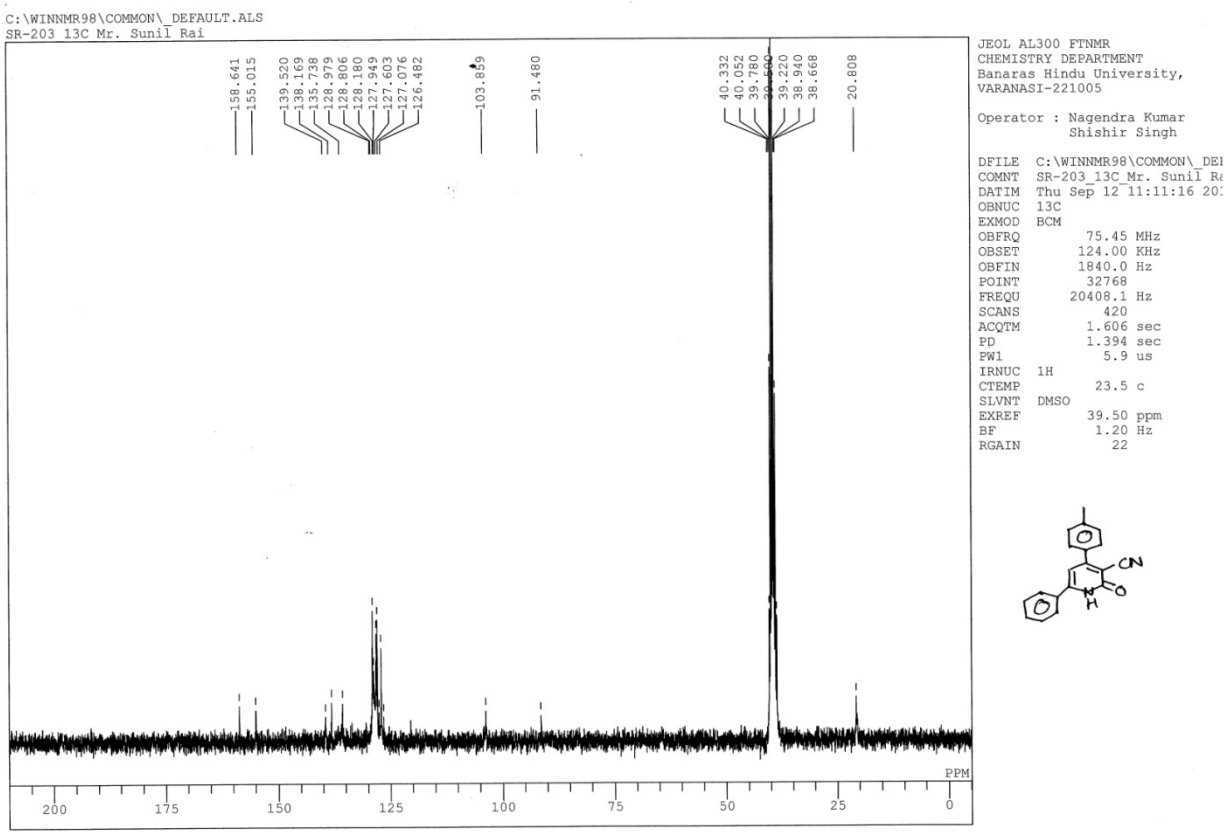
Compound (5b): ^{1}H NMR



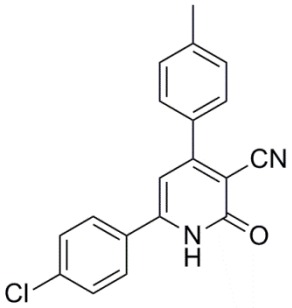


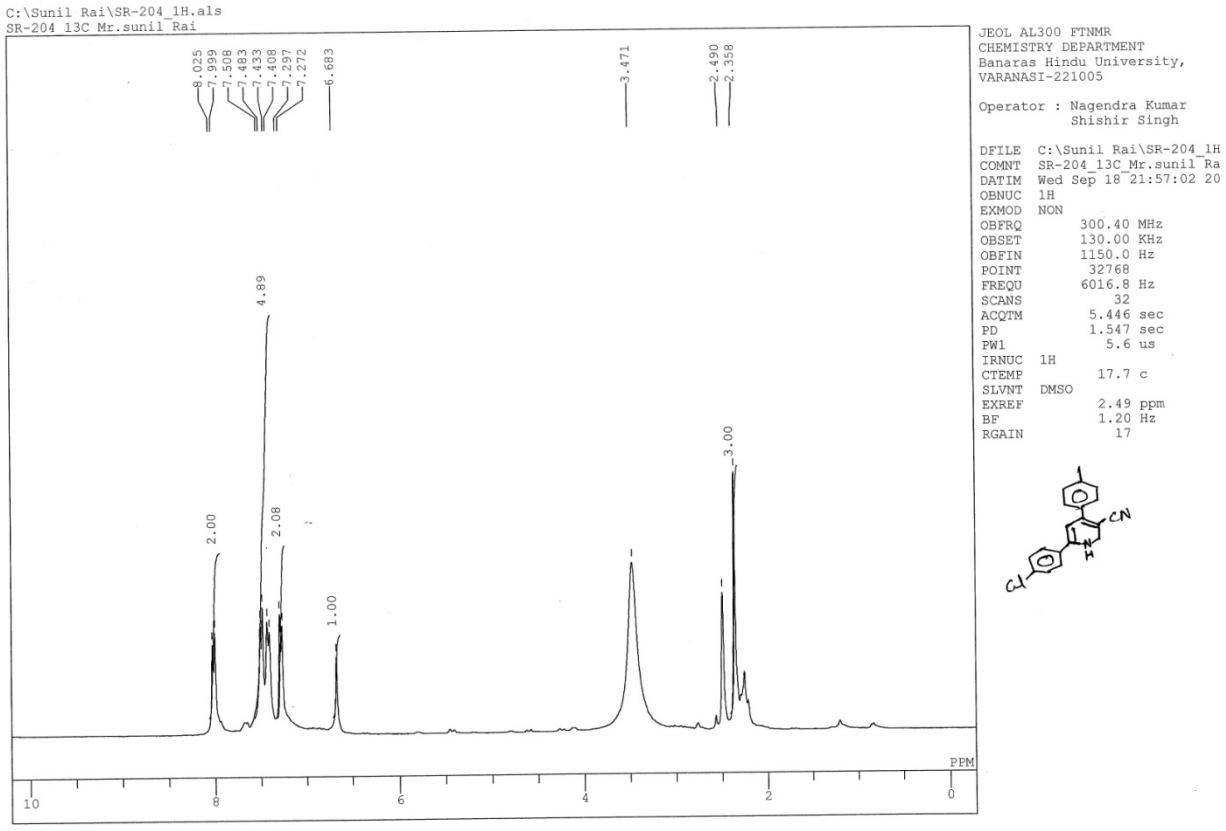
Compound (5b): ^{13}C NMR



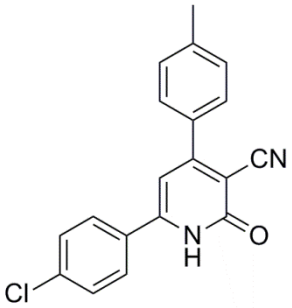


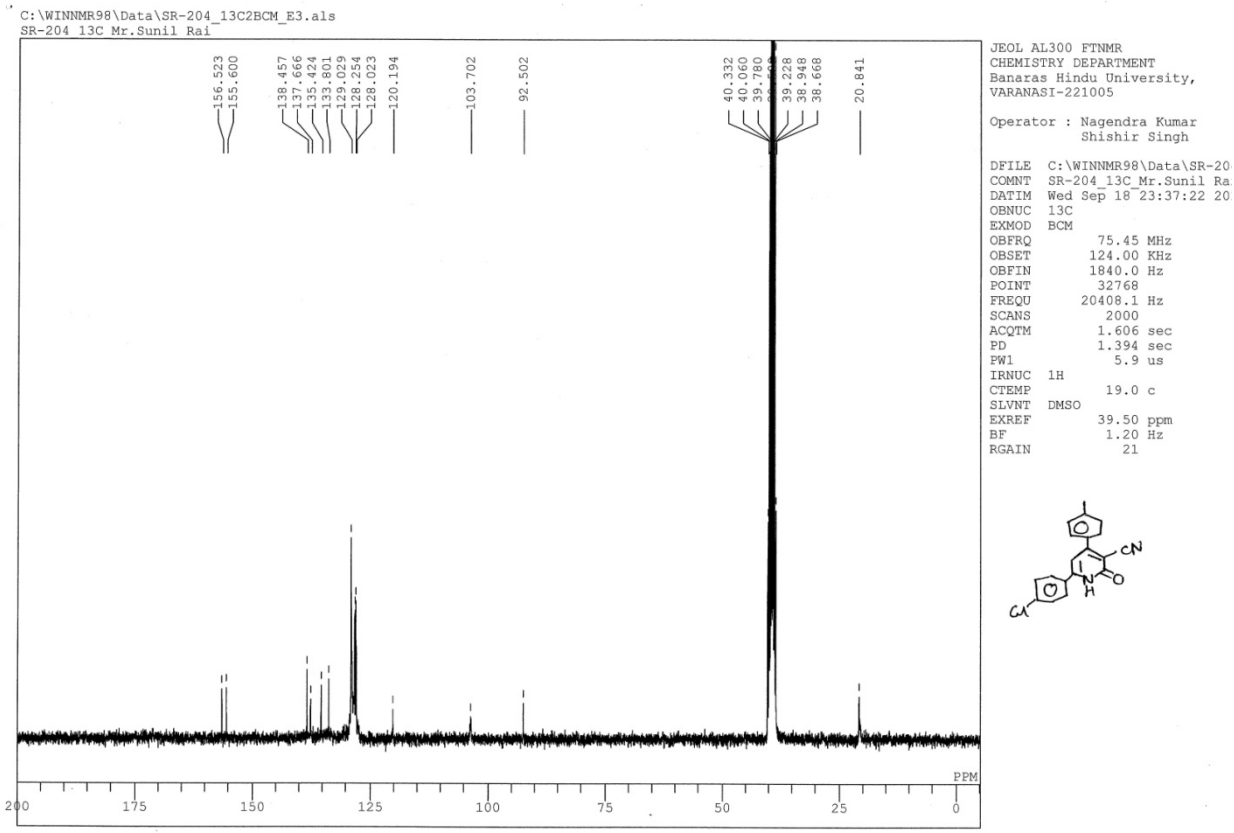
Compound (5c): ^{1}H NMR



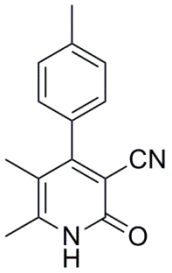


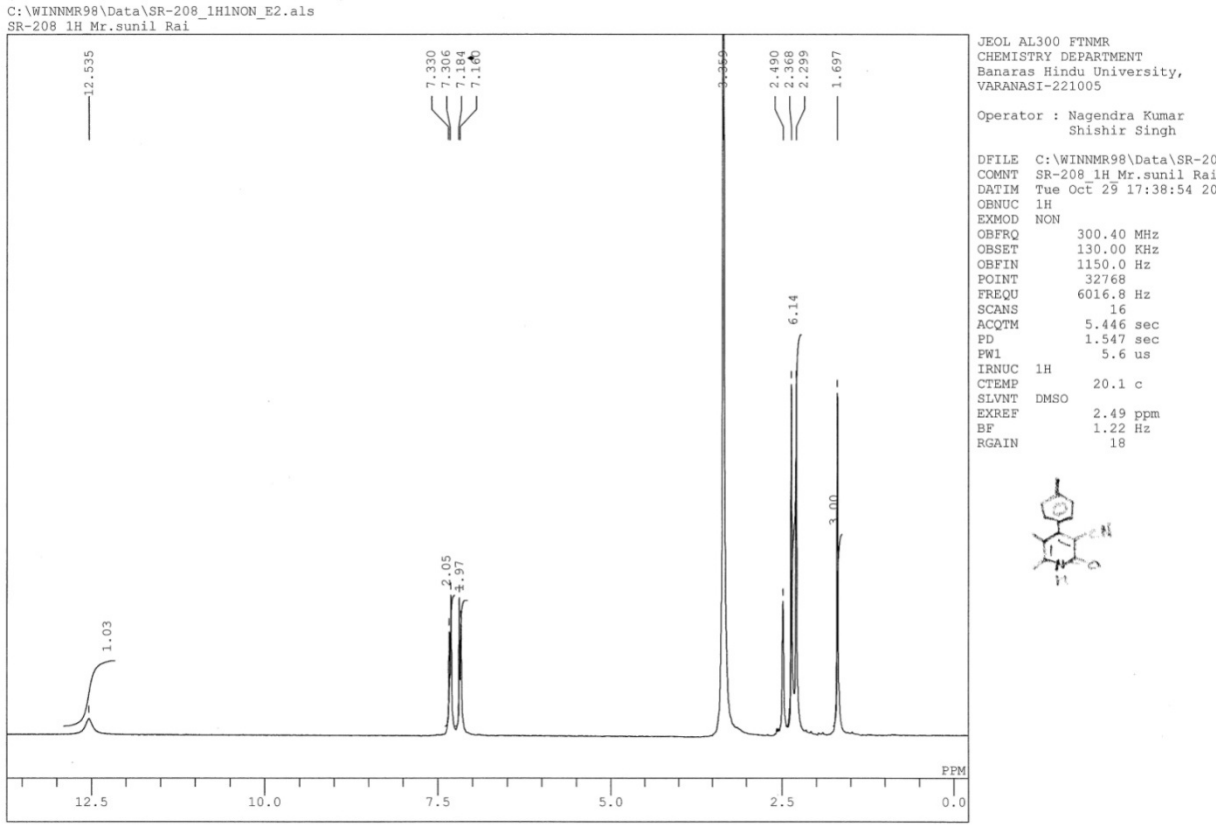
Compound (5c):^{13}C NMR



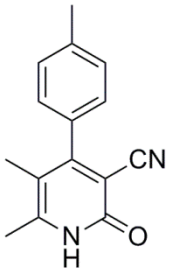


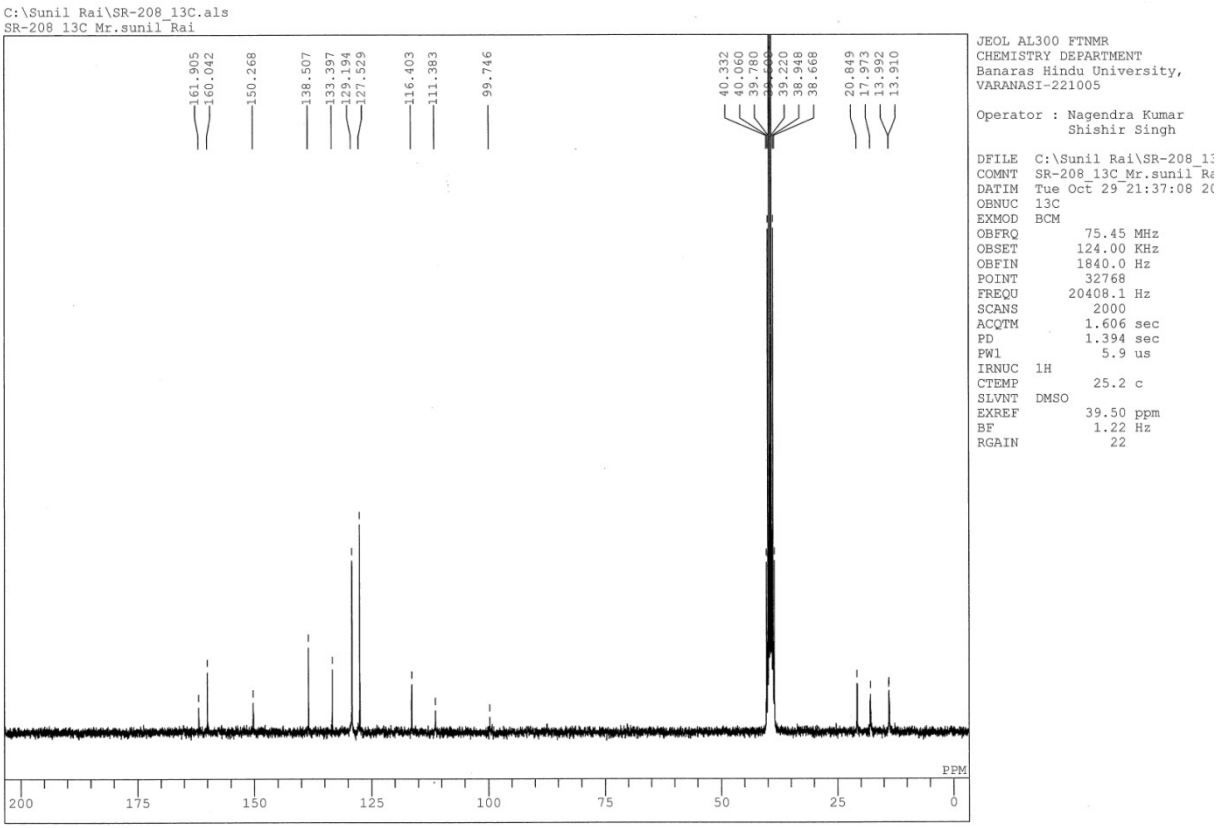
Compound (5d): ^{1}H NMR



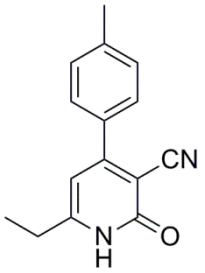


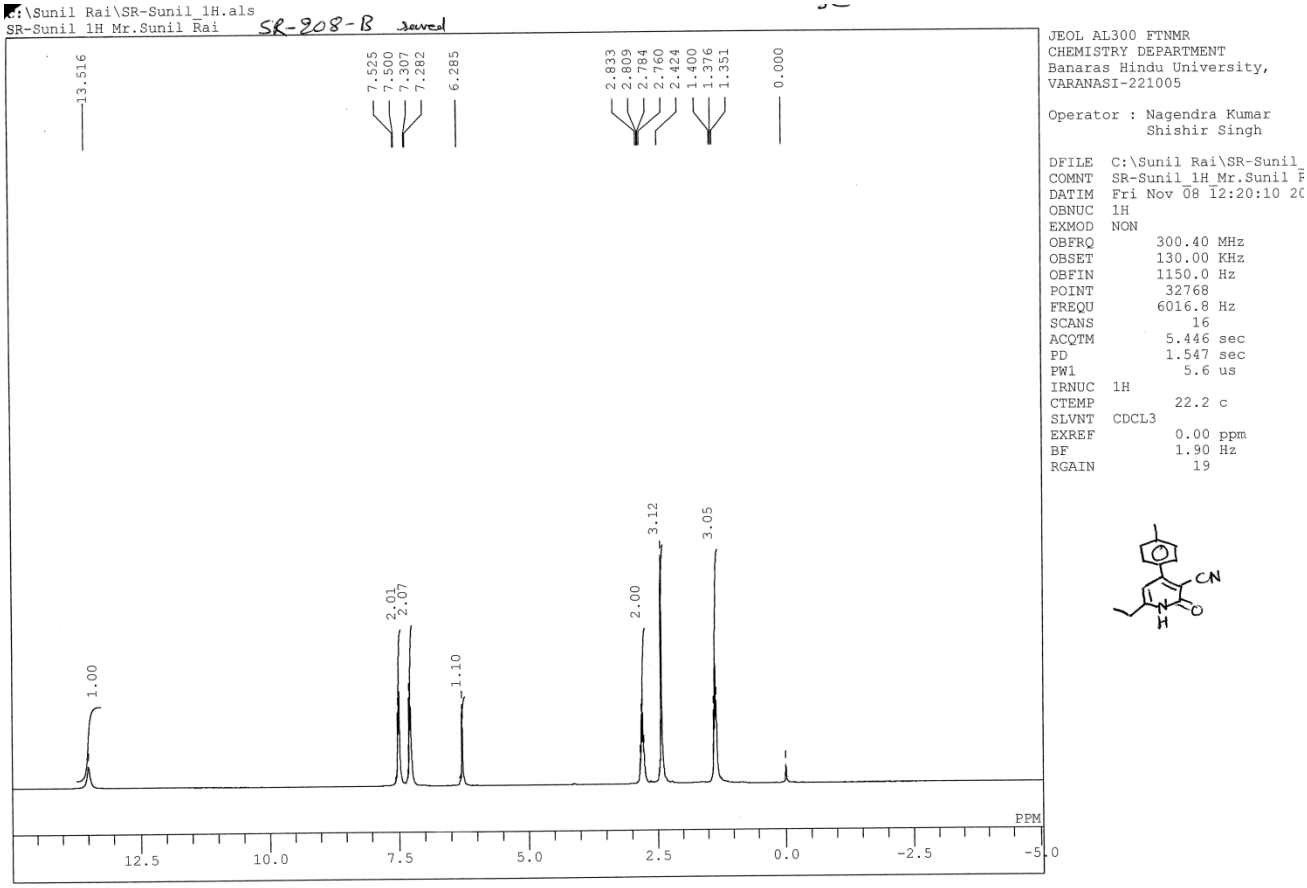
Compound (5d): ^{13}C NMR



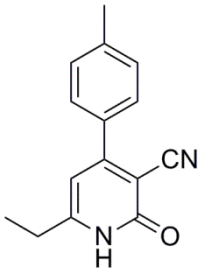


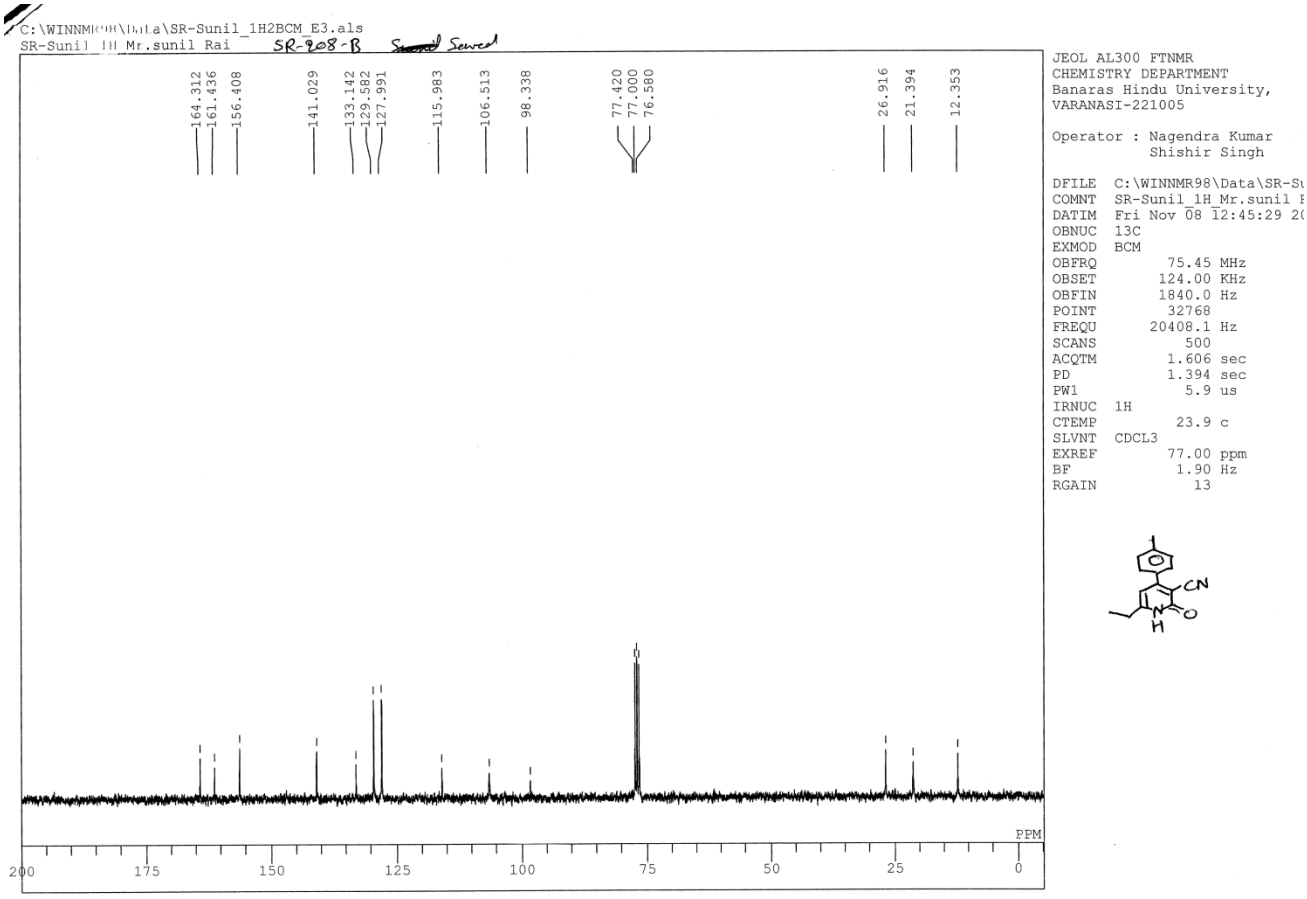
Compound (5e): ^{1}H NMR



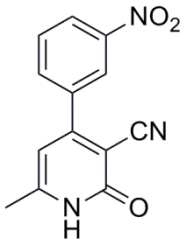


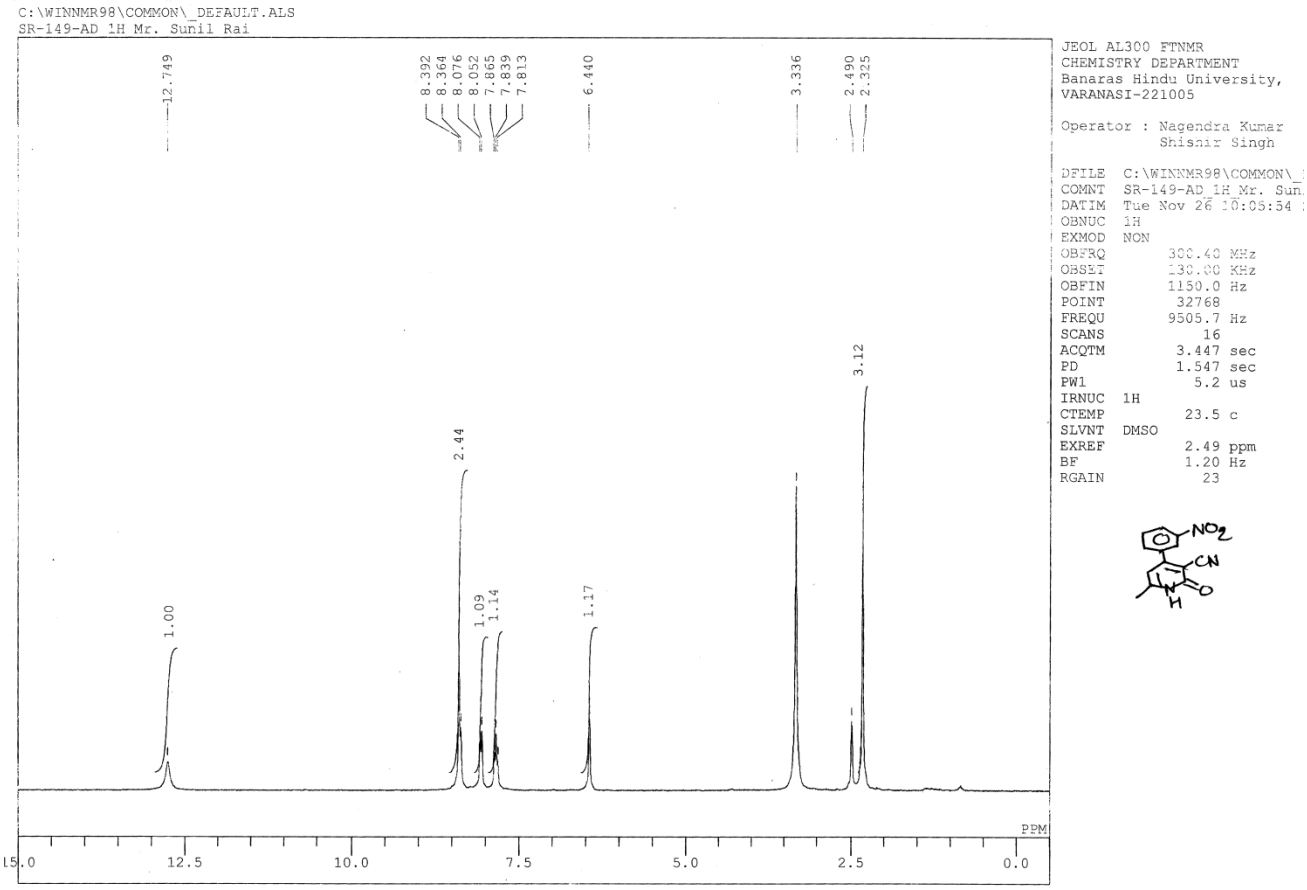
Compound (5e): 13C NMR



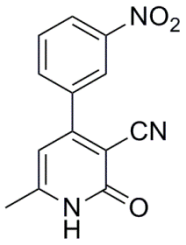


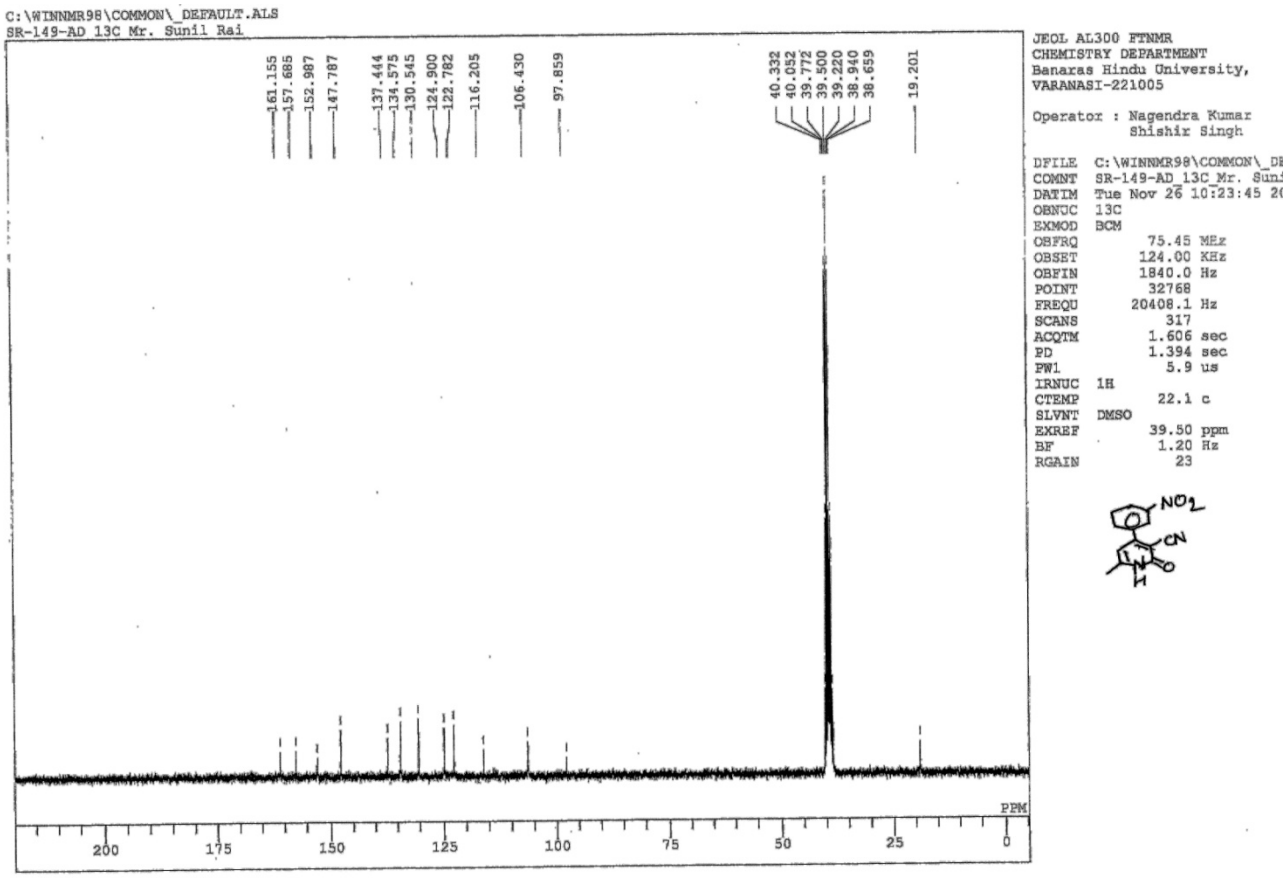
Compound (6a): ^{1}H NMR



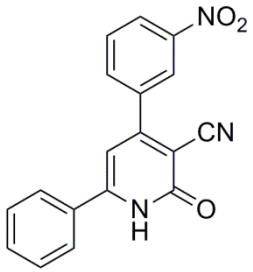


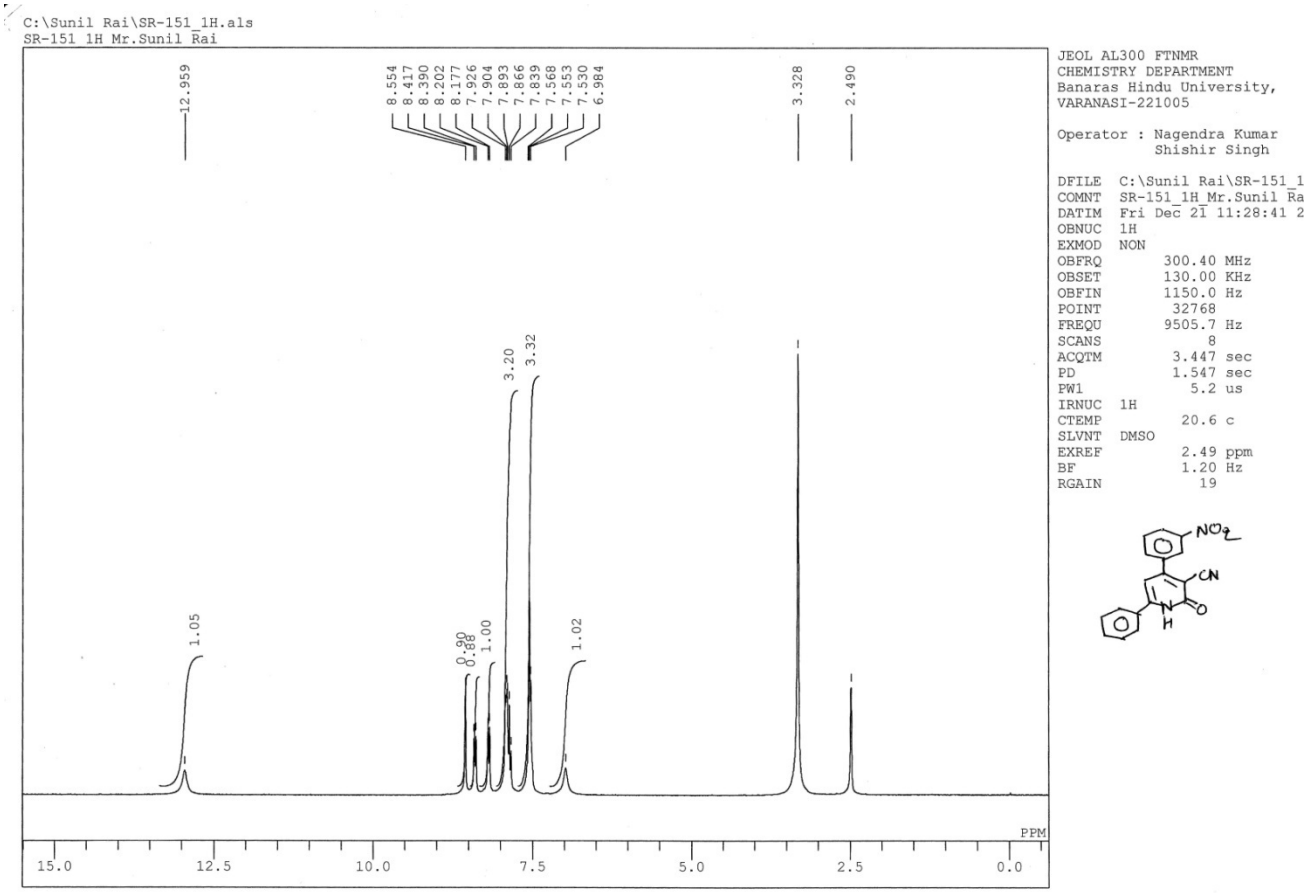
Compound (6a): ^{13}C NMR



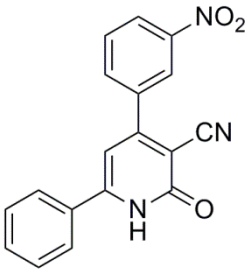


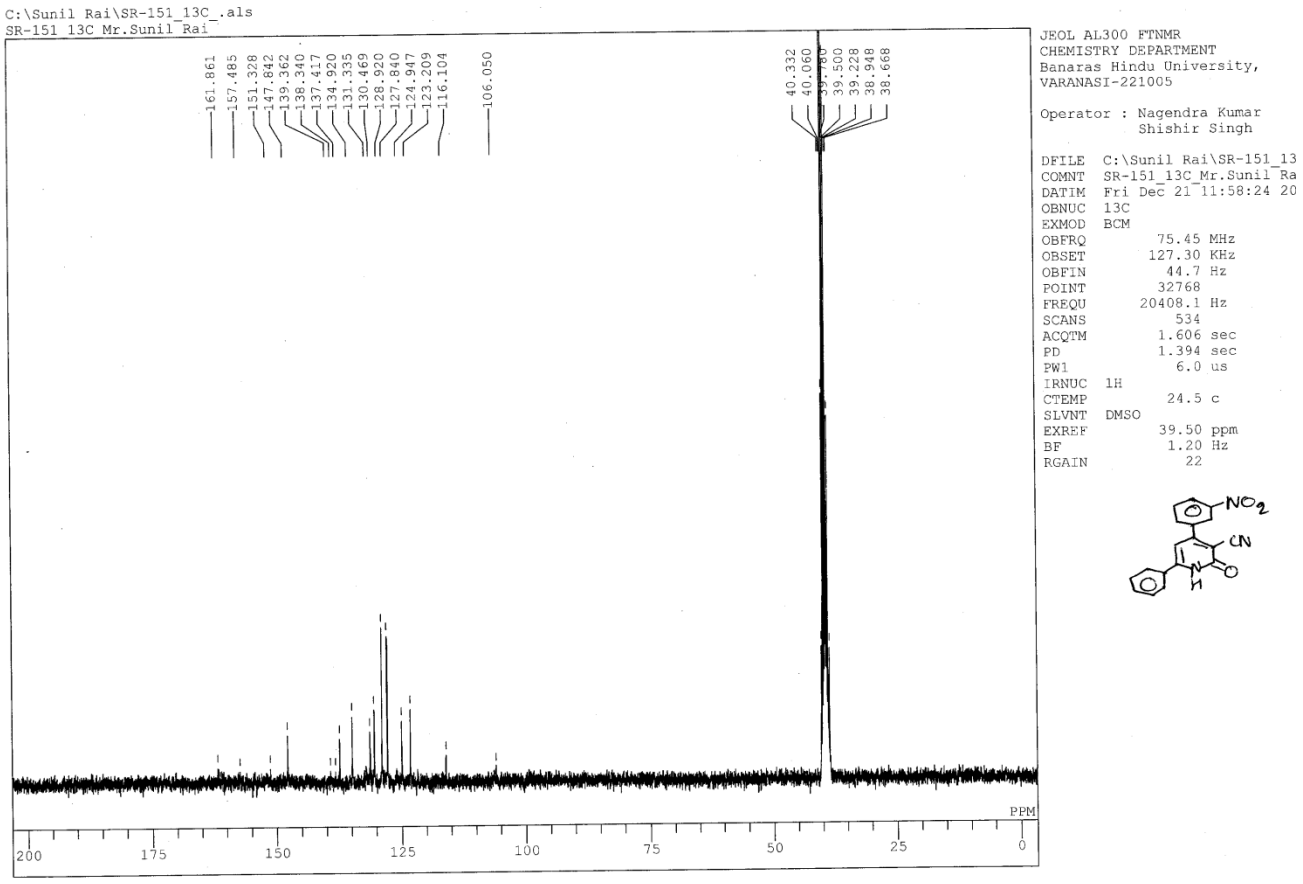
Compound (6b): ^{1}H NMR



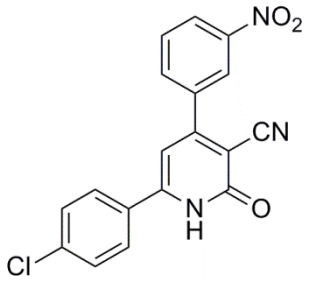


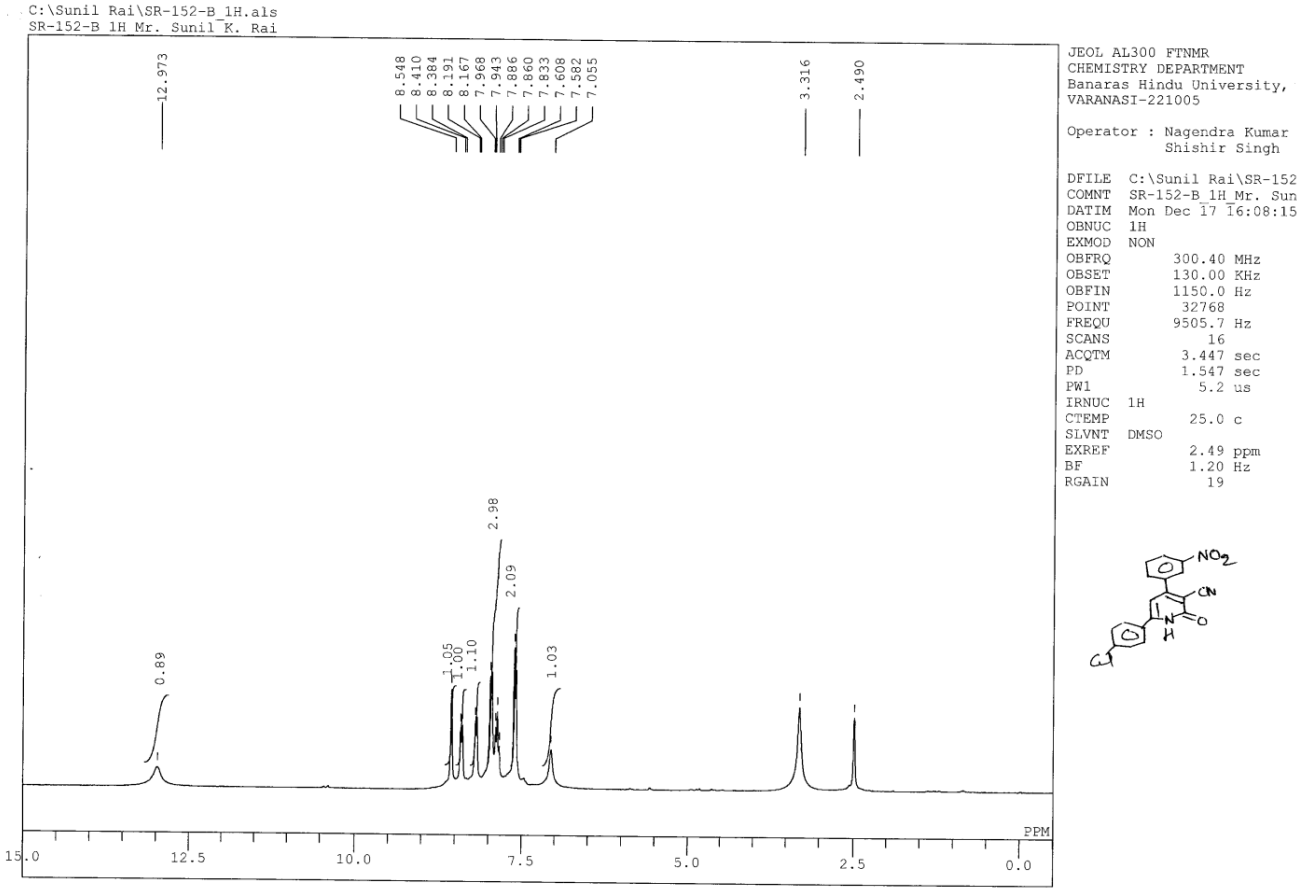
Compound (6b): 13C NMR



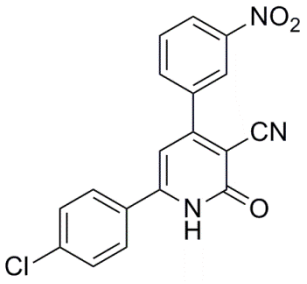


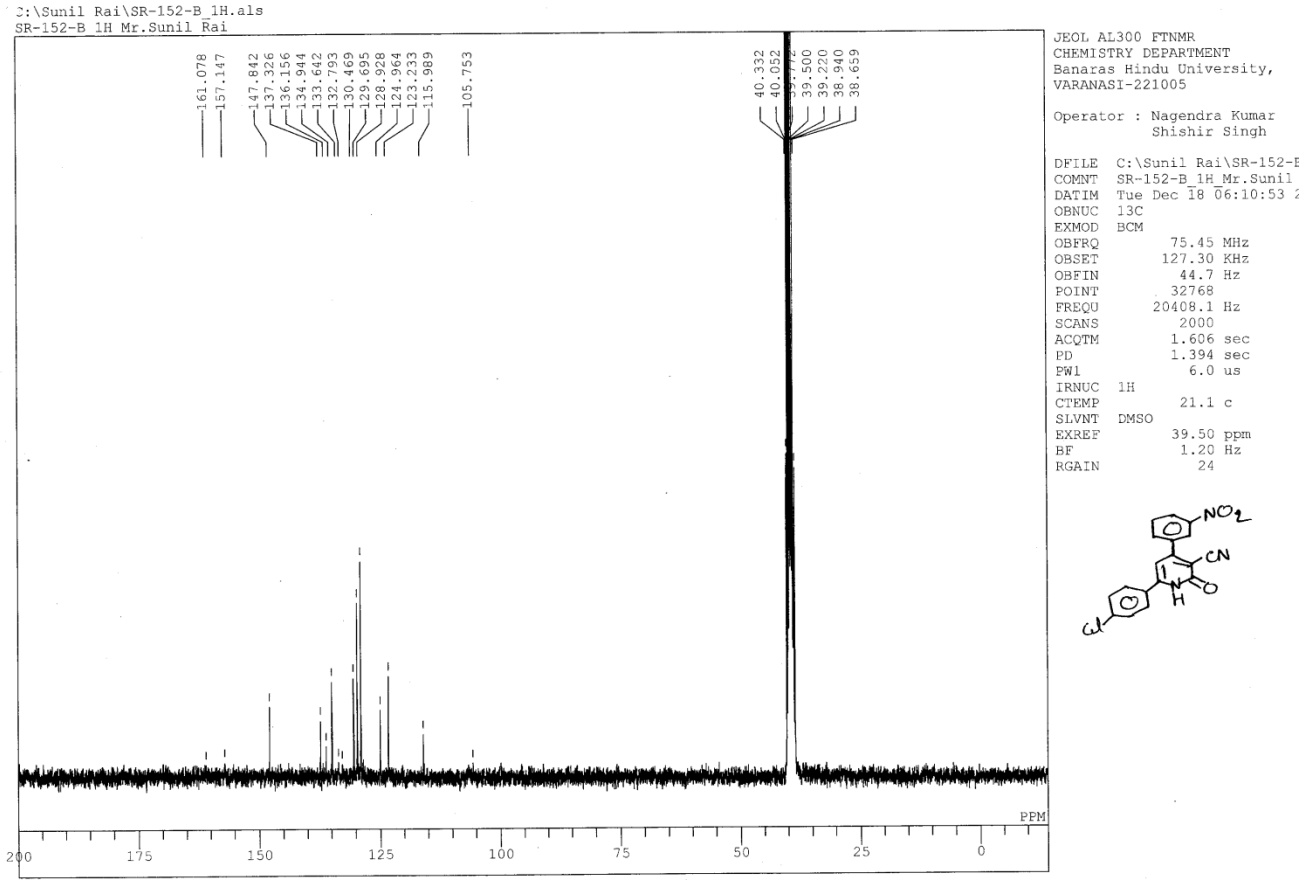
Compound (6c): ^{1}H NMR



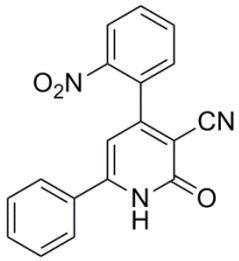


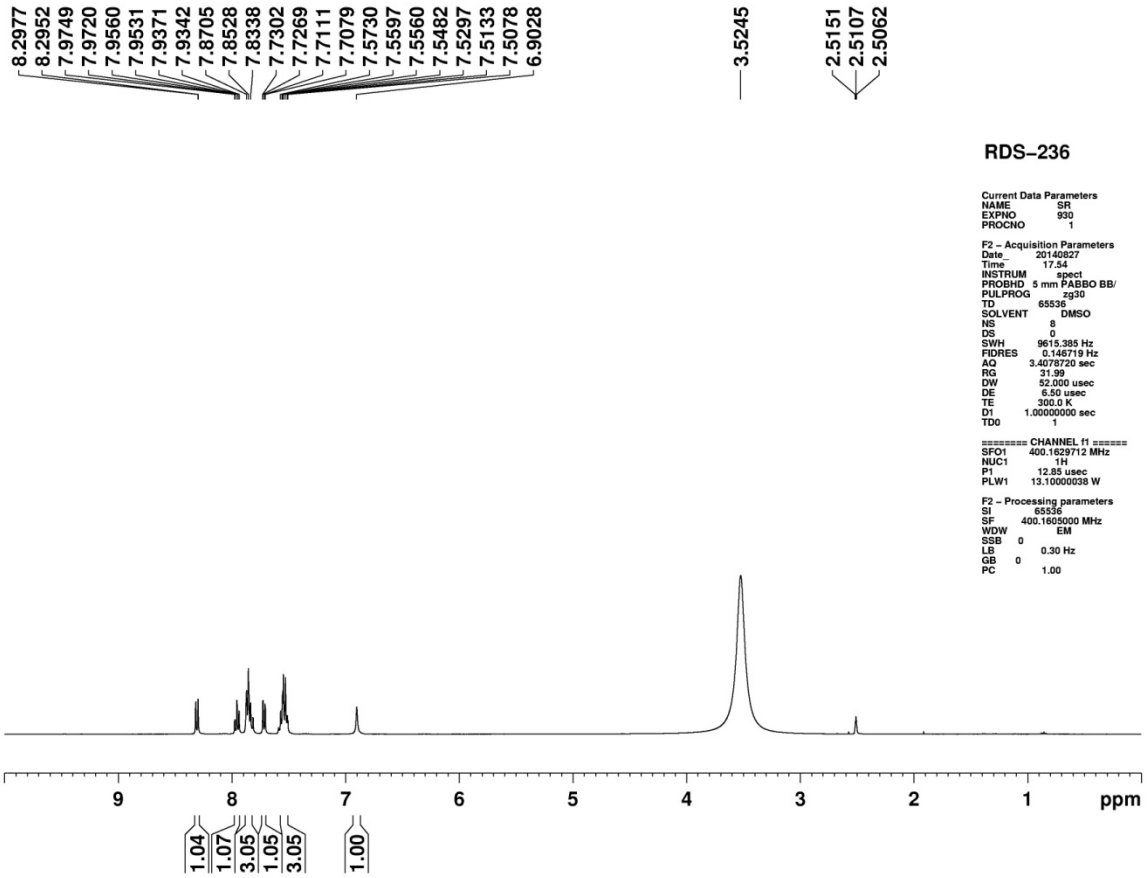
Compound (6c): ^{13}C NMR



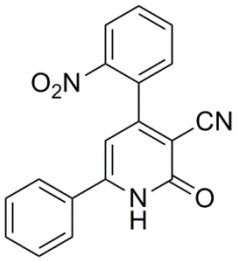


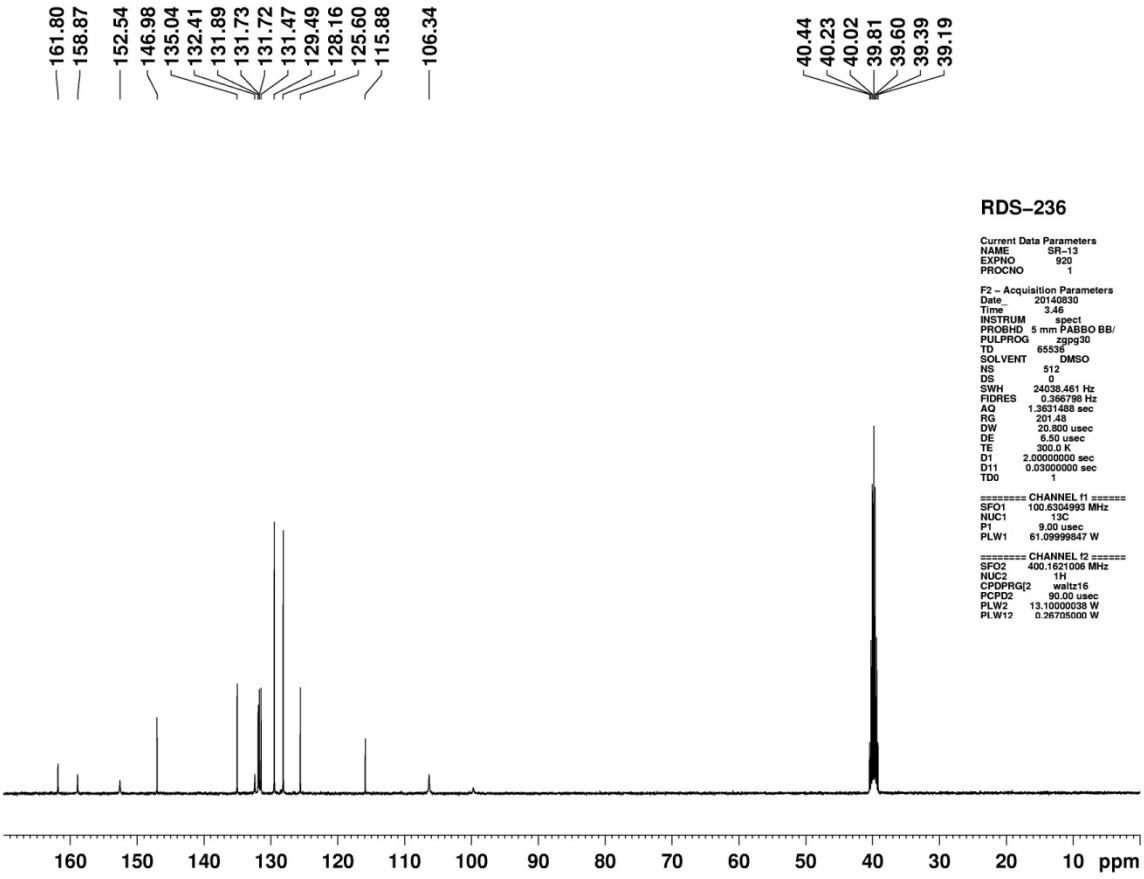
Compound (7a): ^{1}H NMR



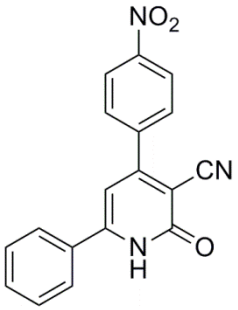


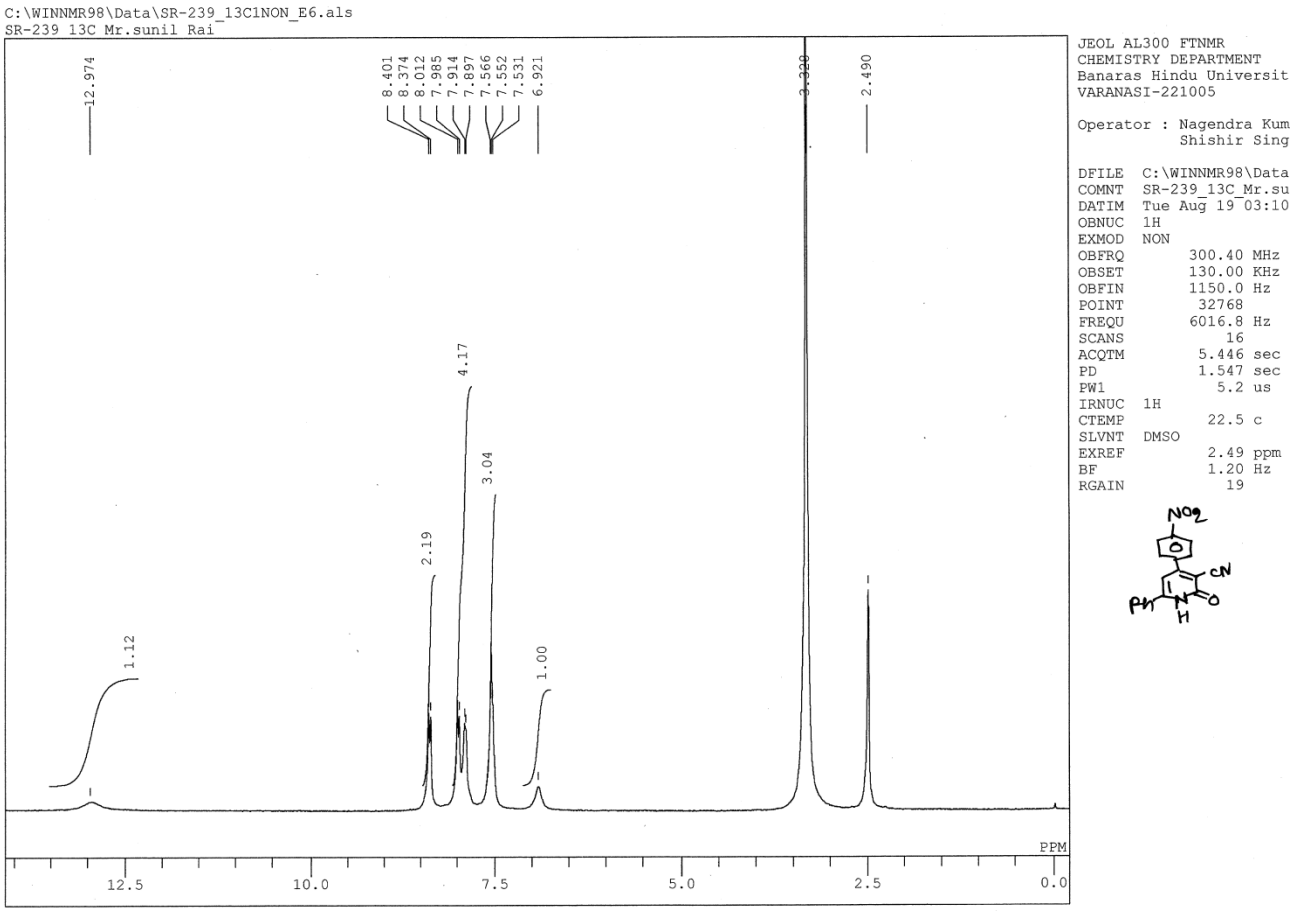
Compound (7a): ^{13}C NMR



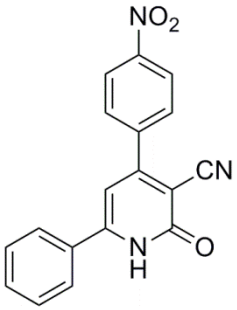


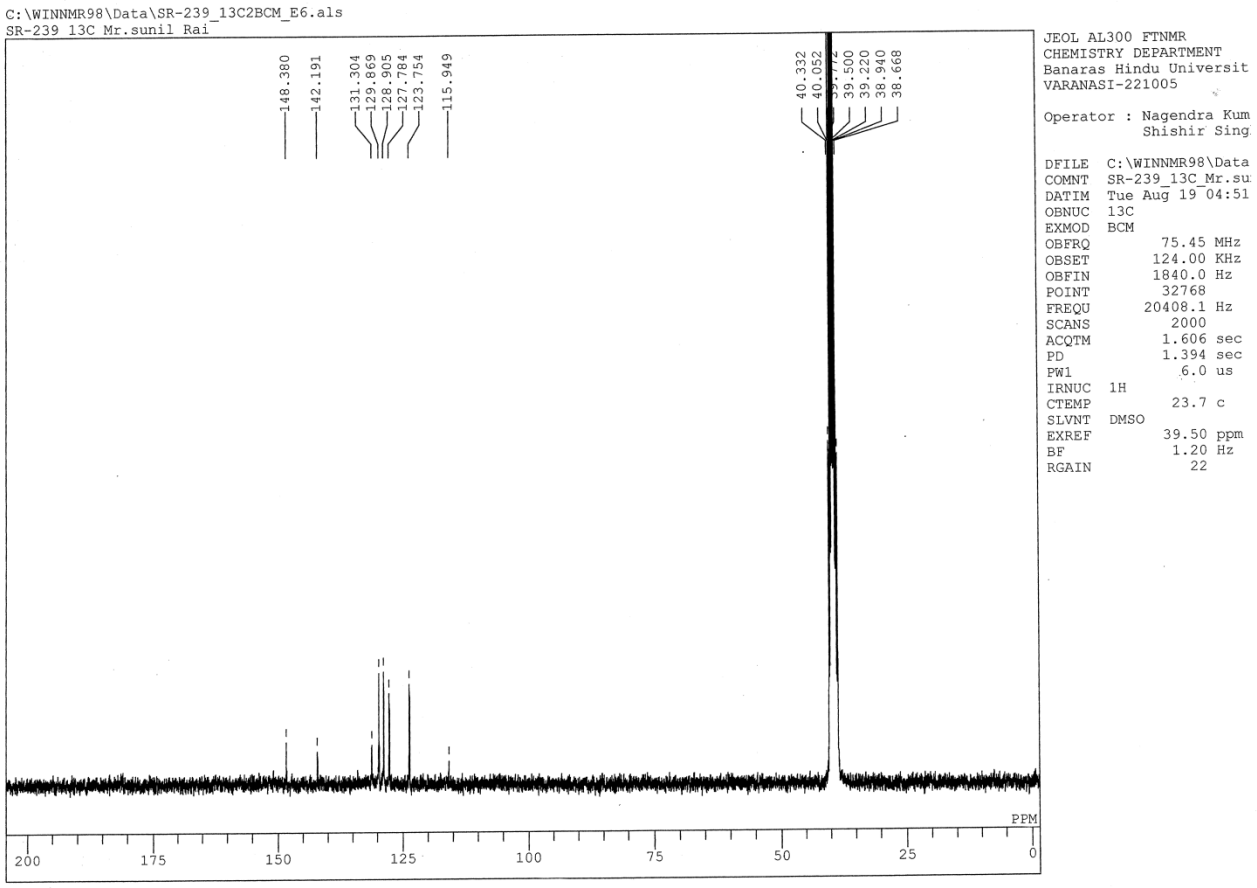
Compound (8a): ^{1}H NMR





Compound (8a): ^{13}C NMR





3. Single Crystal X-ray data:

The X-ray diffraction data of compounds **1d**, **1e**, **1g** and **2d** was collected on Bruker SMART APEX CCD area detector diffractometer. The structure was solved and refined by using SHELXS program.[1] Molecular graphics were designed by using Mercury version-3.2.[2]

Table S1. Crystal data and structure refinement parameters for compound **1d.**

compound name	*5,6-dimethyl-2-oxo-4-phenyl-1,2-dihydropyridine-3-carbonitrile*
CCDC Number	981162
empirical Formula	$C_{14}H_{12}N_2O$
formula weight	224.26
temperature	293 K
wavelength	0.71073 Å
crystal system	Triclinic
space group	P-1
unit cell dimensions	a = 7.4066 (7) Å, α = 116.399 (13) ° b = 9.4392 (12) Å, β = 97.846 (9) ° c = 9.7203 (13) Å, γ = 90.409 (9) °
cell volume	601.24 (12) $Å^3$
$D_{calculated}$	1.239 mg/ m^3
F(000)	236
crystal size	0.40 × 0.38 × 0.36 mm
Z	2
R factor (%)	6.31
theta range	3.4 to 32.6º
limiting Indices	-10 ≤ h ≤ 10, -14 ≤ k ≤ 14, -14 ≤ l ≤ 14
μ(Mo KR)/mm-1	0.08
R_{int}	0.021
measured reflections	6568
independent refln	3913
reflections with $I > 2\sigma(I)$	2298
parameters	158
goodness of fit	1.0

$R[F^2 > 2\sigma(F^2)]$	0.063
$wR(F^2)$	0.200

Table S2. Crystal data and structure refinement parameters for compound **1e.**

compound name	*(6-ethyl-2-oxo-4-phenyl-1,2-dihydropyridine-3-carbonitrile)*
CCDC Number	981163
empirical Formula	$C_{14}H_{12}N_2O$
formula weight	224.26
temperature	293 K
wavelength	0.71073 Å
crystal system	Monoclinic
space group	$P2_1/c$
unit cell dimensions	a = 7.3809 (6) Å, α = 90 ° b = 8.0626 (6) Å, β = 98.378 (6)° c = 19.9265 (12) Å, γ = 90°
cell volume	1173.16 (15) $Å^3$
$D_{calculated}$	1.270 mg/ m^3
F(000)	472
crystal size	0.45 × 0.43 × 0.41mm
Z	4
R factor (%)	6.83
theta range	3.2 to 29.0º
limiting Indices	$-10 \leq h \leq 10$, $-11 \leq k \leq 11$, $-27 \leq l \leq 27$
μ(Mo KR)/mm-1	0.08
R_{int}	0.022
measured reflections	5083
independent refln	2686
reflections with $I > 2\sigma(I)$	1537
parameters	158
goodness of fit	1.02

$R[F^2 > 2\sigma(F^2)]$	0.068
$wR(F^2)$	0.191

Table S3. Crystal data and structure refinement parameters for compound **1g.**

compound name	*2-oxo-4-phenyl-6-propyl-1,2-dihydropyridine-3-carbonitrile*
CCDC Number	981430
empirical Formula	$C_{15}H_{14}N_2O$
formula weight	238.28
temperature	293 K
wavelength	0.71073 Å
crystal system	Triclinic
space group	P-1
unit cell dimensions	a = 9.7064 (10) Å, α = 82.404 (8)°
	b = 9.7294 (10) Å, β = 77.082 (9)°
	c = 14.4315 (14) Å, γ = 75.690 (9)°
cell volume	1282.9 (2) $Å^3$
$D_{calculated}$	1.234 mg/ m^3
F(000)	504
crystal size	0.52 × 0.50 × 0.48 mm
Z	4
R factor (%)	5.74
theta range	3.3 to 29.1º
limiting Indices	$-13 \leq h \leq 13$, $-13 \leq k \leq 13$, $-19 \leq l \leq 19$
μ(Mo KR)/mm-1	0.08
R_{int}	0.022
measured reflections	10237
independent refln	5798
reflections with $I > 2\sigma(I)$	2362
parameters	335
goodness of fit	1.03

$R[F^2 > 2\sigma(F^2)]$	0.057
wR(F^2)	0.156

Table S4. Crystal data and structure refinement parameters for compound **2d.**

compound name	*4-(4-chlorophenyl)-5,6-dimethyl-2-oxo-1,2-dihydropyridine-3-carbonitrile*
CCDC Number	981164
empirical Formula	$C_{14}H_{11}ClN_2O$
formula weight	258.70
temperature	293 K
wavelength	0.71073 Å
crystal system	Triclinic
space group	P-1
unit cell dimensions	a = 9.3937 (10) Å, α = 61.217 (12)°
	b = 17.428 (2) Å, β = 78.071 (9)°
	c = 18.0482 (18) Å, γ = 87.092 (9)°
cell volume	2529.7 (5) $Å^3$
$D_{calculated}$	1.359mg/ m^3
F(000)	1072
crystal size	0.54 × 0.53 × 0.52 mm
Z	8
R factor (%)	9.09
theta range	3.2 to 29.2º
limiting Indices	-12 ≤ h ≤ 12, -23 ≤ k ≤ 23, -24 ≤ l ≤ 24
μ(Mo KR)/mm-1	0.08
R_{int}	0.040
measured reflections	21373
independent refln	11464
reflections with $I > 2\sigma(I)$	5232
parameters	665
goodness of fit	1.00
$R[F^2 > 2\sigma(F^2)]$	0.091
wR(F^2)	0.250

4. References

1. G. M. Sheldrick, *Acta Cryst A* 2008, A64, 112-122.
2. I. J. Bruno, J. C. Cole, P. R. Edgington, M. K. Kessler, C. F. Macrae, P. McCabe, J. Pearson, R. Taylor, *Acta Crystallogr*. B58, 2002, 389-397.