Electronic Supplementary Information

L-Proline catalyzed regioselective C1 arylation of tetrahydro-isoquinolines through a multi-component reaction under solvent-free conditions

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Table of Contents:

General information

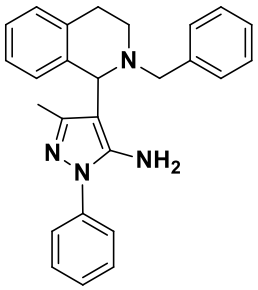
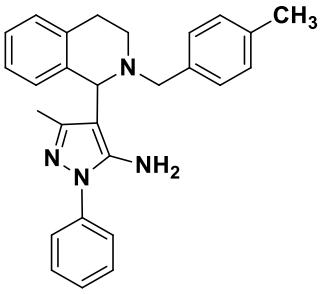
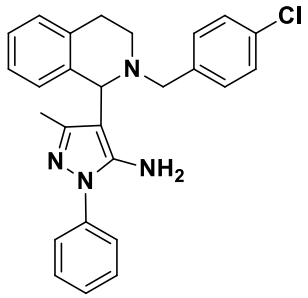
All the commercially available reagents were used as received. Melting points were determined in open capillary tubes with a Buchi-540 micro melting point apparatus and were uncorrected. I.R. spectra were recorded on a Perkin-Elmer system 2000 FT-IR spectrometer. Mass spectra (ESI-HRMS) were recorded on Agilent Accurate-Mass Q-TOF LC/MS 6520. NMR spectra were recorded on Bruker Avance DPX-300, 400 and -500 NMR spectrometer with tetramethylsilane (TMS) as the internal standard at room temperature. Chemical shifts (δ) are quoted in ppm and coupling constants (*J*) are measured in Hertz (Hz). All the experiments were monitored by thin layer chromatography (TLC) on pre-coated silica gel plates (Merck) and visualized under UV lamp at 254 nm for UV active materials. Further visualization was achieved by iodine vapour. Column chromatography was performed on silica gel (100-200 mesh, Merck) using ethyl acetate/hexane as eluent.

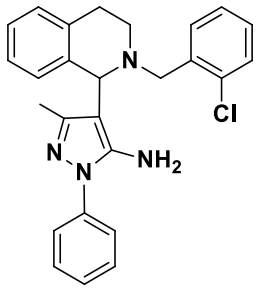
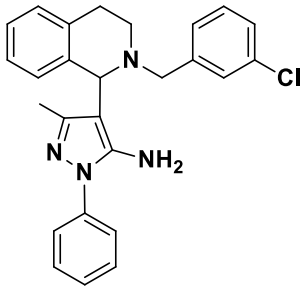
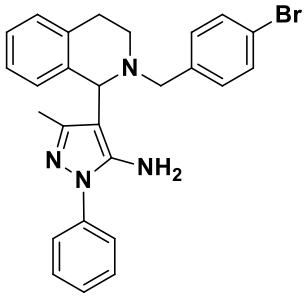
General procedure for the synthesis of 4 or 7:

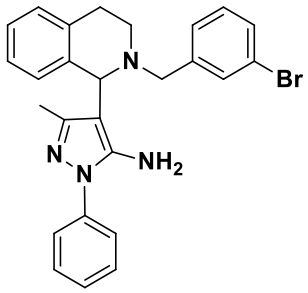
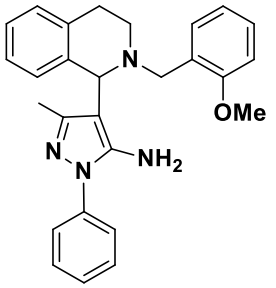
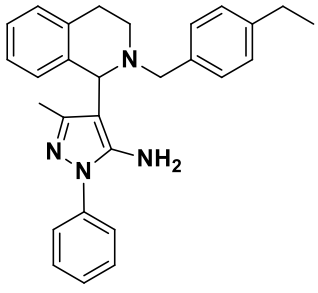
A mixture of THIQ (1.2 mmol, 160 mg), benzaldehyde (1.2 mmol, 127 mg) and L-proline (20 mol %, 23 mg) were taken in a round bottom flask, stirred for 10 mins. at room temperature and then added 5-aminopyrazole **3a** (1 mmol, 173 mg) or indole **6a** (1 mmol, 117 mg). The mixture was then heated at 120 ^{o}C for 6 h in neat condition. Then cooled the reaction mixture, poured to dichloromethane (30 mL) and washed with water (2 x 20 mL). The organic fraction was dried with anhydrous Na_2SO_4 and then filtered. Removed the solvent in rotavapor and the crude product was then purified by column chromatography using silica gel (100-200 mesh) and hexane/ethyl acetate as eluent.

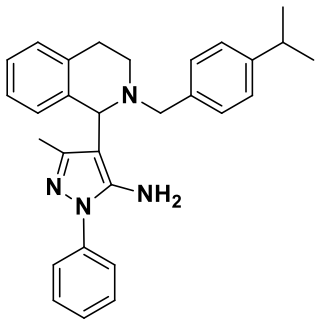
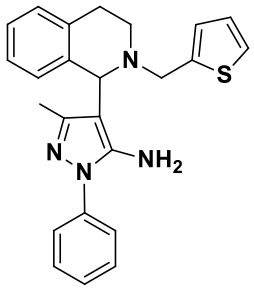
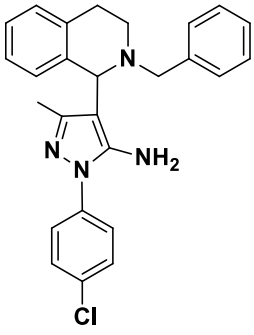
Isolation of compound 5 from the reaction

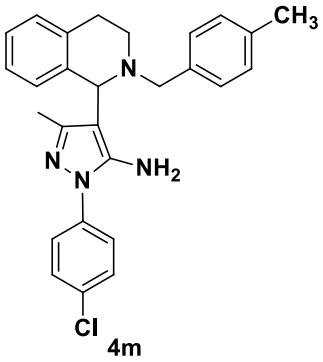
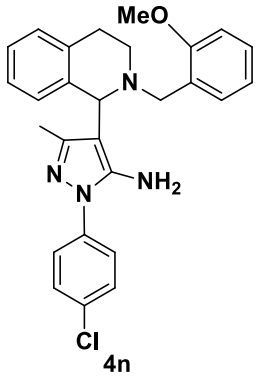
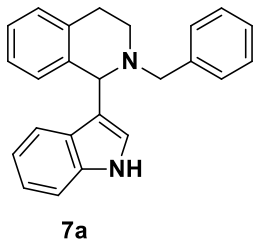
A mixture of THIQ (1.2 mmol, 160 mg), benzaldehyde (1.2 mmol, 127 mg), 5-aminopyrazole **3a** (1 mmol, 173 mg) and $Cu(OAc)_2.H_2O$ (20 mol %, 40 mg) were taken in a round bottom flask and heated at 120 ^{o}C for 6 h in neat condition. Then cooled the reaction mixture, poured to dichloromethane (30 mL) and washed with water (2 x 20 mL). The organic fraction was dried with anhydrous Na_2SO_4 and then filtered. Removed the solvent in rotavapor and purified the compound **5** by column chromatography using silica gel (100-200 mesh) and hexane/ethyl acetate as eluent.

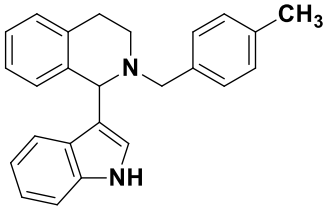
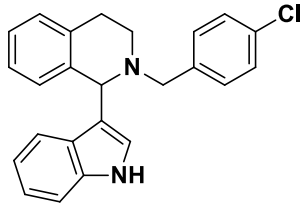
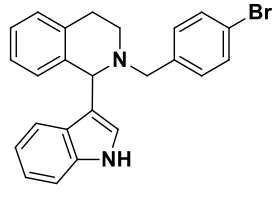
 **4a**	**4-((3,4-dihydroisoquinolin-2(1H)-yl)(phenyl)methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Yellow solid, (323 mg, yield-82%); M.P.: 134-136 ^{o}C ; R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3434, 3051, 2921, 2851, 1619, 1499, 1453, 1122, 743, 698, cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.56-7.53 (m, 2H), 7.44-7.39 (m, 3H), 7.29-7.25 (m, 5H), 7.19-7.08 (m, 3H), 7.01- 6.99 (m, 1H), 4.55 (s, 1H), 4.20-4.16 (m, 3H), 3.21-3.14 (m, 2H), 3.04-3.00 (m, 1H), 2.76-2.70 (m, 1H), 2.48-2.39 (m, 1H), 2.36 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.8, 142.8, 139.2, 138.7, 137.8, 134.7, 129.3, 129.0, 128.2(2C), 127.9, 126.8, 126.6, 126.1, 126.0, 123.1, 103.7, 60.3, 59.3, 49.0, 29.6, 12.4; HRMS (ESI) exact mass calculated for $C_{26}H_{26}N_4$ $[M+H]^+$: 395.2236; Found: 395.2233.
 **4b**	**4-((3,4-dihydroisoquinolin-2(1H)-yl)(p-tolyl)methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Brown solid, (327 mg, yield-80%); M.P.: 148-150 ^{o}C; R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3355, 3285, 3017, 2922, 2793, 1595, 1499, 1454, 1290, 1238, 1137, 1093, 803, 760, 693 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.56-7.53 (m, 2H), 7.44-7.39 (m, 2H), 7.27-7.24 (m, 1H), 7.18-7.16 (m, 2H), 7.12-7.10 (m, 5H), 7.00-6.98 (m, 1H), 4.53 (s, 1H), 4.22 (bs, 2H), 4.13 (d, *J*=13.2, 1H), 3.21-3.11 (m, 2H), 3.06-2.97 (m, 1H), 2.75-2.70 (m, 1H), 2.47-2.38 (m, 1H), 2.36 (s, 3H), 2.33 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.8, 142.8, 138.7, 137.8, 136.4, 136.0, 134.7, 129.3, 129.0, 128.9, 127.9, 126.6, 126.1, 126.0, 123.1, 103.7, 60.2, 59.0, 49.0, 29.6, 21.1, 12.5; (ESI) exact mass calculated for $C_{27}H_{28}N_4$ $[M+H]^+$: 409.2392; Found: 409.2394.
 **4c**	**4-((4-chlorophenyl)(3,4-dihydroisoquinolin-2(1H)-yl)methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Brown solid, (386 mg, yield-90%); M.P.: 138-140 ^{o}C; R_f = 0.5 (hexane/EtOAc, 4:1); IR (KBr): 3363, 3037, 2920, 2794, 1595, 1498, 1454, 1359, 1296, 1141, 1039, 751, 691 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.52-7.49 (m, 2H), 7.43-7.38 (m, 3H), 7.34-7.26 (m, 2H), 7.23-7.18 (m, 2H), 7.16-7.10 (m, 3H), 7.01-6.99 (m, 1H), 4.62 (s, 1H), 4.08-4.03 (m, 3H), 3.55 (d, *J*=14.4 Hz, 1H), 3.21-3.03 (m, 2H), 2.84-2.74 (m, 1H), 2.59-2.51 (m, 1H), 2.35 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.9, 143.0, 138.6, 137.6, 136.8, 134.6, 134.3, 130.4, 129.4, 129.3, 128.2, 127.9, 126.6, 126.2, 126.1, 123.2, 130.6, 60.6, 56.1, 49.4, 29.5, 12.5; HRMS (ESI) exact mass calculated for $C_{26}H_{25}ClN_4$ $[M+H]^+$: 429.1846; Found: 429.1844

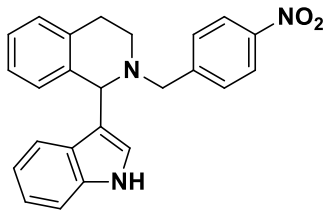
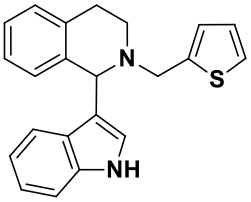
 **4d**	**4-((2-chlorophenyl)(3,4-dihydroisoquinolin-2(1H)-yl)methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Yellow solid, (378 mg, yield-88%); M.P.: 74-76 ^{o}C; R_f = 0.5 (hexane/EtOAc, 4:1); IR (KBr): 3402, 3127, 2920, 2851, 1598, 1490, 1444, 1394, 1090, 1015, 744, cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.57-7.52 (m, 2H), 7.46-7.39 (m, 2H), 7.33-7.21 (m, 5H), 7.18-7.08 (m, 3H), 6.99-6.97 (m, 1H), 4.53 (s, 1H), 4.15-4.10 (m, 3H), 3.16-3.08 (m, 2H), 3.04-2.97 (m, 1H), 2.76-2.71 (m, 1H), 2.48-2.39 (m, 1H), 2.35 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.8, 142.7, 138.6, 137.7, 137.6, 134.6, 132.5, 130.3, 129.3, 128.9, 128.8, 128.3, 128.2, 127.9, 126.7, 126.2, 126.1, 123.1, 103.5, 60.3, 58.6, 49.1, 29.6, 12.4; HRMS (ESI) exact mass calculated for $C_{26}H_{25}ClN_4$ $[M+H]^+$: 429.1846; Found: 429.1848
 **4e**	**4-((3-chlorophenyl)(3,4-dihydroisoquinolin-2(1H)-yl)methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Brown solid, (365 mg, yield-85%); M.P.: 78-80 ^{o}C; R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3411, 3041, 2921, 1598, 1499, 1454, 1379, 1291, 1075, 743 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.56-7.53 (m, 2H), 7.44-7.40 (m, 3H), 7.30-7.27 (m, 2H), 7.23-7.19 (m, 3H), 7.13-7.08 (m, 2H), 6.99-6.97 (m, 1H), 4.53 (s, 1H), 4.14 (d, *J*=13.3 Hz, 1H), 4.10 (bs, 2H), 3.18-3.12 (m, 2H), 3.10-3.04 (m, 1H), 2.77-2.72 (m, 1H), 2.49-2.43 (m, 1H), 2.35(s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 148.8, 142.8, 141.4, 138.7, 134.6, 134.1, 129.5, 129.3 (2C), 129.0, 128.2, 127.9, 127.0 (2C), 126.7, 126.2, 126.1, 123.1, 103.4, 60.2, 58.8, 49.3, 29.6, 12.4; HRMS (ESI) exact mass calculated for $C_{26}H_{25}ClN_4$ $[M+H]^+$: 429.1846; Found: 429.1845
 **4f**	**4-((4-bromophenyl)(3,4-dihydroisoquinolin-2(1H)-yl)methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Yellow solid, (387 mg, yield-82%); M.P.:163-165 ^{o}C; R_f = 0.5 (hexane/EtOAc, 4:1); IR (KBr): 3414, 3047, 2921, 2852, 1599, 1487, 1442, 1394, 1070, 1011, 744 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.55-7.52 (m, 2H), 7.46-7.39 (m, 4H), 7.29-7.24 (m, 1H), 7.18-7.07 (m, 5H), 6.99-6.96 (m, 1H), 4.53 (s, 1H), 4.11-4.08 (m, 3H), 3.15-3.08 (m, 2H), 3.04-2.97 (m, 1H), 2.76-2.71 (m, 1H), 2.48-2.39 (m, 1H), 2.35 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.8, 142.7, 138.6, 138.3, 137.6, 134.5, 131.3, 130.6, 129.3, 128.2, 127.9, 126.7, 126.2, 126.1, 123.1, 120.6, 103.5, 60.3, 58.7, 49.1, 29.5, 12.4; HRMS (ESI) exact mass calculated for Chemical Formula: $C_{26}H_{25}BrN_4$ $[M+H]^+$: 473.1341; Found: 473.1339.

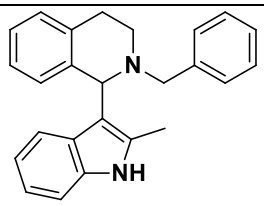
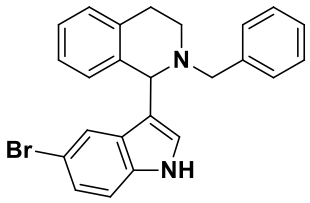
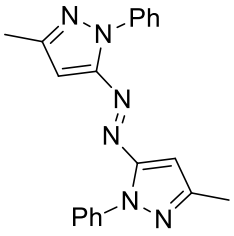
 **4g**	**4-((3-bromophenyl)(3,4-dihydroisoquinolin-2(1H)-yl)methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Yellow solid, (378 mg, yield-80%); M.P.: 73-75 ^{o}C; R_f = 0.5 (hexane/EtOAc, 4:1); IR (KBr): 3307, 3046, 2923, 2853, 2796, 1597, 1499, 1453, 1293, 1069, 743, 695 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.56-7.53 (m, 2H), 7.46-7.35 (m, 3H), 7.29-7.25 (m, 2H), 7.23-7.15 (m, 2H), 7.12-7.08 (m, 3H), 6.99-6.97 (m, 1H), 4.53 (s, 1H), 4.16-4.11 (m, 3H), 3.17-3.13 (m, 2H), 3.07-2.93 (m, 2H), 2.50-2.42 (m, 1H), 2.35 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.8, 142.7, 141.7, 138.6, 137.5, 134.5, 131.9, 129.8, 129.3, 128.2, 127.9, 127.5, 126.7, 126.2, 126.1, 123.1, 122.4, 103.3, 60.2, 58.8, 49.2, 29.6, 12.4; HRMS (ESI) exact mass calculated for $C_{26}H_{25}BrN_4$ $[M+H]^+$: 473.1341; Found: 473.1346.
 **4h**	**4-((3,4-dihydroisoquinolin-2(1H)-yl)(2-methoxyphenyl) methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Yellow solid, (314 mg, yield-74%); M.P.: 215-217 ^{o}C; R_f = 0.3 (hexane/EtOAc, 4:1); IR (KBr): 3393, 3016, 2922, 2852, 2794, 1598, 1492, 1439, 1392, 1242, 1030, 742, cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.53-7.51 (m, 2H), 7.43-7.38 (m, 2H), 7.32-7.19 (m, 4H), 7.15-7.09 (m, 2H), 7.01-6.99 (m, 1H), 6.93-6.83 (m, 2H), 4.60 (s, 1H), 4.22 (bs, 2H), 3.99 (d, *J*=14.0 Hz, 1H), 3.76 (s,3H), 3.43 (d, *J*=14.0 Hz, 1H), 3.26-3.20 (m, 1H), 3.12-3.02 (m, 1H), 2.78-2.73 (m, 1H), 2.52-2.43 (m, 1H), 2.34 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 157.8, 148.8, 143.1, 138.7, 138.0, 134.7, 129.8, 129.2, 128.1, 127.9, 127.8, 127.3, 126.5, 126.1, 125.9, 123.0, 120.3, 110.2, 103.8, 60.5, 55.1, 52.7, 49.2, 29.4, 12.4. HRMS (ESI) exact mass calculated for $C_{27}H_{28}N_4O$ $[M+H]^+$: 425.2341; Found: 425.2340.
 **4i**	**4-((3,4-dihydroisoquinolin-2(1H)-yl)(4-ethylphenyl)methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Yellow gummy, (338 mg, yield-80%); R_f = 0.5 (hexane/EtOAc, 4:1); IR (KBr): 3344, 3020, 2924, 2793, 1598, 1513, 1454, 1377, 1241, 1041, 845, 742 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.55-7.53 (m, 2H), 7.43-7.37 (m, 2H), 7.28-7.24 (m, 2H), 7.20-7.18 (m, 2H), 7.13- 7.07 (m, 4H), 7.00-6.98 (m, 1H), 4.53 (s, 1H), 4.19 (bs, 2H), 4.13 (d, *J*=13.3 Hz, 1H), 3.22-3.18 (m, 1H), 3.15 (d, *J*=13.3 Hz, 1H), 3.06-2.99 (m, 1H), 2.75-2.69 (m, 1H), 2.62 (q, *J*=7.8 Hz, 2H), 2.46-2.38 (m, 1H), 2.34 (s, 3H), 1.21 (t, *J*=7.8 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 148.8, 142.9, 142.8, 138.8, 137.9, 136.3, 134.7, 129.3, 129.0, 128.1, 127.9, 127.7, 126.6, 126.1, 126.0, 123.2, 103.7, 60.3, 59.0, 49.0, 29.6, 28.5, 15.6, 12.5; HRMS

	(ESI) exact mass calculated for $C_{28}H_{30}N_4$ $[M+H]^+$: 423.2549; Found: 423.2551.
 4j	**4-((3,4-dihydroisoquinolin-2(1H)-yl)(4-isopropylphenyl) methyl)-3-methyl-1-phenyl-1H-pyrazol-5-amine:** Yellow gummy, (341 mg, yield-78%); R_f = 0.5 (hexane/EtOAc, 4:1); IR (KBr): 3348, 3021, 2923, 2853, 2799, 1593, 1513, 1154, 1379, 1293, 1139, 1056, 845, 759 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.55-7.53 (m, 2H), 7.42-7.39 (m, 2H), 7.27- 7.24 (m, 2H), 7.21-7.19 (m, 2H), 7.16-7.14 (m, 2H), 7.12-7.11 (m, 1H), 7.09-7.08 (m, 1H), 7.00-6.98 (m, 1H), 4.53 (s, 1H), 4.19 (bs, 2H), 4.14 (d, *J*=13.4 Hz, 1H), 3.23-3.20 (m, 1H), 3.15 (d, *J*=13.4 Hz, 1H), 3.07-3.01 (m, 1H), 2.91-2.85 (m, 1H), 2.75-2.72 (m, 1H), 2.47-2.41 (m, 1H), 2.34 (s, 3H), 1.24 (s, 3H), 1.22 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 148.8, 147.5, 142.9, 138.8, 137.9, 136.4, 134.7, 129.3, 128.9, 128.2, 127.9, 126.6, 126.3, 126.1, 126.0, 123.1, 103.7, 60.2, 59.0, 49.1, 33.7, 29.6, 24.0 (2C), 12.5; HRMS (ESI) exact mass calculated for $C_{29}H_{32}N_4$ $[M+H]^+$: 437.2705; Found: 437.2704.
 4k	**3-methyl-1-phenyl-4-(2-(thiophen-2-ylmethyl)-1,2,3,4-tetrahydroisoquinolin-1-yl)-1H-pyrazol-5-amine:** Yellow gummy, (308 mg, yield-77%); R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3341, 3057, 2919, 1717, 1609, 1502, 1454, 1285, 1023, 853, 746, 684 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.55-7.53 (m, 2H), 7.42-7.39 (m, 2H), 7.27-7.25 (m, 1H), 7.20-7.19 (m, 1H), 7.13-7.08 (m, 3H), 6.98-6.97 (m, 1H), 6.94-6.92 (m, 1H), 6.90-6.89 (m, 1H), 4.58 (s, 1H), 4.27 (bs, 2H), 4.24 (d, *J*=14.1 Hz, 1H), 3.58 (d, *J*=14.1 Hz, 1H), 3.31-3.28 (m, 1H), 3.12-3.06 (m, 1H), 2.78-2.74 (m, 1H), 2.55-2.50 (m, 1H), 2.35 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 148.7, 143.0, 138.7, 137.7, 134.5, 129.3, 128.2, 127.9, 126.6, 126.5, 126.2, 126.1, 125.9, 124.7, 103.1, 59.6, 53.4, 49.2, 29.7, 12.4; HRMS (ESI) exact mass calculated for $C_{24}H_{24}N_4S$ $[M+H]^+$: 401.1800; Found: 401.1802.
 4l	**1-(4-chlorophenyl)-4-((3,4-dihydroisoquinolin-2(1H)-yl) (phenyl)methyl)-3-methyl-1H-pyrazol-5-amine:** Yellow solid, (309 mg, yield-72%); M.P.: 99-101°C; R_f = 0.5 (hexane/EtOAc, 4:1); IR (KBr): 3402, 3026, 2924, 2854, 2796, 1599, 1495, 1391, 1293, 1092, 1012, 935, 834, 742 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.53-7.50 (m, 2H), 7.39-7.36 (m, 2H), 7.33-7.24 (m, 5H), 7.15-7.07 (m, 3H), 6.98-6.95 (m, 1H), 4.54 (s, 1H), 4.18-4.11 (m, 3H), 3.21-3.15 (m, 2H), 3.09-2.98 (m, 1H), 2.76-2.71 (m, 1H), 2.48-2.39 (m, 1H), 2.35 (s, 3H); ^{13}C NMR (75 MHz,

	$CDCl_3$): δ 149.1, 142.8, 139.0, 137.6, 137.3, 134.6, 131.9, 129.3, 128.9, 128.2 (2C), 127.8, 126.9, 126.2, 126.0, 124.0, 104.2, 60.2, 59.3, 49.0, 29.5, 12.4; HRMS (ESI) exact mass calculated for $C_{26}H_{25}ClN_4$ $[M+H]^+$: 429.1846; Found: 429.1847.
 4m	**1-(4-chlorophenyl)-3-methyl-4-(2-(4-methylbenzyl)-1,2,3,4-tetrahydroisoquinolin-1-yl)-1H-pyrazol-5-amine:** Yellow gummy, (319 mg, yield-72%); R_f = 0.5 (hexane/EtOAc, 4:1); IR (KBr): 3394, 3021, 2919, 2834, 1715, 1606, 1485, 1374, 1254, 1083, 1009, 791, 742 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.52-7.49 (m, 1H), 7.39-7.36 (m, 2H), 7.27-7.25 (m, 1H), 7.17-7.08 (m, 7H), 6.97-6.95 (m, 1H), 4.52 (s, 1H), 4.20 (bs, 2H), 4.10 (d, *J*=13.2 Hz, 1H), 3.13 (d, *J*=13.2Hz, 1H), 3.02-2.85 (m, 2H), 2.79-2.70 (m, 1H), 2.46-2.37 (m, 1H), 2.35(s, 3H), 2.33(s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 149.1, 142.9, 137.7, 137.3, 136.5, 135.8, 134.7, 132.0, 129.3, 128.9, 128.2, 127.8, 126.2, 126.0, 124.1, 122.2, 104.2, 60.1, 59.0, 48.9, 29.5, 21.1, 12.4; HRMS (ESI) exact mass calculated for $C_{27}H_{27}ClN_4$ $[M+H]^+$: 443.2002; Found: 443.2006.
 4n	**1-(4-chlorophenyl)-4-(2-(2-methoxybenzyl)-1,2,3,4-tetrahydroisoquinolin-1-yl)-3-methyl-1H-pyrazol-5-amine:** Yellow gummy, (307 mg, yield-67%); R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3399, 3027, 2919, 1593, 1485, 1239, 1084, 838, 731 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$): δ 7.51-7.48 (m, 2H), 7.38-7.35 (m, 2H), 7.30-7.28 (m, 1H), 7.23-7.19 (m, 1H), 7.14-7.08 (m, 3H), 6.99-6.96 (m, 1H), 6.93-6.89 (m, 1H), 6.85-6.83 (m, 1H), 4.59 (s, 1H), 4.17 (bs, 2H), 3.96 (d, *J*=14.2 Hz, 1H), 3.26-3.20 (m, 1H), 3.12-3.05 (m, 1H), 2.78-2.74 (m, 1H), 2.51-2.45 (m, 1H), 2.33 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 157.9, 149.3, 143.3, 138.0, 137.5, 134.9, 132.0, 129.8, 129.4, 128.3, 128.0, 127.9, 127.3, 126.3, 126.1, 124.2, 120.4, 110.4, 104.6, 60.6, 55.3, 52.9, 49.3, 29.5, 12.6; HRMS (ESI) exact mass calculated for $C_{27}H_{27}ClN_4O$ $[M+H]^+$: 459.1952; Found: 459.1953.
 7a	**2-benzyl-1-(1H-indol-3-yl)-1,2,3,4-tetrahydroisoquinoline:**[1] Yellow solid, (284 mg, yield-84%); M.P.: 127-129 ^oC; R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3406, 3066, 3017, 2919, 2785, 1606, 1485, 1461, 1412, 1339, 1241, 1096, 1009, 925, 742 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): 7.87 (bs, 1H), 7.59 (d, *J*=8.1Hz, 1H), 7.28-7.26 (m, 2H), 7.24-7.22 (m, 1H), 7.21-7.20 (m, 1H), 7.19-7.15 (m, 2H), 7.12-7.09 (m, 2H), 7.08-7.05 (m, 1H), 7.02-6.99 (m, 1H), 6.95-6.91(m, 1H), 6.89-6.87 (m, 2H), 4.95 (s, 1H), 3.88 (d, *J*=13.5 Hz, 1H), 3.32 (d, *J*=13.5 1H), 3.13-3.10 (m, 1H),

	3.04-2.99 (m, 1H),2.85-2.80 (m, 1H), 2.55-2.50 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 139.8, 138.5, 136.5, 134.7, 128.9, 128.3(2C), 128.1, 126.8, 126.6, 125.8, 125.5, 124.4, 121.9, 120.6, 119.3, 118.4, 110.9, 60.9, 58.8, 46.9, 28.6; HRMS (ESI) exact mass calculated for $C_{24}H_{22}N_2$ $[M+H]^+$: 339.1861; Found: 339.1863.
 **7b**	**1-(1H-indol-3-yl)-2-(4-methylbenzyl)-1,2,3,4-tetrahydroisoquinoline:** Yellow solid, (290 mg, yield-82%); M.P.: 133-135 ^{o}C; R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3418, 3028, 2919, 2785, 1619, 1508, 1448, 1339, 1096, 1009, 742, 584 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.98 (bs, 1H), 7.61(d, *J*=7.7 Hz, 1H), 7.29 (d, *J*=8.1 Hz, 1H), 7.18-7.15 (m, 2H), 7.14-7.12 (m, 2H), 7.10-7.06 (m, 3H), 7.04-7.01(m, 1H), 7.00-6.99 (m, 1H), 6.97-6.94 (m, 1H), 6.91-6.90 (m, 1H), 4.96 (s, 1H), 3.86 (d, *J*=13.3 Hz, 1H), 3.31 (d, *J*=13.3 Hz, 1H), 3.16-3.12 (m, 1H), 3.06-3.00 (m, 1H), 2.86-2.82 (m, 1H), 2.56-2.51 (m, 1H), 2.30 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 138.6, 136.7, 136.6, 136.1, 134.7, 128.9, 128.7, 128.4, 128.3, 126.9, 125.8, 125.5, 124.3, 121.9, 120.7, 119.3, 118.7, 110.9, 60.9, 58.5, 46.8, 28.7, 21.1; HRMS (ESI) exact mass calculated for $C_{25}H_{24}N_2$ $[M+H]^+$: 353.2018; Found: 353.2017.
 **7c**	**2-(4-chlorobenzyl)-1-(1H-indol-3-yl)-1,2,3,4-tetrahydroisoquinoline:** Pale white solid, (320 mg, yield-86%); M.P.: 154-156 ^{o}C; R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3418, 3053, 2919, 2798, 1619, 1485, 1448, 1350, 1096, 1009, 804, 742, 584 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.01 (bs, 1H), 8.58 (d, *J*=7.8 Hz, 1H), 7.33-7.31 (m, 1H), 7.25-7.23 (m, 1H), 7.20-7.07 (m, 6H), 7.06-7.01 (m, 2H), 6.98-6.94 (m, 1H), 6.91-6.89 (m, 1H), 4.95 (s, 1H), 3.86 (d, *J*=13.7 Hz, 1H), 3.29 (d, *J*=13.7 Hz, 1H), 3.12-3.01 (m, 2H), 2.88-2.81 (m, 1H), 2.54-2.51 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 138.5, 138.4, 136.6, 134.6, 132.2, 130.1, 128.4, 128.3, 128.2, 126.7, 125.9, 125.6, 124.3, 122.1, 120.6, 119.4, 118.5, 111.0, 61.1, 58.1, 47.1, 28.8; HRMS (ESI) exact mass calculated for $C_{24}H_{21}ClN_2$ $[M+H]^+$: 373.1472; Found: 373.1469.
 **7d**	**2-(4-bromobenzyl)-1-(1H-indol-3-yl)-1,2,3,4-tetrahydroisoquinoline:** Yellow solid, (354 mg, yield-85%); M.P.: 171-173 ^{o}C; R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3418, 3028, 2919, 2785, 1619, 1448, 1339, 1009, 806, 742, 584 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 8.07 (bs, 1H), 7.59-7.57 (m, 1H), 7.37-7.32 (m, 3H), 7.16-7.03 (m, 7H), 7.00-6.91 (m, 2H), 4.95 (s,

	1H), 3.85 (d, *J*=13.6 Hz, 1H), 3.23 (d, *J*=13.6 Hz, 1H), 3.08-3.03 (m, 2H), 2.87-2.81 (m, 1H), 2.57-2.53 (m, 1H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 138.9, 138.3, 136.6, 134.5, 131.1, 130.5, 128.3(2C), 126.6, 125.9, 125.6, 124.4, 122.1, 120.6, 120.3, 119.4, 118.3, 111.0, 61.0, 58.1, 47.1, 28.8; HRMS (ESI) exact mass calculated for $C_{24}H_{21}BrN_2$ $[M+H]^+$: 417.0966; Found: 417.0963.
 **7e**	**1-(1H-indol-3-yl)-2-(4-nitrobenzyl)-1,2,3,4-tetrahydroisoquinoline:** Purple gummy, (337 mg, yield-88%); R_f = 0.3 (hexane/EtOAc, 4:1); IR (KBr): 3418, 3031, 2932, 1606, 1521, 1448, 1339, 1096, 998, 851, 742 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.14 (bs, 1H), 8.07 (d, *J*=8.4 Hz, 2H), 7.57 (d, *J*=7.9 Hz, 1H), 7.42 (d, *J*=8.4 Hz, 2H), 7.33 (d, *J*=8.1 Hz, 1H), 7.17-7.09 (m, 4H), 7.04-7.01(m, 1H), 6.98-6.95 (m, 1H), 6.90-6.89 (m, 1H), 4.96 (s, 1H), 3.99 (d, *J*=14.3 Hz, 1H), 3.41(d, *J*=14.3 Hz, 1H), 3.14-3.05 (m, 2H), 2.87-2.84 (m, 1H), 2.60-2.55 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 148.3, 146.7, 138.1, 136.7, 134.3, 129.2, 128.3, 128.2, 126.4, 126.0, 125.7, 124.5, 123.3, 122.2, 120.5, 119.5, 118.0, 111.1, 61.5 58.5, 47.9, 29.0; HRMS (ESI) exact mass calculated for $C_{24}H_{21}N_3O_2$ $[M+H]^+$: 384.1712; Found: 384.1711.
 **7f**	**1-(1H-indol-3-yl)-2-(thiophen-2-ylmethyl)-1,2,3,4-tetrahydroisoquinoline:** White solid, (282 mg, yield-82%); M.P.: 137-139 ^{o}C; R_f = 0.3 (hexane/EtOAc, 4:1); IR (KBr): 3418, 3066, 2919, 2798, 1630, 1448, 1339, 1229, 1096, 998, 742 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.02 (bs, 1H), 7.64 (d, *J*=7.9 Hz, 1H), 7.32 (d, *J*=8.1 Hz, 1H), 7.18-7.12 (m, 3H), 7.10-7.07 (m, 2H), 7.05-7.02 (m, 1H), 6.97-6.94 (m, 1H), 6.91-6.89 (m, 2H), 6.84 (m, 1H), 5.04 (s, 1H), 3.98 (d, *J*=14.3 Hz, 1H), 3.72 (d, *J*=14.3 Hz, 1H), 3.25-3.21 (m, 1H), 3,15-3.08 (m, 1H), 2.90-2.85 (m, 1H), 2.69-2.64 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 143.4, 138.4, 136.6, 134.6, 128.4, 128.3, 126.8, 126.3, 125.8, 125.6, 125.4, 124.5, 124.3, 122.1, 120.8, 113.4, 118.3, 110.9, 60.2, 53.2, 47.2, 28.9; HRMS (ESI) exact mass calculated for $C_{22}H_{20}N_2S$ $[M+H]^+$: 345.1425; Found: 345.1423.
	2-benzyl-1-(2-methyl-1H-indol-3-yl)-1,2,3,4-tetrahydroisoquinoline:[1] Yellow solid, (296 mg, yield-84%); M.P.: 123-125 ^{o}C; R_f = 0.4 (hexane/EtOAc, 4:1); IR (KBr): 3406, 3028, 2919, 2785, 1606, 1497, 1461, 1290, 1120, 1009, 938, 742, 693 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.77 (bs, 1H), 7.56 (d *J*=7.8 Hz, 1H), 7.26-7.24 (m, 1H), 7.22-7.21 (m, 4H), 7.18-7.14 (m, 1H), 7.11-7.10 (m, 1H), 7.09-7.04 (m, 2H), 7.10-6.97 (m,

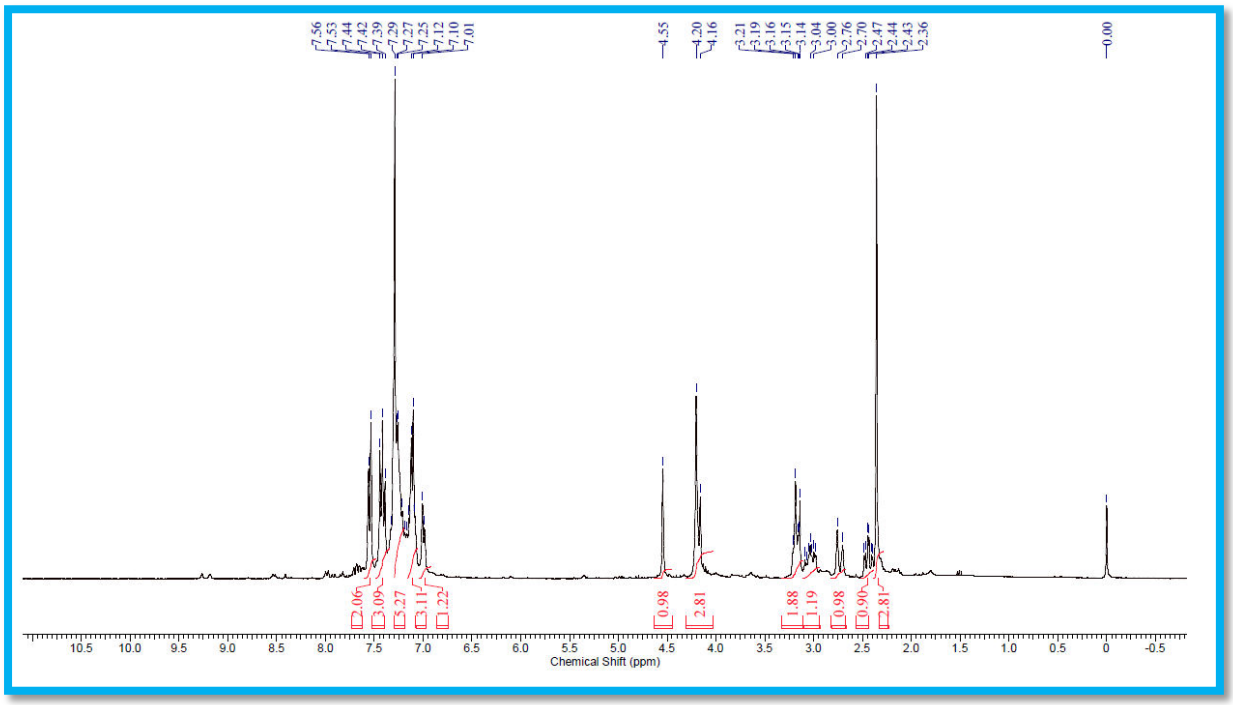
 **7g**	1H), 6.93-6.90 (m, 1H), 6.77 (d, *J*=7.8 Hz, 1H), 4.87 (s, 1H), 3.98 (d, *J*=13.7 Hz, 1H), 3.22-3.14 (m, 2H), 2.08 (d, *J*=13.7 Hz, 1H), 2.78-2.74 (m, 1H), 2.50-2.43 (m, 1H), 2.39 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 140.2, 139.0, 135.2, 135.0, 133.3, 128.8, 128.4, 128.1, 128.0, 127.9, 126.4, 125.6(2C), 120.9, 119.6, 119.2, 113.8, 109.9, 61.0, 59.1, 49.1, 29.8, 12.3; HRMS (ESI) exact mass calculated for $C_{25}H_{24}N_2$ $[M+H]^+$: 353.2018; Found: 353.2016.
 **7h**	**2-benzyl-1-(5-bromo-1H-indol-3-yl)-1,2,3,4-tetrahydroisoquinoline:** Yellow solid, (333 mg, yield-80%); M.P.: 148-151 ^{o}C; R_f = 0.3 (hexane/EtOAc, 4:1); IR (KBr): 3431, 3028, 2919, 2785, 1594, 1497, 1448, 1339, 1290, 1096, 889, 791, 742, 706, 584 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.01 (bs, 1H), 7.71-7.70 (m, 1H), 7.29-7.27 (m, 4H), 7.24-7.22 (m, 1H), 7.20-7.17 (m, 1H), 7.14-7.07 (m, 3H), 7.00-6.96 (m, 1H), 6.90-6.86 (m, 2H), 4.89 (s, 1H), 3.85 (d, *J*=13.3 Hz, 1H), 3.34 (d, *J*=13.3 Hz, 1H), 3.17-3.11 (m, 1H), 3.03-2.96 (m, 1H), 2.87-2.81 (m, 1H), 2.59-2.53 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 139.5, 137.8, 135.1, 134.6, 128.9, 128.5, 128.4, 128.3, 128.2, 126.8, 126.0, 125.6, 125.4, 124.9, 123.1, 118.6, 112.7, 112.4, 60.2, 58.6, 46.8, 28.1; HRMS (ESI) exact mass calculated for $C_{24}H_{21}BrN_2$ $[M+H]^+$: 417.0966; Found: 417.0970.
 **5**	**(E)-1,2-bis(3-methyl-1-phenyl-1H-pyrazol-5-yl)diazene:**[2] Yellow solid, (229 mg, yield-67%); M. P.: 202-204 ^{o}C; R_f = 0.6 (hexane/EtOAc, 4:1); ^{1}H NMR (300 MHz, $CDCl_3$): 7.71-7.69 (m, 4H), 7.53-7.46 (m, 4H), 7.42-7.67 (m, 2H), 6.40 (s, 2H), 2.39 (s, 6H); HRMS (ESI) exact mass calculated for $C_{20}H_{18}N_6$ $[M+H]^+$: 343.1671; Found: 343.1667.

References

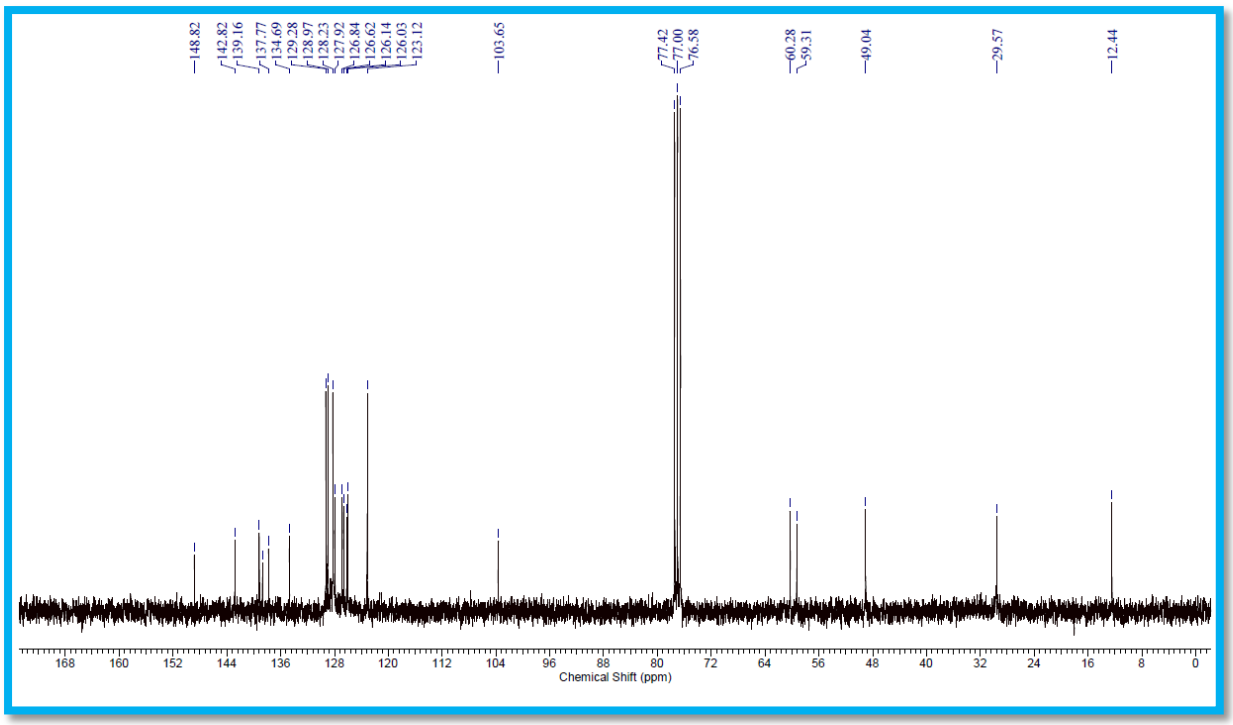
1. F. Yi, J. Su, S. Zhang, W. Yi and L. Zhang, *Eur. J. Org. Chem.*, 2015, 7360.

2. B. Jiang, Y. Ning, W. Fan, S.-J. Tu and G. Li, *J. Org. Chem.*, 2014, **79**, 4018.

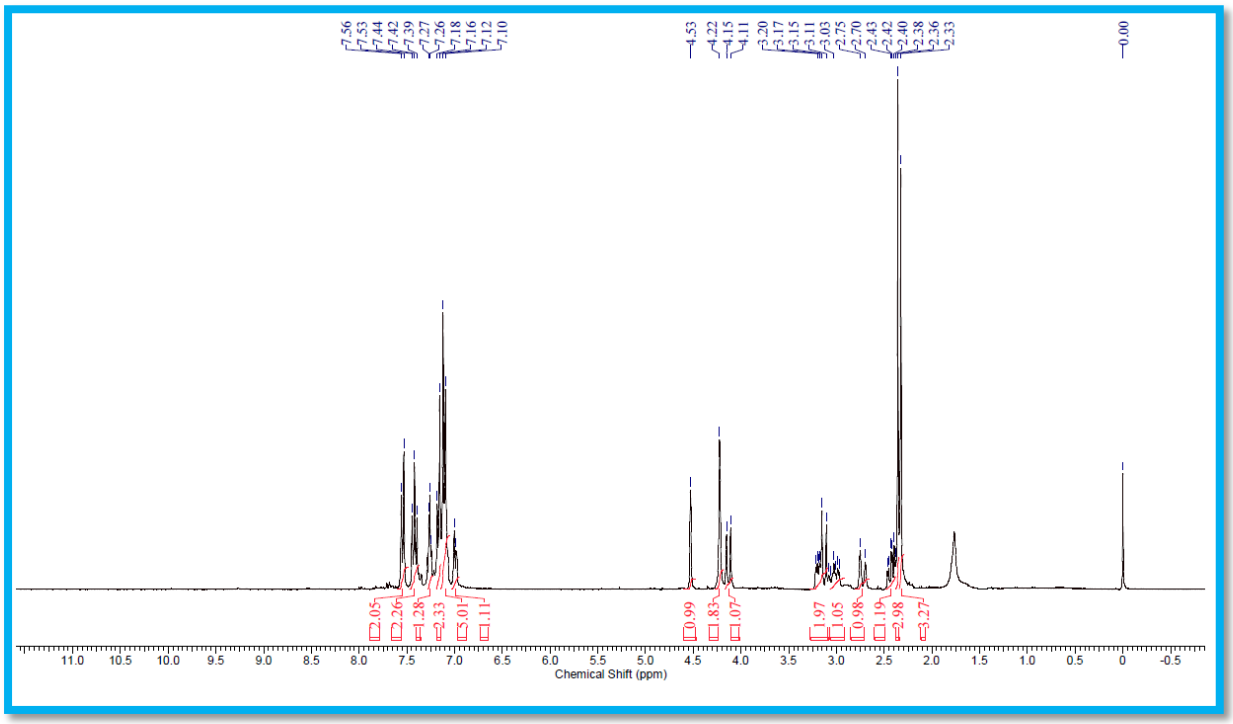
^{1}H-NMR of 4a



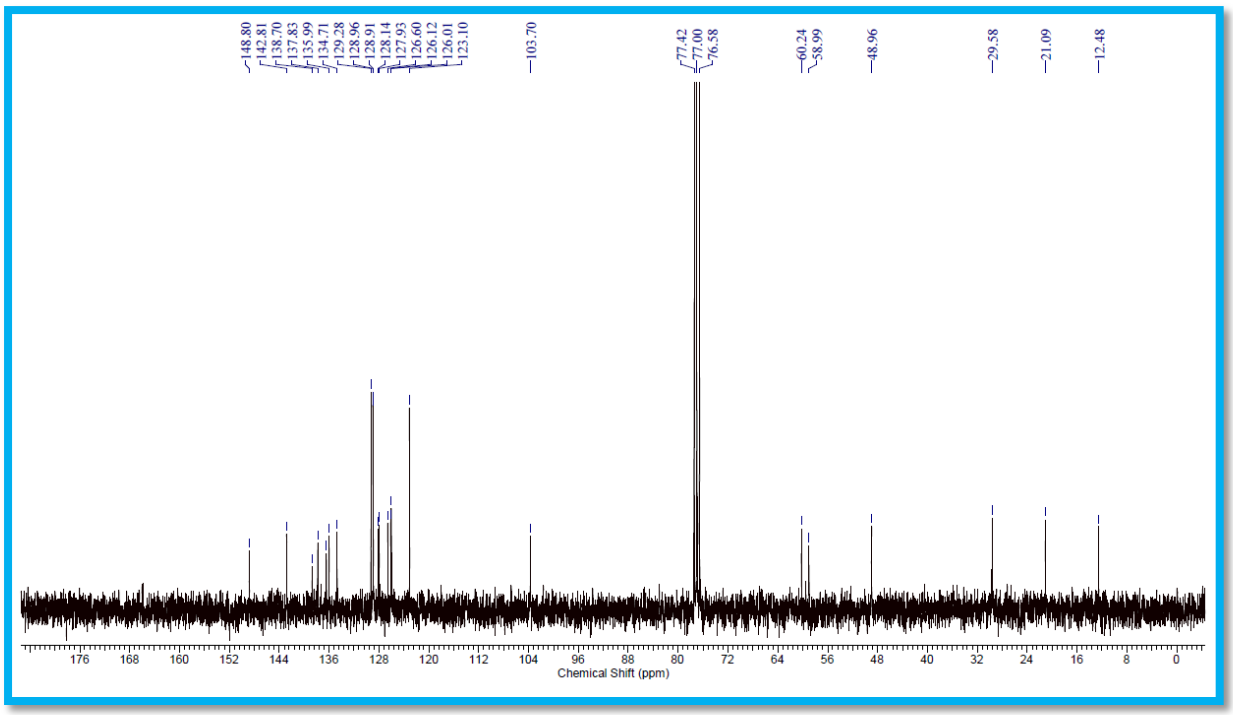
^{13}C-NMR of 4a



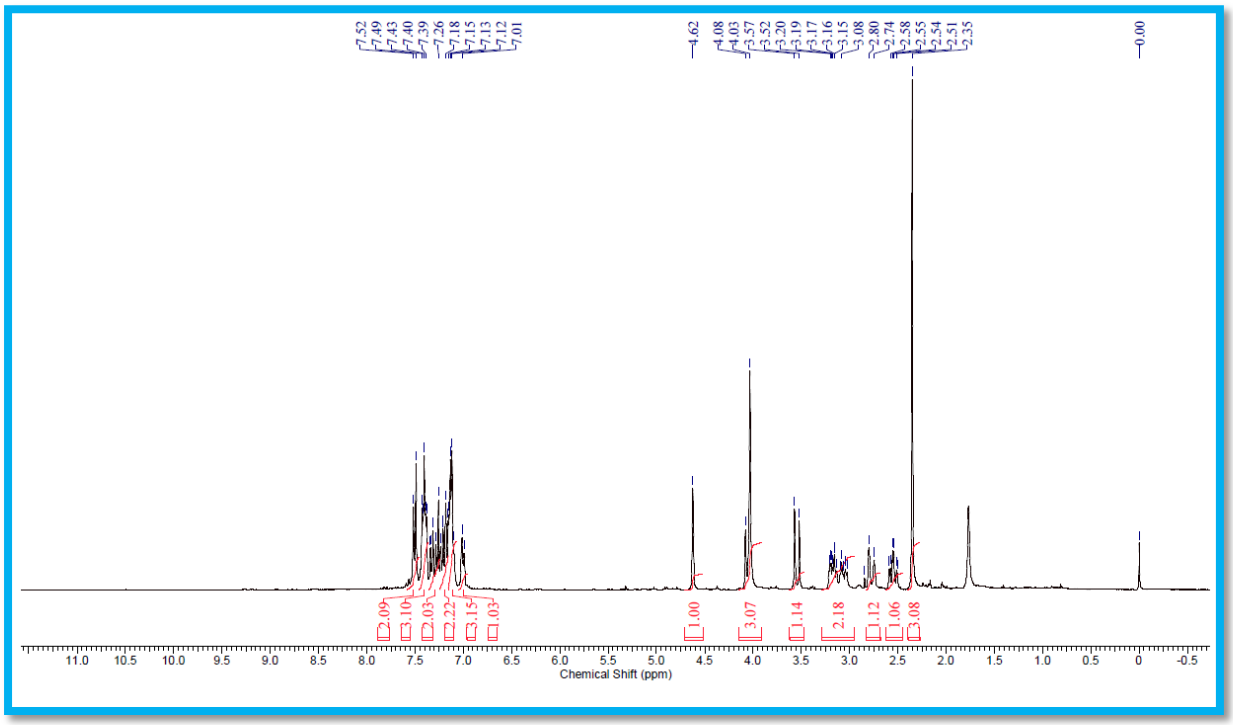
^{1}H-NMR of 4b



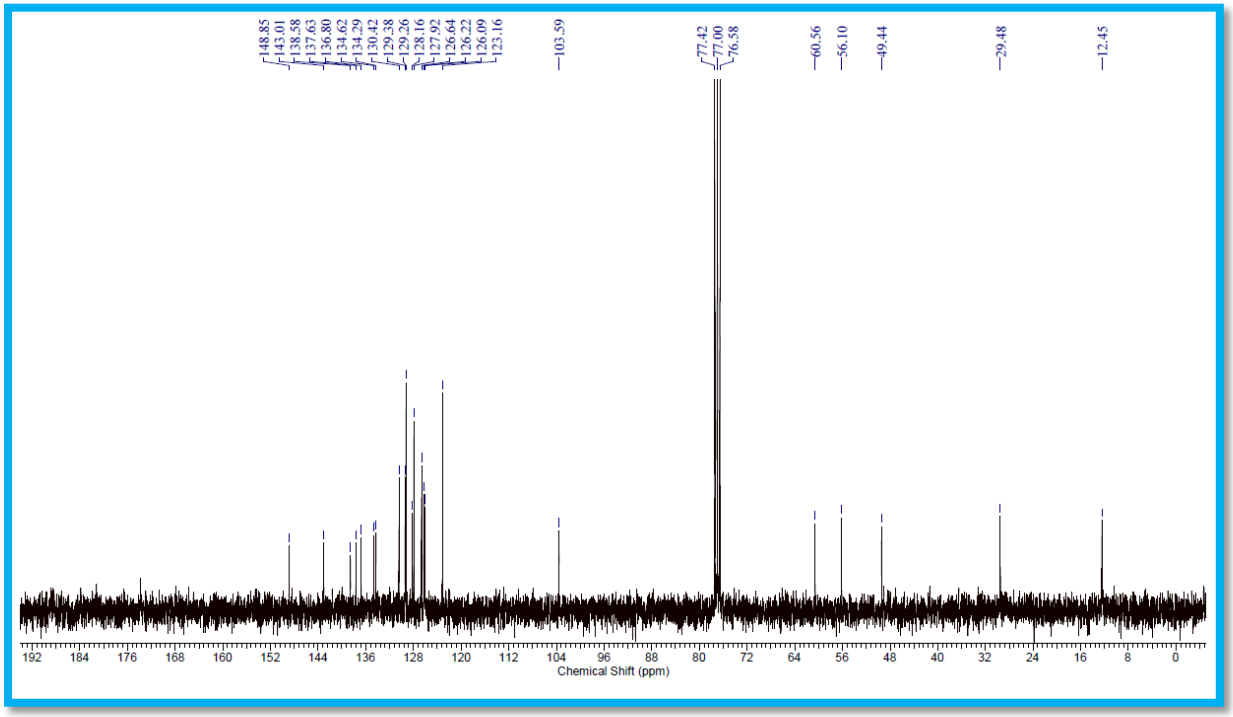
^{13}C-NMR of 4b



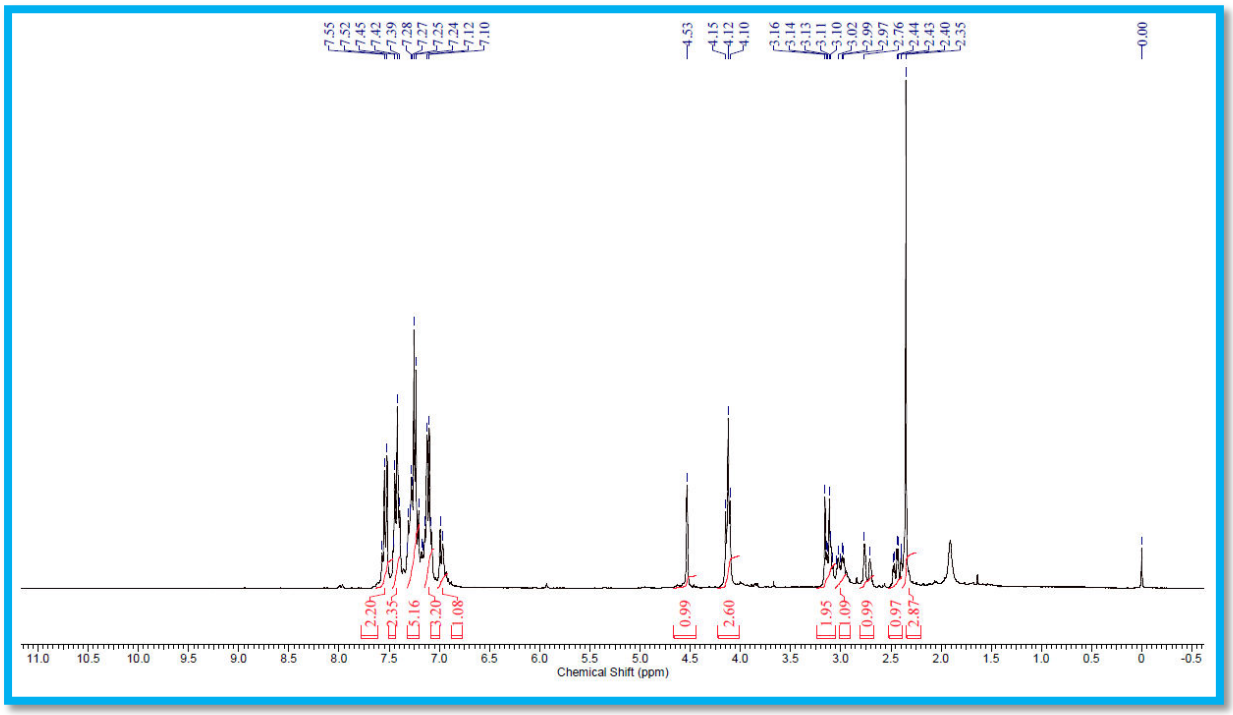
^{1}H-NMR of 4c



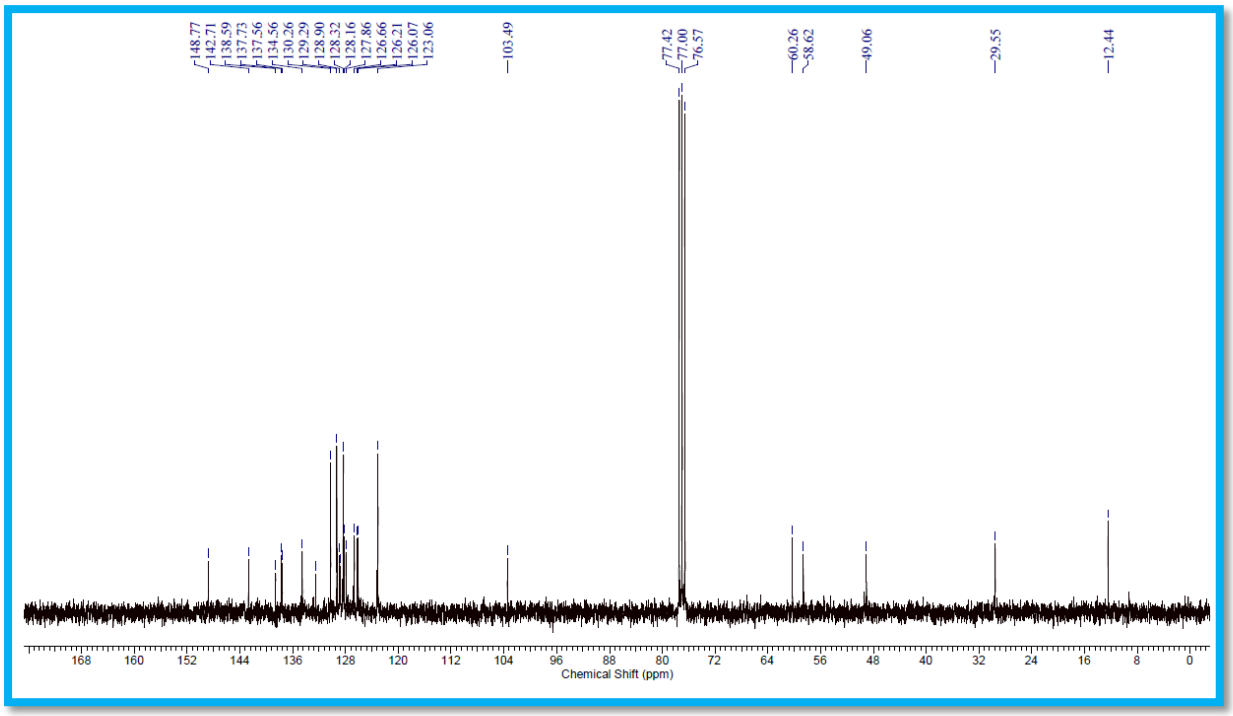
^{13}C-NMR of 4c



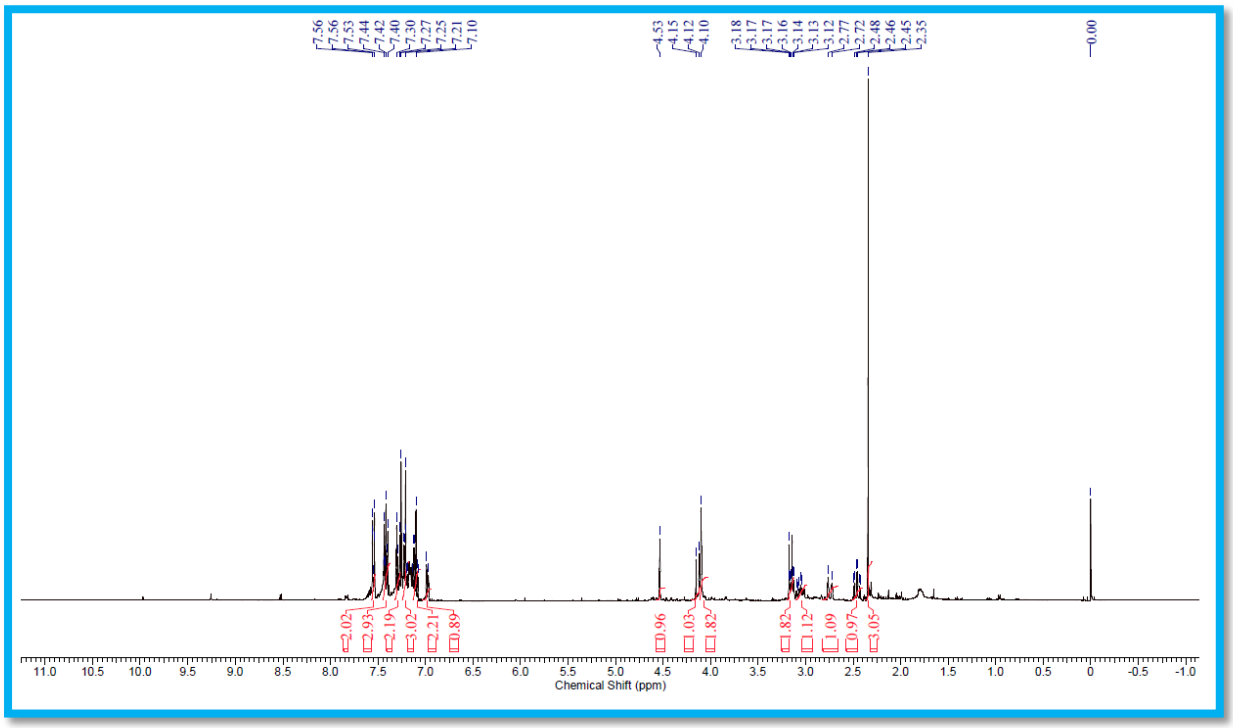
^{1}H-NMR of 4d



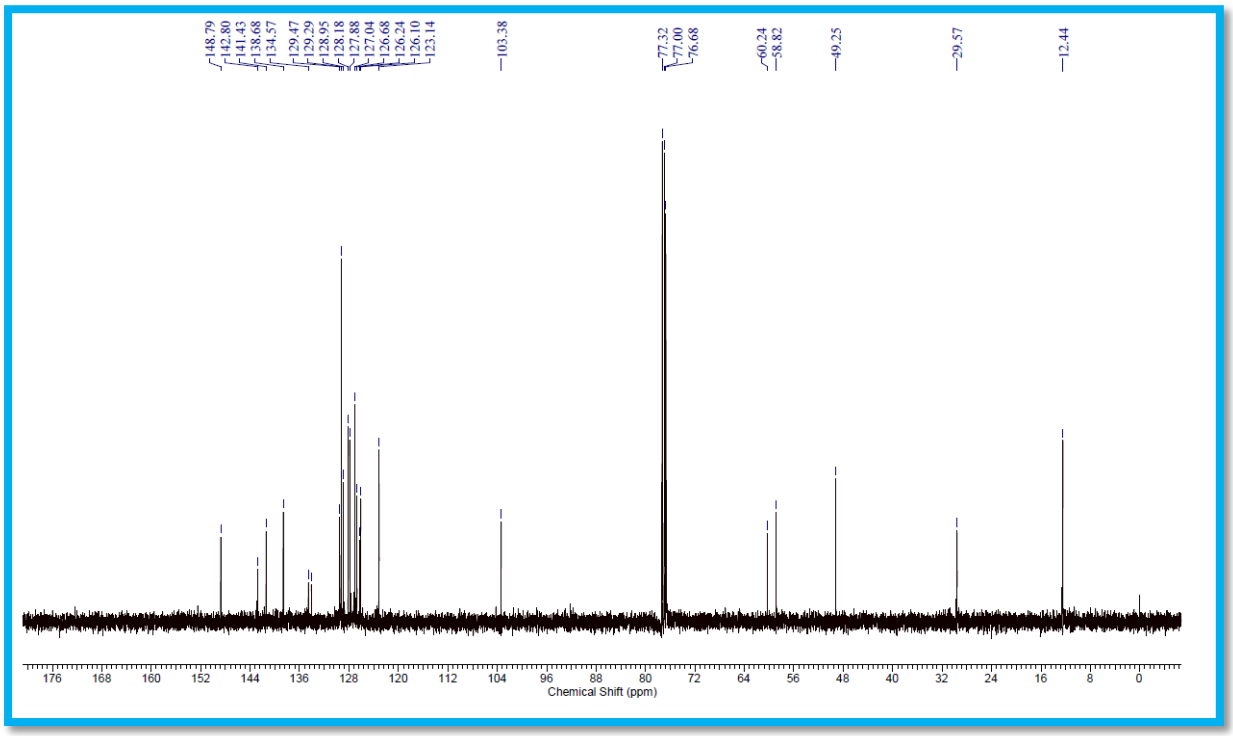
^{13}C-NMR of 4d



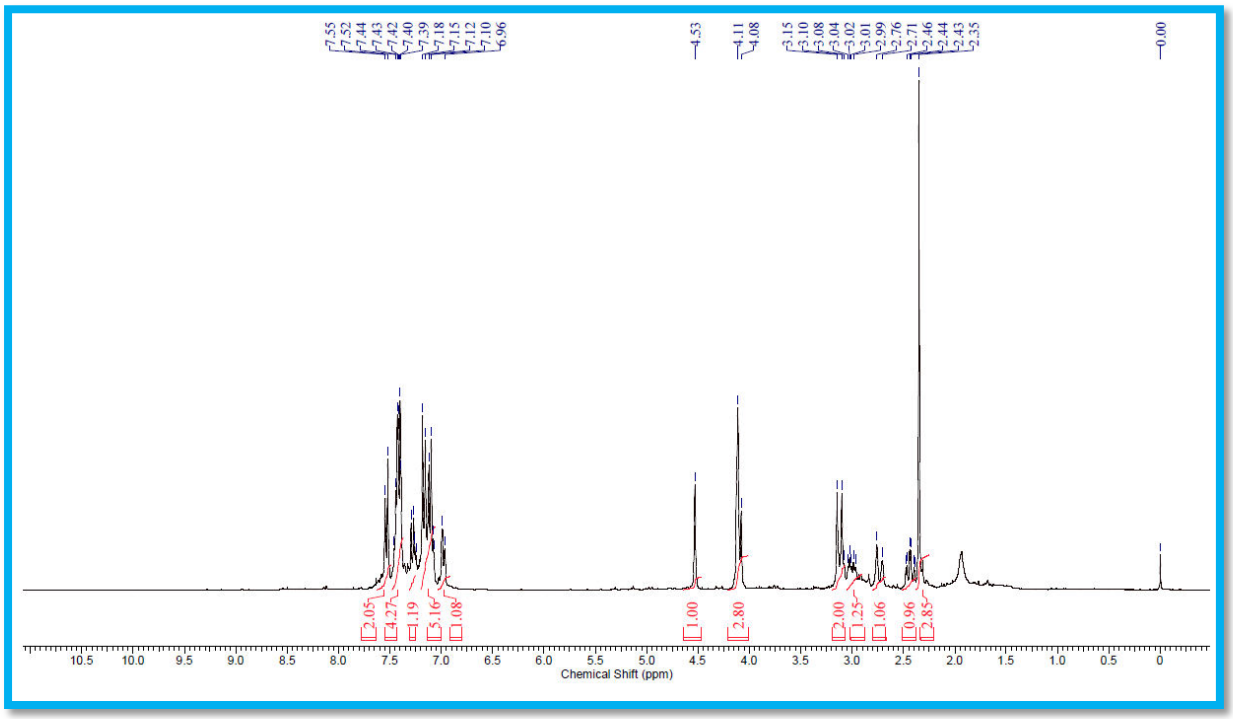
^{1}H-NMR of 4e



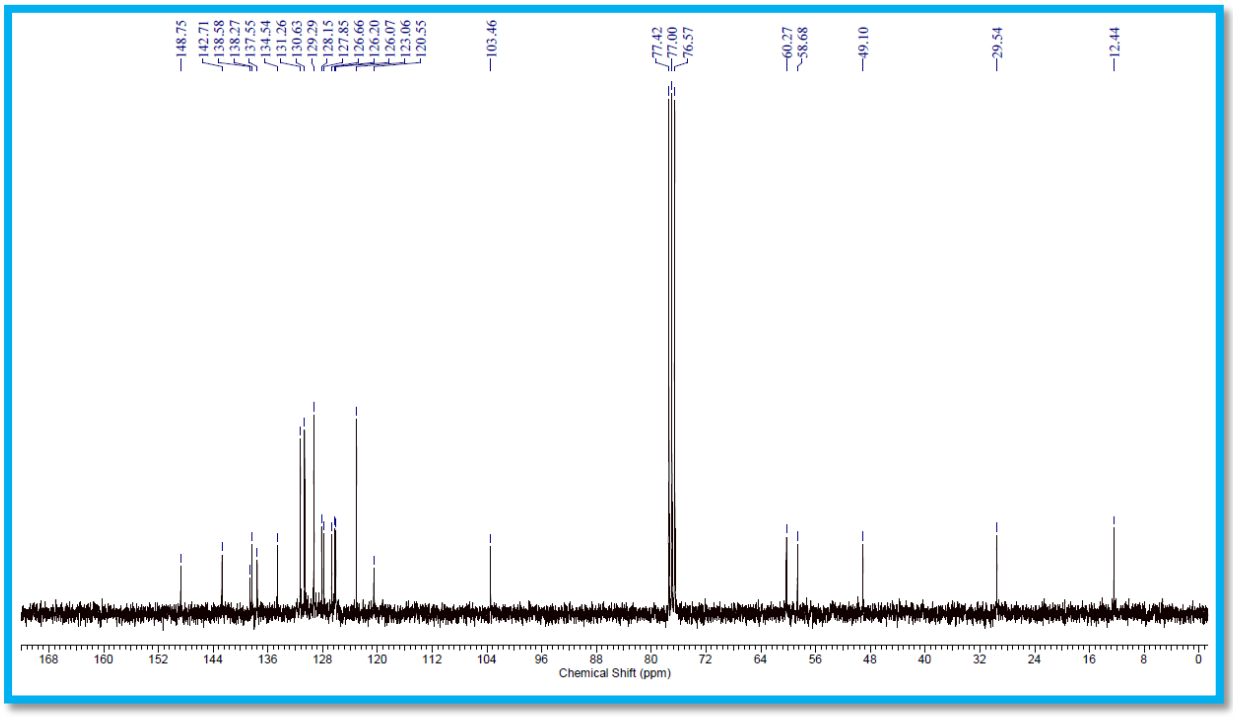
^{13}C-NMR of 4e



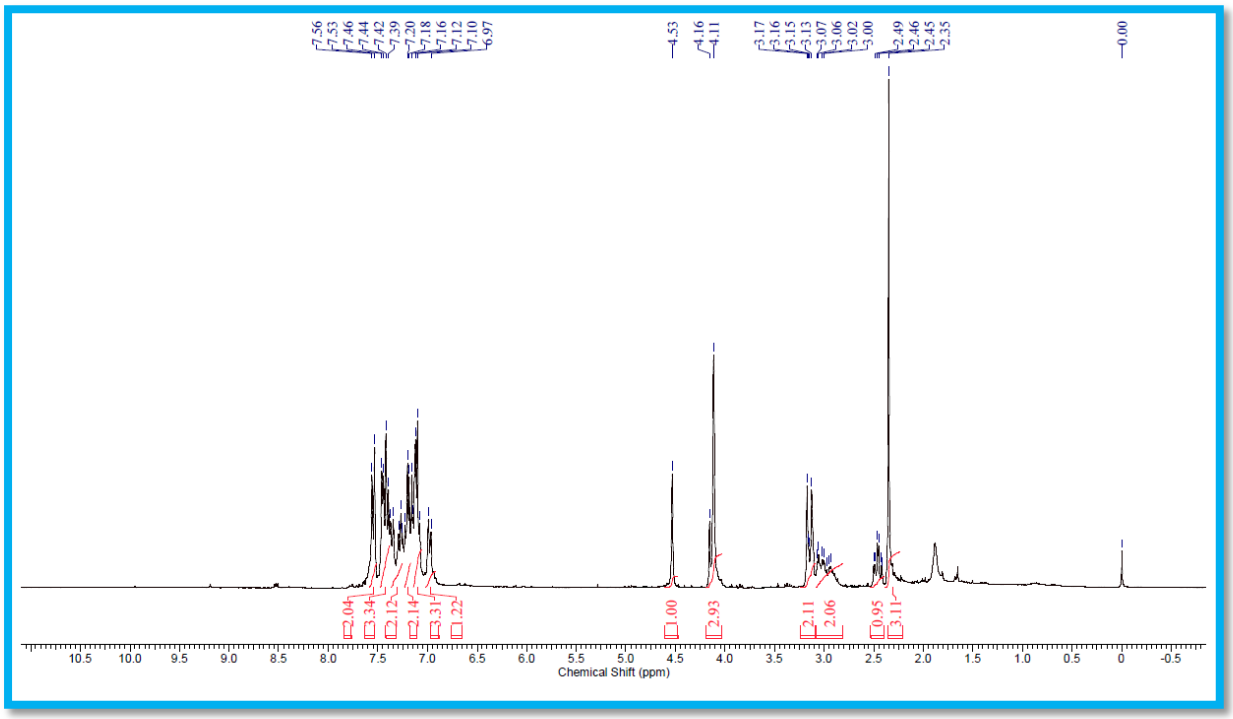
^{1}H-NMR of 4f



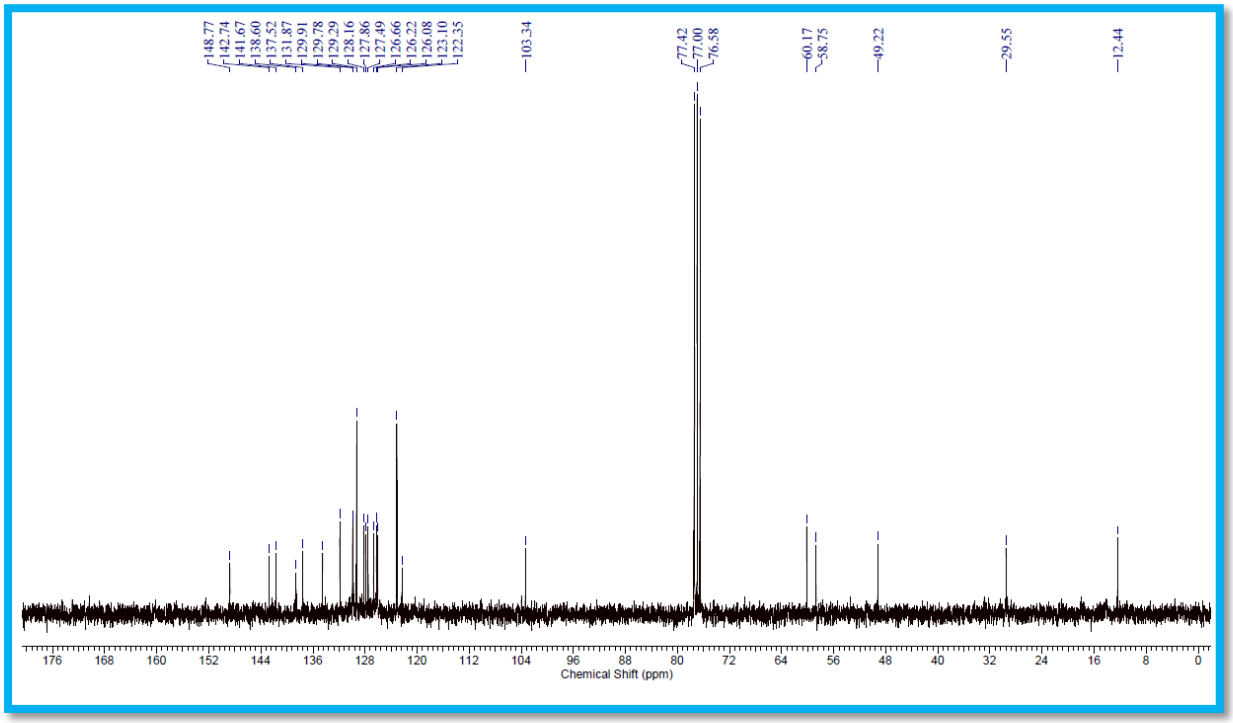
^{13}C-NMR of 4f



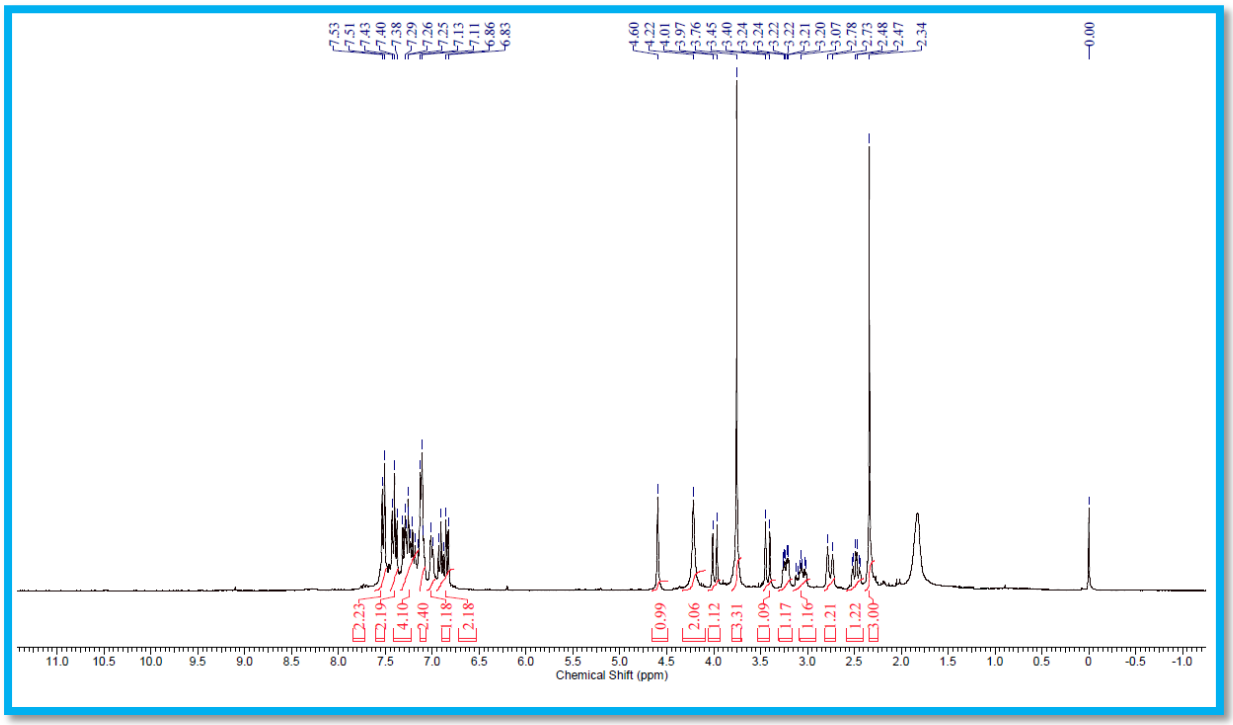
^{1}H-NMR of 4g



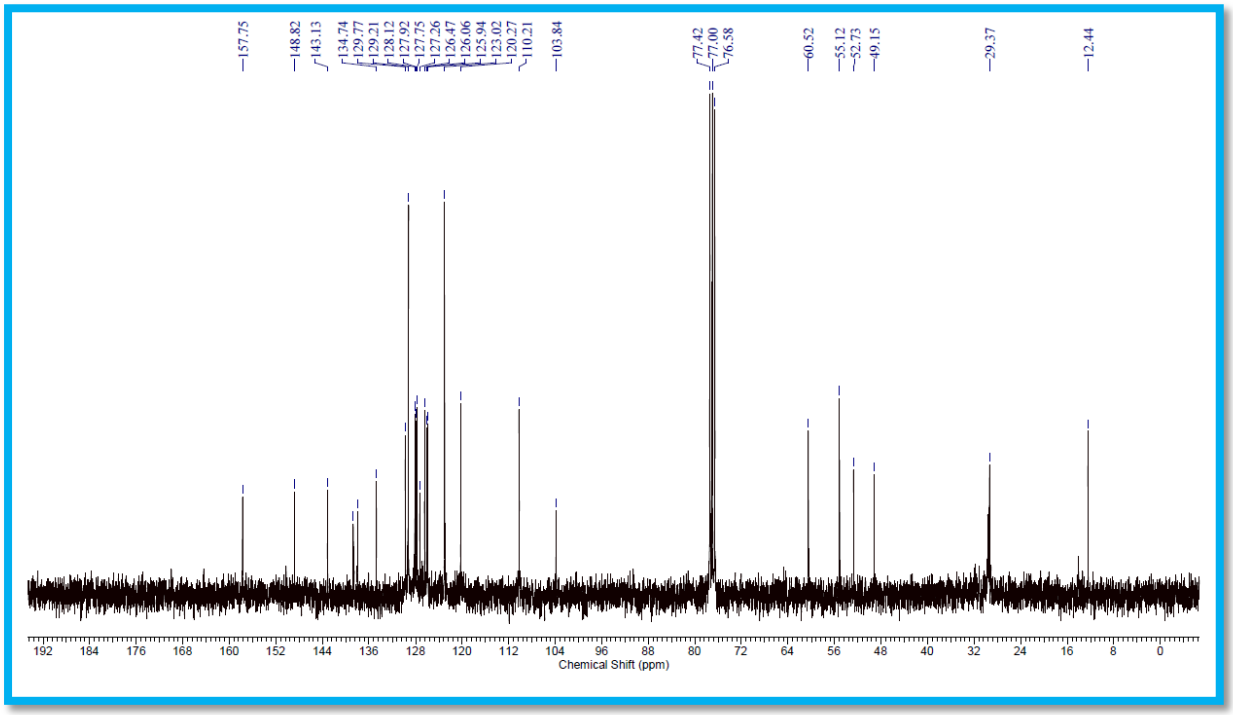
^{13}C-NMR of 4g



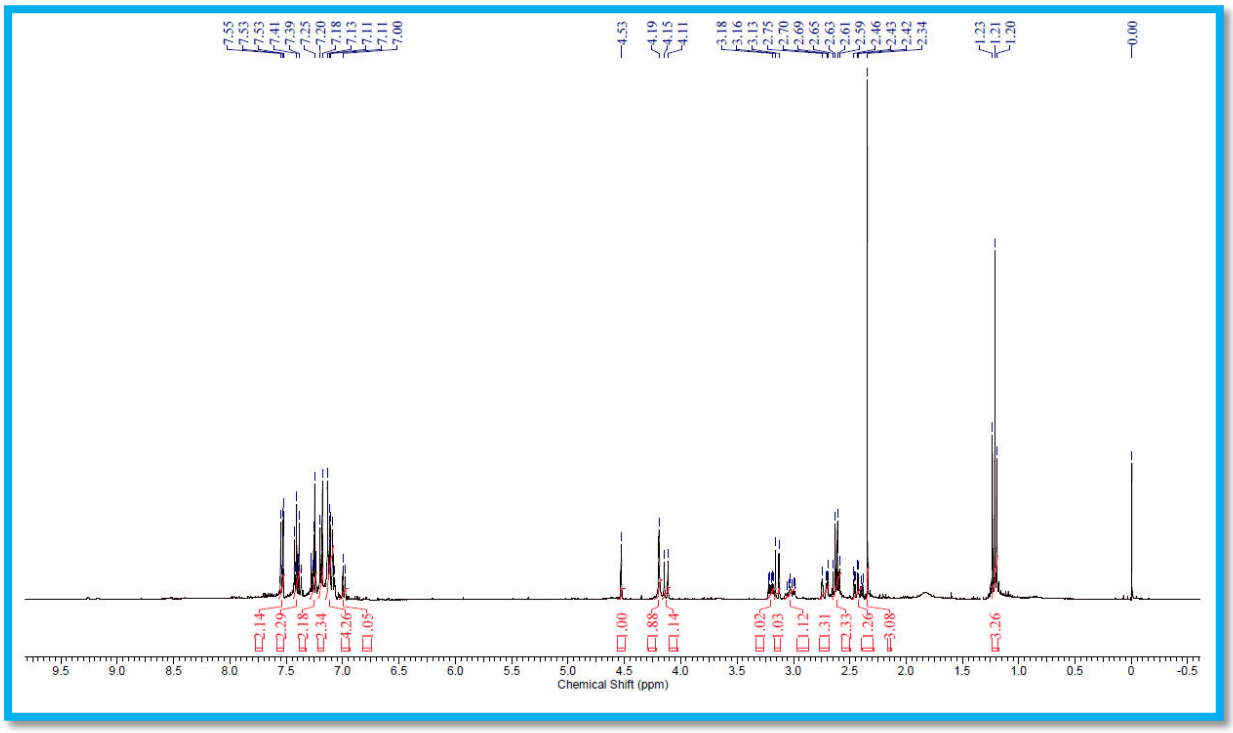
^{1}H-NMR of 4h



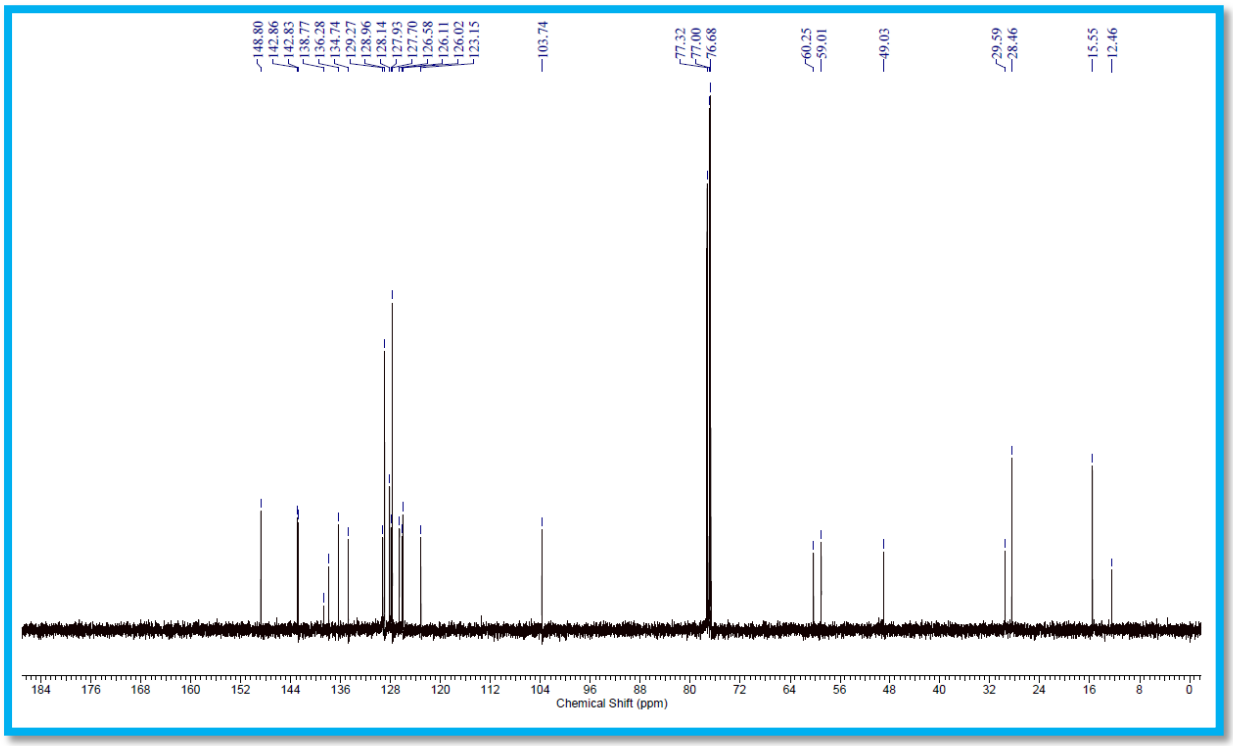
^{13}C-NMR of 4h



^{1}H-NMR of 4i



^{13}C-NMR of 4i



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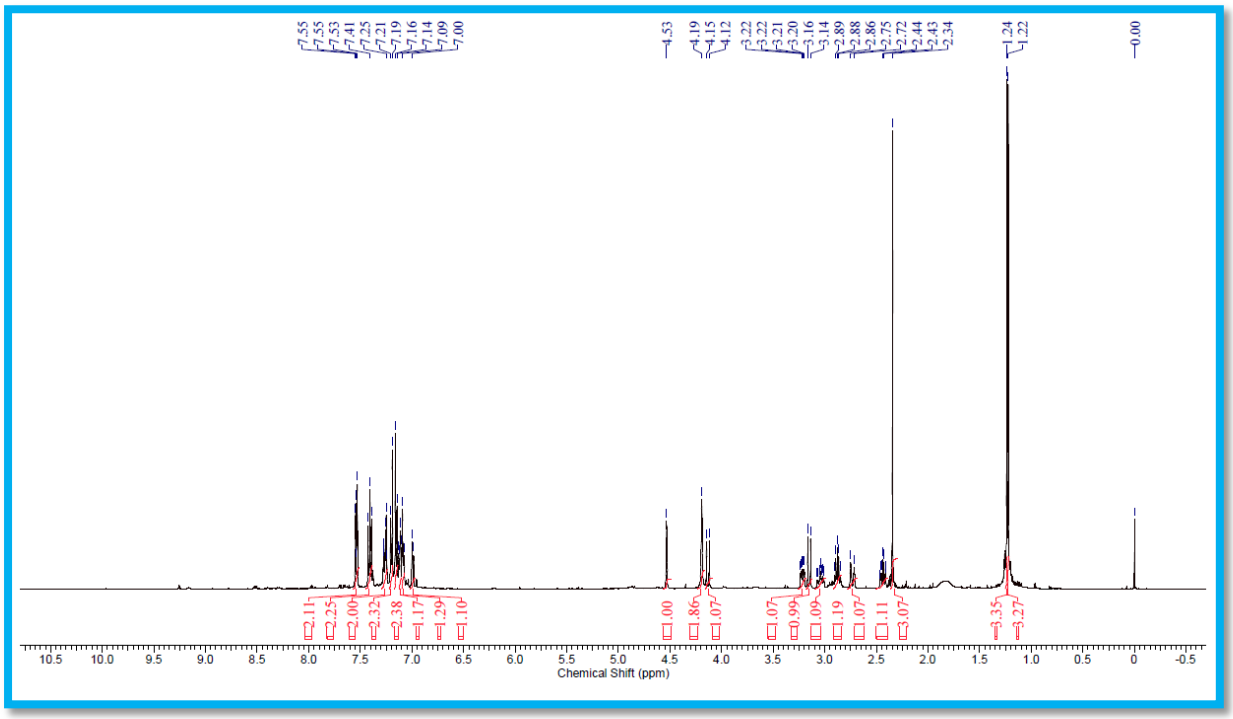

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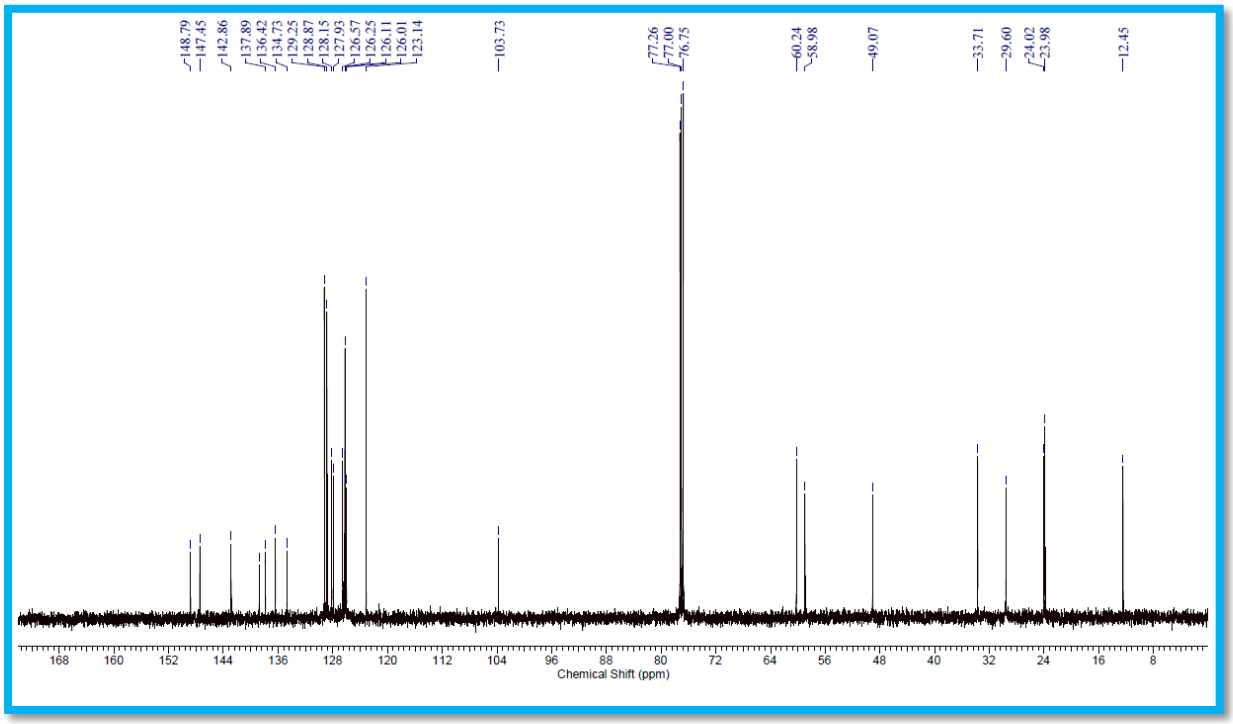
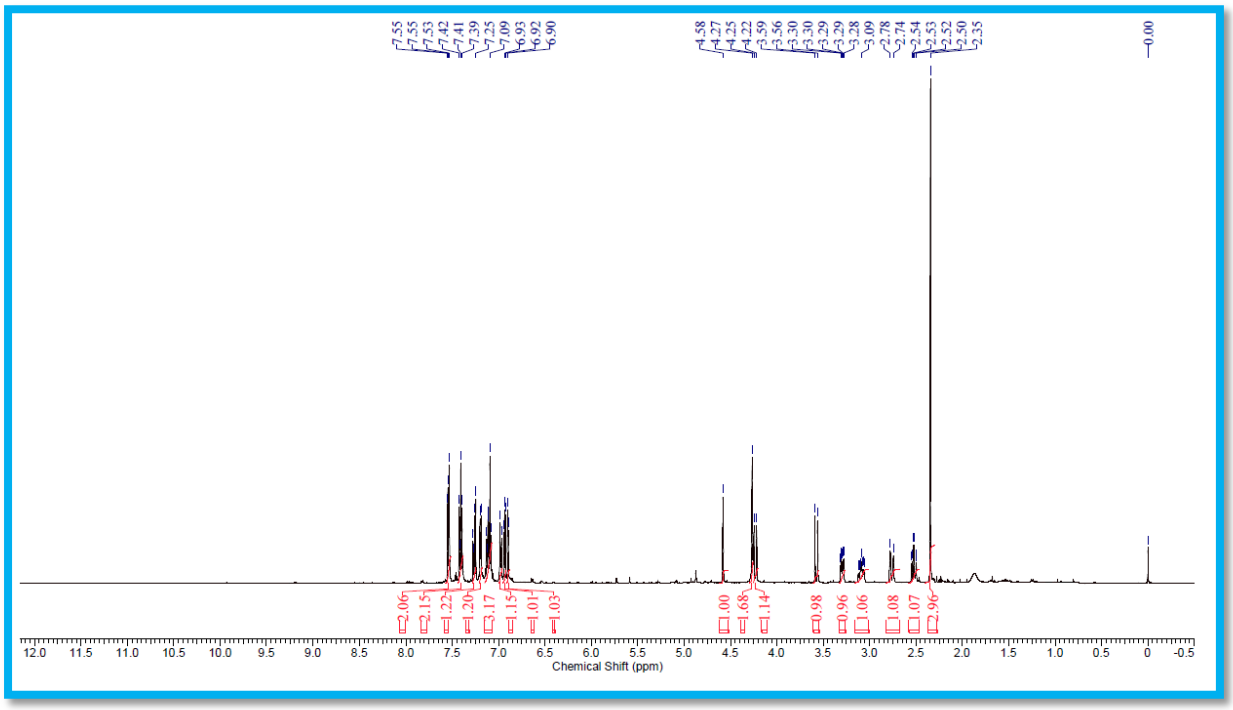


^{1}H-NMR of 4k



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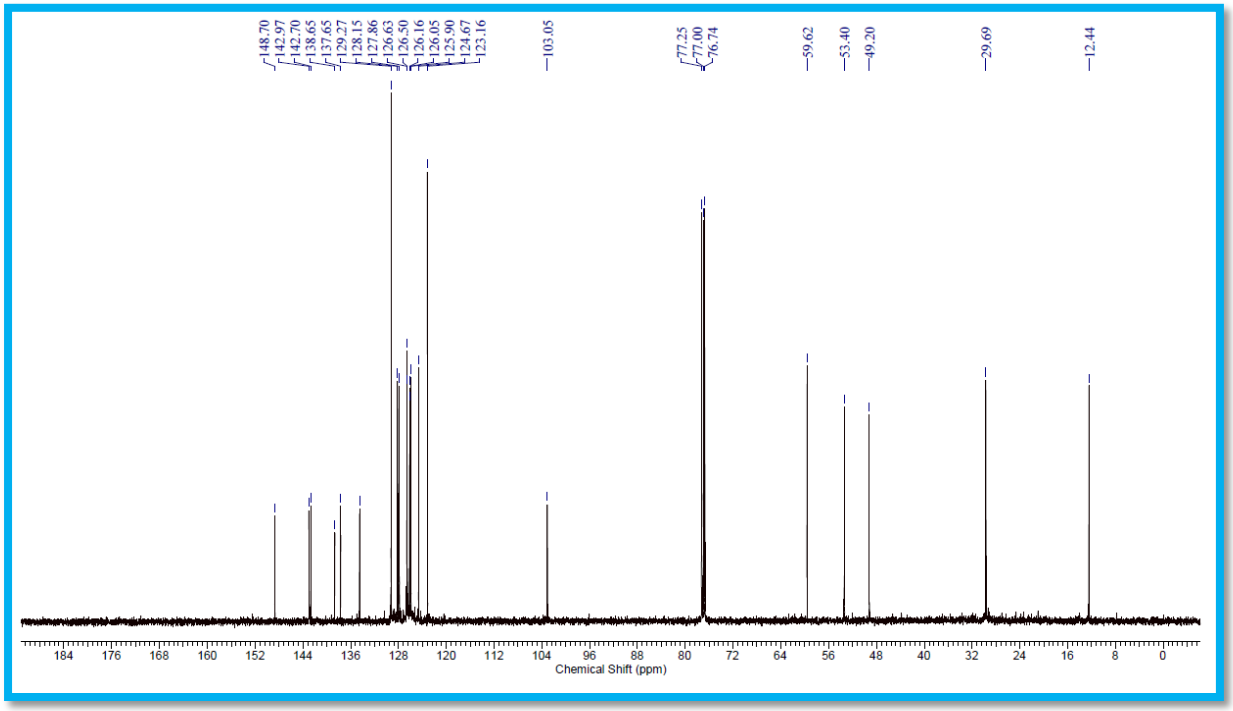
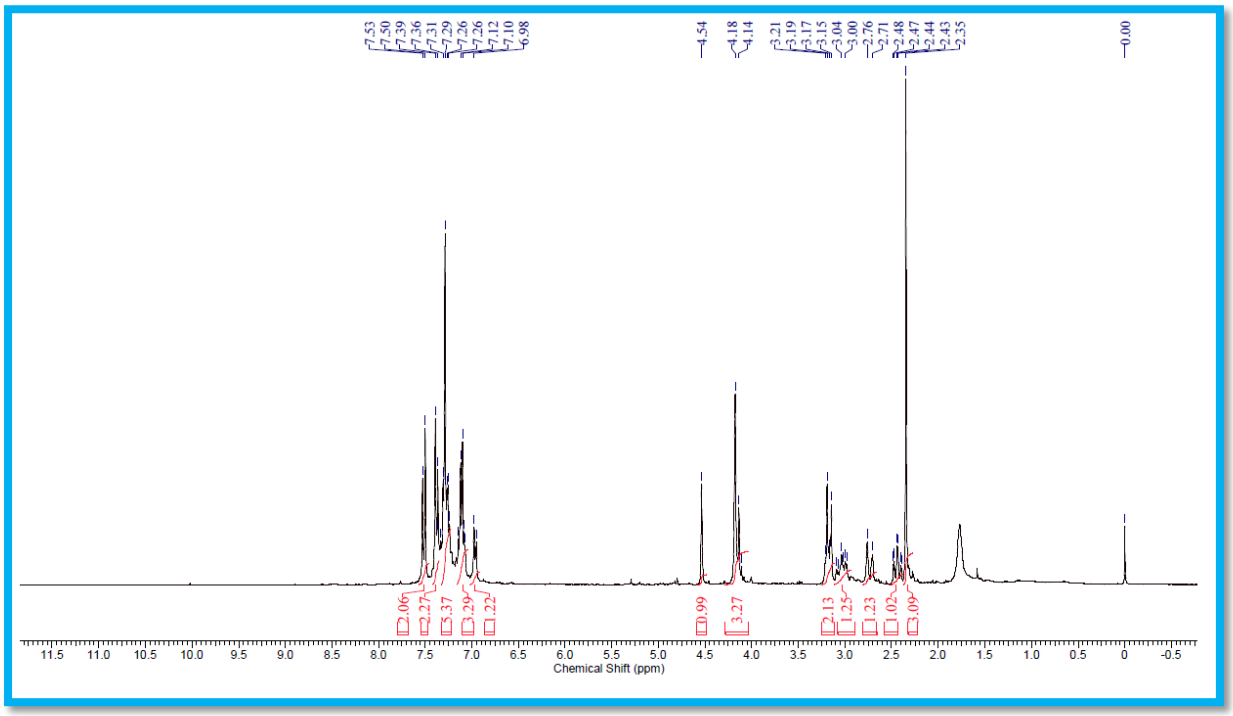
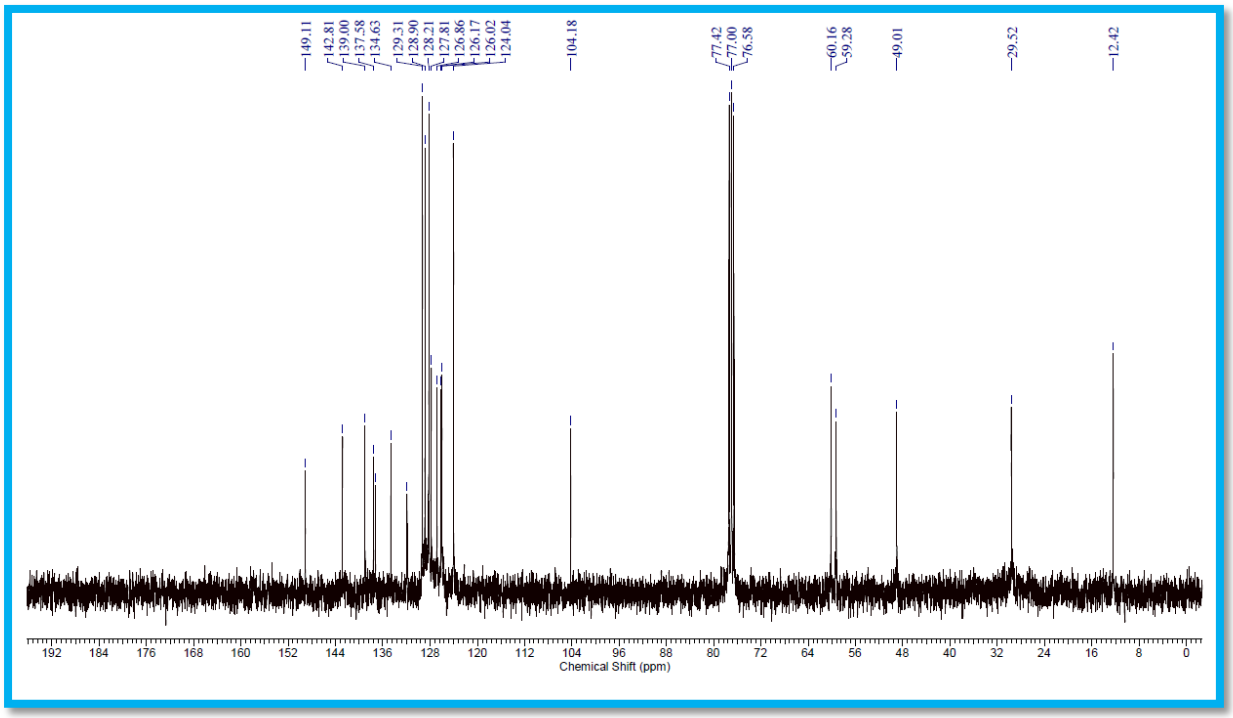


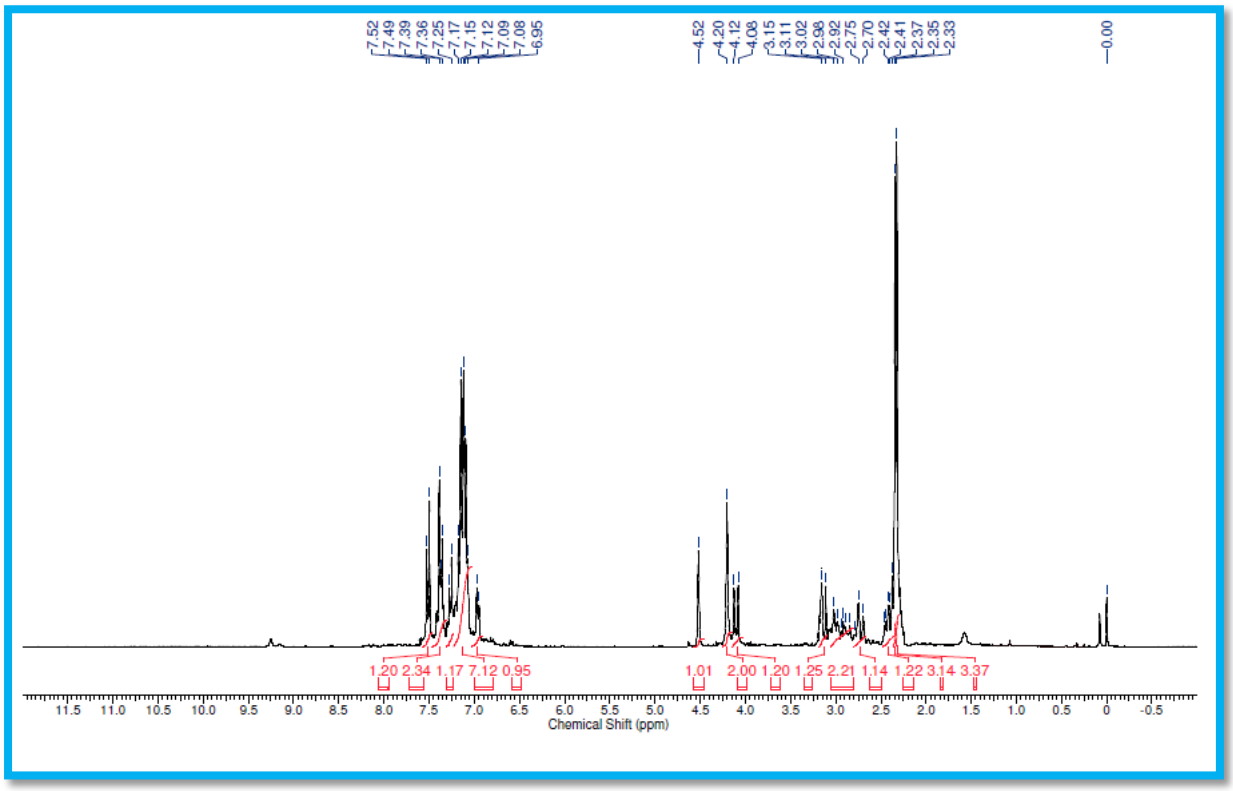
^{1}H-NMR of 4l



^{13}C-NMR of 4l



^{1}H-NMR of 4m



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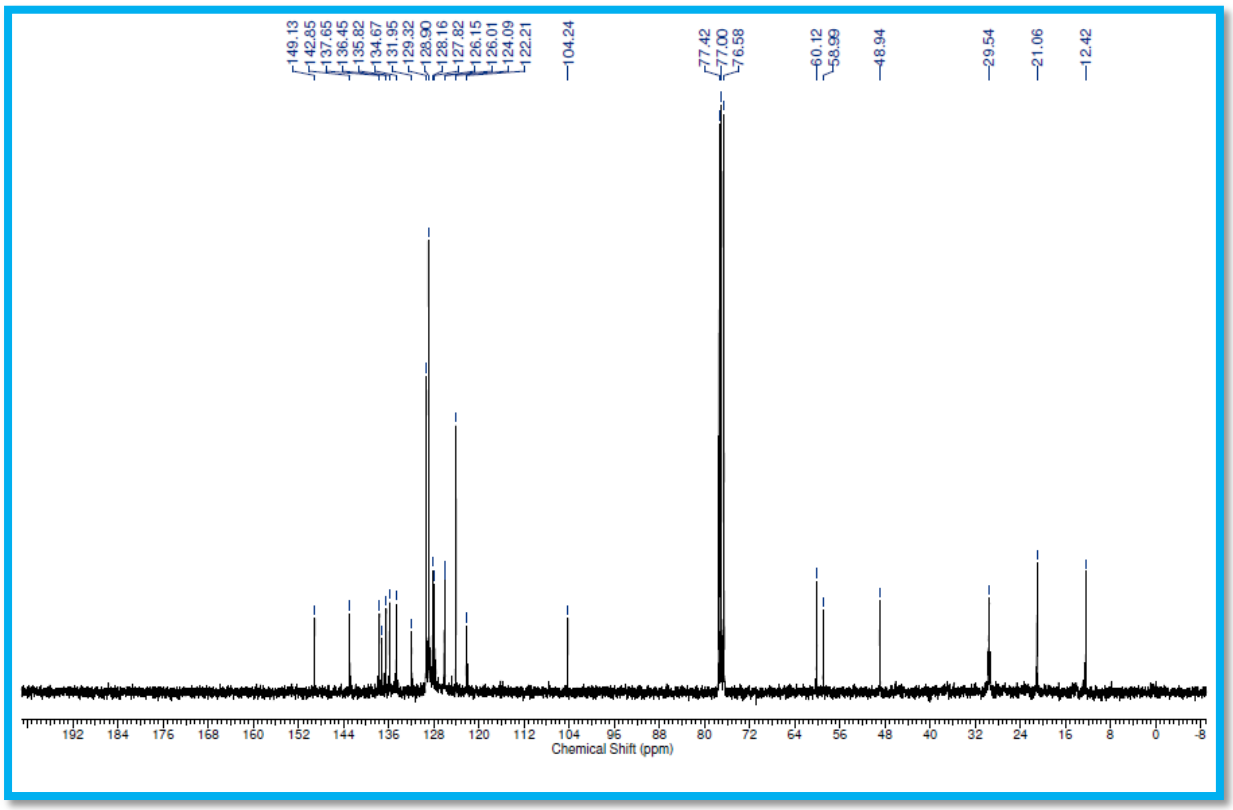
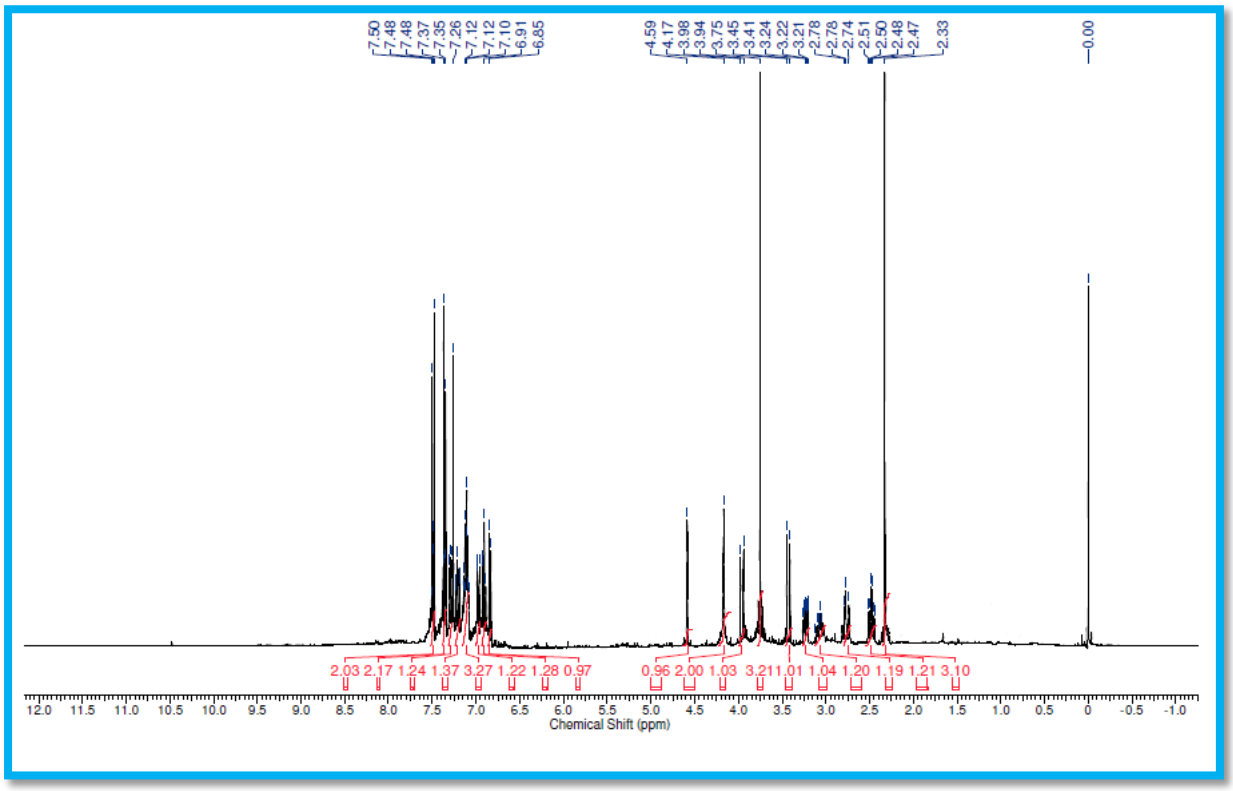


^{1}H-NMR of 4n



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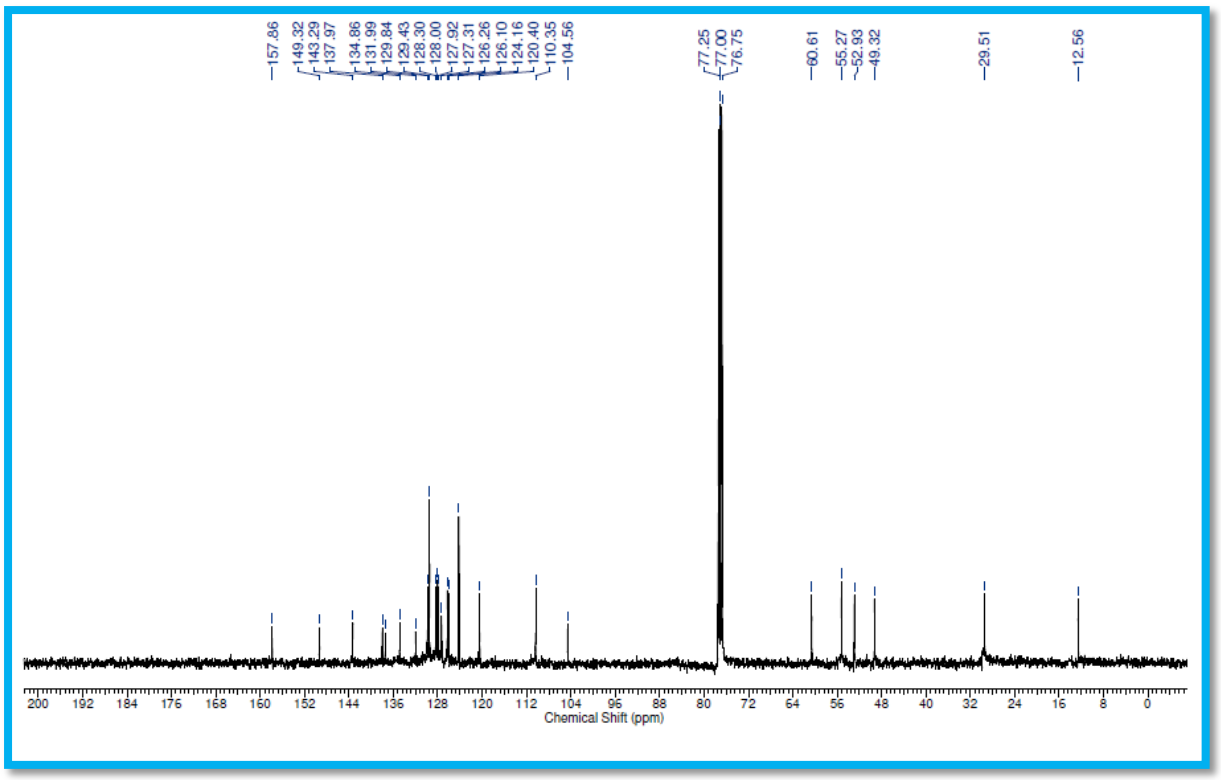
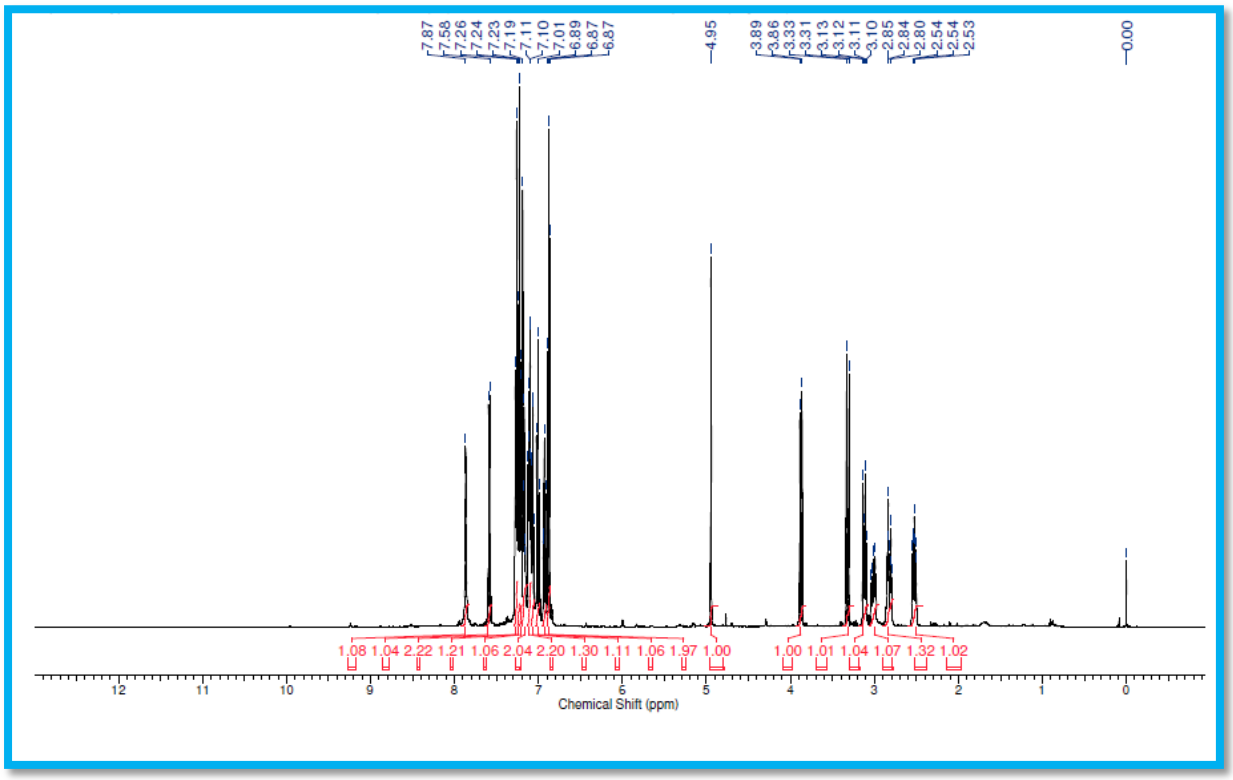


^{1}H-NMR of 7a



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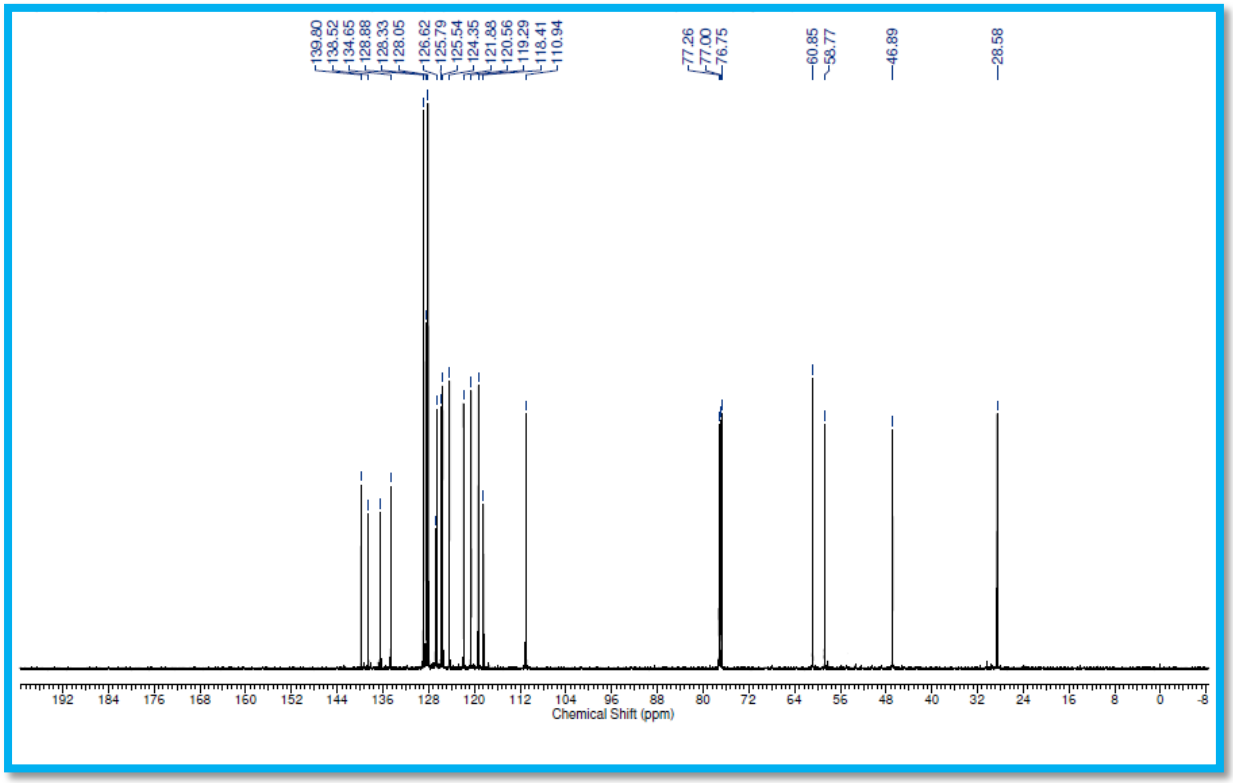
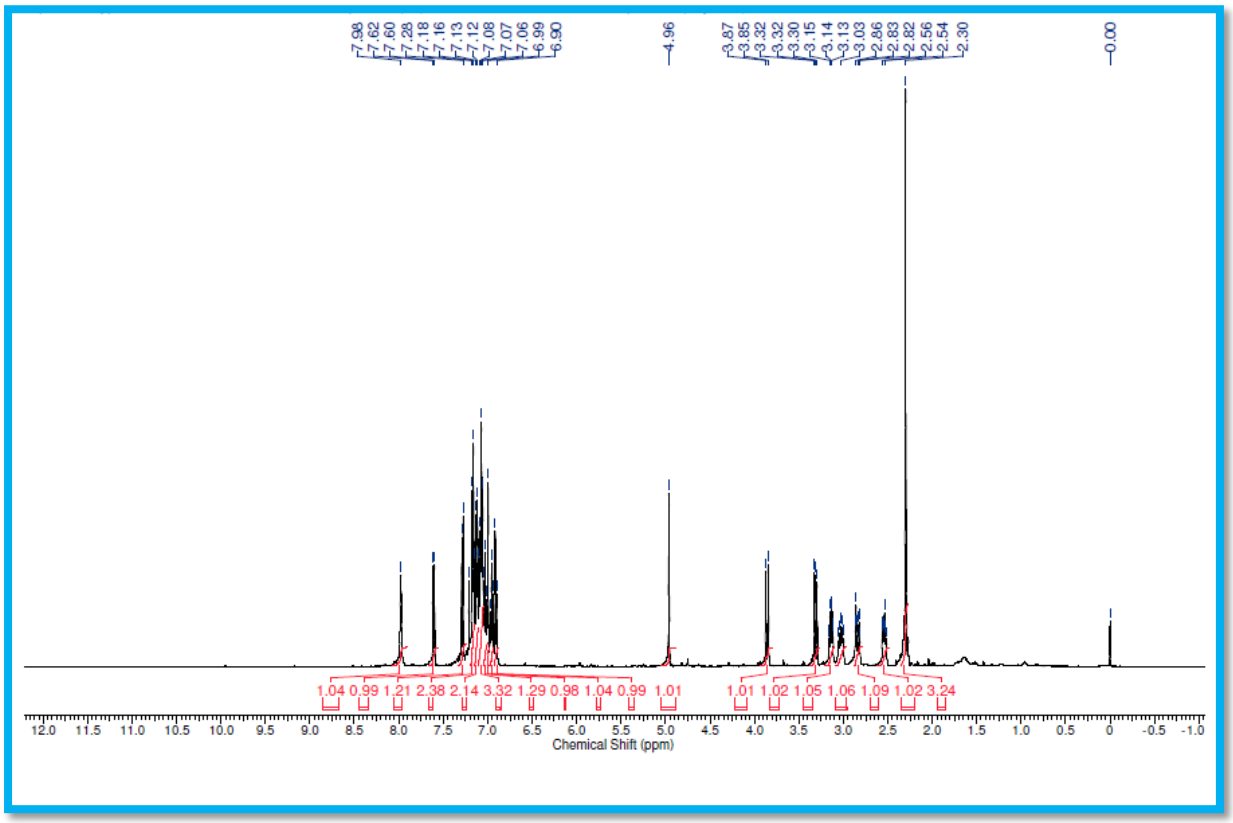


^{1}H-NMR of 7b



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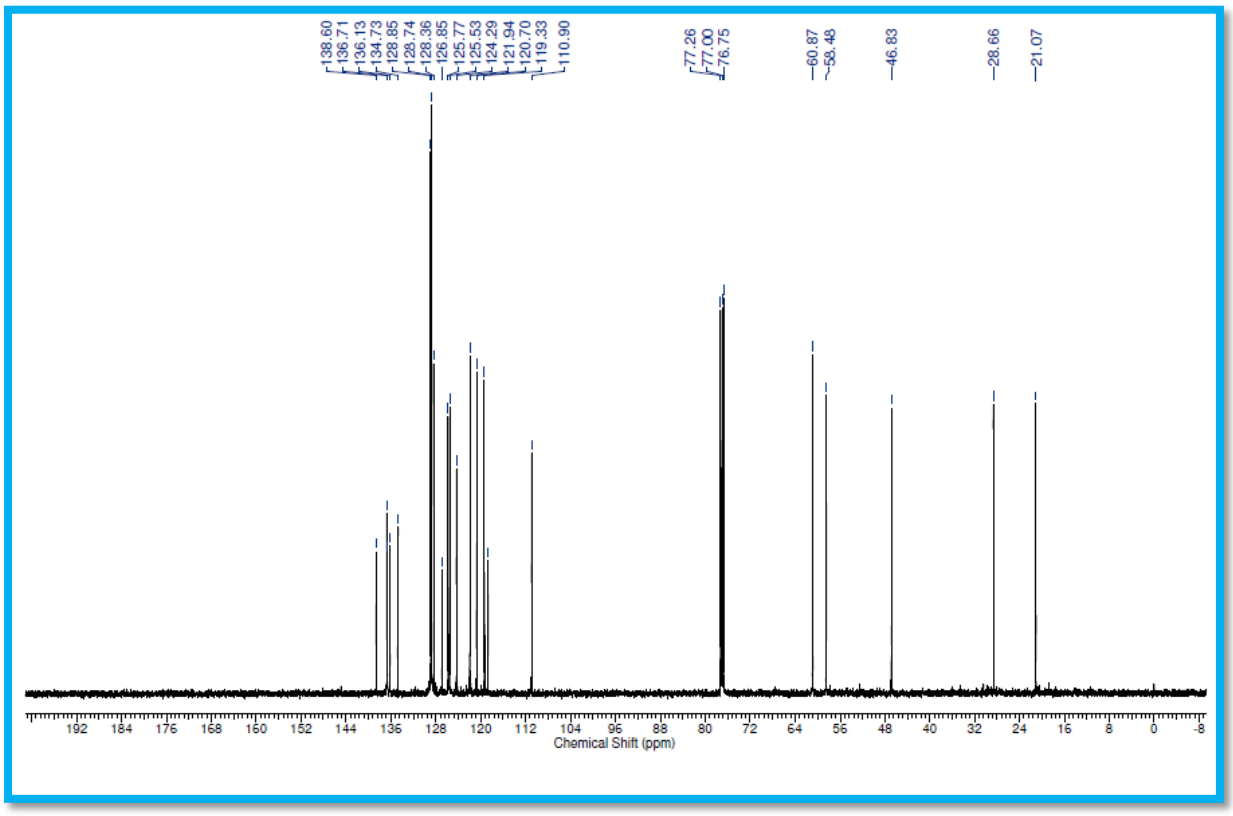
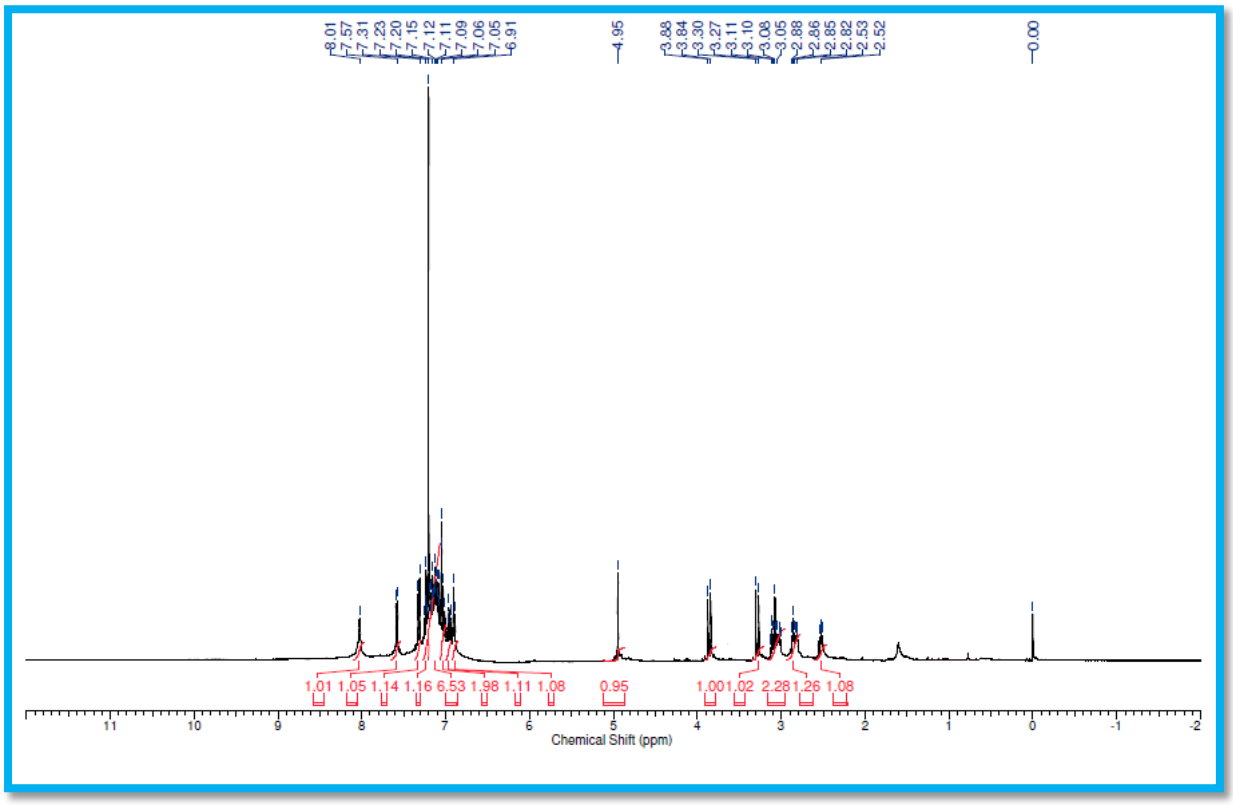


^{1}H-NMR of 7c



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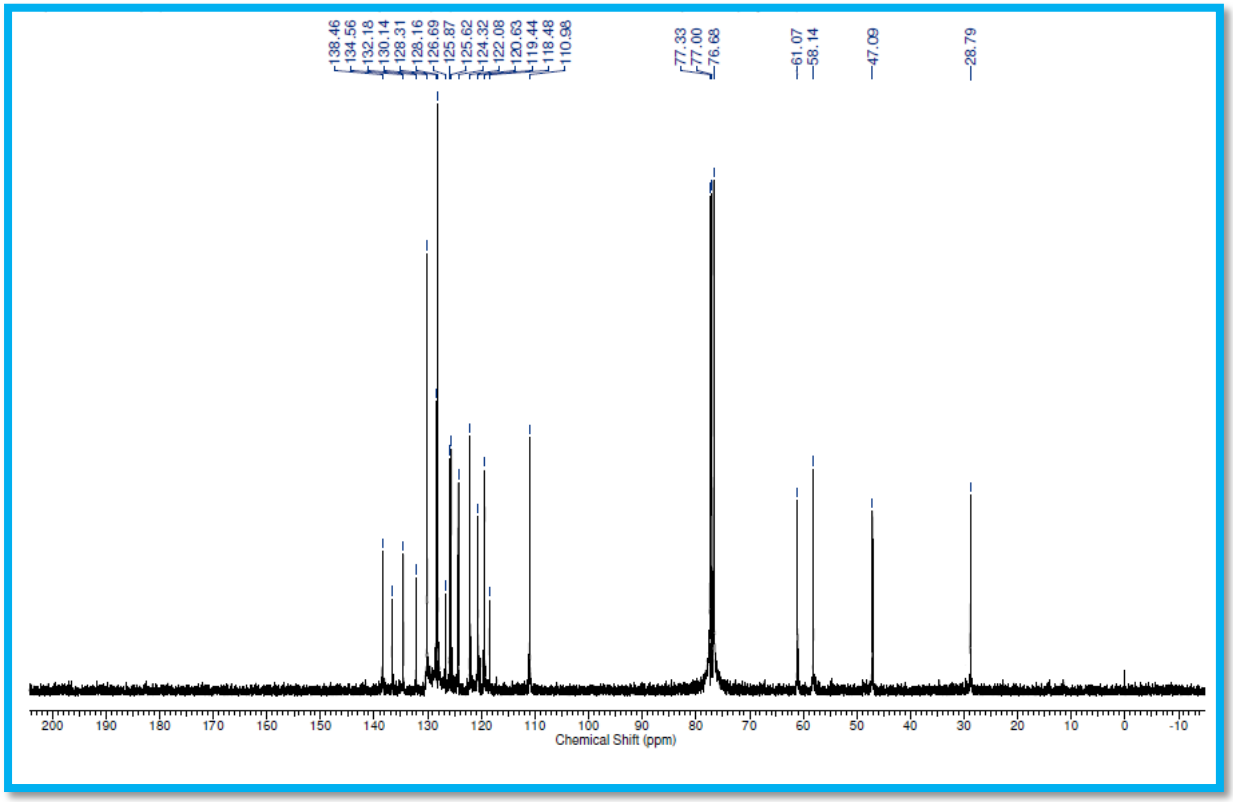
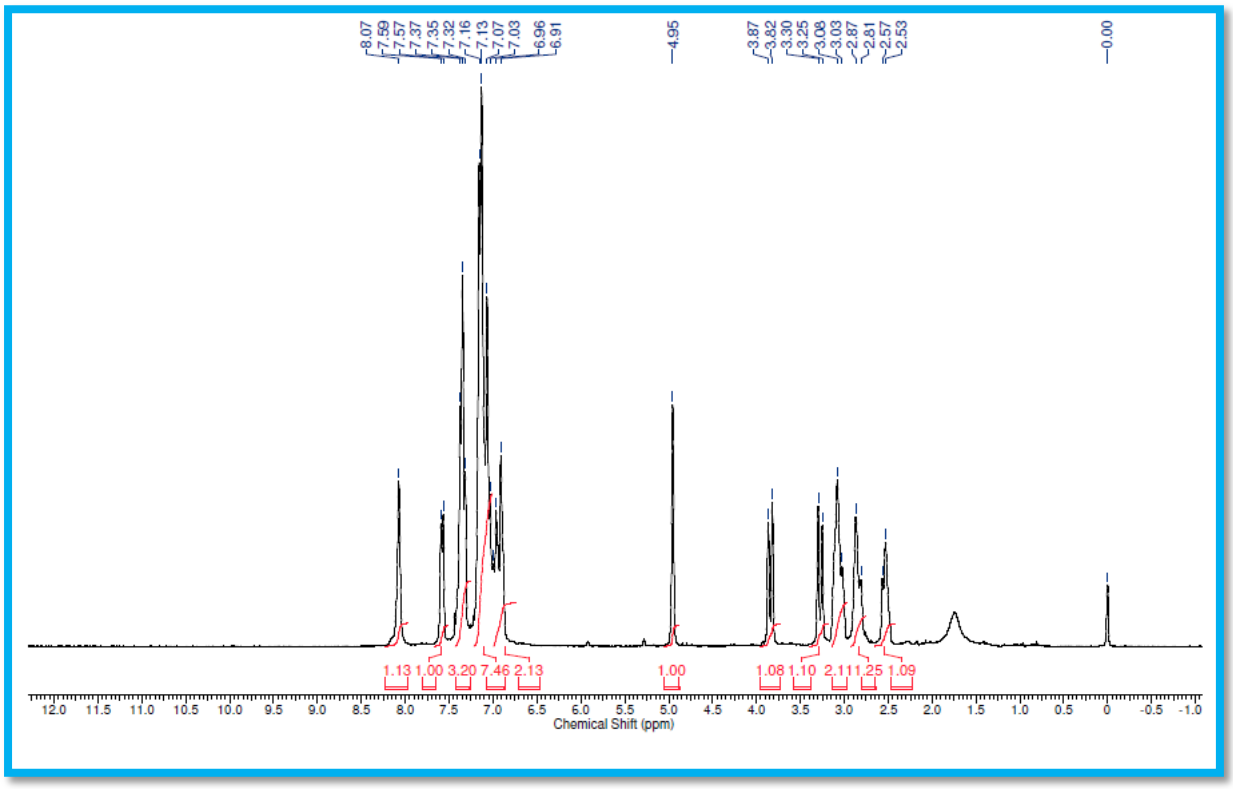
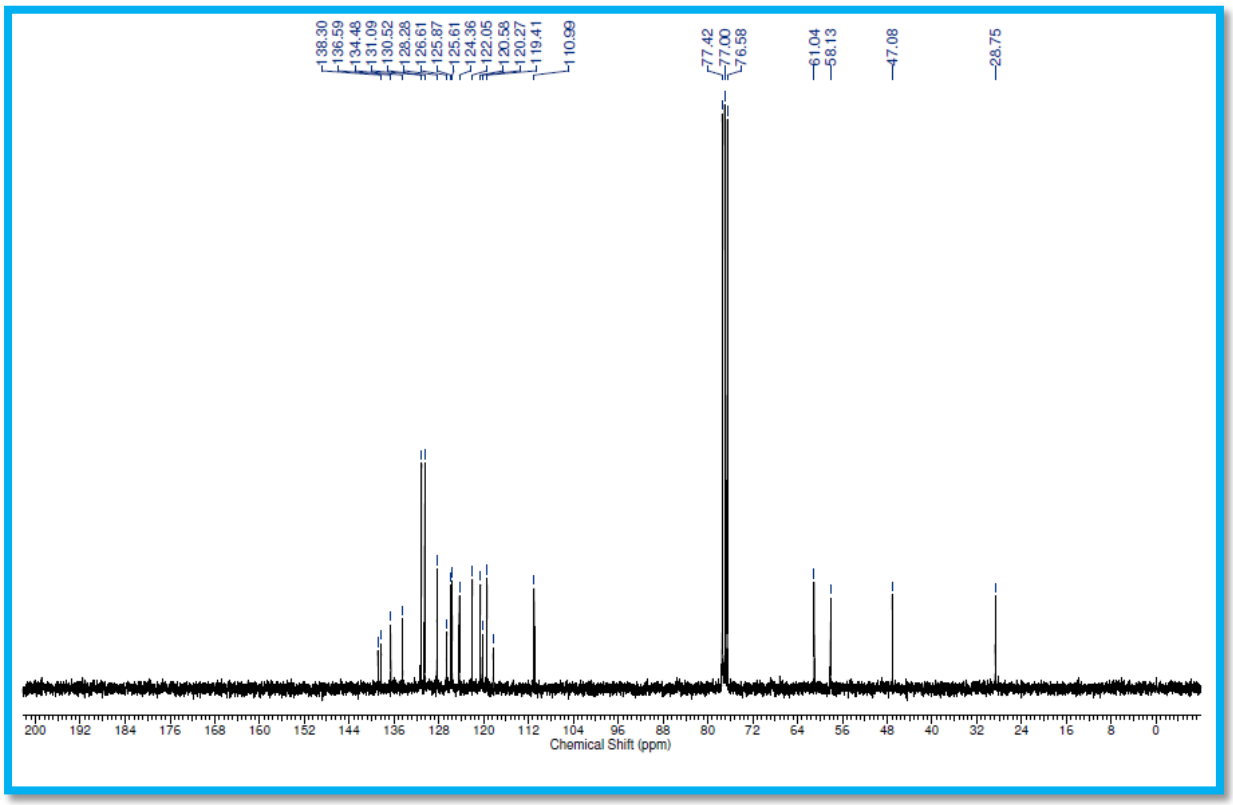


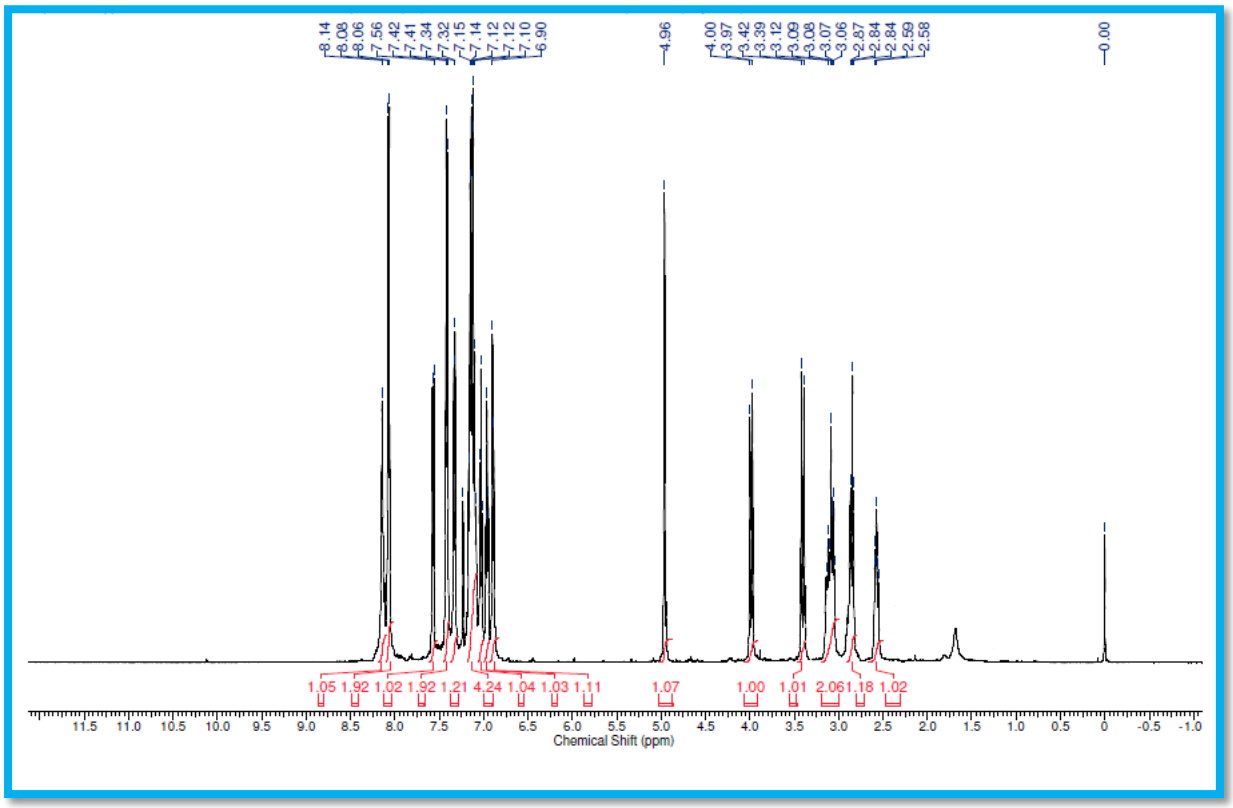
^{1}H-NMR of 7d



^{13}C-NMR of 7d



^{1}H-NMR of 7e



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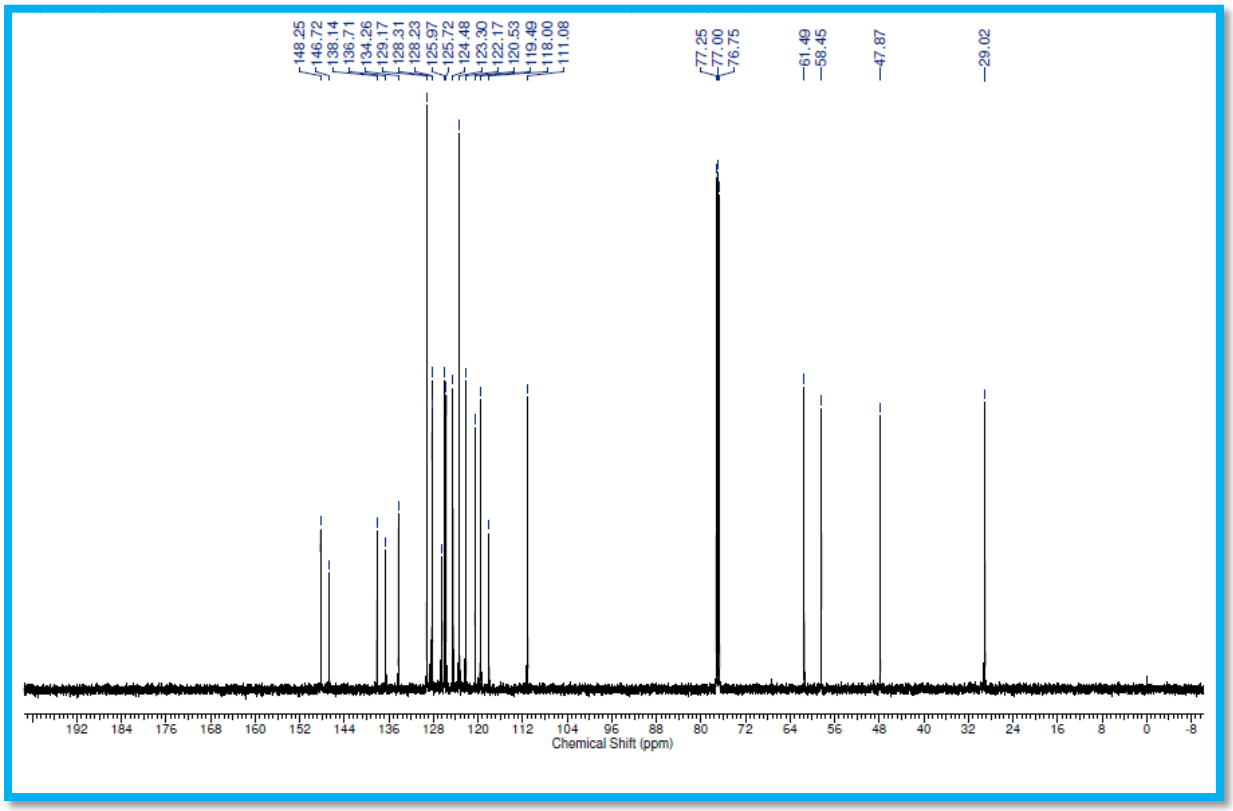
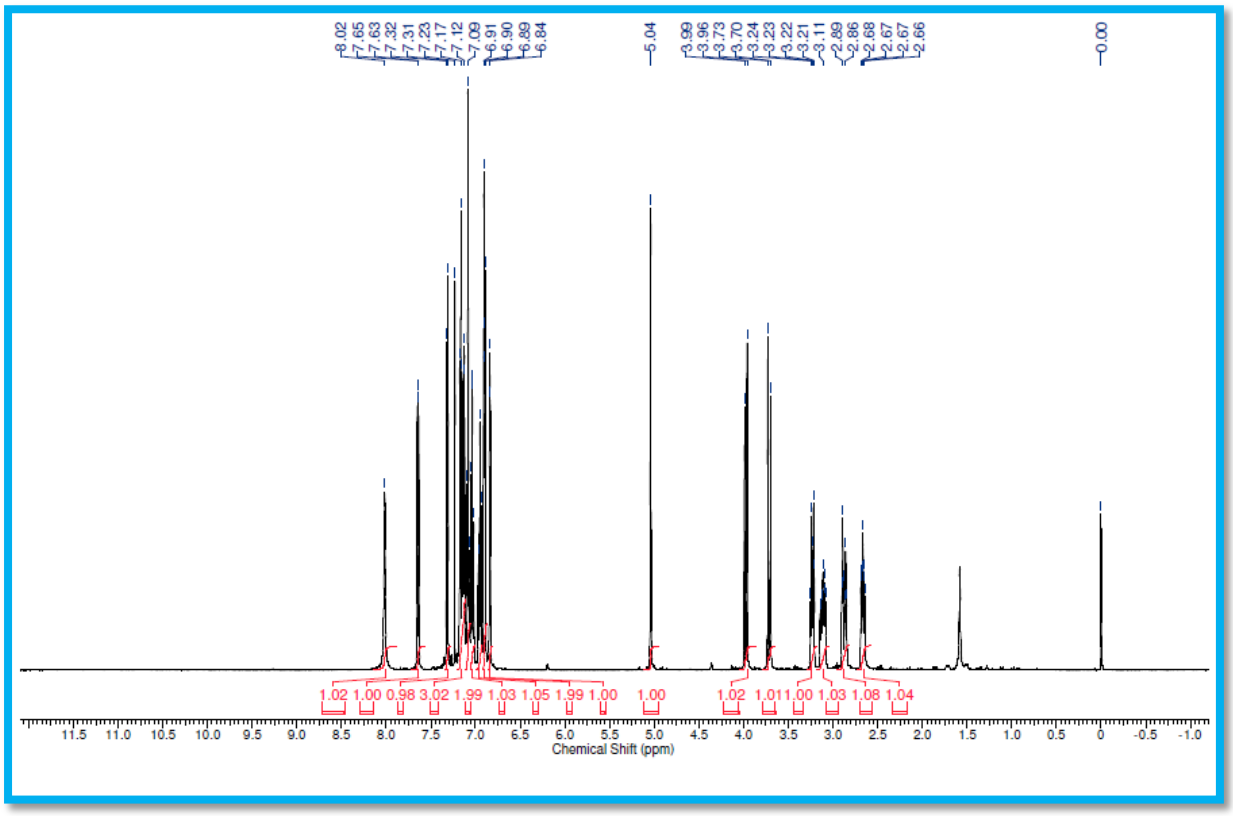
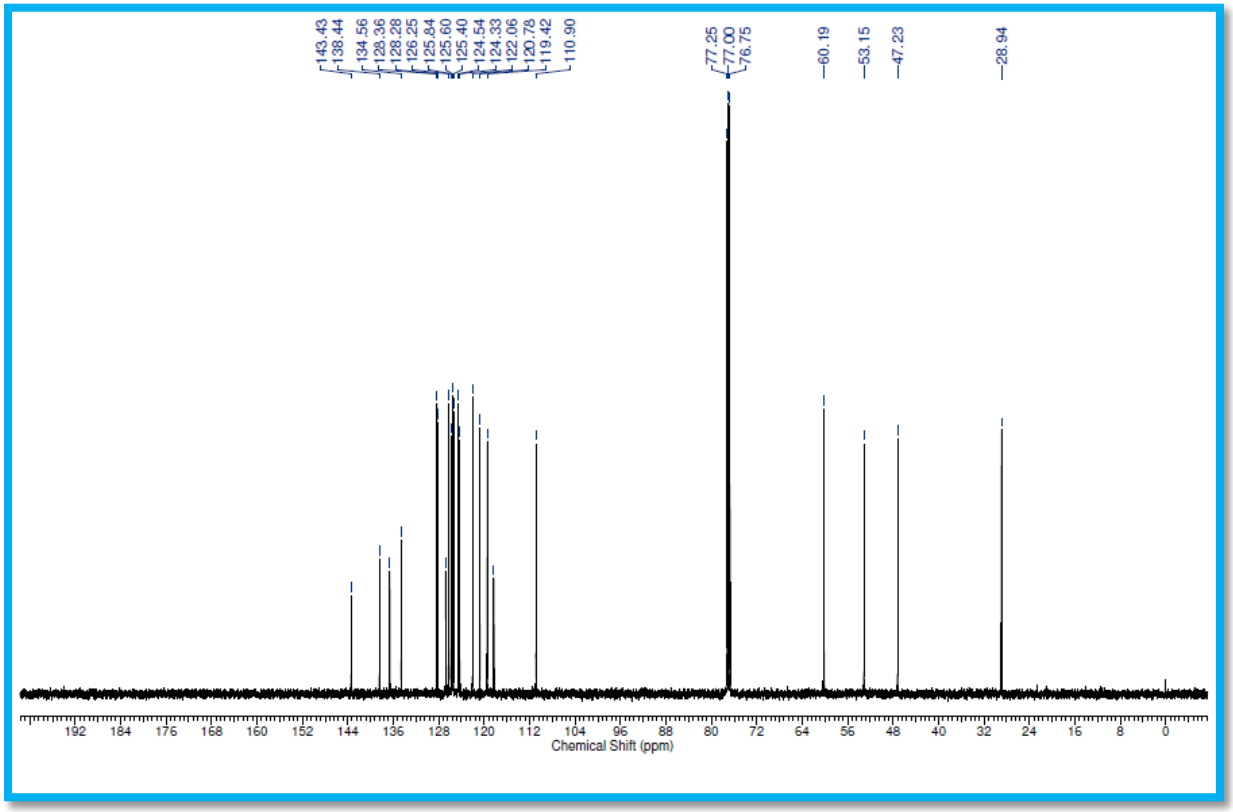


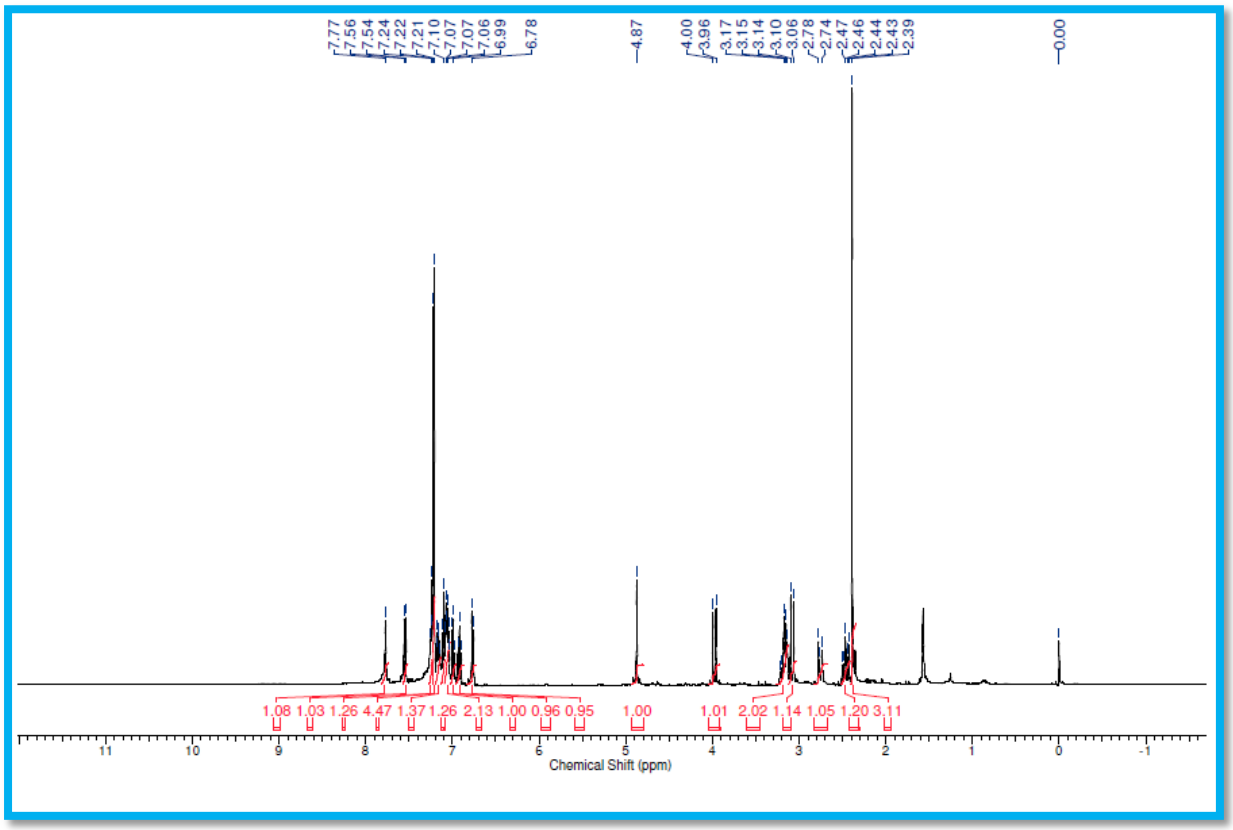
^{1}H-NMR of 7f



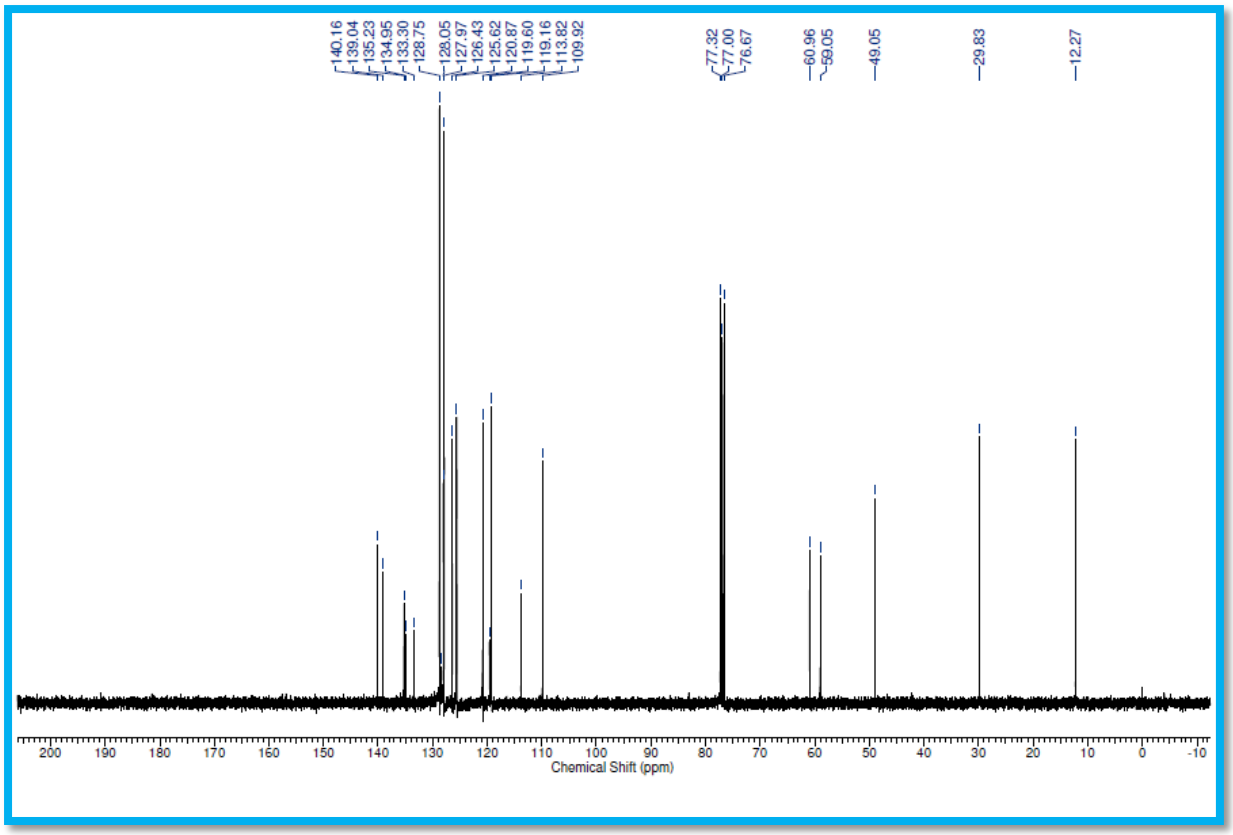
^{13}C-NMR of 7f



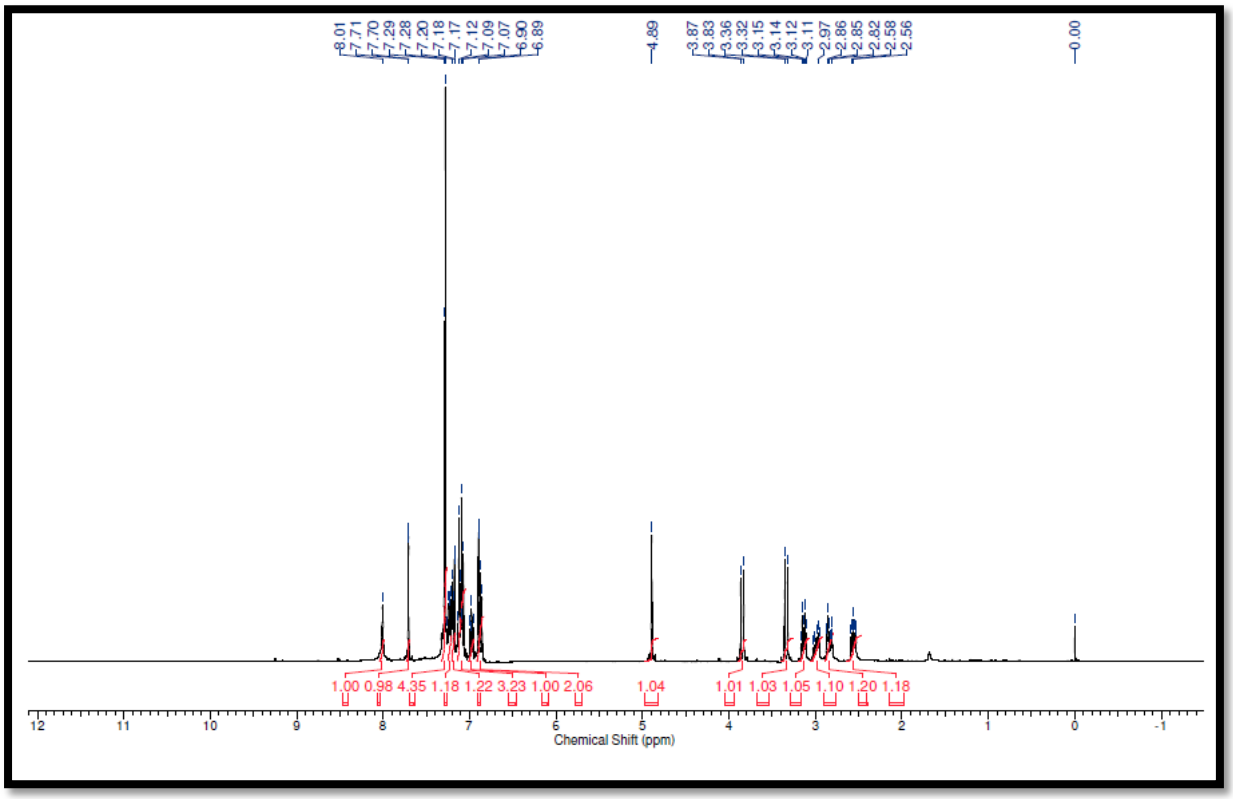
^{1}H-NMR of 7g



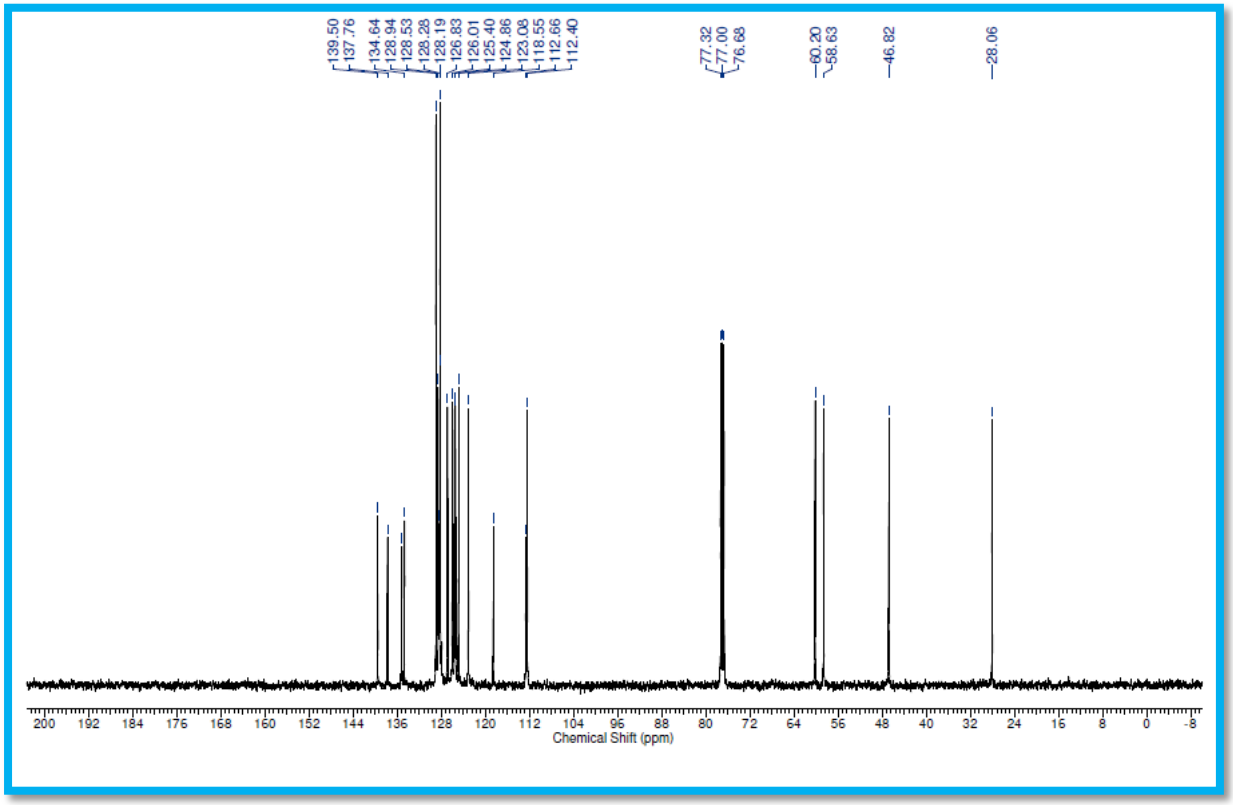
^{13}C-NMR of 7g



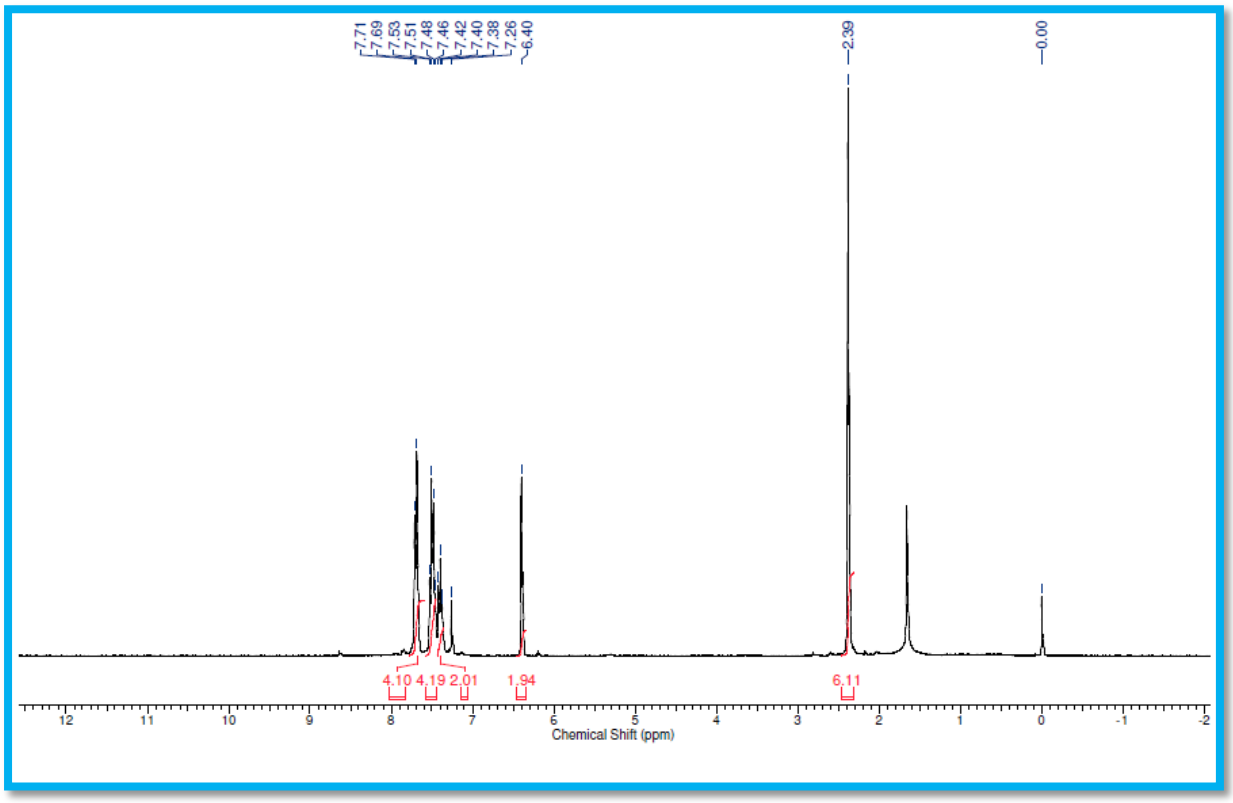
^{1}H-NMR of 7h



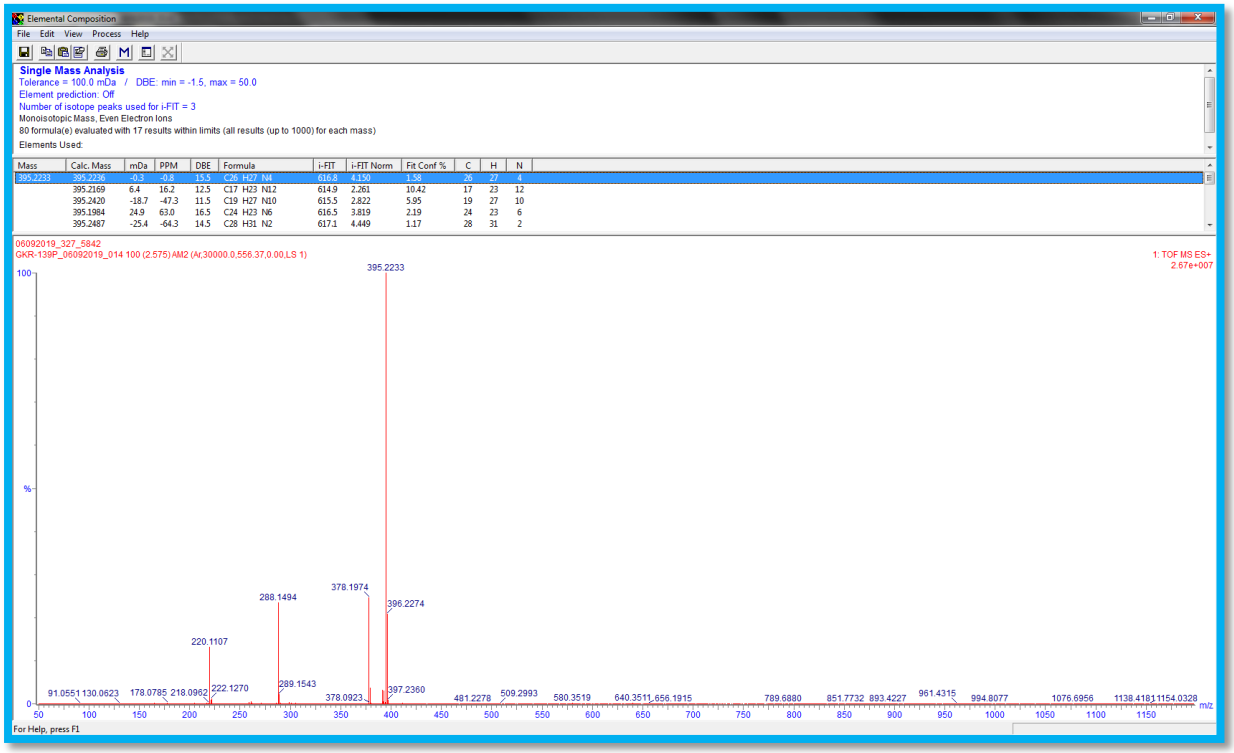
^{13}C-NMR of 7h



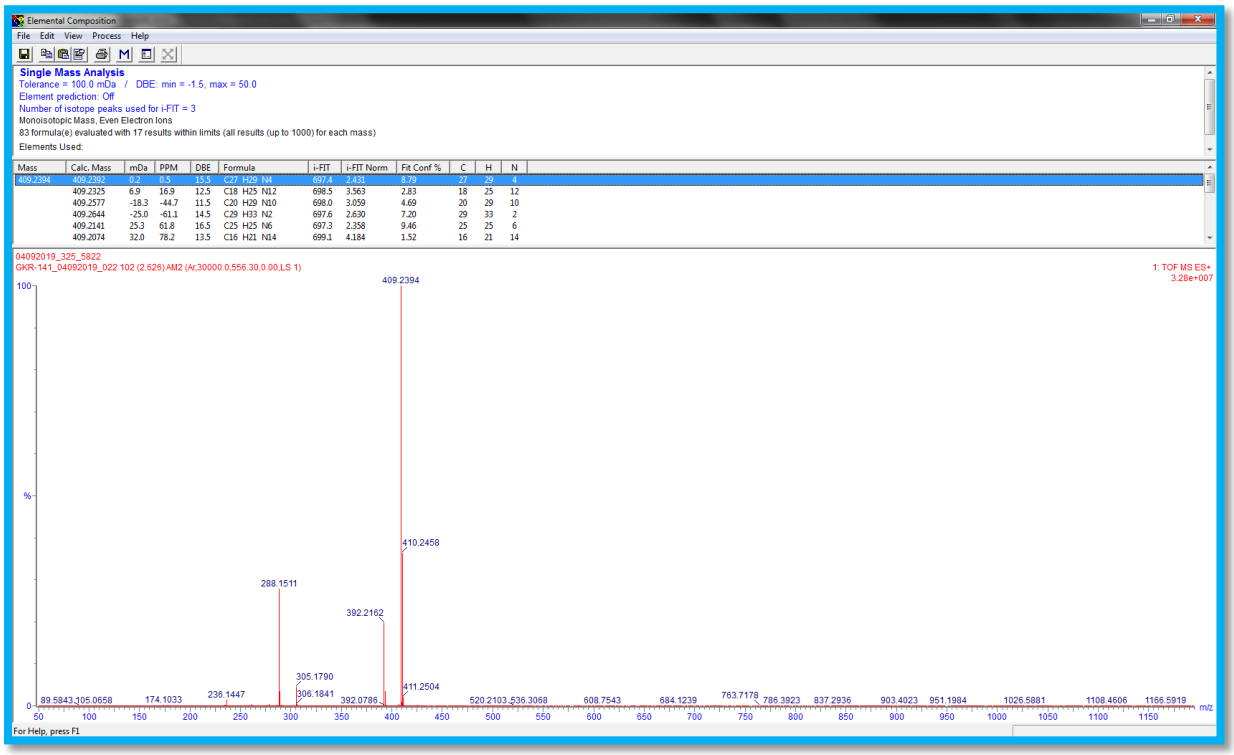
^{1}H-NMR of 5



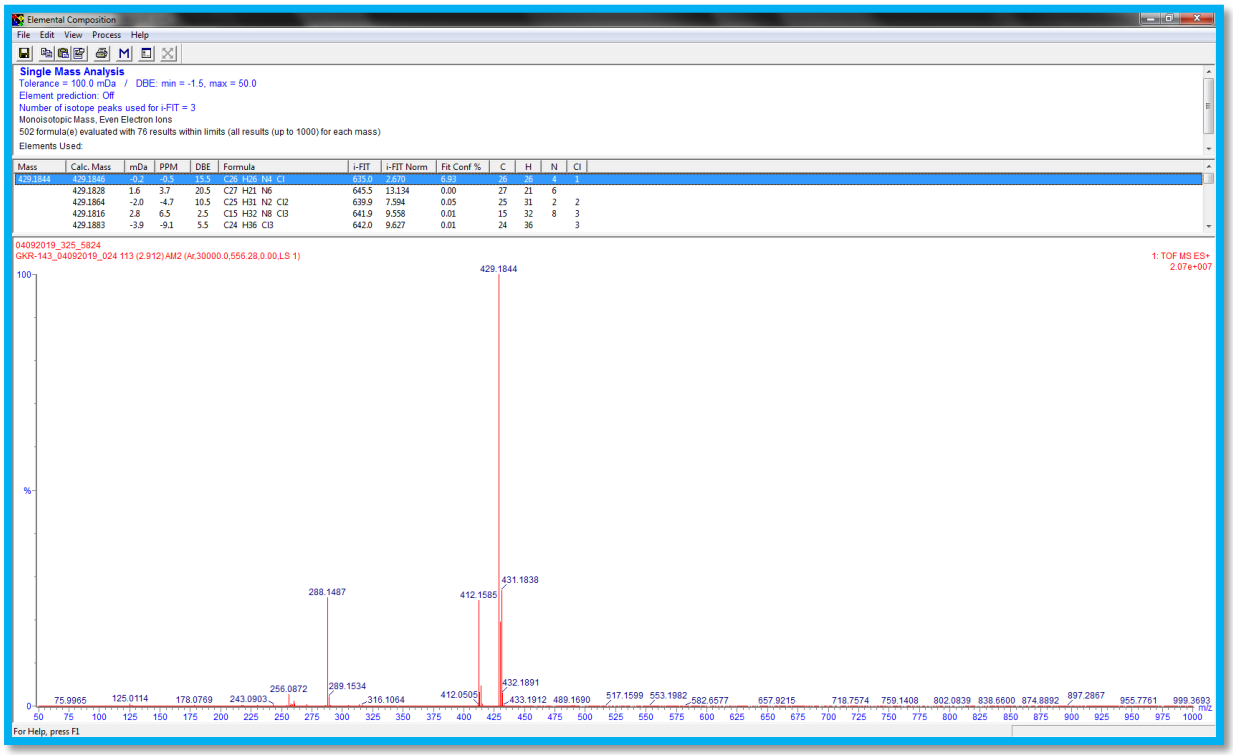
HRMS of 4a



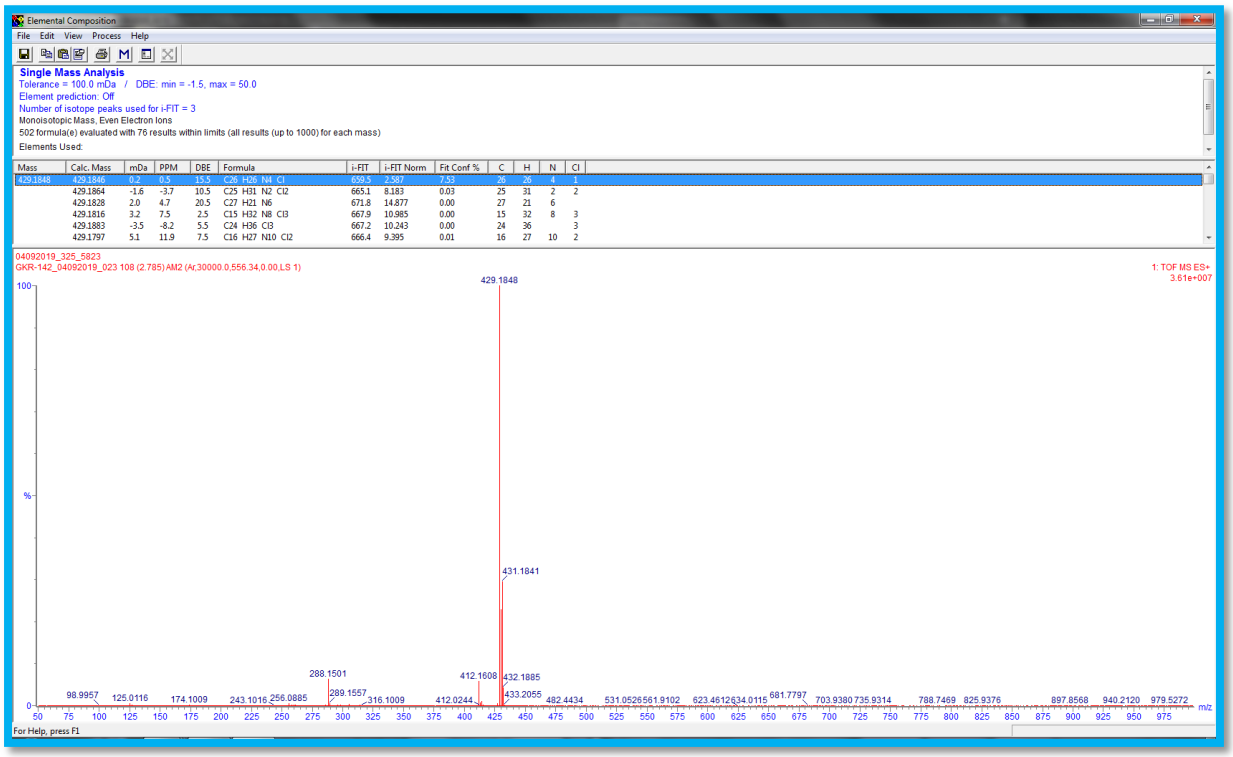
HRMS of 4b



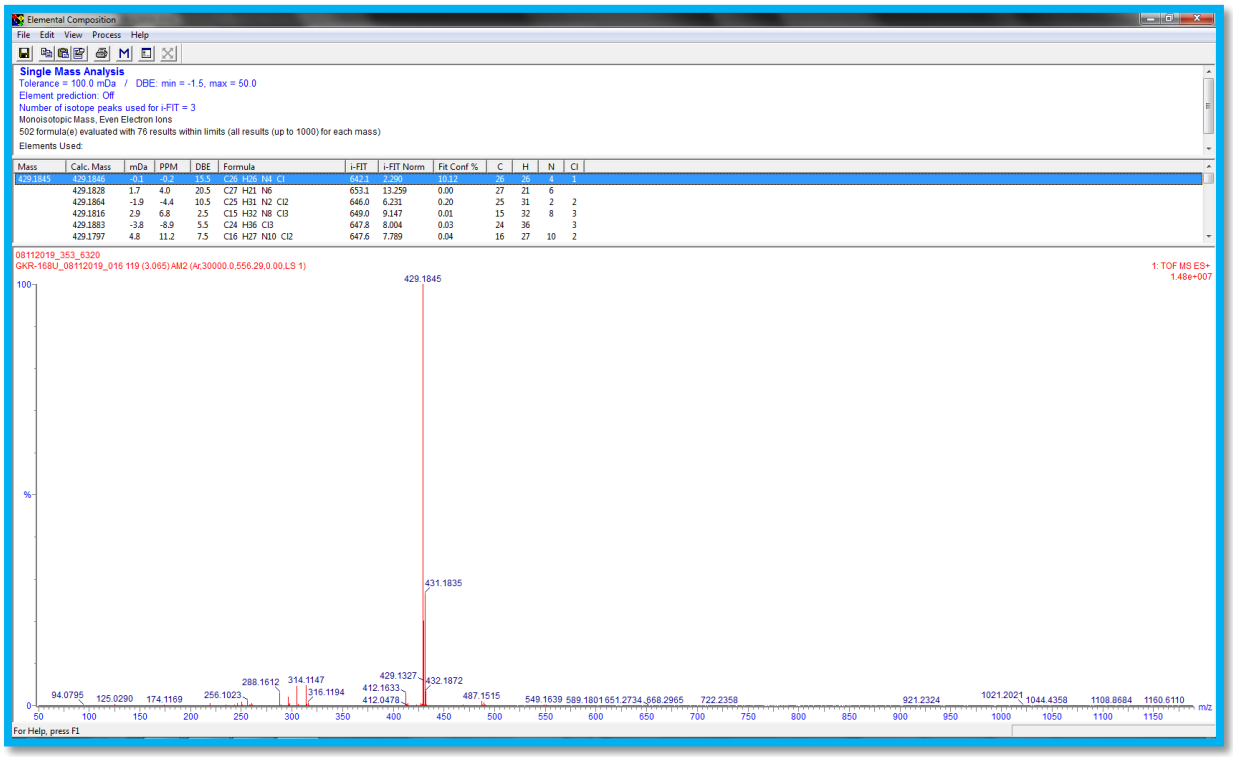
HRMS of 4c



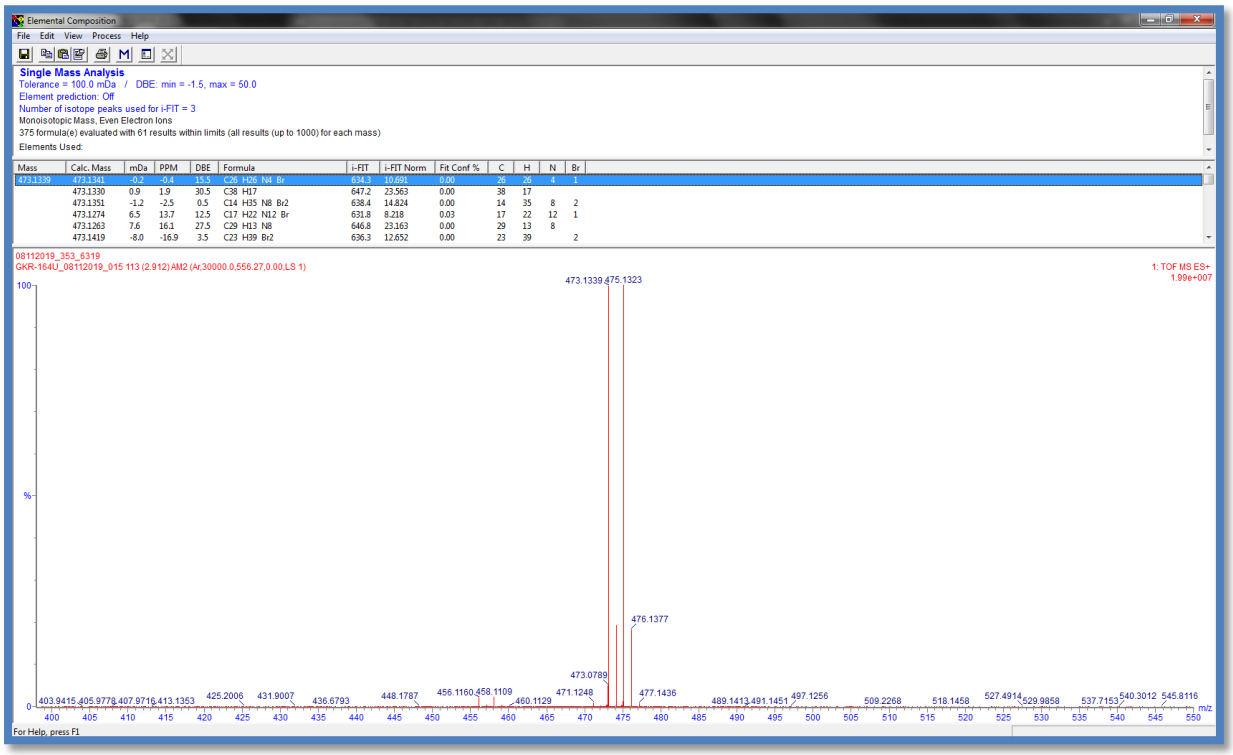
HRMS of 4d



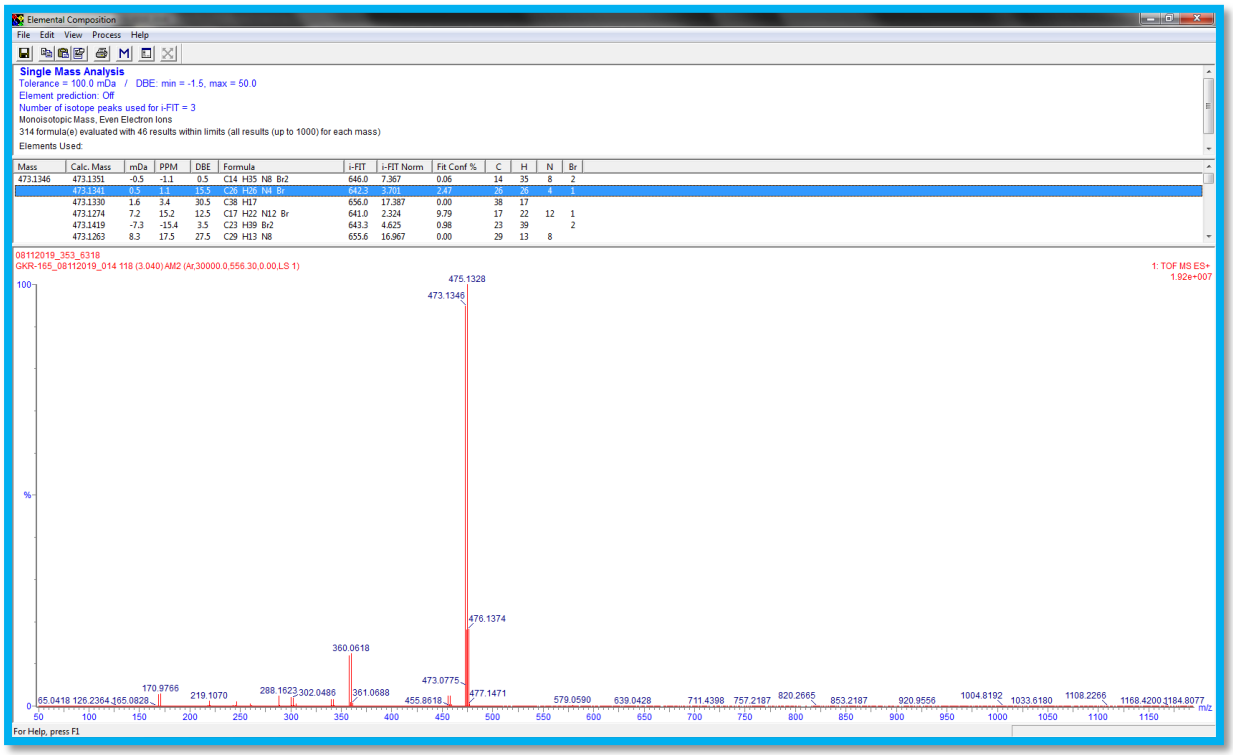
HRMS of 4e



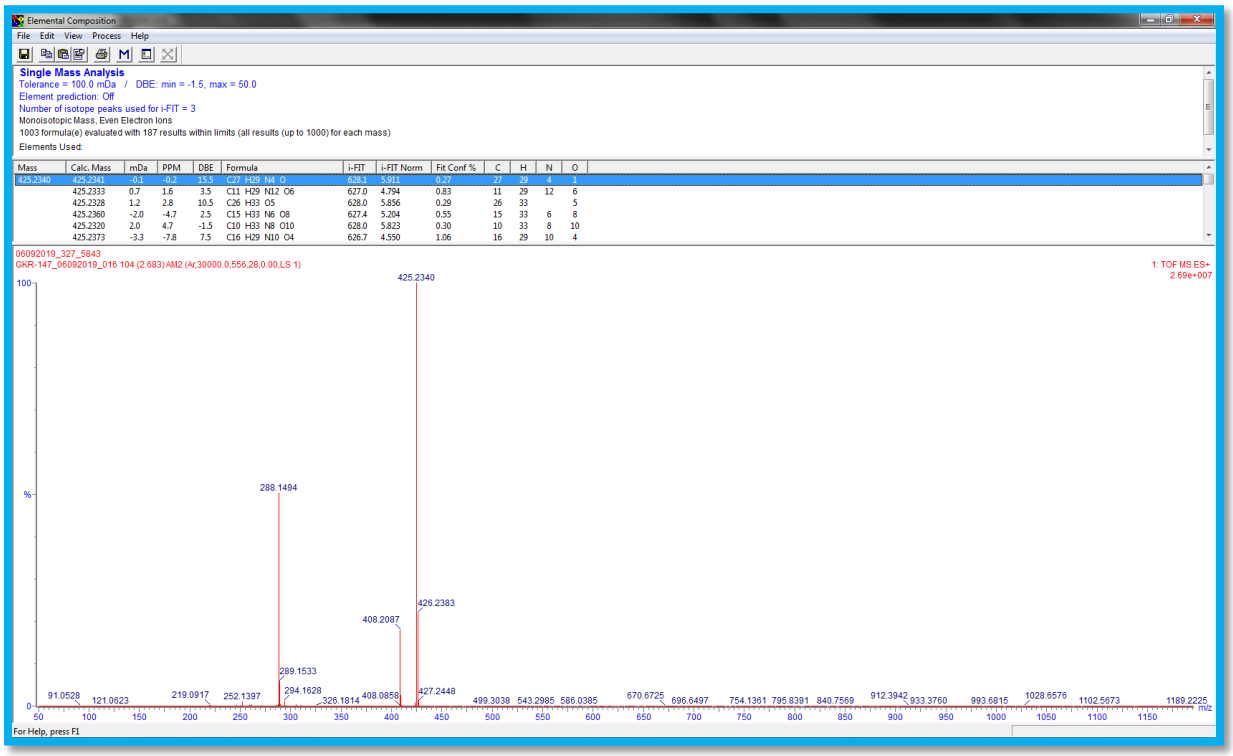
HRMS of 4f



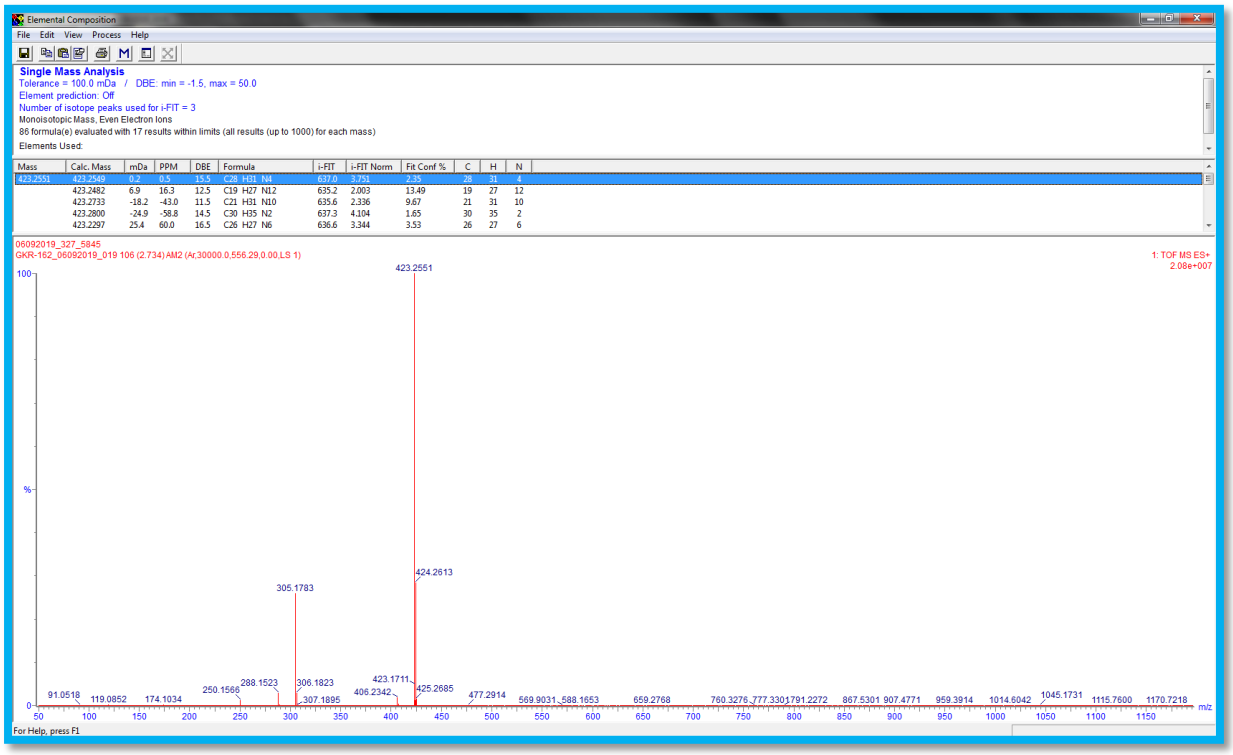
HRMS of 4g



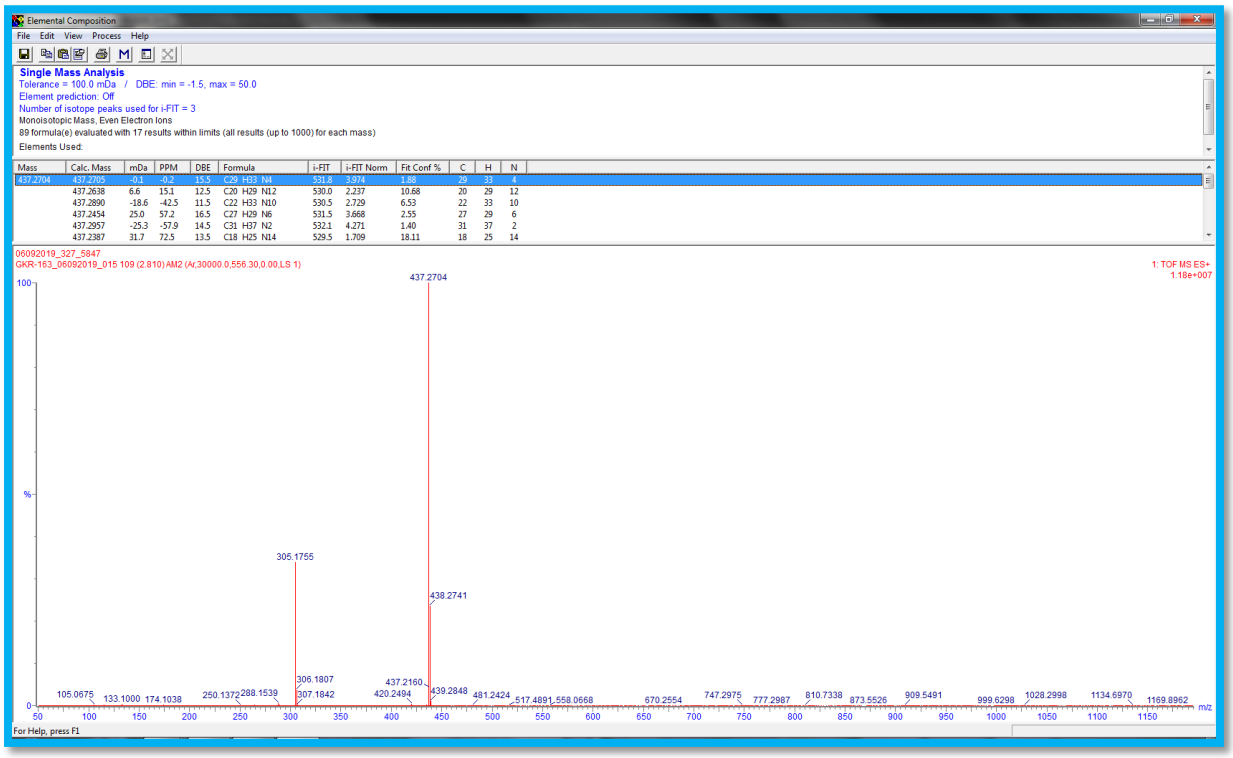
HRMS of 4h



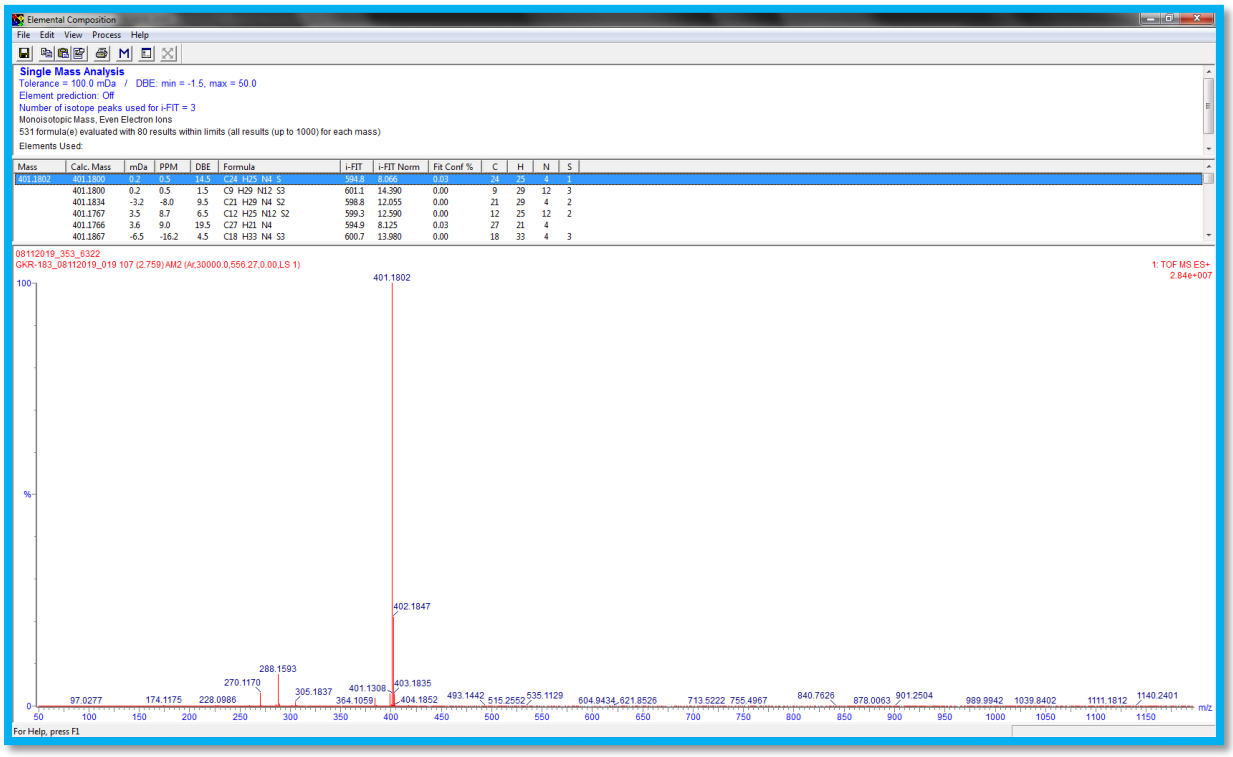
HRMS of 4i



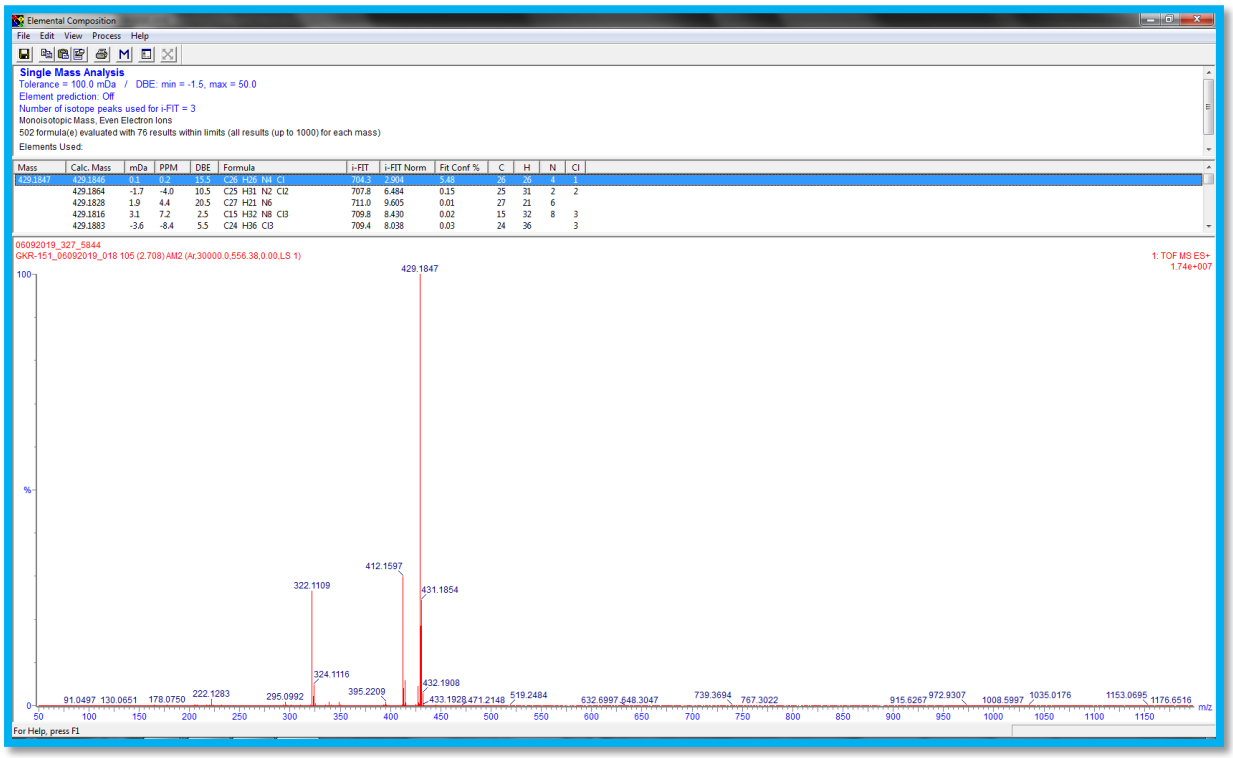
HRMS of 4j



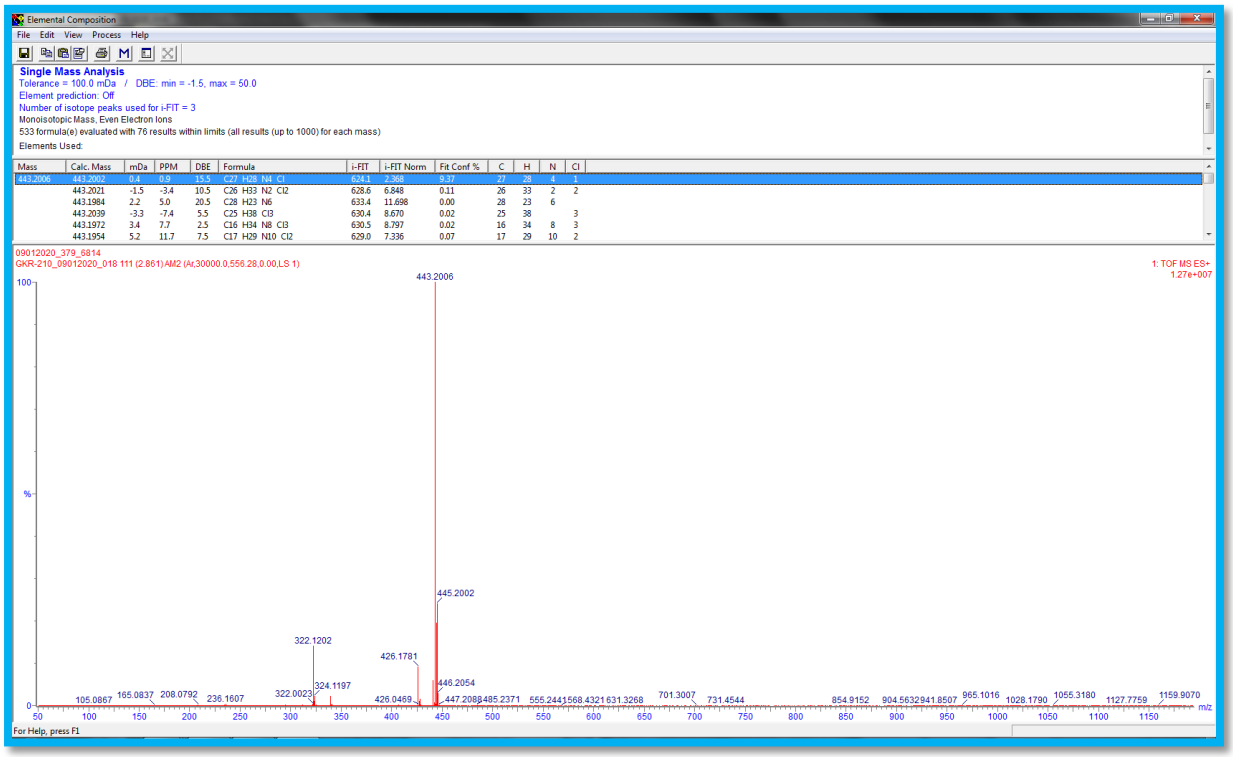
HRMS of 4k



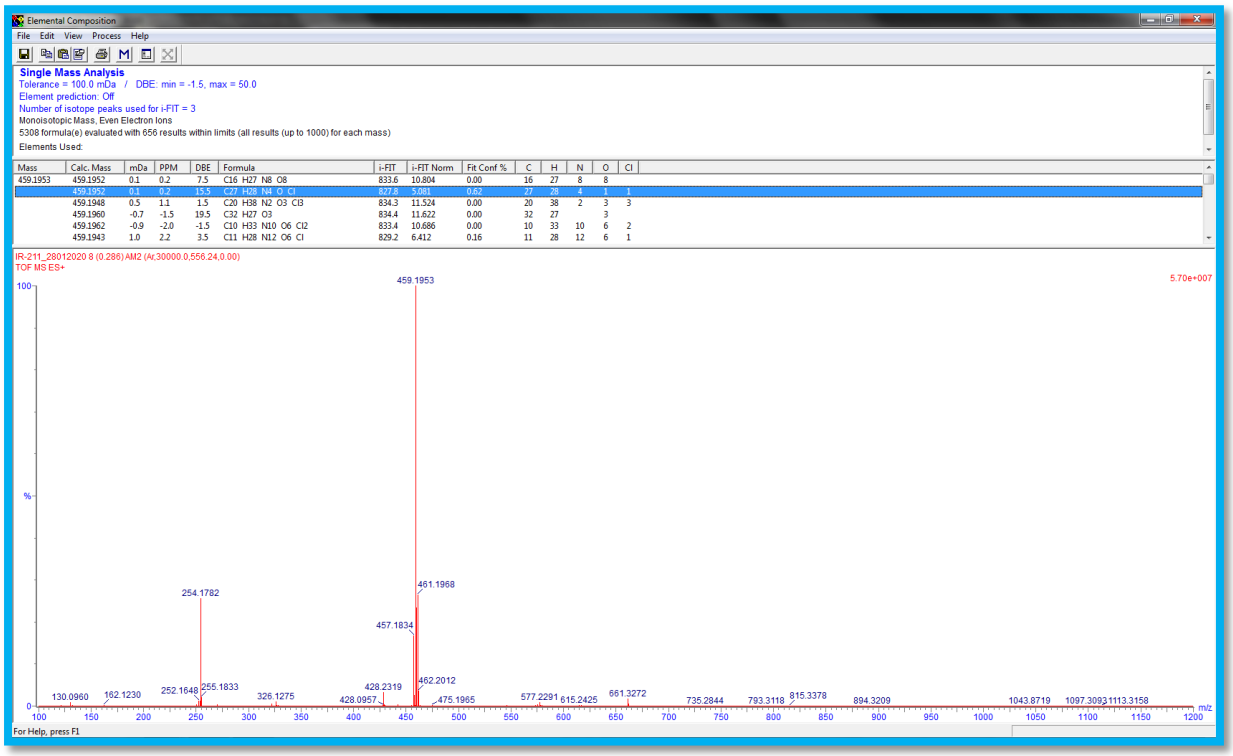
HRMS of 4l



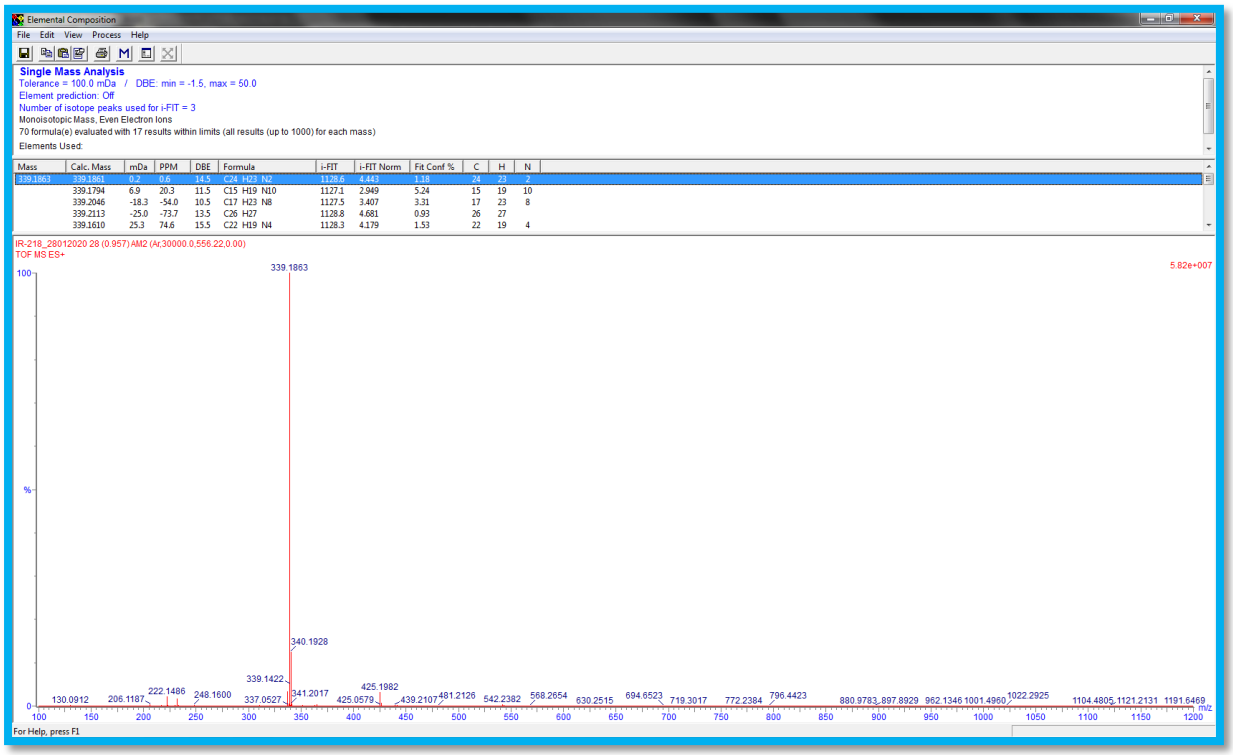
HRMS of 4m



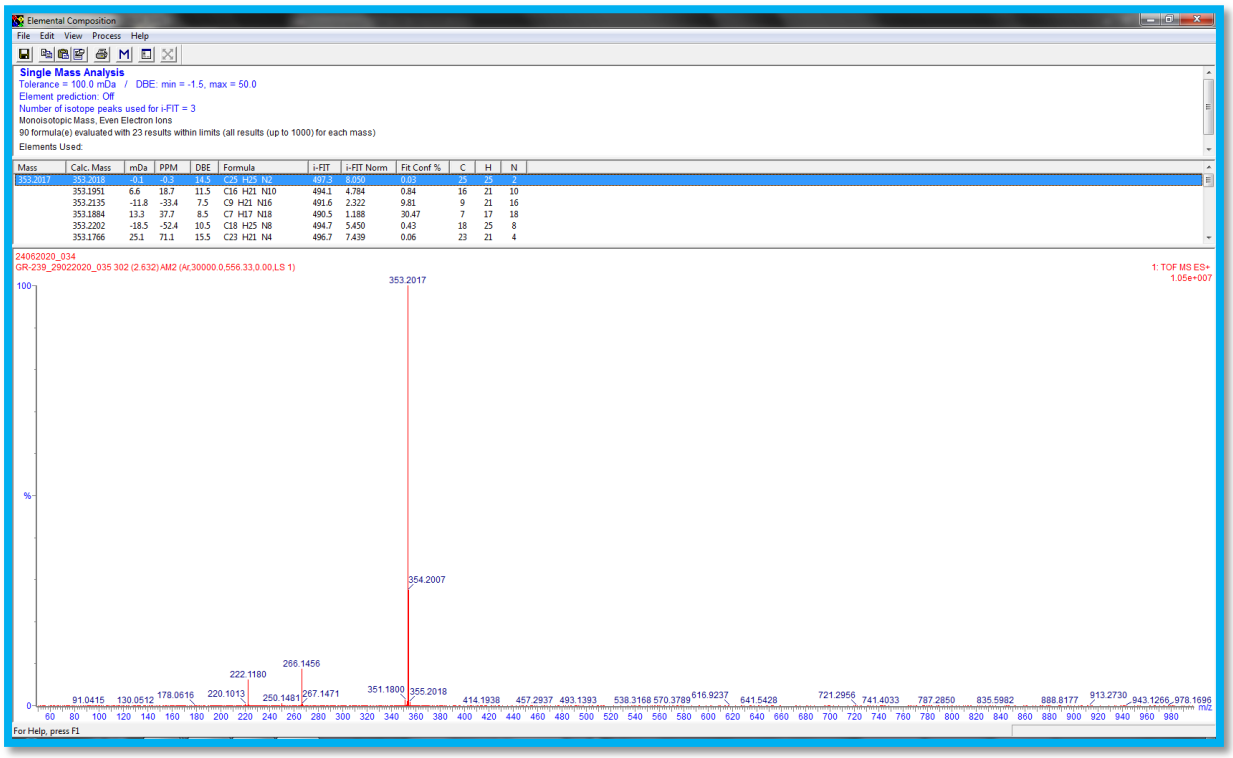
HRMS of 4n



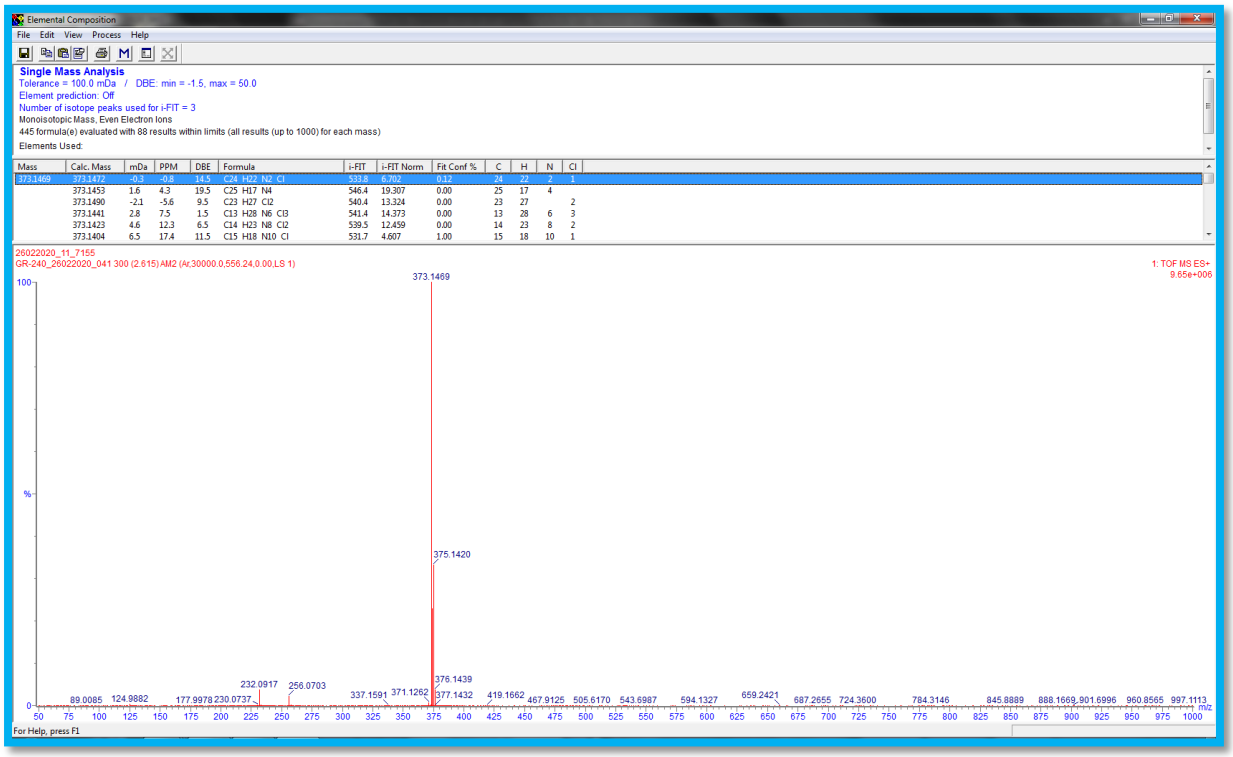
HRMS of 7a



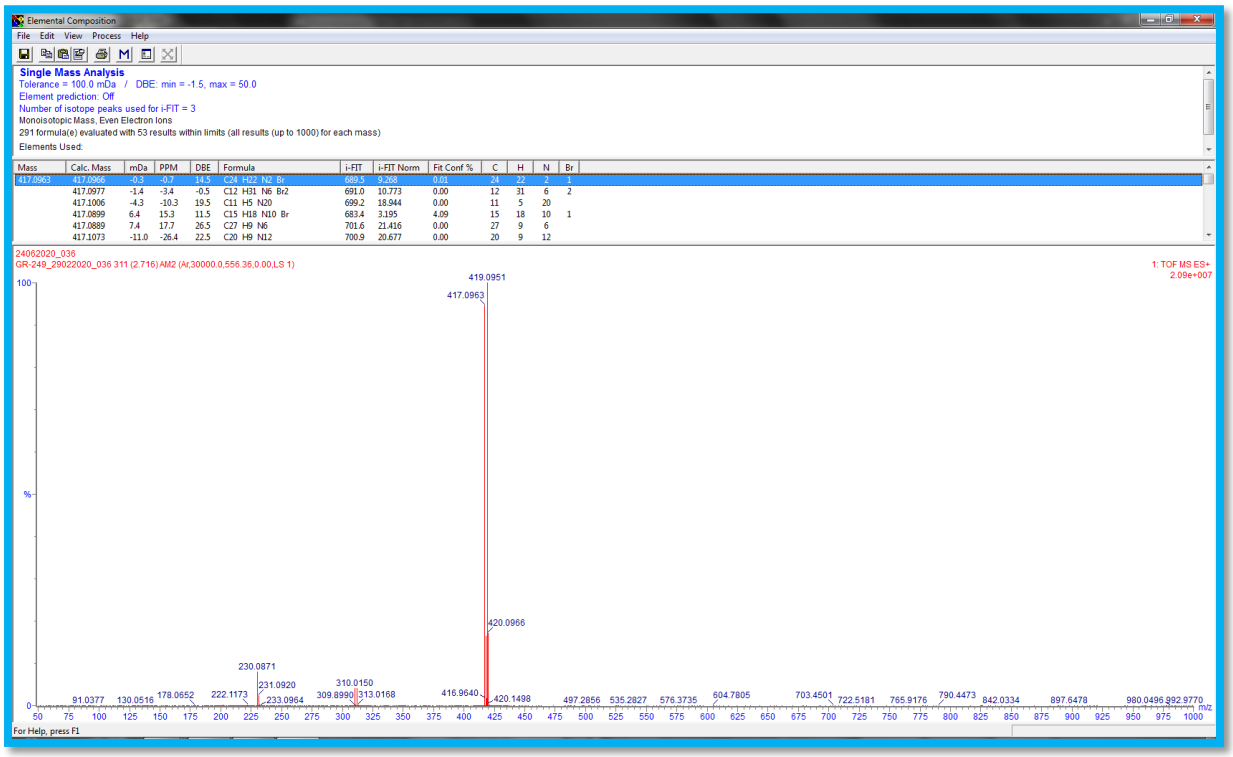
HRMS of 7b



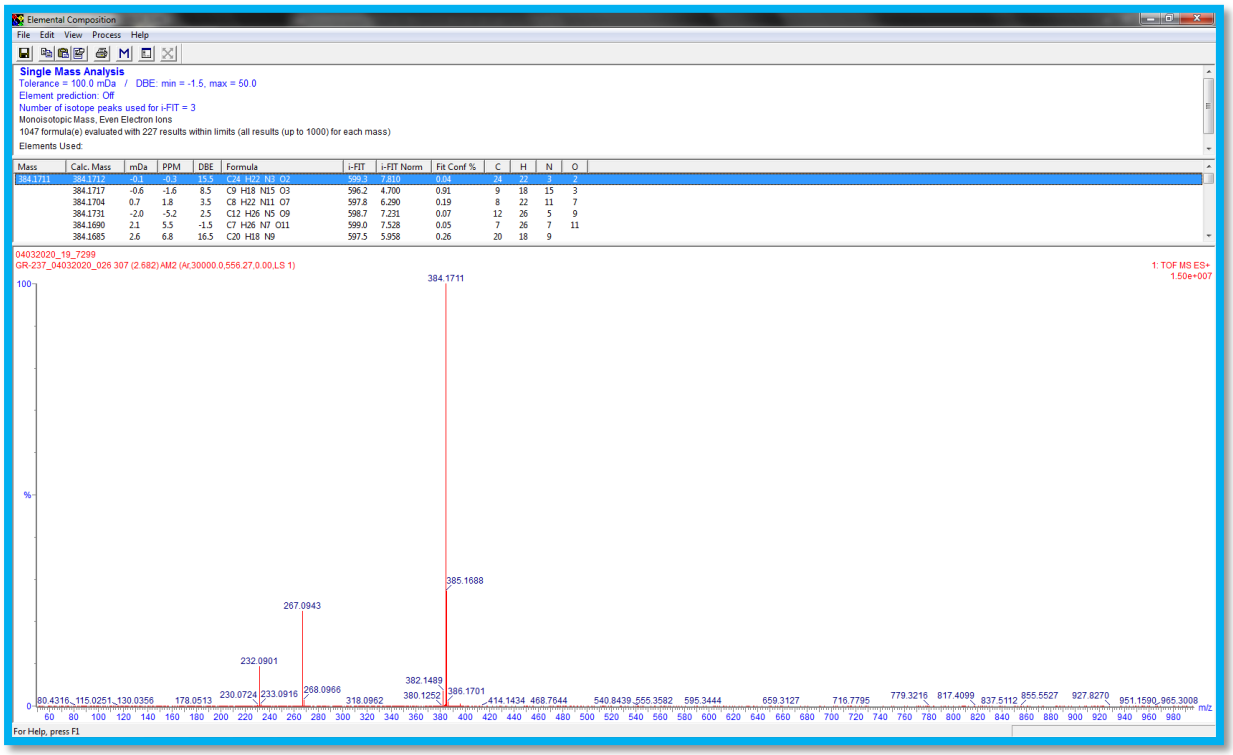
HRMS of 7c



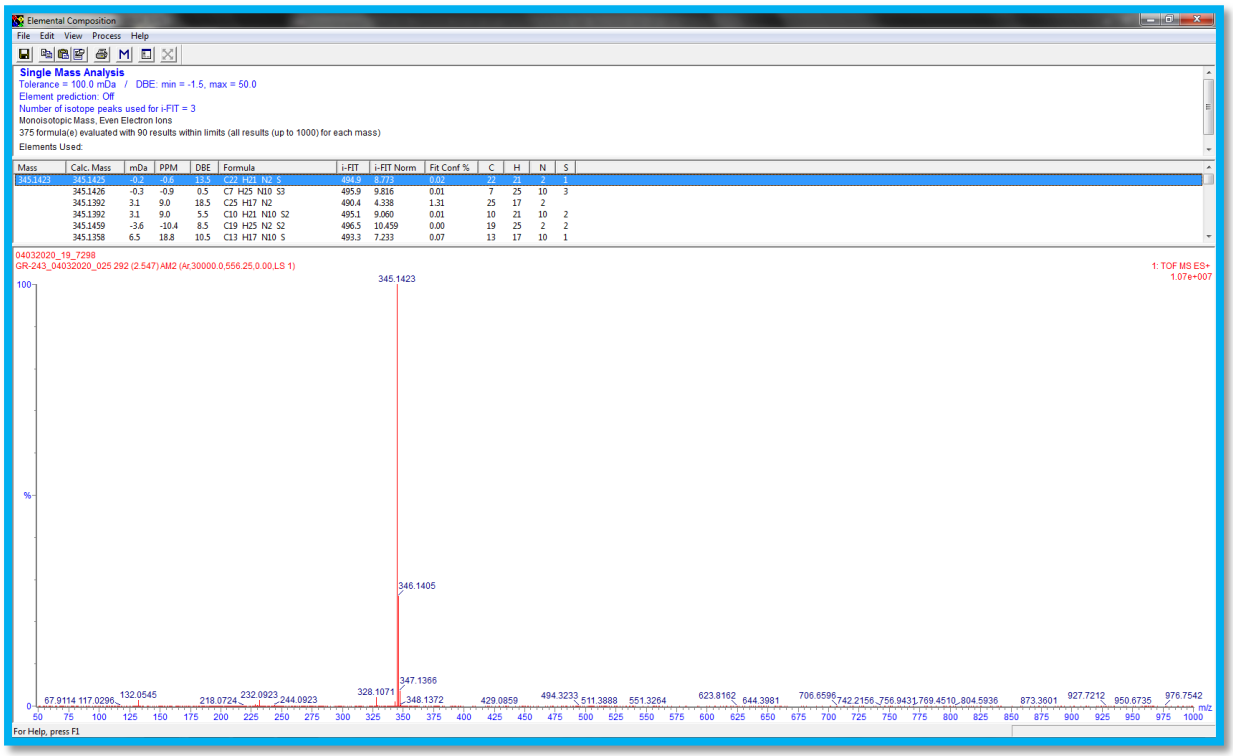
HRMS of 7d



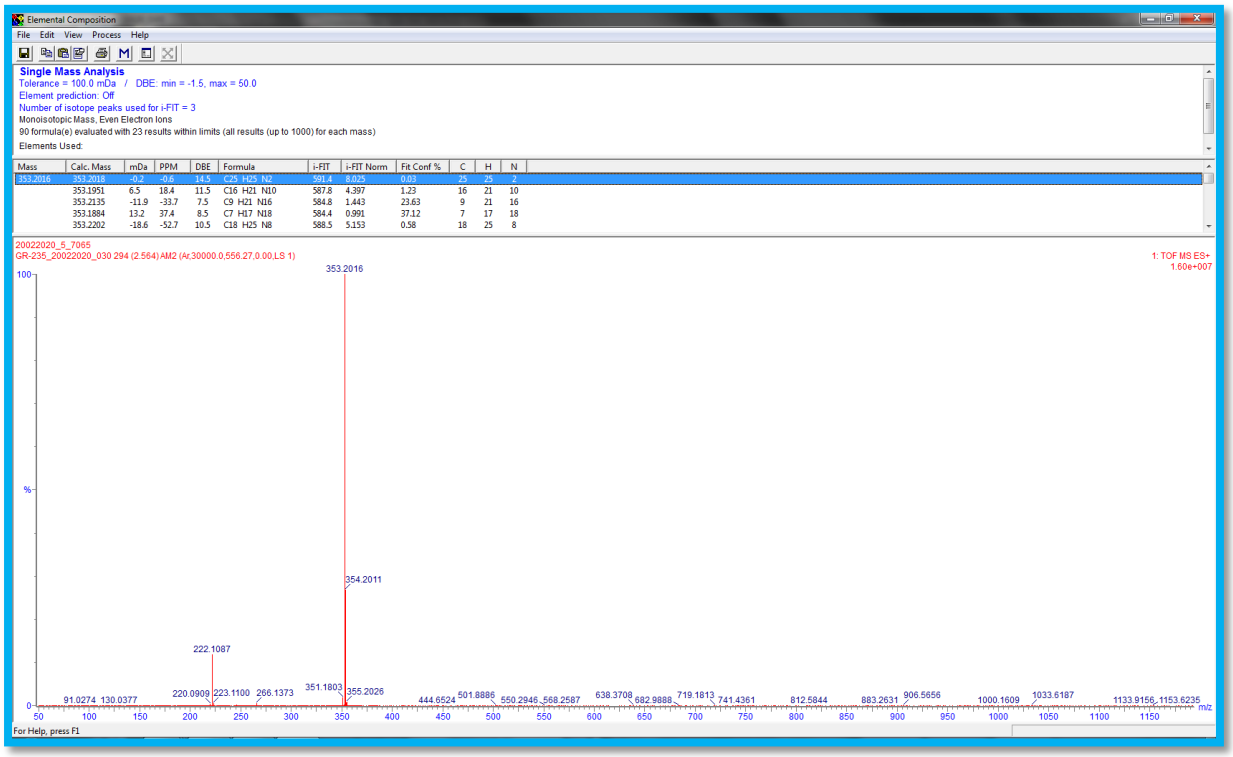
HRMS of 7e



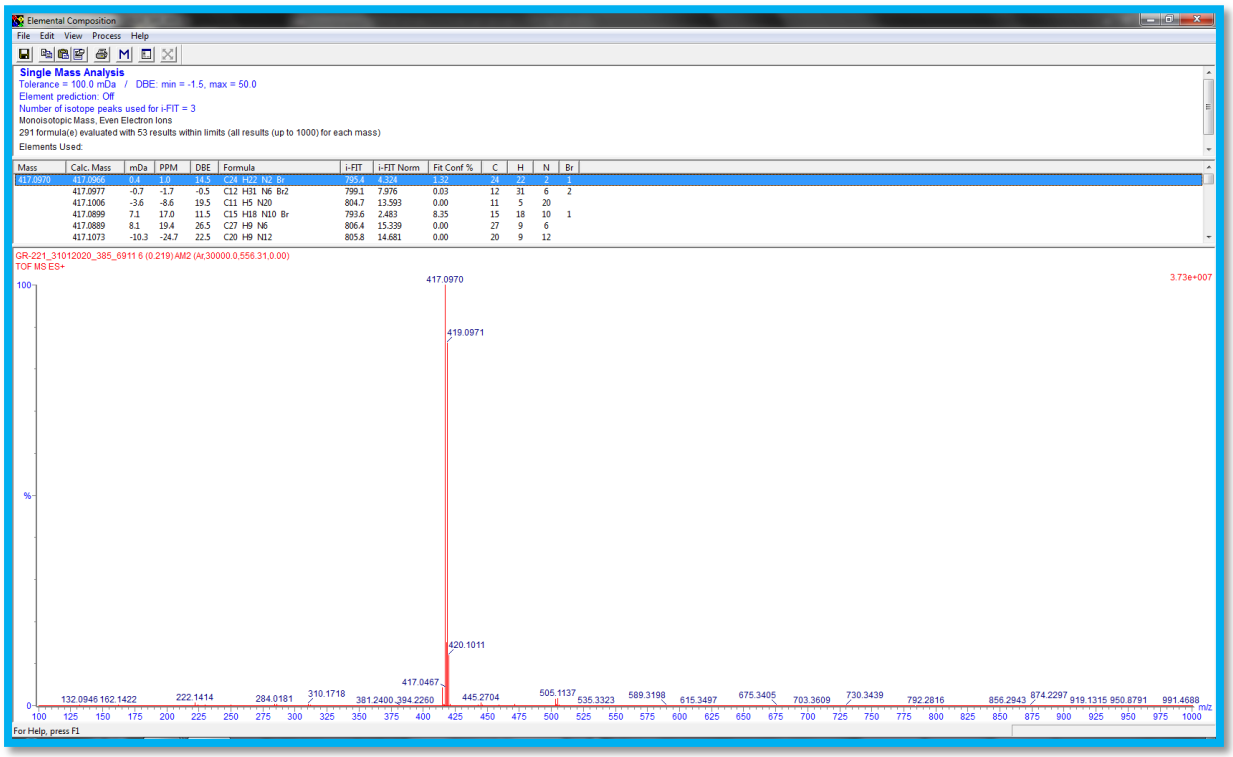
HRMS of 7f



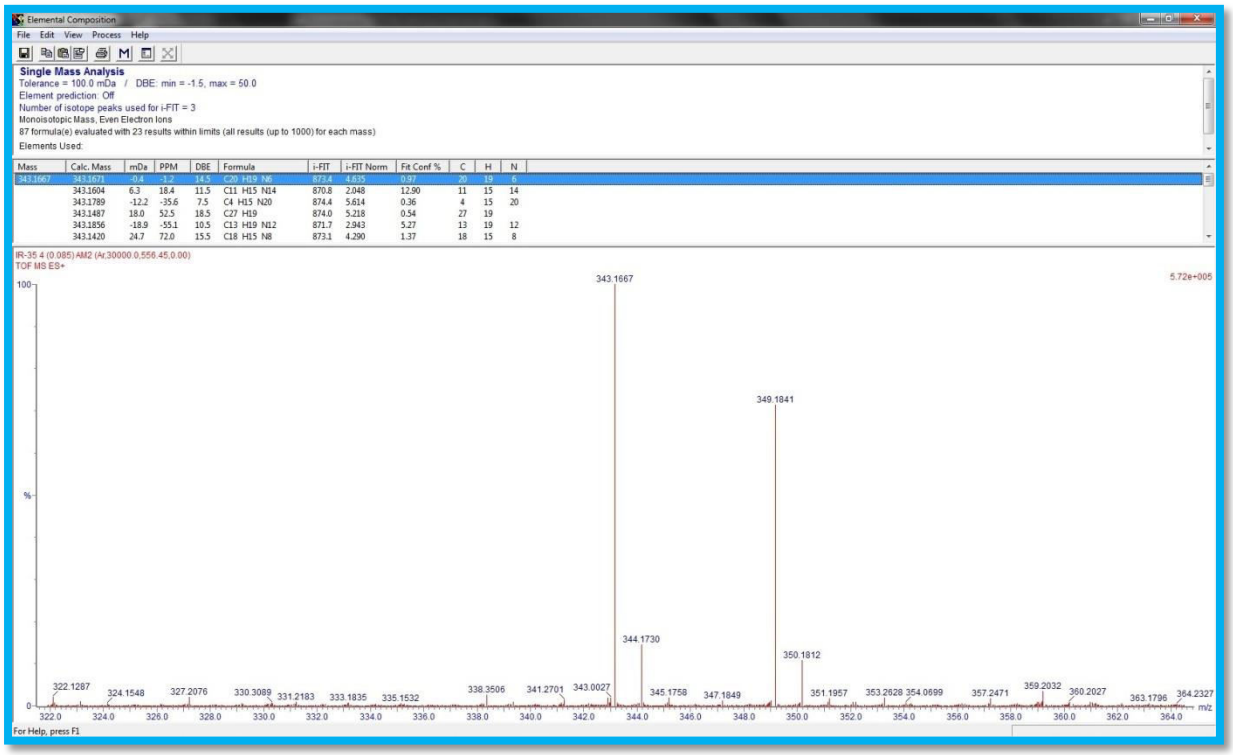
HRMS of 7g



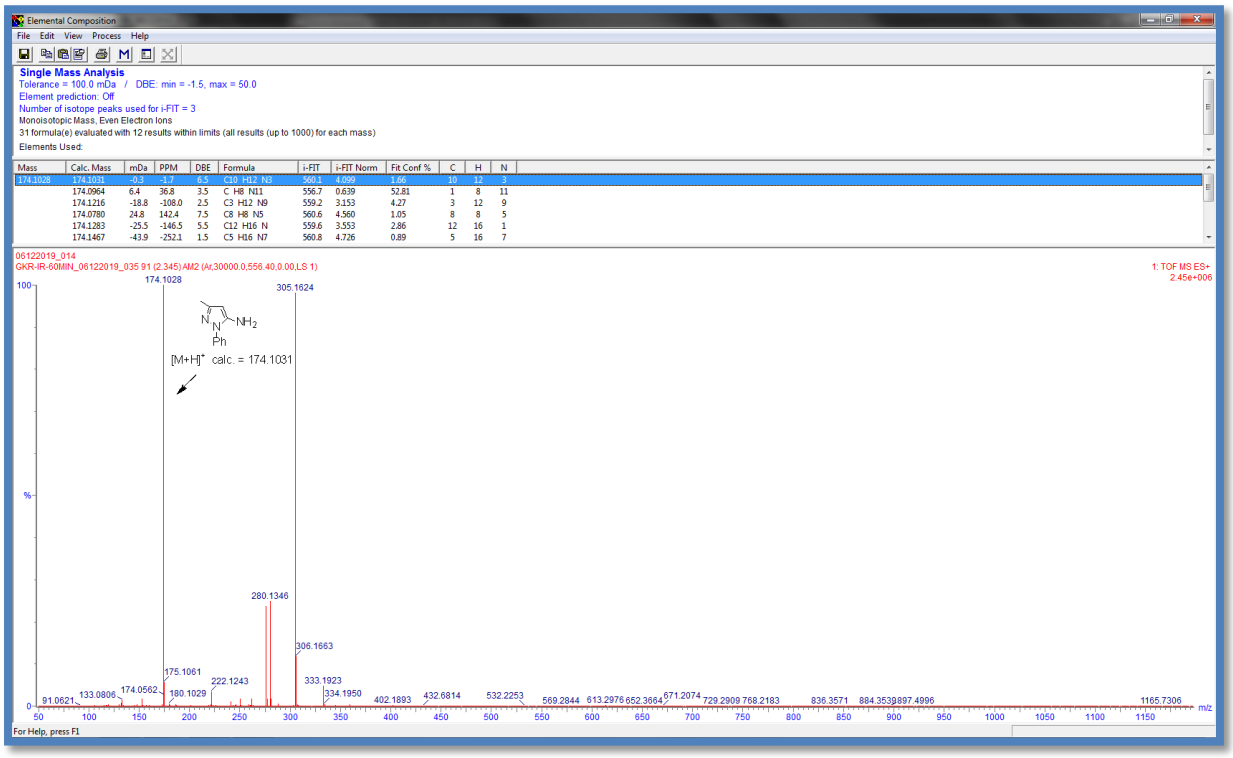
HRMS of 7h



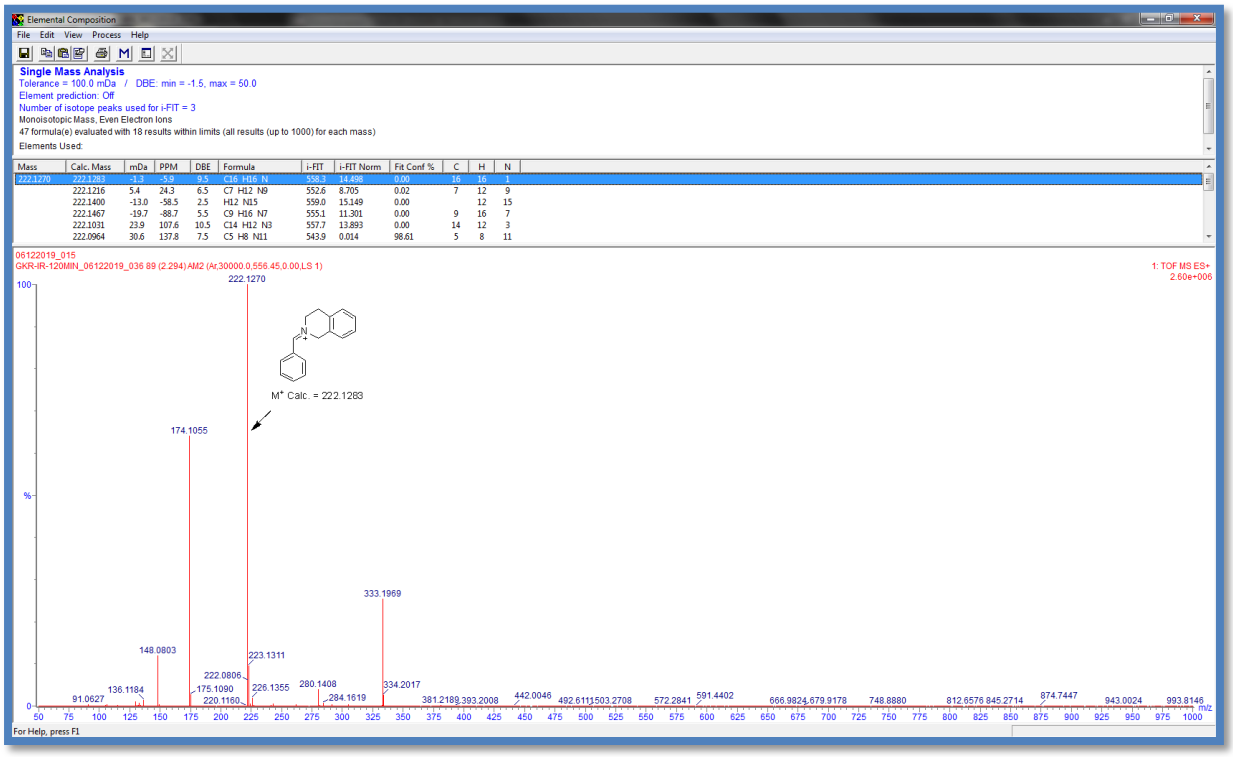
HRMS of 5



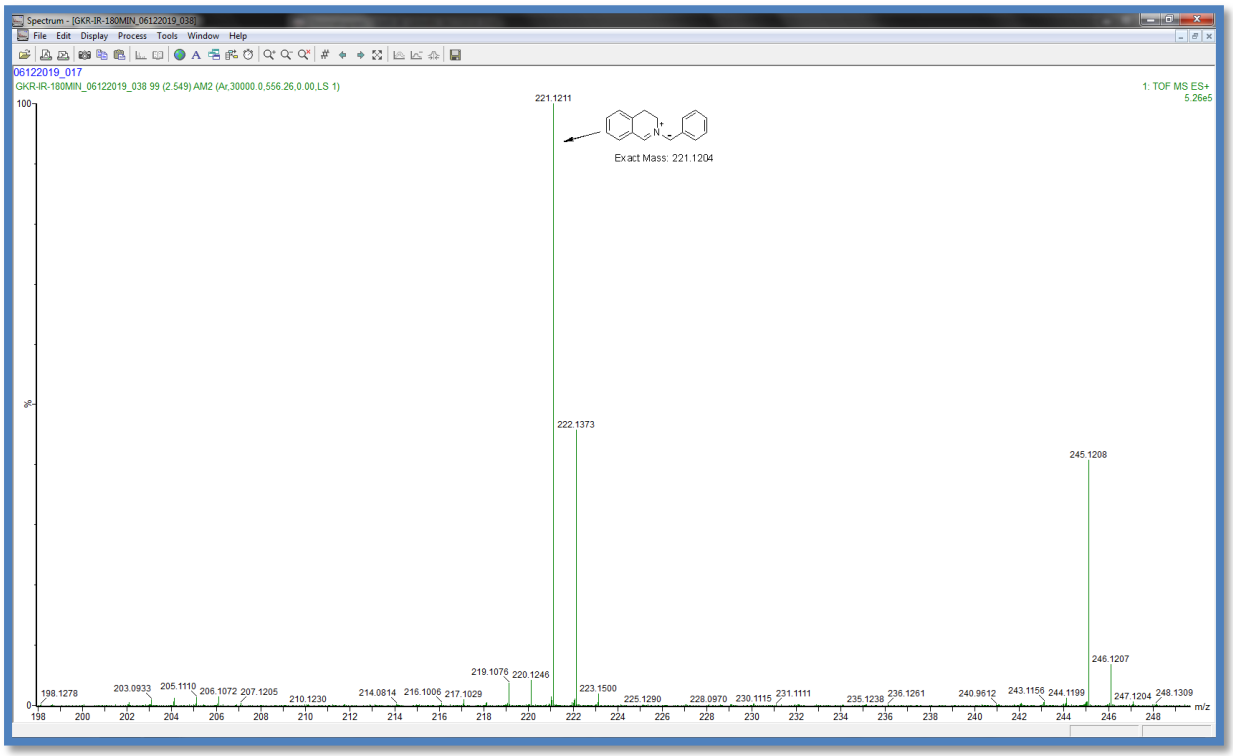
HRMS for the crude reaction mixture at 60 min



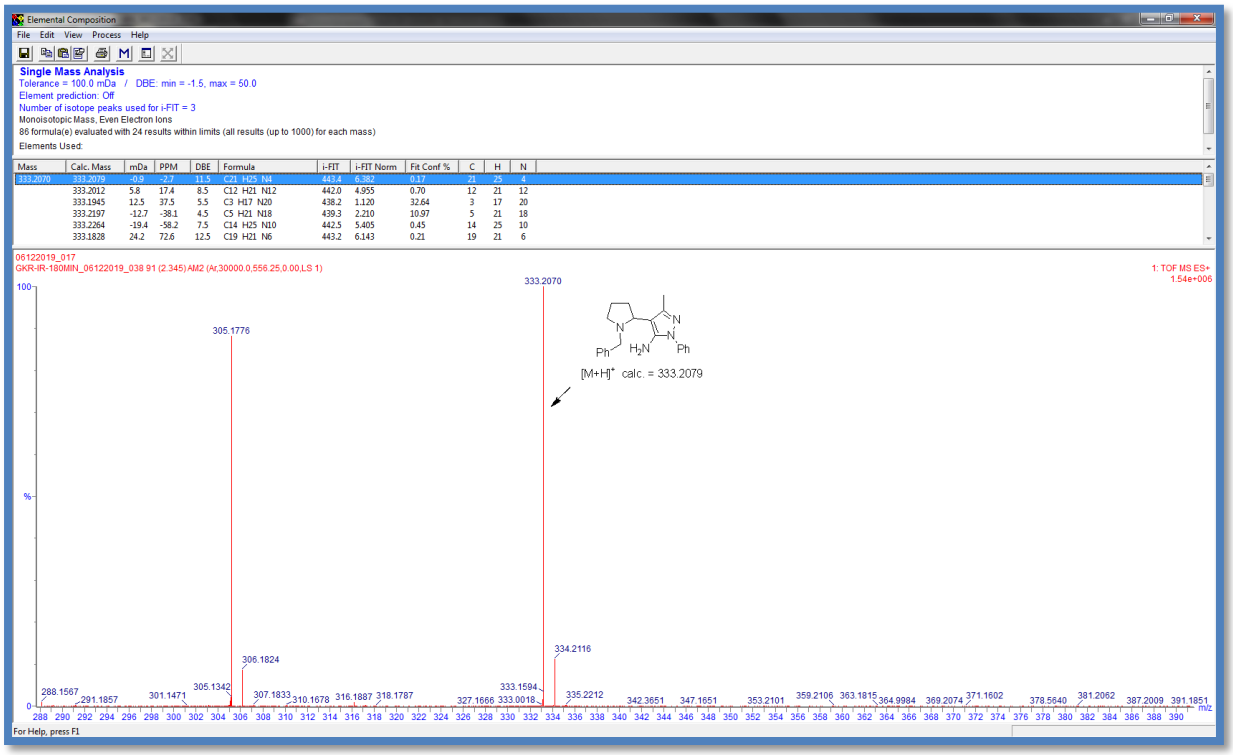
HRMS for the crude reaction mixture at 120 min



HRMS for the crude reaction mixture at 180 min (expanded)



HRMS for the crude reaction mixture at 180 min (expanded)



HRMS for the crude reaction mixture at 240 min