Electronic Supplementary Material (ESI) for RSC Advances.

Late-Stage *ortho*-C–H Alkenylation of 2-Arylindazoles in Aqueous Medium by Manganese(I)-Catalysis

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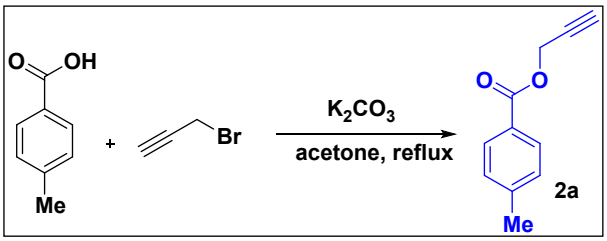
1. General information:

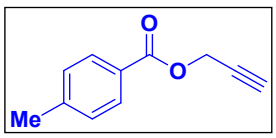
All reagents were purchased from commercial sources and used without further purification. ^{1}H NMR spectra were determined on 400 MHz spectrometer as solutions in $CDCl_3$. Chemical shifts are expressed in parts per million (δ) and the signals were reported as s (singlet), d (doublet), t (triplet), m (multiplate) and coupling constants (J) were given in Hz. $^{13}C\{^1H\}$ NMR spectra were recorded at 100 MHz in $CDCl_3$ and DMSO-d_6 solution. NMR data are reported relative to residual $CHCl_3$ (^{1}H, δ = 7.26 ppm) and $CDCl_3$ (^{13}C, δ = 77.16 ppm) or DMSO-d_6 (^{1}H, δ = 2.50 ppm). TLC was done on silica gel coated glass slide. All 2-arylindazoles[1] were prepared by the reported methods. All solvents were dried and distilled before use. Commercially available solvents were freshly distilled before the reaction. All reactions involving moisture sensitive reactants were executed using oven dried glassware. Melting points (M.p.) were determined after recrystallization of solid compounds from a solution of dichloromethane/petroleum ether (1:3).

2. Experimental procedures:

2.1. Typical procedures for the synthesis of prop-2-yn-1-yl benzoate derivatives (2):[2]

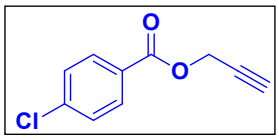


A mixture of 4-methylbenzoic acid (10.0 mmol, 1.36 g), 3-bromoprop-1-yne (12.0 mmol, 1.45 g) and anhydrous K_2CO_3 (4.14 g, 3.0 equiv.) in acetone (15 mL) was stirred for 12 h in reflux. When the reaction was complete (as monitored by TLC), the solvent was evaporated under reduced pressure. The residue was purified by column chromatography over silica gel with mixtures of PE/AcOEt to give the desired product **2**.

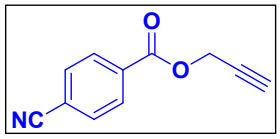


Prop-2-yn-1-yl 4-methylbenzoate **(2a):** Yellow gummy mass (91%, 1.5 g); R_f = 0.50 (PE/ EA = 96 : 4); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.89 (d, J = 8.0 Hz, 2H), 7.17 (d, J = 8.0 Hz, 2H), 4.83 (d, J = 2.4 Hz, 2H), 2.44 (t, J = 2.8 Hz, 1H), 2.34 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz,

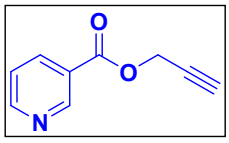
$CDCl_3$): δ 165.9, 144.2, 129.9, 129.2, 126.7, 77.9, 75.0, 52.3, 21.8; Anal. Calcd for $C_{11}H_{10}O_2$: C, 75.84; H, 5.79%; Found: C, 75.97; H, 5.75%.



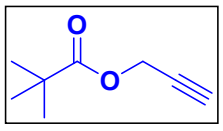
Prop-2-yn-1-yl 4-chlorobenzoate **(2b):** Yellow gummy mass (89%, 1.7 g); R_f = 0.50 (PE/ EA = 97 : 3); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.98 (d, J = 8.4 Hz, 2H), 7.40 (d, J = 8.4 Hz, 2H), 4.90 (d, J = 2.4 Hz, 2H), 2.53 (t, J = 2.4 Hz, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 165.0, 139.9, 131.2, 128.9, 127.8, 77.5, 75.3, 52.7; Anal. Calcd for $C_{10}H_7ClO_2$: C, 61.72; H, 3.63%; Found: C, 61.57; H, 3.68%.



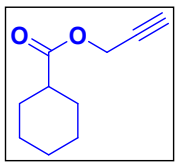
Prop-2-yn-1-yl 4-cyanobenzoate **(2c):** Yellow solid (82%, 1.5 g); R_f = 0.50 (PE/ EA = 95 : 5); M.P. 85-86 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.17 (d, J = 8.4 Hz, 2H), 7.76 (d, J = 8.4 Hz, 2H), 4.95 (d, J = 2.4 Hz, 2H), 2.55 (t, J = 2.4 Hz, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 164.3, 133.2, 132.4, 130.4, 118.0, 116.8, 75.7, 53.3; Anal. Calcd for $C_{11}H_7NO_2$: C, 71.35; H, 3.81; N, 7.56%; Found: C, 71.49; H, 3.78; N, 7.49%.



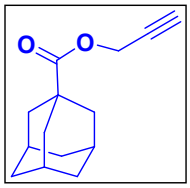
Prop-2-yn-1-yl nicotinate **(2d):** Yellow gummy mass (84%, 1.3 g); R_f = 0.45 (PE/ EA = 92 : 8); ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.15 (s, 1H), 8.71–8.69 (m, 1H), 8.25–8.21 (m, 1H), 7.35–7.31 (m, 1H), 4.92–4.87 (m, 2H), 2.53–2.52 (m, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 164.4, 153.6, 150.8, 137.2, 125.2, 123.3, 75.5, 52.7; Anal. Calcd for $C_9H_7NO_2$: C, 67.08; H, 4.38; N, 8.69%; Found: C, 66.91; H, 4.40; N, 8.81%.



Prop-2-yn-1-yl pivalate **(2e):** Yellow liquid (94%, 1.3 g); R_f = 0.55 (PE/ EA = 98 : 2); ^{1}H NMR (400 MHz, $CDCl_3$): δ 4.62 (d, J = 2.4 Hz, 2H), 2.42 (t, J = 2.4 Hz, 1H), 1.18 (s, 9H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 177.7, 78.0, 74.6, 52.0, 38.7, 27.1; Anal. Calcd for $C_8H_{12}O_2$: C, 68.55; H, 8.63%; Found: C, 68.75; H, 8.59%.

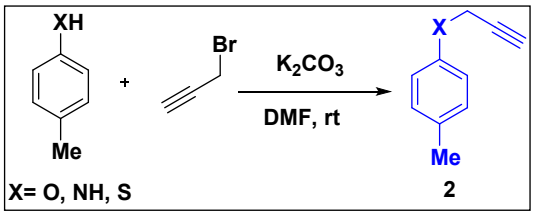


***Prop-2-yn-1-yl cyclohexanecarboxylate* (2f):** Yellow liquid (92%, 1.5 g); R_f = 0.55 (PE/ EA = 97 : 3); ^{1}H NMR (400 MHz, $CDCl_3$): δ 4.63 (d, J = 2.4 Hz, 2H), 2.44 (t, J = 2.8 Hz, 1H), 2.35–2.28 (m, 1H), 1.90–1.87 (m, 2H), 1.74–1.70 (m, 2H), 1.62–1.59 (m, 1H), 1.46–1.37 (m, 2H), 1.30–1.16 (m, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 175.2, 77.9, 74.7, 51.7, 42.9, 28.9, 25.7, 25.4; Anal. Calcd for $C_{10}H_{14}O_2$: C, 72.26; H, 8.49%; Found: C, 72.08; H, 8.53%.

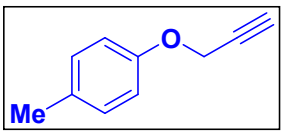


***Prop-2-yn-1-yl (3r,5r,7r)-adamantane-1-carboxylate* (2g):** Yellow liquid (98%, 2.1 g); R_f = 0.50 (PE/ EA = 96 : 4); ^{1}H NMR (400 MHz, $CDCl_3$): δ 4.61 (d, J = 2.4 Hz, 2H), 2.43–2.42 (m, 1H), 1.98 (s, 3H), 1.87 (s, 6H), 1.68 (t, J = 14.8 Hz, 6H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 176.8, 78.1, 74.5, 51.7, 40.7, 38.6, 36.4, 27.9; Anal. Calcd for $C_{14}H_{18}O_2$: C, 77.03; H, 8.31%; Found: C, 77.19; H, 8.28%.

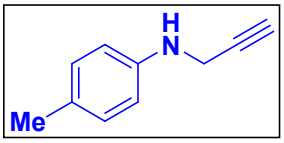
2.2. Typical procedures for the synthesis of 1-methyl-4-(prop-2-yn-1-yloxy)benzene (2):[3]



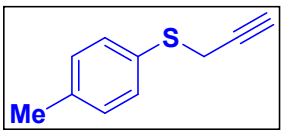
A mixture of *p*-cresol (10.0 mmol, 1.08 g), 3-bromoprop-1-yne (12.0 mmol, 1.45 g) and anhydrous K_2CO_3 (4.14 g, 3.0 equiv.) in DMF (15 mL) was stirred for 12 h at room temperature. After completion of the reaction (TLC), the reaction mixture was extracted with DCM. The organic phase was dried over anhydrous Na_2SO_4. The crude residue was obtained after evaporating the solvent in vacuum and was purified by column chromatography on silica gel using a mixture of petroleum ether and ethyl acetate as an eluting solvent to afford the pure product **2**.



***1-methyl-4-(prop-2-yn-1-yloxy)benzene* (2i):** Yellow gummy mass (96%, 1.4 g); R_f = 0.45 (PE/ EA = 95 : 5); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.14 (d, J = 8.4 Hz, 2H), 6.93-6.89 (m, 2H), 4.68 (d, J = 2.4 Hz, 2H), 2.54 (t, J = 2.4 Hz, 1H), 2.33 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 155.4, 130.9, 130.0, 114.7, 78.8, 75.4, 55.8, 20.5; Anal. Calcd for $C_{10}H_{10}O$: C, 82.16; H, 6.90%; Found: C, 81.95; H, 6.95%.

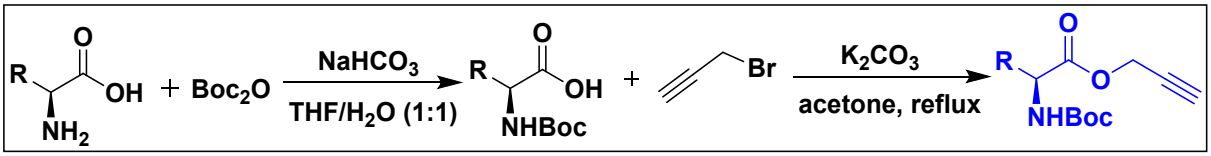


***4-methyl-N-(prop-2-yn-1-yl)aniline* (2j):** Brown solid (91%, 1.3 g); R_f = 0.50 (PE/ EA = 95 : 5); M.P. 46-47 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.10-7.07 (m, 2H), 6.68-6.65 (m, 2H), 3.94 (s, 2H), 3.78 (s, 1H), 2.31 (s, 3H), 2.25 (t, J = 2.0 Hz, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 144.6, 129.7, 127.9, 113.8, 81.3, 71.2, 33.9, 20.4; Anal. Calcd for $C_{10}H_{11}N$: C, 82.72; H, 7.64; N, 9.65%; Found: C, 82.85; H, 7.62, N, 9.56%.

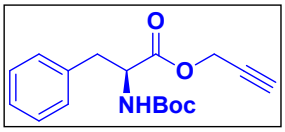


***Prop-2-yn-1-yl(p-tolyl)sulfane* (2k):** Yellow gummy mass (86%, 1.3 g); R_f = 0.50 (PE/ EA = 97 : 3); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.39 (d, J = 8.0 Hz, 2H), 7.15 (d, J = 8.0 Hz, 2H), 3.56 (d, J = 2.8 Hz, 2H), 2.35 (s, 3H), 2.24 (t, J = 2.4 Hz, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 137.3, 131.1, 131.0, 129.8, 80.1, 71.5, 23.2, 21.1; Anal. Calcd for $C_{10}H_{10}S$: C, 74.03; H, 6.21%; Found: C, 73.88; H, 6.23%.

2.3. Typical procedures for the synthesis of (2):[4]

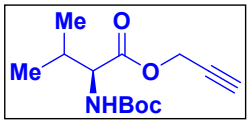


A mixture of phenylalanine (10.0 mmol, 1.65 g) and $NaHCO_3$ (3.0 equiv., 2.52 g) in THF and H_2O (1:1 v/v) was stirred for 15 min at room temperature. After that, Boc_2O (12.0 mmol, 2.62 g) was added to the reaction mixture at 0 °C for 30 min. Then the reaction was stirred at room temperature for overnight. When the reaction was complete (as monitored by TLC), 2.0 (M) HCl was added drop wise to maintain the pH = 2-3. The reaction mixture was extracted with EtOAc. The organic phase was dried over anhydrous Na_2SO_4. The crude residue was obtained after evaporating the solvent in vacuum. The resulting crude material was used for the next step without further purification. Next step was similar to the procedure 2.1.

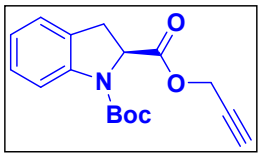


***Prop-2-yn-1-yl (tert-butoxycarbonyl)-L-phenylalaninate* (2l):** Yellow liquid (82%, 2.4 g); R_f = 0.50 (PE/ EA = 90 : 10); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.32-7.23 (m, 3H), 7.21-7.16 (m, 2H), 5.04 (d, J = 6.0 Hz, 1H), 4.78-4.56 (m, 3H), 3.18-3.06 (m, 2H), 2.53 (t, J = 2.4 Hz, 1H),

1.42 (s, 9H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 171.1, 155.0, 135.7, 129.4, 128.5, 127.1, 80.0, 77.0, 75.5, 54.3, 52.6, 38.0, 28.2; Anal. Calcd for $C_{17}H_{21}NO_4$: C, 67.31; H, 6.98; N, 4.62%; Found: C, 67.47; H, 7.01; N, 4.49%.

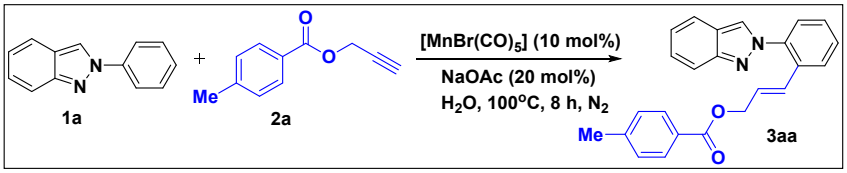


***Prop-2-yn-1-yl (tert-butoxycarbonyl)-L-valinate* (2m):** Yellow liquid (67%, 1.7 g); R_f = 0.50 (PE/ EA = 94 : 6); ^{1}H NMR (400 MHz, $CDCl_3$): δ 5.04 (d, J = 8.8 Hz, 1H), 4.72-4.56 (m, 2H), 2.44 (s, 1H), 2.11-2.04 (m, 1H), 1.40-1.39 (m, 1H), 1.34 (s, 9H), 0.90-0.81 (m, 6H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 171.6, 155.5, 79.7, 75.3, 58.3, 52.3, 31.2, 28.2, 18.9, 17.4; Anal. Calcd for $C_{13}H_{21}NO_4$: C, 61.16; H, 8.29; N, 5.49%; Found: C, 61.04; H, 8.27; N, 5.57%.



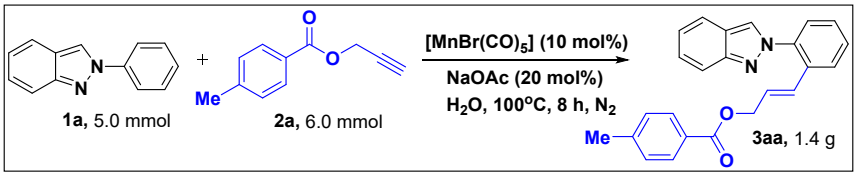
***1-(tert-butyl) 2-(prop-2-yn-1-yl) (S)-indoline-1,2-dicarboxylate* (2n):** Yellow liquid (72%, 2.1 g); R_f = 0.45 (PE/ EA = 90 : 10); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.89 (d, J = 6.8 Hz, 1H), 7.18 (t, J = 7.6 Hz, 1H), 7.09 (d, J = 7.2 Hz, 1H), 6.95-6.91 (m, 1H), 4.88 (d, J = 8.4 Hz, 1H), 4.78-4.67 (m, 2H), 3.53-3.46 (m, 1H), 3.13-3.08 (m, 1H), 2.49 (s, 1H), 1.50 (s, 9H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 171.1, 151.4, 142.4, 127.9, 127.6, 124.8, 124.3, 122.6, 114.6, 81.5, 75.4, 60.1, 52.6, 32.5, 28.2; Anal. Calcd for $C_{17}H_{19}NO_4$: C, 67.76; H, 6.36; N, 4.65%; Found: C, 67.93; H, 6.32; N, 4.59%.

2.4. Typical experimental procedure for 3aa:



A mixture of 2-phenyl-2*H*-indazole (**1a**) (0.25 mmol, 48.5 mg), $MnBr(CO)_5$ (10 mol%, 6.8 mg), and NaOAc (20 mol%, 4.1 mg) was taken in an oven dried screw-capped reaction tube. Then the reaction vessel was evacuated and filled with nitrogen for three times. Then prop-2-yn-1-yl 4-methylbenzoate (**2a**) (0.3 mmol, 52.2 mg) and H_2O (2 mL) was added to the mixture and the resultant mixture was stirred at 100 °C in a preheated oil bath for 8 h. After completion of the reaction (TLC), the reaction was cooled to room temperature and extracted with ethyl acetate. The organic phase was dried over anhydrous Na_2SO_4. The crude residue was obtained after evaporating the solvent in vacuum and was purified by column chromatography on silica gel using a mixture of petroleum ether and ethyl acetate.

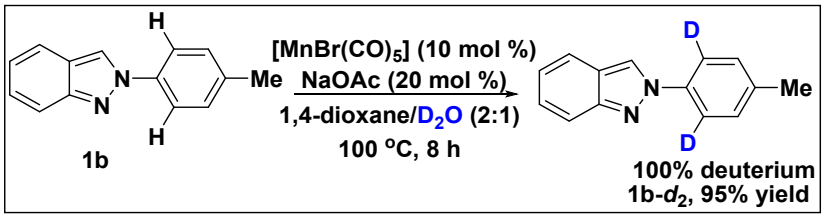
2.5. Synthesis of 3aa on 5 mmol scale:



A mixture of 2-phenyl-2*H*-indazole (**1a**) (5.0 mmol, 0.97 g), $MnBr(CO)_5$ (10 mol%, 137.0 mg), and NaOAc (20 mol%, 83.0 mg) was taken in an oven dried screw-capped reaction tube. Then the reaction vessel was evacuated and filled with nitrogen for three times. Then prop-2-yn-1-yl 4-methylbenzoate (**2a**) (6.0 mmol, 1.04 g) and H_2O (25 mL) was added to the mixture and the resultant mixture was stirred at 100 °C in a preheated oil bath for 8 h. After completion of the reaction (TLC), the reaction was cooled to room temperature and extracted with ethyl acetate. The organic phase was dried over anhydrous Na_2SO_4. The crude residue was obtained after evaporating the solvent in vacuum and was purified by column chromatography on silica gel using a mixture of petroleum ether and ethyl acetate (85:15) as an eluting solvent to afford the pure product **3aa** (1.4 g, 79%) as a Yellow gummy mass.

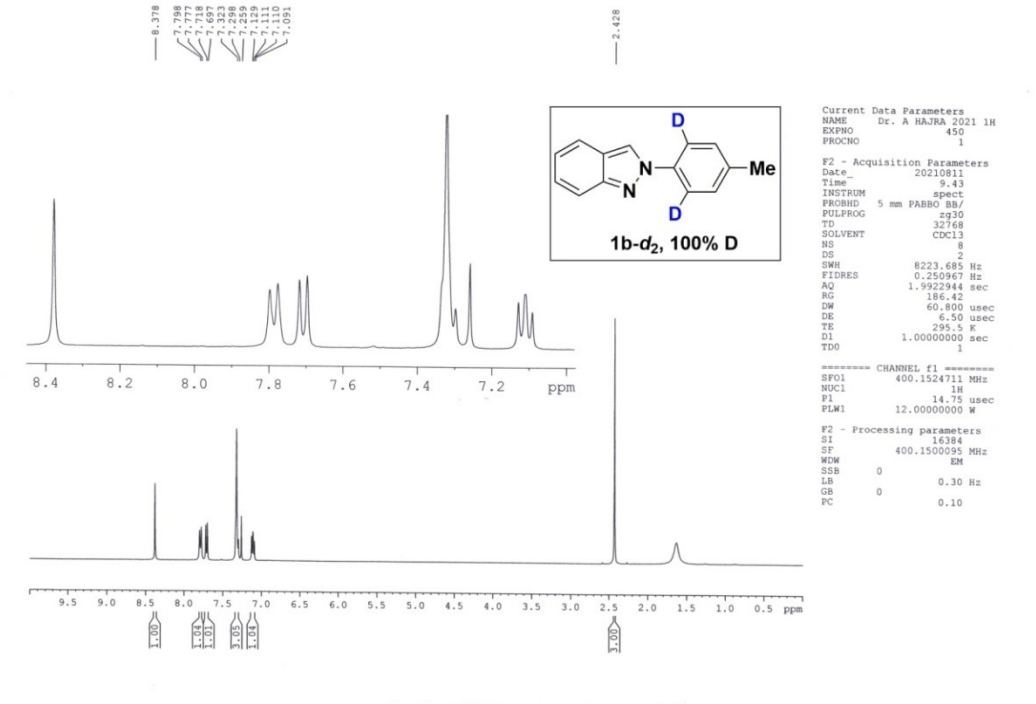
3. Mechanistic investigations:[5]

3.1. Preparation of 2-(4-methylphenyl-2,6-d_2)-2*H*-indazole (1b-d_2):

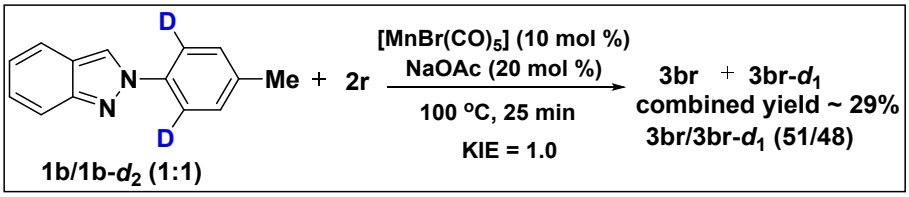


A mixture of 2-(*p*-tolyl)-2*H*-indazole (0.25 mmol, 52 mg) (**1b**), $[MnBr(CO)_5]$ (10 mol %, 6.8 mg), and NaOAc (20 mol%, 4.1 mg) was taken in an oven dried screw-capped reaction tube. Then 1,4-dioxane (2 mL) was added to the mixture and stirred for 5 min at room temperature under open atmosphere. After that, D_2O (1 mL) was added, and the resultant mixture was stirred at 100 °C for 8 h. Then, the reaction was cooled to room temperature and extracted with dichloromethane. The organic phase was dried over anhydrous Na_2SO_4. The crude residue was obtained after evaporating the solvent in vacuum and was purified by column chromatography on silica gel using a mixture of petroleum ether and ethyl acetate (85:15) as an eluting solvent to afford the pure product **1b-d_2** as a white solid. The deuterium incorporation was determined using 400 MHz ^{1}H NMR as 100%.

^{1}H NMR (400 MHz, $CDCl_3$)spectrum of 1b-d_2

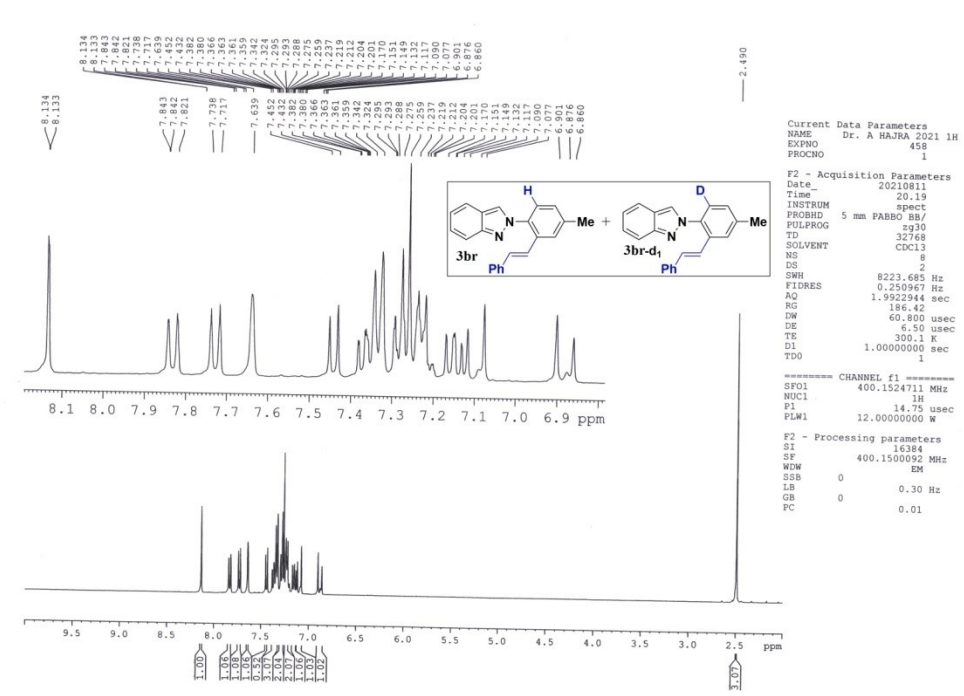


3.2. Intermolecular kinetic isotope effect study:

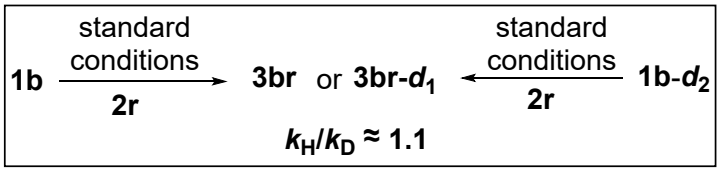


Ethynylbenzene (**2r**) (0.24 mmol, 24.5 mg) was reacted with 2-(*p*-tolyl)-2*H*-indazole (**1b**) (0.1 mmol, 20.8 mg) and 2-(4-methylphenyl-2,6-d_2)-2*H*-indazole (**1b-d_2**) (0.1 mmol, 21.0 mg) for 25 min under standard reaction condition. The resulting solution was then diluted with dichloromethane (3 x 10 mL) and washed with brine (2 x 5 mL) and water (5 mL). The organic phase was dried over anhydrous Na_2SO_4. The crude residue was obtained after evaporating the solvent in vacuum and was purified by column chromatography on silica gel using a mixture of petroleum ether and ethyl acetate (95:5). The intermolecular $\boldsymbol{k_H/k_D}$ was found to be **1.0** after 25 min at ~29% conversion, based on 400 MHz ^{1}H NMR of the product **3br** and **3br-d_1**.

^{1}H NMR (400 MHz, $CDCl_3$)spectrum of 3br and 3br-d_1



3.3. Parallel kinetic isotope effect study:



In a set of two experiments: in first set, ethynylbenzene (**2r**) (0.12 mmol, 12.2 mg) was reacted with 2-(*p*-tolyl)-2*H*-indazole (**1b**) (0.1 mmol, 20.8 mg) under standard reaction conditions. Whereas in another set, 2-(4-methylphenyl-2,6-d_2)-2*H*-indazole (**1b-d_2**) (0.1 mmol, 21.0 mg) was used instead of **1b** in the reaction with ethynylbenzene (**2r**) under the standard reaction conditions. The reactions were quenched at 25 min, 50 min, 75 min, 100 min respectively. The resulting solution was then diluted with dichloromethane (3 x 10 mL) and washed with brine (2 x 5 mL) and water (5 mL). The organic phase was dried over anhydrous Na_2SO_4. The crude residue was obtained after evaporating the solvent in vacuum and was purified by column chromatography. The calculated k_H/k_D value was found to be **1.1**.

t/min / **yield**	25	50	75	100

3br	15.5%	23.6%	28.6%	32.1%
3br-d_1	14.1%	21.4%	26.2%	29.1%

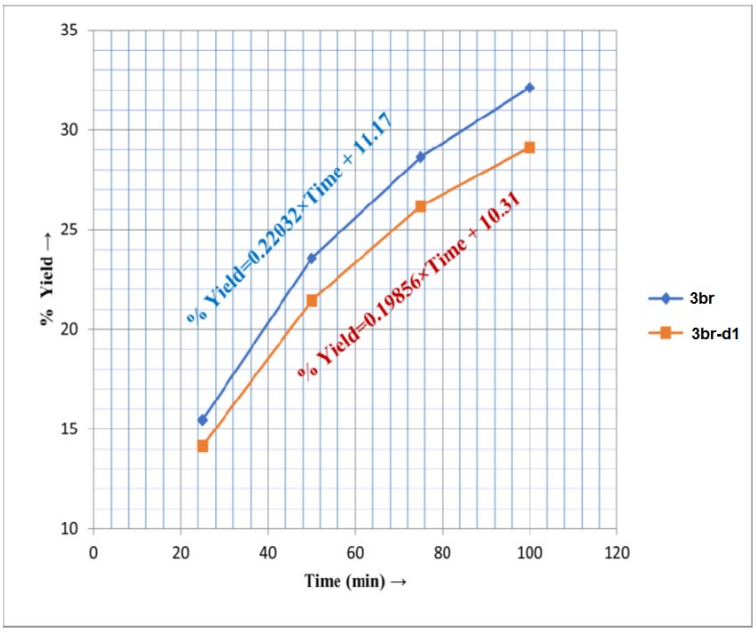
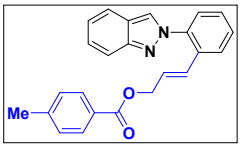
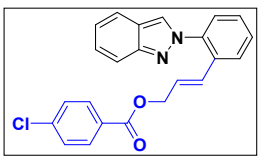


Figure S1. The reaction rate of 1b and 1b-d_2

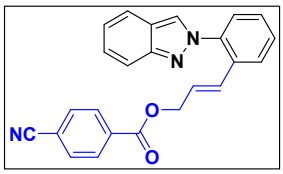
4. Characterization data for the synthesized products:



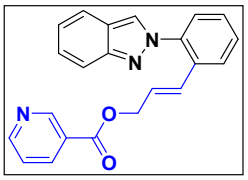
***(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl 4-methylbenzoate* (3aa):** Yellow gummy mass (91%, 83.8 mg); R_f = 0.50 (PE/ EA = 85 : 15); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.14 (s, 1H), 7.80 (d, J = 8.0 Hz, 2H), 7.74-7.71 (m, 1H), 7.53-7.40 (m, 3H), 7.38-7.34 (m, 1H), 7.17-7.12 (m, 3H), 6.55 (d, J = 16.0 Hz, 1H), 6.45-6.38 (m, 1H), 4.86 (d, J = 5.6 Hz, 2H), 2.38 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 166.3, 149.5, 143.7, 139.0, 132.3, 129.6, 129.3, 129.1, 128.6, 127.8, 127.2, 126.97, 126.94, 126.8, 126.7, 125.4, 122.4, 122.1, 120.5, 118.0, 64.8, 21.7; Anal. Calcd for $C_{24}H_{20}N_2O_2$: C, 78.24; H, 5.47; N, 7.60%; Found: C, 78.39; H, 5.50; N, 7.70%.



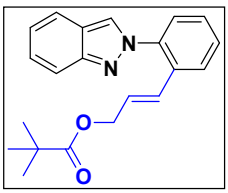
(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl 4-chlorobenzoate **(3ab):** White solid (94%, 91.3 mg); R_f = 0.50 (PE/ EA = 85 : 15); M.P. 81-82 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.09 (s, 1H), 7.80-7.75 (m, 3H), 7.71-7.67 (m, 2H), 7.49-7.32 (m, 4H), 7.26-7.24 (m, 2H), 7.15-7.12 (m, 1H), 6.50 (d, J = 16.0 Hz, 1H), 6.40-6.33 (m, 1H), 4.85-4.83 (m, 2H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 165.2, 149.5, 139.4, 138.9, 132.2, 130.9, 129.3, 128.7, 128.6, 128.3, 127.7, 126.9, 126.7, 126.6, 126.3, 125.3, 122.4, 122.0, 120.4, 117.9, 64.9; Anal. Calcd for $C_{23}H_{17}ClN_2O_2$: C, 71.04; H, 4.41; N, 7.20%; Found: C, 71.22; H, 4.39; N, 7.12%.



(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl 4-cyanobenzoate **(3ac):** Yellow solid (90%, 85.3 mg); R_f = 0.50 (PE/ EA = 80 : 20); M.P. 107-108 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.11 (s, 1H), 7.94 (d, J = 8.0 Hz, 2H), 7.82-7.69 (m, 3H), 7.58 (d, J = 8.4 Hz, 2H), 7.50-7.46 (m, 2H), 7.44-7.42 (m, 1H), 7.38-7.34 (m, 1H), 7.18-7.14 (m, 1H), 6.51 (d, J = 16.0 Hz, 1H), 6.42-6.35 (m, 1H), 4.91-4.89 (m, 2H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 164.5, 149.5, 139.0, 133.6, 132.2, 132.1, 130.0, 129.4, 128.7, 127.8, 126.9, 126.8, 126.6, 125.7, 125.3, 122.4, 122.0, 120.4, 118.0, 117.9, 116.3, 65.4; Anal. Calcd for $C_{24}H_{17}N_3O_2$: C, 75.98; H, 4.52; N, 11.08%; Found: C, 75.78; H, 4.57; N, 10.96%.

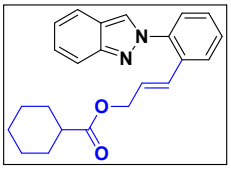


(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl isonicotinate **(3ad):** Yellow gummy mass (78%, 69.3 mg); R_f = 0.45 (PE/ EA = 80 : 20); ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.16 (d, J = 1.2 Hz, 1H), 8.73-8.72 (m, 1H), 8.12-8.09 (m, 2H), 7.77 (d, J = 9.0 Hz, 1H), 7.73-7.69 (m, 2H), 7.51-7.45 (m, 2H), 7.44-7.41 (m, 1H), 7.36-7.32 (m, 1H), 7.27-7.24 (m, 1H), 7.15-7.12 (m, 1H), 6.53 (d, J = 16.0 Hz, 1H), 6.42-6.35 (m, 1H), 4.90-4.88 (m, 2H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 164.8, 153.3, 150.8, 149.4, 138.9, 137.0, 132.1, 129.3, 128.7, 128.6, 126.9, 126.8, 126.0, 125.3, 123.3, 122.4, 122.0, 120.4, 117.8, 65.4; Anal. Calcd for $C_{22}H_{17}N_3O_2$: C, 74.35; H, 4.82; N, 11.82%; Found: C, 74.51; H, 4.78; N, 11.90%.

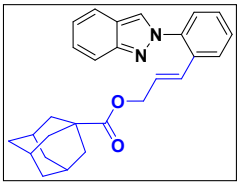


(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl pivalate **(3ae):** Yellow gummy mass (96%, 80.2 mg); R_f = 0.50 (PE/ EA = 92 : 8); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.10 (s, 1H), 7.79 (d, J = 8.4 Hz, 1H), 7.73-7.67 (m, 2H), 7.50-7.31 (m, 4H), 7.15-7.11 (m, 1H), 6.39 (d, J = 16.0 Hz, 1H), 6.32-6.25 (m, 1H), 4.63-4.61 (m, 2H), 1.05 (s, 9H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 178.0, 149.5, 138.9, 132.4, 129.3, 128.4, 127.0, 126.9, 126.7, 126.67, 126.62, 125.3, 122.3,

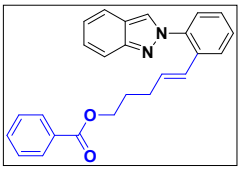
122.1, 120.3, 117.9, 64.0, 38.7, 27.0; Anal. Calcd for $C_{21}H_{22}N_2O_2$: C, 75.42; H, 6.63; N, 8.38%; Found: C, 75.61; H, 6.60; N, 8.44%.



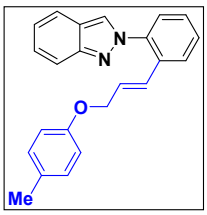
***(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl cyclohexanecarboxylate* (3af):** Yellow gummy mass (94%, 84.6 mg); R_f = 0.50 (PE/ EA = 90 : 10); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.10 (s, 1H), 7.81-7.78 (m, 1H), 7.73 (d, J = 8.4 Hz, 1H), 7.69-7.67 (m, 1H), 7.50-7.32 (m, 4H), 7.16-7.12 (m, 1H), 6.38 (d, J = 16.0 Hz, 1H), 6.31-6.25 (m, 1H), 4.63-4.62 (m, 2H), 2.22-2.14 (m, 1H), 1.77-1.73 (m, 1H), 1.64-1.54 (m, 3H), 1.31-1.22 (m, 3H), 1.18-1.10 (m, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 175.6, 149.4, 138.8, 132.3, 129.2, 128.4, 127.0, 126.9, 126.7, 125.3, 122.3, 122.0, 120.4, 117.9, 63.9, 43.1, 28.9, 25.6, 25.4; Anal. Calcd for $C_{23}H_{24}N_2O_2$: C, 76.64; H, 6.71; N, 7.77%; Found: C, 76.87; H, 6.75; N, 7.68%.



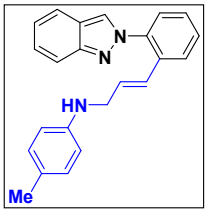
***(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl (3r,5r,7r)-adamantane-1-carboxylate* (3ag):** Yellow solid (89%, 91.7 mg); R_f = 0.50 (PE/ EA = 90 : 10); M.P. 87-88 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.10 (s, 1H), 7.79 (d, J = 9.2 Hz, 1H), 7.74-7.67 (m, 2H), 7.50-7.38 (m, 3H), 7.35-7.31 (m, 1H), 7.13 (t, J = 8.4 Hz, 1H), 6.37 (d, J = 14.4 Hz, 1H), 6.32-6.25 (m, 1H), 4.64-4.63 (m, 2H), 1.90-1.86 (m, 3H), 1.70 (d, J = 2.4 Hz, 6H), 1.63 (d, J = 12.4 Hz, 3H), 1.53 (d, J = 11.6 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 177.2, 149.5, 138.9, 132.5, 129.3, 128.4, 127.2, 126.9, 126.7, 126.6, 126.2, 125.4, 122.4, 122.1, 120.4, 117.9, 63.6, 40.7, 38.7, 36.4, 27.8; Anal. Calcd for $C_{27}H_{28}N_2O_2$: C, 78.61; H, 6.84; N, 6.79%; Found: C, 78.44; H, 6.86; N, 6.89%.



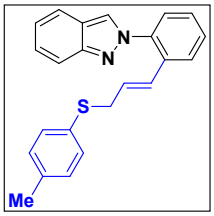
***(E)-5-(2-(2H-indazol-2-yl)phenyl)pent-4-en-1-yl benzoate* (3ah):** Yellow gummy mass (49%, 46.8 mg); R_f = 0.45 (PE/ EA = 90 : 10); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.11 (s, 1H), 8.00-7.97 (m, 2H), 7.80 (d, J = 8.4 Hz, 1H), 7.72 (d, J = 8.4 Hz, 1H), 7.65 (d, J = 7.6 Hz, 1H), 7.53 (t, J = 7.6 Hz, 1H), 7.48-7.45 (m, 2H), 7.43-7.33 (m, 4H), 7.12 (t, J = 8.0 Hz, 1H), 6.30-6.23 (m, 1H), 6.19 (d, J = 15.6 Hz, 1H), 4.31 (t, J = 6.4 Hz, 2H), 2.31-2.26 (m, 2H), 1.90-1.83 (m, 2H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 166.7, 149.4, 138.5, 133.6, 133.1, 133.0, 130.3, 129.6, 129.3, 128.4, 127.7, 127.0, 126.7, 126.6, 125.6, 125.3, 122.3, 122.1, 120.5, 118.0, 64.3, 29.7, 28.3; Anal. Calcd for $C_{25}H_{22}N_2O_2$: C, 78.51; H, 5.80; N, 7.32%; Found: C, 78.38; H, 5.76; N, 7.25%.



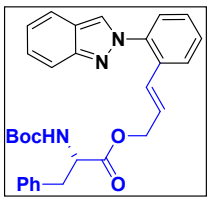
(E)-2-(2-(3-(p-tolyloxy)prop-1-en-1-yl)phenyl)-2H-indazole **(3ai):** Yellow gummy mass (95%, 80.8 mg); R_f = 0.50 (PE/ EA = 90 : 10); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.07 (s, 1H), 7.85 (d, J = 8.8 Hz, 1H), 7.73 (d, J = 8.0 Hz, 2H), 7.53 (d, J = 7.6 Hz, 1H), 7.49-7.37 (m, 3H), 7.18 (t, J = 7.6 Hz, 1H), 7.07 (d, J = 8.4 Hz, 2H), 6.77 (d, J = 8.4 Hz, 2H), 6.54 (d, J = 16.0 Hz, 1H), 6.47-6.42 (m, 1H), 4.58 (d, J = 5.6 Hz, 2H), 2.30 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 156.2, 149.4, 138.8, 132.3, 130.1, 129.9, 129.2, 128.45, 128.41, 127.5, 126.9, 126.8, 126.6, 125.3, 122.3, 122.0, 120.4, 117.9, 114.6, 68.4, 20.5; Anal. Calcd for $C_{23}H_{20}N_2O$: C, 81.15; H, 5.92; N, 8.23%; Found: C, 81.34; H, 5.97; N, 8.31%.



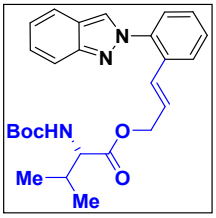
(E)-N-(3-(2-(2H-indazol-2-yl)phenyl)allyl)-4-methylaniline **(3aj):** Yellow gummy mass (79%, 67.0 mg); R_f = 0.50 (PE/ EA = 90 : 10); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (s, 1H), 7.79 (d, J = 9.2 Hz, 1H), 7.68-7.66 (m, 2H), 7.51-7.48 (m, 1H), 7.46-7.33 (m, 3H), 7.16-7.12 (m, 1H), 6.95 (d, J = 8.4 Hz, 2H), 6.50 (d, J = 8.4 Hz, 2H), 6.41 (d, J = 16.0 Hz, 1H), 6.35-6.29 (m, 1H), 3.82 (d, J = 5.2 Hz, 2H), 2.24 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.5, 145.1, 138.7, 132.8, 130.9, 129.8, 129.2, 128.2, 127.2, 127.0, 126.9, 126.7, 126.4, 125.4, 122.3, 122.1, 120.5, 118.0, 113.5, 46.5, 20.5; Anal. Calcd for $C_{23}H_{21}N_3$: C, 81.38; H, 6.24; N, 12.38%; Found: C, 81.52; H, 6.21; N, 12.27%.



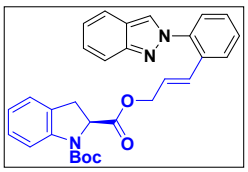
(E)-2-(2-(3-(p-tolylthio)prop-1-en-1-yl)phenyl)-2H-indazole **(3ak):** Yellow gummy mass (71%, 63.2 mg); R_f = 0.50 (PE/ EA = 92 : 8); ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.85 (s, 1H), 7.79 (d, J = 8.8 Hz, 1H), 7.69 (d, J = 8.4 Hz, 1H), 7.64-7.62 (m, 1H), 7.49-7.47 (m, 1H), 7.45-7.41 (m, 1H), 7.39-7.33 (m, 2H), 7.21 (d, J = 8.0 Hz, 2H), 7.17-7.13 (m, 1H), 7.06 (d, J = 8.0 Hz, 2H), 6.30-6.22 (m, 1H), 6.16 (d, J = 15.6 Hz, 1H), 3.53 (d, J = 7.2 Hz, 2H), 2.32 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.5, 138.7, 136.9, 132.5, 131.6, 131.4, 129.7, 129.3, 129.2, 128.2, 127.1, 127.0, 126.9, 126.6, 125.3, 122.3, 122.1, 120.4, 118.0, 37.9, 21.2; Anal. Calcd for $C_{23}H_{20}N_2S$: C, 77.49; H, 5.66; N, 7.86%; Found: C, 77.34; H, 5.64; N, 7.76%.



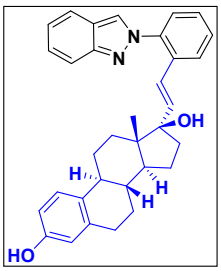
***(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl (tert-butoxycarbonyl)-L-phenylalaninate* (3al):** Yellow gummy mass (82%, 100.0 mg); R_f = 0.50 (PE/ EA = 75 : 25); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.09 (s, 1H), 7.79 (d, J = 8.4 Hz, 1H), 7.73 (d, J = 8.4 Hz, 1H), 7.69-7.67 (m, 1H), 7.53-7.42 (m, 3H), 7.36-7.32 (m, 1H), 7.24-7.18 (m, 3H), 7.16-7.12 (m, 1H), 7.07-7.05 (m, 2H), 6.44 (d, J = 16.0 Hz, 1H), 6.25-6.18 (m, 1H), 4.94 (d, J = 8.0 Hz, 1H), 4.66-4.63 (m, 2H), 4.56-4.51 (m, 1H), 3.05-2.89 (m, 2H), 1.40 (s, 9H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 171.6, 155.1, 149.6, 139.0, 136.0, 132.1, 129.4, 129.3, 129.2, 128.8, 128.5, 127.07, 127.00, 126.9, 126.8, 126.1, 125.4, 122.5, 122.1, 120.4, 118.0, 80.0, 65.6, 54.5, 38.3, 28.3; Anal. Calcd for $C_{30}H_{31}N_3O_4$: C, 72.41; H, 6.28; N, 8.44%; Found: C, 72.57; H, 6.24; N, 8.56%.



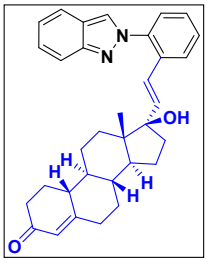
***(E)-3-(2-(2H-indazol-2-yl)phenyl)allyl (tert-butoxycarbonyl)-L-valinate* (3am):** Yellow gummy mass (77%, 86.5 mg); R_f = 0.50 (PE/ EA = 80 : 20); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.10 (s, 1H), 7.80-7.77 (m, 1H), 7.73 (d, J = 8.8 Hz, 1H), 7.68-7.66 (m, 1H), 7.50-7.40 (m, 3H), 7.36-7.32 (m, 1H), 7.16-7.12 (m, 1H), 6.45 (d, J = 15.6 Hz, 1H), 6.31-6.24 (m, 1H), 4.99 (d, J = 8.8 Hz, 1H), 4.72-4.61 (m, 2H), 4.18-4.15 (m, 1H), 2.05-1.97 (m, 1H), 1.41 (s, 9H), 0.86 (d, J = 7.2 Hz, 3H), 0.76 (d, J = 6.8 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 172.1, 155.7, 149.5, 138.9, 132.1, 129.3, 128.8, 128.7, 126.9, 126.8, 126.7, 126.1, 125.3, 122.4, 122.1, 120.4, 117.9, 79.7, 65.2, 58.5, 31.2, 28.3, 19.0, 17.4; Anal. Calcd for $C_{26}H_{31}N_3O_4$: C, 69.47; H, 6.95; N, 9.35%; Found: C, 69.27; H, 6.97; N, 9.27%.



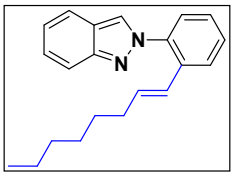
***(E)-2-(3-(2-(2H-indazol-2-yl)phenyl)allyl) 1-(tert-butyl) (S)-indoline-1,2-dicarboxylate* (3an):** Yellow gummy mass (72%, 89.1 mg); R_f = 0.50 (PE/ EA = 75 : 25); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.10 (s, 1H), 7.89-7.66 (m, 4H), 7.51-7.41 (m, 3H), 7.36 (t, J = 8.4 Hz, 1H), 7.19-7.13 (m, 2H), 7.02 (d, J = 7.2 Hz, 1H), 6.91 (t, J = 7.2 Hz, 1H), 6.45 (d, J = 16.0 Hz, 1H), 6.32-6.25 (m, 1H), 4.87-4.73 (m, 2H), 4.68-4.64 (m, 1H), 3.38-3.31 (m, 1H), 2.99-2.94 (m, 1H), 1.45 (s, 9H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 171.5, 151.5, 149.4, 142.4, 138.9, 131.9, 129.2, 128.9, 128.7, 127.8, 126.8, 126.7, 126.3, 125.9, 125.3, 124.7, 124.3, 122.5, 122.4, 122.1, 120.4, 117.8, 114.5, 81.2, 65.3, 60.2, 32.5, 28.2; Anal. Calcd for $C_{30}H_{29}N_3O_4$: C, 72.71; H, 5.90; N, 8.48%; Found: C, 72.57; H, 5.93; N, 8.54%.



(8R,9S,13S,14S,17R)-17-((E)-2-(2H-indazol-2-yl)styryl)-13-methyl-7,8,9,11,12,13,14,15,16,17-decahydro-6H-cyclopenta[a]phenanthrene-3,17-diol **(3ao):** White solid (68%, 83.3 mg); R_f = 0.45 (PE/ EA = 70 : 30), M.P. 109-110 °C; ^{1}H NMR (400 MHz, DMSO-d_6): δ 9.03 (s, 1H), 8.53 (s, 1H), 7.76 (t, J = 8.8 Hz, 2H), 7.68 (d, J = 8.8 Hz, 1H), 7.56-7.48 (m, 2H), 7.43 (t, J = 8.0 Hz, 1H), 7.30 (t, J = 8.4 Hz, 1H), 7.09 (t, J = 7.6 Hz, 1H), 7.99 (d, J = 8.4 Hz, 1H), 6.50-6.48 (m, 1H), 6.43 (s, 1H), 6.32 (d, J = 16.0 Hz, 1H), 6.21 (d, J = 16.0 Hz, 1H), 4.65 (s, 1H), 2.66 (d, J = 4.4 Hz, 2H), 2.50 (s, 1H), 2.12 (d, J = 8.8 Hz, 1H), 1.91 (s, 2H), 1.71-1.62 (m, 3H), 1.44 (d, J = 9.2 Hz, 1H), 1.25-1.17 (m, 4H), 1.13-1.06 (m, 1H), 0.75 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6): δ 154.9, 148.6, 140.5, 138.4, 137.2, 133.6, 130.5, 129.5, 127.6, 127.19, 127.13, 126.3, 126.2, 126.0, 121.8, 121.0, 120.8, 117.4, 114.9, 112.7, 82.8, 48.3, 47.1, 43.1, 36.1, 32.1, 29.2, 27.0, 26.1, 22.8, 21.1, 14.2; Anal. Calcd for $C_{33}H_{34}N_2O_2$: C, 80.78; H, 6.99; N, 5.71%; Found: C, 80.95; H, 6.94; N, 5.80%.

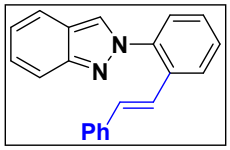


(8R,9S,10R,13S,14S,17R)-17-((E)-2-(2H-indazol-2-yl)styryl)-17-hydroxy-13-methyl-1,2,6,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-3H-cyclopenta[a]phenanthren-3-one **(3ap):** White solid (60%, 73.8 mg); R_f = 0.50 (PE/ EA = 70 : 30); M.P. 115-116 °C; ^{1}H NMR (400 MHz, DMSO-d_6): δ 8.54 (s, 1H), 7.74-7.71 (m, 2H), 7.66 (d, J = 8.8 Hz, 1H), 7.53 (t, J = 8.0 Hz, 1H), 7.49-7.41 (m, 2H), 7.29 (t, J = 8.4 Hz, 1H), 7.08 (t, J = 8.0 Hz, 1H), 6.25 (d, J = 16.0 Hz, 1H), 6.17 (d, J = 16.0 Hz, 1H), 5.74 (s, 1H), 4.61 (s, 1H), 2.48 (d, J = 14.4 Hz, 1H), 2.21-2.06 (m, 5H), 1.72-1.58 (m, 4H), 1.47-1.33 (m, 3H), 1.29-1.22 (m, 3H), 1.08-0.98 (m, 2H), 0.86-0.82 (m, 1H), 0.78 (s, 3H), 0.65-0.57 (m, 1H); ^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6): δ 198.5, 167.0, 148.5, 140.6, 138.3, 133.5, 129.5, 127.5, 127.16, 127.11, 126.3, 126.1, 123.6, 121.75, 121.71, 121.0, 120.8, 117.3, 82.7, 59.7, 48.5, 48.0, 46.8, 41.6, 36.1, 36.0, 34.7, 31.8, 30.2, 26.0, 25.6, 22.9, 14.1; Anal. Calcd for $C_{33}H_{36}N_2O_2$: C, 80.45; H, 7.37; N, 5.69%; Found: C, 80.22; H, 7.41; N, 5.62%.

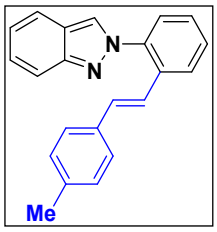


(E)-2-(2-(Oct-1-en-1-yl)phenyl)-2H-indazole **(3aq):** Yellow gummy mass (57%, 43.3 mg); R_f = 0.55 (PE/ EA = 97 : 3); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.12 (s, 1H), 7.82-7.80 (m, 1H),

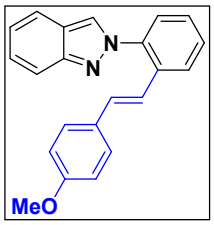
7.74 (d, J = 8.4 Hz, 1H), 7.66-7.64 (m, 1H), 7.49-7.46 (m, 1H), 7.45-7.41 (m, 1H), 7.37-7.33 (m, 2H), 7.14 (t, J = 8.4 Hz, 1H), 6.26-6.19 (m, 1H), 6.12 (d, J = 16.0 Hz, 1H), 2.12-2.07 (m, 2H), 1.40-1.35 (m, 2H), 1.33-1.21 (m, 6H), 0.85 (t, J = 6.8 Hz, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 139.0, 138.4, 135.1, 134.0, 129.2, 127.4, 127.0, 126.7, 126.6, 125.3, 124.6, 122.3, 122.1, 120.4, 118.1, 33.2, 31.8, 29.2, 28.9, 22.7, 14.2; Anal. Calcd for $C_{21}H_{24}N_2$: C, 82.85; H, 7.95; N, 9.20%; Found: C, 82.70; H, 8.00; N, 9.30%.



(E)-2-(2-Styrylphenyl)-2H-indazole **(3ar):** Yellow gummy mass (75%, 55.5 mg); R_f = 0.50 (PE / EA = 96 : 4); ^1H NMR (400 MHz, $CDCl_3$): δ 8.17 (s, 1H), 7.84 (d, J = 8.4 Hz, 2H), 7.74 (d, J = 8.4 Hz, 1H), 7.57-7.55 (m, 1H), 7.53-7.49 (m, 1H), 7.45-7.37 (m, 2H), 7.34 (d, J = 8.4 Hz, 2H), 7.30-7.28 (m, 2H), 7.25-7.21 (m, 1H), 7.18-7.08 (m, 2H), 6.91 (d, J = 16 Hz, 1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 149.6, 139.1, 136.9, 133.3, 132.0, 129.3, 128.8, 128.26, 128.22, 127.1, 126.9, 126.78, 126.72, 125.5, 123.4, 122.4, 122.2, 120.5, 118.1 ; Anal. Calcd for $C_{21}H_{16}N_2$: C, 85.11; H, 5.44; N, 9.45%; Found: C, 85.25; H, 5.41; N, 9.34%.

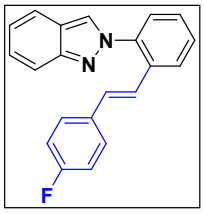


(E)-2-(2-(4-Methylstyryl)phenyl)-2H-indazole **(3as):** Yellow gummy mass (72%, 55.8 mg); R_f = 0.50 (PE / EA = 95 : 5); ^1H NMR (400 MHz, $CDCl_3$): δ 8.07 (s, 1H), 7.75-7.72 (m, 2H), 7.63 (d, J = 8.4 Hz, 1H), 7.47-7.45 (m, 1H), 7.40 (t, J = 7.2 Hz, 1H), 7.33-7.28 (m, 2H), 7.15 (t, J = 8 Hz, 2H), 7.08-7.04 (m, 1H), 7.00 (t, J = 8.8 Hz, 3H), 6.75 (d, J = 16.4 Hz, 1H), 2.22 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 149.6, 139.0, 138.2, 134.1, 133.4, 132.0, 129.5, 129.3, 128.0, 127.0, 126.8, 126.7, 126.6, 125.5, 122.4, 122.3, 122.2, 120.5, 118.1, 21.3; Anal. Calcd for $C_{22}H_{18}N_2$: C, 85.13; H, 5.85; N, 9.03%; Found: C, 85.29; H, 5.81; N, 8.91%.

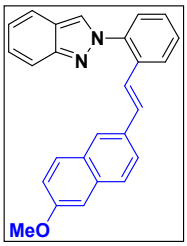


(E)-2-(2-(4-Methoxystyryl)phenyl)-2H-indazole **(3at):** Yellow gummy mass (61%, 49.7 mg); R_f = 0.50 (PE : EA = 92 : 8); ^1H NMR (400 MHz, $CDCl_3$): δ 8.17 (s, 1H), 7.85-7.81 (m, 2H), 7.74 (d, J = 8.4 Hz, 1H), 7.55-7.53 (m, 1H), 7.51-7.47 (m, 1H), 7.42-7.35 (m, 2H), 7.29 (t, J = 4.4 Hz, 2H), 7.18-7.14 (m, 1H), 7.07 (d, J = 16.0 Hz, 1H), 6.81 (d, J = 8.4 Hz, 2H), 6.75 (d, J = 16.4 Hz, 1H), 3.78 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 138.8, 133.6, 131.5, 129.7, 129.3, 128.2, 127.8, 127.1, 126.7, 126.49, 126.44, 125.6, 125.5, 122.3, 122.1,

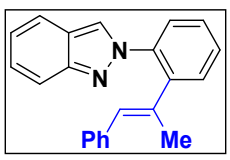
121.1, 120.5, 118.1, 114.1, 55.4; Anal. Calcd for $C_{22}H_{18}N_2O$: C, 80.96; H, 5.56; N, 8.58%; Found: C, 80.81; H, 5.52; N, 8.51%.



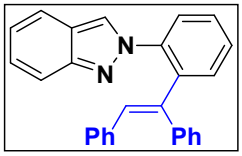
(E)-2-(2-(4-fluorostyryl)phenyl)-2H-indazole **(3au):** Yellow gummy mass (87%, 68.3 mg); R_f = 0.50 (PE : EA = 95 : 5); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.16 (s, 1H), 7.86-7.81 (m, 2H), 7.75 (d, J = 8.8 Hz, 1H), 7.56-7.48 (m, 2H), 7.44-7.36 (m, 2H), 7.31-7.28 (m, 2H), 7.19-7.15 (m, 1H), 7.07 (d, J = 16.4 Hz, 1H), 6.99-6.94 (m, 2H), 6.83 (d, J = 16.4 Hz, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 162.6 (C-F, $^1J_{C\text{-}F}$ = 246.0 Hz), 149.6, 139.0, 133.1 (C-F, $^3J_{C\text{-}F}$ = 8.0 Hz), 133.0, 130.7, 129.3, 128.4 (C-F, $^3J_{C\text{-}F}$ = 8.0 Hz), 128.2, 127.0, 126.6 (C-F, $^2J_{C\text{-}F}$ = 24.0 Hz), 125.4, 123.16, 123.14, 122.4, 122.2, 120.5, 118.0, 115.7 (C-F, $^2J_{C\text{-}F}$ = 22.0 Hz); Anal. Calcd for $C_{21}H_{15}FN_2$: C, 80.24; H, 4.81; N, 8.91%; Found: C, 80.41; H, 4.84; N, 9.03%.



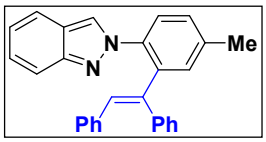
(E)-2-(2-(2-(6-Methoxynaphthalen-2-yl)vinyl)phenyl)-2H-indazole **(3av):** Yellow solid (76%, 71.5 mg); R_f = 0.50 (PE : EA = 93 : 7); M.P. 98-99 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.18 (s, 1H), 7.87-7.84 (m, 2H), 7.73 (d, J = 8.4 Hz, 1H), 7.65 (d, J = 9.2 Hz, 2H), 7.60-7.54 (m, 2H), 7.50 (t, J = 7.6 Hz, 1H), 7.43-7.35 (m, 3H), 7.23 (t, J = 8.0 Hz, 1H), 7.17-7.13 (m, 1H), 7.11-7.05 (m, 2H), 6.70 (d, J = 16.4 Hz, 1H), 3.88 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 158.1, 149.6, 139.0, 134.5, 133.5, 132.5, 132.3, 132.2, 129.7, 129.3, 129.0, 128.4, 128.0, 127.3, 127.2, 127.1, 126.7, 126.6, 125.6, 124.1, 122.6, 122.4, 122.2, 120.6, 119.2, 118.1, 105.9, 55.4 ; Anal. Calcd for $C_{26}H_{20}N_2O$: C, 82.95; H, 5.36; N, 7.44%; Found: C, 82.74; H, 5.41; N, 7.36%.



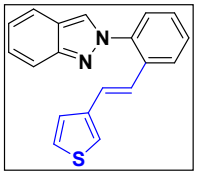
(E)-2-(2-(1-Phenylprop-1-en-2-yl)phenyl)-2H-indazole **(3aw):** Yellow gummy mass (82%, 63.6 mg); R_f = 0.50 (PE/ EA = 95 : 5); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (s, 1H), 7.60 (d, J = 8.8 Hz, 1H), 7.49-7.46 (m, 2H), 7.30-7.25 (m, 3H), 7.12 (t, J = 6.8 Hz, 3H), 7.03 (d, J = 7.2 Hz, 3H), 6.92-6.88 (m, 1H), 6.42 (s, 1H), 1.45 (d, J = 1.2 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.3, 141.0, 138.6, 137.5, 136.9, 130.9, 130.0, 129.0, 128.3, 128.2, 128.1, 126.9, 126.8, 126.7, 124.8, 122.5, 122.2, 120.5, 118.0, 18.3; Anal. Calcd for $C_{22}H_{18}N_2$: C, 85.13; H, 5.85; N, 9.03%; Found: C, 85.27; H, 5.81; N, 8.93%.



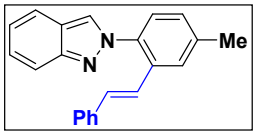
(E)-2-(2-(1,2-diphenylvinyl)phenyl)-2H-indazole **(3ax):** Yellow solid (57%, 55.2 mg); R_f = 0.50 (PE : EA = 95 : 5); M.P. 139-140 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.82 (s, 1H), 7.60 (t, J = 9.6 Hz, 1H), 7.54-7.45 (m, 4H), 7.19 (t, J = 8.4 Hz, 1H), 7.08 (t, J = 2.4 Hz, 3H), 7.03-7.00 (m, 2H), 6.97 (t, J = 7.2 Hz, 1H), 6.91-6.88 (m, 1H), 6.82-6.76 (m, 5H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.1, 140.8, 140.2, 139.5, 138.3, 137.0, 131.7, 131.0, 129.5, 129.4, 129.1, 128.5, 128.0, 127.5, 127.3, 127.1, 127.0, 126.1, 124.8, 122.0, 121.7, 120.1, 117.7; Anal. Calcd for $C_{27}H_{20}N_2$: C, 87.07; H, 5.41; N, 7.52 %; Found: C, 86.92; H, 5.44; N, 7.64%.



(E)-2-(2-(1,2-diphenylvinyl)-4-methylphenyl)-2H-indazole **(3bx):** Yellow solid (55%, 53.1 mg); R_f = 0.50 (PE : EA = 95 : 5); M.P. 137-138 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.78 (s, 1H), 7.59-7.57 (m, 1H), 7.44 (d, J = 9.4 Hz, 1H), 7.39 (d, J = 8.4 Hz, 2H), 7.28 (d, J = 1.6 Hz, 1H), 7.19-7.15 (m, 1H), 7.09-7.07 (m, 3H), 7.01-6.99 (m, 2H), 6.97-6.93 (m, 1H), 6.91-6.87 (m, 1H), 6.82-6.77 (m, 5H), 2.48 (s, 3H), ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 140.5, 140.3, 139.1, 138.4, 137.2, 137.1 132.2, 130.9, 129.5, 129.2 129.1, 128.0, 127.8, 127.5, 127.1, 127.0, 126.9, 126.0, 124.9, 122.0, 121.6, 120.1, 117.7, 21.3; Anal. Calcd for $C_{28}H_{22}N_2$: C, 87.01; H, 5.74; N, 7.25%; Found: C, 87.14; H, 5.72; N, 7.14%.

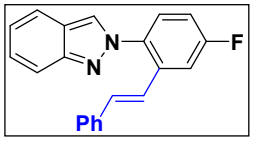


(E)-2-(2-(2-(thiophen-3-yl)vinyl)phenyl)-2H-indazole **(3ay):** Yellow gummy mass (76%, 57.3 mg); R_f = 0.50 (PE : EA = 95 : 5); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.16 (s, 1H), 7.86 (d, J = 8.8 Hz, 1H), 7.79 (d, J = 7.6 Hz, 1H), 7.74 (d, J = 8.4 Hz, 1H), 7.55 (d, J = 8.0 Hz, 1H), 7.51-7.47 (m, 1H), 7.43-7.36 (m, 2H), 7.21-7.11 (m, 4H), 7.07 (t, J = 3.6 Hz, 1H), 6.75 (d, J = 16.0 Hz, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.5, 139.7, 138.8, 133.2, 129.2, 128.0, 127.0, 126.7, 126.3, 125.9, 125.4, 125.0, 123.4, 123.2, 122.3, 122.1, 120.5, 118.0; Anal. Calcd for $C_{19}H_{14}N_2S$: C, 75.47; H, 4.67; N, 9.26%; Found: C, 75.28; H, 4.62; N, 9.33%.

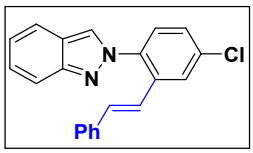


(E)-2-(4-Methyl-2-styrylphenyl)-2H-indazole **(3br):** Yellow solid (78%, 60.5 mg); R_f = 0.50 (PE / EA = 95 : 5); M.P. 108-109 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (s, 1H), 7.72 (d, J

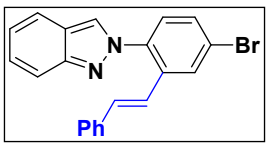
= 9.2 Hz, 1H), 7.62 (d, *J* = 8.4 Hz, 1H), 7.53 (s, 1H), 7.33 (d, *J* = 8.4 Hz, 1H), 7.27-7.22 (m, 3H), 7.18-7.11 (m, 4H), 7.06-6.97 (m, 2H), 6.77 (d, *J* = 16.0 Hz, 1H), 2.38 (s, 3H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 149.5, 139.2, 136.99, 136.90, 132.9, 131.7, 129.0, 128.7, 128.1, 127.0, 126.8, 126.6, 125.5, 123.5, 122.3, 122.1, 120.5, 118.0, 21.4; Anal. Calcd for $C_{22}H_{18}N_2$: C, 85.13; H, 5.85; N, 9.03%; Found: C, 84.96; H, 5.90; N, 9.15%.



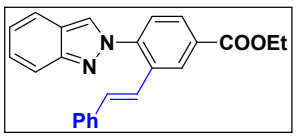
(E)-2-(4-fluoro-2-styrylphenyl)-2H-indazole **(3cr):** Yellow gummy mass (80%, 62.8 mg); R_f = 0.45 (PE / EA = 95 : 5); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.13 (s, 1H), 7.82 (d, *J* = 8.4 Hz, 1H), 7.73 (d, *J* = 8.4 Hz, 1H), 7.54-7.50 (m, 2H), 7.40-7.36 (m, 1H), 7.33-7.28 (m, 3H), 7.26-7.24 (m, 2H), 7.19-7.15 (m, 1H), 7.14-7.09 (m, 2H), 6.82 (d, *J* = 16 Hz, 1H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 162.9 (C-F, $^{1}J_{C\text{-}F}$ = 247.0 Hz), 149.7, 136.4, 135.7, 135.6, 135.3, 133.2, 129.06 (C-F, $^{3}J_{C\text{-}F}$ = 9.0 Hz), 128.8, 128.6, 127.0, 126.9, 125.6, 122.5, 122.3 (C-F, $^{3}J_{C\text{-}F}$ = 7.0 Hz), 120.5, 118.1, 115.1 (C-F, $^{2}J_{C\text{-}F}$ = 23.0 Hz), 112.8 (C-F, $^{2}J_{C\text{-}F}$ = 24.0 Hz); Anal. Calcd for $C_{21}H_{15}FN_2$: C, 80.24; H, 4.81; N, 8.91%; Found: C, 80.45; H, 4.83; N, 8.83%.



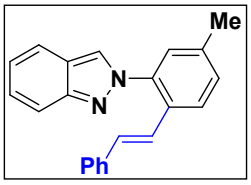
(E)-2-(4-Chloro-2-styrylphenyl)-2H-indazole **(3dr):** Yellow solid (58%, 47.9 mg); R_f = 0.50 (PE / EA = 95 : 5); M.P. 101-102 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.14 (s, 1H), 7.83-7.81 (m, 2H), 7.73 (d, *J* = 8.4 Hz, 1H), 7.50 (d, *J* = 8.4 Hz, 1H), 7.40-7.37 (m, 2H), 7.36-7.33 (m, 2H), 7.31-7.29 (m, 1H), 7.27-7.25 (m, 2H), 7.18-7.16 (m, 1H), 7.11 (d, *J* = 16 Hz, 1H), 6.84 (d, *J* = 16.4 Hz, 1H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 149.8, 137.5, 136.4, 135.2, 134.9, 133.2, 128.8, 128.6, 128.4, 128.1, 127.08, 127.02, 126.5, 125.5, 122.6, 122.36, 122.30, 120.5, 118.1; Anal. Calcd for $C_{21}H_{15}ClN_2$: C, 76.25; H, 4.57; N, 8.47%; Found: C, 76.44; H, 4.53; N, 8.57%.



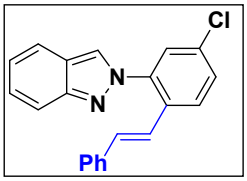
(E)-2-(4-Bromo-2-styrylphenyl)-2H-indazole **(3er):** Yellow solid (64%, 60 mg); R_f = 0.50 (PE / EA = 95 : 5); M.P. 140-141 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.10 (s, 1H), 7.93 (d, *J* = 2.4 Hz, 1H), 7.80-7.78 (m, 1H), 7.69 (d, *J* = 8.4 Hz, 1H), 7.52-7.49 (m, 1H), 7.40 (d, *J* = 8.4 Hz, 1H), 7.36-7.34 (m, 1H), 7.32-7.29 (m, 2H), 7.28-7.26 (m, 1H), 7.24-7.21 (m, 2H), 7.15-7.11 (m, 1H), 7.08 (d, *J* = 16.4 Hz, 1H), 6.81 (d, *J* = 16.4 Hz, 1H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 149.8, 138.0, 136.4, 135.1, 133.3, 131.0, 129.5, 128.8, 128.6, 128.5, 127.08, 127.04, 125.4, 123.3, 122.6, 122.3, 122.2, 120.5, 118.1; HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{21}H_{16}BrN_2$: 375.0491; found: 375.0497.



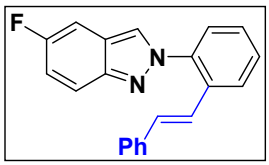
Ethyl (E)-4-(2H-Indazol-2-yl)-3-styrylbenzoate **(3fr):** Yellow solid (73%, 67.2 mg); R_f = 0.50 (PE/ EA = 92 : 8); M.P. 110-111 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.51 (d, J = 1.6 Hz, 1H), 8.21 (s, 1H), 8.09-8.07 (m, 1H), 7.83 (d, J = 8.4 Hz, 1H), 7.73 (d, J = 8.8 Hz, 1H), 7.67 (d, J = 8.4 Hz, 1H), 7.40-7.36 (m, 3H), 7.32-7.27 (m, 3H), 7.24 (d, J = 12.0 Hz, 1H), 7.19-7.15 (m, 1H), 6.99 (d, J = 16.4 Hz, 1H), 4.49-4.44 (m, 2H), 1.46 (t, J = 6.8 Hz, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 165.8, 149.9, 142.1, 136.6, 133.1, 131.0, 129.9, 129.0, 128.87, 128.83, 128.5, 128.4, 127.1, 127.0, 125.4, 122.8, 122.7, 122.4, 120.6, 118.1, 61.9, 14.5; HRMS (ESI-TOF) m/z: [M +H]+ Calcd for $C_{24}H_{21}N_2O_2$: 369.1598; found: 369.1598.



(E)-2-(5-Methyl-2-styrylphenyl)-2H-indazole **(3gr):** Yellow solid (92%, 71.3 mg); R_f = 0.50 (PE / EA = 95 : 5); M.P. 96-97 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.01 (s, 1H), 7.70 (d, J = 8.8 Hz, 1H), 7.60-7.57 (m, 2H), 7.23-7.11 (m, 7H), 7.09-7.05 (m, 1H), 7.01 (t, J = 8.0 Hz, 1H), 6.95 (d, J = 16 Hz, 1H), 6.74 (d, J = 16.4 Hz, 1H), 2.29 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.5, 138.9, 138.6, 137.0, 131.1, 130.2, 130.1, 128.7, 128.0, 127.5, 126.79, 126.72, 126.5, 125.5, 123.4, 122.3, 122.1, 120.5, 118.0, 21.1; HRMS (ESI-TOF) m/z: [M +H]+ Calcd for $C_{22}H_{19}N_2$: 311.1543; found: 311.1556.

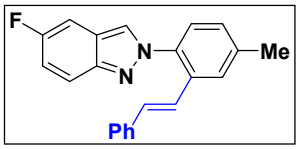


(E)-2-(5-chloro-2-styrylphenyl)-2H-indazole **(3hr):** Yellow solid (74%, 61.2 mg); R_f = 0.50 (PE / EA = 95 : 5); M.P. 161-162 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.03 (s, 1H), 7.87 (d, J = 8.4 Hz, 1H), 7.70-7.68 (m, 2H), 7.62-7.59 (m, 1H), 7.41-7.38 (m, 1H), 7.19 (d, J = 19.2 Hz, 5H), 7.05-7.01 (m, 1H), 6.84-6.79 (m, 1H), 6.37-6.32 (m, 1H), 6.26-6.21 (m, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 149.3, 136.8, 136.5, 135.6, 135.0, 134.6, 133.0, 132.7, 131.3, 128.7, 128.5, 128.2, 126.9, 126.6, 126.5, 124.8, 122.5, 122.0, 120.6, 118.2; Anal.Calcd for $C_{21}H_{15}ClN_2$: C, 76.25; H, 4.57; N, 8.47%; Found: C, 76.13; H, 4.59; N, 8.54%.

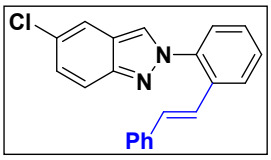


(E)-5-Fluoro-2-(2-styrylphenyl)-2H-indazole **(3ir):** Yellow gummy mass (62%, 48.7 mg); R_f = 0.50 (PE / EA = 95 : 5); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.11 (s, 1H), 7.83-7.78 (m, 2H), 7.53-7.48 (m, 2H), 7.41 (t, J = 7.6 Hz, 1H), 7.33-7.27 (m, 4H), 7.24-7.13 (m, 3H), 7.09 (d, J

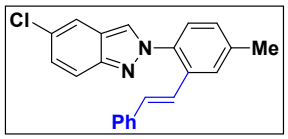
= 16.4 Hz, 1H), 6.85 (d, J = 16.4 Hz, 1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 158.7 (C-F, $^1J_{C\text{-}F}$ = 239.0 Hz), 147.1, 138.9, 136.8, 133.3, 132.2, 129.5, 128.8, 128.2, 126.99, 126.91, 126.7, 125.6 (C-F, $^3J_{C\text{-}F}$ = 9.0 Hz), 123.2, 121.5, 121.4, 120.2 (C-F, $^3J_{C\text{-}F}$ = 10.0 Hz), 118.4 (C-F, $^2J_{C\text{-}F}$ = 28.0 Hz), 102.8 (C-F, $^2J_{C\text{-}F}$ = 25.0 Hz); Anal. Calcd for $C_{21}H_{15}FN_2$: C, 80.24; H, 4.81; N, 8.91%; Found: C, 80.38; H, 4.78; N, 8.82%.



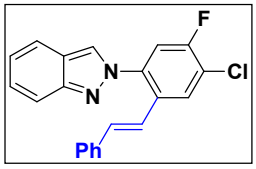
(E)-5-fluoro-2-(4-methyl-2-styrylphenyl)-2H-indazole **(3jr):** Yellow gummy mass (76%, 62.3 mg); R_f = 0.50 (PE : EA = 95 : 5); ^1H NMR (400 MHz, $CDCl_3$): δ 7.95 (s, 1H), 7.68-7.65 (m, 1H), 7.50 (s, 1H), 7.28 (d, J = 8.0 Hz, 1H), 7.21-7.18 (m, 2H), 7.17-7.13 (m, 3H), 7.11-7.07 (m, 2H), 7.05-7.00 (m, 1H), 6.95 (d, J = 16.4 Hz, 1H), 6.71 (d, J = 16.4 Hz, 1H), 2.35 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 158.6 (C-F, $^1J_{C\text{-}F}$ = 238.0 Hz), 147.0, 139.4, 136.9, 136.7, 132.9, 131.8, 129.0, 128.7, 128.1, 127.0, 126.8, 125.6 (C-F, $^3J_{C\text{-}F}$ = 8.0 Hz), 123.3, 121.4, 121.3, 120.1 (C-F, $^3J_{C\text{-}F}$ = 10.0 Hz), 118.2 (C-F, $^2J_{C\text{-}F}$ = 29.0 Hz), 102.8 (C-F, $^2J_{C\text{-}F}$ = 24.0 Hz), 21.4; Anal. Calcd for $C_{22}H_{17}FN_2$: C, 80.47; H, 5.22; N, 8.53%; Found: C, 80.29; H, 5.27; N, 8.42%.



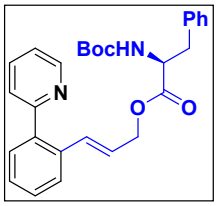
(E)-5-chloro-2-(2-styrylphenyl)-2H-indazole **(3kr):** Yellow gummy mass (52%, 43.2 mg); R_f = 0.50 (PE / EA = 95 : 5); ^1H NMR (400 MHz, $CDCl_3$): δ 8.11 (s, 1H), 7.84 (d, J = 8.0 Hz, 1H), 7.77 (d, J = 9.2 Hz, 1H), 7.71 (d, J = 1.2 Hz, 1H), 7.55-7.50 (m, 2H), 7.45-7.41 (m, 1H), 7.34-7.23 (m, 6H), 7.11 (d, J = 16.0 Hz, 1H), 6.84 (d, J = 16.0 Hz, 1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 148.0, 138.8, 136.8, 133.3, 132.3, 129.6, 128.8, 128.35, 128.32, 128.2, 128.1, 127.0, 126.9, 126.8, 125.1, 123.1, 122.5, 119.7, 119.2; Anal. Calcd for $C_{21}H_{15}ClN_2$ C, 76.25; H, 4.57; N, 8.47%; Found: C, 76.05; H, 4.54; N, 8.55%.



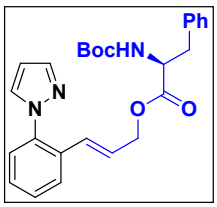
(E)-5-Chloro-2-(4-methyl-2-styrylphenyl)-2H-indazole **(3lr):** Yellow solid (79%, 68.1 mg); R_f = 0.50 (PE : EA = 95 : 5); M.P. 104-105 °C; ^1H NMR (400 MHz, $CDCl_3$): δ 8.06 (s, 1H), 7.75 (d, J = 8.8 Hz, 1H), 7.68 (d, J = 1.2 Hz, 1H), 7.62 (s, 1H), 7.41 (d, J = 8.0 Hz, 1H), 7.32-7.27 (m, 5H), 7.24-7.21 (m, 2H), 7.08 (d, J = 16.4 Hz, 1H), 6.80 (d, J = 16.0 Hz, 1H), 2.47 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 147.8, 139.5, 136.8, 136.5, 132.8, 131.9, 129.0, 128.8, 128.2, 128.0, 127.9, 127.0, 126.8, 126.7, 125.1, 123.2, 122.5, 119.6, 119.1, 21.5; Anal. Calcd for $C_{22}H_{17}ClN_2$: C, 76.63; H, 4.97; N, 8.12%; Found: C, 76.76; H, 4.99; N 8.21%.



(E)-2-(4-Chloro-5-fluoro-2-styrylphenyl)-2H-indazole **(3mr):** Yellow solid (79%, 68.8 mg); R_f = 0.50 (PE : EA = 94 : 6); M.P. 131-132 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.23 (s, 1H), 7.95 (d, J = 8.8 Hz, 1H), 7.80 (d, J = 8.4 Hz, 1H), 7.65-7.62 (m, 1H), 7.51 (t, J = 8.8 Hz, 1H), 7.41-7.34 (m, 4H), 7.30-7.28 (m, 3H), 7.08 (d, J = 16.8 Hz, 1H), 6.51 (d, J = 20.4 Hz, 1H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 158.7 (C-F, $^1J_{C\text{-}F}$ = 249.0 Hz), 149.4, 137.1, 136.3, 136.03, 136.00, 134.9, 128.7 (C-F, $^3J_{C\text{-}F}$ = 4.0 Hz), 127.1 (C-F, $^3J_{C\text{-}F}$ = 10.0 Hz), 126.8, 125.5, 122.4 (C-F, $^2J_{C\text{-}F}$ = 29.0 Hz), 121.6, 120.5, 119.86, 119.84, 117.9, 114.8 (C-F, $^2J_{C\text{-}F}$ = 23.0 Hz); HRMS (ESI-TOF) *m/z*: $[M + H]^+$ Calcd for $C_{21}H_{15}ClFN_2$: 349.0902; found: 349.0908.



(E)-3-(2-(pyridin-2-yl)phenyl)allyl (tert-butoxycarbonyl)-L-phenylalaninate **(3nl):** Yellow gummy mass (86%, 98.5 mg); R_f = 0.50 (PE/ EA = 80 : 20); ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.78 (s, 1H), 7.81 (t, J = 7.6 Hz, 1H), 7.69-7.66 (m, 1H), 7.58-7.56 (m, 1H), 7.48-7.43 (m, 3H), 7.34-7.24 (m, 4H), 7.17 (d, J = 6.8 Hz, 1H), 6.83 (d, J = 16.4 Hz, 1H), 6.26-6.19 (m, 1H), 5.04 (d, J = 8.0 Hz, 1H), 4.80-4.70 (m, 2H), 4.66-4.61 (m, 1H), 3.18-3.06 (m, 2H), 1.47 (s, 9H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 171.7, 158.6, 149.4, 139.5, 136.4, 136.0, 134.5, 133.4, 130.2, 129.5, 128.7, 128.6, 128.3, 127.1, 126.6, 125.0, 123.9, 122.1, 80.0, 66.0, 54.5, 38.4, 28.4; Anal. Calcd for $C_{28}H_{30}N_2O_4$: C, 73.34; H, 6.59; N, 6.11%; Found: C, 73.52; H, 6.56; N, 6.03%.

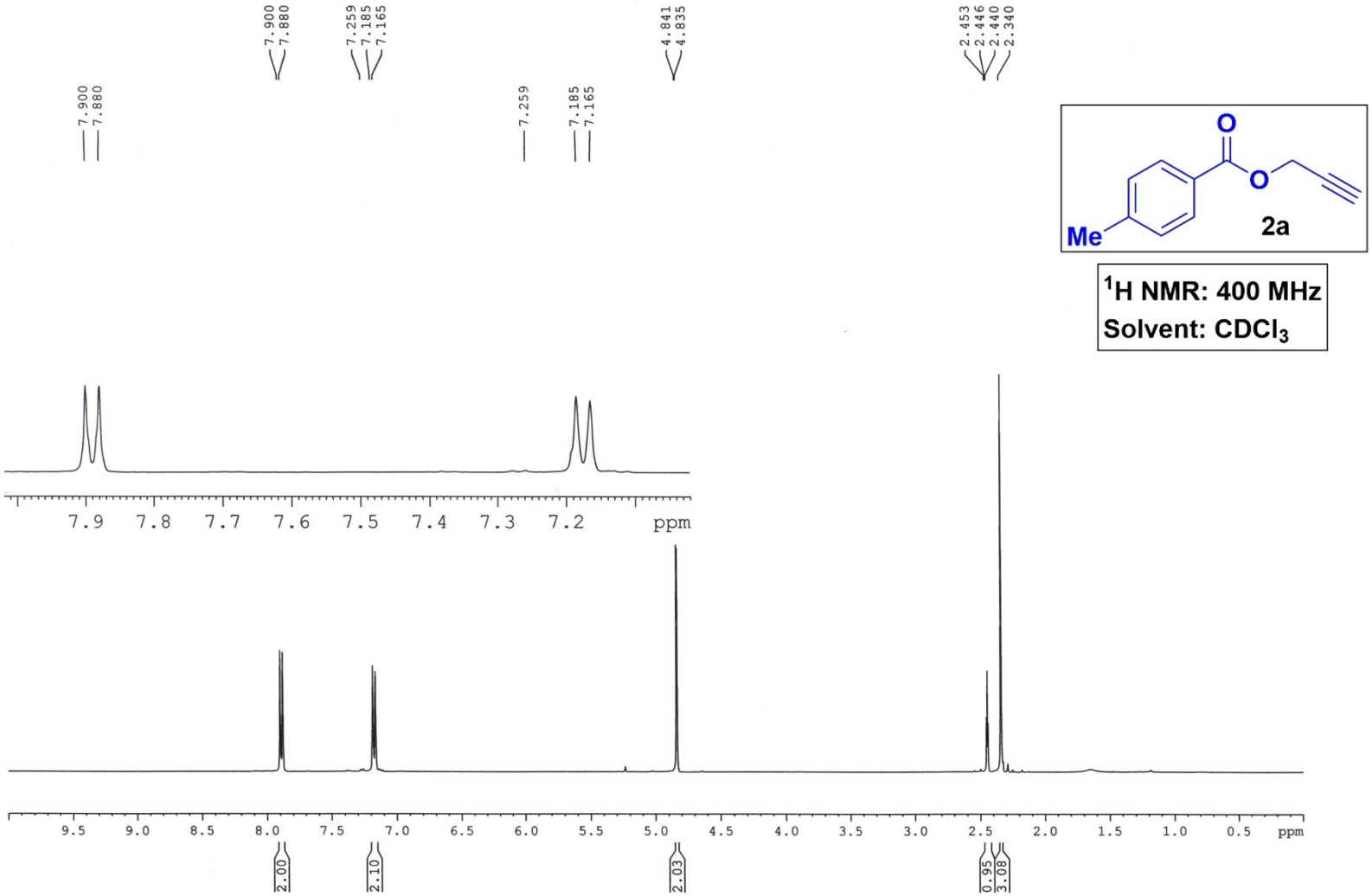


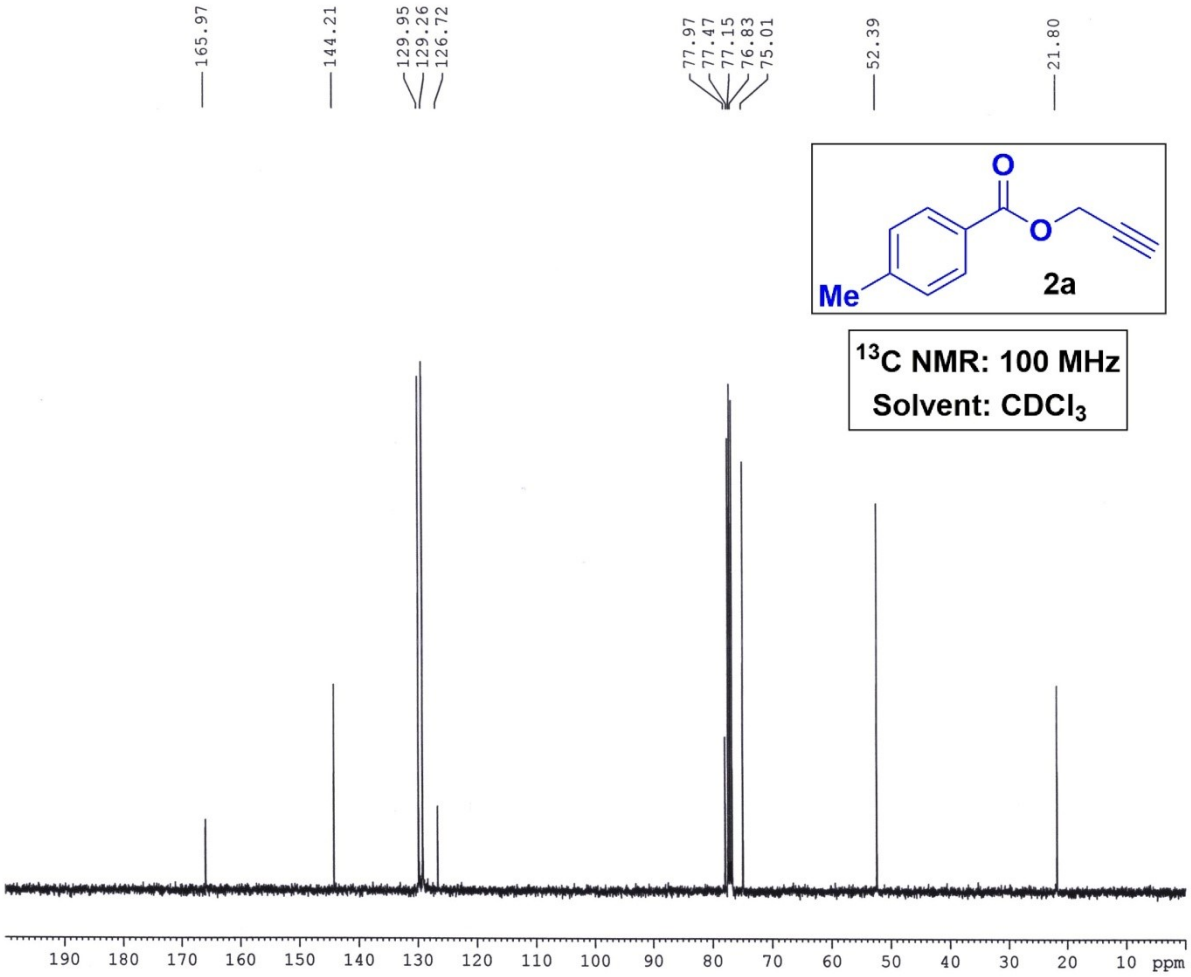
(E)-3-(2-(1H-pyrazol-1-yl)phenyl)allyl (tert-butoxycarbonyl)-L-phenylalaninate **(3ol):** White solid (88%, 98.4 mg); R_f = 0.50 (PE/ EA = 80 : 20); M.P. 61-62 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.62 (s, 1H), 7.52-7.48 (m, 2H), 7.31-7.26 (m, 3H), 7.15-7.07 (m, 3H), 7.01 (d, J = 6.8 Hz, 2H), 6.40 (d, J = 16.0 Hz, 1H), 6.34 (t, J = 2.0 Hz, 1H), 6.08-6.01 (m, 1H), 4.92 (d, J = 8.0 Hz, 1H), 4.62-4.53 (m, 2H), 4.50-4.45 (m, 1H), 3.02-2.89 (m, 2H), 1.30 (s, 9H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$): δ 171.6, 155.1, 140.8, 138.7, 135.9, 131.7, 131.4, 129.6, 129.4, 128.8, 128.5, 128.4, 127.0, 126.9, 126.3, 125.3, 106.7, 79.9, 65.6, 54.5, 38.3, 28.3; Anal. Calcd for $C_{26}H_{29}N_3O_4$: C, 69.78; H, 6.53; N, 9.39%; Found: C, 69.57; H, 6.57; N, 9.27%.

5. References:

(1) (a) M. R. Kumar, A. Park, N. Park, S. Lee, *Org. Lett*., 2011, **13**, 3542-3545; (b) G. Bogonda, H. Y. Kim, K. Oh, *Org. Lett*., 2018, **20**, 2711-2715. (2) P. W. Skelly, J. Sae-Jew, A. P. Kitos Vasconcelos, J. Tasnim, L. Li, J. A. Raskatov, R. Braslau, *J. Org. Chem*., 2019, **84**, 13615-13623. (3) S. Das, A. Azim, S. K. Hota, S. P. Panda, S. Murarka, S. De Sarkar, *Chem. Commun*., 2021, **57**, 13130-13133. (4) R. M. Borzilleri, X. Zheng, R. J. Schmidt, J. A. Johnson, S. -H. Kim, J. D. DiMarco, C. R. Fairchild, J. Z. Gougoutas, F. Y. F. Lee, B. H. Long, G. D. Vite, *J. Am. Chem. Soc*., 2000, **122**, 8890-8897. (5) A. Maji, S. Guin, S. Feng, A. Dahiya, V. K. Singh, P. Liu, D. Maiti, *Angew. Chem. Int. Ed*., 2017, **56**, 14903-14907.

6. NMR spectra for the synthesized products


7.900
7.880
7.259
7.185
7.165
4.841
4.835
2.453
2.446
2.440
2.340
O
O
Me
2a
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
ppm
2.00
2.10
2.03
0.95
3.08

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EXPNO                  479
PROCNO                   1

F2 - Acquisition Parameters
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Time                 10.08
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PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     220
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   77.59
DW                  20.800 usec
DE                   6.50 usec
TE                  294.6 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1            100.6278588 MHz
NUC1                   13C
P1                    8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2            400.1516006 MHz
NUC2                   1H
CPDPRG[2            waltz16
PCPD2                90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
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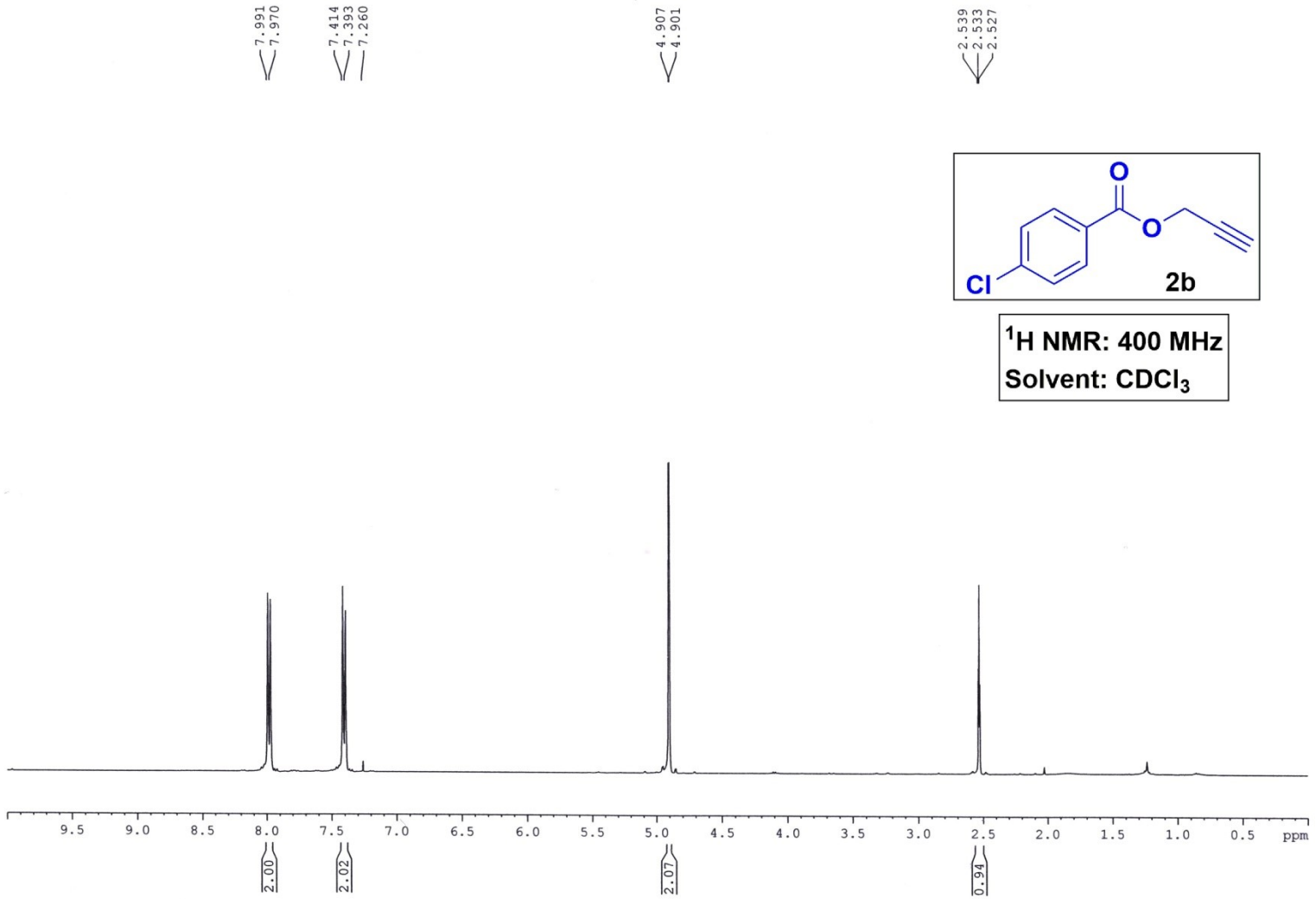
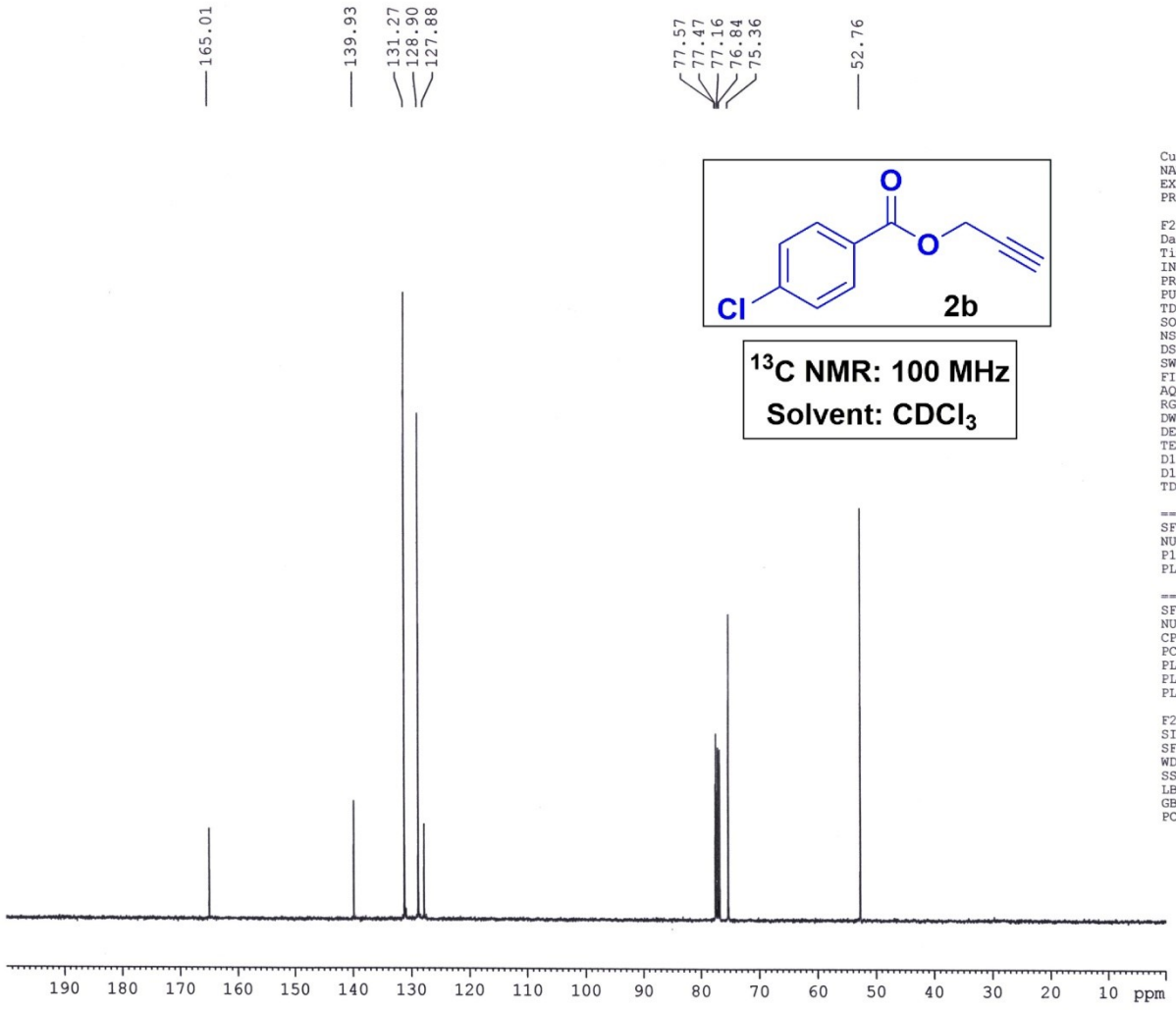
WDW                    EM
SSB          0
LB                    1.00 Hz
GB           0
PC                    1.40
```


7.991
7.970
7.414
7.393
7.260
4.907
4.901
2.539
2.533
2.527
O
O
Cl
2b
1H NMR: 400 MHz
Solvent: CDCl3
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
2.00
2.02
2.07
0.94

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Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  490
PROCNO                   1

F2 - Acquisition Parameters
Date_              20211212
Time                 16.00
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                    300
DS                      2
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   62.69
DW                  20.800 usec
DE                   6.50 usec
TE                  294.3 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                  13C
P1                   8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                    16384
SF            100.6177904 MHz
WDW                     EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.40
```
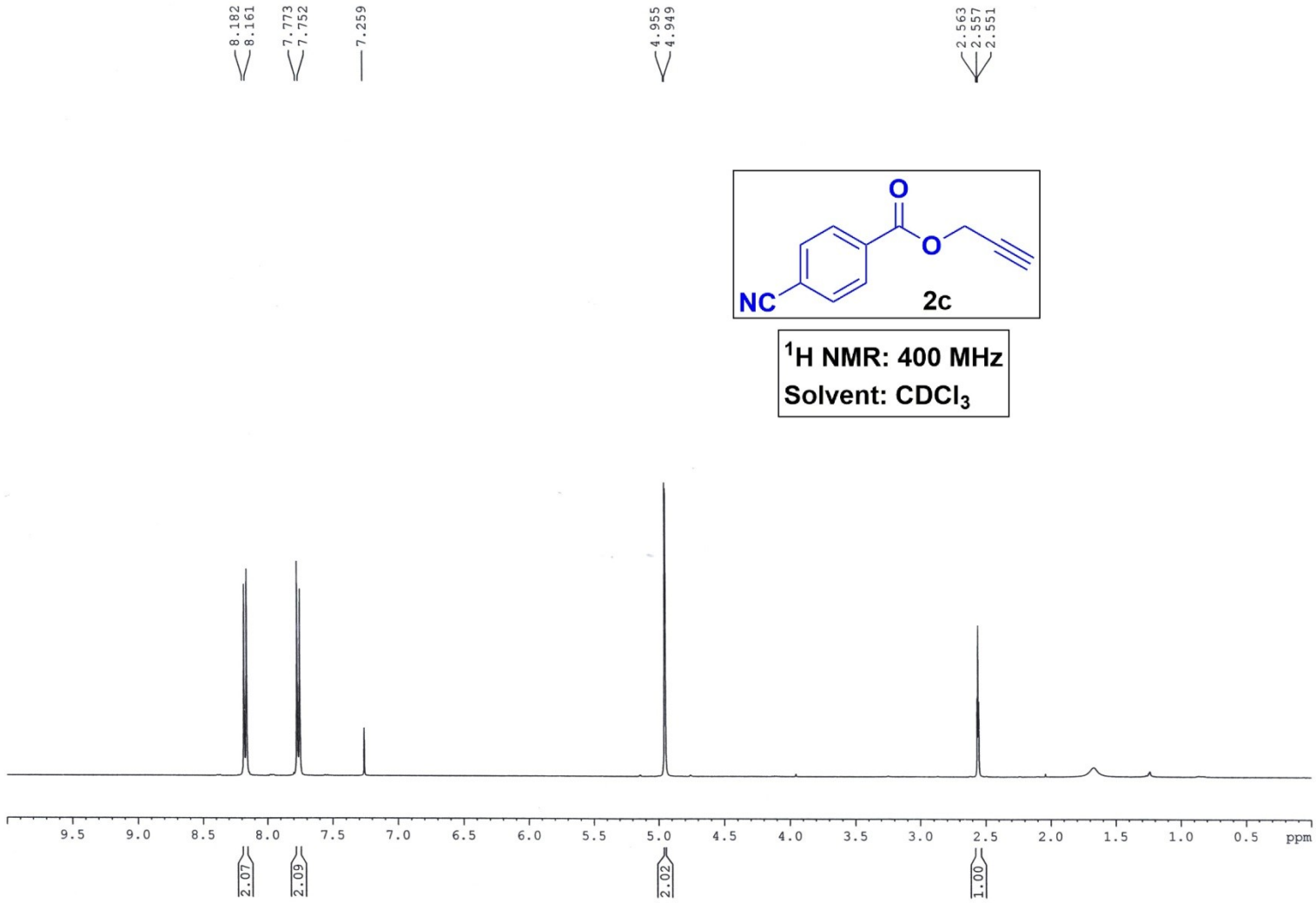
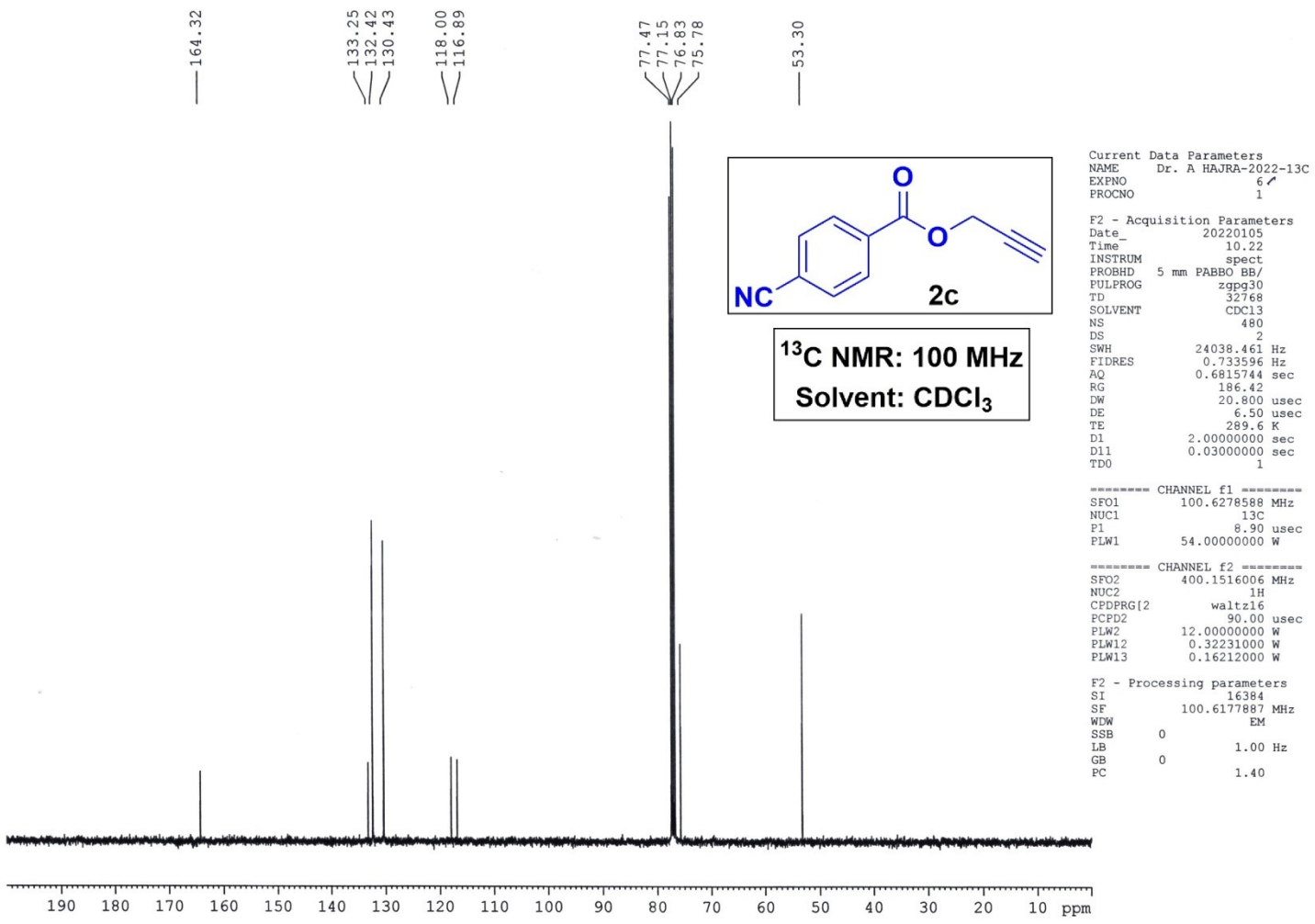


8.182
8.161
7.773
7.752
7.259
4.955
4.949
2.563
2.557
2.551
O
O
NC
2c
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
2.07
2.09
2.02
1.00

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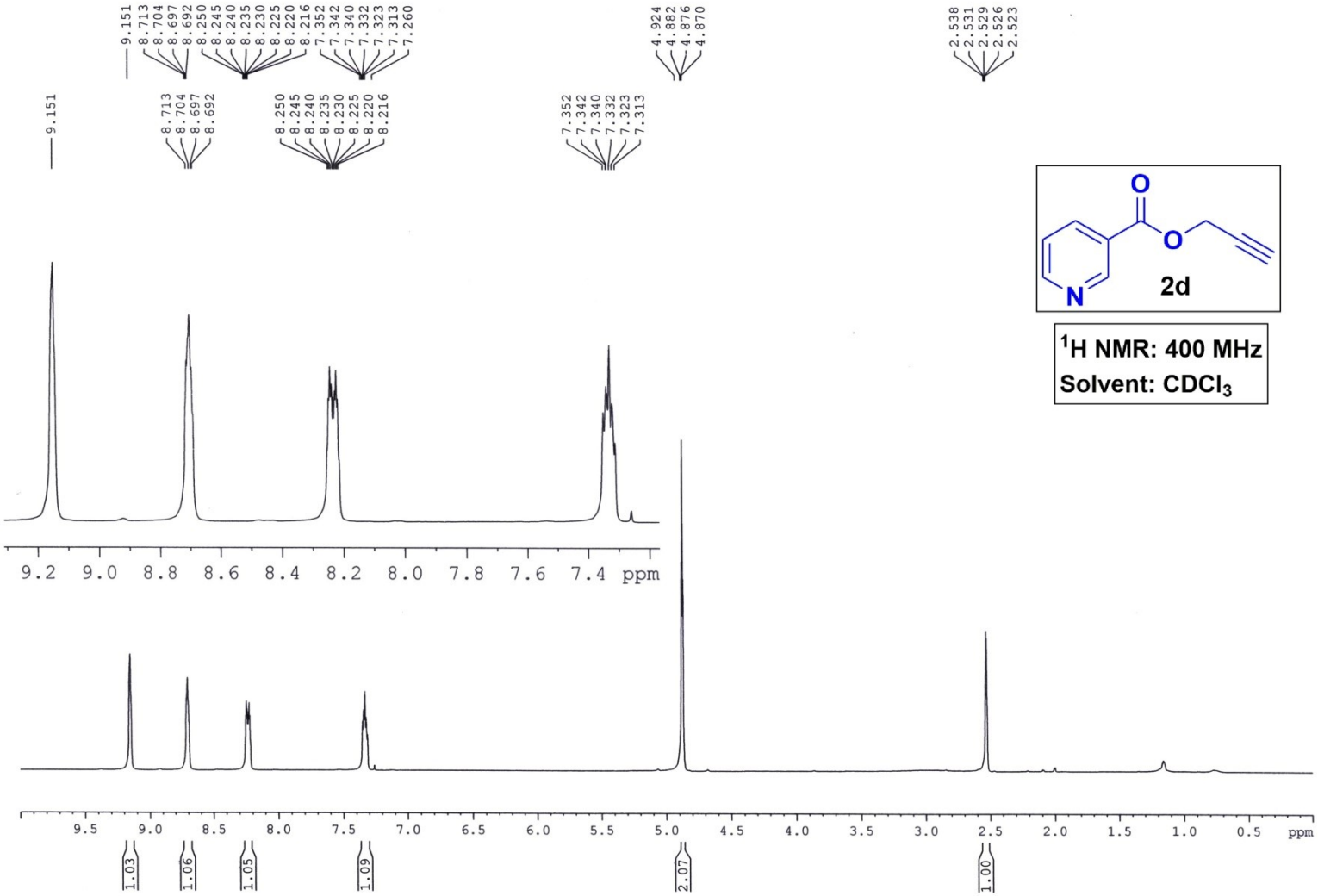
NAME      Dr. A HAJRA-2022-13C
EXPNO                       6
PROCNO                      1

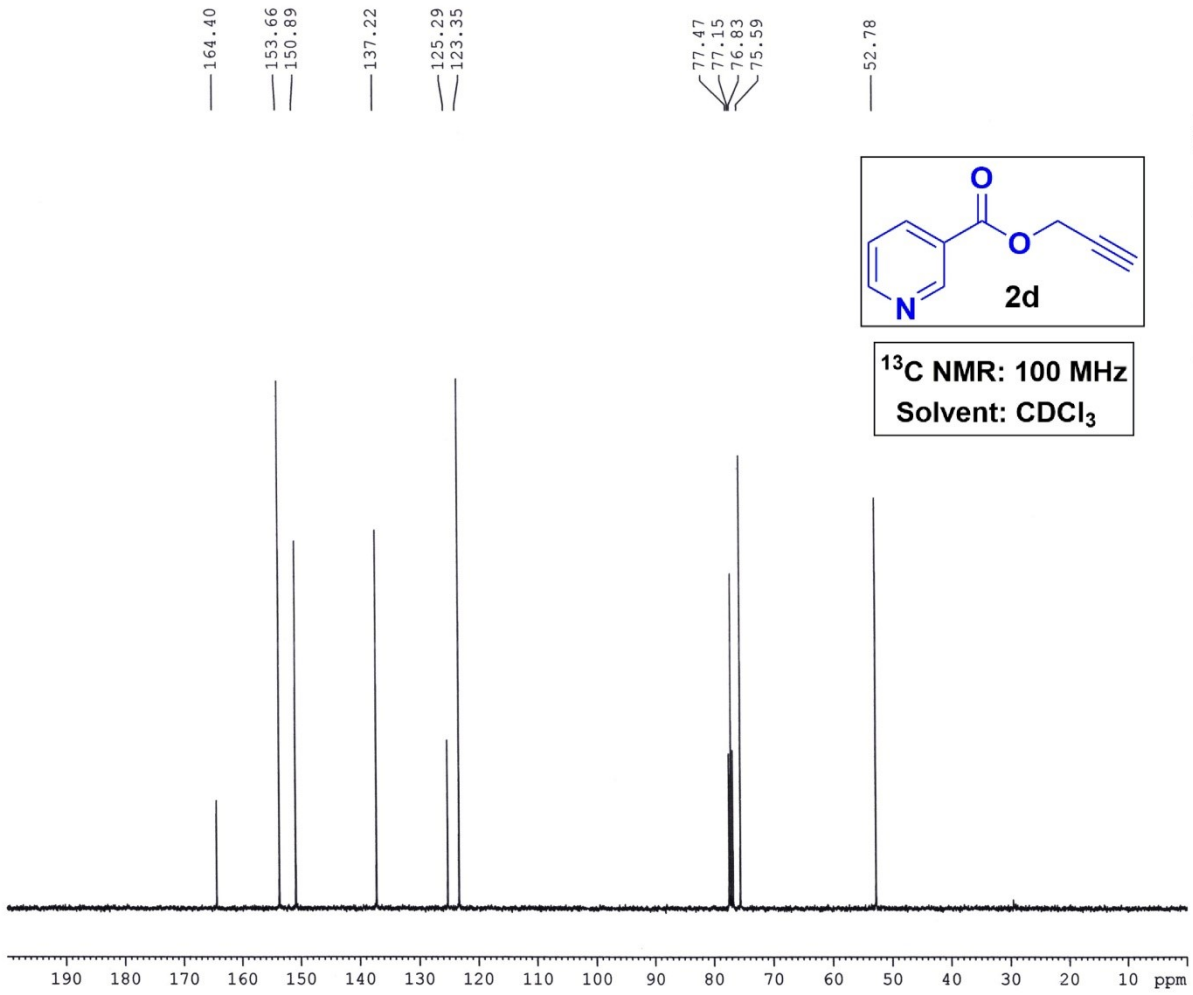
F2 - Acquisition Parameters
Date_              20220105
Time                 10.22
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     480
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   186.42
DW                   20.800 usec
DE                    6.50 usec
TE                   289.6 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                   13C
P1                    8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177887 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```


9.151
8.713
8.704
8.697
8.692
8.250
8.245
8.240
8.235
8.230
8.225
8.220
8.216
7.352
7.342
7.340
7.332
7.323
7.313
7.260
4.924
4.882
4.876
4.870
2.538
2.531
2.529
2.526
2.523
O
O
N
2d
1H NMR: 400 MHz
Solvent: CDCl3
9.2 9.0 8.8 8.6 8.4 8.2 8.0 7.8 7.6 7.4 ppm
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
1.03
1.06
1.05
1.09
2.07
1.00

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EXPNO                  486
PROCNO                   1

F2 - Acquisition Parameters
Date_               20211212
Time                    9.37
INSTRUM                spect
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PULPROG              zgpg30
TD                    32768
SOLVENT                CDCl3
NS                       120
DS                         2
SWH                24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                     26.53
DW                    20.800 usec
DE                     6.50 usec
TE                    290.1 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
SFO1           100.6278588 MHz
NUC1                    13C
P1                     8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2           400.1516006 MHz
NUC2                    1H
CPDPRG[2            waltz16
PCPD2                 90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
SI                     16384
SF             100.6178004 MHz
WDW                       EM
SSB       0
LB                     1.00 Hz
GB        0
PC                     1.40
```
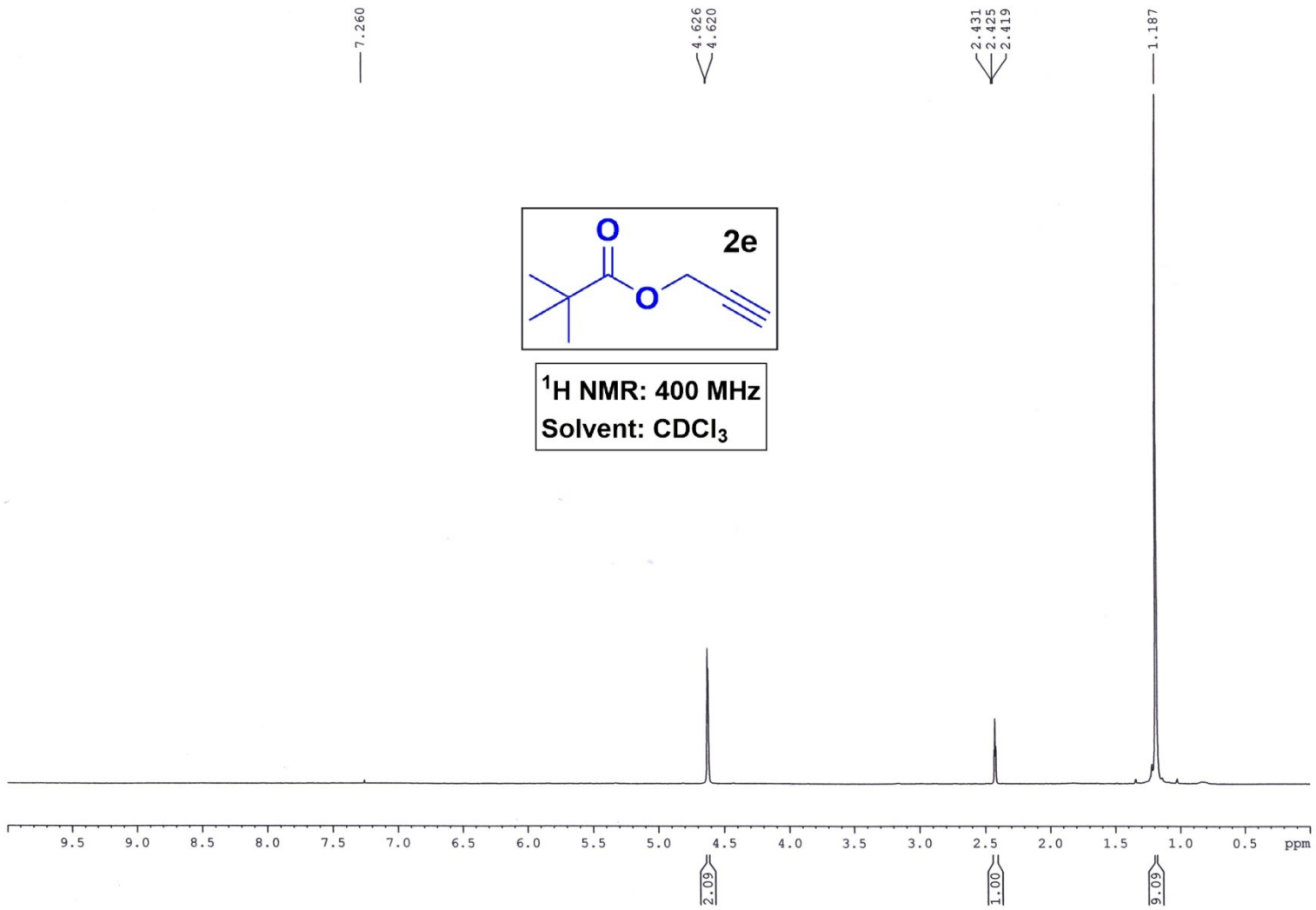
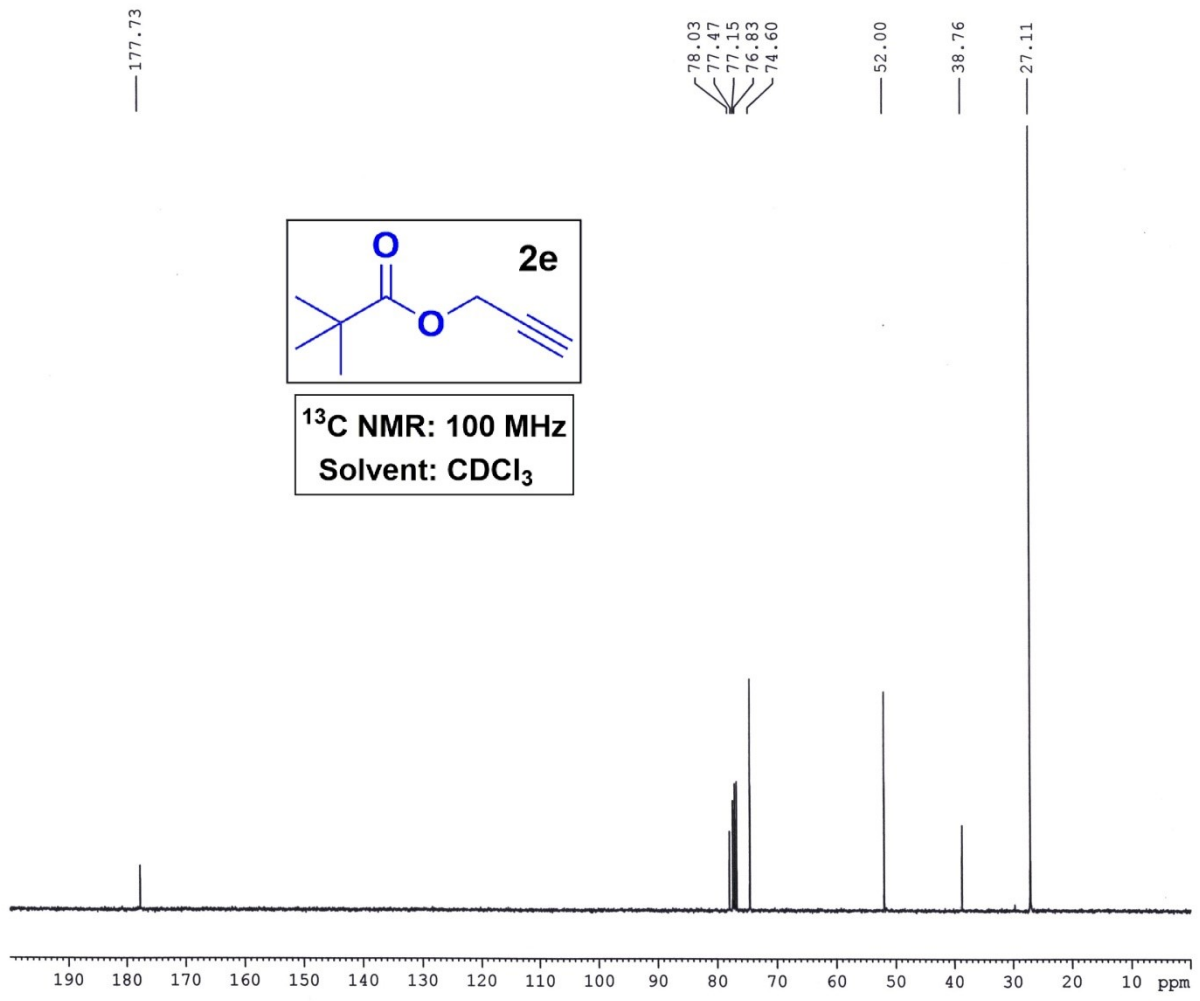


7.260
4.626
4.620
2.431
2.425
2.419
1.187
2e
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
2.09
1.00
9.09

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Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  481
PROCNO                   1

F2 - Acquisition Parameters
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Time                 13.18
INSTRUM              spect
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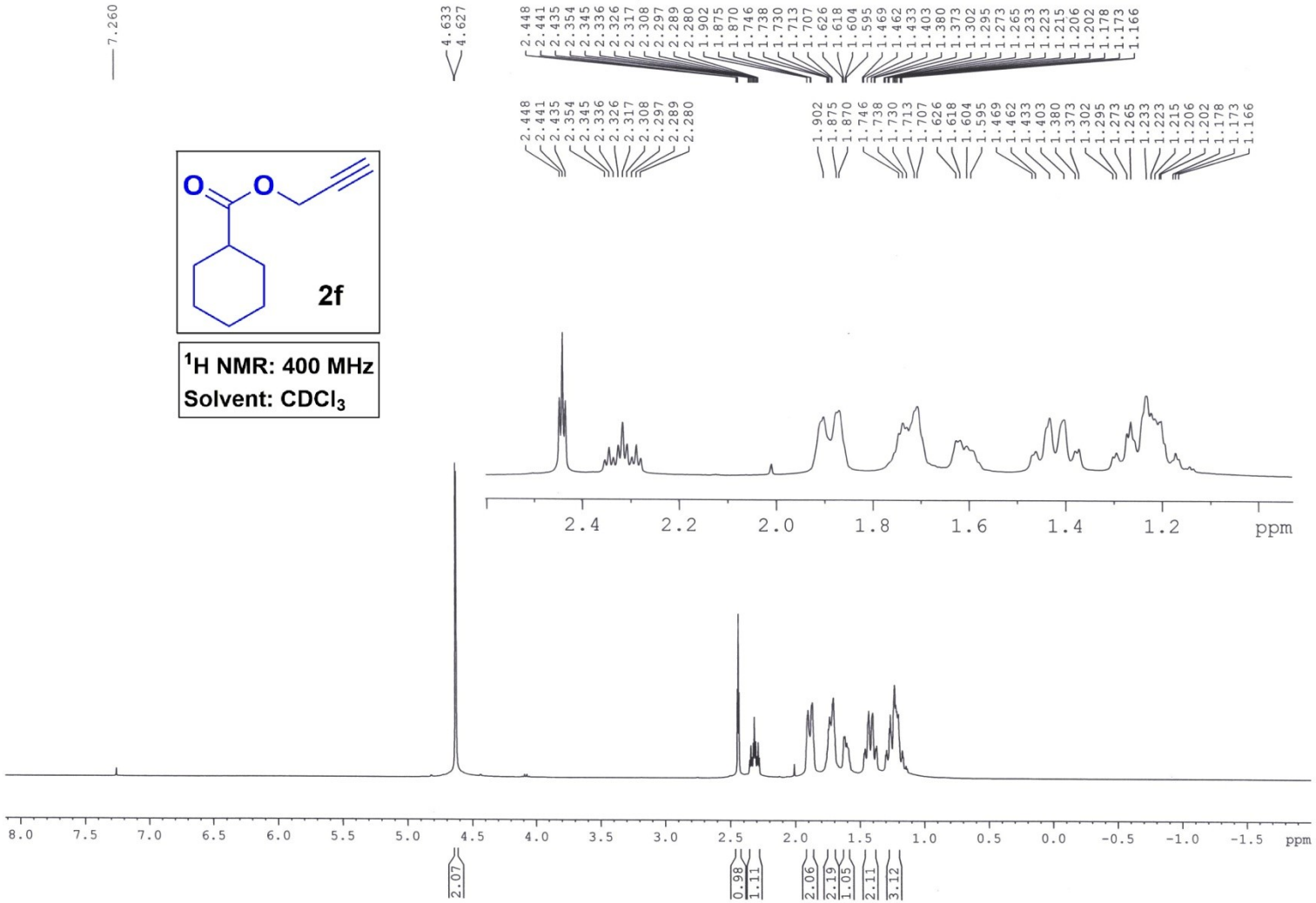
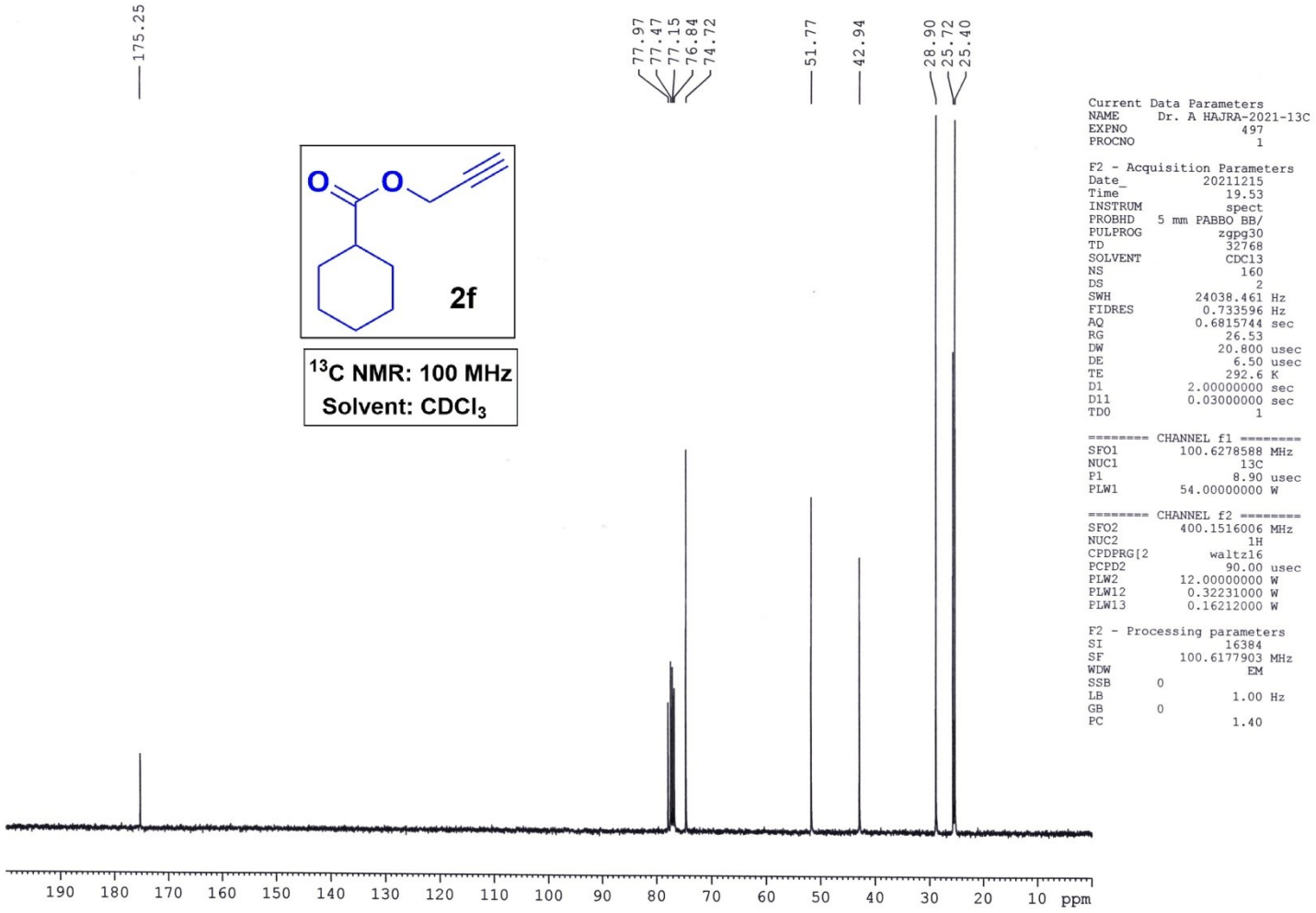
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     120
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                    23.55
DW                   20.800 usec
DE                    6.50 usec
TE                   297.3 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                   13C
P1                    8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177873 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```


7.260
4.633
4.627
2.448
2.441
2.435
2.354
2.345
2.336
2.326
2.317
2.308
2.297
2.289
2.280
1.902
1.875
1.870
1.746
1.738
1.730
1.713
1.707
1.626
1.618
1.604
1.595
1.469
1.462
1.433
1.403
1.380
1.373
1.302
1.295
1.273
1.265
1.233
1.223
1.215
1.206
1.202
1.178
1.173
1.166
O
O
2f
1H NMR: 400 MHz
Solvent: CDCl3
2.4
2.2
2.0
1.8
1.6
1.4
1.2
ppm
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
ppm
2.07
0.98
1.11
2.06
2.19
1.05
2.11
3.12



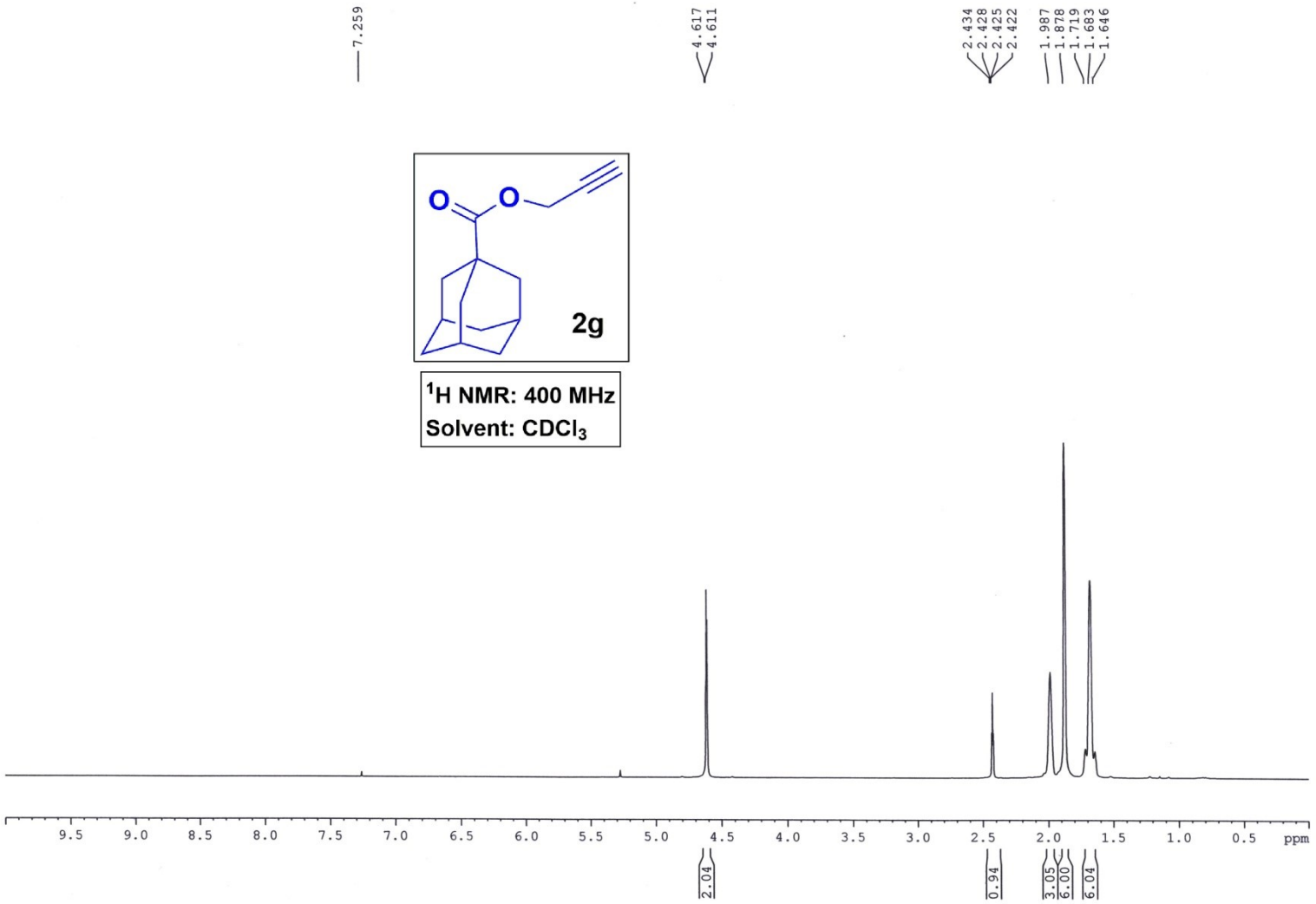

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  497
PROCNO                   1

F2 - Acquisition Parameters
Date_           20211215
Time               19.53
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                  160
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                26.53
DW                20.800 usec
DE                 6.50 usec
TE                292.6 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                13C
P1                 8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                 16384
SF           100.6177903 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```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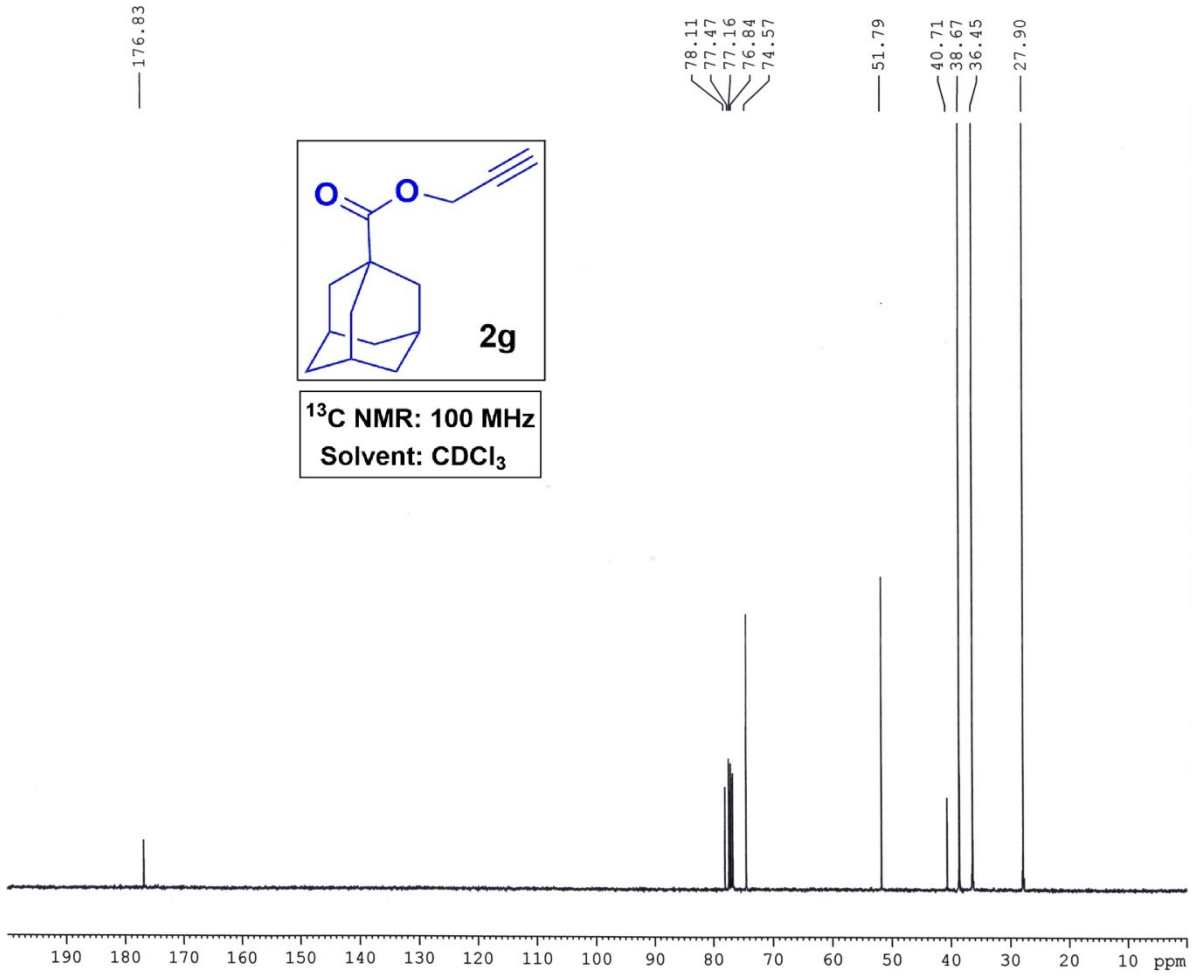
4.617
4.611
2.434
2.428
2.425
2.422
1.987
1.878
1.719
1.683
1.646
2g
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
2.04
0.94
3.05
6.00
6.04

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Current Data Parameters
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EXPNO                  491
PROCNO                   1

F2 - Acquisition Parameters
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Time               13.29
INSTRUM            spect
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PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                  160
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                20.64
DW              20.800 usec
DE               6.50 usec
TE              293.0 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1              13C
P1               8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2              1H
CPDPRG[2        waltz16
PCPD2            90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                16384
SF          100.6177917 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
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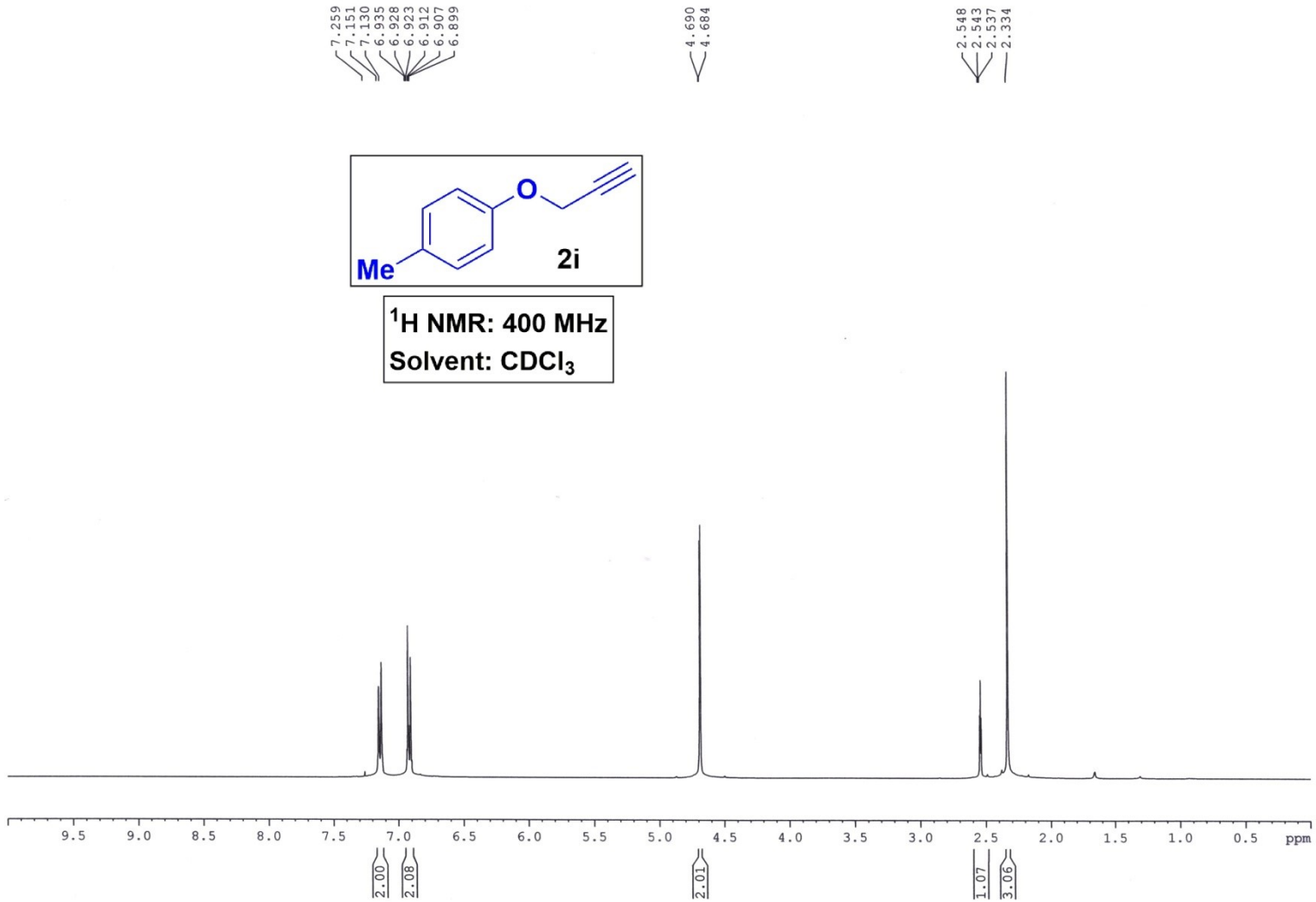
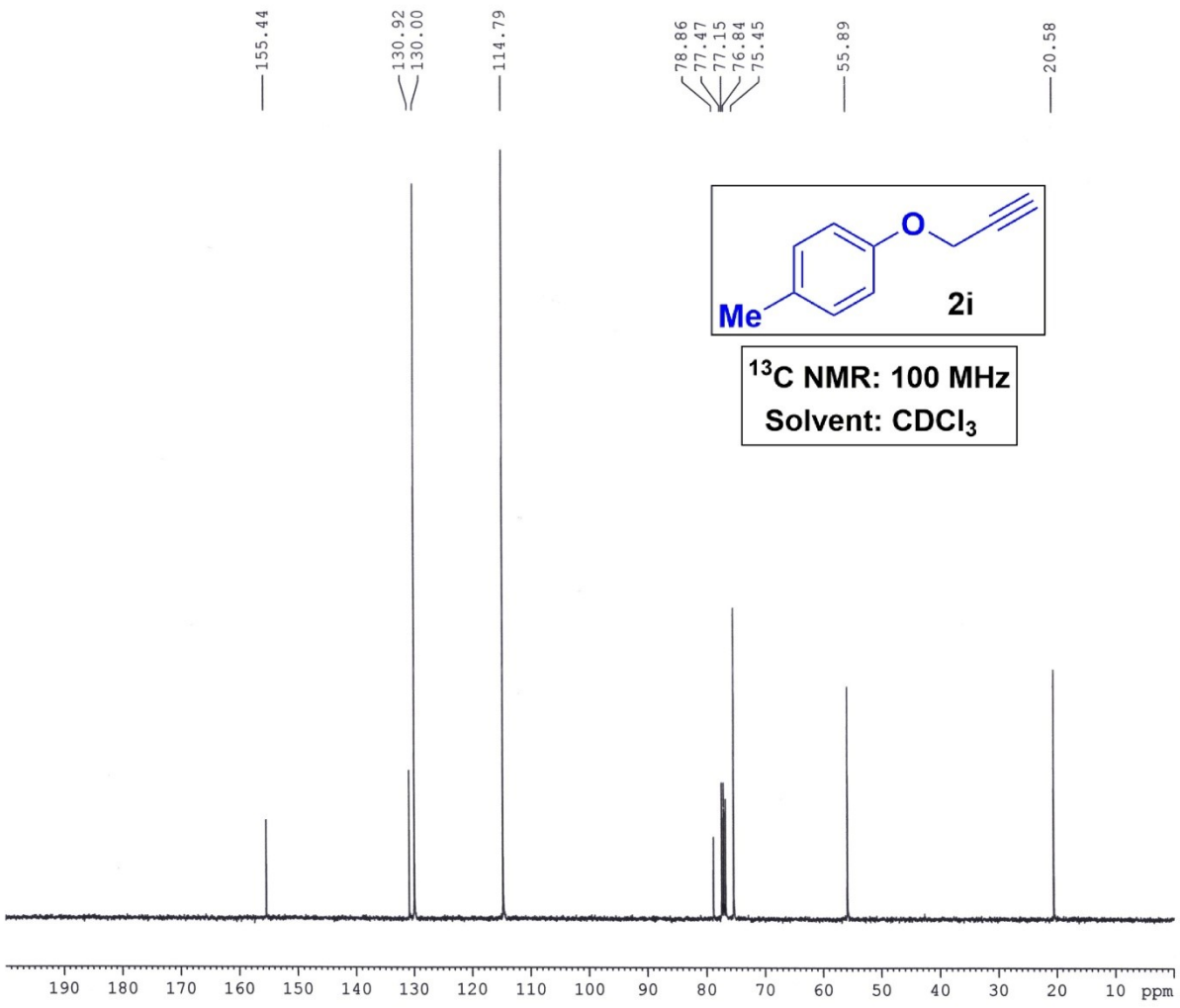

7.259
7.151
7.130
6.935
6.928
6.923
6.912
6.907
6.899
4.690
4.684
2.548
2.543
2.537
2.334
O
Me
2i
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
2.00
2.08
2.01
1.07
3.06

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Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  485
PROCNO                   1

F2 - Acquisition Parameters
Date_              20211212
Time                  9.22
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG           zgpg30
TD                 32768
SOLVENT            CDCl3
NS                   120
DS                     2
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                  26.53
DW                 20.800 usec
DE                  6.50 usec
TE                289.7 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                  13C
P1                   8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                 16384
SF           100.6177975 MHz
WDW                   EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```
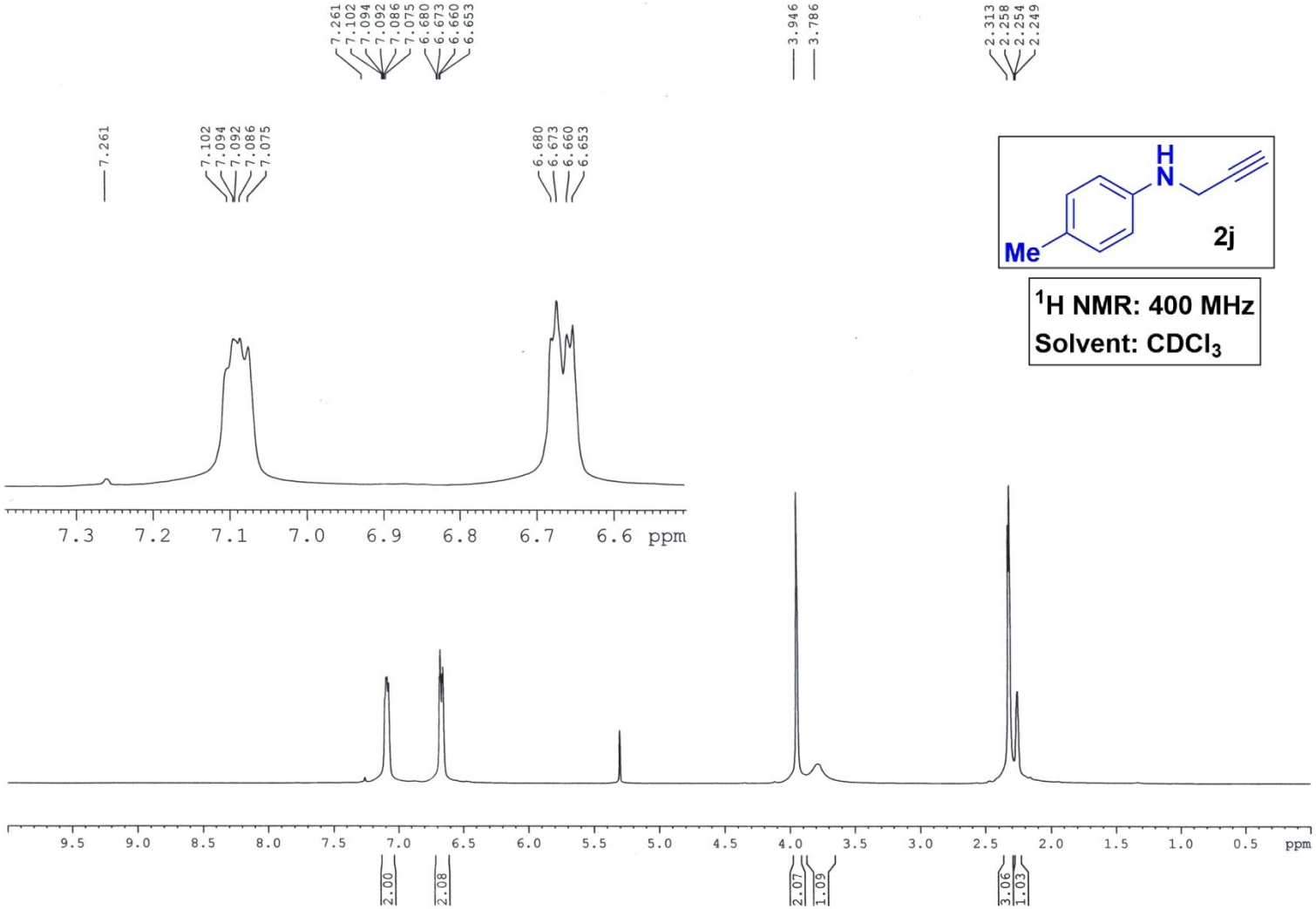
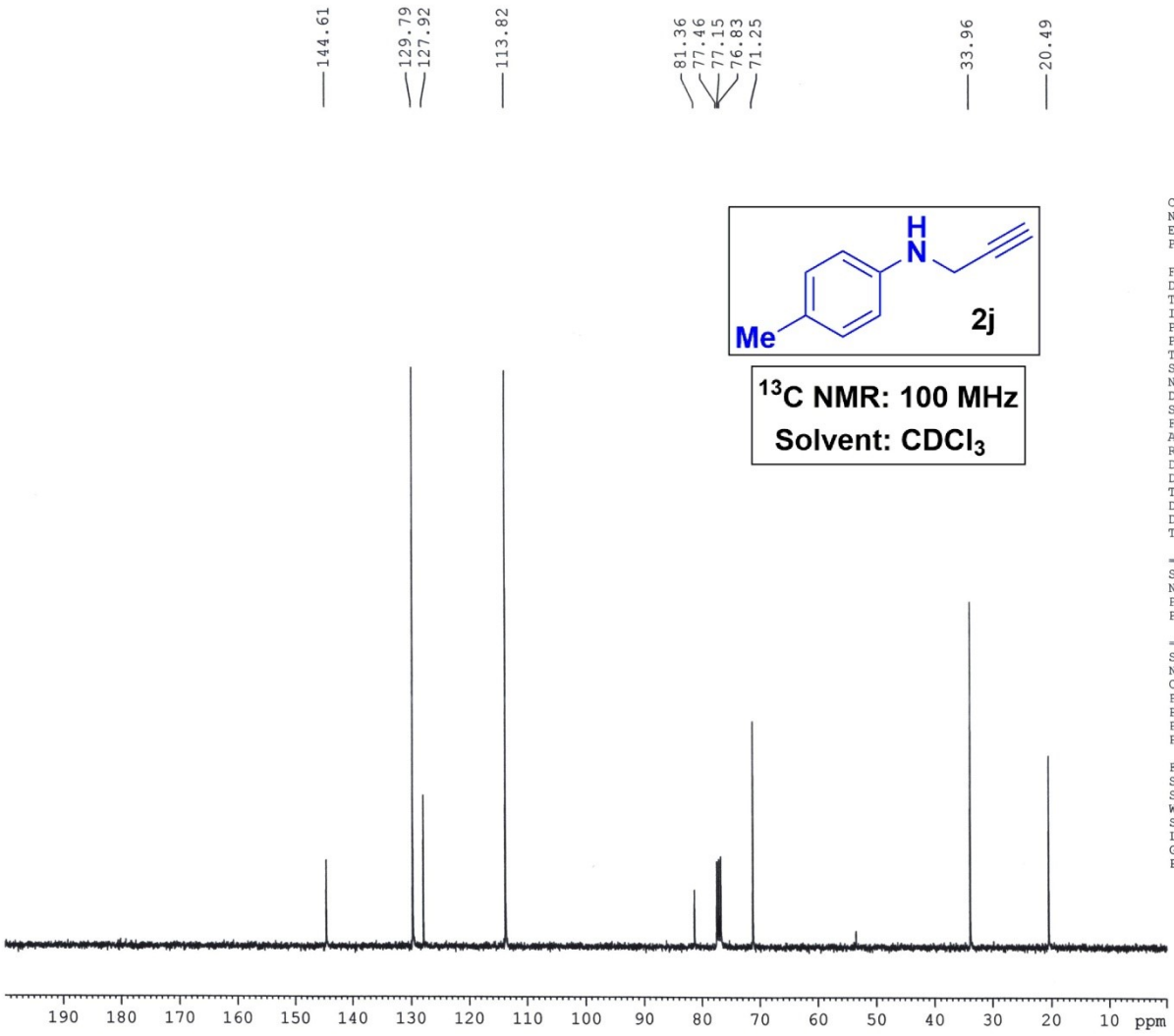
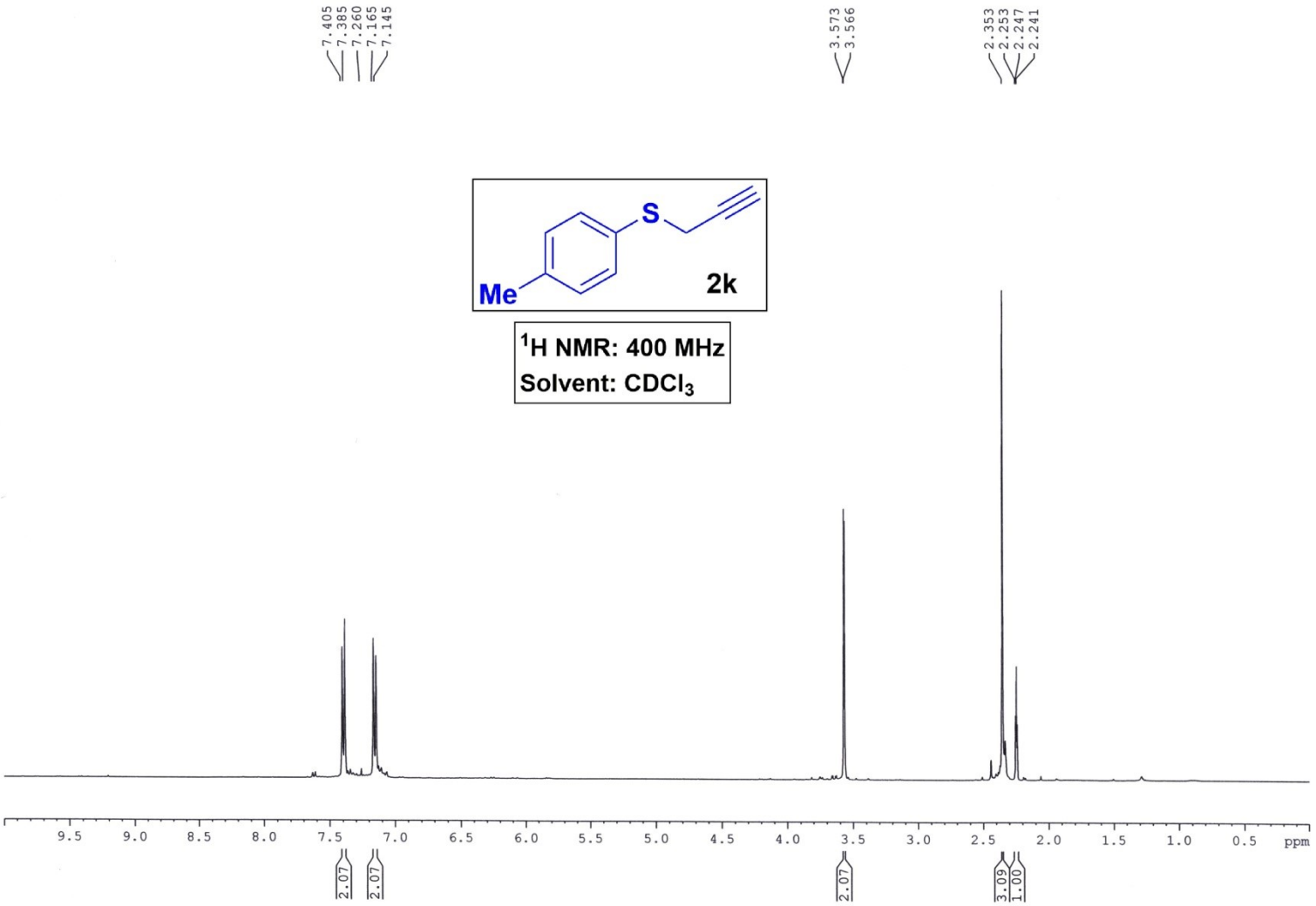
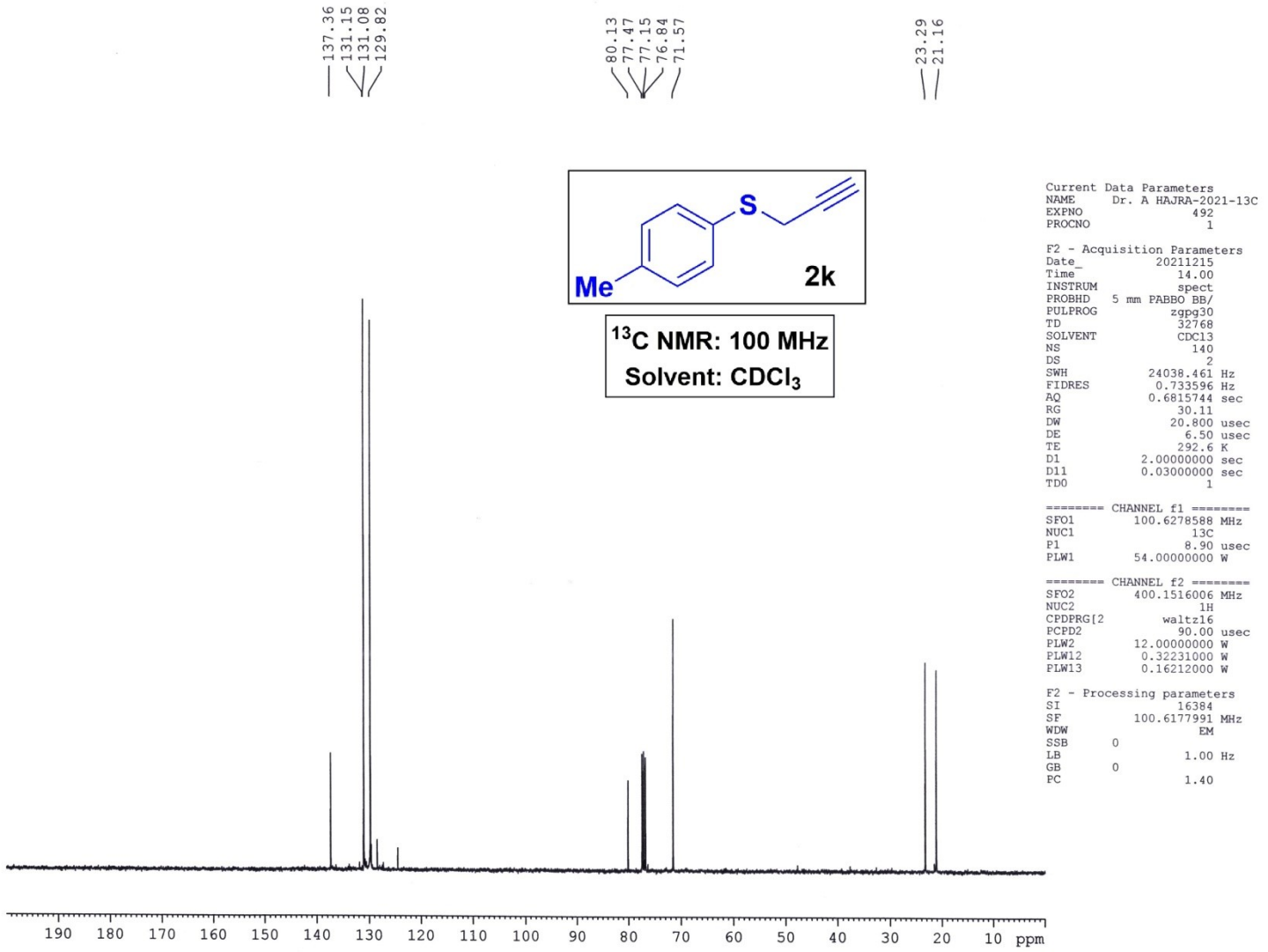


7.261
7.102
7.094
7.092
7.086
7.075
6.680
6.673
6.660
6.653
3.946
3.786
2.313
2.258
2.254
2.249
H
N
Me
2j
1H NMR: 400 MHz
Solvent: CDCl3
7.3 7.2 7.1 7.0 6.9 6.8 6.7 6.6 ppm
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
2.00
2.08
2.07
1.09
3.06
1.03

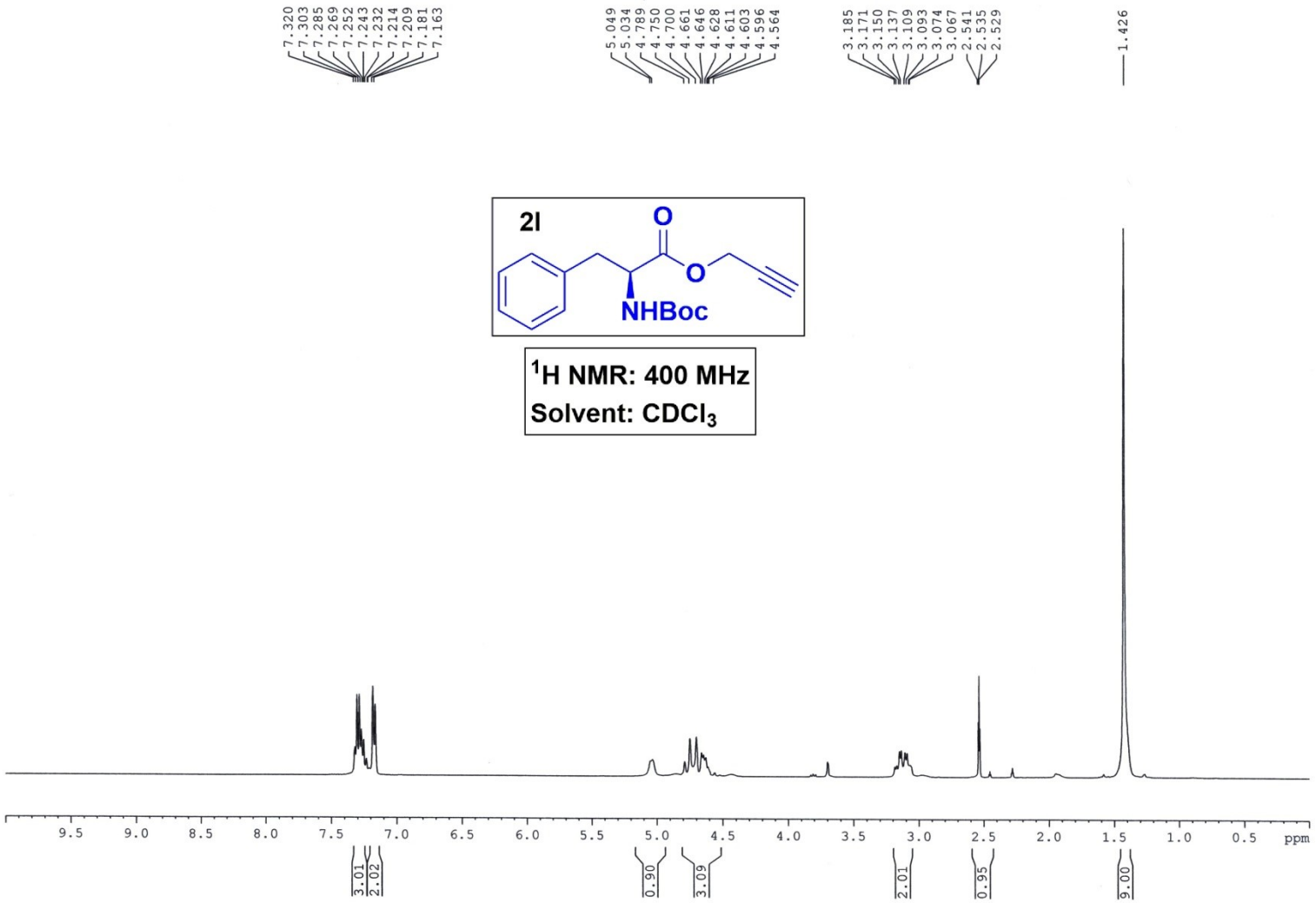


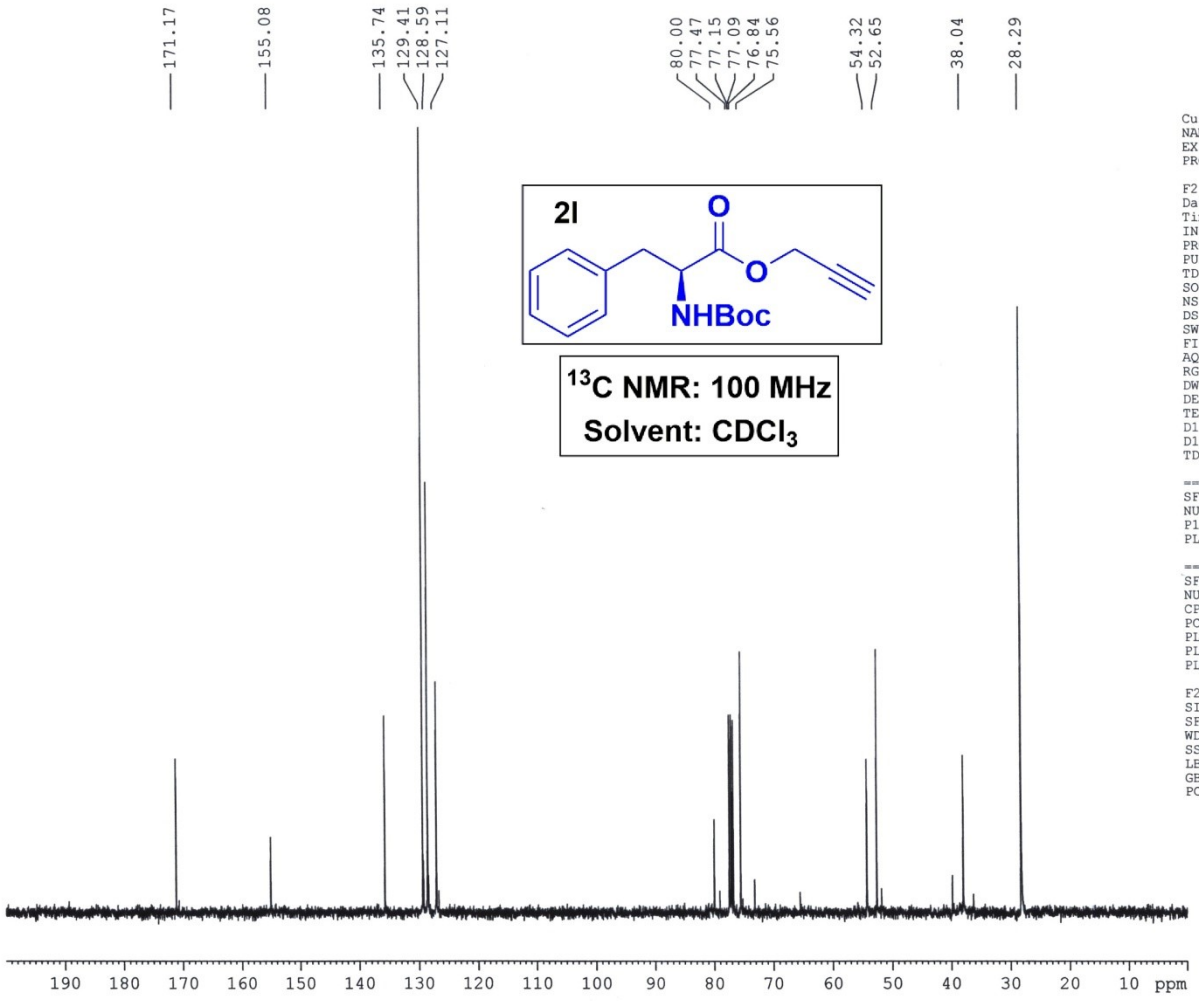

```
Current Data Parameters
NAME      Dr. A HAJRA-2022-13C
EXPNO                        4
PROCNO                       1

F2 - Acquisition Parameters
Date_              20220103
Time                   17.03
INSTRUM                spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                    32768
SOLVENT               CDCl3
NS                       90
DS                        2
SWH                24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                    106.66
DW                    20.800 usec
DE                     6.50 usec
TE                    297.7 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1           100.6278588 MHz
NUC1                     13C
P1                      8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2           400.1516006 MHz
NUC2                     1H
CPDPRG[2             waltz16
PCPD2                 90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
SI                       16384
SF             100.6178009 MHz
WDW                         EM
SSB          0
LB                      1.00 Hz
GB           0
PC                      1.40
```


7.405
7.385
7.260
7.165
7.145
3.573
3.566
2.353
2.253
2.247
2.241
S
Me
2k
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
2.07
2.07
2.07
3.09
1.00

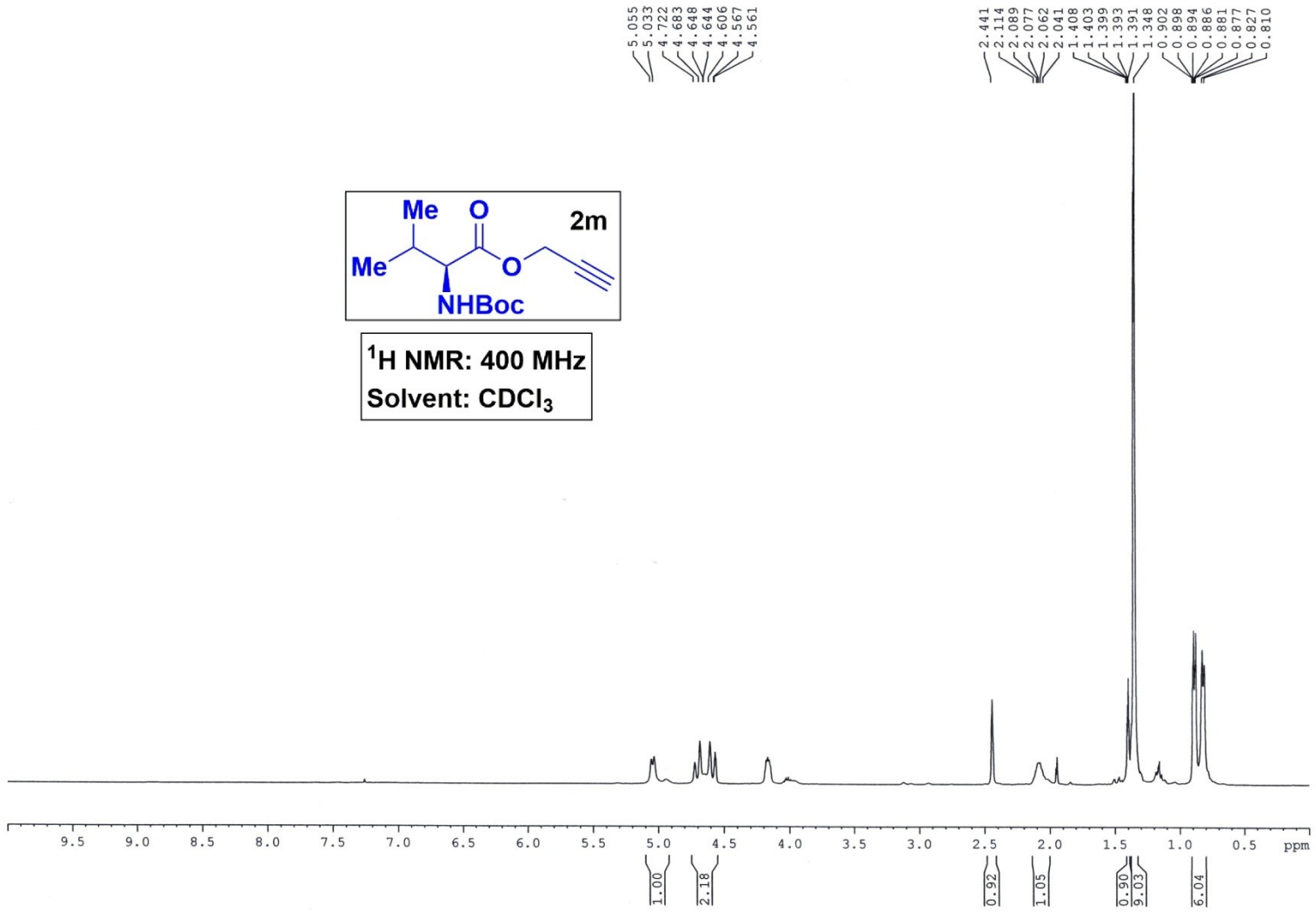


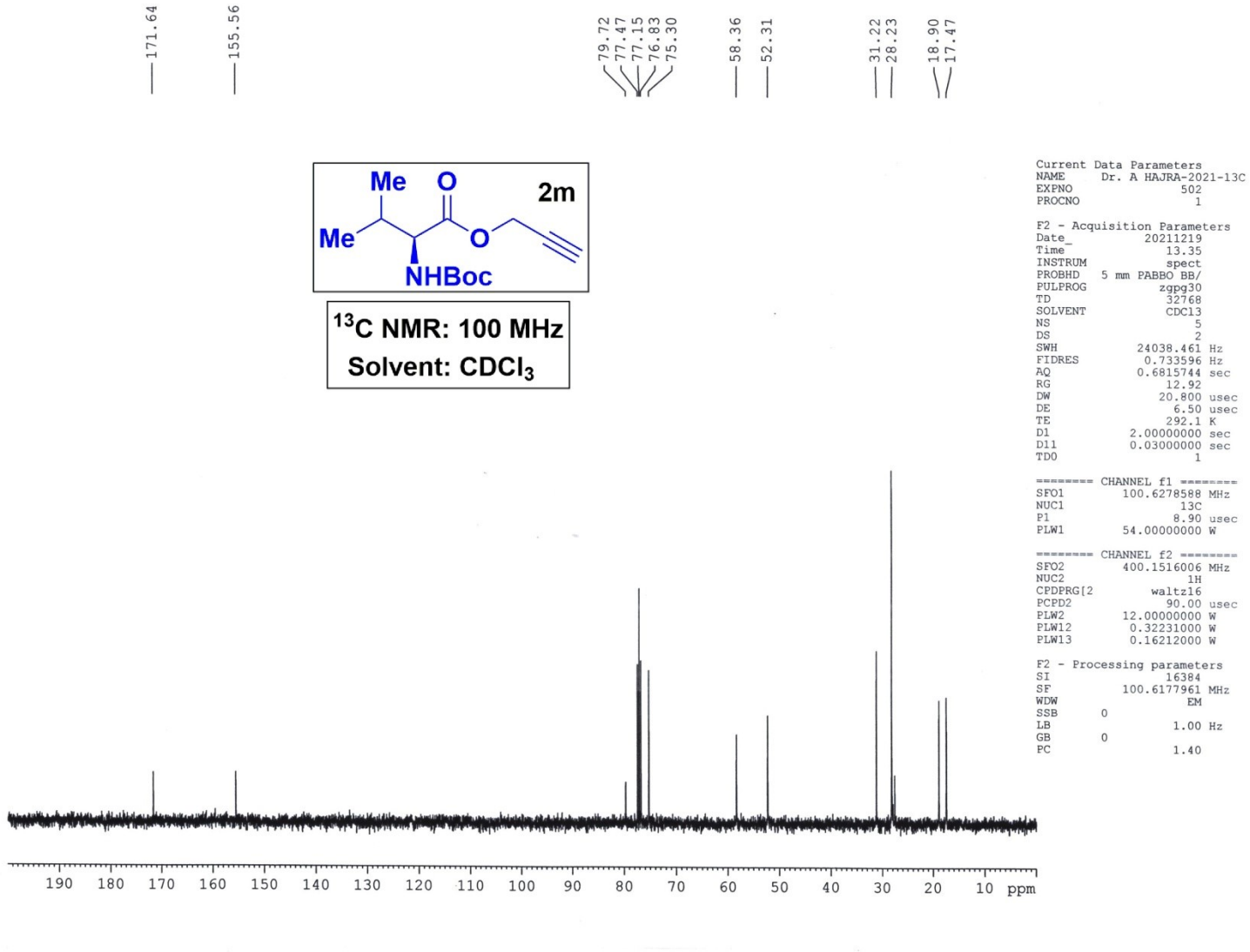

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  492
PROCNO                   1

F2 - Acquisition Parameters
Date_             20211215
Time                 14.00
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                    140
DS                      2
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   30.11
DW                 20.800 usec
DE                  6.50 usec
TE                 292.6 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                  13C
P1                   8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                   16384
SF           100.6177991 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```

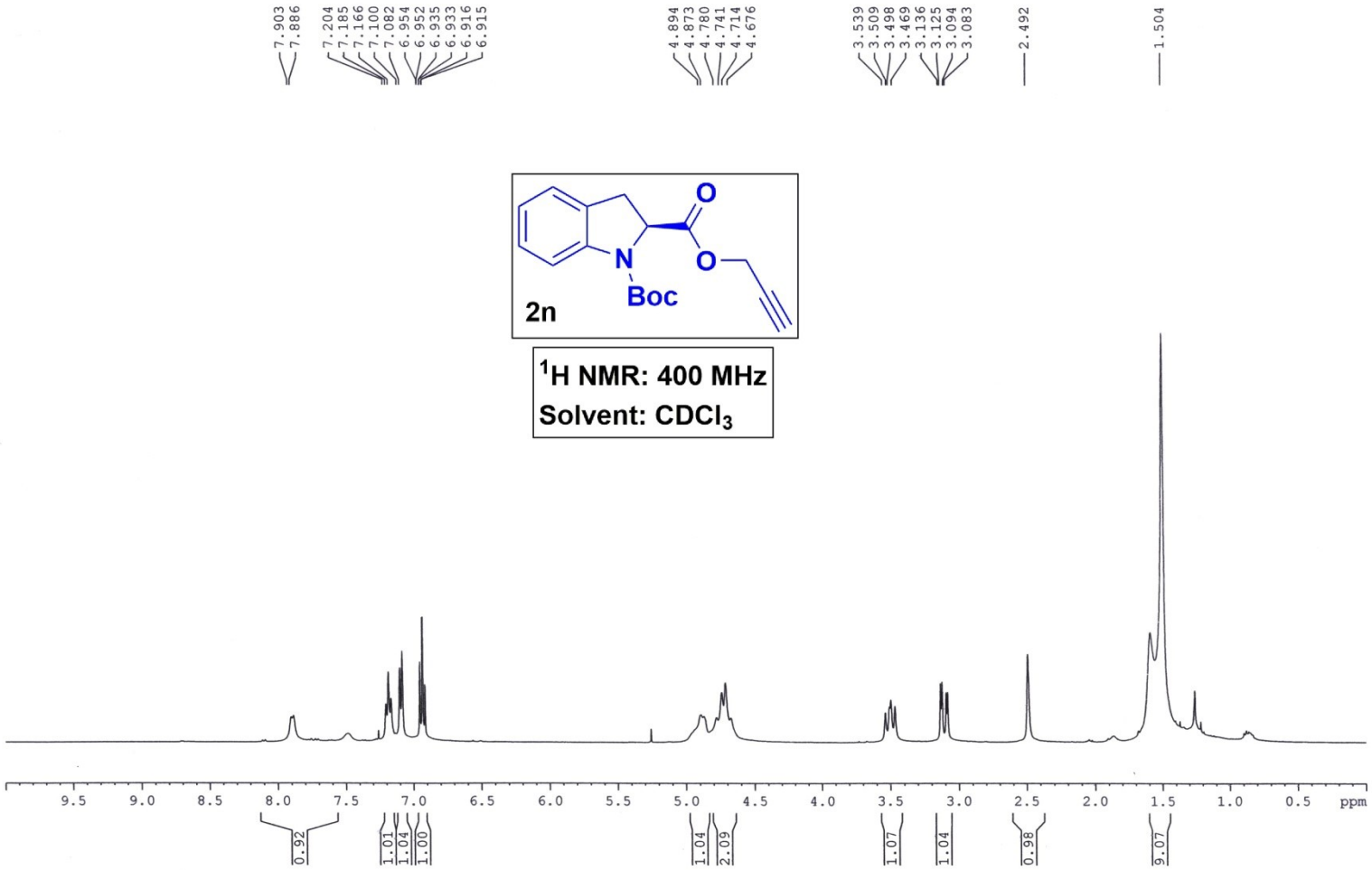

7.320
7.303
7.285
7.269
7.252
7.243
7.232
7.214
7.209
7.181
7.163
5.049
5.034
4.789
4.750
4.700
4.661
4.646
4.628
4.611
4.603
4.596
4.564
3.185
3.171
3.150
3.137
3.109
3.093
3.074
3.067
2.541
2.535
2.529
1.426
2l
O
O
NHBoc
1H NMR: 400 MHz
Solvent: CDCl3
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
3.01
2.02
0.90
3.09
2.01
0.95
9.00

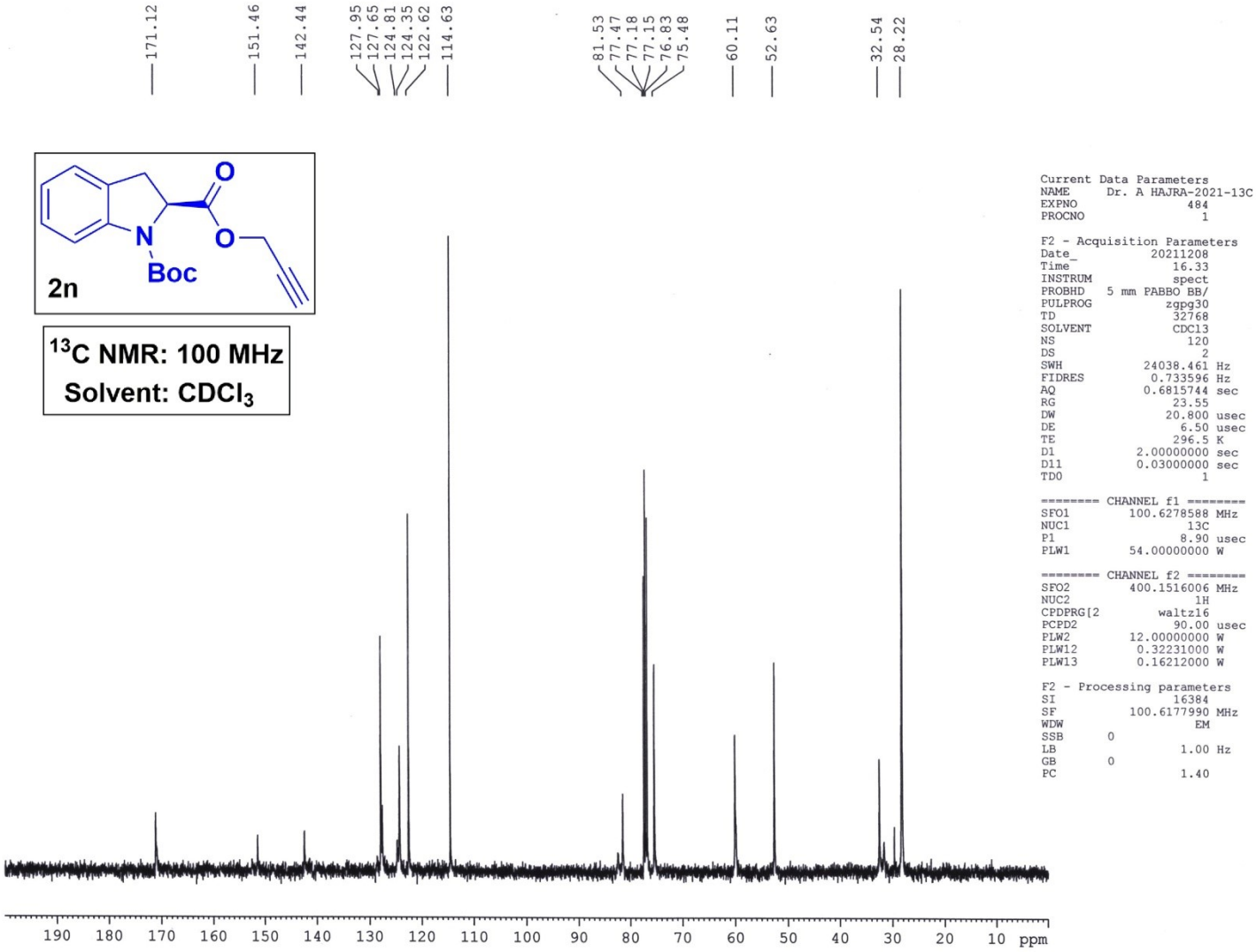


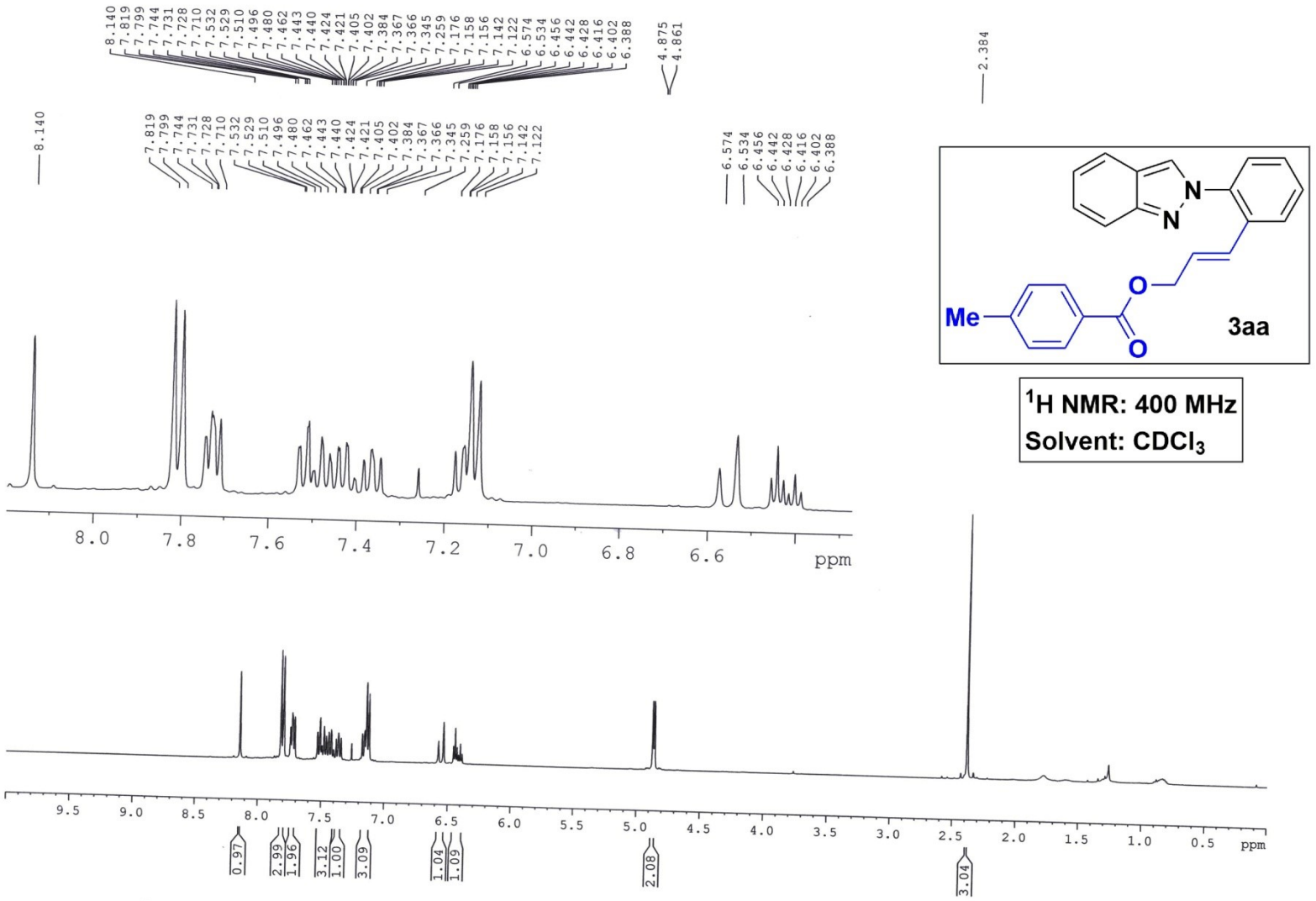

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  506
PROCNO                   1

F2 - Acquisition Parameters
Date_           20211226
Time              13.28
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD              32768
SOLVENT         CDCl3
NS                 50
DS                  2
SWH          24038.461 Hz
FIDRES        0.733596 Hz
AQ            0.6815744 sec
RG               20.64
DW               20.800 usec
DE                6.50 usec
TE              294.8 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                 1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1               13C
P1                8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2               1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                16384
SF          100.6177976 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

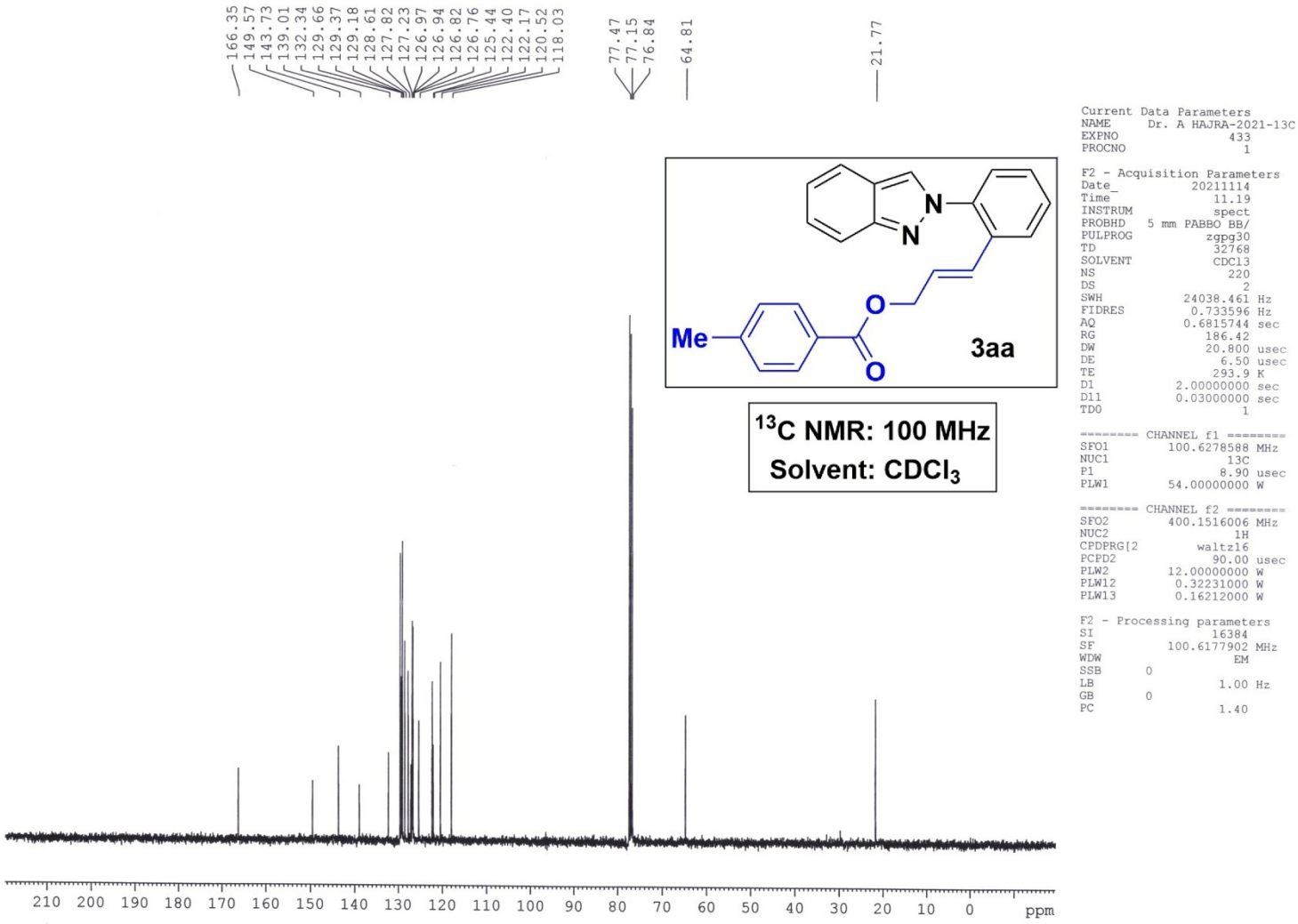

5.055
5.033
4.722
4.683
4.648
4.644
4.606
4.567
4.561
2.441
2.114
2.089
2.077
2.062
2.041
1.408
1.403
1.399
1.393
1.391
1.348
0.902
0.898
0.894
0.886
0.881
0.877
0.827
0.810
Me
O
2m
Me
O
NHBoc
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
1.00
2.18
0.92
1.05
0.90
9.03
6.04


171.64
155.56
79.72
77.47
77.15
76.83
75.30
58.36
52.31
31.22
28.23
18.90
17.47
Me
O
2m
Me
O
NHBoc
^{13}C NMR: 100 MHz
Solvent: CDCl$_3$
Current Data Parameters
NAME Dr. A HAJRA-2021-13C
EXPNO 502
PROCNO 1
F2 - Acquisition Parameters
Date_ 20211219
Time 13.35
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 5
DS 2
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 12.92
DW 20.800 usec
DE 6.50 usec
TE 292.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6278588 MHz
NUC1 13C
P1 8.90 usec
PLW1 54.00000000 W
======== CHANNEL f2 ========
SFO2 400.1516006 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 90.00 usec
PLW2 12.00000000 W
PLW12 0.32231000 W
PLW13 0.16212000 W
F2 - Processing parameters
SI 16384
SF 100.6177961 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm

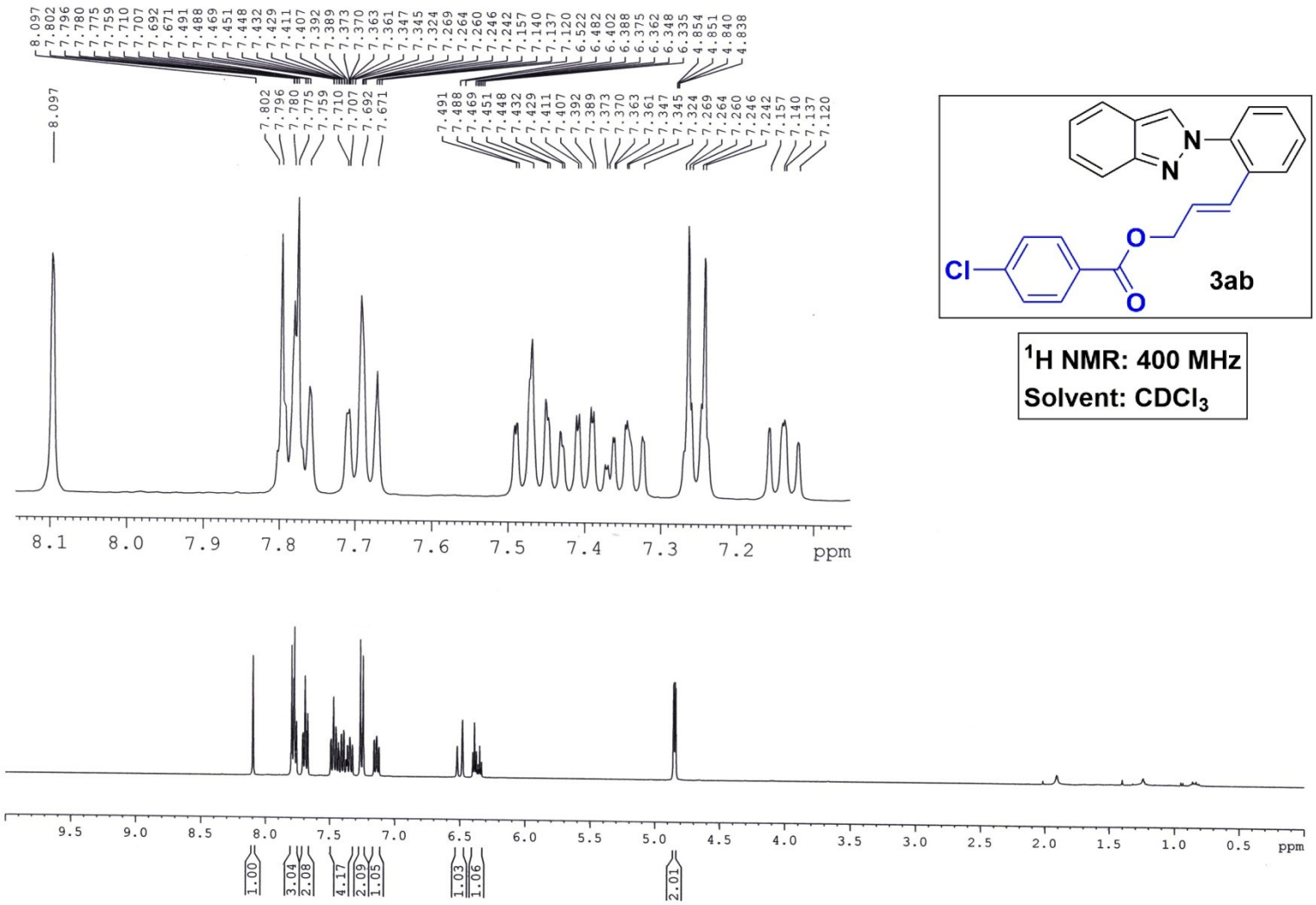

7.903
7.886
7.204
7.185
7.166
7.100
7.082
6.954
6.952
6.935
6.933
6.916
6.915
4.894
4.873
4.780
4.741
4.714
4.676
3.539
3.509
3.498
3.469
3.136
3.125
3.094
3.083
2.492
1.504
O
N
O
Boc
2n
1H NMR: 400 MHz
Solvent: CDCl3
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
0.92
1.01
1.04
1.00
1.04
2.09
1.07
1.04
0.98
9.07


171.12
151.46
142.44
127.95
127.65
124.81
124.35
122.62
114.63
81.53
77.47
77.18
77.15
76.83
75.48
60.11
52.63
32.54
28.22
O
N
O
Boc
2n
^{13}C NMR: 100 MHz
Solvent: CDCl$_3$
Current Data Parameters
NAME Dr. A HAJRA-2021-13C
EXPNO 484
PROCNO 1
F2 - Acquisition Parameters
Date_ 20211208
Time 16.33
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 120
DS 2
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 23.55
DW 20.800 usec
DE 6.50 usec
TE 296.5 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6278588 MHz
NUC1 13C
P1 8.90 usec
PLW1 54.00000000 W
======== CHANNEL f2 ========
SFO2 400.1516006 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 90.00 usec
PLW2 12.00000000 W
PLW12 0.32231000 W
PLW13 0.16212000 W
F2 - Processing parameters
SI 16384
SF 100.6177990 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm

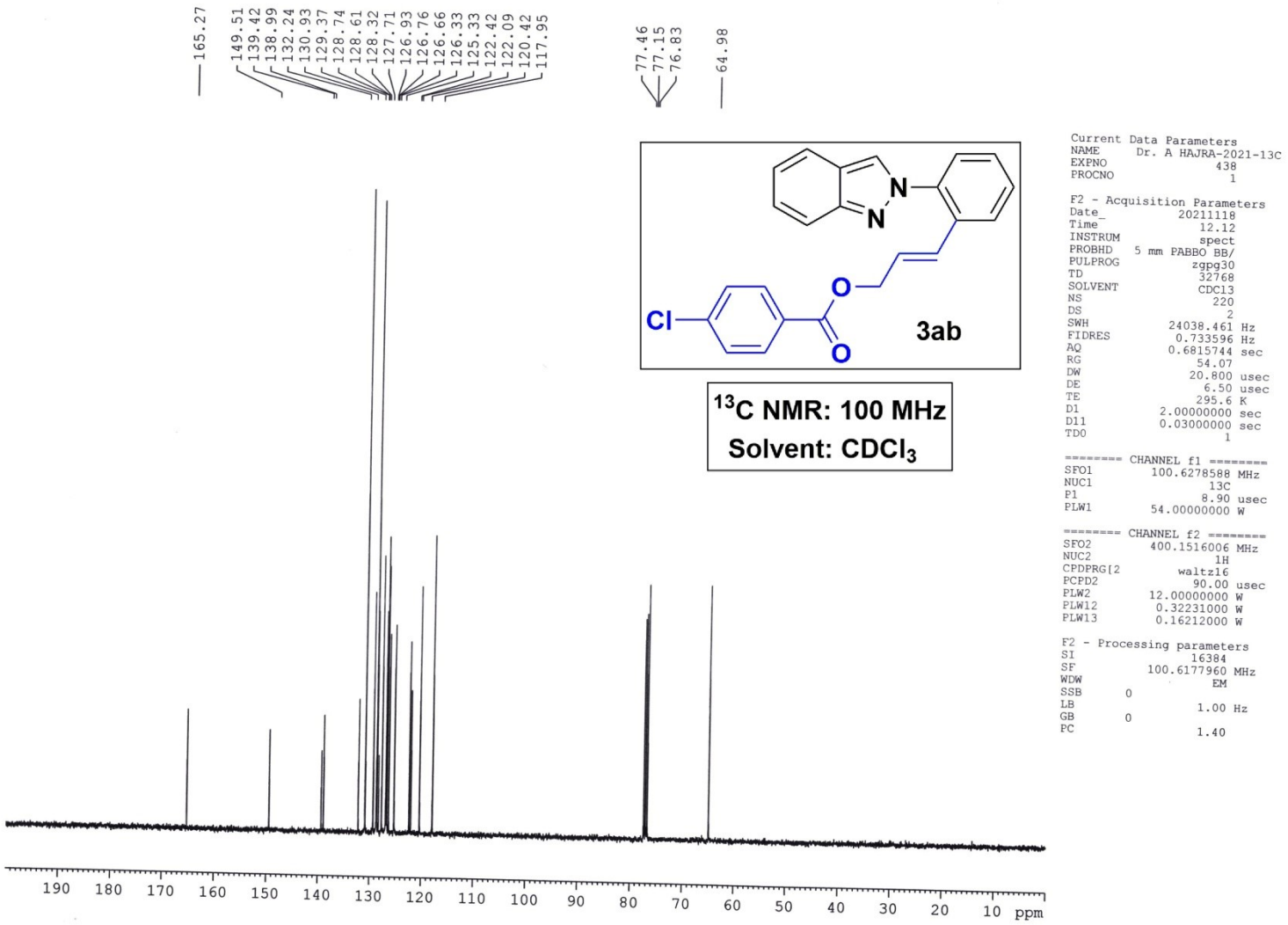

8.140
7.819
7.799
7.744
7.731
7.728
7.710
7.532
7.529
7.510
7.496
7.480
7.462
7.443
7.440
7.424
7.421
7.405
7.402
7.384
7.367
7.366
7.345
7.259
7.176
7.158
7.156
7.142
7.122
6.574
6.534
6.456
6.442
6.428
6.416
6.402
6.388
4.875
4.861
2.384
Me
3aa
1H NMR: 400 MHz
Solvent: CDCl3
ppm
0.97
2.99
1.96
3.12
1.00
3.09
1.04
1.09
2.08
3.04



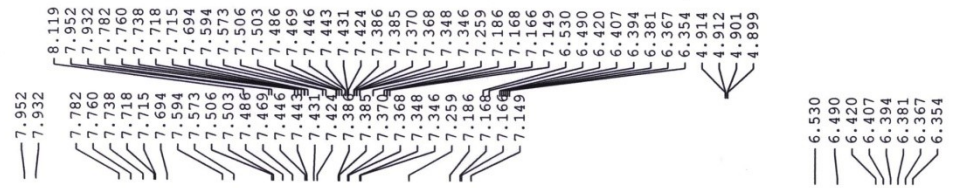

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  433
PROCNO                   1

F2 - Acquisition Parameters
Date_           20211114
Time              11.19
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD              32768
SOLVENT           CDCl3
NS                  220
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                186.42
DW              20.800 usec
DE               6.50 usec
TE              293.9 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1                13C
P1                8.90 usec
PLW1       54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2                1H
CPDPRG[2        waltz16
PCPD2             90.00 usec
PLW2       12.00000000 W
PLW12       0.32231000 W
PLW13       0.16212000 W

F2 - Processing parameters
SI                16384
SF          100.6177902 MHz
WDW                  EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

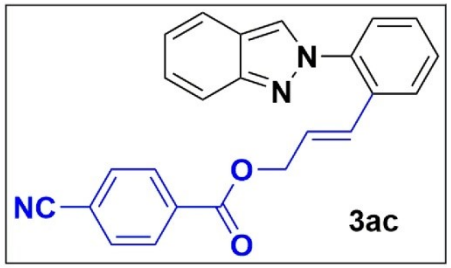


^{1}H NMR: 400 MHz
Solvent: $CDCl_3$

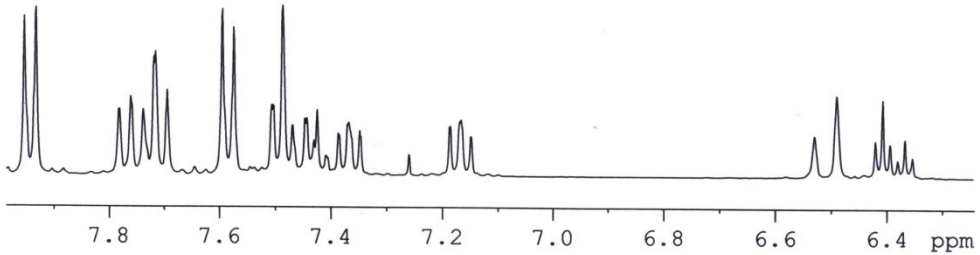


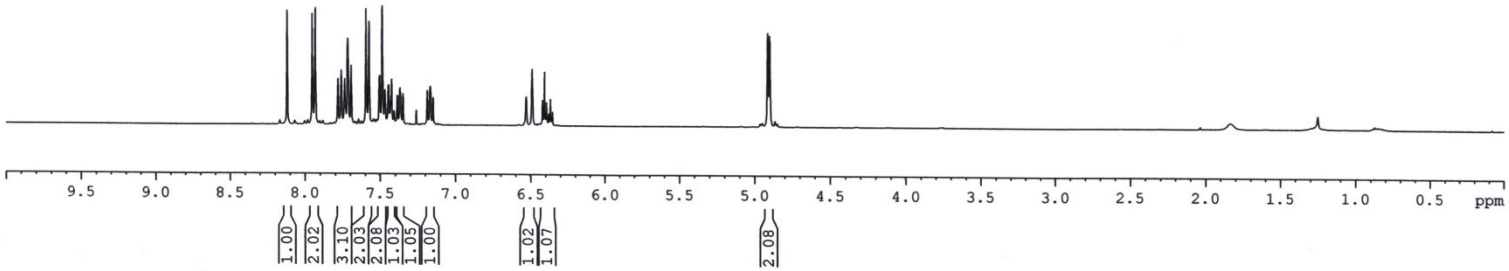

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  438
PROCNO                   1

F2 - Acquisition Parameters
Date_              20211118
Time                 12.12
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                    220
DS                      2
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   54.07
DW                20.800 usec
DE                 6.50 usec
TE                 295.6 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                   13C
P1                  8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                   16384
SF           100.6177960 MHz
WDW                     EM
SSB                  0
LB                  1.00 Hz
GB                   0
PC                  1.40
```

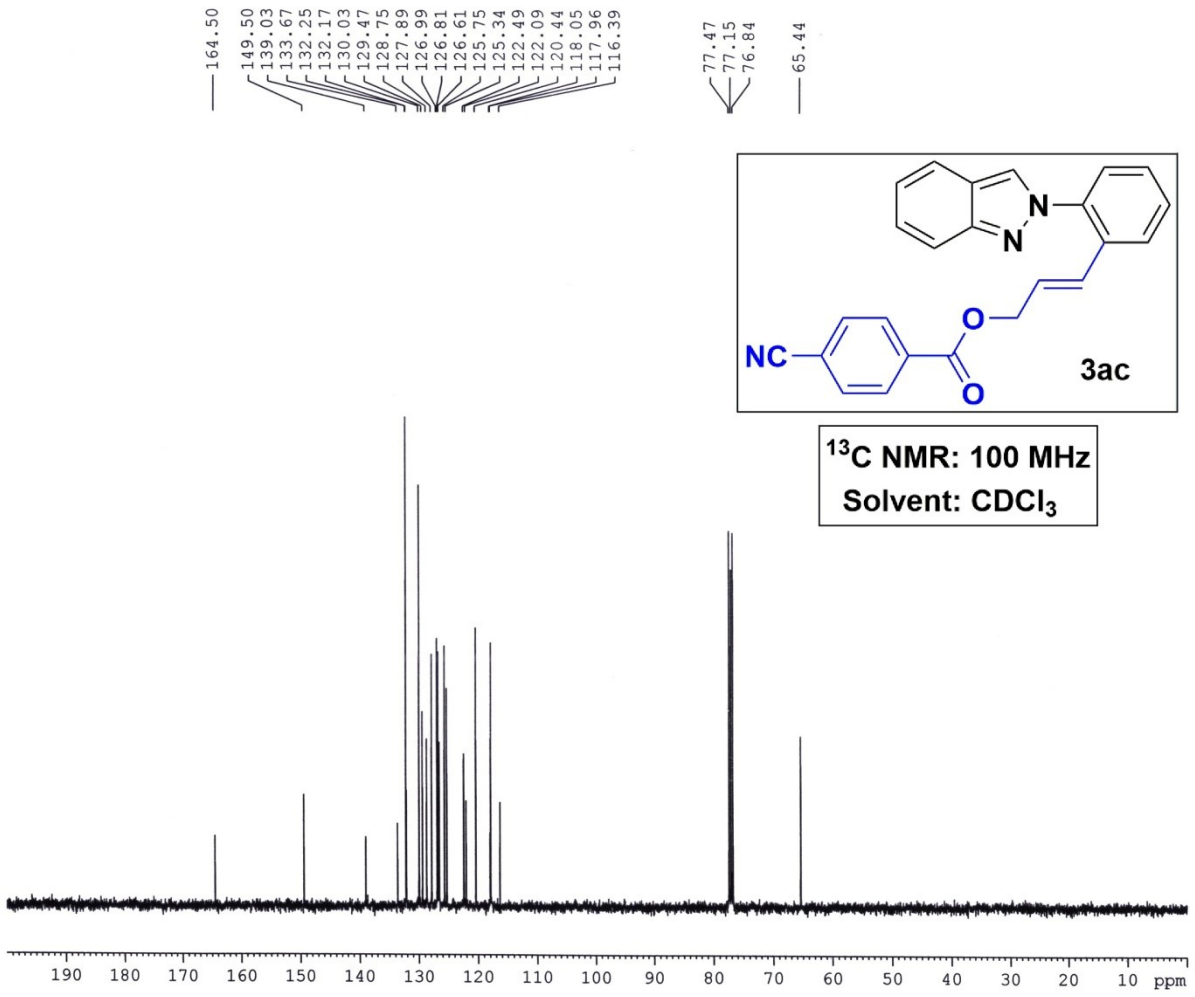




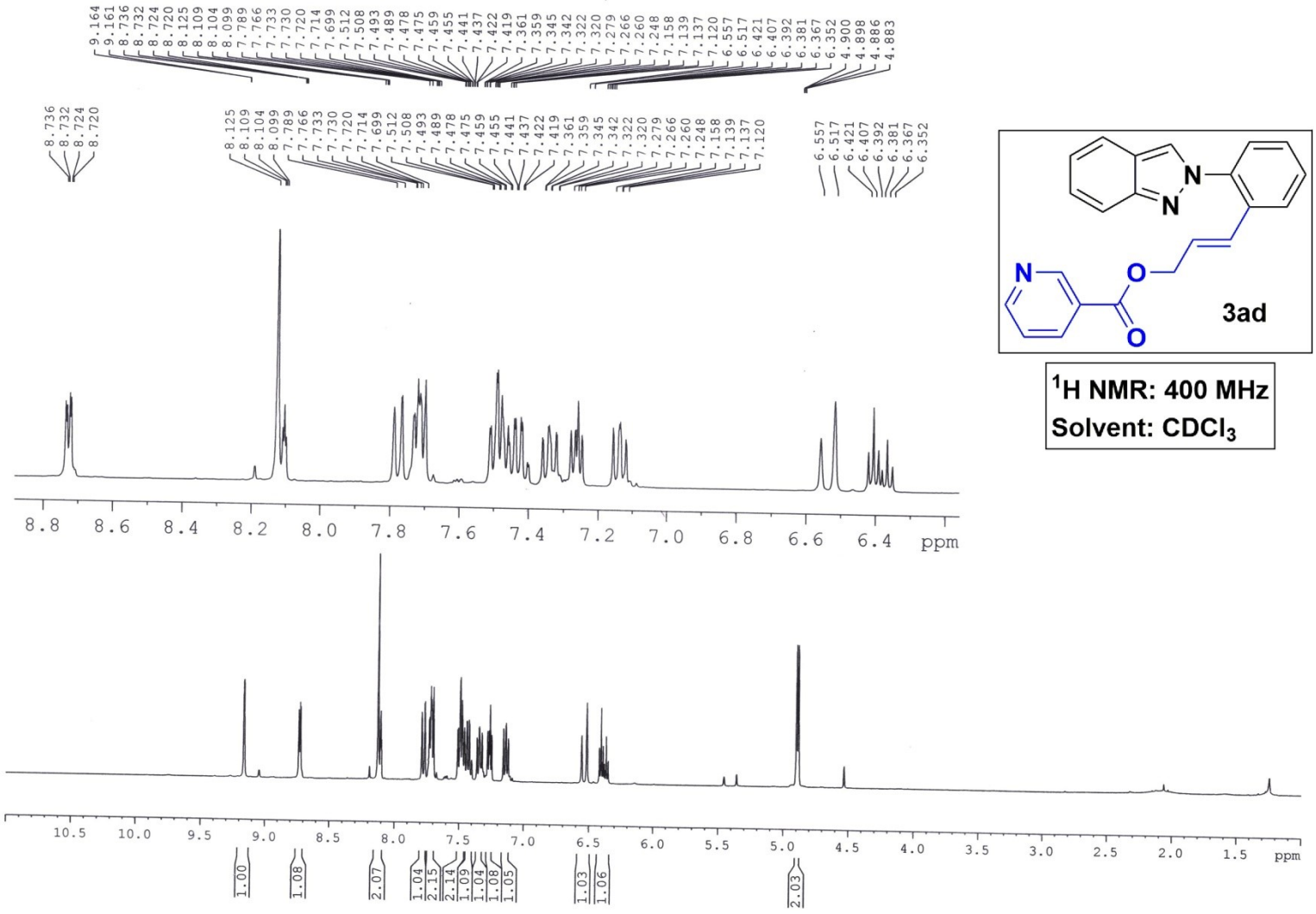
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$

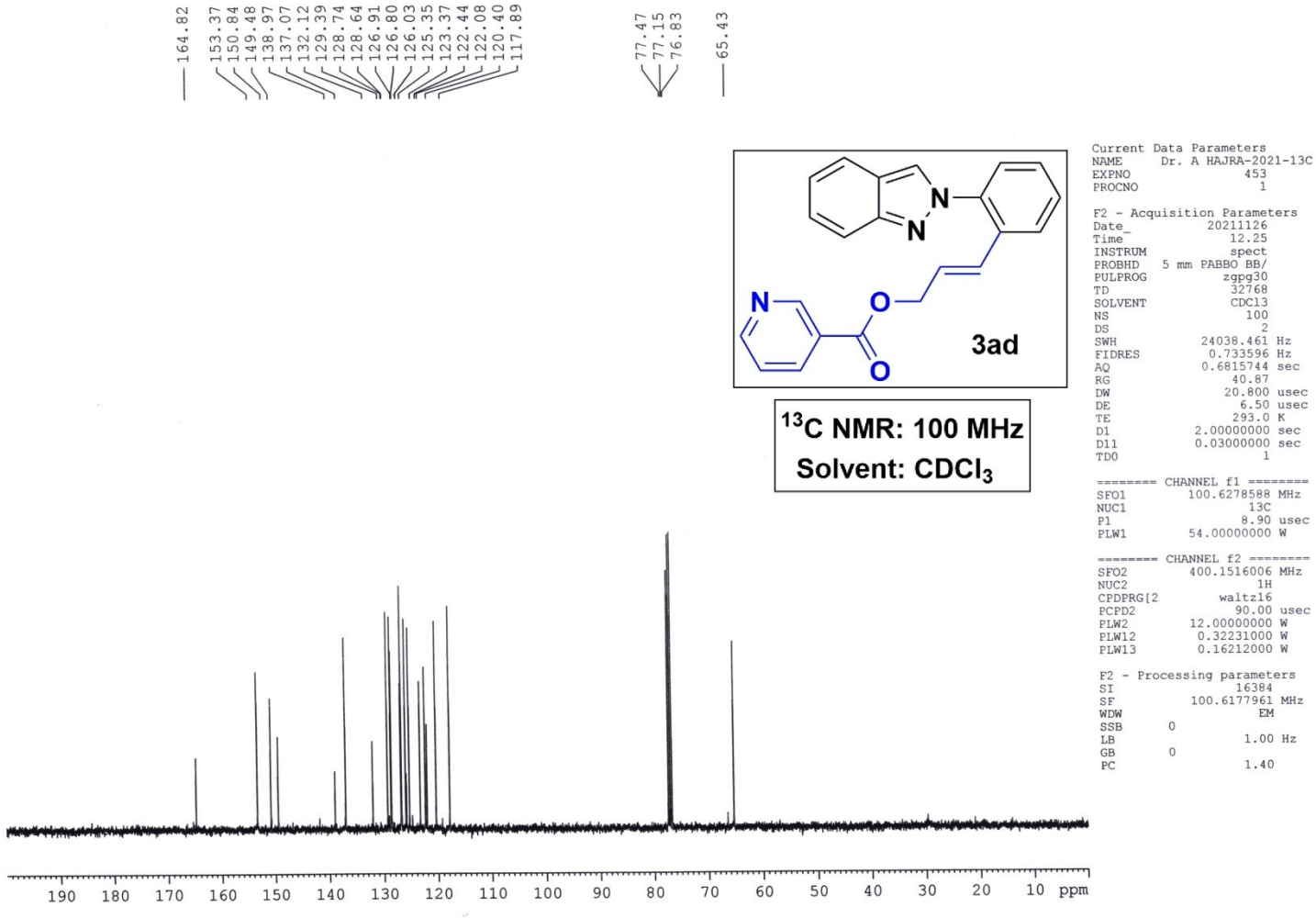




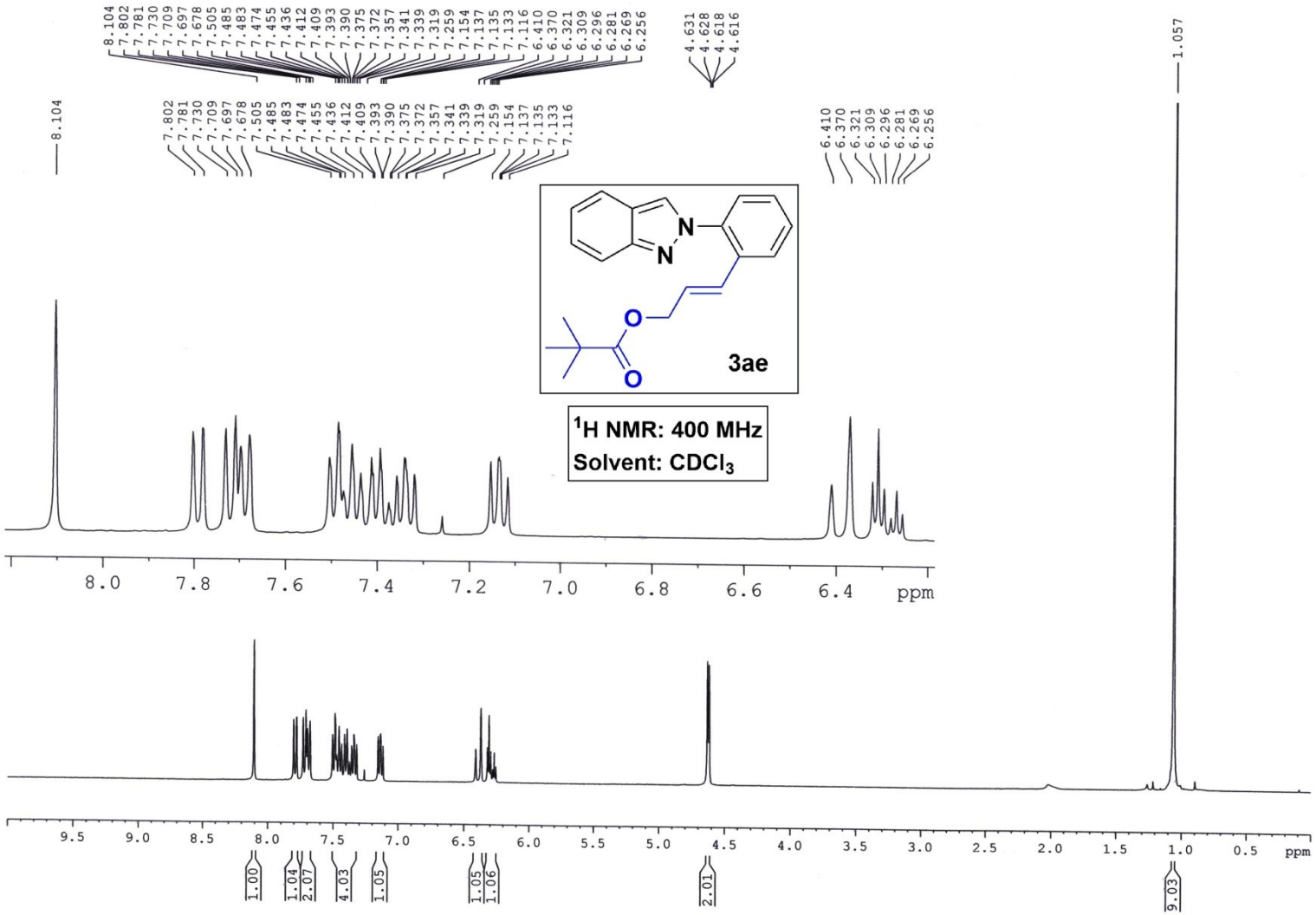


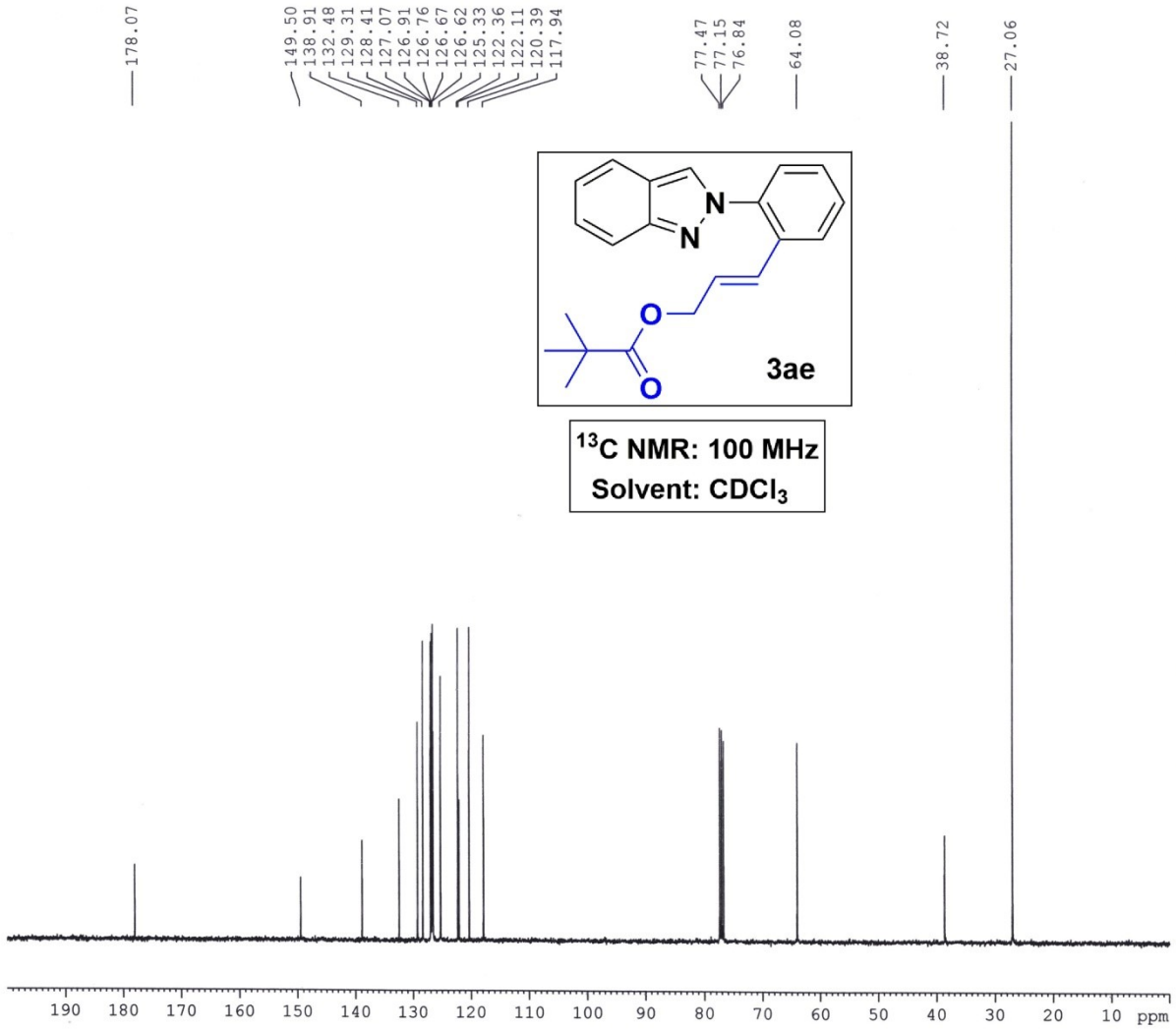

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  454
PROCNO                   1

F2 - Acquisition Parameters
Date_              20211126
Time                 12.41
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG           zgpg30
TD                 32768
SOLVENT            CDCl3
NS                   120
DS                     2
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                 67.81
DW                20.800 usec
DE                 6.50 usec
TE                293.4 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                 13C
P1                  8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                 1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                   16384
SF           100.6177936 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```


9.164
9.161
8.736
8.732
8.724
8.720
8.125
8.109
8.104
8.099
7.789
7.766
7.733
7.730
7.720
7.714
7.699
7.512
7.508
7.493
7.489
7.478
7.475
7.459
7.455
7.441
7.437
7.422
7.419
7.361
7.359
7.345
7.342
7.322
7.320
7.279
7.266
7.260
7.248
7.158
7.139
7.137
7.120
6.557
6.517
6.421
6.407
6.392
6.381
6.367
6.352
4.900
4.898
4.886
4.883
8.8
8.6
8.4
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
ppm
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm
1.00
1.08
2.07
1.04
2.15
2.14
1.09
1.04
1.08
1.05
1.03
1.06
2.03
N
N
O
N
O
O
3ad
1H NMR: 400 MHz
Solvent: CDCl3

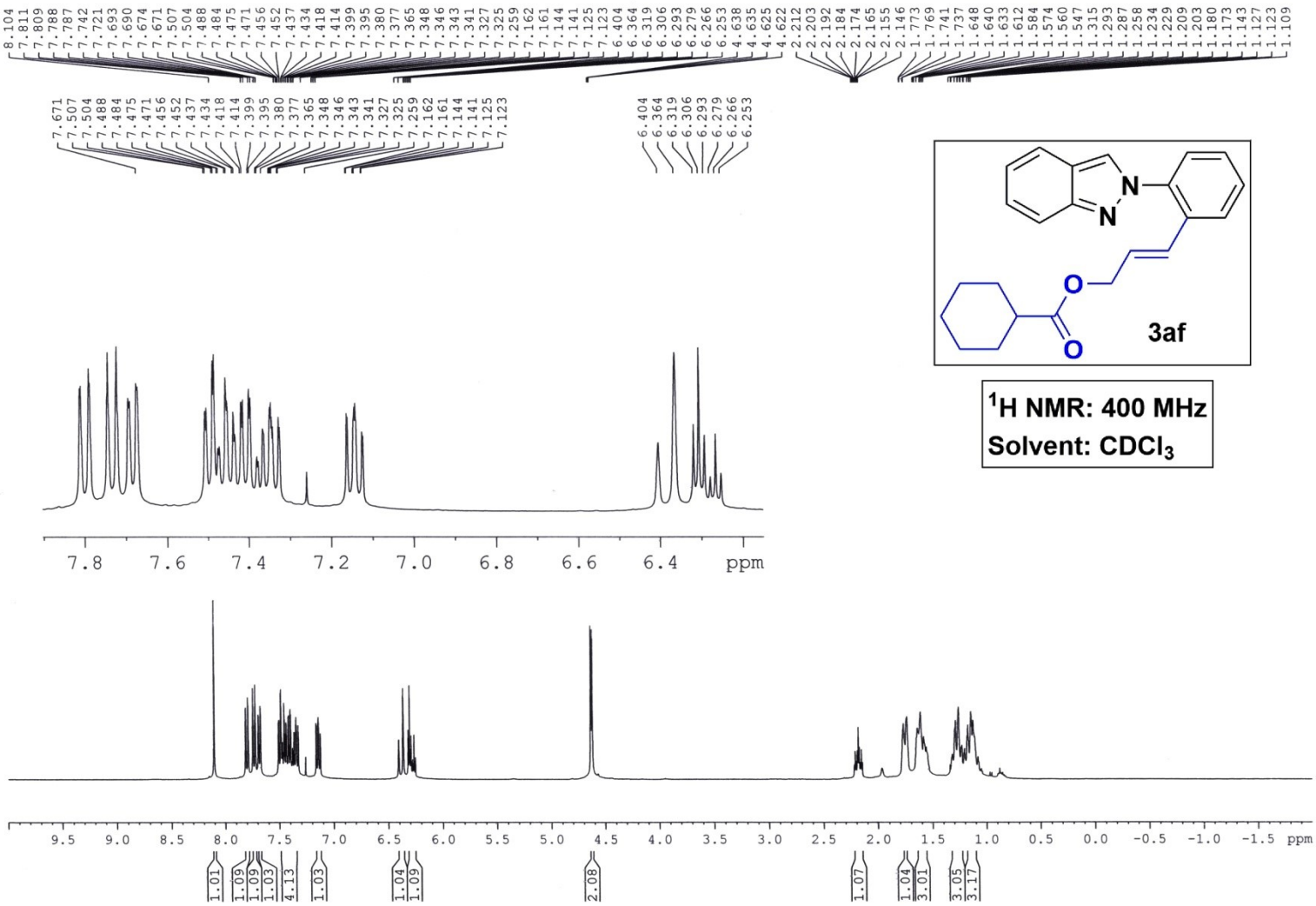


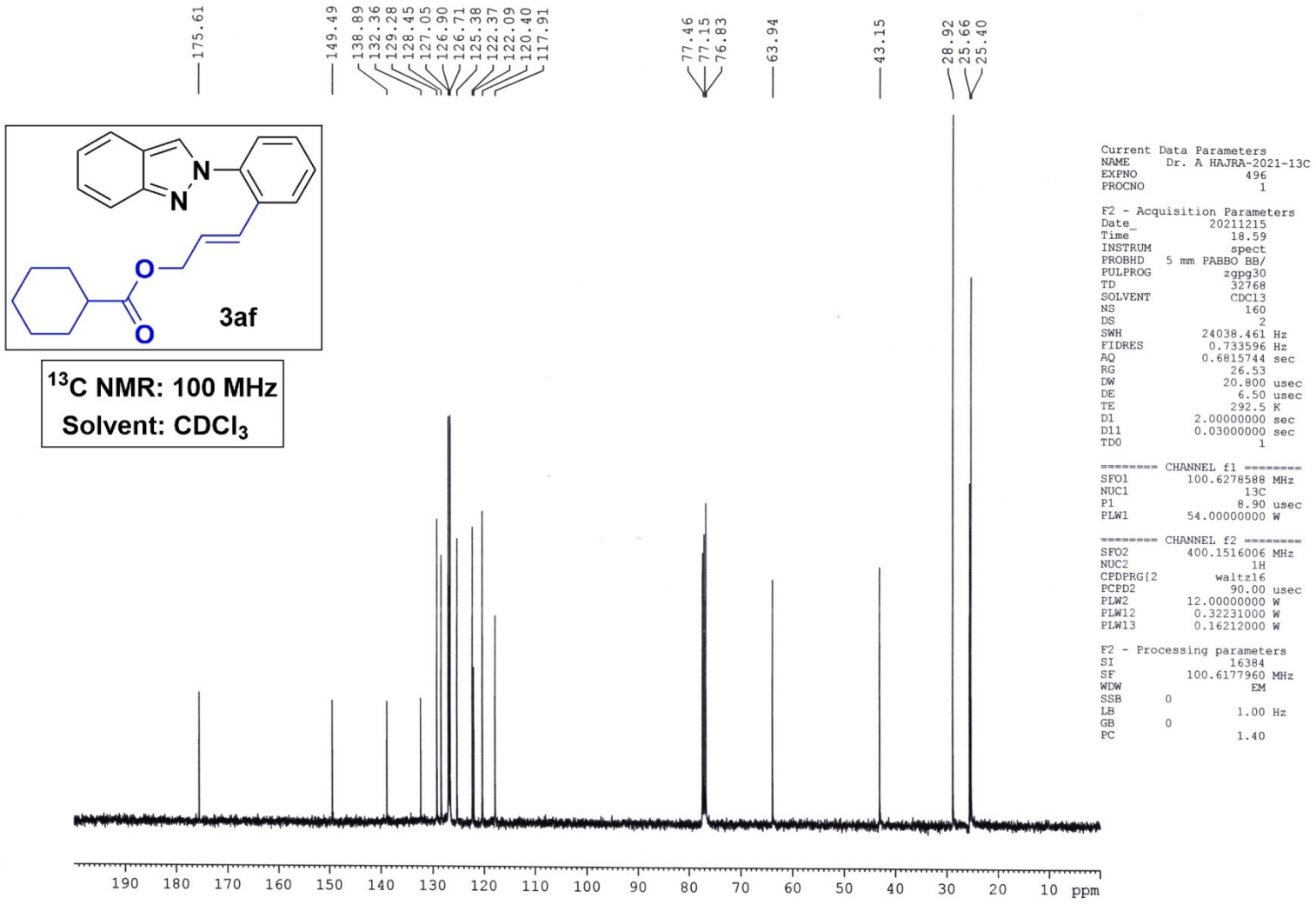

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  453
PROCNO                   1

F2 - Acquisition Parameters
Date_             20211126
Time                12.25
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 32768
SOLVENT            CDCl3
NS                   100
DS                     2
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                  40.87
DW                 20.800 usec
DE                  6.50 usec
TE                293.0 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                 13C
P1                  8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                 1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                 16384
SF            100.6177961 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```


8.104
7.802
7.781
7.730
7.709
7.697
7.678
7.505
7.485
7.483
7.474
7.455
7.436
7.412
7.409
7.393
7.390
7.375
7.372
7.357
7.341
7.339
7.319
7.259
7.154
7.137
7.135
7.133
7.116
6.410
6.370
6.321
6.309
6.296
6.281
6.269
6.256
4.631
4.628
4.618
4.616
1.057
3ae
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
ppm
1.00
1.04
2.07
4.03
1.05
1.05
1.06
2.01
9.03

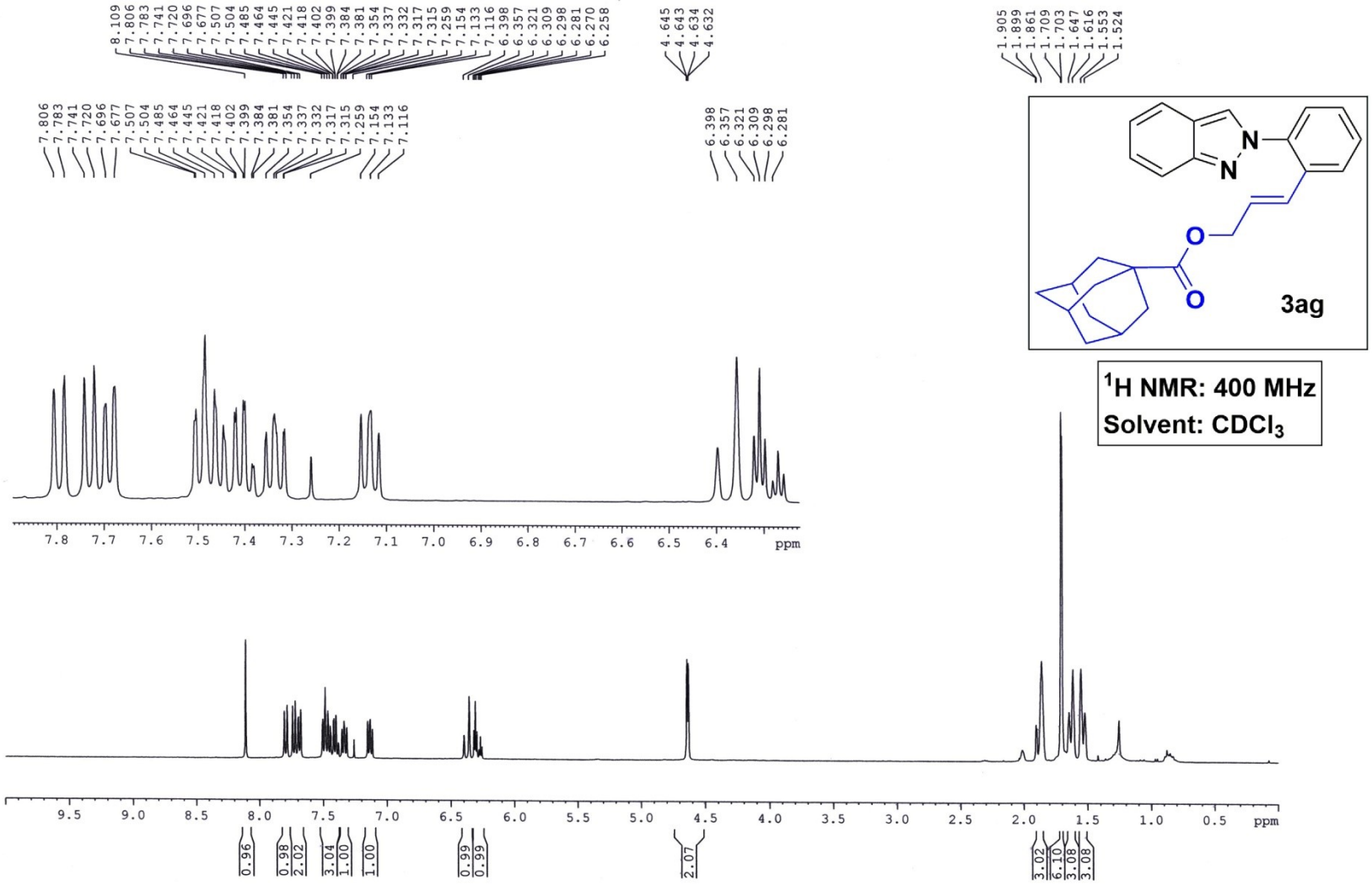


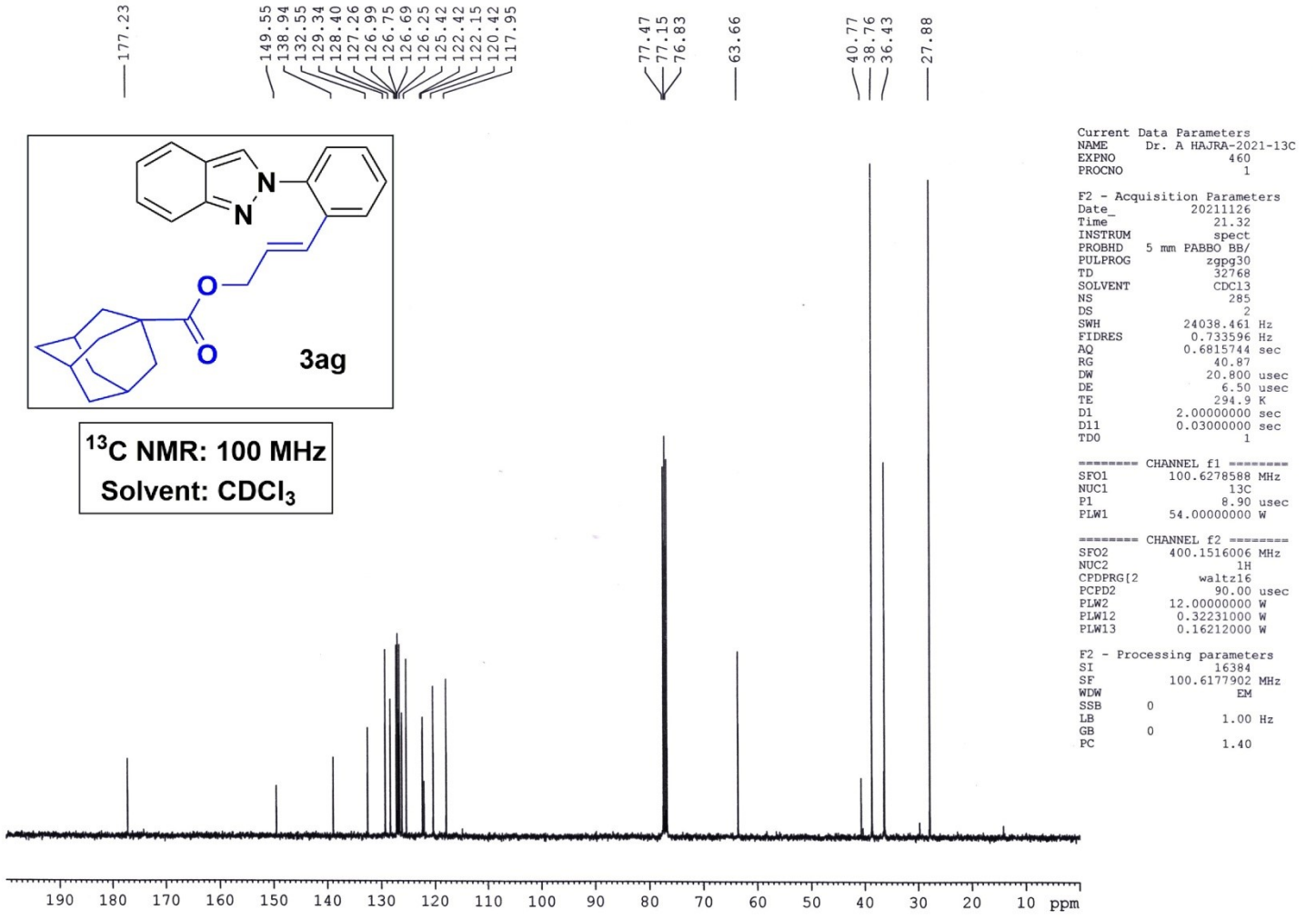

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  474
PROCNO                   1

F2 - Acquisition Parameters
Date_           20211205
Time              18.13
INSTRUM           spect
PROBHD    5 mm PABBO BB/
PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                  230
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                30.11
DW               20.800 usec
DE                6.50 usec
TE               295.7 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1               13C
P1                8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2               1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                16384
SF           100.6177961 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

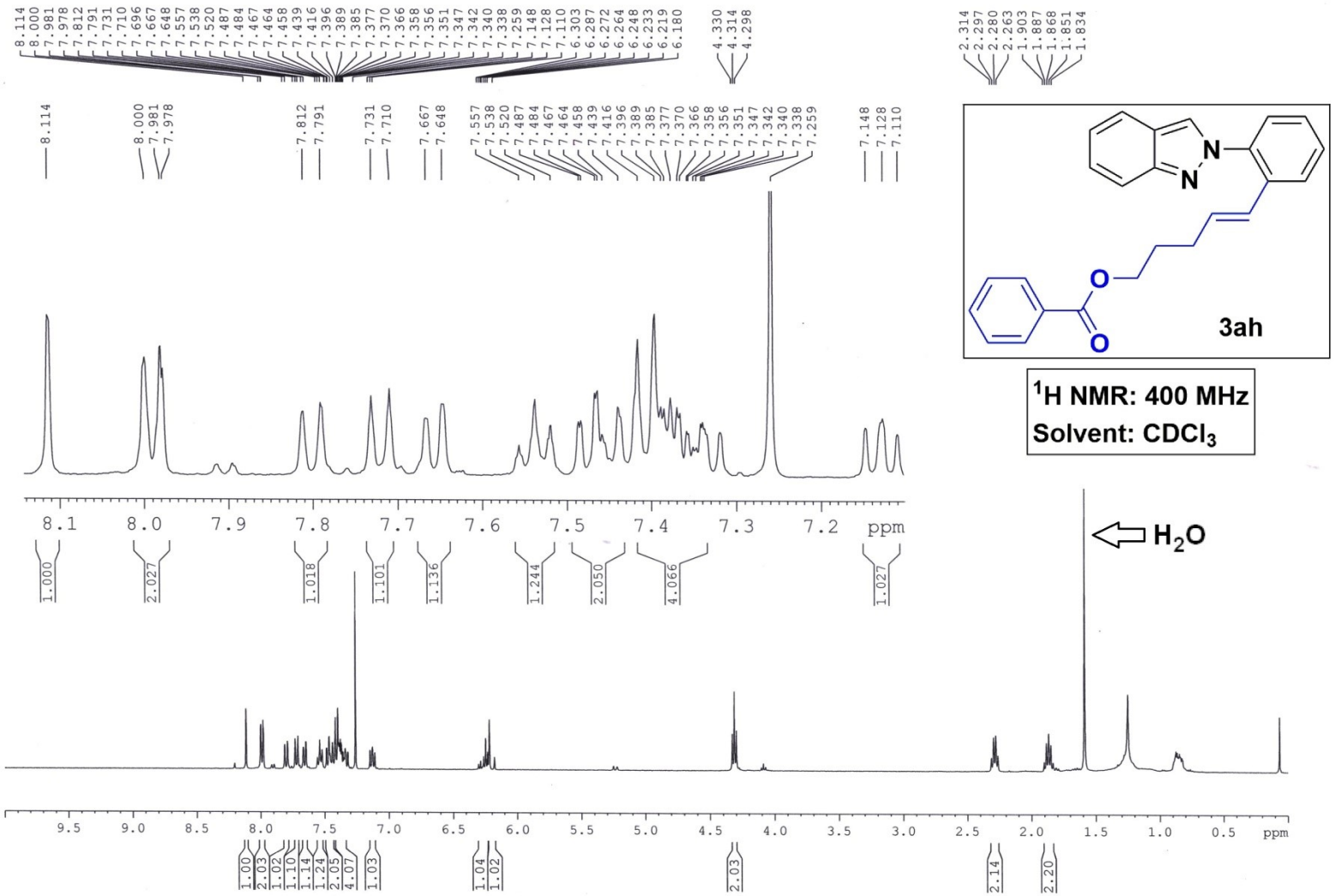

3af
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
ppm

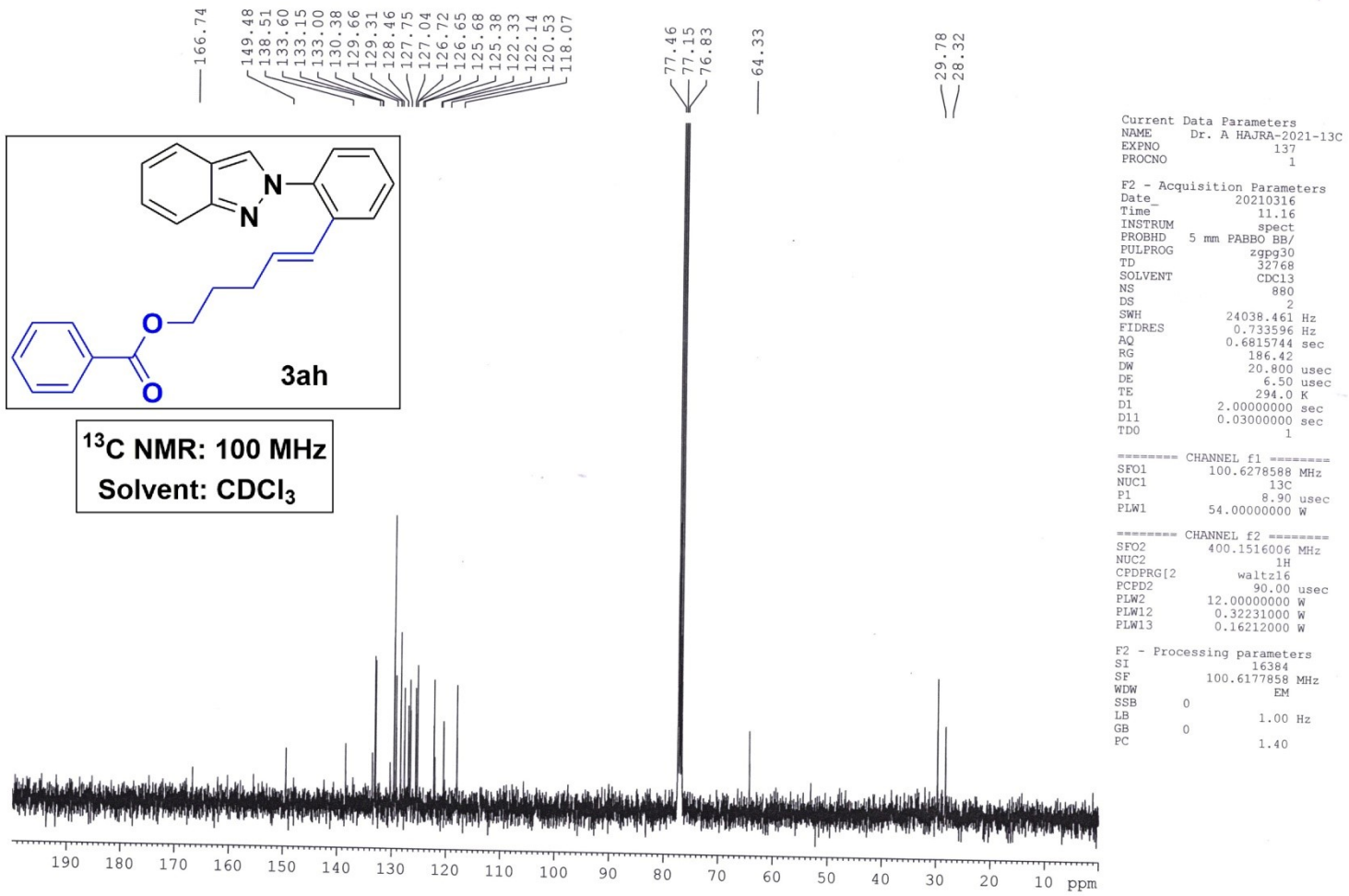



```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  496
PROCNO                   1

F2 - Acquisition Parameters
Date_              20211215
Time                 18.59
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     160
DS                       2
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   26.53
DW                  20.800 usec
DE                   6.50 usec
TE                  292.5 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                   13C
P1                    8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177960 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```

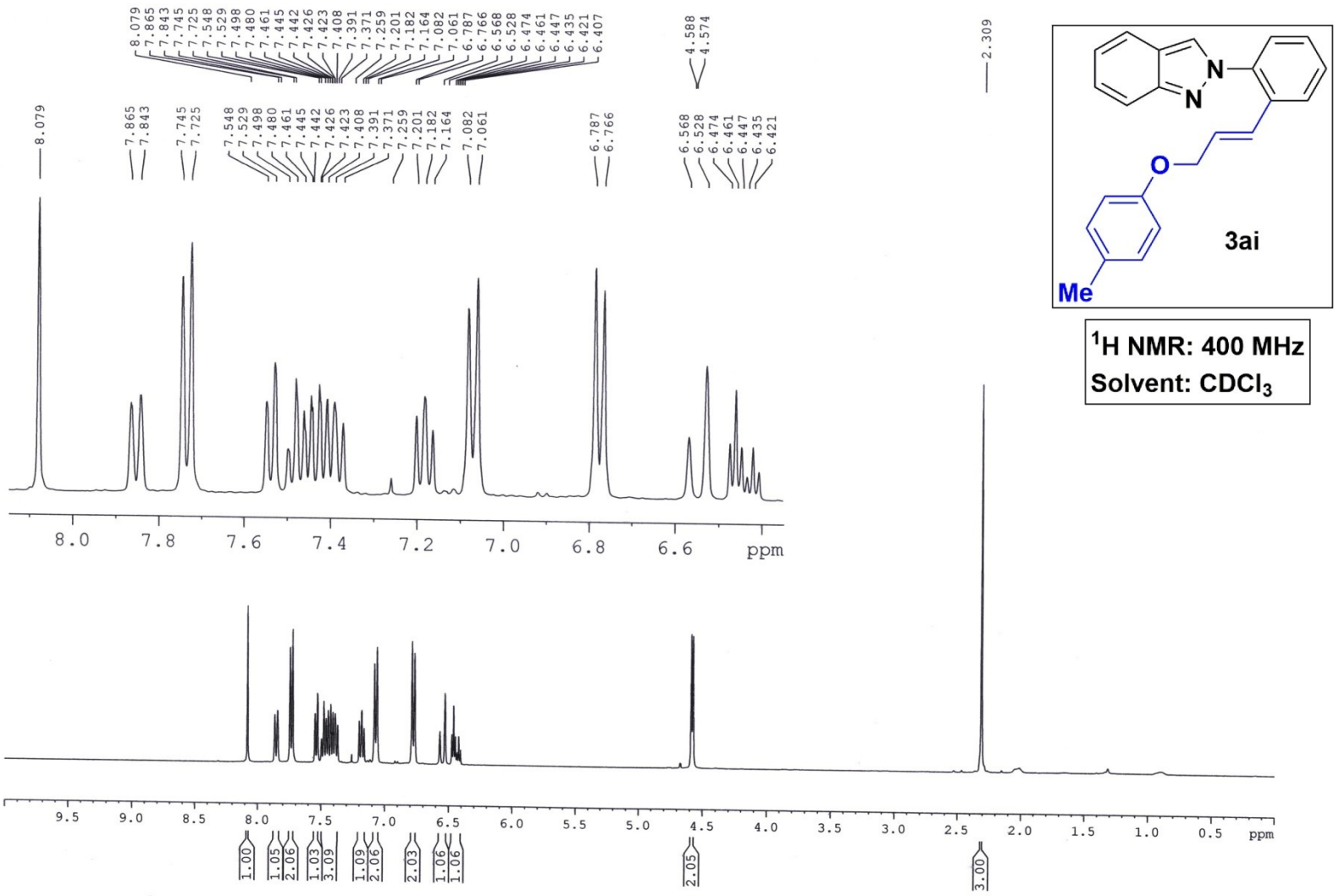

8.109
7.806
7.783
7.741
7.720
7.696
7.677
7.507
7.504
7.485
7.464
7.445
7.421
7.418
7.402
7.399
7.384
7.381
7.354
7.337
7.332
7.317
7.315
7.259
7.154
7.133
7.116
6.398
6.357
6.321
6.309
6.298
6.281
6.270
6.258
4.645
4.643
4.634
4.632
1.905
1.899
1.861
1.709
1.703
1.647
1.616
1.553
1.524
N
N
O
O
3ag
1H NMR: 400 MHz
Solvent: CDCl3
ppm
0.96
0.98
2.02
3.04
1.00
1.00
0.99
0.99
2.07
3.02
6.10
3.08
3.08

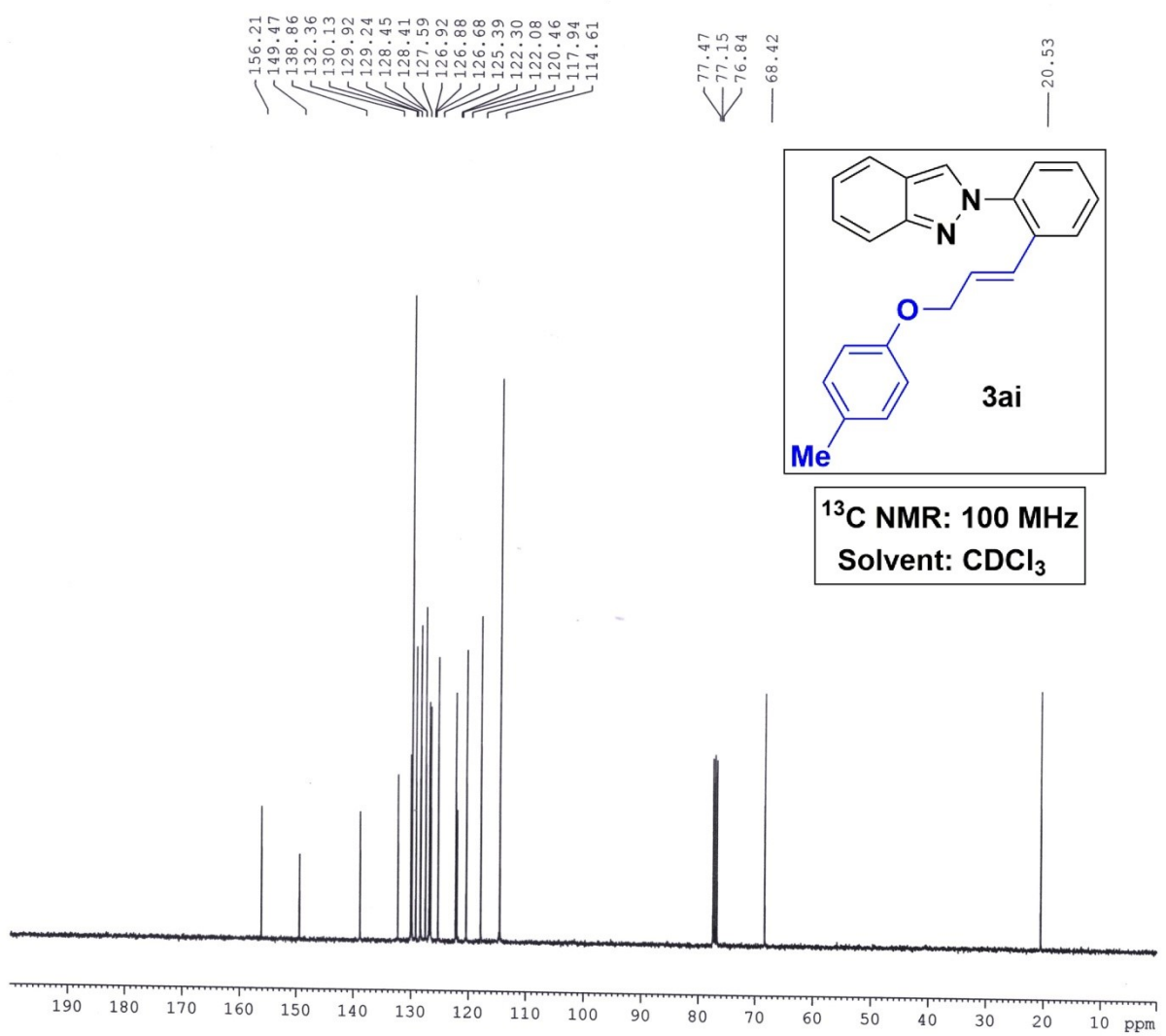

177.23
149.55
138.94
132.55
129.34
128.40
127.26
126.99
126.75
126.69
126.25
125.42
122.42
122.15
120.42
117.95
77.47
77.15
76.83
63.66
40.77
38.76
36.43
27.88
N
N
O
O
3ag
13C NMR: 100 MHz
Solvent: CDCl3
Current Data Parameters
NAME Dr. A HAJRA-2021-13C
EXPNO 460
PROCNO 1
F2 - Acquisition Parameters
Date_ 20211126
Time 21.32
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 285
DS 2
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 40.87
DW 20.800 usec
DE 6.50 usec
TE 294.9 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6278588 MHz
NUC1 13C
P1 8.90 usec
PLW1 54.00000000 W
CHANNEL f2
SFO2 400.1516006 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 90.00 usec
PLW2 12.00000000 W
PLW12 0.32231000 W
PLW13 0.16212000 W
F2 - Processing parameters
SI 16384
SF 100.6177902 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm


3ah
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
H$_2$O
ppm

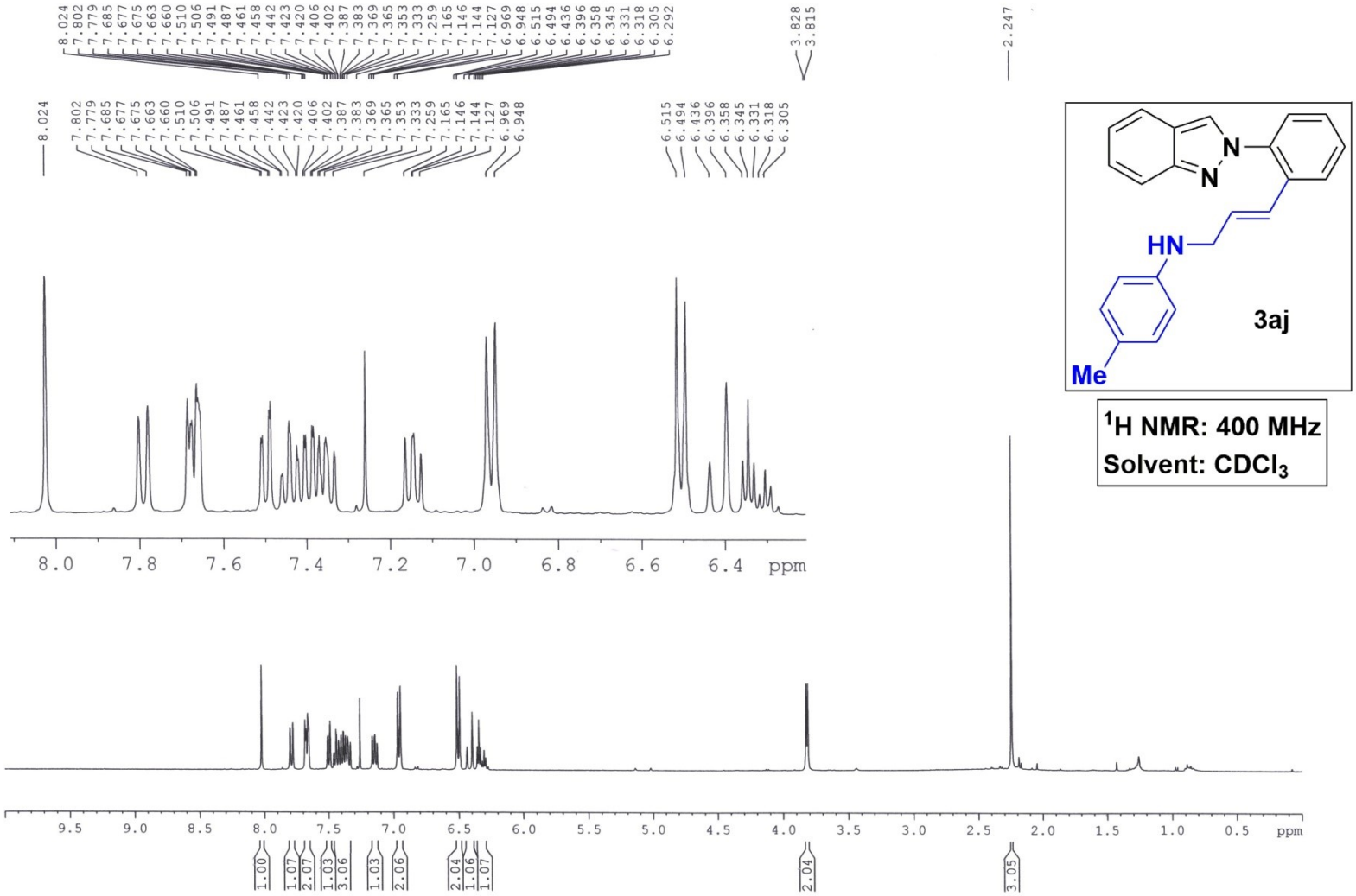


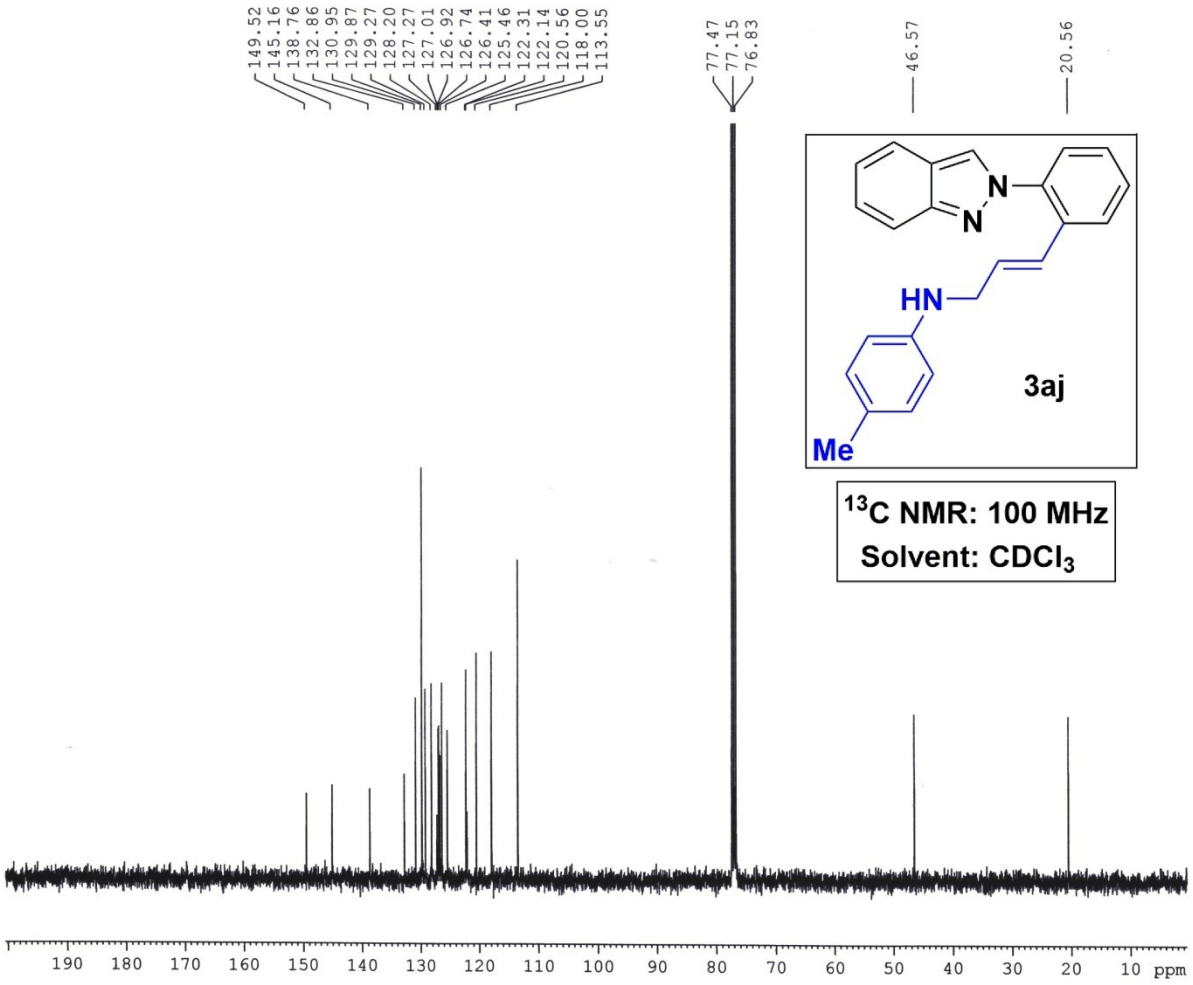

```
Current Data Parameters
NAME          Dr. A HAJRA-2021-13C
EXPNO                  137
PROCNO                   1

F2 - Acquisition Parameters
Date_               20210316
Time                   11.16
INSTRUM                spect
PROBHD     5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     880
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   186.42
DW                  20.800 usec
DE                   6.50 usec
TE                  294.0 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6278588 MHz
NUC1                    13C
P1                    8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2           400.1516006 MHz
NUC2                    1H
CPDPRG[2            waltz16
PCPD2                90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
SI                     16384
SF             100.6177858 MHz
WDW                       EM
SSB                    0
LB                    1.00 Hz
GB                     0
PC                    1.40
```


8.079
7.865
7.843
7.745
7.725
7.548
7.529
7.498
7.480
7.461
7.445
7.442
7.426
7.423
7.408
7.391
7.371
7.259
7.201
7.182
7.164
7.082
7.061
6.787
6.766
6.568
6.528
6.474
6.461
6.447
6.435
6.421
6.407
4.588
4.574
2.309
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
ppm
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
1.00
1.05
2.06
1.03
3.09
1.09
2.06
2.03
1.06
1.06
2.05
3.00
N
N
O
Me
3ai
1H NMR: 400 MHz
Solvent: CDCl3

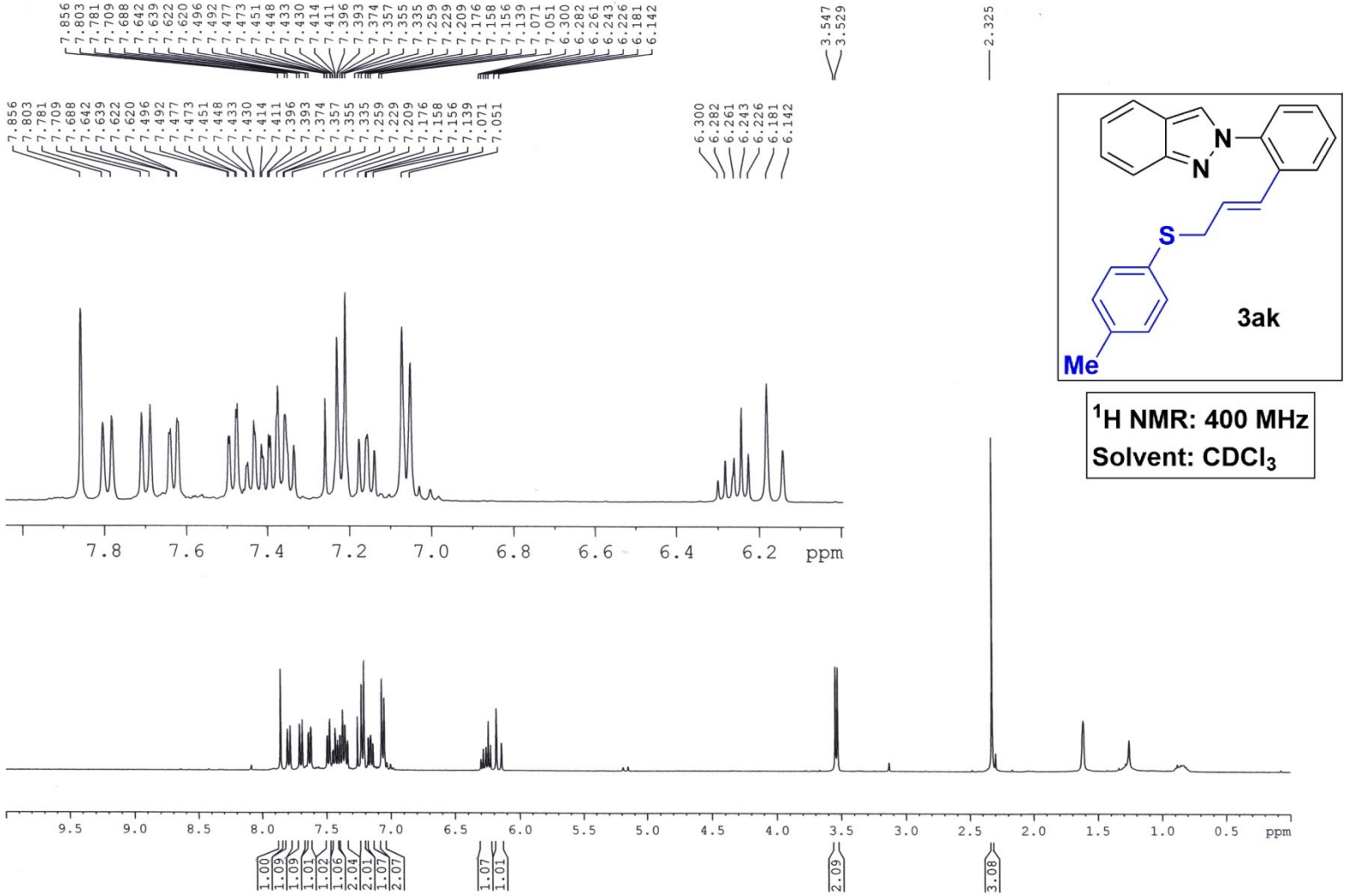


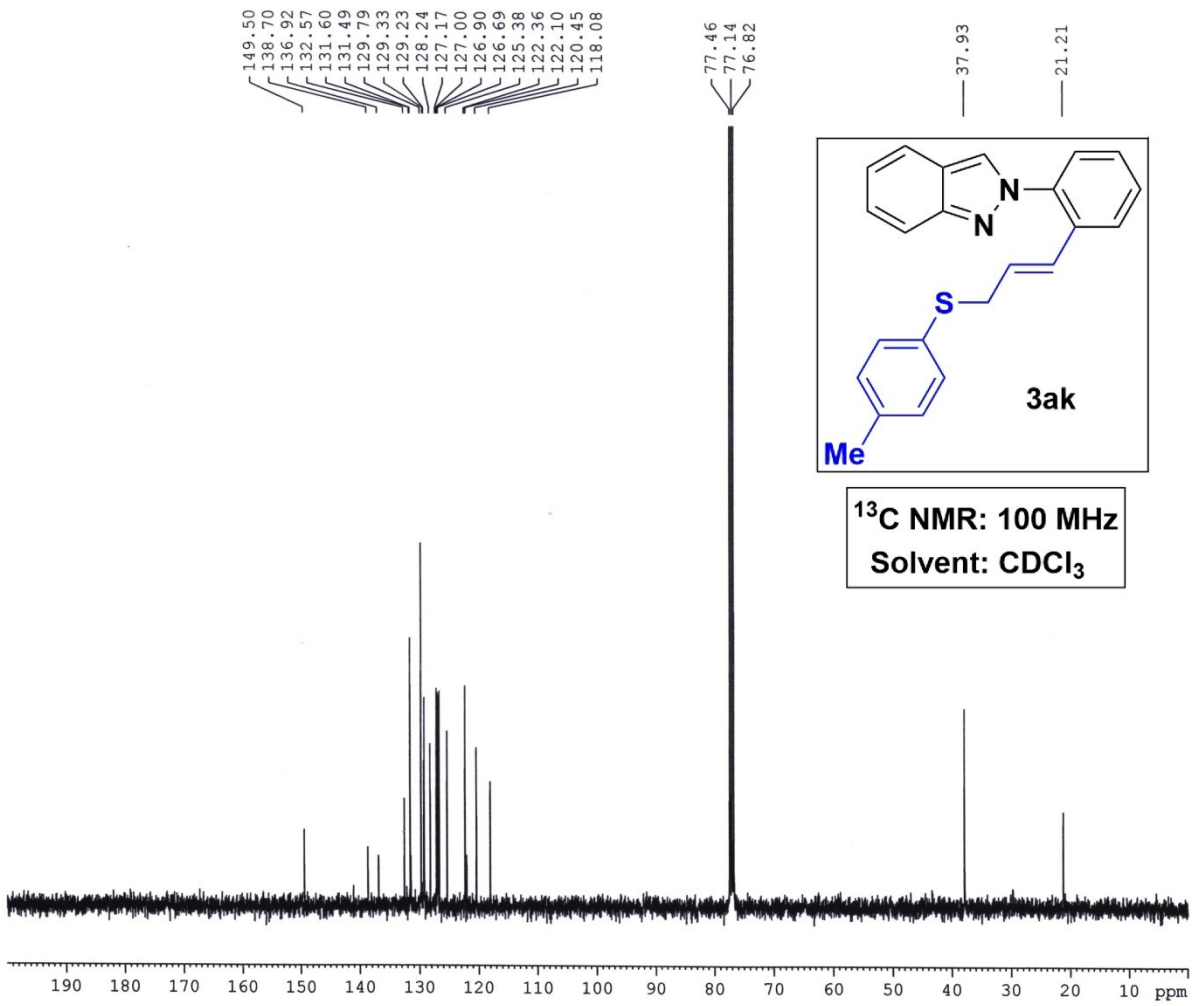

```
Current Data Parameters
NAME          Dr. A HAJRA-2021-13C
EXPNO                          446
PROCNO                           1

F2 - Acquisition Parameters
Date_                     20211121
Time                         10.47
INSTRUM                      spect
PROBHD     5 mm PABBO BB/
PULPROG                   zgpg30
TD                            32768
SOLVENT                     CDCl3
NS                              220
DS                                2
SWH                   24038.461 Hz
FIDRES                 0.733596 Hz
AQ                     0.6815744 sec
RG                            30.11
DW                        20.800 usec
DE                         6.50 usec
TE                          293.1 K
D1                    2.00000000 sec
D11                   0.03000000 sec
TD0                              1

======== CHANNEL f1 ========
SFO1                100.6278588 MHz
NUC1                         13C
P1                         8.90 usec
PLW1                54.00000000 W

======== CHANNEL f2 ========
SFO2                400.1516006 MHz
NUC2                         1H
CPDPRG[2                waltz16
PCPD2                     90.00 usec
PLW2                12.00000000 W
PLW12                0.32231000 W
PLW13                0.16212000 W

F2 - Processing parameters
SI                           16384
SF                  100.6178020 MHz
WDW                             EM
SSB                  0
LB                            1.00 Hz
GB                   0
PC                            1.40
```


8.024
7.802
7.779
7.685
7.677
7.675
7.663
7.660
7.510
7.506
7.491
7.487
7.461
7.458
7.442
7.423
7.420
7.406
7.402
7.387
7.383
7.369
7.365
7.353
7.333
7.259
7.165
7.146
7.144
7.127
6.969
6.948
6.515
6.494
6.436
6.396
6.358
6.345
6.331
6.318
6.305
6.292
3.828
3.815
2.247
HN
Me
3aj
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
ppm
1.00
1.07
2.07
1.03
3.06
1.03
2.06
2.04
1.06
1.07
2.04
3.05

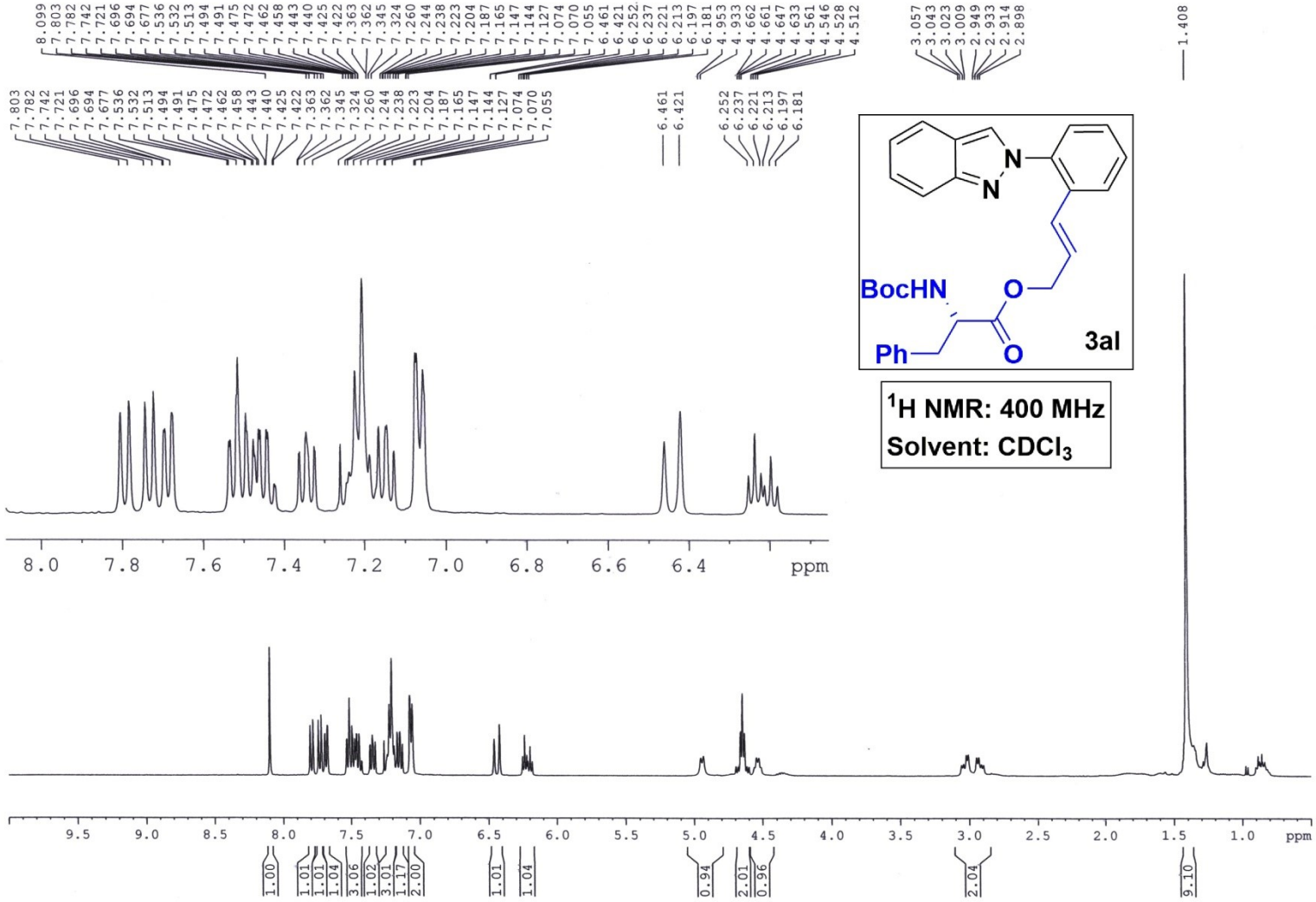


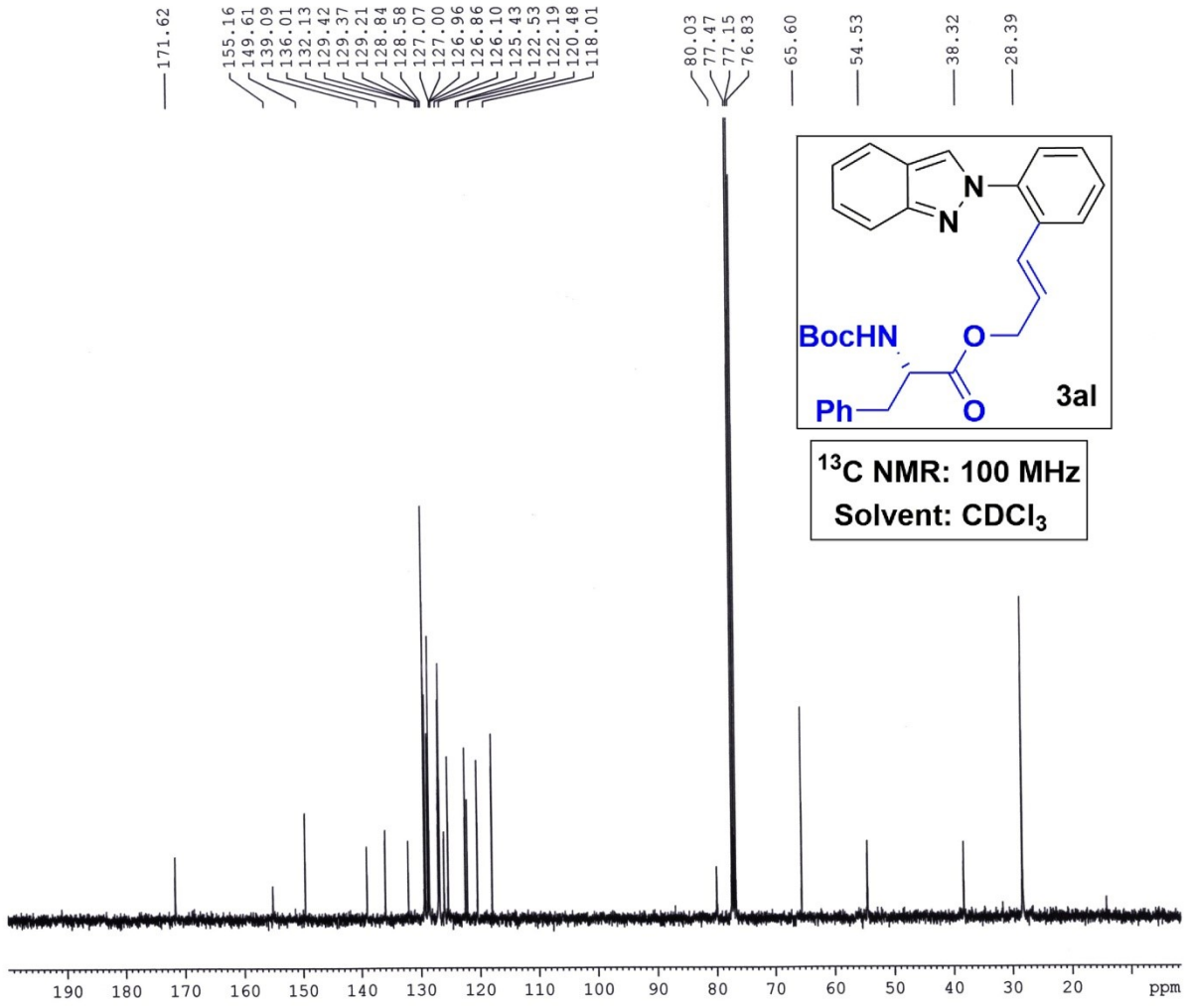

```
Current Data Parameters
NAME       Dr. A HAJRA-2021-13C
EXPNO                   449
PROCNO                    1

F2 - Acquisition Parameters
Date_               20211121
Time                   15.49
INSTRUM                spect
PROBHD     5 mm PABBO BB/
PULPROG             zgpg30
TD                     32768
SOLVENT                CDCl3
NS                       450
DS                         2
SWH                24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                     168.31
DW                    20.800 usec
DE                     6.50 usec
TE                    296.6 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
SFO1            100.6278588 MHz
NUC1                     13C
P1                     8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2            400.1516006 MHz
NUC2                     1H
CPDPRG[2              waltz16
PCPD2                 90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
SI                       16384
SF              100.6177858 MHz
WDW                         EM
SSB          0
LB                     1.00 Hz
GB           0
PC                     1.40
```


7.856
7.803
7.781
7.709
7.688
7.642
7.639
7.622
7.620
7.496
7.492
7.477
7.473
7.451
7.448
7.433
7.430
7.414
7.411
7.396
7.393
7.374
7.357
7.355
7.335
7.259
7.229
7.209
7.176
7.158
7.156
7.139
7.071
7.051
6.300
6.282
6.261
6.243
6.226
6.181
6.142
3.547
3.529
2.325
S
Me
3ak
1H NMR: 400 MHz
Solvent: CDCl3
ppm
1.00
1.09
1.09
1.01
1.02
1.06
2.04
2.01
1.07
2.07
1.07
1.01
2.09
3.08

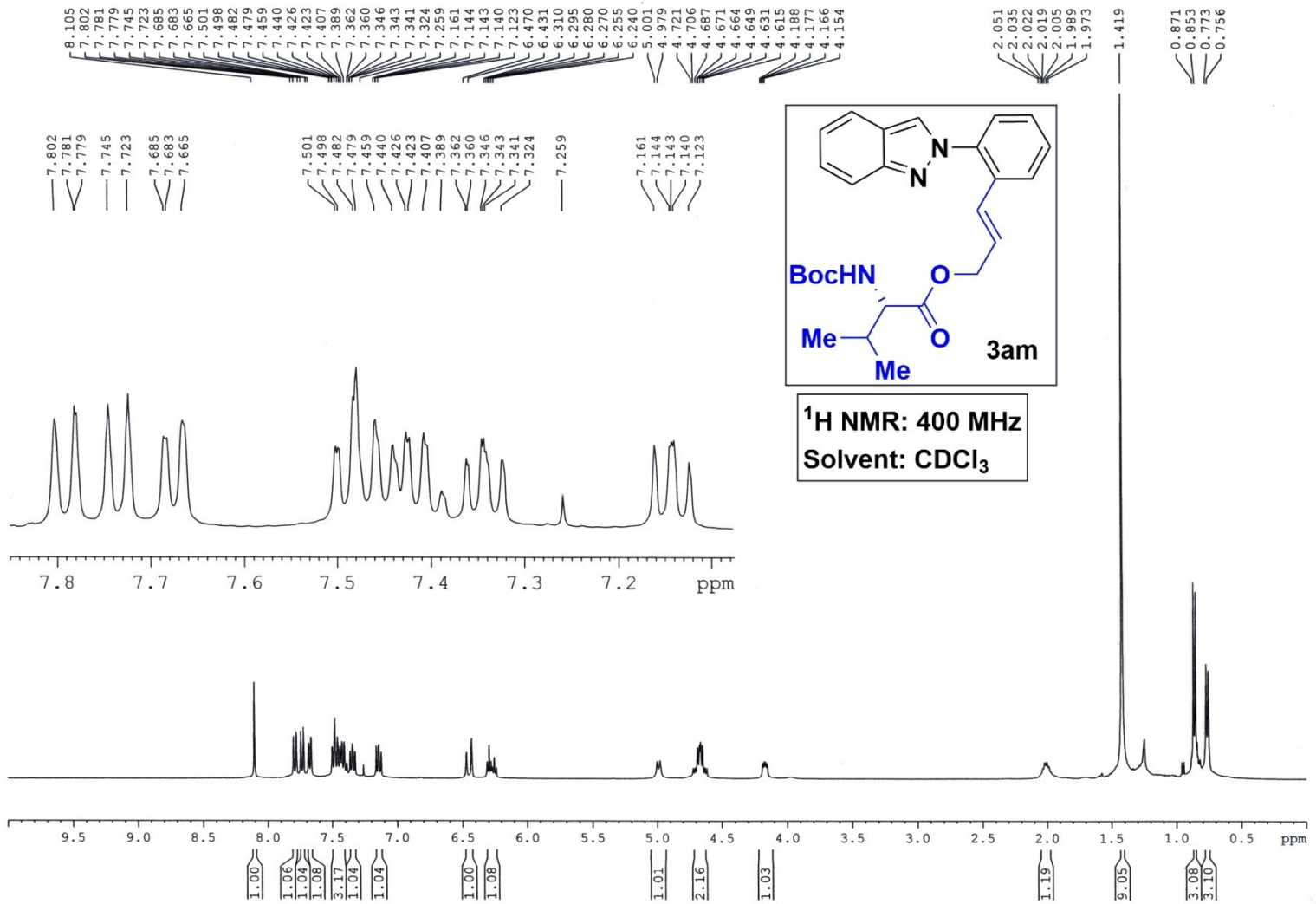


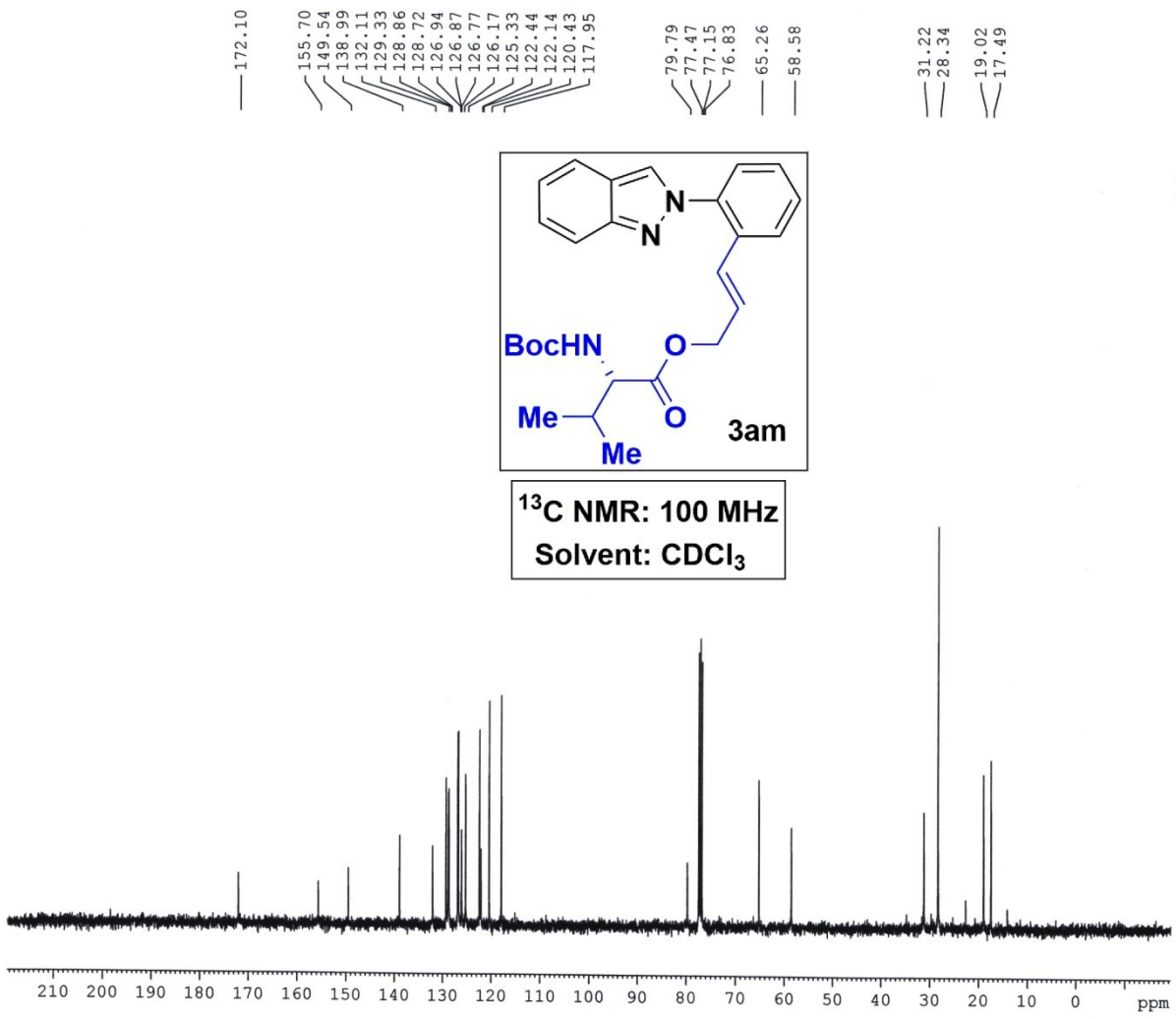

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  465
PROCNO                   1

F2 - Acquisition Parameters
Date_           20211128
Time              20.54
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                  300
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                135.7
DW                20.800 usec
DE                 6.50 usec
TE               298.3 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1              13C
P1                8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2              1H
CPDPRG[2        waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                16384
SF          100.6177867 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```


BocHN
O
Ph
O
3al
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
ppm

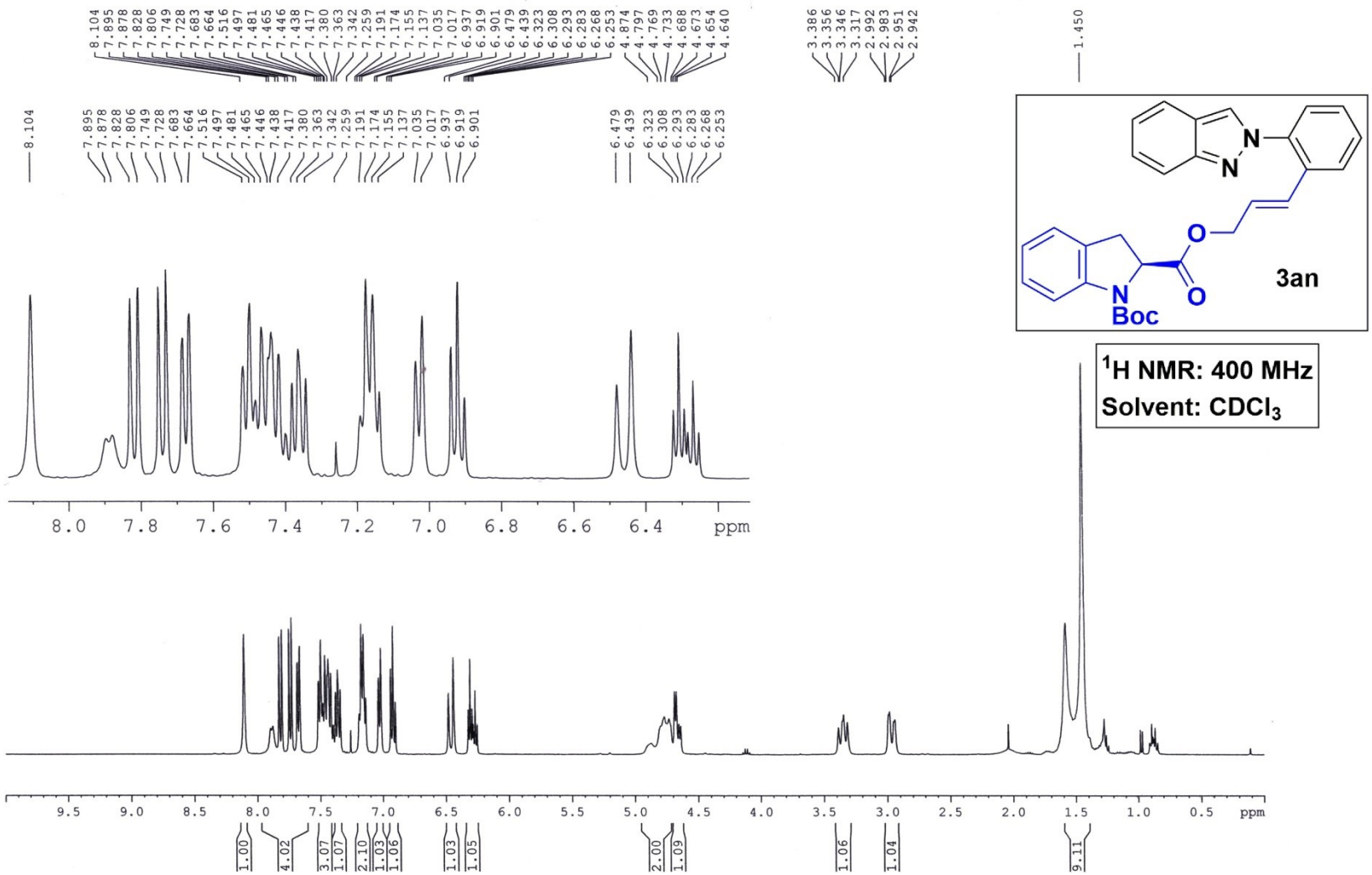


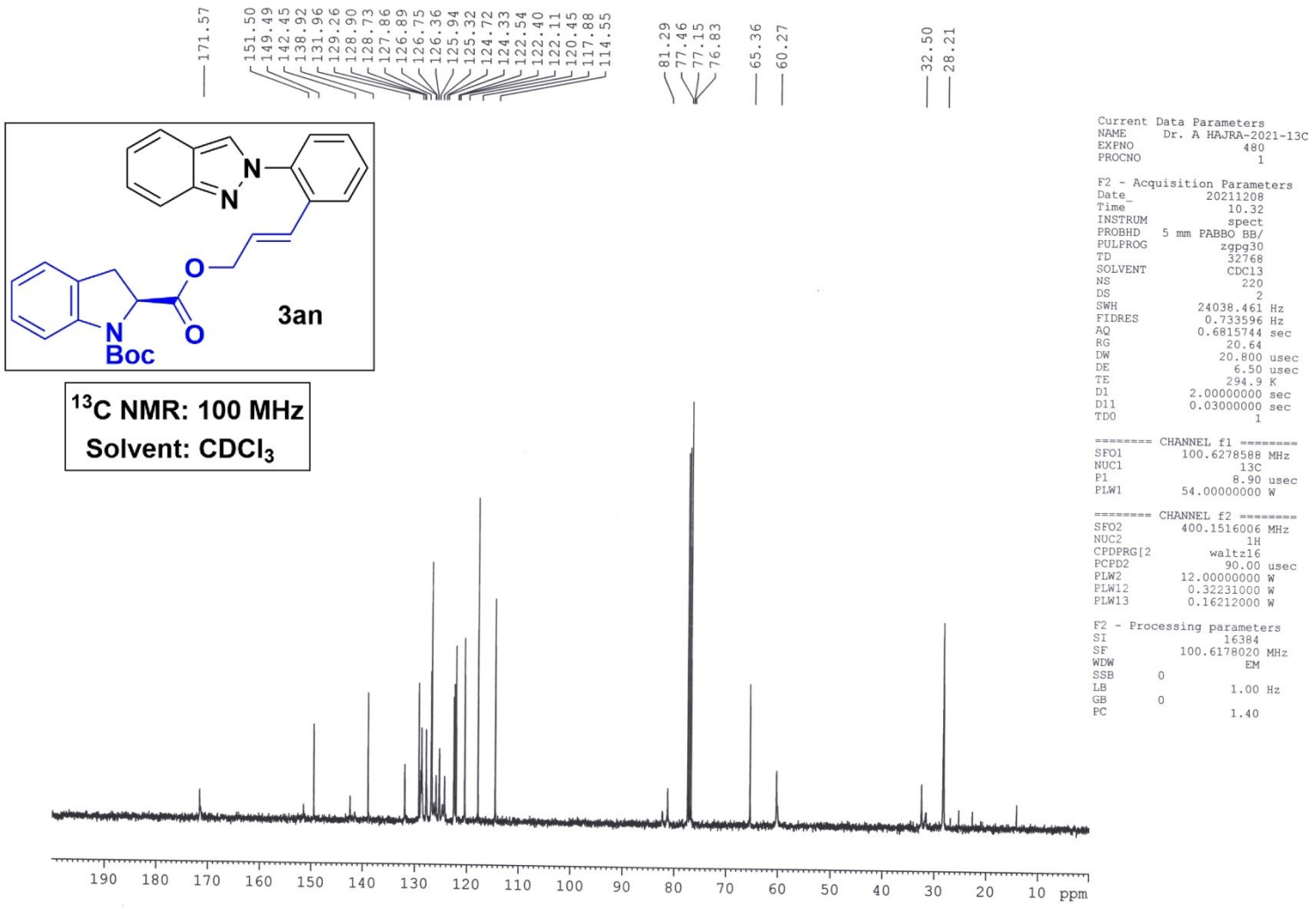

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  462
PROCNO                   1

F2 - Acquisition Parameters
Date_             20211128
Time                 18.52
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                    285
DS                      2
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                   62.69
DW                 20.800 usec
DE                  6.50 usec
TE                 297.4 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                  13C
P1                   8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177889 MHz
WDW                    EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.40
```

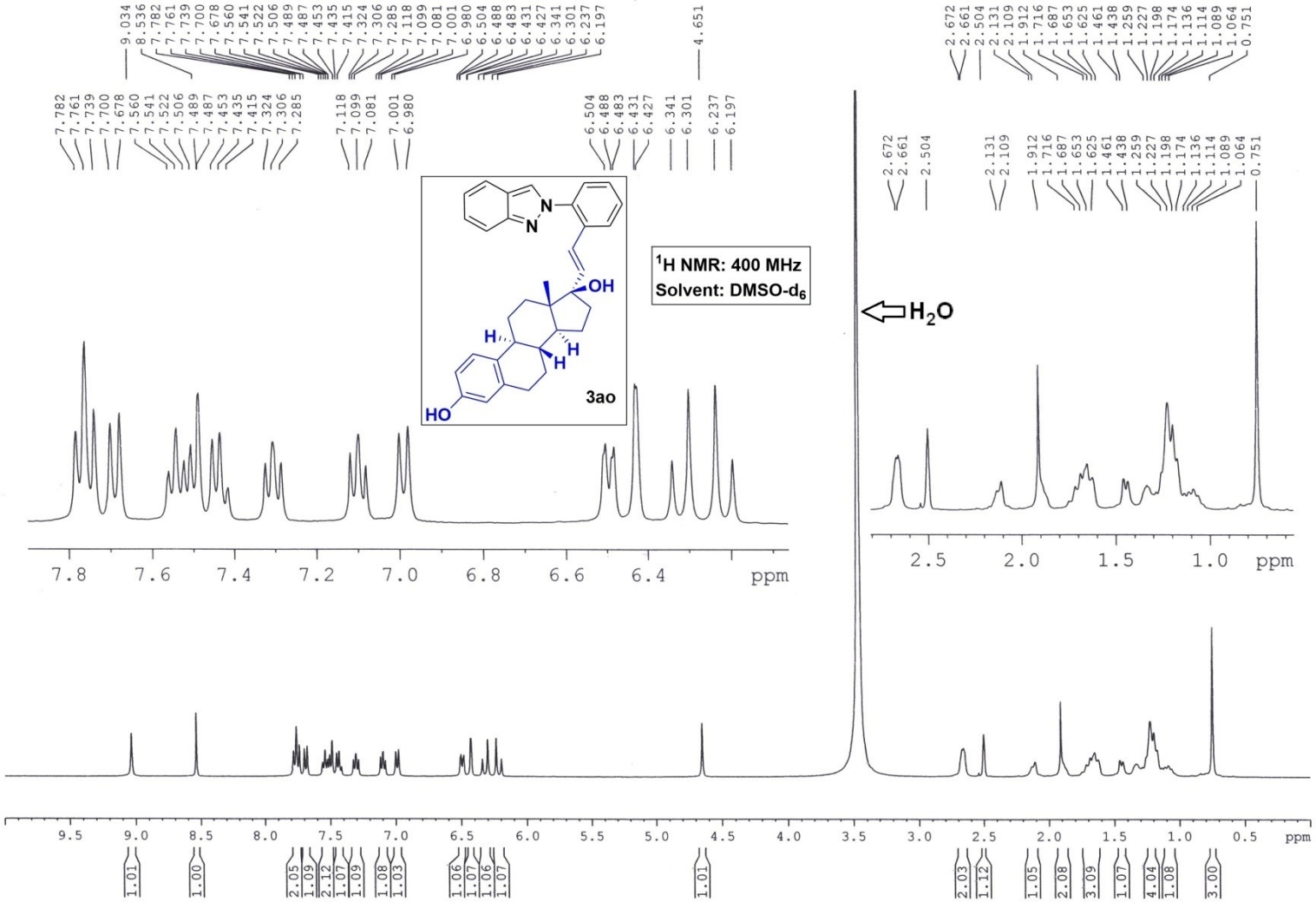

BocHN
O
Me
O
Me
3am
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
ppm

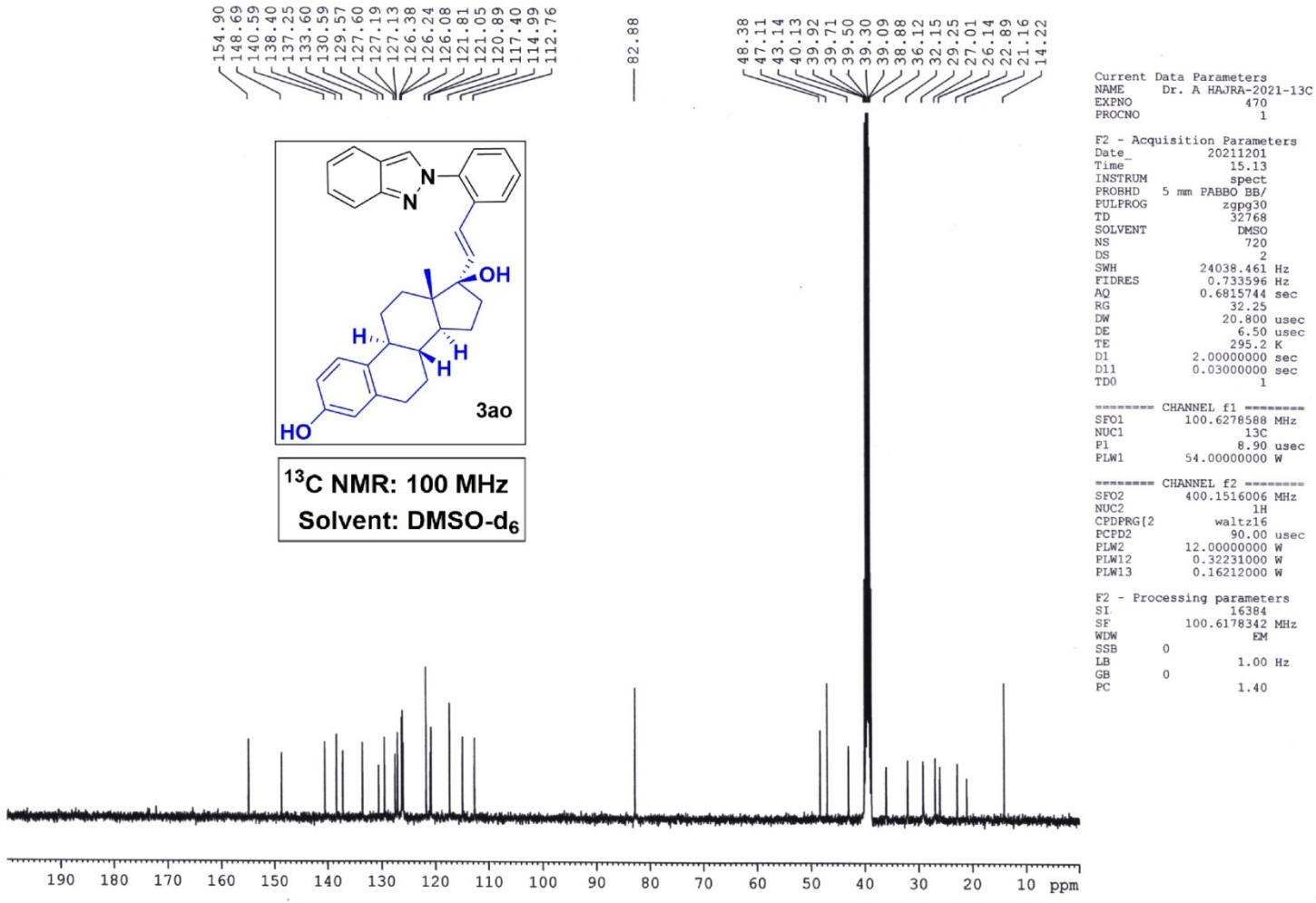



```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  505
PROCNO                   1

F2 - Acquisition Parameters
Date_              20211226
Time                 13.11
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                      80
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   20.64
DW                  20.800 usec
DE                   6.50 usec
TE                  294.7 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                   13C
P1                    8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                   16384
SF           100.6177947 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```

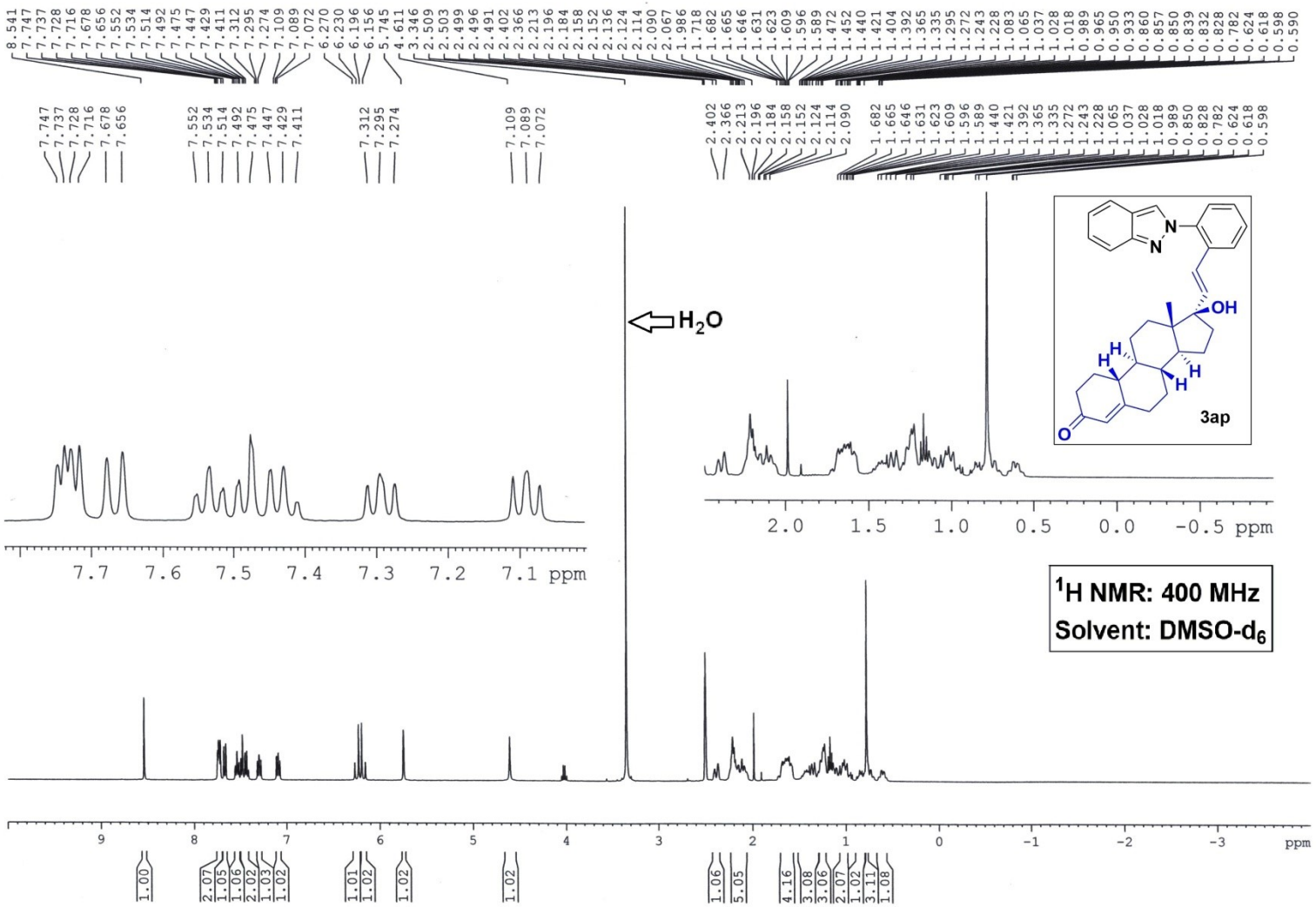

3an
Boc
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
ppm

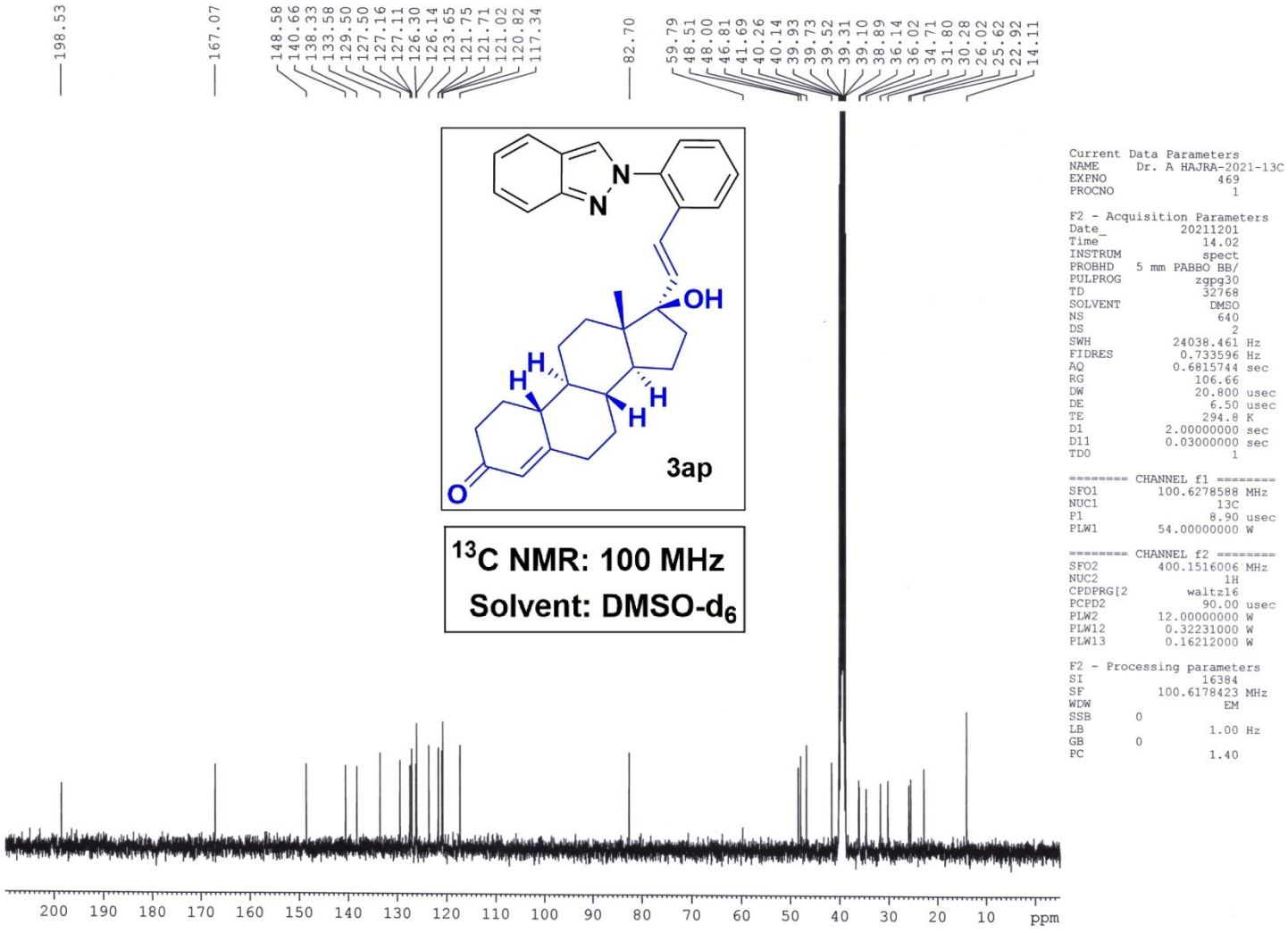

171.57
151.50
149.49
142.45
138.92
131.96
129.26
128.90
128.73
127.86
126.89
126.75
126.36
125.94
125.32
124.72
124.33
122.54
122.40
122.11
120.45
117.88
114.55
81.29
77.46
77.15
76.83
65.36
60.27
32.50
28.21
3an
Boc
13C NMR: 100 MHz
Solvent: CDCl3
Current Data Parameters
NAME Dr. A HAJRA-2021-13C
EXPNO 480
PROCNO 1
F2 - Acquisition Parameters
Date_ 20211208
Time 10.32
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 32768
SOLVENT CDCl3
NS 220
DS 2
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 0.6815744 sec
RG 20.64
DW 20.800 usec
DE 6.50 usec
TE 294.9 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6278588 MHz
NUC1 13C
P1 8.90 usec
PLW1 54.00000000 W
======== CHANNEL f2 ========
SFO2 400.1516006 MHz
NUC2 1H
CPDPRG[2 waltz16
PCPD2 90.00 usec
PLW2 12.00000000 W
PLW12 0.32231000 W
PLW13 0.16212000 W
F2 - Processing parameters
SI 16384
SF 100.6178020 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm


9.034
8.536
7.782
7.761
7.739
7.700
7.678
7.560
7.541
7.522
7.506
7.489
7.487
7.453
7.435
7.415
7.324
7.306
7.285
7.118
7.099
7.081
7.001
6.980
6.504
6.488
6.483
6.431
6.427
6.341
6.301
6.237
6.197
4.651
2.672
2.661
2.504
2.131
2.109
1.912
1.716
1.687
1.653
1.625
1.461
1.438
1.259
1.227
1.198
1.174
1.136
1.114
1.089
1.064
0.751
OH
HO
H
H
H
3ao
1H NMR: 400 MHz
Solvent: DMSO-d6
H2O
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
ppm
2.5
2.0
1.5
1.0
ppm
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
1.01
1.00
2.05
1.09
2.12
1.07
1.09
1.08
1.03
1.06
1.07
1.06
1.07
1.01
2.03
1.12
1.05
2.08
3.09
1.07
4.04
1.08
3.00

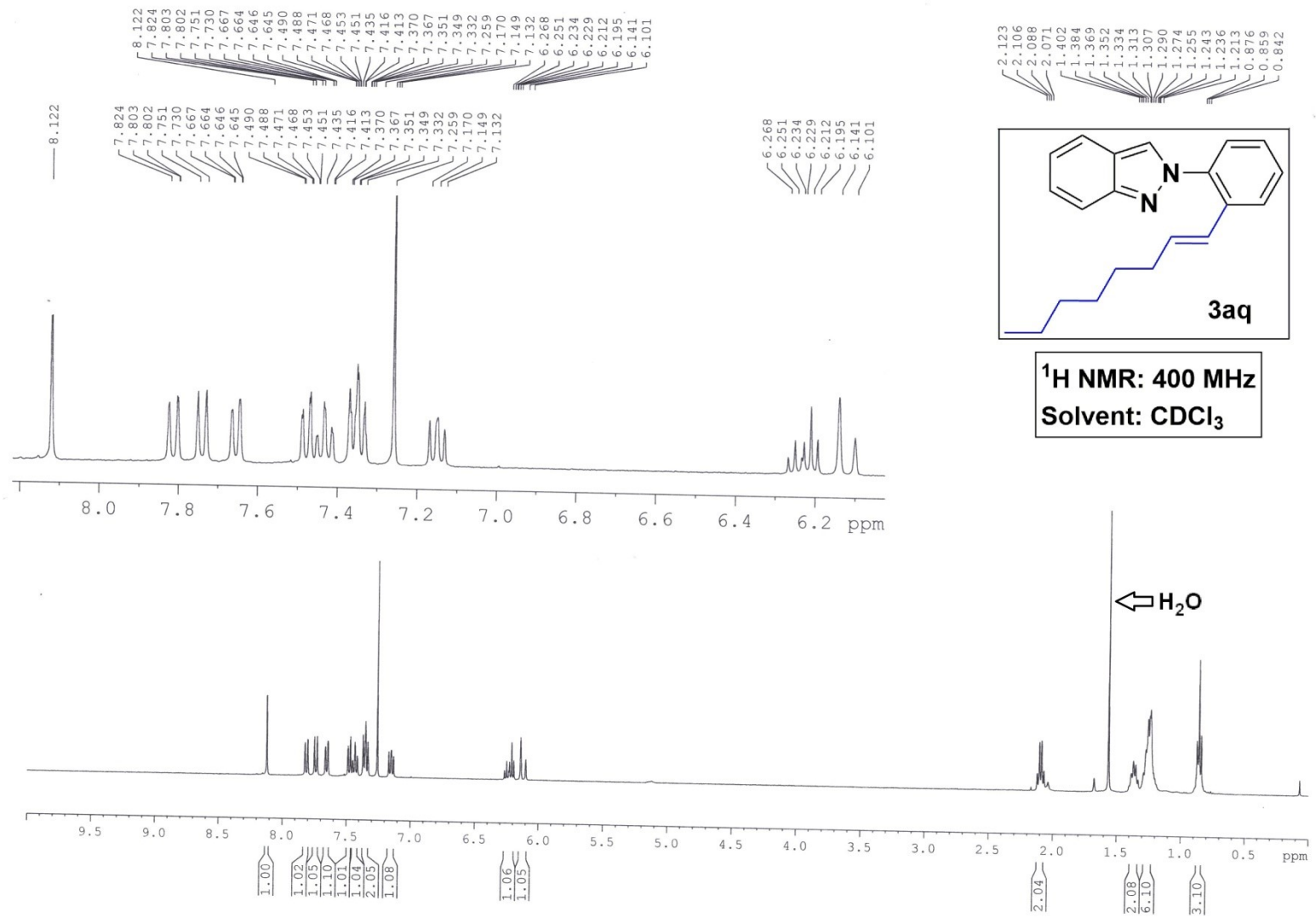


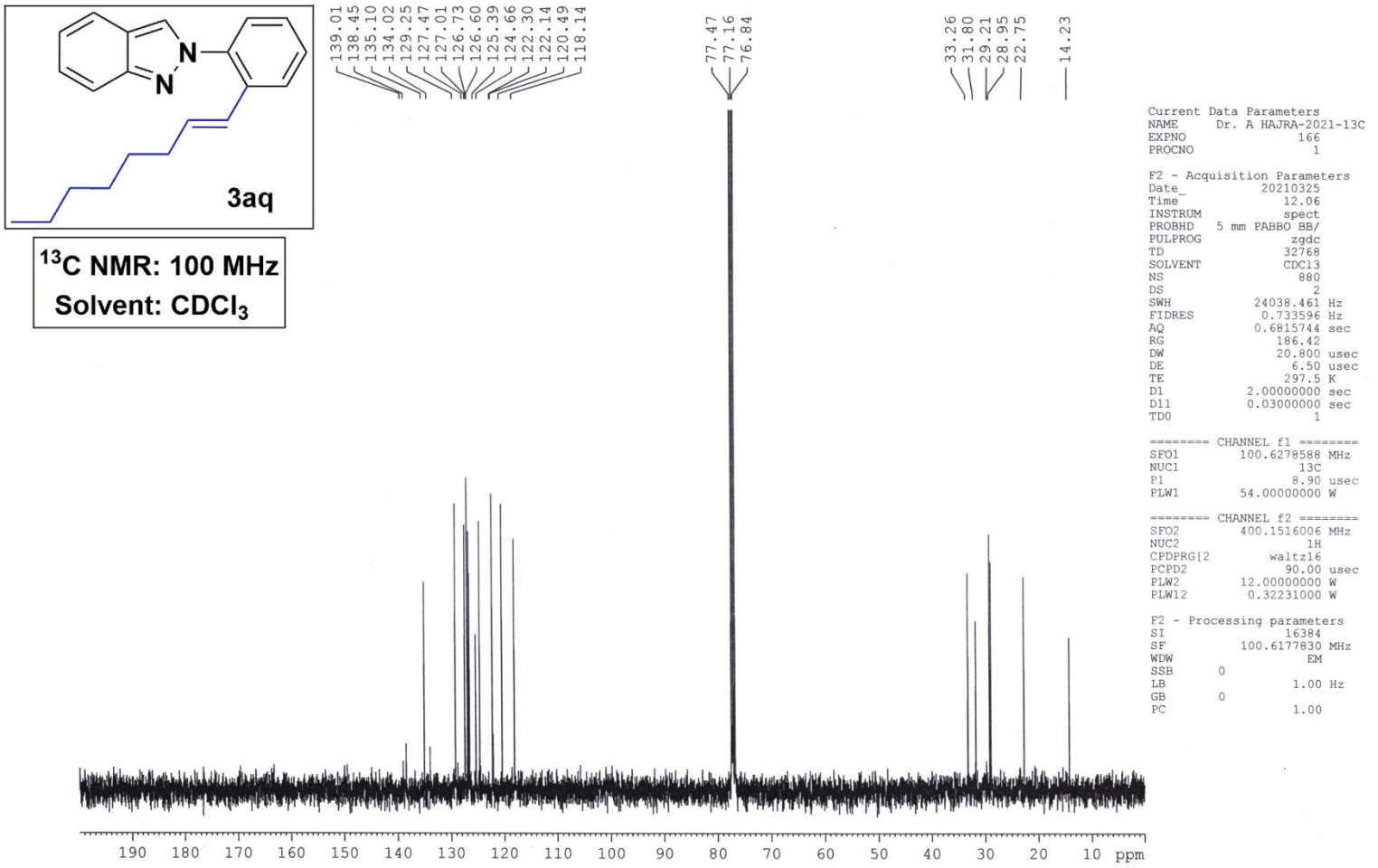

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  470
PROCNO                   1

F2 - Acquisition Parameters
Date_              20211201
Time                 15.13
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT                DMSO
NS                       720
DS                         2
SWH              24038.461 Hz
FIDRES               0.733596 Hz
AQ                   0.6815744 sec
RG                      32.25
DW                      20.800 usec
DE                       6.50 usec
TE                      295.2 K
D1                   2.00000000 sec
D11                  0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
SFO1           100.6278588 MHz
NUC1                    13C
P1                       8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2           400.1516006 MHz
NUC2                    1H
CPDPRG[2             waltz16
PCPD2                   90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
SI                      16384
SF             100.6178342 MHz
WDW                       EM
SSB       0
LB                       1.00 Hz
GB        0
PC                       1.40
```


H2O
OH
H
H
H
O
3ap
1H NMR: 400 MHz
Solvent: DMSO-d6
ppm

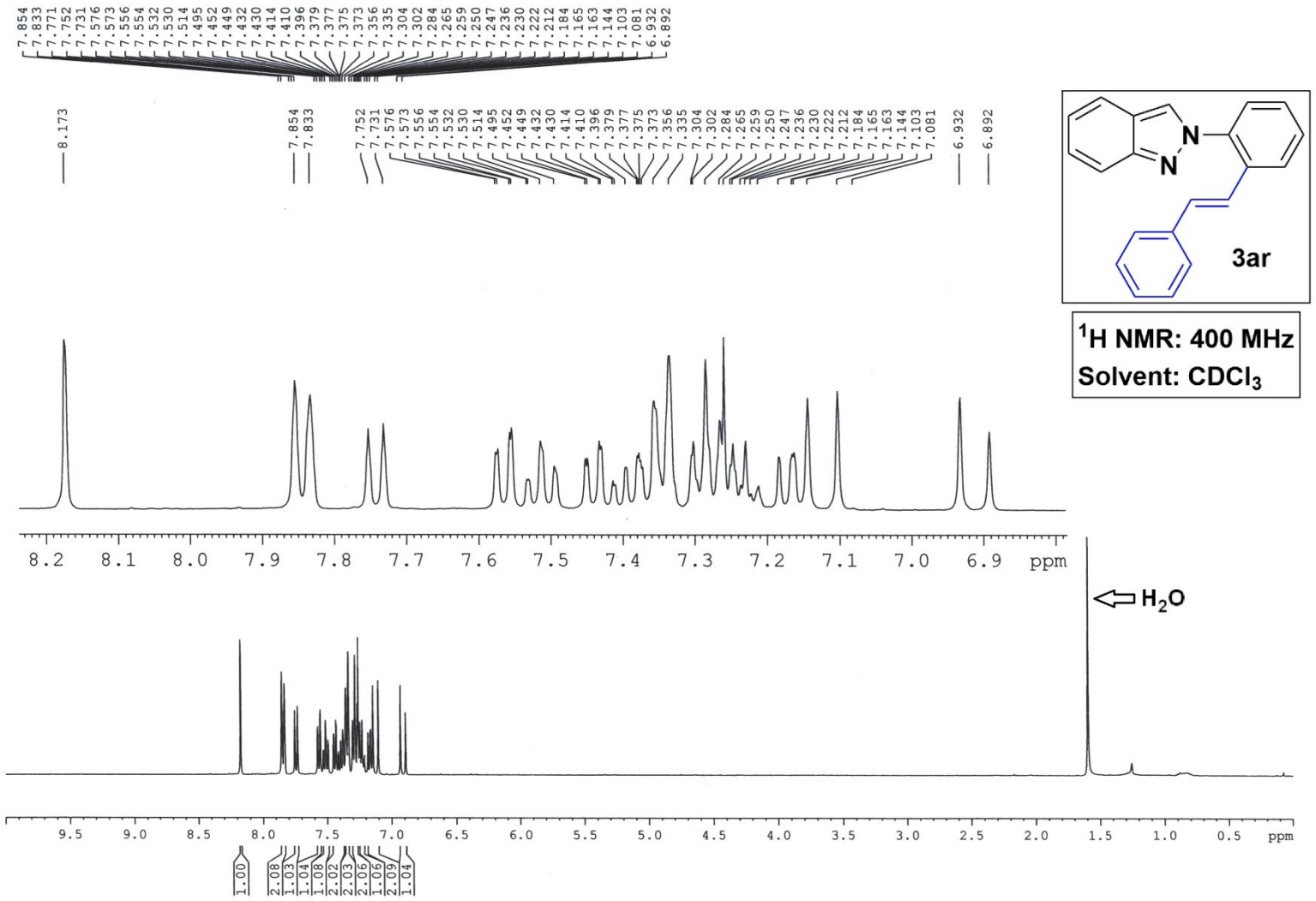


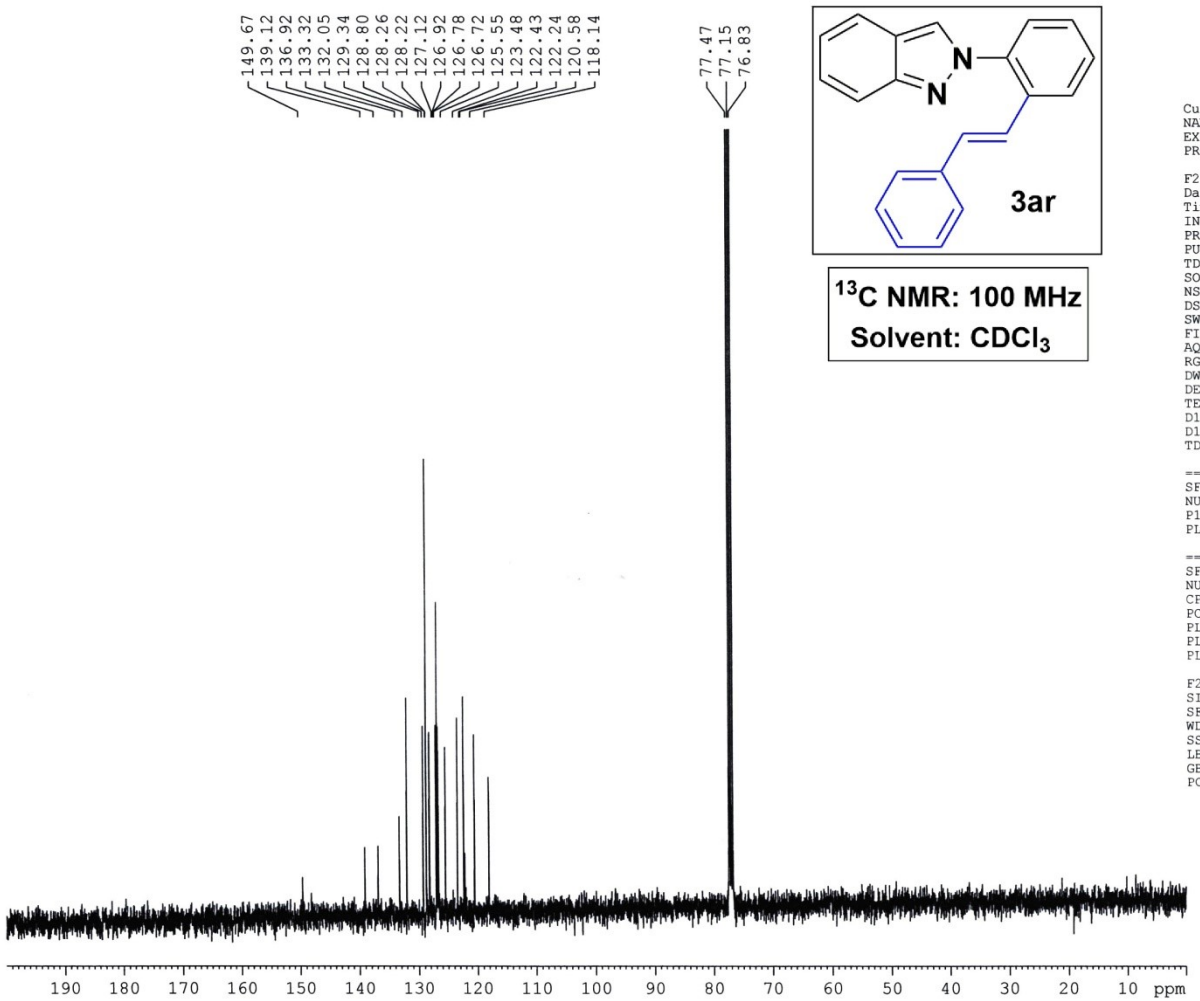

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO              469
PROCNO               1

F2 - Acquisition Parameters
Date_          20211201
Time             14.02
INSTRUM          spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD              32768
SOLVENT          DMSO
NS                640
DS                  2
SWH         24038.461 Hz
FIDRES       0.733596 Hz
AQ           0.6815744 sec
RG              106.66
DW              20.800 usec
DE               6.50 usec
TE              294.8 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                 1

======== CHANNEL f1 ========
SFO1       100.6278588 MHz
NUC1              13C
P1               8.90 usec
PLW1       54.00000000 W

======== CHANNEL f2 ========
SFO2       400.1516006 MHz
NUC2              1H
CPDPRG[2       waltz16
PCPD2            90.00 usec
PLW2       12.00000000 W
PLW12       0.32231000 W
PLW13       0.16212000 W

F2 - Processing parameters
SI               16384
SF         100.6178423 MHz
WDW                EM
SSB       0
LB               1.00 Hz
GB        0
PC               1.40
```


3aq
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
H$_2$O

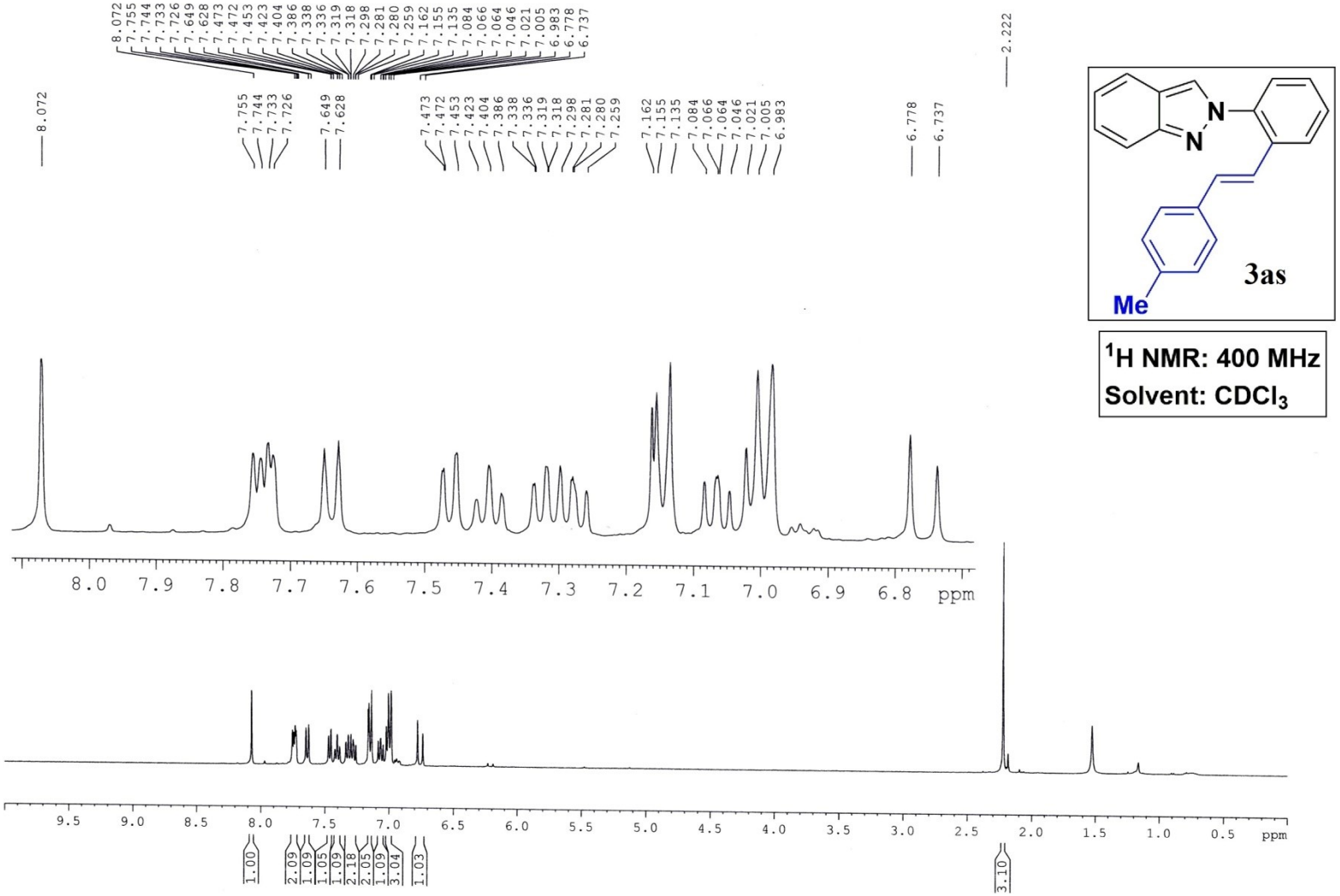


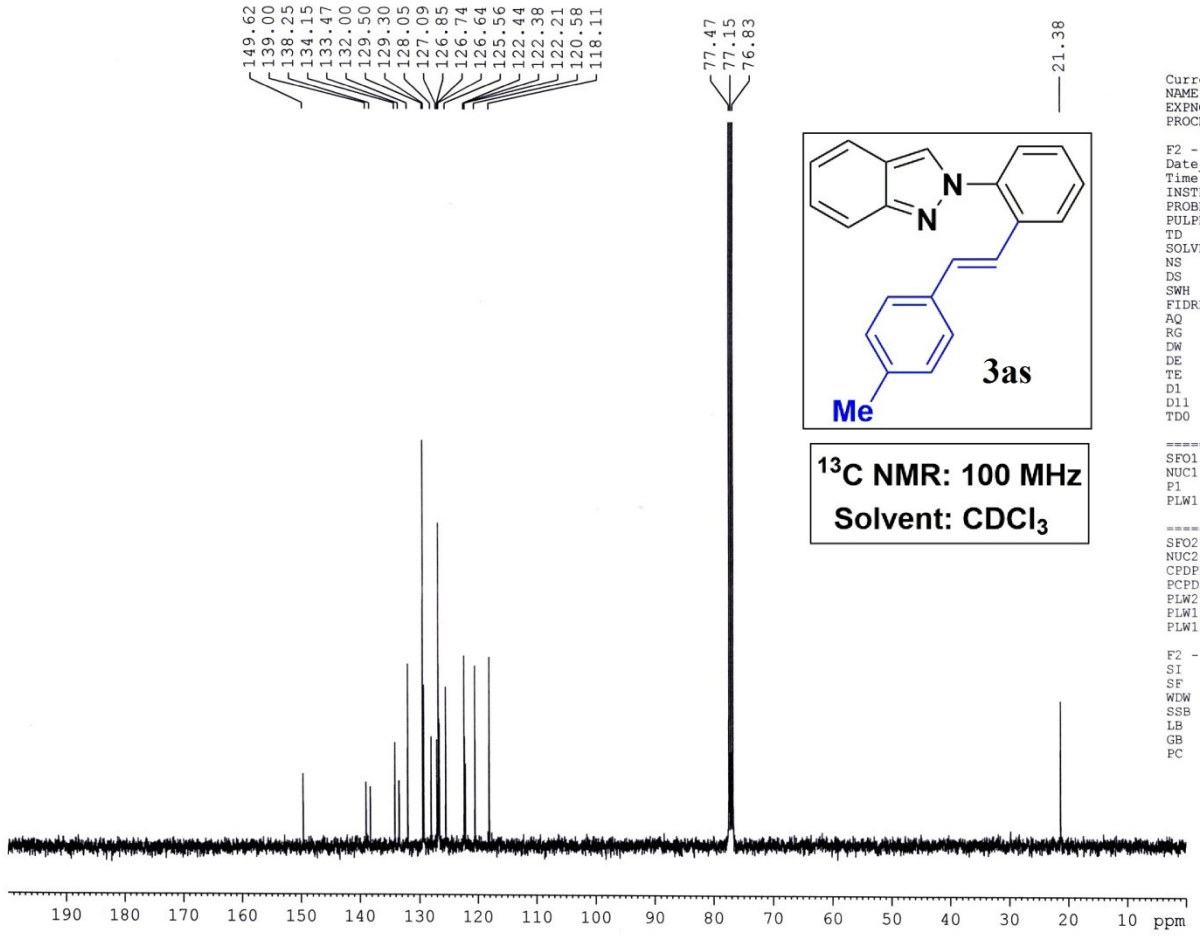

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  166
PROCNO                   1

F2 - Acquisition Parameters
Date_           20210325
Time              12.06
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zgdc
TD               32768
SOLVENT          CDCl3
NS                 880
DS                   2
SWH          24038.461 Hz
FIDRES        0.733596 Hz
AQ            0.6815744 sec
RG              186.42
DW               20.800 usec
DE                6.50 usec
TE              297.5 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1              13C
P1                8.90 usec
PLW1       54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2              1H
CPDPRG[2        waltz16
PCPD2            90.00 usec
PLW2       12.00000000 W
PLW12       0.32231000 W

F2 - Processing parameters
SI               16384
SF          100.6177830 MHz
WDW                EM
SSB       0
LB               1.00 Hz
GB        0
PC               1.00
```


7.854
7.833
7.771
7.752
7.731
7.576
7.573
7.556
7.554
7.532
7.530
7.514
7.495
7.452
7.449
7.432
7.430
7.414
7.410
7.396
7.379
7.377
7.375
7.373
7.356
7.335
7.304
7.302
7.284
7.265
7.259
7.250
7.247
7.236
7.230
7.222
7.212
7.184
7.165
7.163
7.144
7.103
7.081
6.932
6.892
8.173
7.854
7.833
7.752
7.731
7.576
7.573
7.556
7.554
7.532
7.530
7.514
7.495
7.452
7.449
7.432
7.430
7.414
7.410
7.396
7.379
7.377
7.375
7.373
7.356
7.335
7.304
7.302
7.284
7.265
7.259
7.250
7.247
7.236
7.230
7.222
7.212
7.184
7.165
7.163
7.144
7.103
7.081
6.932
6.892
N
N
3ar
1H NMR: 400 MHz
Solvent: CDCl3
8.2 8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 ppm
H2O
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
1.00
2.08
1.03
1.04
1.08
2.02
2.03
2.06
1.06
2.09
1.04

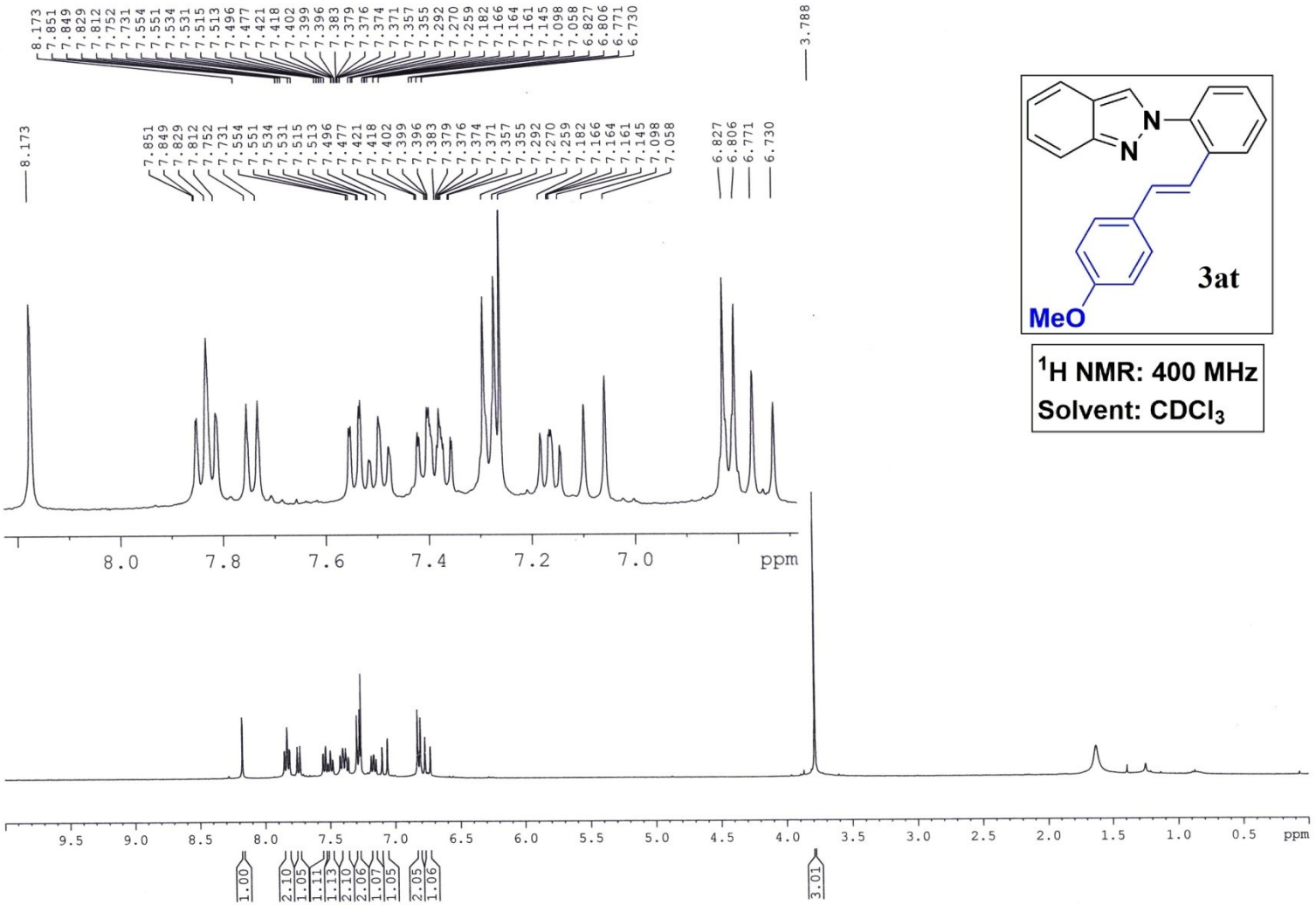



```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                   50
PROCNO                   1

F2 - Acquisition Parameters
Date_           20210126
Time              21.12
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD              32768
SOLVENT           CDCl3
NS                  380
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                186.42
DW                20.800 usec
DE                 6.50 usec
TE               295.4 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1               13C
P1                8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                16384
SF          100.6177858 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```

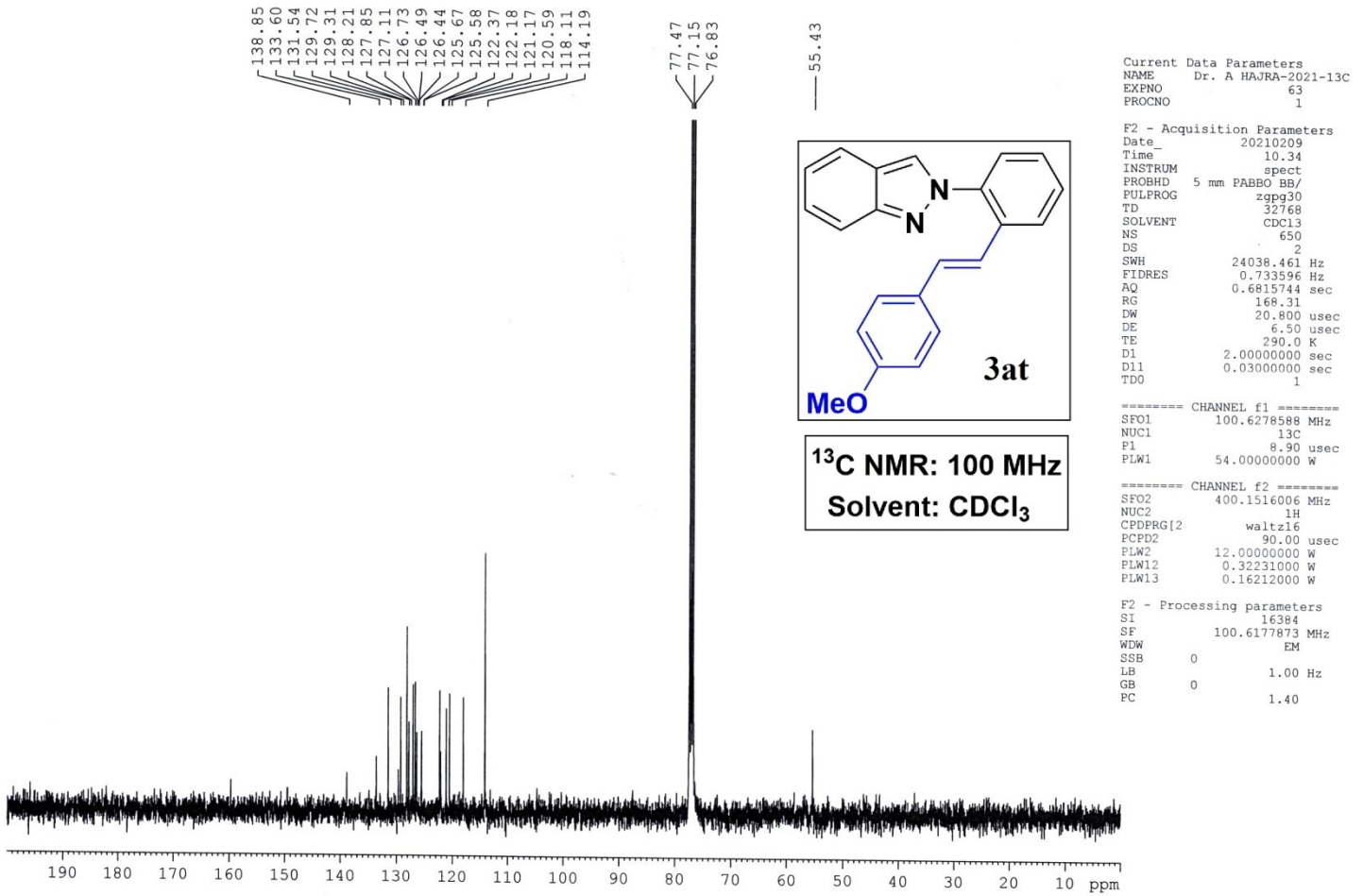

8.072
7.755
7.744
7.733
7.726
7.649
7.628
7.473
7.472
7.453
7.423
7.404
7.386
7.338
7.336
7.319
7.318
7.298
7.281
7.280
7.259
7.162
7.155
7.135
7.084
7.066
7.064
7.046
7.021
7.005
6.983
6.778
6.737
2.222
N
N
3as
Me
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
ppm
1.00
2.09
1.09
1.05
1.09
2.18
2.05
1.09
3.04
1.03
3.10



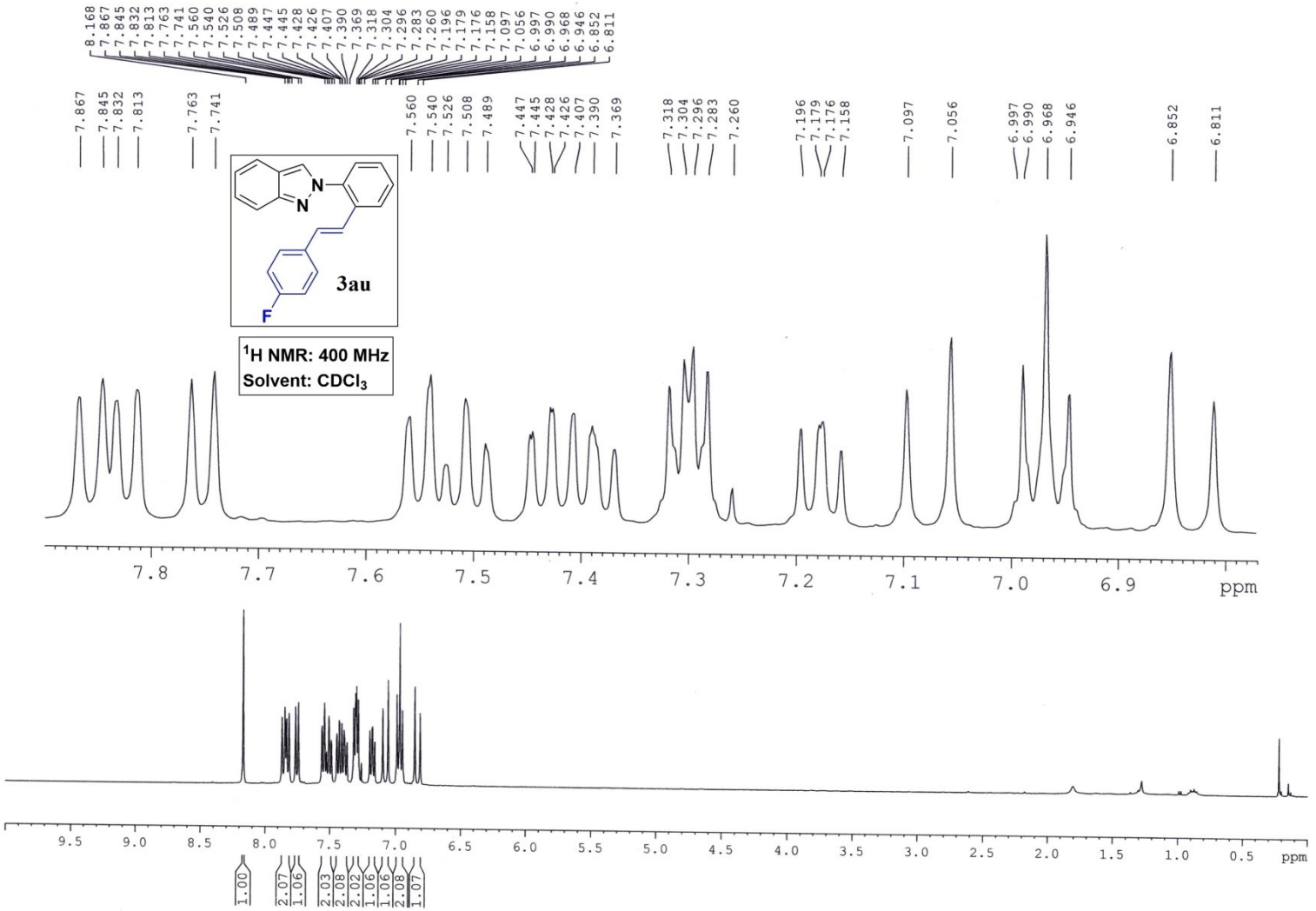

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                   88
PROCNO                   1

F2 - Acquisition Parameters
Date_              20210218
Time                   0.44
INSTRUM               spect
PROBHD   5 mm PABBO BB/
PULPROG            zgpg30
TD                  32768
SOLVENT             CDCl3
NS                    512
DS                      2
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  120.16
DW                  20.800 usec
DE                   6.50 usec
TE                  294.5 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                  13C
P1                   8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2               90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                  16384
SF           100.6177873 MHz
WDW                    EM
SSB       0
LB                  1.00 Hz
GB        0
PC                  1.40
```

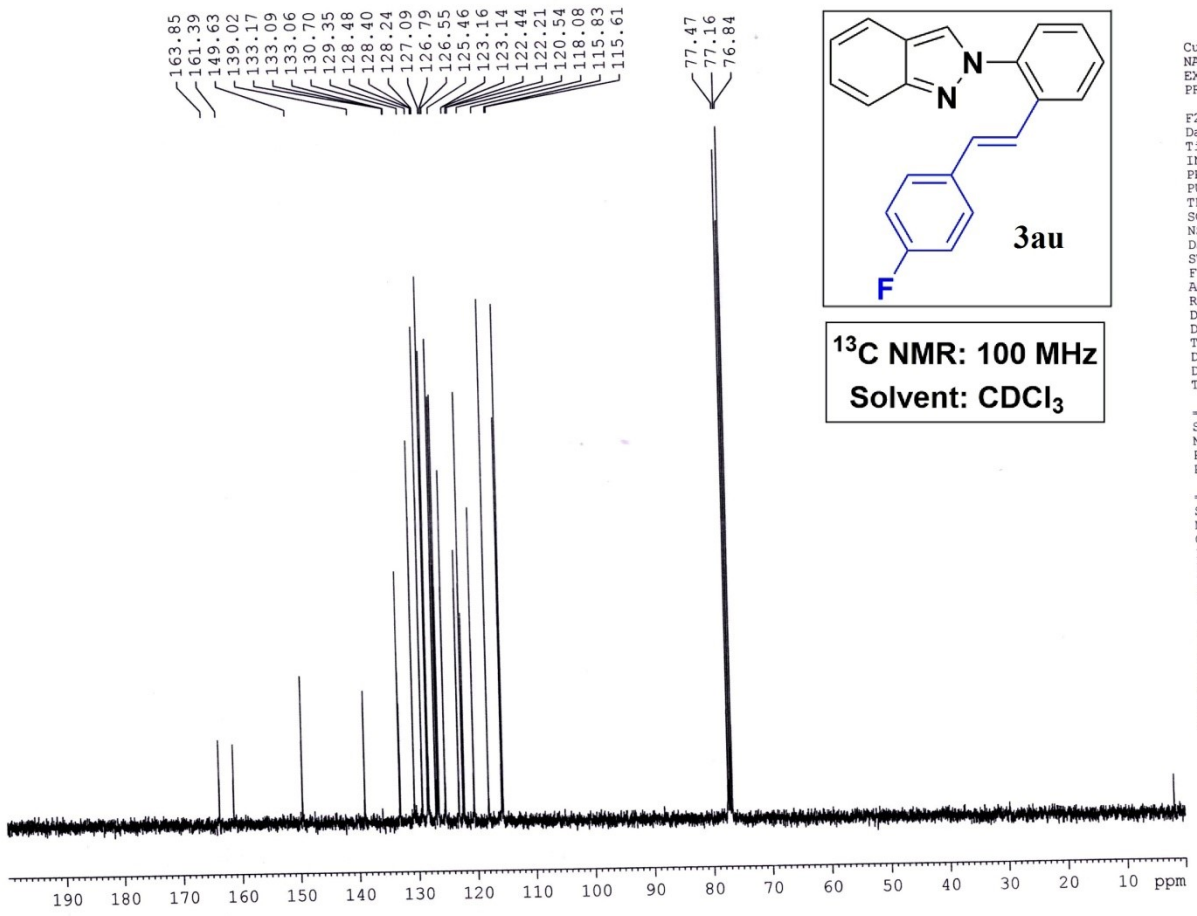


^{1}H NMR: 400 MHz
Solvent: $CDCl_3$

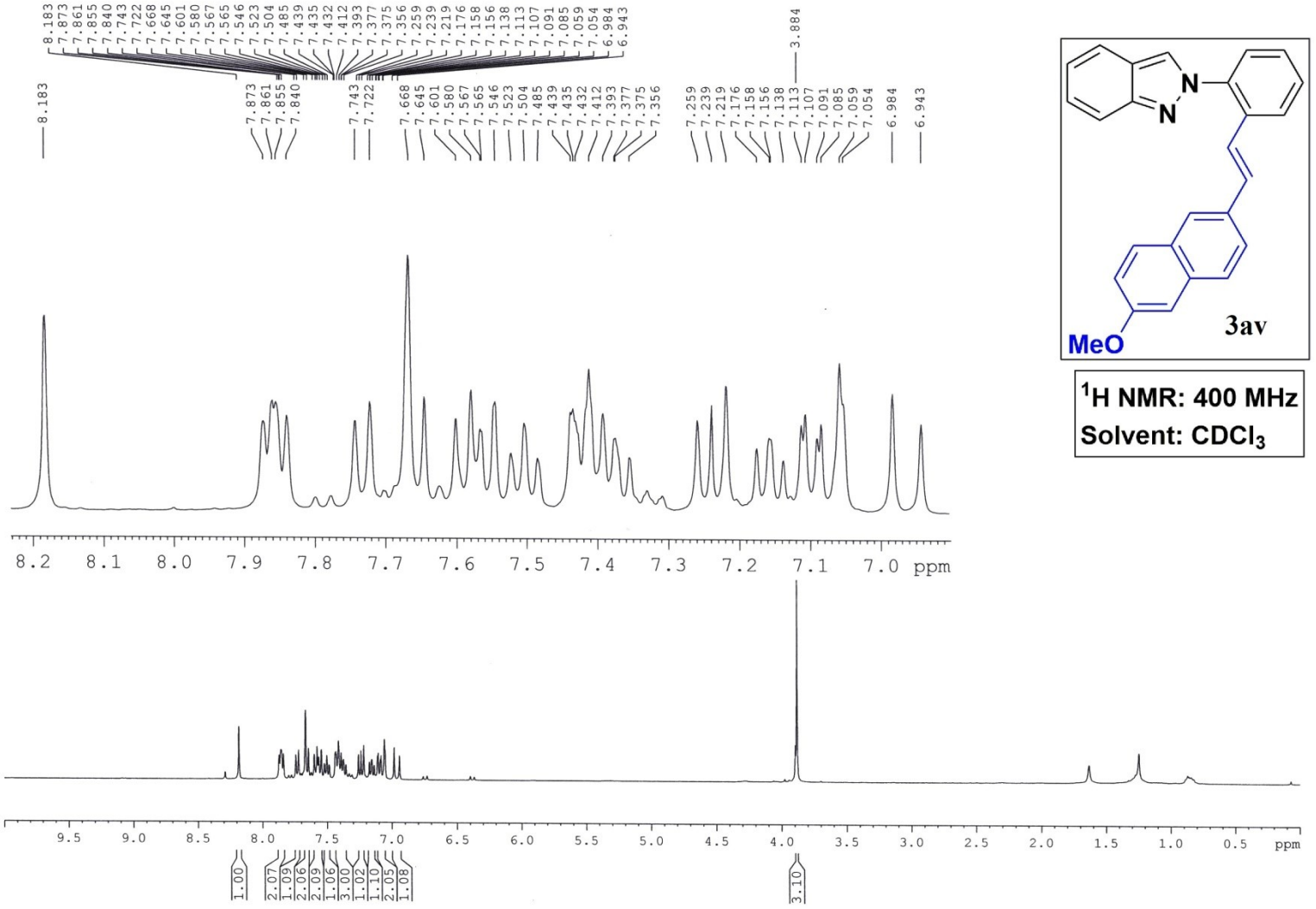



```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                   63
PROCNO                   1

F2 - Acquisition Parameters
Date_             20210209
Time                10.34
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 32768
SOLVENT             CDCl3
NS                    650
DS                      2
SWH             24038.461 Hz
FIDRES              0.733596 Hz
AQ                  0.6815744 sec
RG                    168.31
DW                   20.800 usec
DE                    6.50 usec
TE                   290.0 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                  13C
P1                   8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                  1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177873 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```

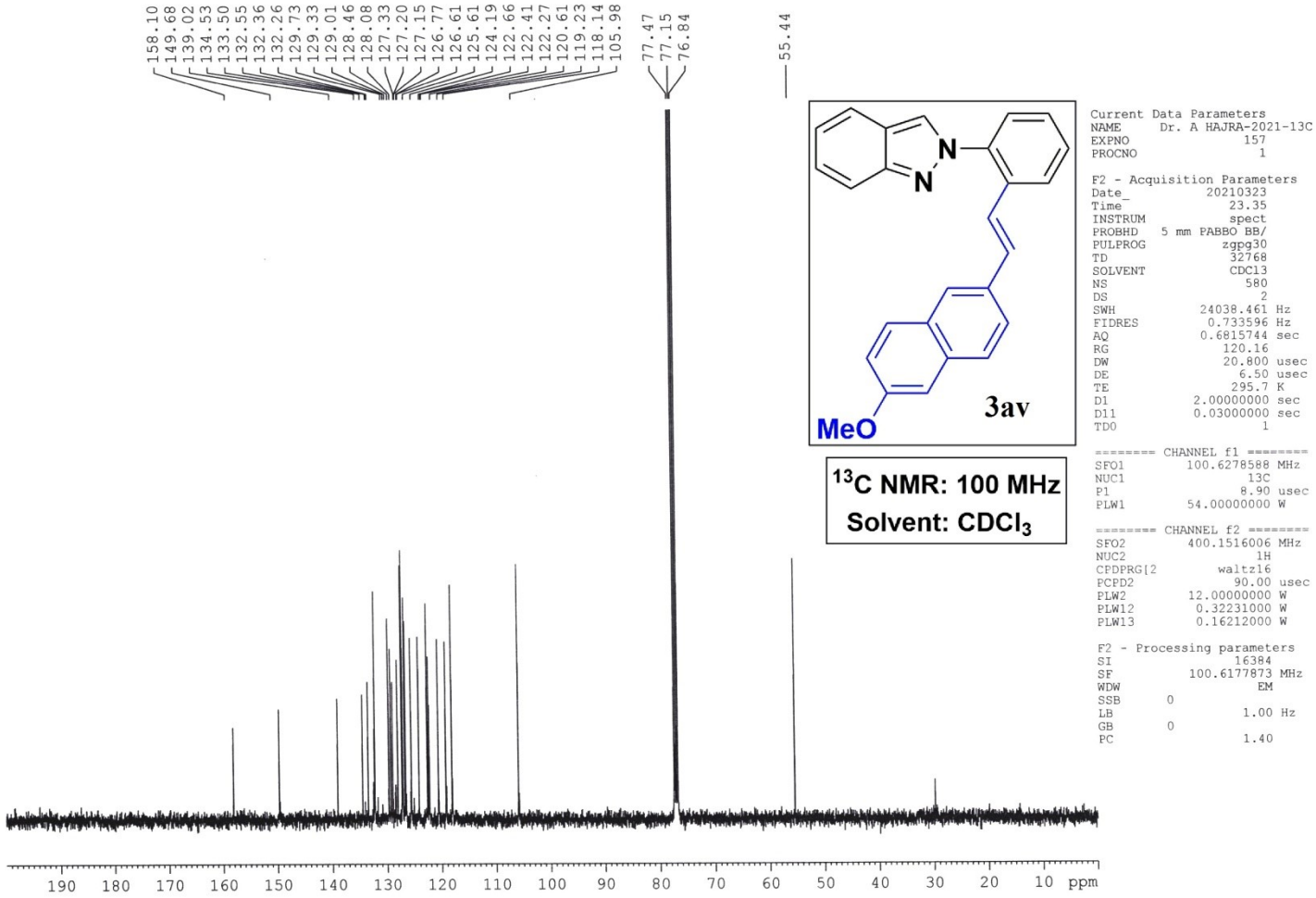

8.168
7.867
7.845
7.832
7.813
7.763
7.741
7.560
7.540
7.526
7.508
7.489
7.447
7.445
7.428
7.426
7.407
7.390
7.369
7.318
7.304
7.296
7.283
7.260
7.196
7.179
7.176
7.158
7.097
7.056
6.997
6.990
6.968
6.946
6.852
6.811
3au
F
1H NMR: 400 MHz
Solvent: CDCl3
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
ppm
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
1.00
2.07
1.06
2.03
2.08
2.02
1.06
1.06
2.08
1.07



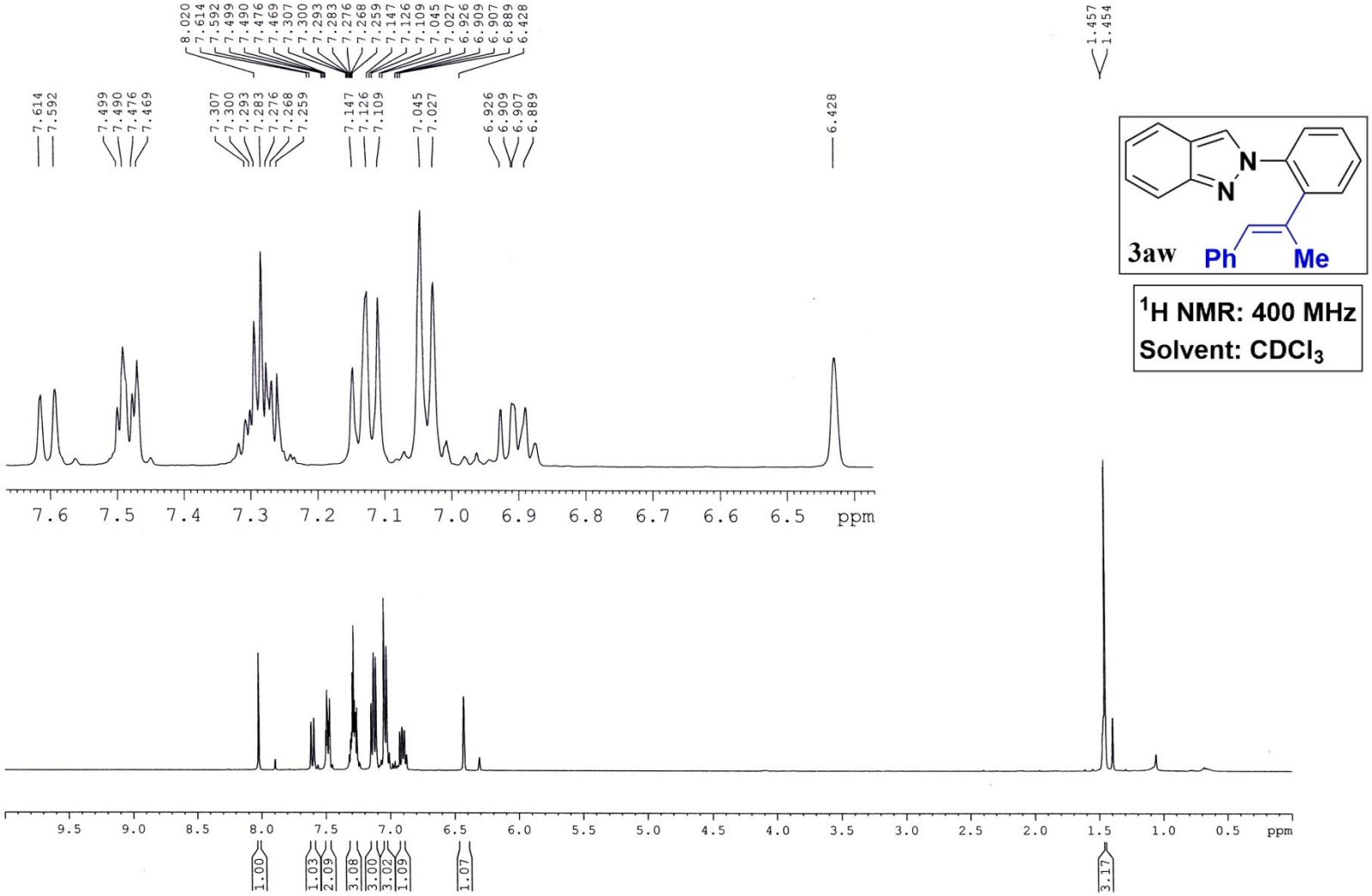

```
Current Data Parameters
NAME       Dr. A HAJRA-2021-13C
EXPNO                        69
PROCNO                        1

F2 - Acquisition Parameters
Date_                  20210209
Time                      23.49
INSTRUM                   spect
PROBHD    5 mm PABBO BB/
PULPROG                zgpg30
TD                      32768
SOLVENT                 CDCl3
NS                        220
DS                          2
SWH                24038.461 Hz
FIDRES              0.733596 Hz
AQ                  0.6815744 sec
RG                      57.28
DW                     20.800 usec
DE                      6.50 usec
TE                     293.3 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1           100.6278588 MHz
NUC1                      13C
P1                     8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2           400.1516006 MHz
NUC2                      1H
CPDPRG[2              waltz16
PCPD2                 90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
SI                        16384
SF             100.6177922 MHz
WDW                          EM
SSB                       0
LB                     1.00 Hz
GB                        0
PC                     1.40
```

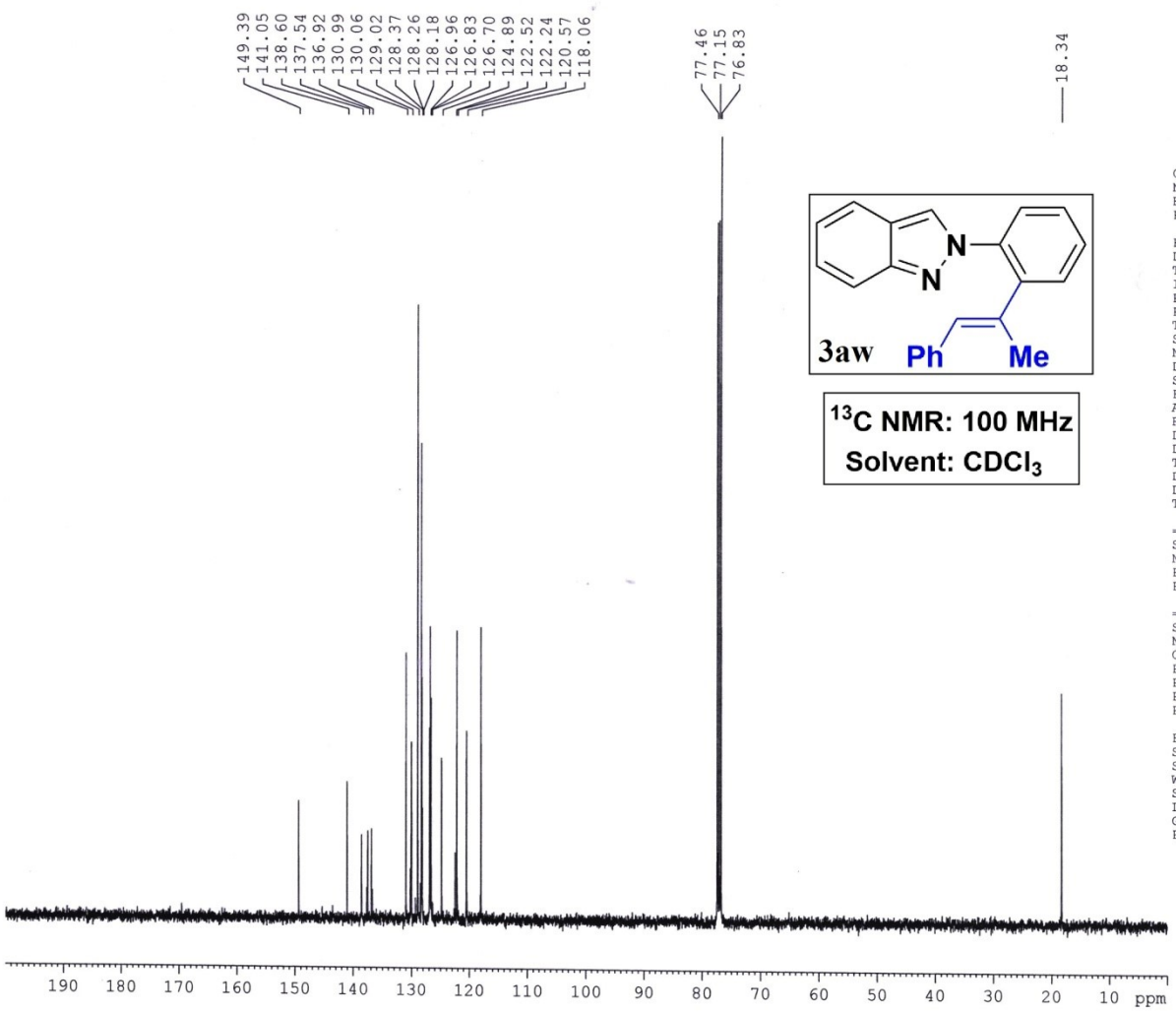


^{1}H NMR: 400 MHz
Solvent: $CDCl_3$

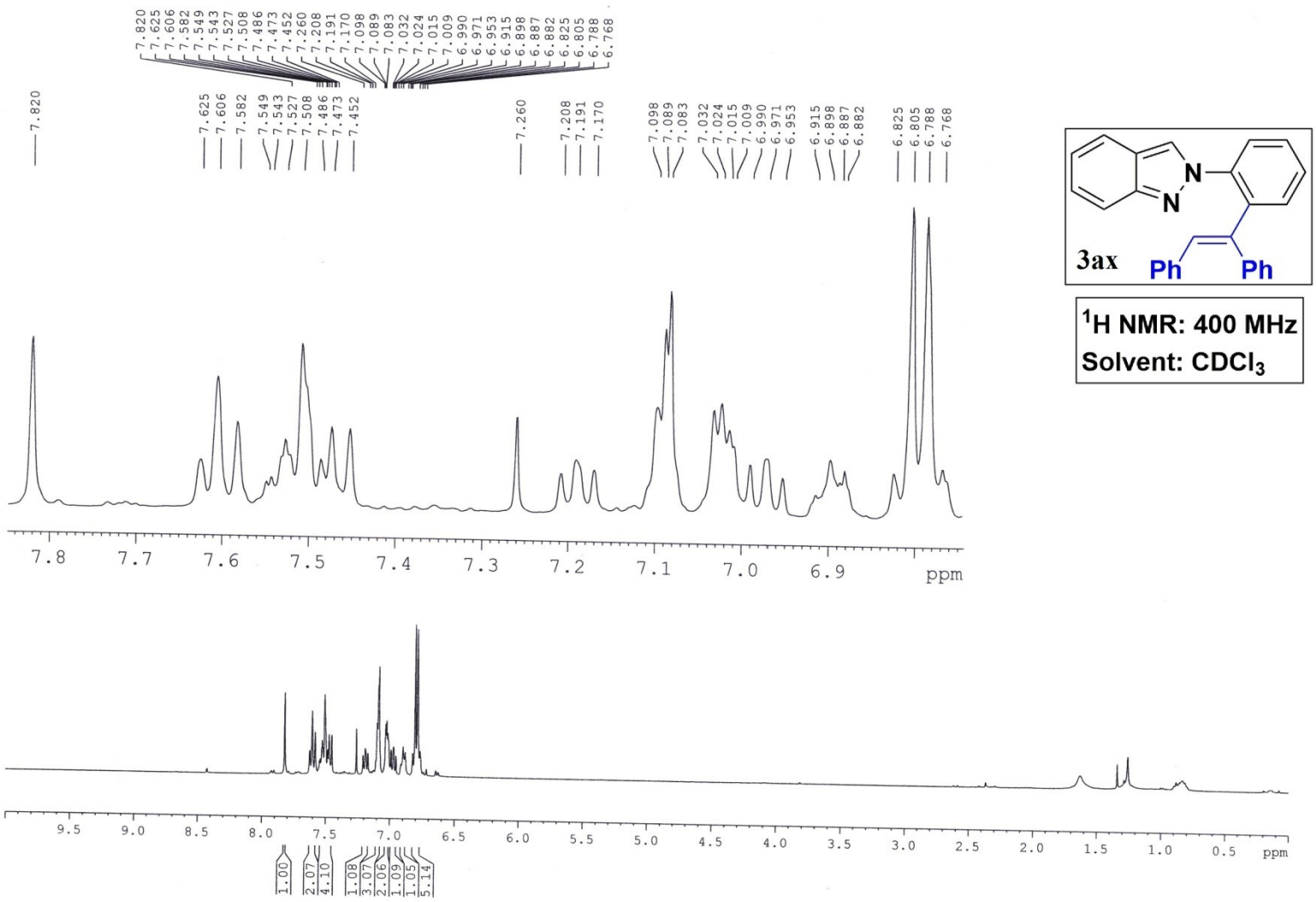



```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  157
PROCNO                   1

F2 - Acquisition Parameters
Date_              20210323
Time_                 23.35
INSTRUM               spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     580
DS                       2
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  120.16
DW                  20.800 usec
DE                   6.50 usec
TE                  295.7 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                    13C
P1                   8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                    1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177873 MHz
WDW                     EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.40
```

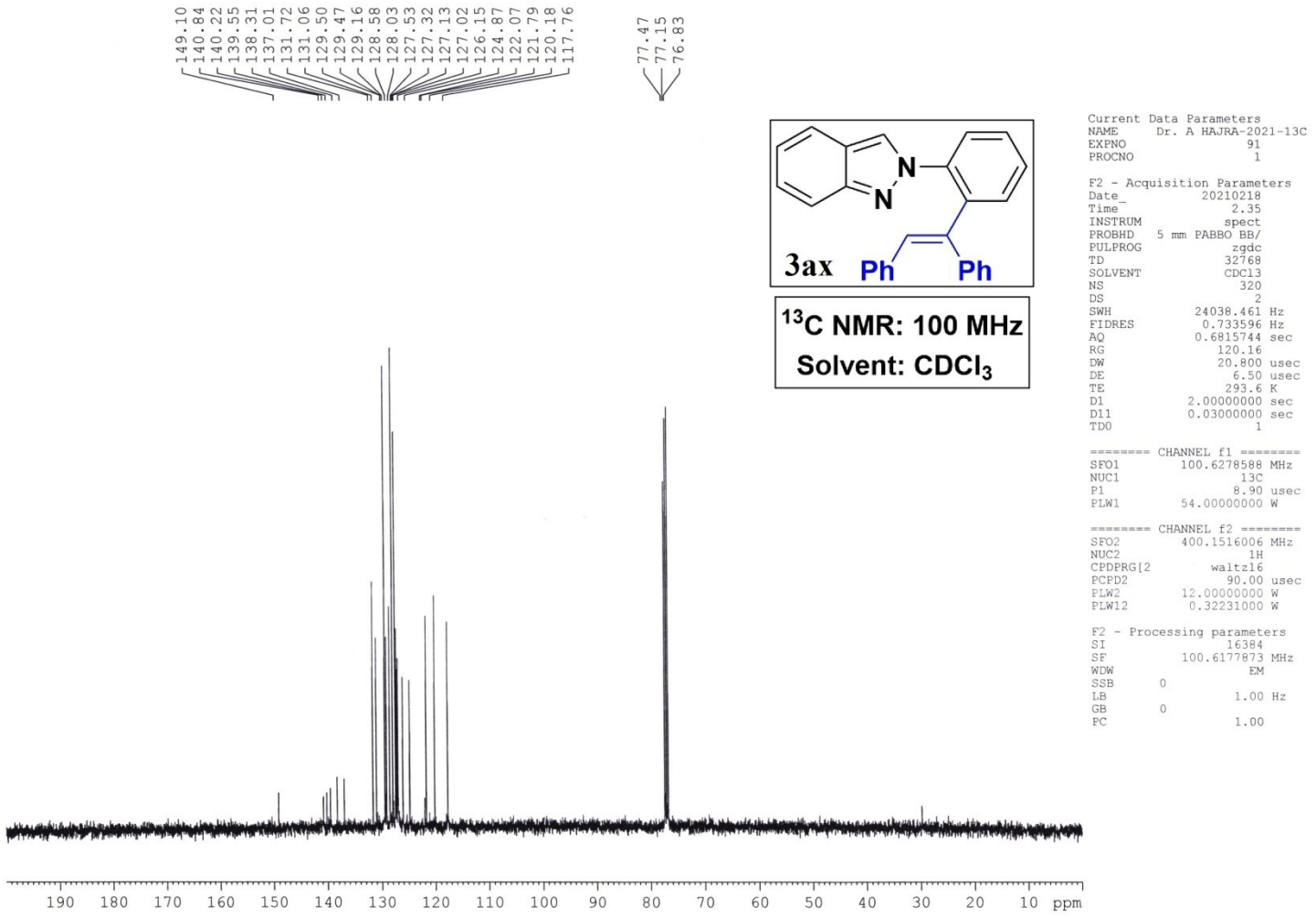

3aw
Ph
Me
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$



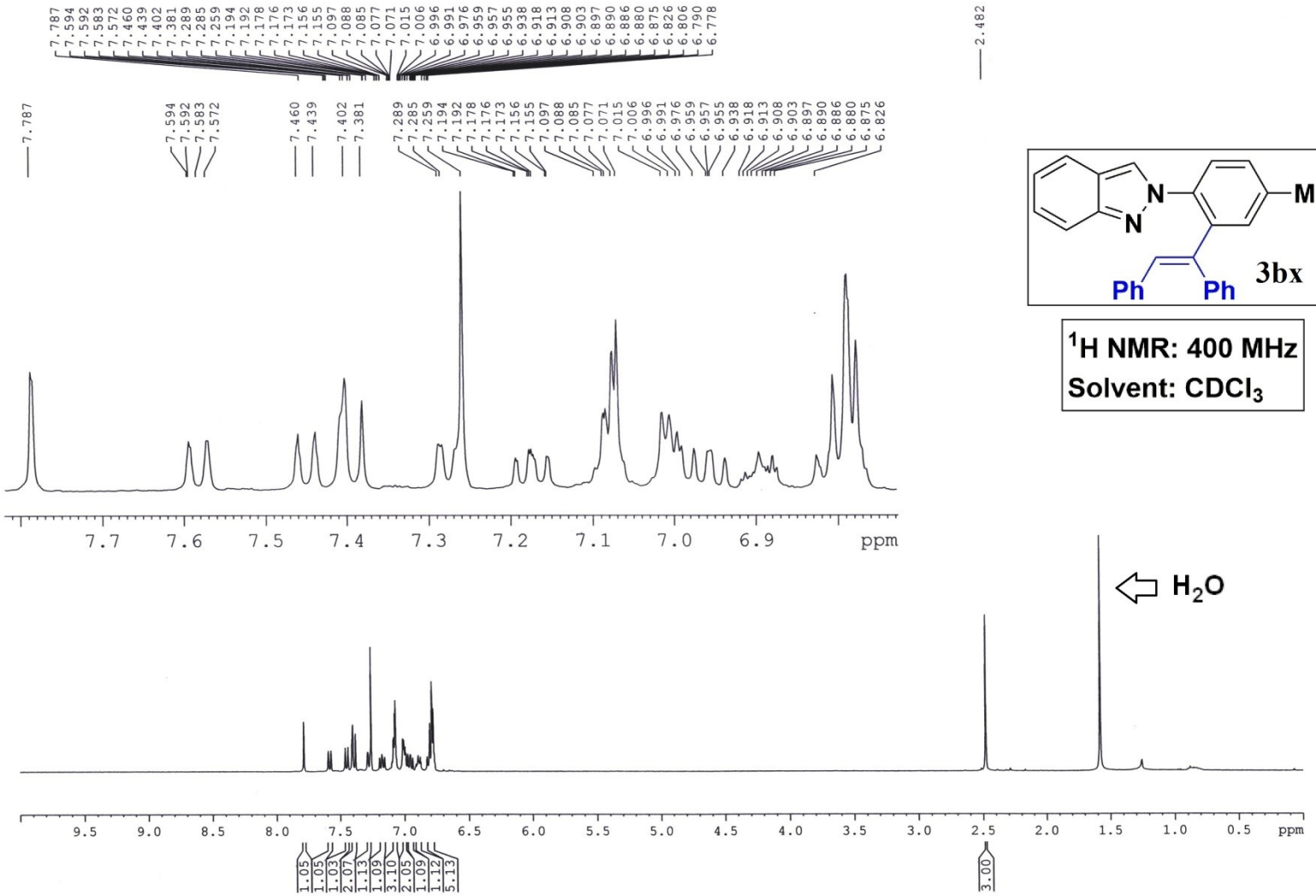

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  191
PROCNO                   1

F2 - Acquisition Parameters
Date_           20210408
Time_              18.53
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                32768
SOLVENT           CDCl3
NS                  512
DS                    2
SWH           24038.461 Hz
FIDRES        0.733596 Hz
AQ            0.6815744 sec
RG                186.42
DW                20.800 usec
DE                 6.50 usec
TE                298.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1               13C
P1                8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2               1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                16384
SF          100.6177872 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```



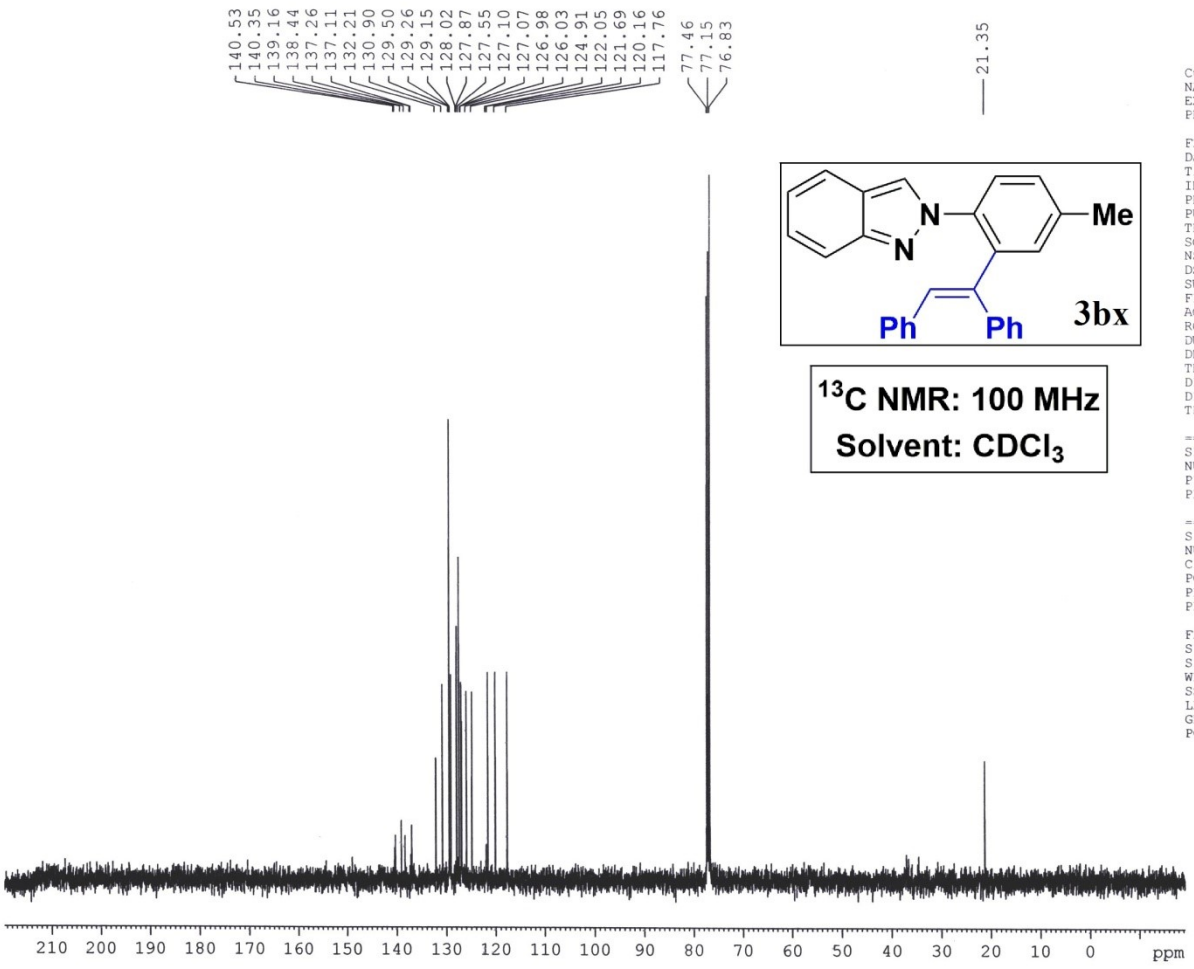
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$



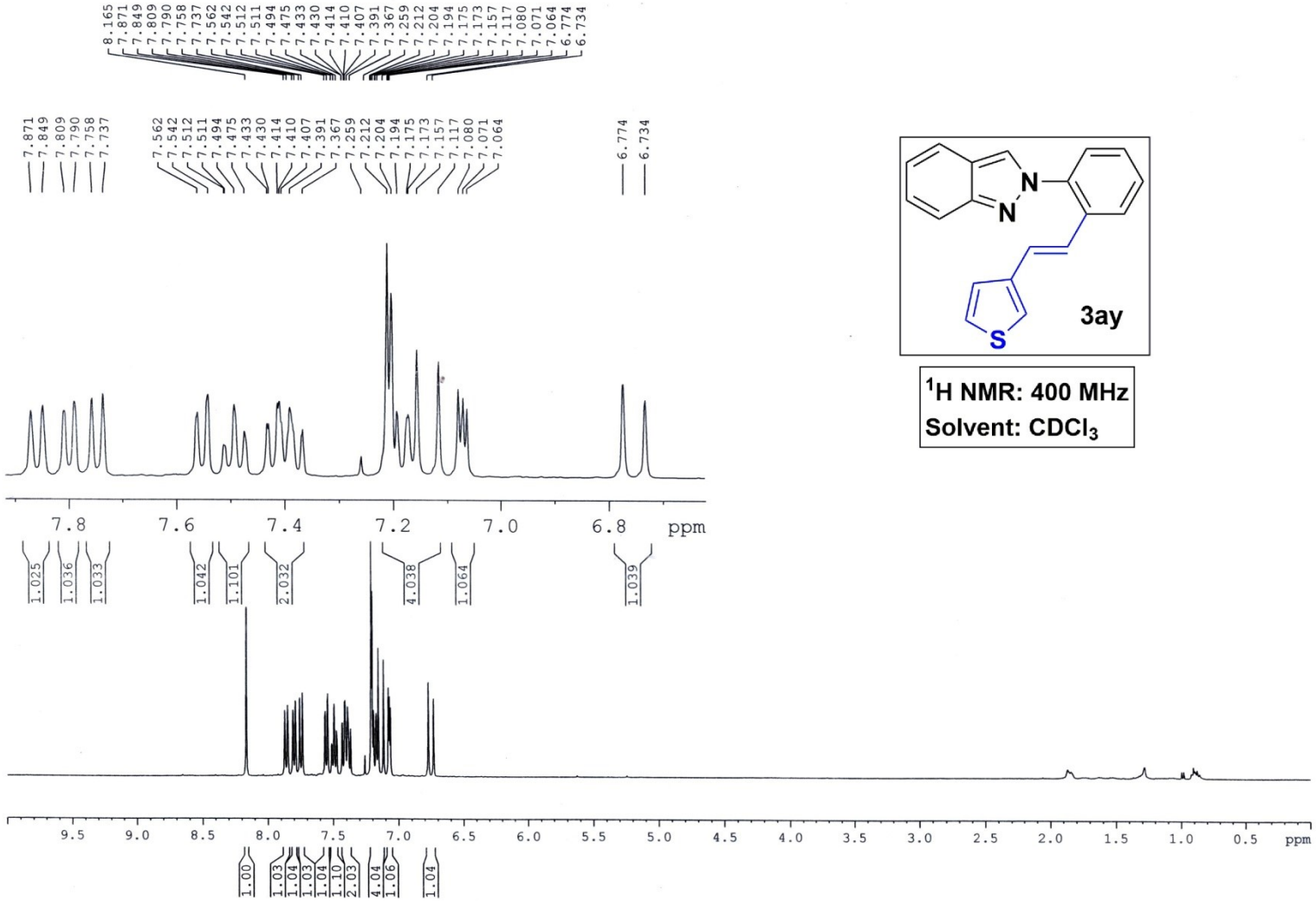

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                   91
PROCNO                   1

F2 - Acquisition Parameters
Date_           20210218
Time                2.35
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG             zgdc
TD                 32768
SOLVENT            CDCl3
NS                   320
DS                     2
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                 120.16
DW                 20.800 usec
DE                  6.50 usec
TE                 293.6 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                13C
P1                 8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2              90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W

F2 - Processing parameters
SI                 16384
SF           100.6177873 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```



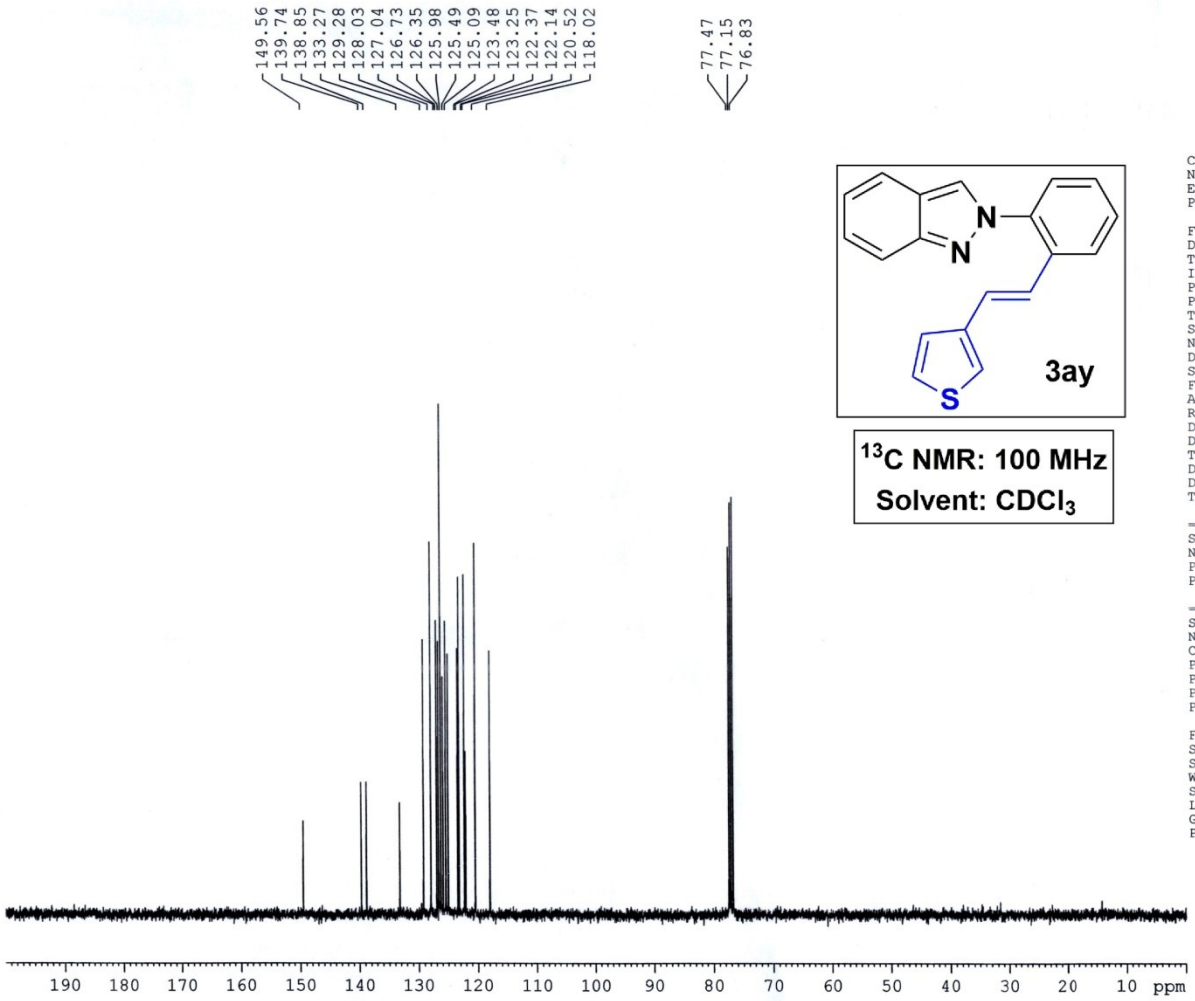
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$



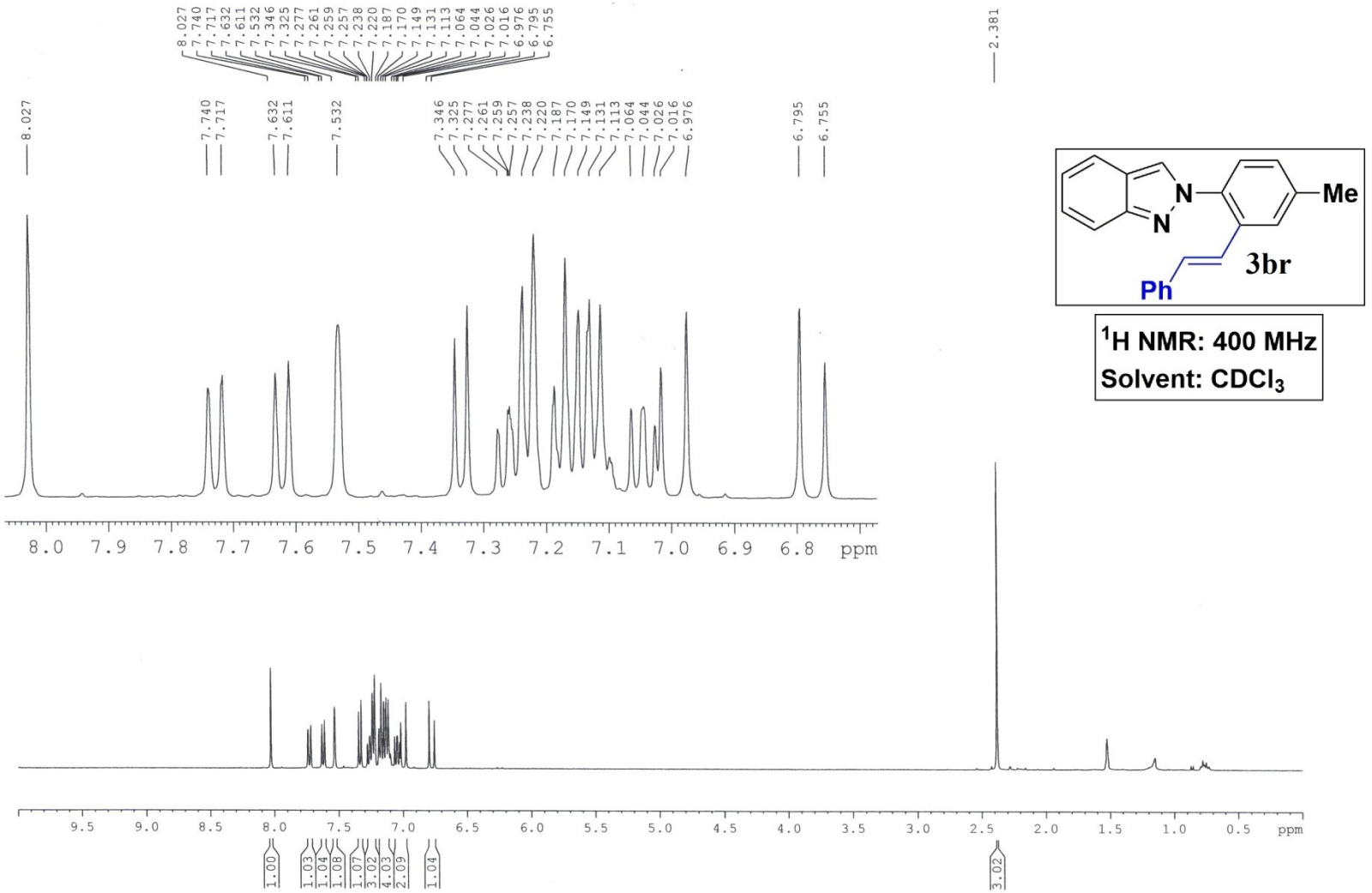

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO              299
PROCNO               1

F2 - Acquisition Parameters
Date_          20210818
Time_             19.33
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zgdc
TD               32768
SOLVENT          CDCl3
NS                 640
DS                   2
SWH          24038.461 Hz
FIDRES        0.733596 Hz
AQ            0.6815744 sec
RG              186.42
DW              20.800 usec
DE               6.50 usec
TE              298.5 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1       100.6278588 MHz
NUC1              13C
P1                8.90 usec
PLW1      54.00000000 W

======== CHANNEL f2 ========
SFO2       400.1516006 MHz
NUC2              1H
CPDPRG[2        waltz16
PCPD2            90.00 usec
PLW2      12.00000000 W
PLW12      0.32231000 W

F2 - Processing parameters
SI                16384
SF         100.6177842 MHz
WDW                EM
SSB       0
LB               1.00 Hz
GB        0
PC               1.00
```

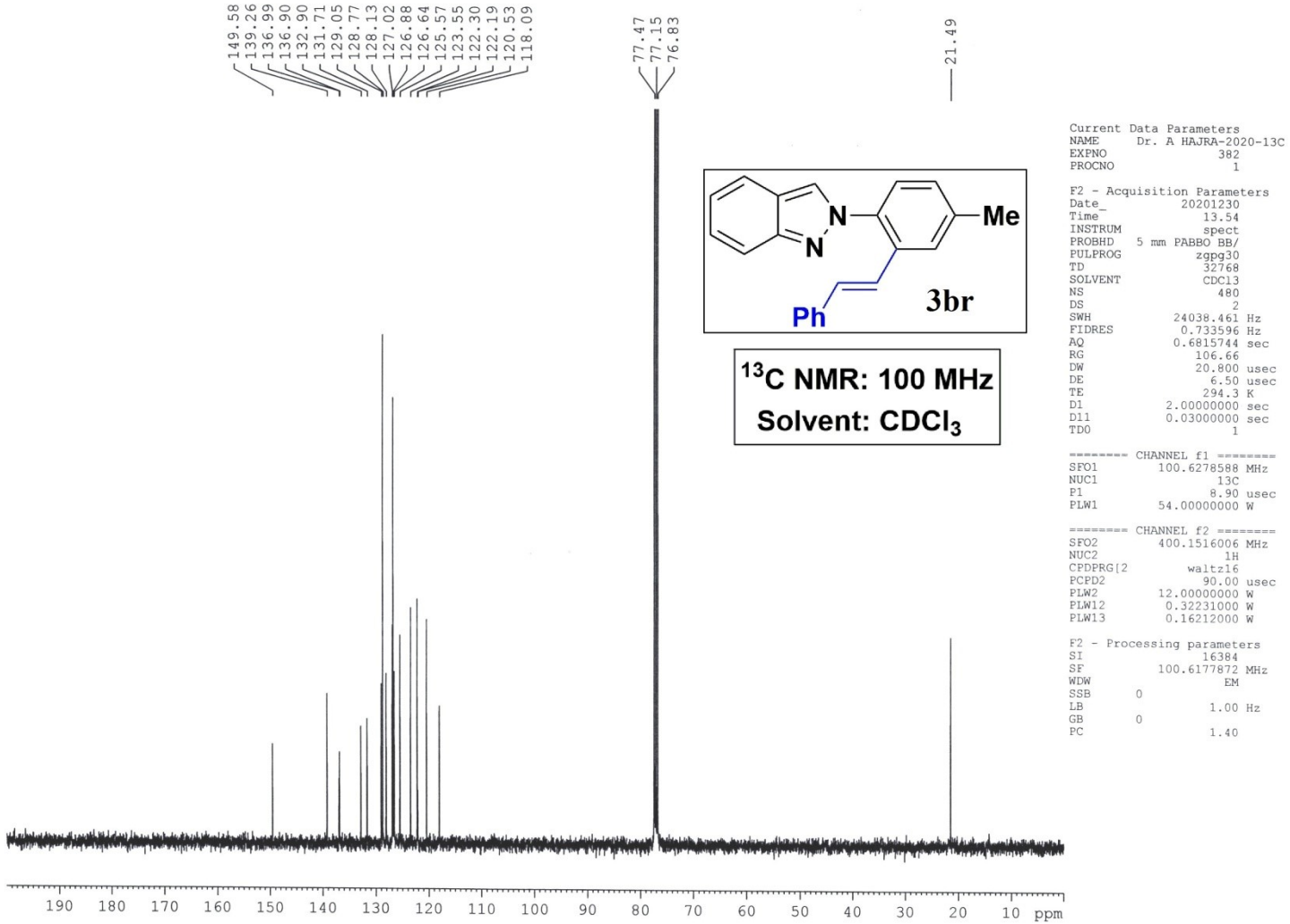


^{1}H NMR: 400 MHz
Solvent: $CDCl_3$

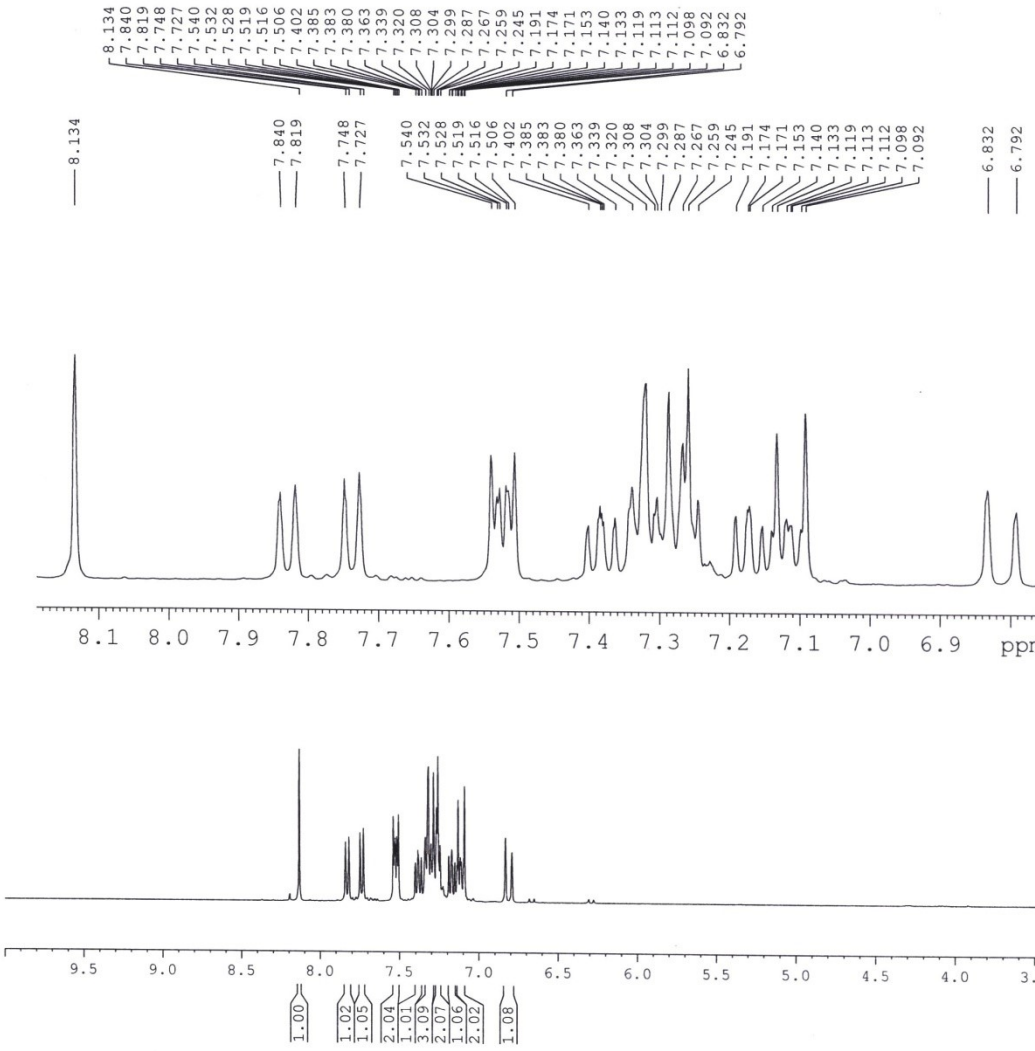


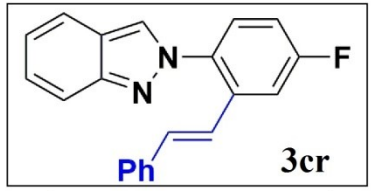

```
Current Data Parameters
NAME      Dr. A HAJRA-2022-13C
EXPNO                  9
PROCNO                 1

F2 - Acquisition Parameters
Date_           20220109
Time              13.29
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD              32768
SOLVENT           CDCl3
NS                  120
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                62.69
DW               20.800 usec
DE                6.50 usec
TE               290.9 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1               13C
P1                8.90 usec
PLW1       54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2            90.00 usec
PLW2       12.00000000 W
PLW12       0.32231000 W
PLW13       0.16212000 W

F2 - Processing parameters
SI                16384
SF          100.6177961 MHz
WDW                EM
SSB       0
LB                1.00 Hz
GB        0
PC                1.40
```


8.027
7.740
7.717
7.632
7.611
7.532
7.346
7.325
7.277
7.261
7.259
7.257
7.238
7.220
7.187
7.170
7.149
7.131
7.113
7.064
7.044
7.026
7.016
6.976
6.795
6.755
2.381
N
N
Me
Ph
3br
1H NMR: 400 MHz
Solvent: CDCl3
ppm
1.00
1.03
1.04
1.08
1.07
3.02
4.03
2.09
1.04
3.02

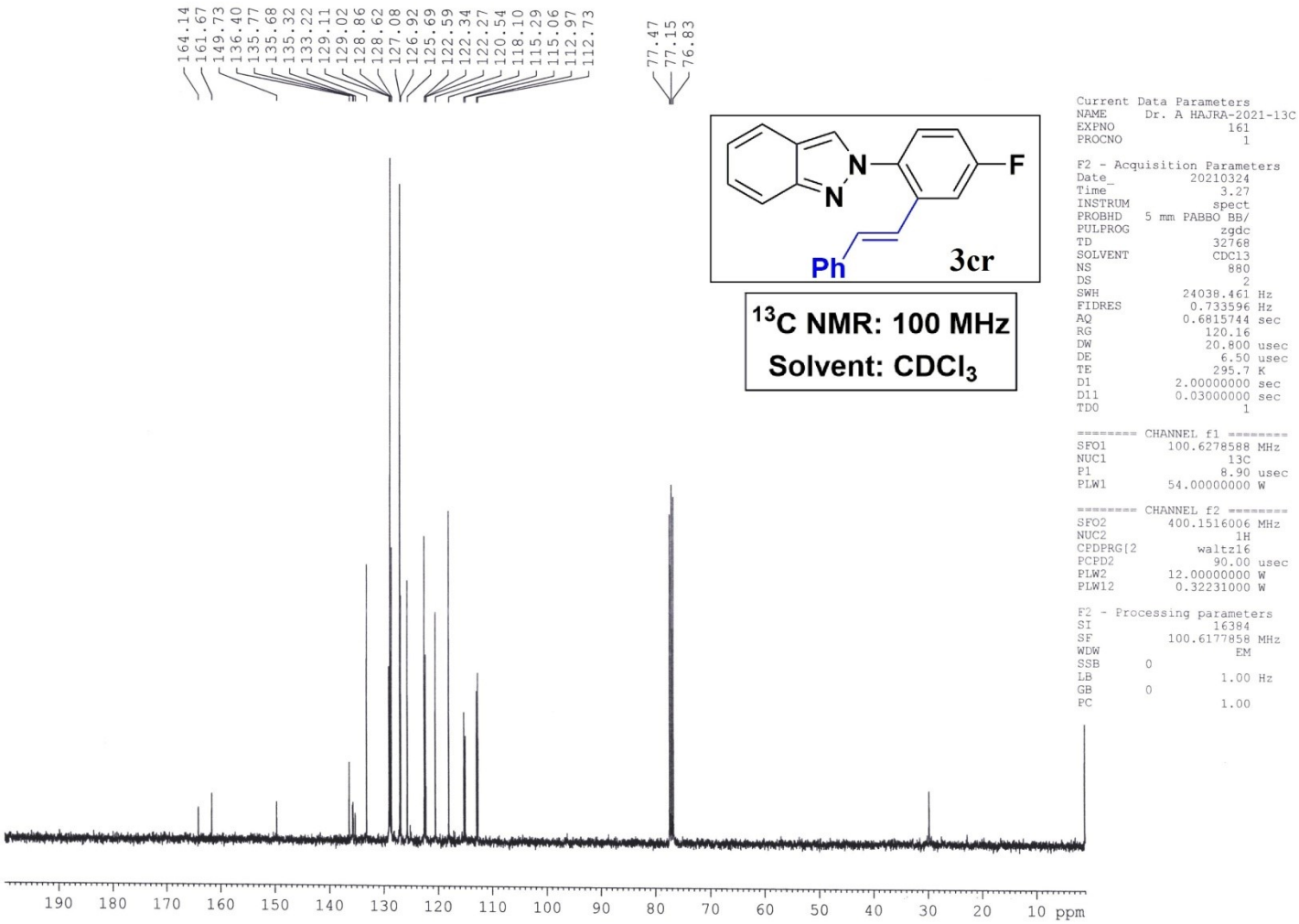



```
Current Data Parameters
NAME      Dr. A HAJRA-2020-13C
EXPNO                  382
PROCNO                   1

F2 - Acquisition Parameters
Date_              20201230
Time                 13.54
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     480
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   106.66
DW                 20.800 usec
DE                  6.50 usec
TE                  294.3 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                    13C
P1                   8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                    1H
CPDPRG[2            waltz16
PCPD2               90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177872 MHz
WDW                     EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.40
```

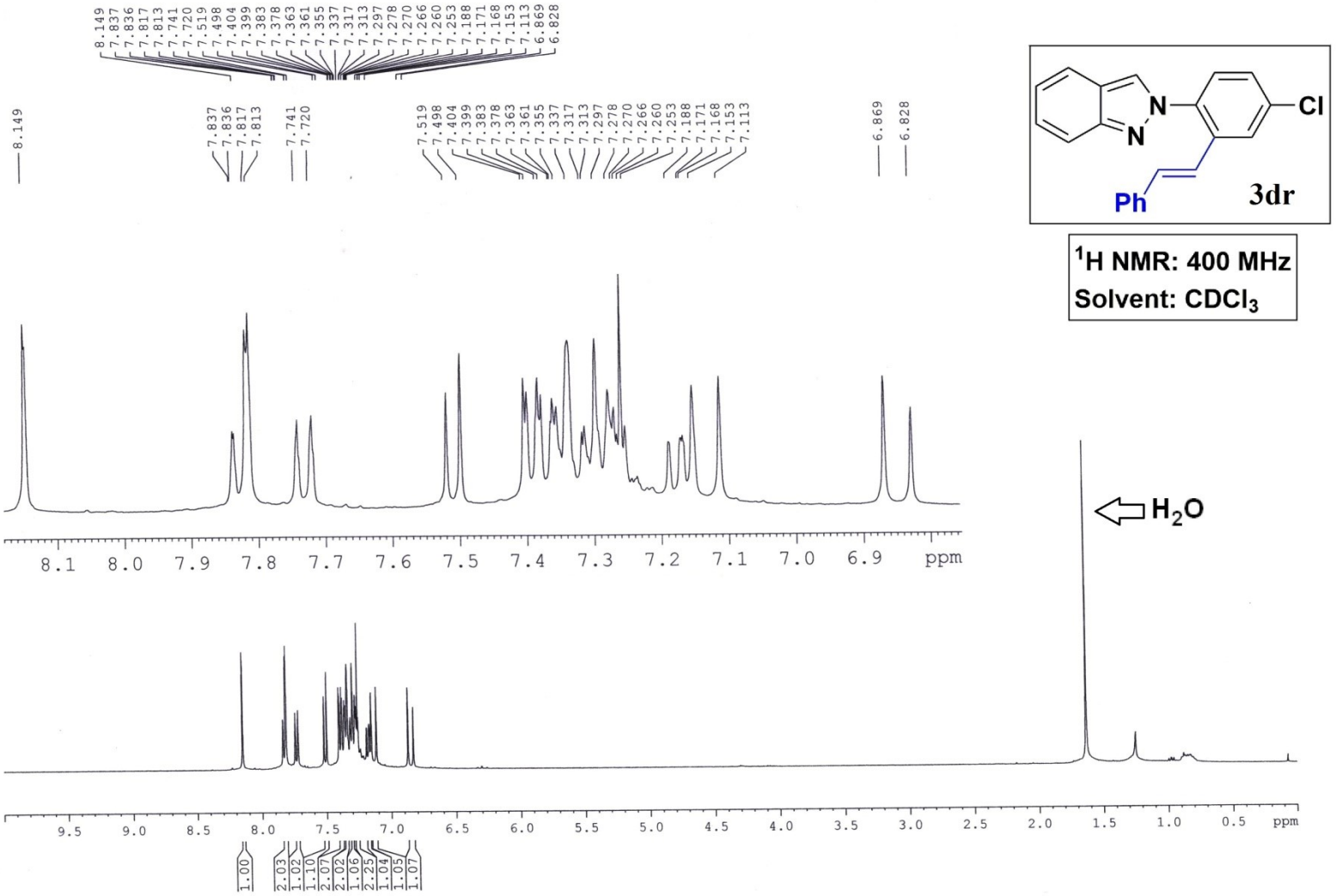


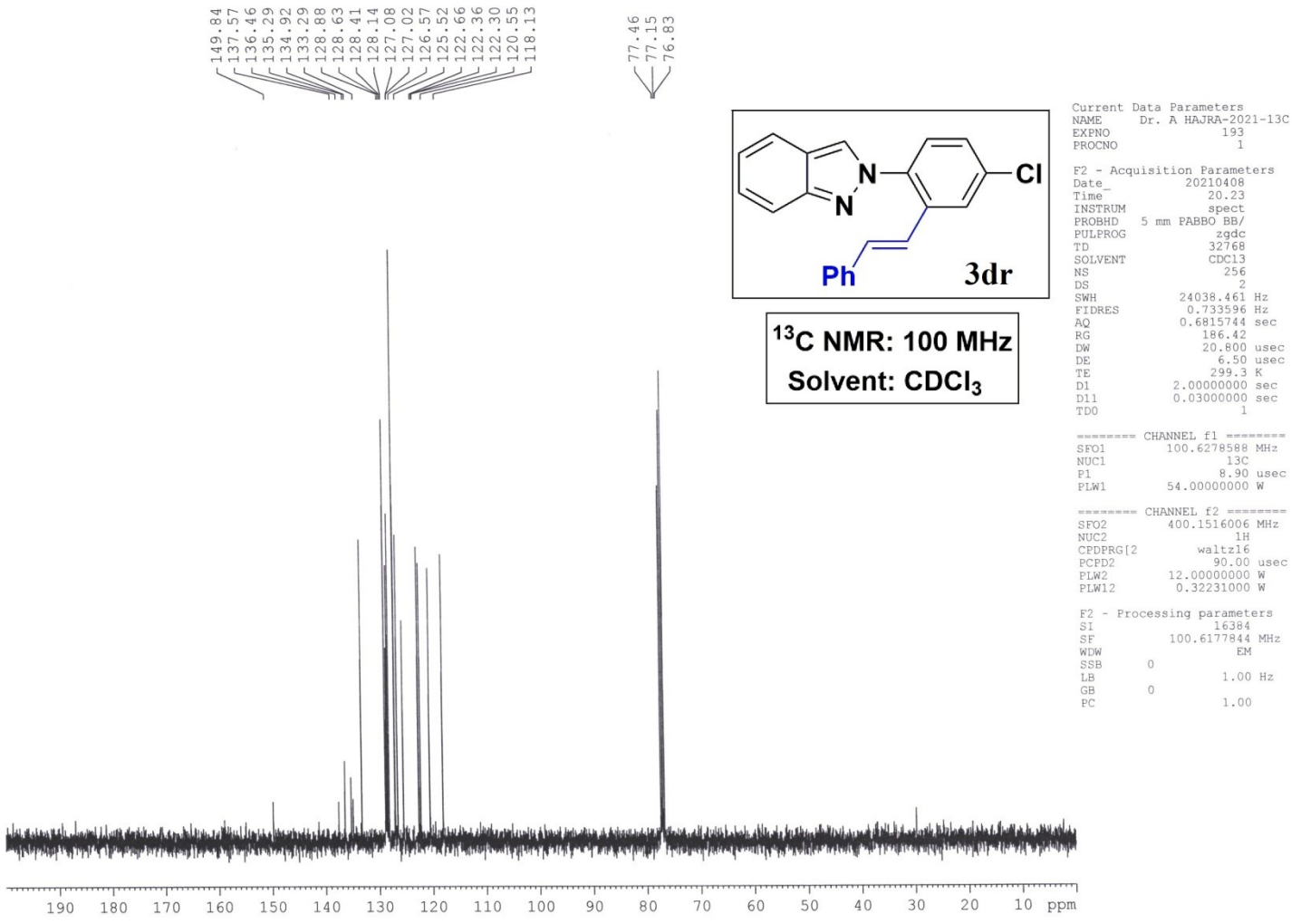


^{1}H NMR: 400 MHz
Solvent: $CDCl_3$

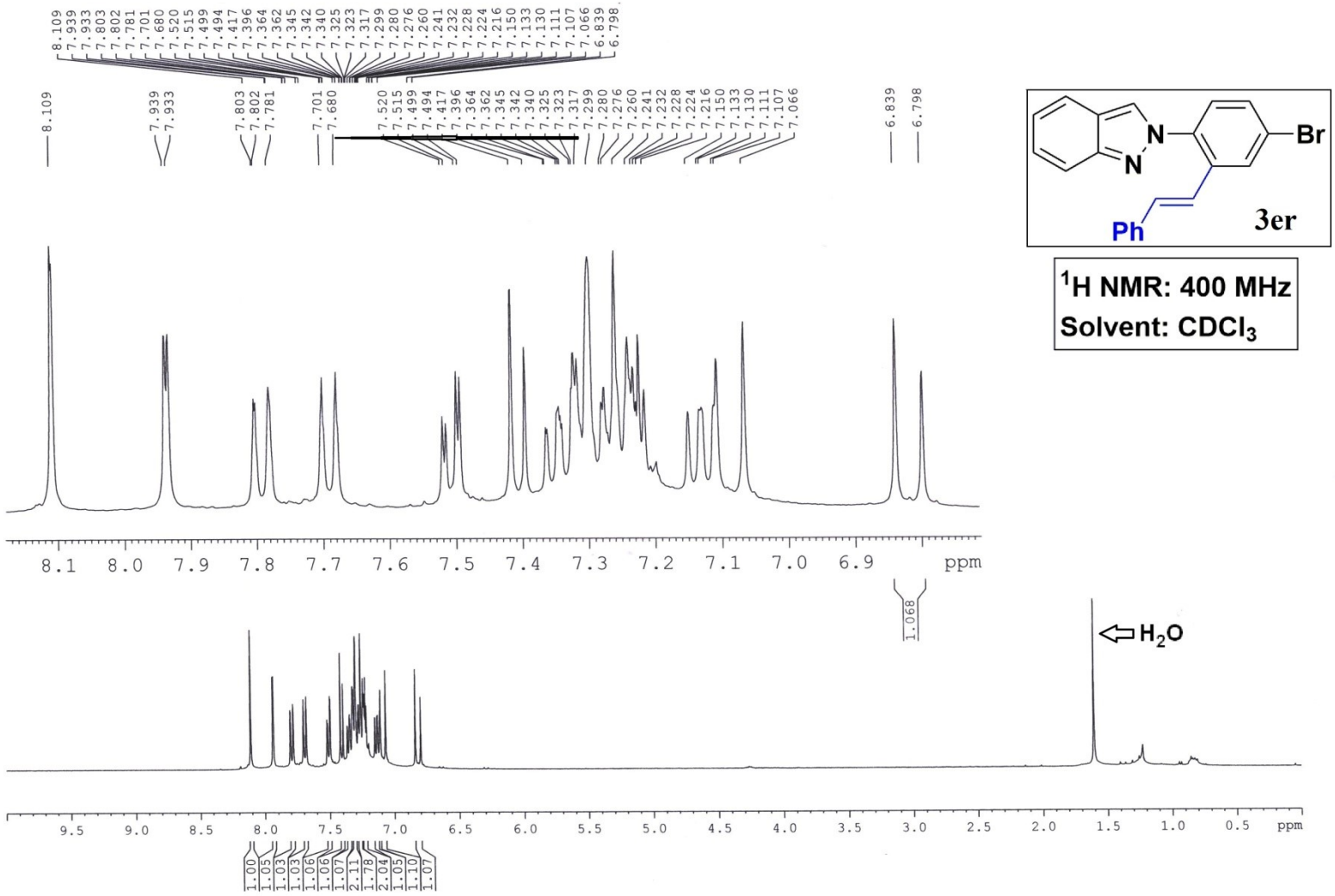


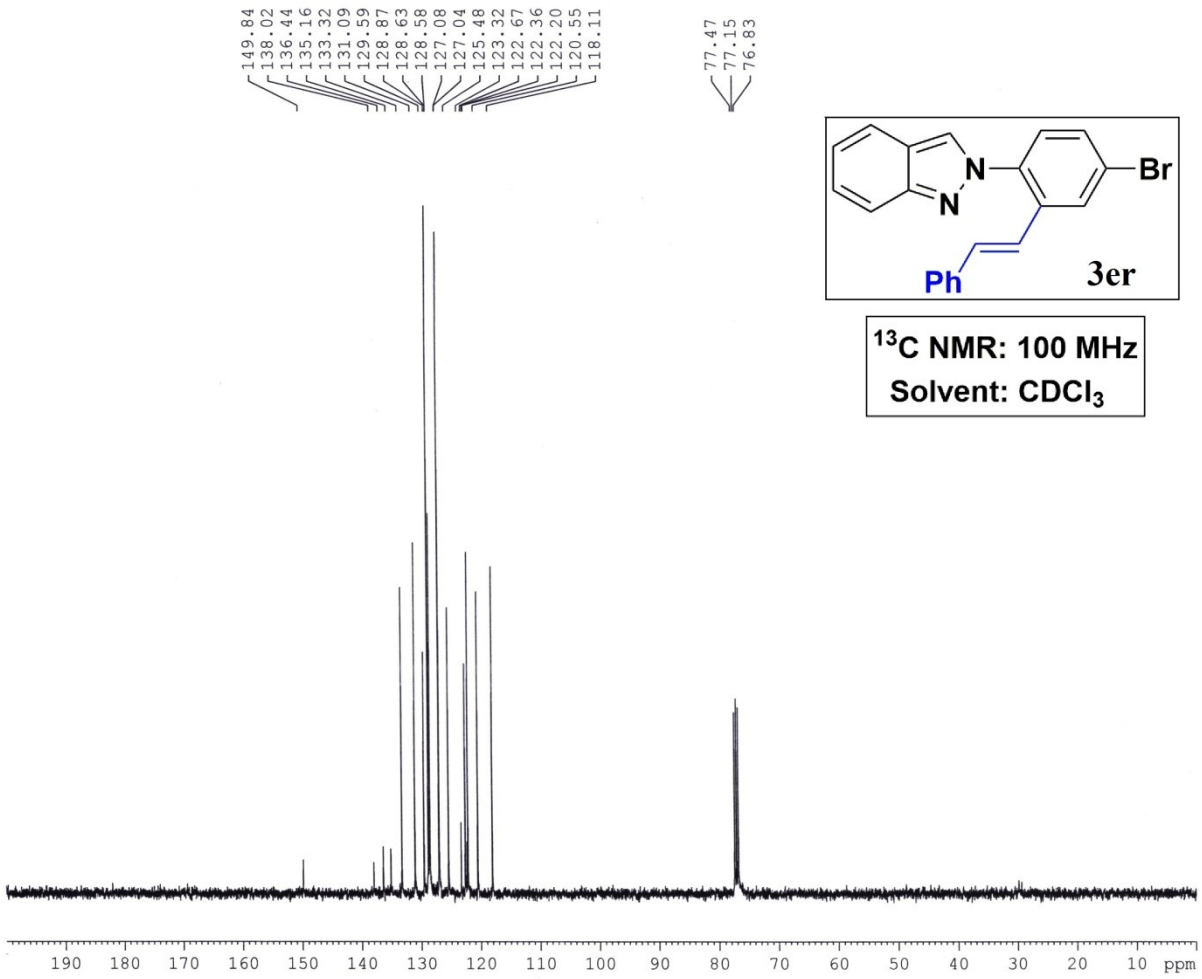

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  161
PROCNO                   1

F2 - Acquisition Parameters
Date_             20210324
Time                 3.27
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG              zgdc
TD                  32768
SOLVENT             CDCl3
NS                    880
DS                      2
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  120.16
DW                20.800 usec
DE                 6.50 usec
TE                 295.7 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                  13C
P1                 8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2             90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W

F2 - Processing parameters
SI                   16384
SF           100.6177858 MHz
WDW                     EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.00
```


8.149
7.837
7.836
7.817
7.813
7.741
7.720
7.519
7.498
7.404
7.399
7.383
7.378
7.363
7.361
7.355
7.337
7.317
7.313
7.297
7.278
7.270
7.266
7.260
7.253
7.188
7.171
7.168
7.153
7.113
6.869
6.828
N
N
Cl
Ph
3dr
1H NMR: 400 MHz
Solvent: CDCl3
H2O
ppm
1.00
2.03
1.02
1.10
2.07
2.02
1.06
2.25
1.04
1.05
1.07

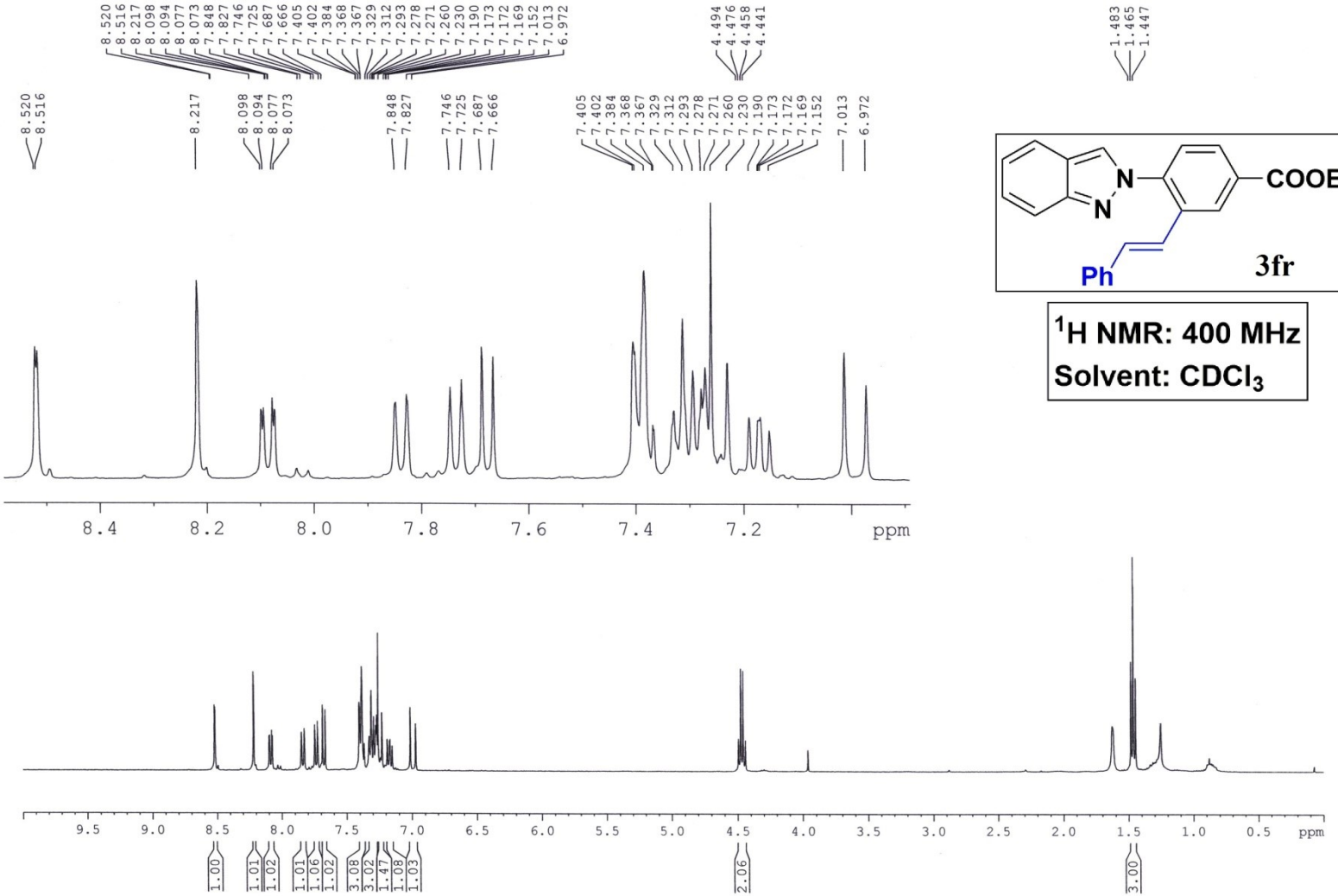


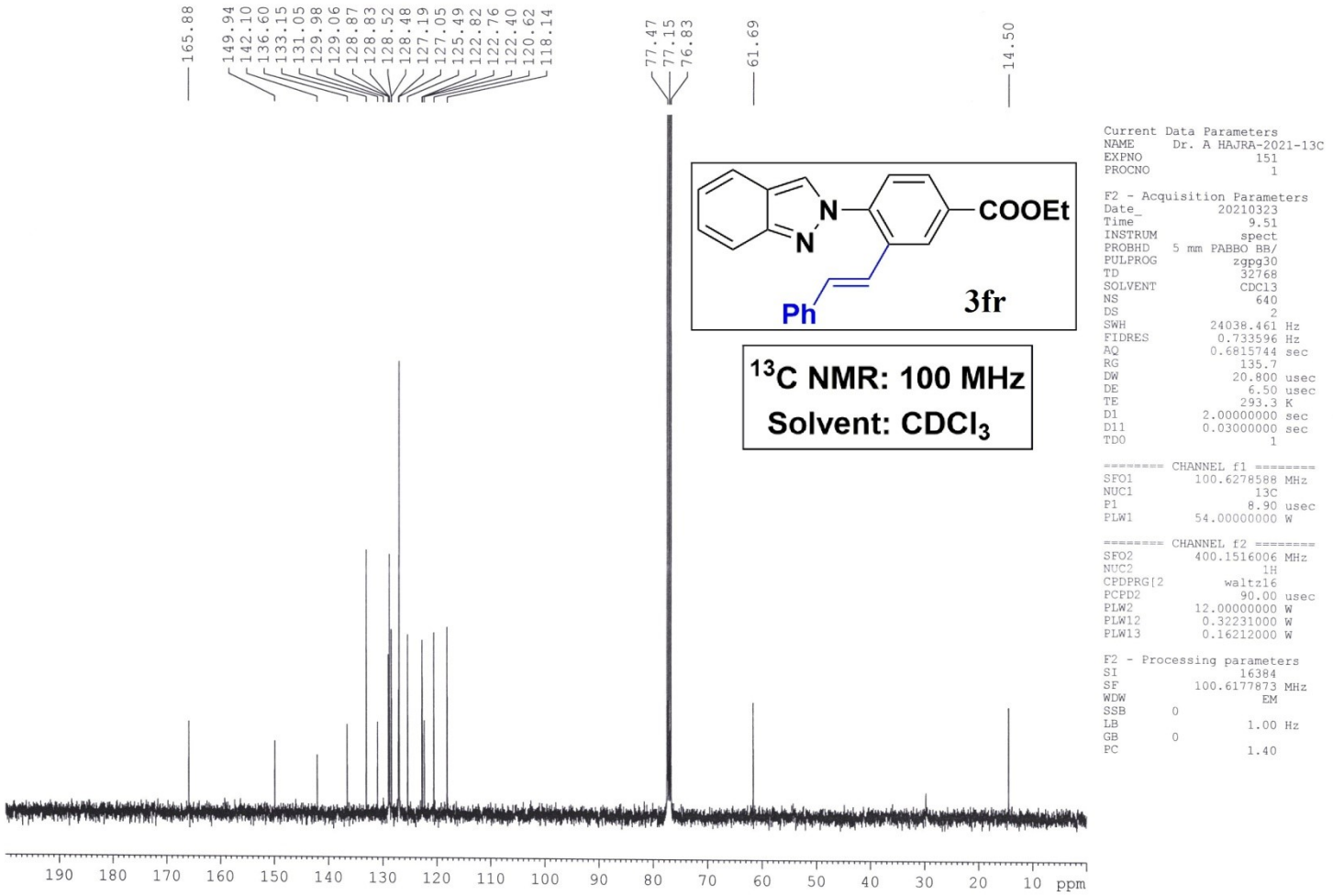

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  193
PROCNO                   1

F2 - Acquisition Parameters
Date_              20210408
Time                 20.23
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG              zgdc
TD                  32768
SOLVENT             CDCl3
NS                    256
DS                      2
SWH             24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  186.42
DW                   20.800 usec
DE                    6.50 usec
TE                   299.3 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                  13C
P1                   8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                  1H
CPDPRG[2          waltz16
PCPD2                90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W

F2 - Processing parameters
SI                   16384
SF            100.6177844 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.00
```


8.109
7.939
7.933
7.803
7.802
7.781
7.701
7.680
7.520
7.515
7.499
7.494
7.417
7.396
7.364
7.362
7.345
7.342
7.340
7.325
7.323
7.317
7.299
7.280
7.276
7.260
7.241
7.232
7.228
7.224
7.216
7.150
7.133
7.130
7.111
7.107
7.066
6.839
6.798
Br
N
N
Ph
3er
1H NMR: 400 MHz
Solvent: CDCl3
ppm
1.068
H2O

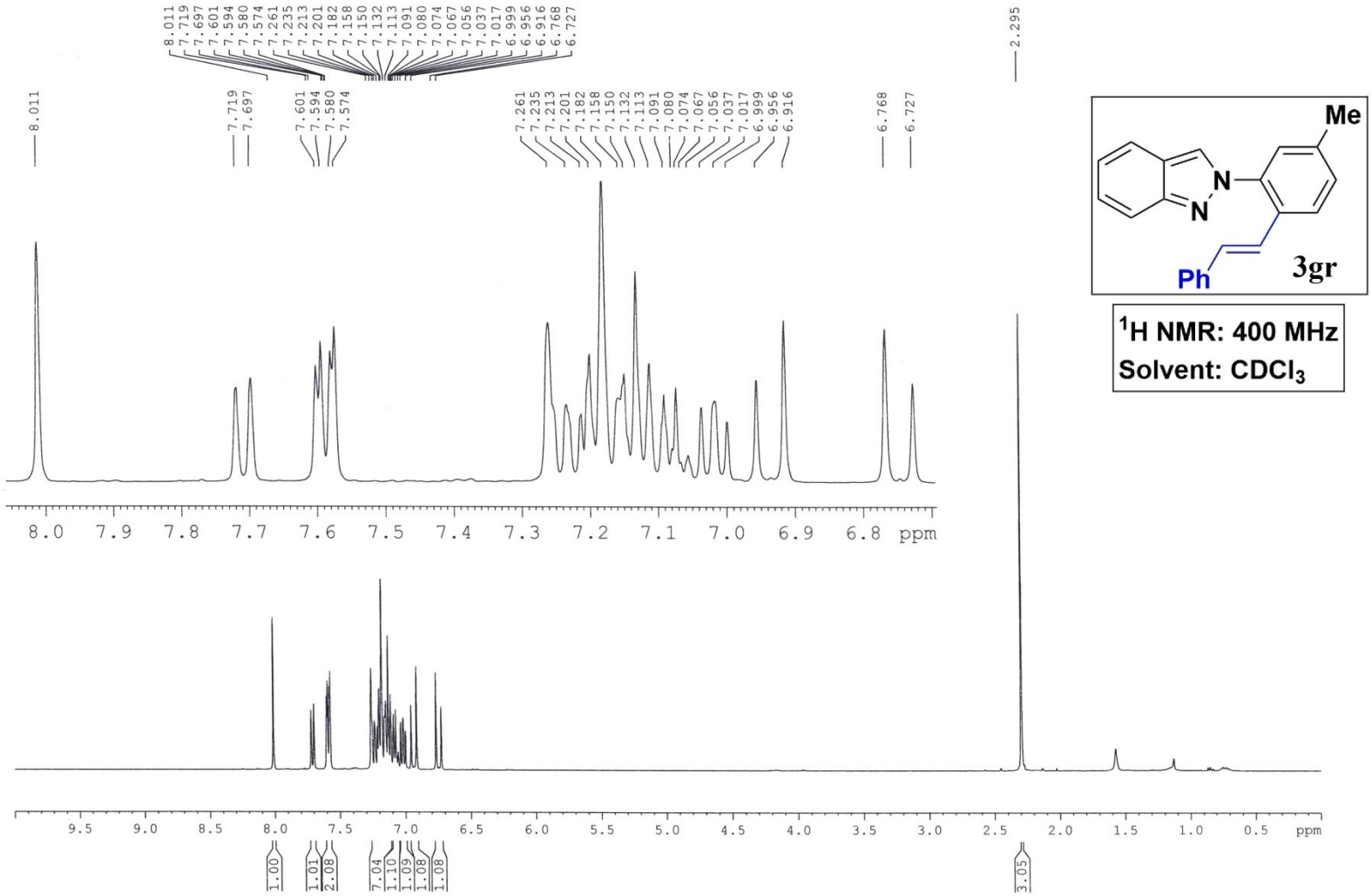


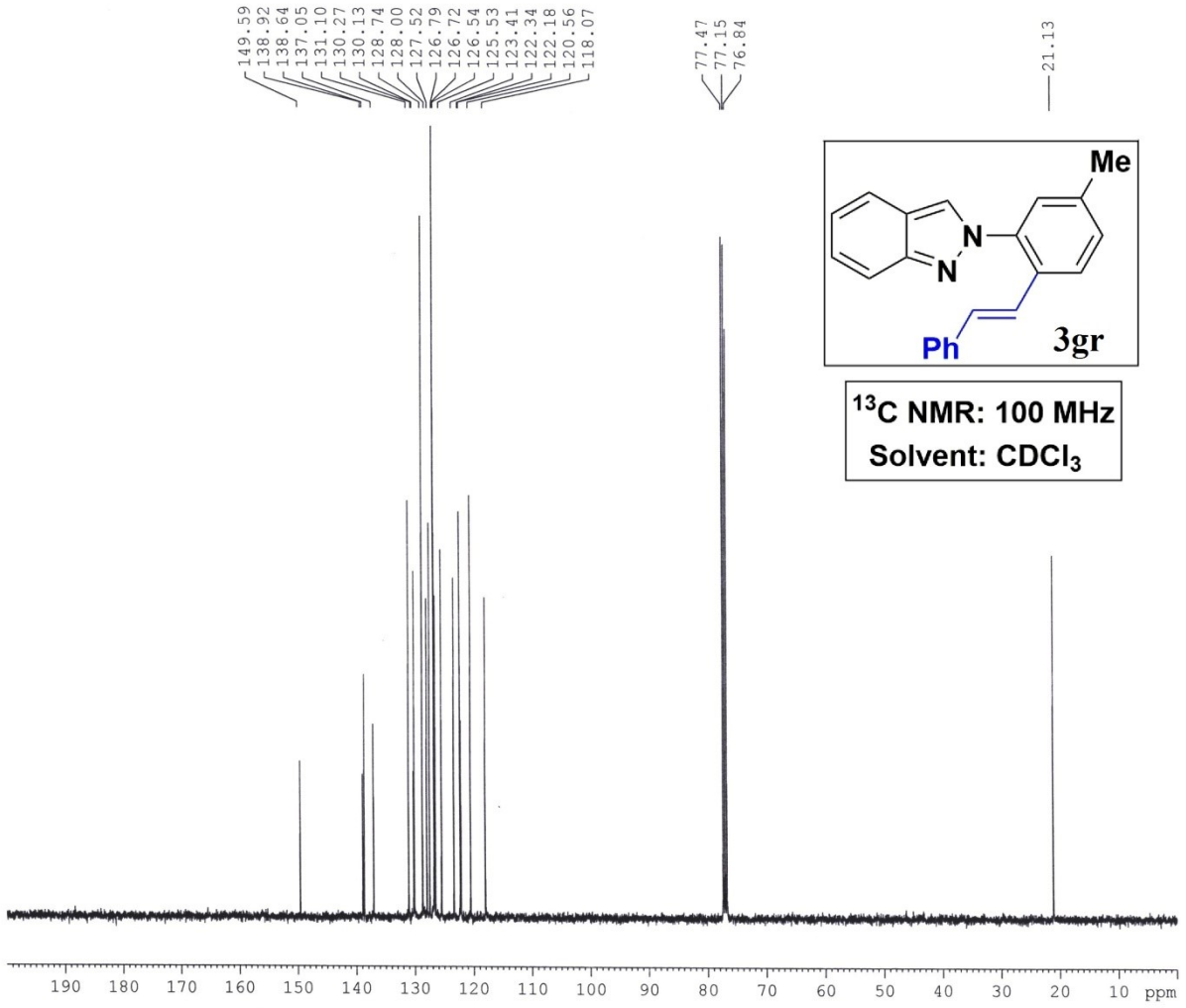

```
Current Data Parameters
NAME        Dr. A HAJRA-2021-13C
EXPNO                        190
PROCNO                         1

F2 - Acquisition Parameters
Date_                   20210408
Time                       14.12
INSTRUM                    spect
PROBHD    5 mm PABBO BB/
PULPROG                    zgdc
TD                        32768
SOLVENT                   CDCl3
NS                          640
DS                            2
SWH                   24038.461 Hz
FIDRES                 0.733596 Hz
AQ                     0.6815744 sec
RG                        148.91
DW                        20.800 usec
DE                         6.50 usec
TE                       298.8 K
D1                    2.00000000 sec
D11                   0.03000000 sec
TD0                            1

======== CHANNEL f1 ========
SFO1                100.6278588 MHz
NUC1                        13C
P1                         8.90 usec
PLW1                54.00000000 W

======== CHANNEL f2 ========
SFO2                400.1516006 MHz
NUC2                        1H
CPDPRG[2                waltz16
PCPD2                     90.00 usec
PLW2                12.00000000 W
PLW12                0.32231000 W

F2 - Processing parameters
SI                         16384
SF                  100.6177858 MHz
WDW                           EM
SSB                0
LB                         1.00 Hz
GB                 0
PC                         1.00
```


8.520
8.516
8.217
8.098
8.094
8.077
8.073
7.848
7.827
7.746
7.725
7.687
7.666
7.405
7.402
7.384
7.368
7.367
7.329
7.312
7.293
7.278
7.271
7.260
7.230
7.190
7.173
7.172
7.169
7.152
7.013
6.972
4.494
4.476
4.458
4.441
1.483
1.465
1.447
N
N
COOEt
Ph
3fr
1H NMR: 400 MHz
Solvent: CDCl3
ppm
1.00
1.01
1.02
1.01
1.06
1.02
3.08
3.02
1.47
1.08
1.03
2.06
3.00

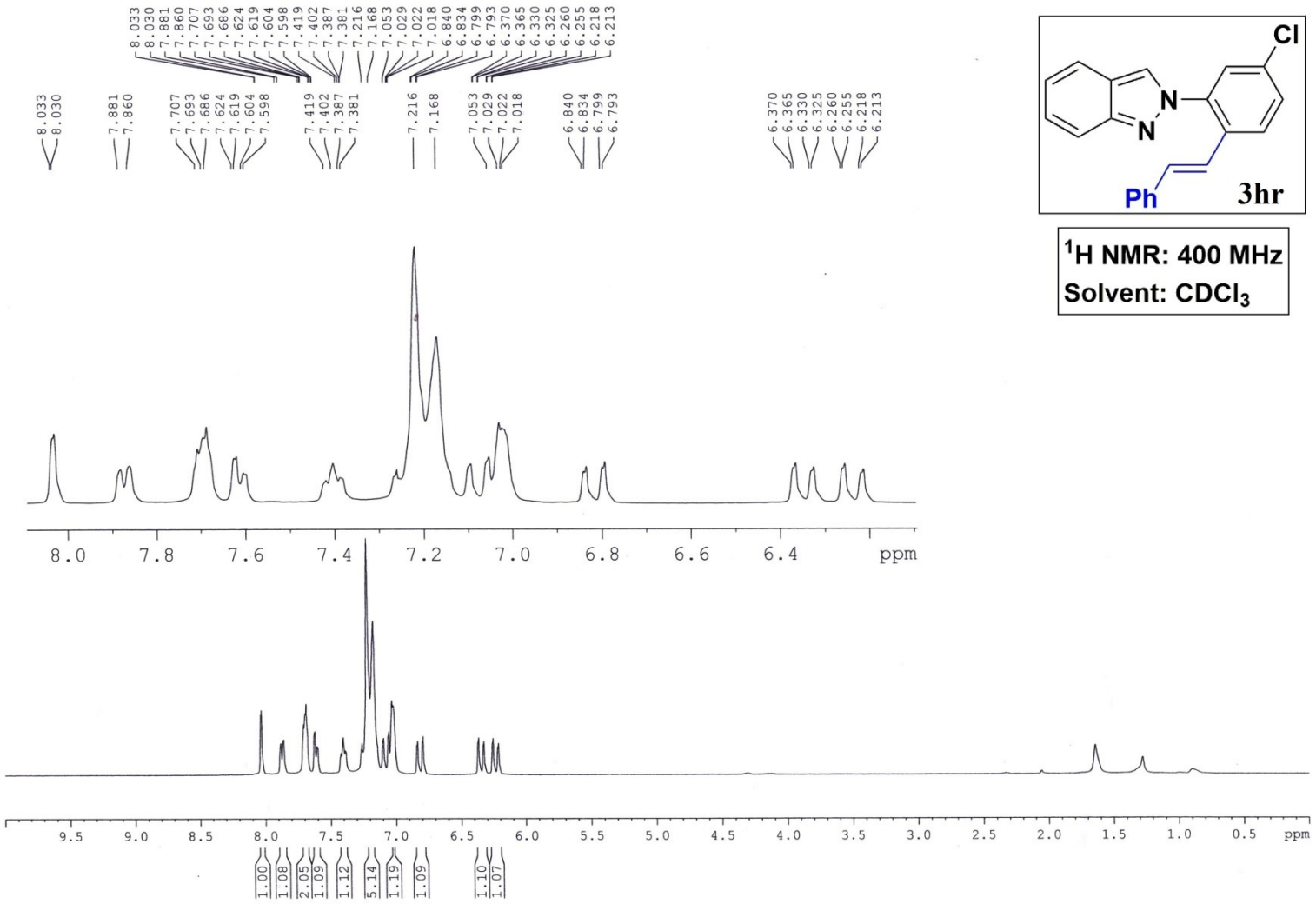



```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  151
PROCNO                   1

F2 - Acquisition Parameters
Date_           20210323
Time                9.51
INSTRUM            spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD                32768
SOLVENT           CDCl3
NS                  640
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                135.7
DW                20.800 usec
DE                 6.50 usec
TE                293.3 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1                13C
P1                 8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                 16384
SF          100.6177873 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```

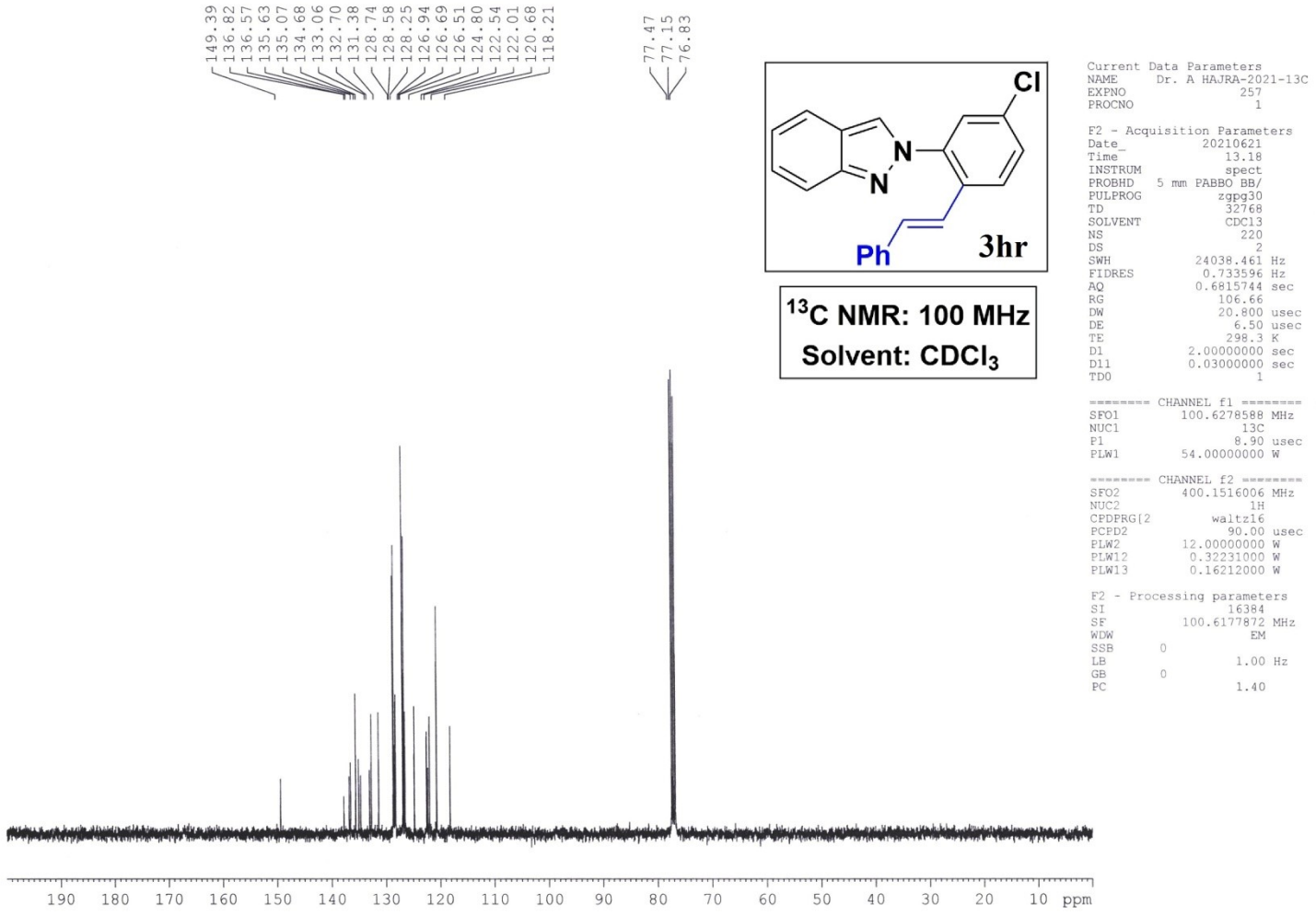

8.011
7.719
7.697
7.601
7.594
7.580
7.574
7.261
7.235
7.213
7.201
7.182
7.158
7.150
7.132
7.113
7.091
7.080
7.074
7.067
7.056
7.037
7.017
6.999
6.956
6.916
6.768
6.727
2.295
Me
N
N
Ph
3gr
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
ppm
1.00
1.01
2.08
7.04
1.10
1.09
1.08
1.08
3.05



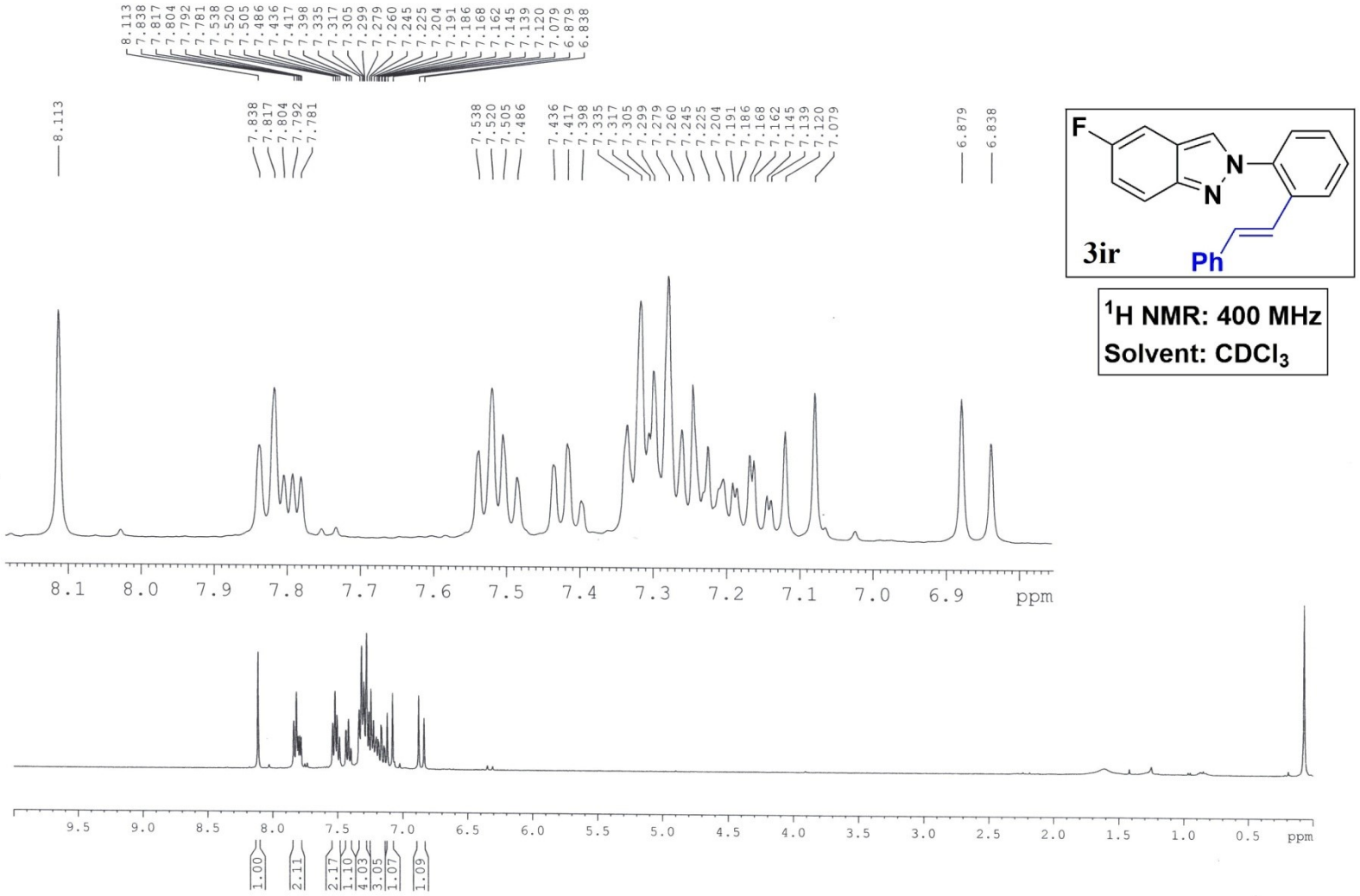

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  209
PROCNO                   1

F2 - Acquisition Parameters
Date_              20210414
Time                   2.38
INSTRUM               spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     512
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                    77.59
DW                 20.800 usec
DE                  6.50 usec
TE                  296.4 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                    13C
P1                   8.90 usec
PLW1         54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                    1H
CPDPRG[2           waltz16
PCPD2               90.00 usec
PLW2         12.00000000 W
PLW12         0.32231000 W
PLW13         0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177903 MHz
WDW                     EM
SSB       0
LB                   1.00 Hz
GB        0
PC                   1.40
```

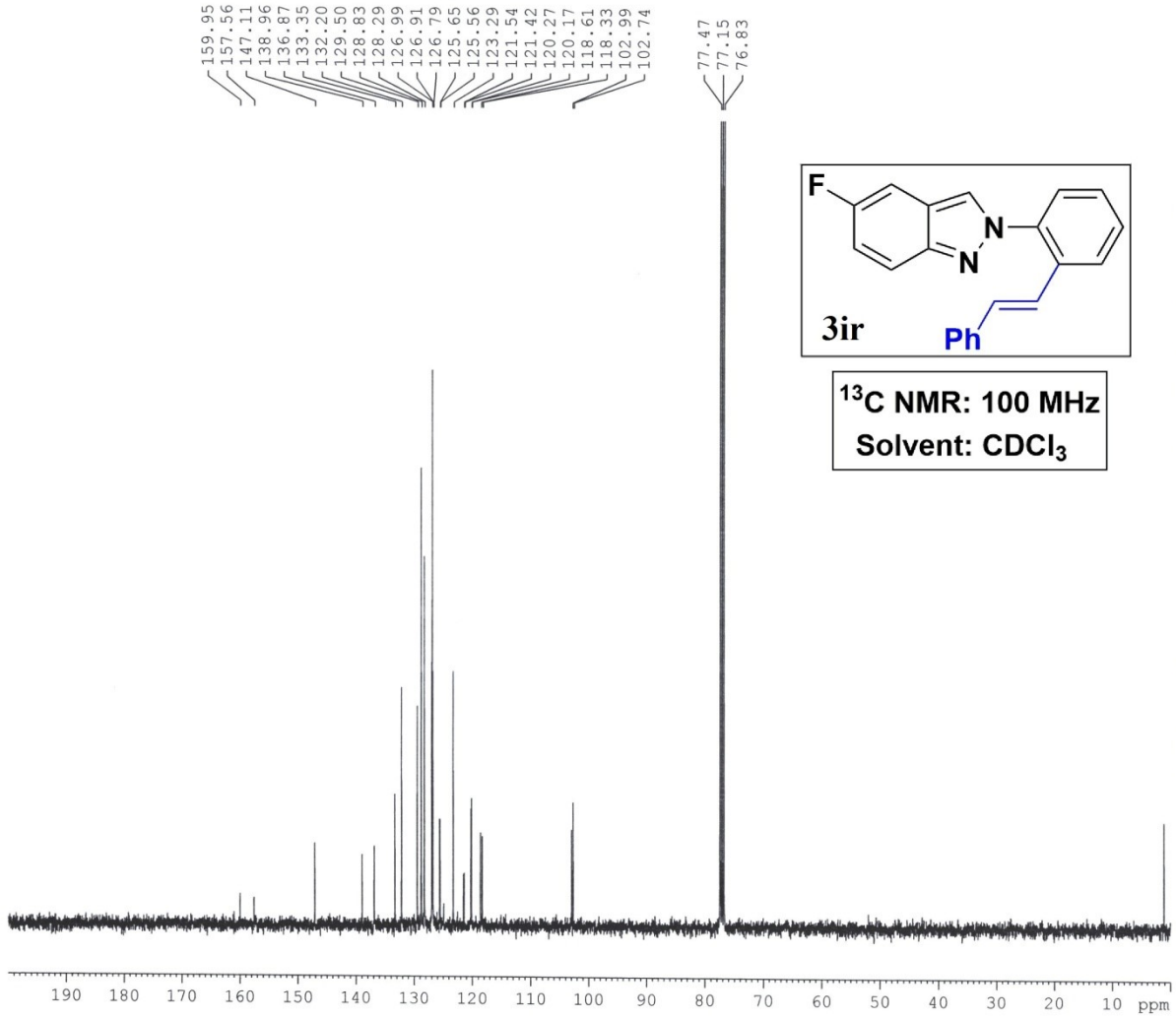


^{1}H NMR: 400 MHz
Solvent: $CDCl_3$

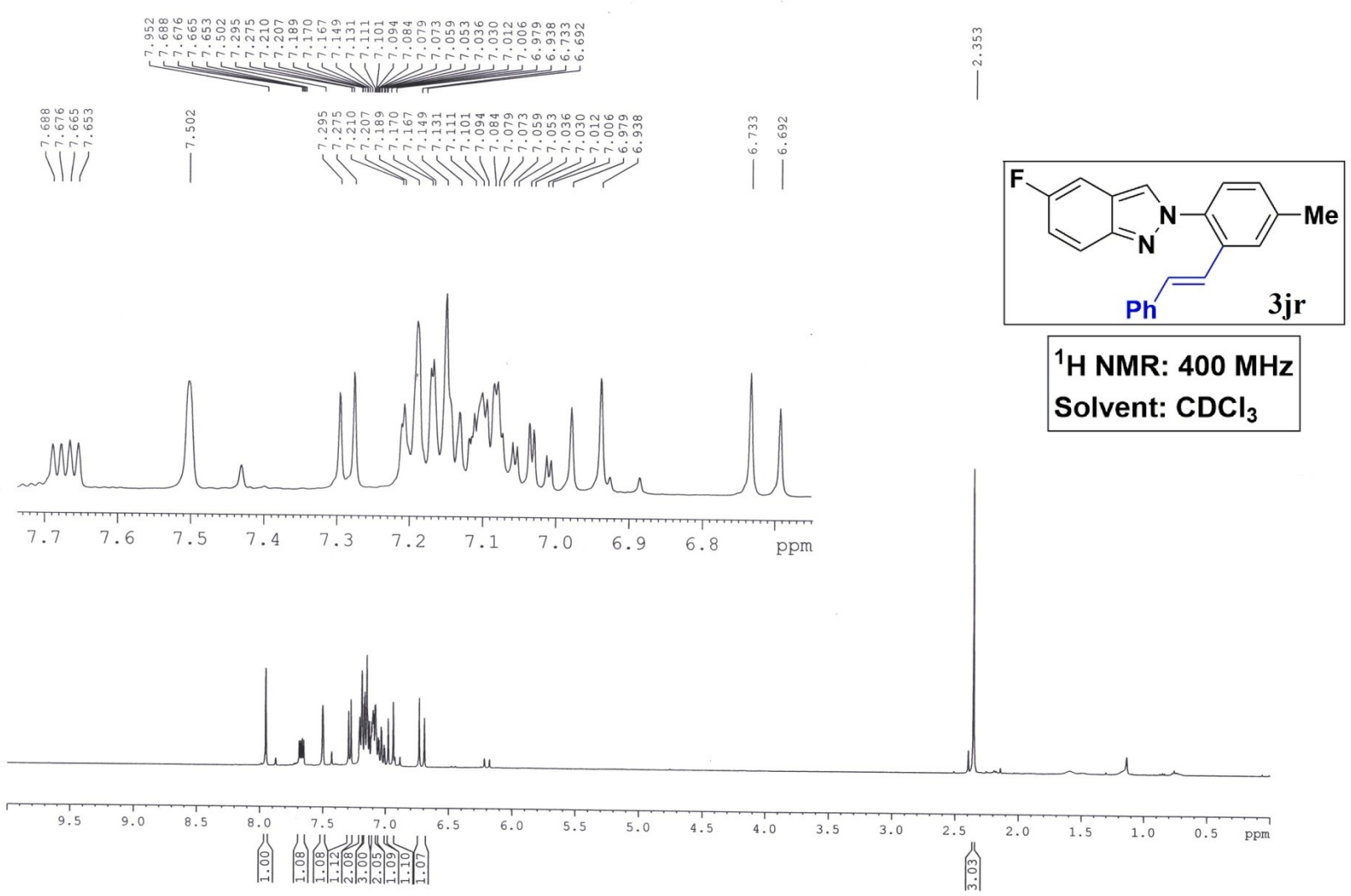


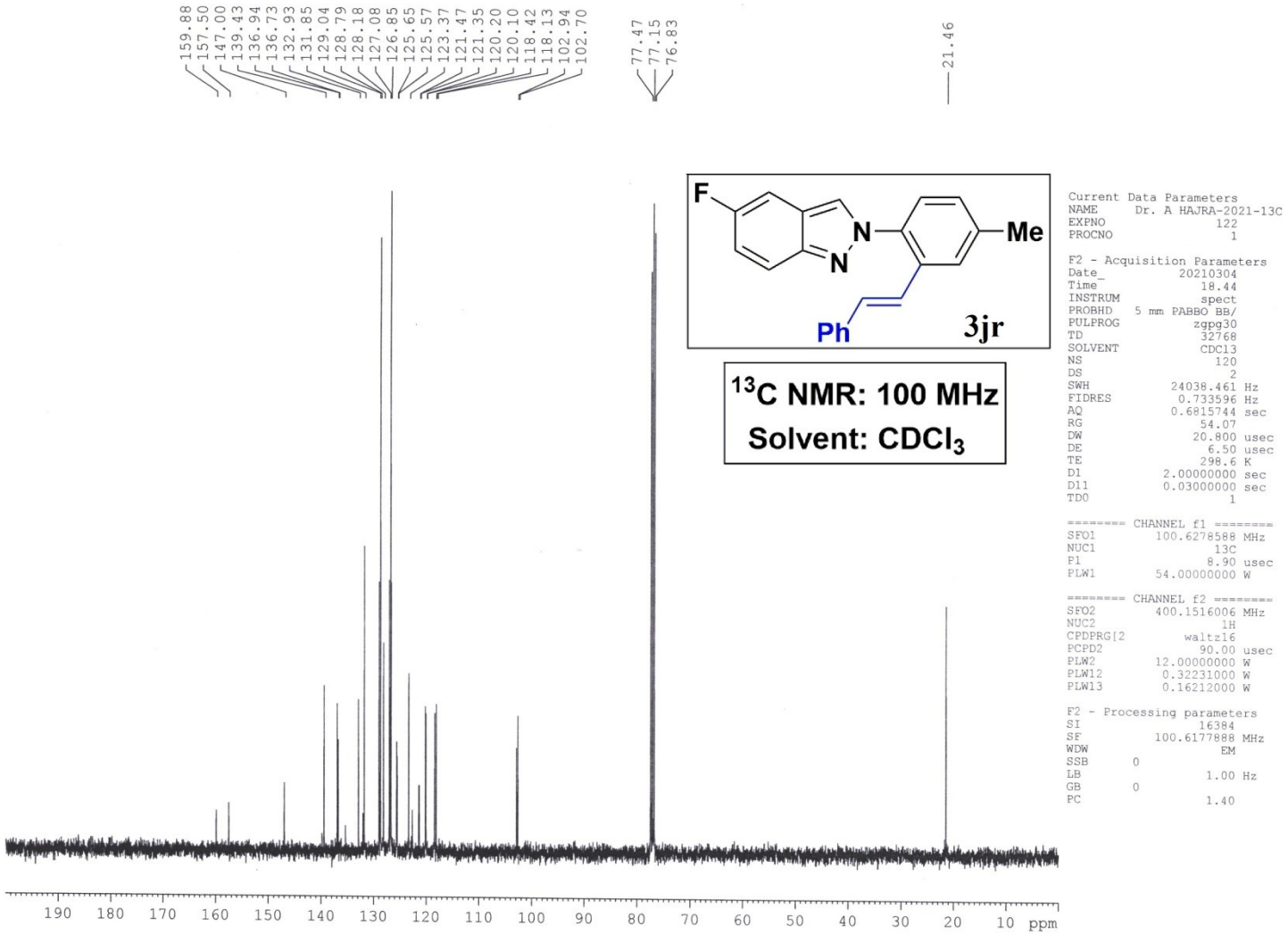

```
Current Data Parameters
NAME        Dr. A HAJRA-2021-13C
EXPNO                        257
PROCNO                         1

F2 - Acquisition Parameters
Date_                   20210621
Time                       13.18
INSTRUM                    spect
PROBHD    5 mm PABBO BB/
PULPROG                  zgpg30
TD                        32768
SOLVENT                   CDCl3
NS                          220
DS                            2
SWH                   24038.461 Hz
FIDRES                 0.733596 Hz
AQ                     0.6815744 sec
RG                        106.66
DW                        20.800 usec
DE                         6.50 usec
TE                        298.3 K
D1                    2.00000000 sec
D11                   0.03000000 sec
TD0                           1

======== CHANNEL f1 ========
SFO1                100.6278588 MHz
NUC1                        13C
P1                         8.90 usec
PLW1                54.00000000 W

======== CHANNEL f2 ========
SFO2                400.1516006 MHz
NUC2                        1H
CPDPRG[2                waltz16
PCPD2                     90.00 usec
PLW2                12.00000000 W
PLW12                0.32231000 W
PLW13                0.16212000 W

F2 - Processing parameters
SI                        16384
SF                  100.6177872 MHz
WDW                          EM
SSB                   0
LB                         1.00 Hz
GB                    0
PC                         1.40
```


8.113
7.838
7.817
7.804
7.792
7.781
7.538
7.520
7.505
7.486
7.436
7.417
7.398
7.335
7.317
7.305
7.299
7.279
7.260
7.245
7.225
7.204
7.191
7.186
7.168
7.162
7.145
7.139
7.120
7.079
6.879
6.838
F
N
N
3ir
Ph
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
ppm
1.00
2.11
2.17
1.10
4.03
3.05
1.07
1.09

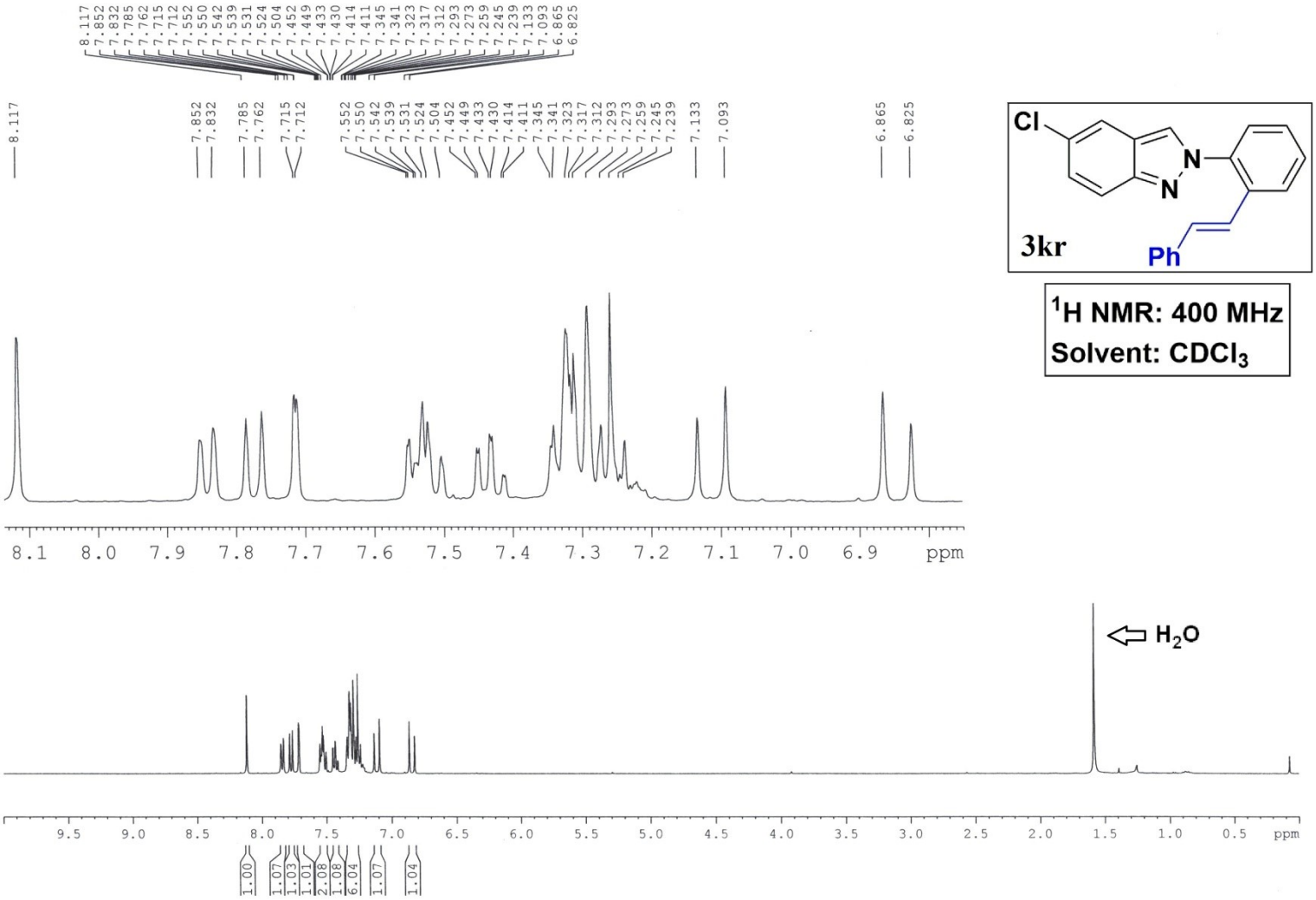


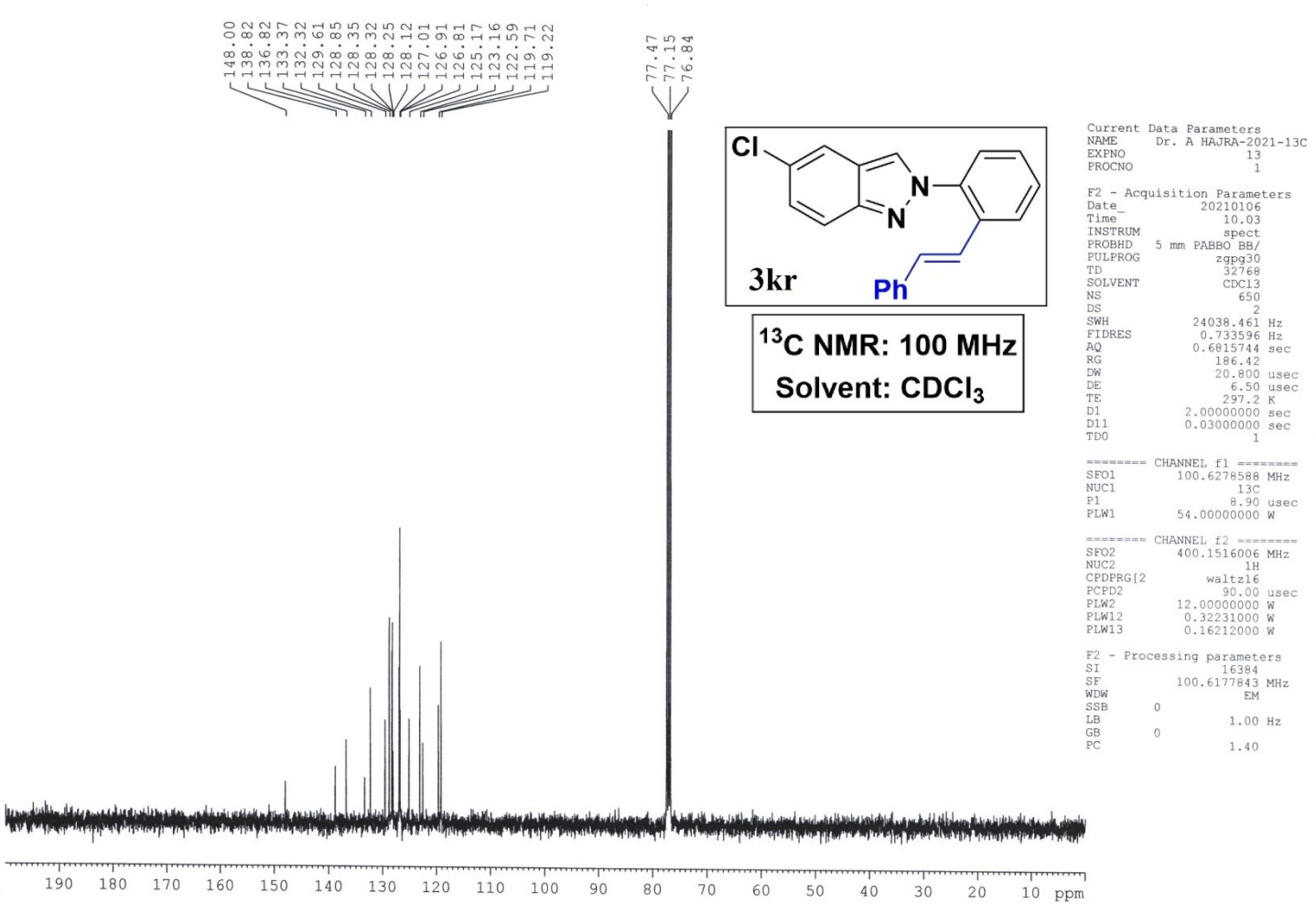

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                       23
PROCNO                       1

F2 - Acquisition Parameters
Date_              20210113
Time                   2.01
INSTRUM               spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     420
DS                       2
SWH              24038.461 Hz
FIDRES           0.733596 Hz
AQ               0.6815744 sec
RG                  120.16
DW                  20.800 usec
DE                   6.50 usec
TE                  298.1 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1           100.6278588 MHz
NUC1                    13C
P1                     8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2           400.1516006 MHz
NUC2                    1H
CPDPRG[2             waltz16
PCPD2                 90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
SI                     16384
SF             100.6177859 MHz
WDW                       EM
SSB       0
LB                     1.00 Hz
GB        0
PC                     1.40
```


7.952
7.688
7.676
7.665
7.653
7.502
7.295
7.275
7.210
7.207
7.189
7.170
7.167
7.149
7.131
7.111
7.101
7.094
7.084
7.079
7.073
7.059
7.053
7.036
7.030
7.012
7.006
6.979
6.938
6.733
6.692
2.353
F
N
N
Me
Ph
3jr
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
ppm
1.00
1.08
1.08
1.12
2.08
3.00
2.05
1.09
1.10
1.07
3.03

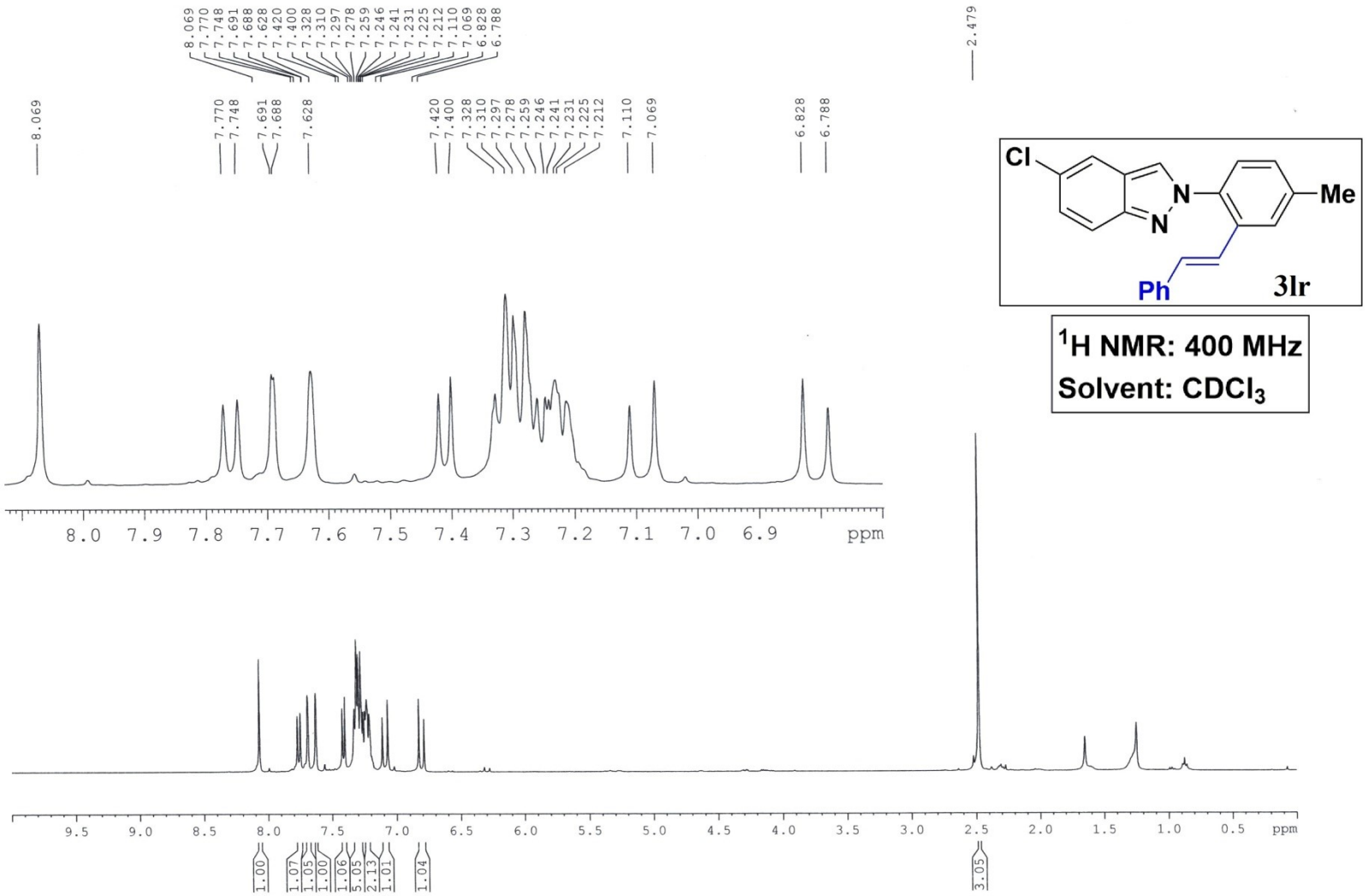


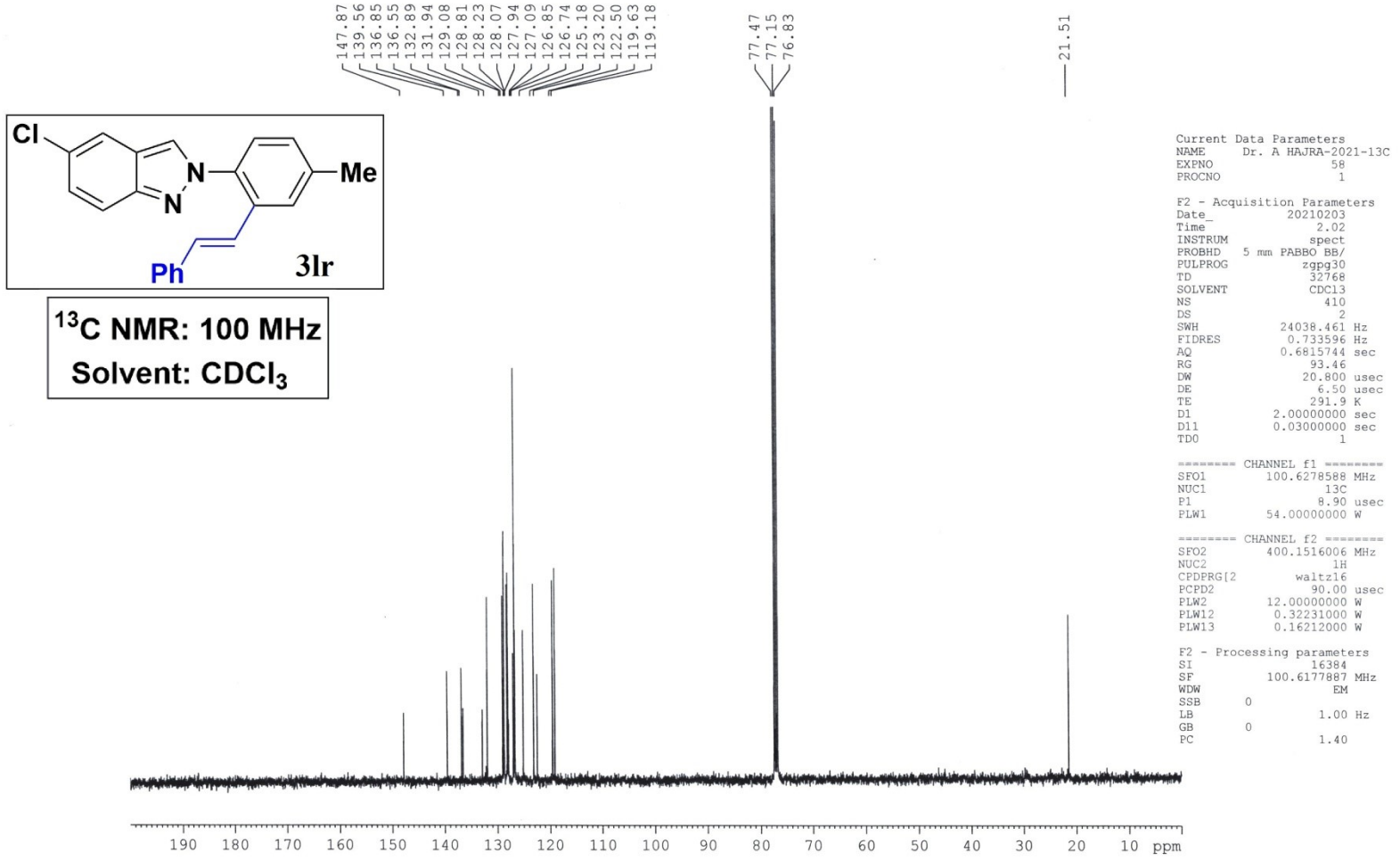

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  122
PROCNO                   1

F2 - Acquisition Parameters
Date_             20210304
Time                 18.44
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 32768
SOLVENT            CDCl3
NS                   120
DS                     2
SWH            24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                 54.07
DW                 20.800 usec
DE                  6.50 usec
TE                298.6 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                 13C
P1                  8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                 1H
CPDPRG[2          waltz16
PCPD2              90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                 16384
SF           100.6177888 MHz
WDW                  EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```


8.117
7.852
7.832
7.785
7.762
7.715
7.712
7.552
7.550
7.542
7.539
7.531
7.524
7.504
7.452
7.449
7.433
7.430
7.414
7.411
7.345
7.341
7.323
7.317
7.312
7.293
7.273
7.259
7.245
7.239
7.133
7.093
6.865
6.825
Cl
N
N
3kr
Ph
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
8.1 8.0 7.9 7.8 7.7 7.6 7.5 7.4 7.3 7.2 7.1 7.0 6.9 ppm
H_2O
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
1.00
1.07
1.03
1.01
2.08
1.08
6.04
1.07
1.04

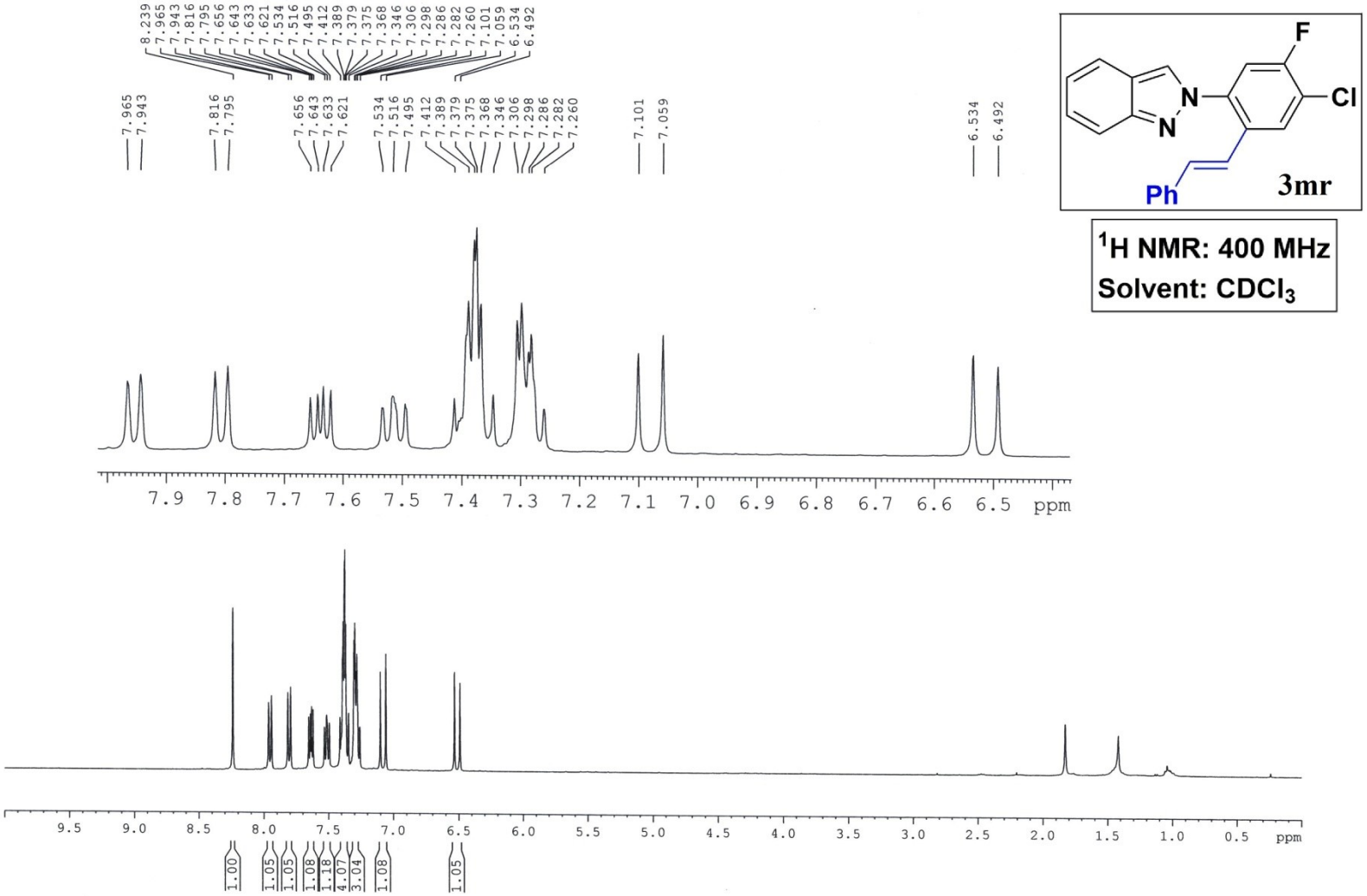


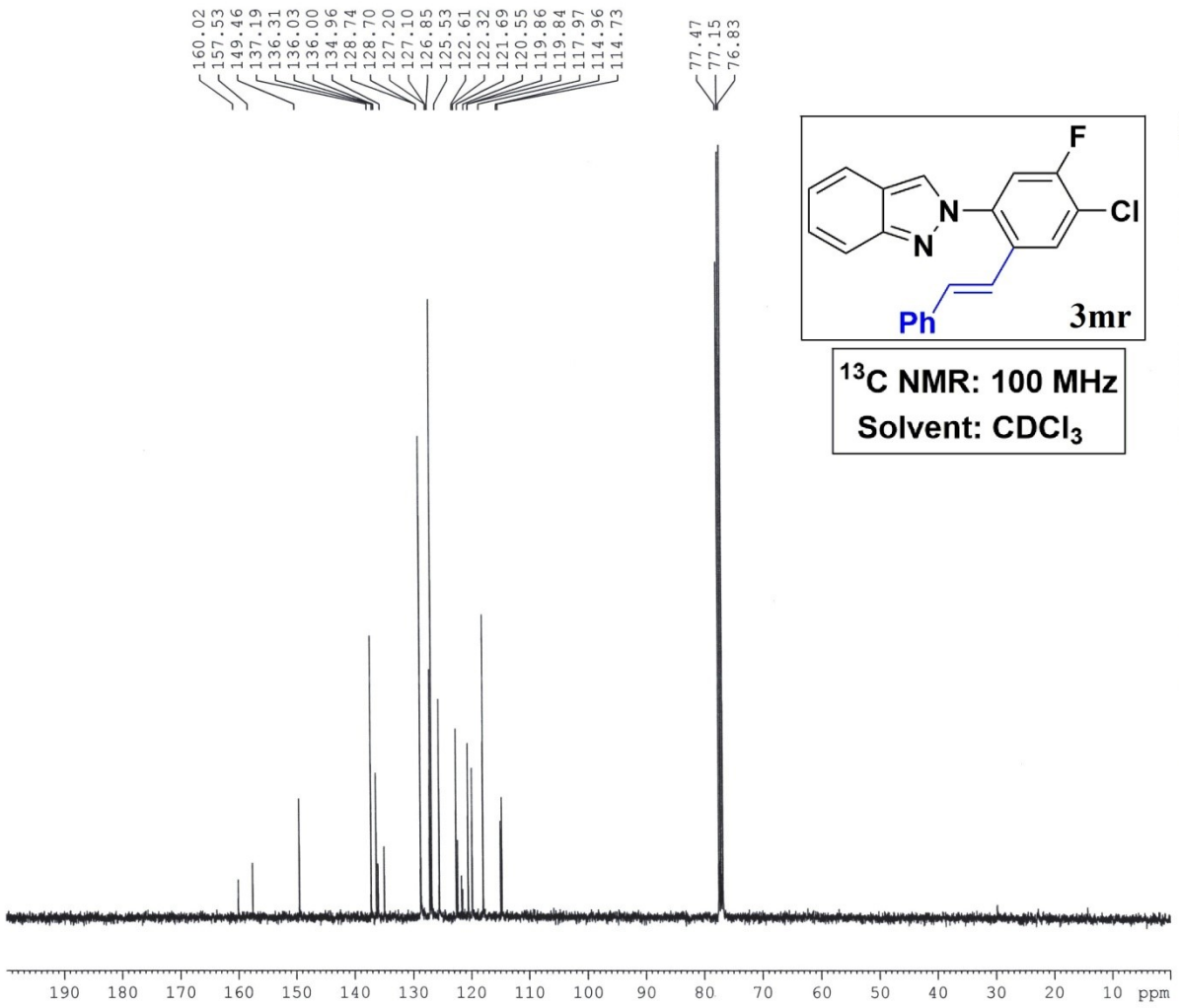

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                   13
PROCNO                   1

F2 - Acquisition Parameters
Date_             20210106
Time                10.03
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                 32768
SOLVENT            CDCl3
NS                   650
DS                     2
SWH             24038.461 Hz
FIDRES          0.733596 Hz
AQ              0.6815744 sec
RG                186.42
DW                20.800 usec
DE                 6.50 usec
TE                297.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         100.6278588 MHz
NUC1                13C
P1                 8.90 usec
PLW1        54.00000000 W

======== CHANNEL f2 ========
SFO2         400.1516006 MHz
NUC2                1H
CPDPRG[2         waltz16
PCPD2             90.00 usec
PLW2        12.00000000 W
PLW12        0.32231000 W
PLW13        0.16212000 W

F2 - Processing parameters
SI                 16384
SF          100.6177843 MHz
WDW                   EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```


8.069
7.770
7.748
7.691
7.688
7.628
7.420
7.400
7.328
7.310
7.297
7.278
7.259
7.246
7.241
7.231
7.225
7.212
7.110
7.069
6.828
6.788
2.479
Cl
N
N
Me
Ph
3lr
^{1}H NMR: 400 MHz
Solvent: CDCl$_3$
ppm
1.00
1.07
1.05
1.00
1.06
5.05
2.13
1.01
1.04
3.05

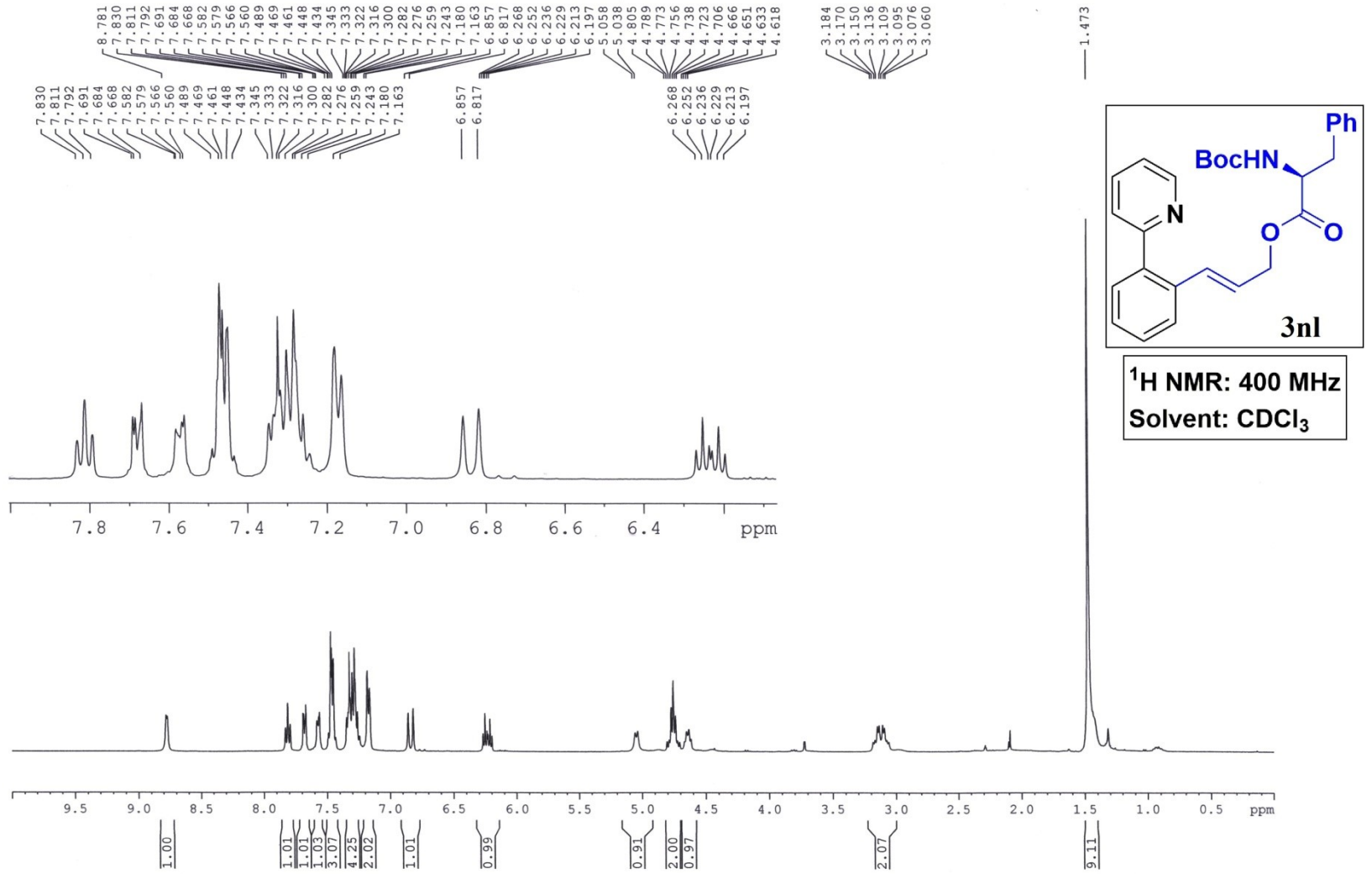


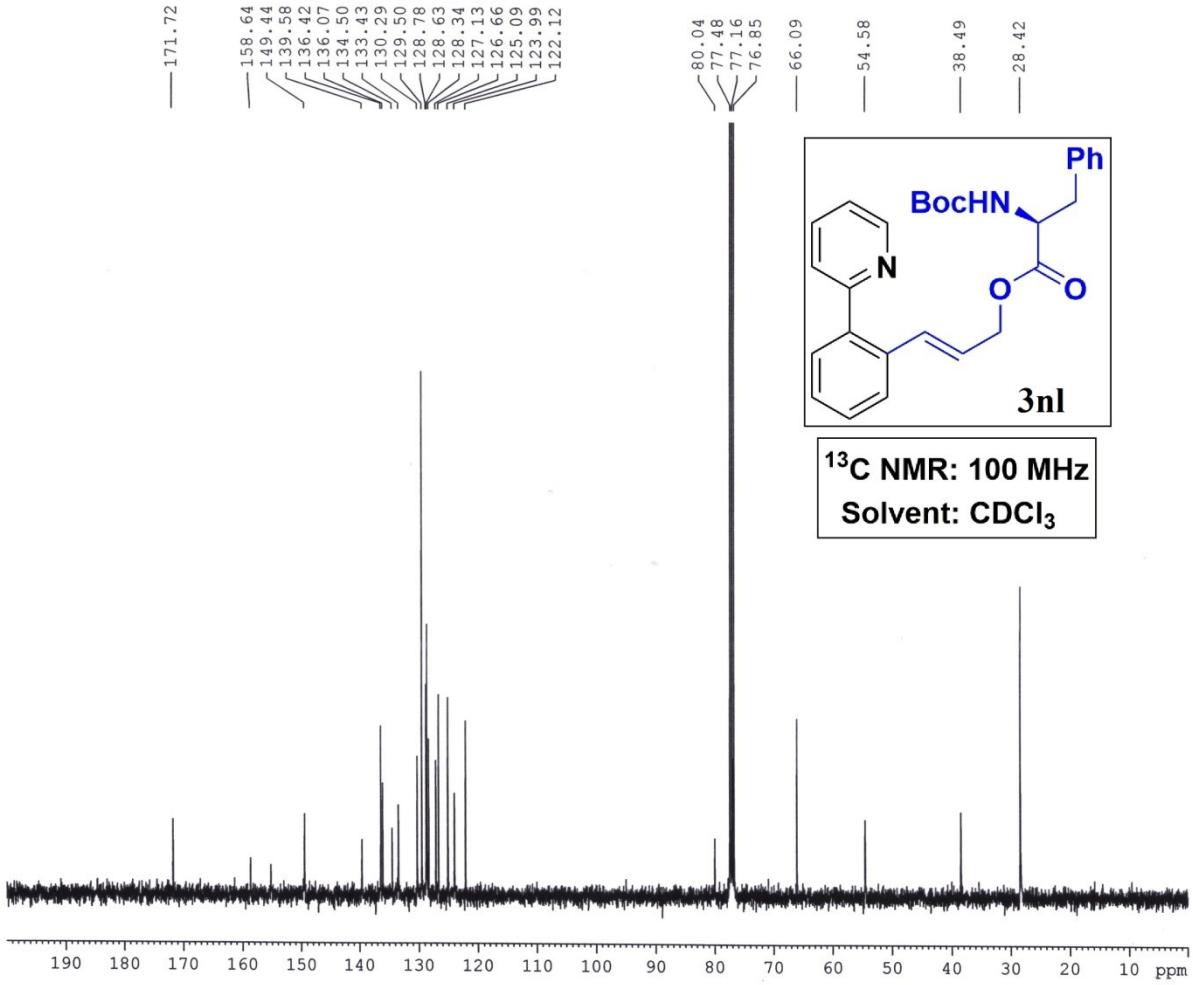

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                   58
PROCNO                   1

F2 - Acquisition Parameters
Date_              20210203
Time                  2.02
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG              zgpg30
TD                    32768
SOLVENT               CDCl3
NS                      410
DS                        2
SWH               24038.461 Hz
FIDRES             0.733596 Hz
AQ                 0.6815744 sec
RG                    93.46
DW                   20.800 usec
DE                    6.50 usec
TE                   291.9 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                    13C
P1                     8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                    1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                    16384
SF            100.6177887 MHz
WDW                      EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```


8.239
7.965
7.943
7.816
7.795
7.656
7.643
7.633
7.621
7.534
7.516
7.495
7.412
7.389
7.379
7.375
7.368
7.346
7.306
7.298
7.286
7.282
7.260
7.101
7.059
6.534
6.492
F
Cl
N
N
Ph
3mr
1H NMR: 400 MHz
Solvent: CDCl3
ppm
1.00
1.05
1.05
1.08
1.18
4.07
3.04
1.08
1.05

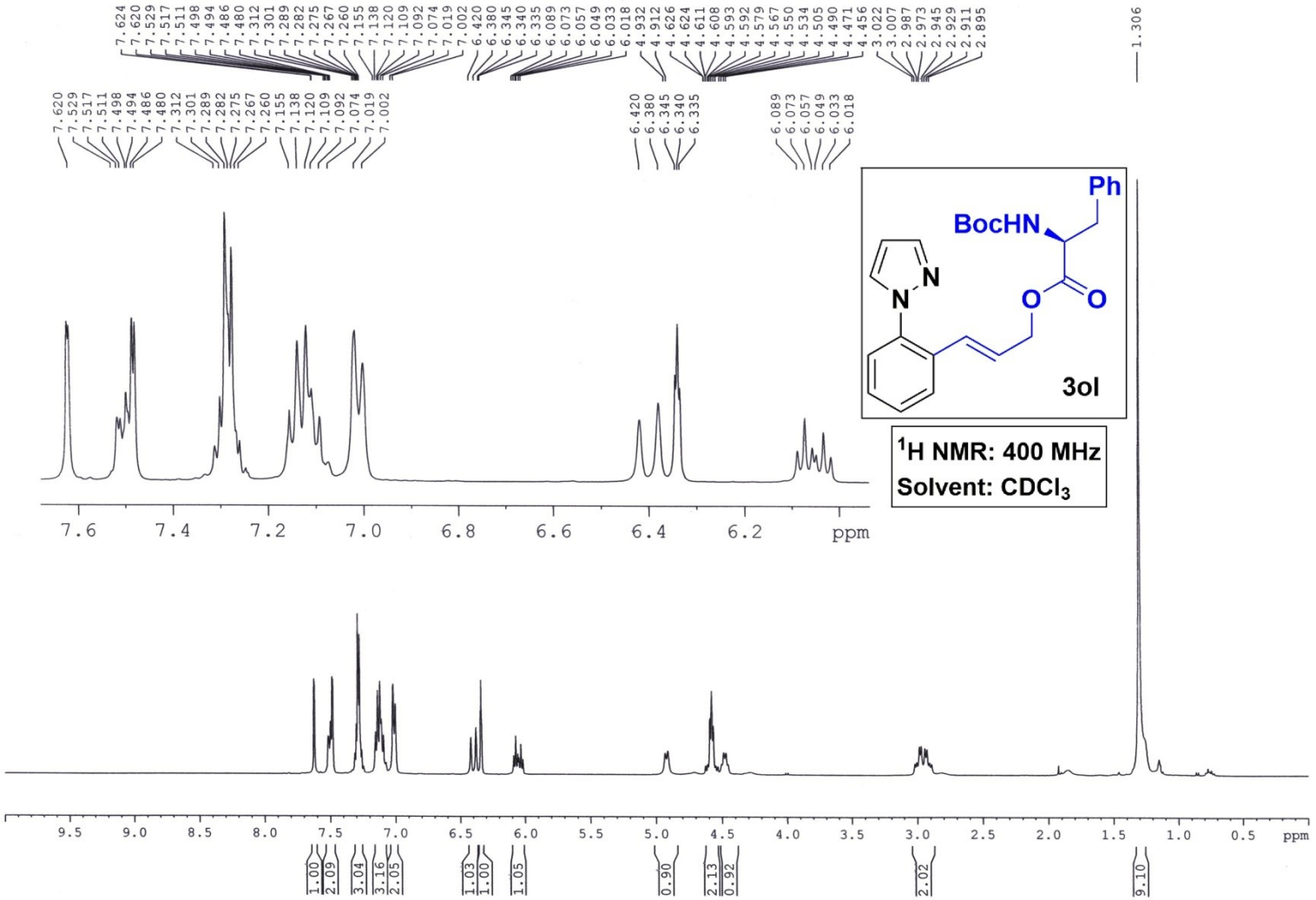


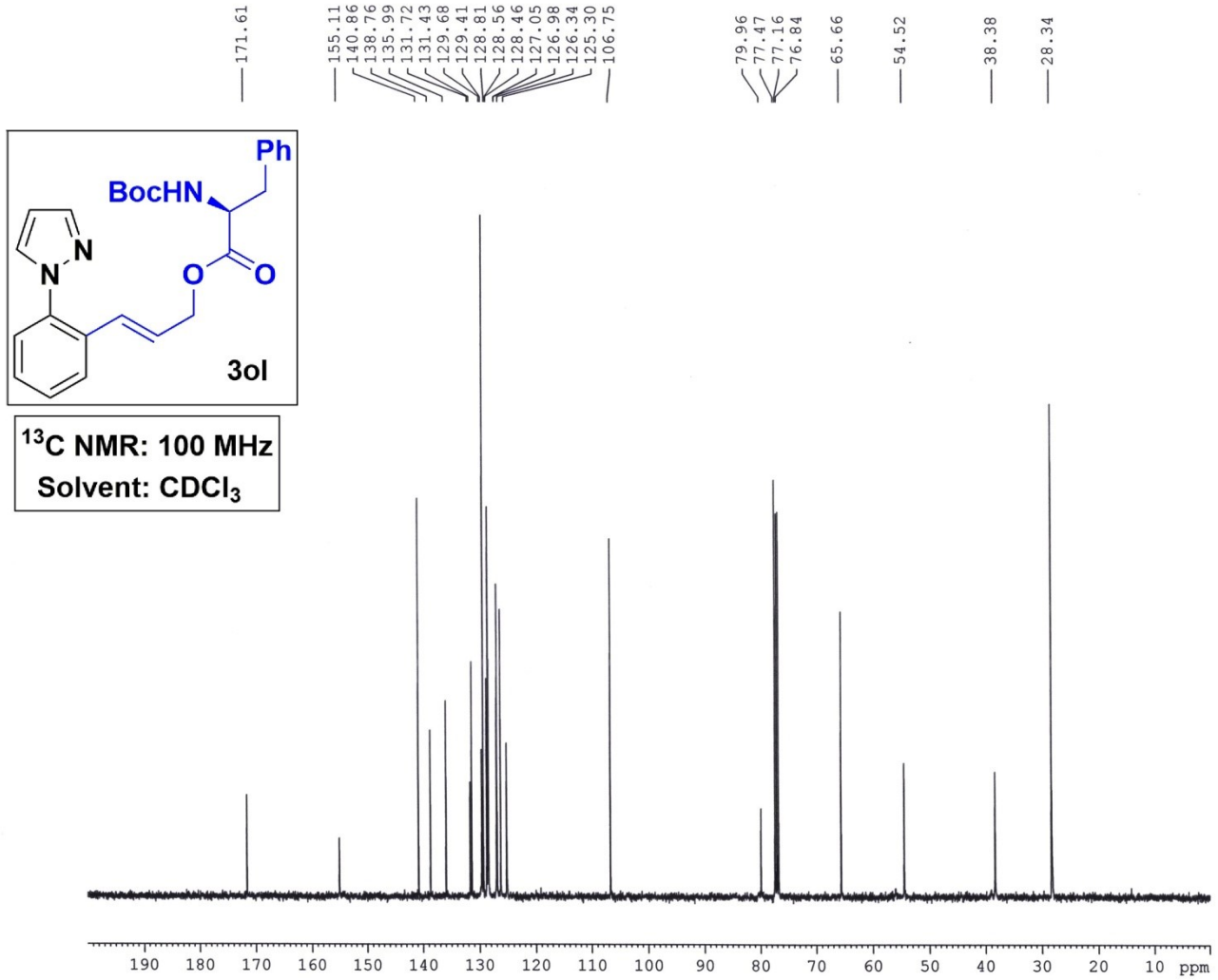

```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                        5
PROCNO                       1

F2 - Acquisition Parameters
Date_              20210105
Time                 13.22
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG              zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     480
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   106.66
DW                  20.800 usec
DE                   6.50 usec
TE                  293.6 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
SFO1            100.6278588 MHz
NUC1                     13C
P1                    8.90 usec
PLW1           54.00000000 W

======== CHANNEL f2 ========
SFO2            400.1516006 MHz
NUC2                     1H
CPDPRG[2              waltz16
PCPD2                90.00 usec
PLW2           12.00000000 W
PLW12           0.32231000 W
PLW13           0.16212000 W

F2 - Processing parameters
SI                       16384
SF              100.6177887 MHz
WDW                         EM
SSB          0
LB                    1.00 Hz
GB           0
PC                    1.40
```


Ph
BocHN
N
O
O
3nl
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
ppm




```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  463
PROCNO                   1

F2 - Acquisition Parameters
Date_           20211128
Time              19.21
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD              32768
SOLVENT           CDCl3
NS                  400
DS                    2
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             0.6815744 sec
RG                106.66
DW                20.800 usec
DE                 6.50 usec
TE                297.7 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                   1

======== CHANNEL f1 ========
SFO1        100.6278588 MHz
NUC1               13C
P1                8.90 usec
PLW1       54.00000000 W

======== CHANNEL f2 ========
SFO2        400.1516006 MHz
NUC2               1H
CPDPRG[2        waltz16
PCPD2             90.00 usec
PLW2       12.00000000 W
PLW12       0.32231000 W
PLW13       0.16212000 W

F2 - Processing parameters
SI                16384
SF          100.6177855 MHz
WDW                EM
SSB       0
LB                 1.00 Hz
GB        0
PC                 1.40
```


Ph
BocHN
N
N
O
O
3ol
^{1}H NMR: 400 MHz
Solvent: $CDCl_3$
ppm




```
Current Data Parameters
NAME      Dr. A HAJRA-2021-13C
EXPNO                  473
PROCNO                   1

F2 - Acquisition Parameters
Date_              20211205
Time                 17.34
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   32768
SOLVENT              CDCl3
NS                     380
DS                       2
SWH              24038.461 Hz
FIDRES            0.733596 Hz
AQ                0.6815744 sec
RG                   30.11
DW                  20.800 usec
DE                   6.50 usec
TE                  295.7 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6278588 MHz
NUC1                   13C
P1                    8.90 usec
PLW1          54.00000000 W

======== CHANNEL f2 ========
SFO2          400.1516006 MHz
NUC2                   1H
CPDPRG[2           waltz16
PCPD2                90.00 usec
PLW2          12.00000000 W
PLW12          0.32231000 W
PLW13          0.16212000 W

F2 - Processing parameters
SI                   16384
SF            100.6177948 MHz
WDW                     EM
SSB       0
LB                    1.00 Hz
GB        0
PC                    1.40
```