Electronic Supplementary Material (ESI) for RSC Advances.

Electronic supporting information

Microwave Assisted Novel and Regioselctive Functionalization of Imidazopyridines with Chromene acetals and *β*-Nitrostyrenes

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Contents

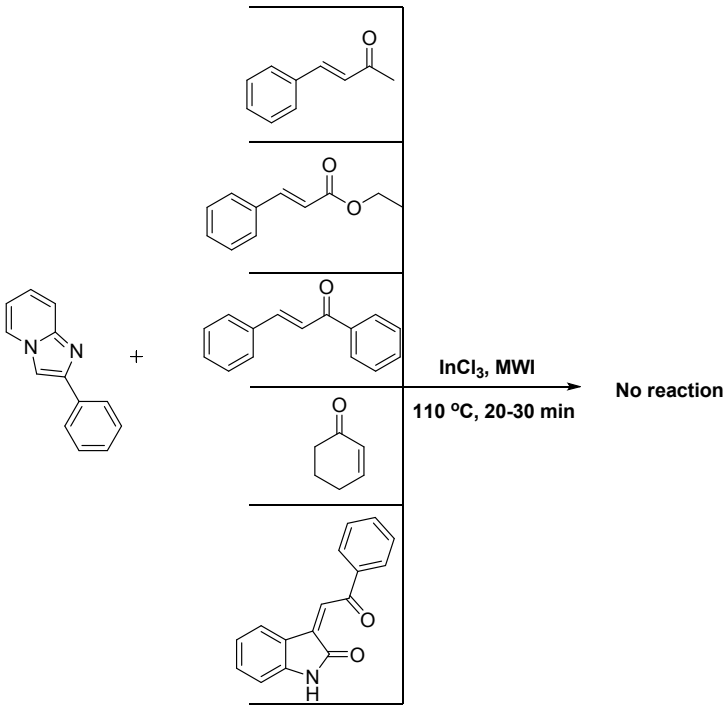
Experimental Section:

General information: Salicyladehydes, *β*-diketones, *β*-keto esters, amino pyridine, phenacyl bromide, PTSA, $InCl_3$, nitromethane, nitroethane, aldehydes and all solvents were purchased from Sigma Aldrich and Alpha Aesar company and used without further purification as received. All ^1H and ^{13}C NMR spectra were recorded in deuterated chloroform ($CDCl_3$) or $CDCl_3$+DMSO (deuterated dimethyl sulfoxide) (6:4) on Avance 300 or Avance 400 or Avance 500 spectrometers. Chemical shifts (δ) are reported in parts per million (ppm) relative to residual $CHCl_3$ (^1H: δ 7.26 ppm, ^{13}C: δ 77.00 ppm) as an internal reference. Coupling constants (J) are reported in Hertz (Hz). Peak multiplicity is indicated as follows: s—singlet, d—doublet, t—triplet, q—quartet, m—multiplet and dd—doublet of doublet. Melting points were measured on a BUCHI melting point machine. IR spectra were recorded on Thermo Nicolet FT/IR-5700 spectrometer. Mass spectra were recorded using Waters mass spectrometer. High resolution mass spectrums (HRMS) were recorded using Applied Bio-Sciences HRMS spectrometer at national center for mass spectroscopy-IICT.

General Procedure for preparation for synthesis of (3a-31): Microwave Irradiation Experiment. All microwave irradiation experiments were carried out in a dedicated CEM-Discover monomode microwave apparatus, operating at a frequency of 2.45 GHz with continuous irradiation power from 0 to 300 W with utilization of the standard absorbance level of 300 W maximum power. A sealed 10 mL glass tube containing 2*H*-chromene (1a) (1mmol), imidazopyridine (1mmol) and PTSA (10 mol%) in 1ml of THF kept under microwave irradiation for 10 minutes at 80 °C as mentioned in **Table 1**. After completion of the reaction (indicated by TLC) removed solvent and the crude product was purified by column chromatography using ethyl acetate/hexane (3:6) to get pure compounds as white or pale yellow crystals. The isolated compounds were well characterized by IR, ^1H NMR, ^{13}C NMR and HRMS.

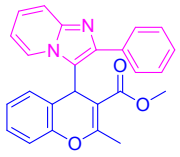
General Procedure for preparation for synthesis of (3l-3x): In a microwave reaction vial *β*-nitrostyrene (1mmol), imidazopyridine (1mmol) and $InCl_3$ (5 mol%) in 1ml of *o*-xylene kept under microwave irradiation for 15 minutes at 100 °C as mentioned in **Table 3**. After completion of the reaction (indicated by TLC) removed solvent and the crude product was purified by column chromatography using ethyl acetate/hexane (4:6) to get pure compounds. The isolated compounds were well characterized by IR, ^1H NMR, ^{13}C NMR and HRMS.

Scheme 3: Screening of other Michael acceptors for the synthesis of functionalized IPS:



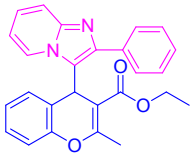
Spectral data of all compounds:

Methyl 2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4a):



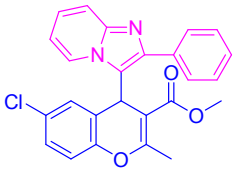
White solid; Mp 118-120 ^{o}C; IR: ν_{max} 2926, 1706, 1640, 1583, 1486, 1361, 1213, 1062, 757, 697 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.86 (d, *J* = 5.4 Hz, 3 H), 7.61 (d, *J* = 9.0 Hz, 1 H), 7.36-7.52 (m, 3 H), 6.93-7.23 (m, 5 H), 6.68 (t, *J* = 6.8 Hz, 1 H), 6.07 (s, 1 H), 3.29 (s, 3 H), 2.41 (s, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 167.0, 160.2, 149.6, 144.6, 144.1, 135.0, 128.7, 128.6, 128.3, 127.7, 124.9, 124.0, 123.2, 122.2, 120.1, 117.7, 116.2, 112.3, 101.4, 51.2, 31.1, 19.1; m/z (ESI); 397 $[M+H]^+$.

Ethyl 2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4b):



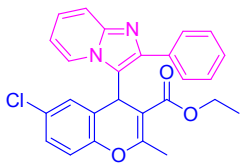
White solid; Mp 124-126 ^{o}C; IR: ν_{max} 2931, 1705, 1647, 1580, 1474, 1359, 1211, 1056, 759, 699 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.78-7.99 (m, 3 H), 7.41-7.49 (m, 1 H), 7.45 (t, *J* = 7.5 Hz, 2 H), 7.38 (t, *J* = 7.3 Hz, 1 H), 7.10-7.21 (m, 2 H), 6.99-7.06 (m, 2 H), 6.98-6.93 (m, 1 H), 6.71 (t, *J* = 6.6 Hz, 1 H), 6.08 (s, 1 H), 3.88-3.95 (m, 1 H), 3.78-3.70 (m, 1 H), 2.37 (s, 3 H), 0.77 (t, *J* = 7.1 Hz, 3 H): ^{13}C NMR (75 MHz, $CDCl_3$): δ 166.6, 159.7, 149.5, 144.5, 143.9, 134.9, 128.7, 128.6, 128.5, 128.3, 127.7, 124.8, 124.0, 123.3, 122.4, 120.3, 117.7, 116.2, 112.3, 101.8, 60.2, 31.0, 19.1, 13.6; m/z (ESI); 411 $[M+H]^+$. HRMS calcd for $C_{26}H_{23}O_3N_2$: 411.17032, found: 411.17029.

Ethyl 6-chloro-2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4c):



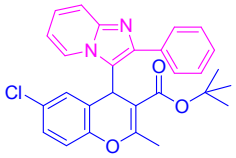
White solid; Mp 131-133 ^{o}C; IR: ν_{max} 3038, 2969, 2924, 1707, 1633, 1470, 1362, 1302, 1231, 1144, 1065, 809, 704 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$+DMSO): δ 7.87-7.97 (m, 1 H), 7.69-7.80 (m, 2 H), 7.63 (d, *J* = 9.0 Hz, 1 H), 7.38.7.59 (m, 3 H), 7.13-7.25(m, 2 H), 6.95-7.02 (m, 2 H), 6.80 (t, *J* = 6.3 Hz, 1 H), 5.99 (s, 1 H), 3.31 (s, 3 H), 2.37 (s, 3 H): ^{13}C NMR (75 MHz, $CDCl_3$+DMSO): δ 165.9, 159.2, 147.4, 143.8, 143.6, 143.5, 134.0, 128.7, 128.1, 127.9, 127.6, 127.2, 127.1, 123.7, 122.4, 121.2, 117.1, 116.9, 112.0, 100.5, 50.6, 30.2, 18.4; m/z (ESI); 431 $[M+H]^+$. HRMS calcd for $C_{26}H_{20}O_3N_2Cl$: 431.15070, found: 431.1501.

Ethyl 6-chloro-2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4d):



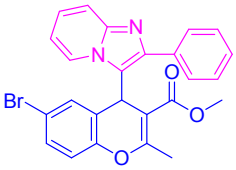
White solid; Mp 134-136 °C; IR: ν_{max} 3032, 2956, 2922, 1704, 1637, 1469, 1352, 1314, 1225, 1143, 1066, 808, 701 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$+DMSO): δ 7.90-7.90 (m, 1 H), 7.70-7.80 (m, 2 H), 7.64 (d, *J* = 8.8 Hz, 1 H), 7.35.7.49 (m, 3 H), 7.11-7.21(m, 2 H), 6.98 (d, *J* = 2.0 Hz, 1 H), 6.94 (d, *J* = 8.7 Hz, 1 H), 6.75 (t, *J* = 6.6 Hz, 1 H), 6.00 (s, 1 H), 3.87-3.96 (m, 1 H), 3.70-3.80 (m, 1 H), 2.34 (s, 3 H), 0.78 (t, *J* = 7.1 Hz, 3 H): ^{13}C NMR (75 MHz, $CDCl_3$+DMSO): δ δ 165.7, 158.9, 147.5, 143.9, 143.6, 134.1, 128.9, 128.3, 128.1, 127.8, 127.4, 127.3, 123.8, 122.6, 121.7, 117.3, 117.2, 112.1, 101.0, 59.8, 30.4, 18.5, 13.1; m/z (ESI); 445 $[M+H]^+$.

Tert-butyl 6-chloro-2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4e):



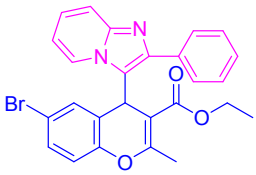
White solid; Mp 196-198 °C; IR: ν_{max} 3040, 2975, 2928, 1710, 1643, 1482, 1361, 1309, 1229, 1159, 1060, 813, 696 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 8.08 (d, *J* = 6.8 Hz, 1 H), 7.62-7.75 (m, 3 H), 7.32-7.47 (m, 3 H), 7.11-7.23 (m, 2 H), 6.92-6.99 (m, 2 H), 6.78 (t, *J* = 6.8 Hz, 1 H), 5.90 (s, 1 H), 2.17 (s, 3 H), 1.01 (s, 9 H). ^{13}C NMR (75 MHz, $CDCl_3$): δ 165.7, 156.7, 148.1, 144.5, 144.3, 134.5, 129.3, 128.7, 128.3, 127.8, 127.7, 124.2, 123.2, 122.4, 117.8, 112.4, 103.4, 81.0, 31.2, 27.5, 18.5; m/z (ESI); 473 $[M+H]^+$. HRMS calcd for $C_{28}H_{26}O_3N_2Cl$: 473.16265, found: 431.16259.

Methyl 6-bromo-2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4f):



White solid; Mp 130-132 °C; IR: ν_{max} 3028, 1716, 1652, 1477, 1432, 1219, 1072, 741, 694 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.72-7.90 (m, 3 H), 7.64 (d, *J* = 9.1 Hz, 1 H), 7.37-7.53 (m, 3 H), 7.25-7.32 (m, 1 H), 7.13-7.22 (m, 2 H), 6.90 (d, *J* = 8.7 Hz, 1 H), 6.73 (t, *J* = 6.8 Hz, 1 H), 6.00 (s, 1 H), 3.28 (s, 3 H), 2.38 (s, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 166.6, 159.8, 146.6, 144.6, 144.4, 134.7, 131.7, 131.1, 128.6, 128.3, 127.8, 124.2, 123.0, 122.3, 121.7, 117.9, 117.8, 117.2, 112.5, 101.3, 51.3, 30.9, 19.0; m/z (ESI); 475 $[M+H]^+$. HRMS calcd for $C_{25}H_{20}O_3N_2Br$: 475.06518, found: 475.06480.

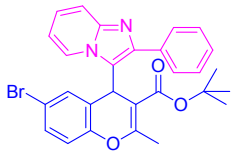
Ethyl 6-bromo-2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4g):



White solid; Mp 138-140 °C; IR: ν_{max} 3031, 1712, 1648, 1466, 1424, 1208, 1075, 743, 699 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.91-7.99 (m, 1 H), 7.72-7.80 (m, 2 H), 7.64 (dt, J_1 = 9.0 Hz, J_2 = 1.0 Hz, 1 H), 7.42-7.49 (m, 2 H), 7.36-7.42 (m, 1 H), 7.27-7.30 (m, 1 H), 7.12-7.21 (m, 2 H), 6.89 (d, *J* = 8.7 Hz, 1 H), 6.76 (t, *J* = 6.8 Hz, 1 H), 6.01 (s, 1 H), 3.86-3.96 (m, 1 H), 3.69-3.78 (m, 1 H), 0.77 (t, *J* = 7.1 Hz, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 166.2, 159.4, 148.6, 144.5, 144.2, 134.7, 131.7, 131.0, 128.6, 128.4, 127.8, 124.2, 123.1, 122.6, 118.0, 117.9, 117.0, 112.5,

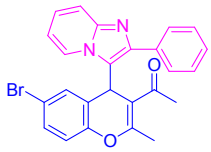
101.8, 60.4, 30.9, 19.0, 13.6; m/z (ESI); 489 $[M+H]^+$. HRMS calcd for $C_{26}H_{22}O_3N_2Br$: 489.08083, found: 489.08083.

Tert-butyl 6-bromo-2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4h):



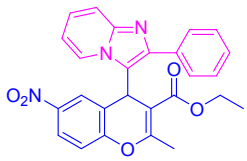
White solid; Mp 201-203 °C; IR: ν_{max} 3043, 1715, 1646, 1479, 1435, 1223, 1069, 747, 700 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 8.08 (d, *J* = 6.0 Hz, 1 H), 7.62-7.75 (m, 3 H), 7.28-7.49 (m, 4 H), 7.20 (t, *J* = 8.3 Hz, 1 H), 7.11 (s, 1 H), 6.90 (d, *J* = 8.7 Hz, 1 H), 6.79 (t, *J* = 8.7 Hz, 1 H), 5.90 (s, 1 H), 2.16 (s, 3 H), 1.00 (s, 9 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 165.7, 156.7, 148.7, 144.5, 144.4, 134.5, 131.7, 130.7, 128.7, 127.9, 124.3, 123.3, 122.9, 118.2, 117.8, 116.8, 112.4, 103.6, 81.1, 31.1, 27.6, 18.6; m/z (ESI); 517 $[M+H]^+$.

1-(6-bromo-2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromen-3-yl)ethanone (4i):



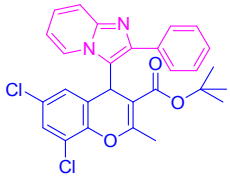
White solid; Mp 146-148 °C; IR: ν_{max} 3035, 1719, 1657, 1482, 1445, 1223, 1068, 749, 698 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.93 (d, *J* = 6.4 Hz, 1 H), 7.70-7.77 (m, 2 H), 7.65 (d, *J* = 9.1 Hz, 1 H), 7.46-7.51 (m, 2 H), 7.42 (t, *J* = 7.3 Hz, 1 H), 7.33 (dd, J_1 = 6.6 Hz, J_2 = 1.4 Hz, 1 H), 7.24-7.26 (m, 1 H), 7.17-7.22 (m, 1 H), 6.93 (d, *J* = 8.7 Hz, 1 H), 6.75 (t, *J* = 6.6 Hz, 1 H), 5.99 (s, 1 H), 2.21 (s, 3 H), 1.79 (s, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 198.9, 156.1, 148.8, 144.9, 144.4, 134.3, 131.9, 130.8, 128.7, 128.6, 128.3, 124.8, 123.1, 122.4, 118.2, 117.9, 117.1, 112.8, 110.9, 31.2, 29.4, 19.2; m/z (ESI); 459 $[M+H]^+$. HRMS calcd for $C_{25}H_{20}O_2N_2Br$: 459.07027, found: 475.07063.

Ethyl 2-methyl-6-nitro-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4j):



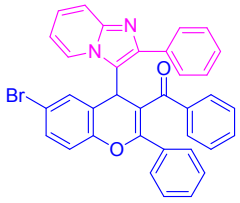
White solid; Mp 153-155 °C; IR: ν_{max} 3027, 2934, 1705, 1637, 1585, 1472, 1366, 1224, 1068, 762, 692 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$+DMSO): δ 8.11-8.21 (m, 1 H), 8.06 (dd, J_1 = 9.1 Hz, J_2 = 2.45 Hz, 1 H), 7.87 (d, *J* = 2.1 Hz, 1 H), 7.48-7.70 (m, 3 H), 7.34-7.47 (m, 3 H), 7.25 (t, *J* = 8.1 Hz, 1 H), 7.10 (d, *J* = 9.1 Hz, 1 H), 6.88 (t, *J* = 6.8 Hz, 1 H), 6.01 (s, 1 H), 3.77-4.01 (m, 2 H), 2.33 (s, 3 H), 0.82 (t, *J* = 7.2 Hz, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$+DMSO): δ 165.3, 158.2, 153.1, 144.4, 143.9, 143.6, 133.9, 128.3, 127.8, 127.5, 124.1, 123.8, 122.5, 121.7, 117.3, 116.8, 112.4, 102.2, 60.1, 30.3, 18.4, 13.2; m/z (ESI); 456 $[M+H]^+$,

Tert-butyl 6,8-dichloro-2-methyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromene-3-carboxylate (4k):



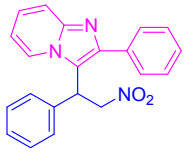
White solid; Mp 184-186 ^{o}C; IR: ν_{max} 3035, 2954, 2928, 1709, 1645, 1453, 1367, 1306, 1211, 1135, 1058, 803, 703 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 8.11(d, J = 6.0 Hz, 1 H), 7.94 (d, J = 1.5 Hz, 1 H), 7.67 (d, J = 9.1 Hz, 1 H), 7.51-7.60 (m, 2 H), 7.33-7.46 (m, 3 H), 7.15-7.26 (m, 2 H), 6.85 (t, J = 6.8 Hz, 1 H), 5.82 (s, 1 H), 2.19 (s, 3 H), 1.02 (s, 9 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 165.7, 156.9, 148.9, 145.9, 144.8, 144.5, 136.8, 134.3, 128.7, 128.3, 128.0, 124.4, 124.0, 123.2, 117.9, 112.7, 104.5, 87.6, 85.8, 81.3, 31.4, 27.6, 18.5; m/z (ESI); 507 $[M+H]^+$.

(6-bromo-2-phenyl-4-(2-phenylimidazo[1,2-a]pyridin-3-yl)-4*H*-chromen-3-yl)(phenyl)methanone (4l):



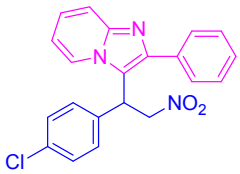
White solid; Mp 176-180 ^{o}C; IR: ν_{max} 3057, 1665, 1637, 1475, 1312, 1227, 1179, 970, 751, 698 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 8.22 (d, J = 7.0 Hz, 1 H), 7.53-7.63 (m, 3 H), 7.30-7.46 (m, 9 H), 7.12-7.23 (m, 5 H), 7.12-7.22 (m, 3 H), 6.95-7.05 (m, 1 H), 6.23 (s, 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 195.4, 153.3, 149.5, 145.3, 144.9, 136.6, 133.9, 133.0, 132.6, 131.9, 130.9, 129.9, 128.8, 128.7, 128.5, 128.3, 128.1, 128.0, 127.9, 125.9, 125.5, 124.6, 123.3, 122.1, 119.6, 118.4, 117.9, 117.5, 117.1, 112.5, 112.3, 110.3, 108.1, 33.4; m/z (ESI); 583 $[M+H]^+$. HRMS calcd for $C_{35}H_{24}O_2N_2Br$: 583.09952, found: 583.10188.

3-(2-nitro-1-phenylethyl)-2-phenylimidazo[1,2-a]pyridine (4m):



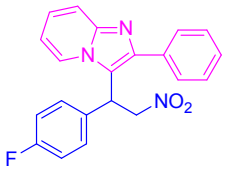
Semi solid; IR: ν_{max} 3056, 2932, 2848, 1551, 1530, 1434, 1347, 745, 725 cm^{-1}; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.72 (d, J = 7.0 Hz, 1 H), 7.66 (d, J = 9.0 Hz, 1 H), 7.59-7.63 (m, 2 H), 7.39-7.46 (m, 3 H), 7.27-7.36 (m, 3 H), 7.16-7.22 (m, 2 H), 6.72 (dt, J_1 = 5.9 Hz, J_2 = 0.9 Hz, 1 H), 5.61 (t, J = 7.6 Hz, 1 H), 5.07 (dd, J_1 = 7.6, Hz, J_2 = 5.6 Hz, 1 H), 4.95 (dd, J_1 = 7.6 Hz, J_2 = 5.65 Hz 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 145.3, 145.1, 135.9, 129.4, 129.1, 128.5, 128.4, 128.1, 126.8, 124.8, 123.3, 117.9, 116.6, 112.8, 76.4, 39.1; m/z (ESI); 344 $[M+H]^+$. HRMS calcd for $C_{21}H_{18}O_2N_3$: 344.13935, found: 344.13955.

3-(1-(4-chlorophenyl)-2-nitroethyl)-2-phenylimidazo[1,2-a]pyridine (4n):



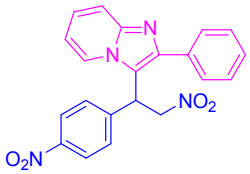
Semi solid; IR: v_{max} 3051, 2933, 2847, 1556, 1509, 1434, 1348, 731, 707 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.66-7.71 (m, 2 H), 7.55-7.59 (m, 2 H), 7.31-7.34 (m, 2 H), 7.22-7.26 (m, 1 H), 7.11-7.16 (m, 2 H), 6.78 (t, J = 7.5 Hz, 1 H), 5.57 (t, J = 7.6 Hz, 1 H), 5.03 (dd, J_1 = 7.6, Hz, J_2 = 5.3 Hz, 1 H), 4.93 (dd, J_1 = 7.3 Hz, J_2 = 5.9 Hz 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 145.4, 145.2, 134.6, 134.2, 134.0, 129.7, 129.1, 128.7, 128.3, 125.1, 123.1, 118.1, 116.2, 113.1, 76.5, 38.8; m/z (ESI); 378 $[M+H]^+$. HRMS calcd for $C_{21}H_{17}O_2N_3Cl$: 378.10038, found: 378.10067.

3-(1-(4-fluorophenyl)-2-nitroethyl)-2-phenylimidazo[1,2-a]pyridine (4o):



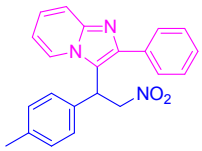
Semi solid; IR: v_{max} 3045, 2928, 2844, 1561, 1524, 1439, 1346, 739, 713 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.67-7.72 (m, 2 H), 7.57-7.61 (m, 2 H), 7.41-7.49 (m, 3 H), 7.22-7.26 (m, 1 H), 7.16-7.20 (m, 2 H), 7.02-7.08 (m, 2 H), 6.78 (dt, J_1 = 5.6 Hz, J_2 = 1.2 Hz, 1 H), 5.57 (t, J = 7.6 Hz, 1 H), 5.03 (dd, J_1 = 8.1, Hz, J_2 = 5.0 Hz, 1 H), 4.94 (dd, J_1 = 7.2 Hz, J_2 = 6.1 Hz 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 145.4, 145.2, 134.2, 131.9, 131.8, 129.2, 128.7, 128.6, 124.9, 123.1, 118.2, 116.6, 116.4, 112.9, 76.7, 38.7; m/z (ESI); 362 $[M+H]^+$. HRMS calcd for $C_{21}H_{17}O_2N_3F$: 362.12993, found: 362.13026

3-(2-nitro-1-(4-nitrophenyl)ethyl)-2-phenylimidazo[1,2-a]pyridine (4p):



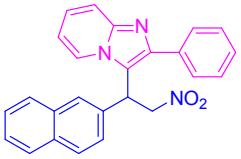
Semi solid; IR: v_{max} 3042, 2924, 2853, 1555, 1523, 1442, 1351, 732, 703 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 8.11-8.16 (m, 1H), 8.07-8.10 (m, 1 H), 7.79 (d, J = 7.0 Hz, 1 H), 7.69 (d, J = 9.0 Hz, 1 H), 7.48-7.55 (m, 4 H), 7.40-7.47 (m, 3 H), 7.24-7.30 (m, 1 H), 6.83 (t, J = 6.9 Hz, 1 H), 5.67 (t, J = 7.6 Hz, 1 H), 5.13 (dd, J_1 = 8.2, Hz, J_2 = 5.3 Hz, 1 H), 5.02 (dd, J_1 = 7.2 Hz, J_2 = 6.4 Hz 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.7, 145.8, 145.2, 138.3, 133.8, 133.2, 130.4, 129.1, 128.7, 128.6, 125.2, 123.2, 122.7, 121.8, 118.2, 115.5, 113.4, 75.9, 38.8; m/z (ESI); 389 $[M+H]^+$. HRMS calcd for $C_{21}H_{17}O_4N_4$: 389.12443, found: 389.12451.

3-(2-nitro-1-(p-tolyl)ethyl)-2-phenylimidazo[1,2-a]pyridine (4q):



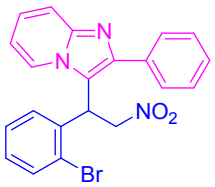
Semi solid; IR: v_{max} 3038, 2931, 2865, 1558, 1517, 1438, 1360, 741, 709 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.72 (d, J = 7.0 Hz, 1 H), 7.68 (d, J = 9.0 Hz, 1 H), 7.60-7.64 (m, 1 H), 7.39-7.47 (m, 3 H), 7.18-7.24 (m, 2 H), 7.11-7.18 (m, 2 H), 7.07-7.11 (m, 2 H), 6.74 (t, J = 6.9 Hz, 1 H), 5.57 (t, J = 7.6 Hz, 1 H), 5.04 (dd, J_1 = 7.6 Hz, J_2 = 5.5 Hz, 1 H), 4.94 (dd, J_1 = 7.63 Hz, J_2 = 5.65 Hz, 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 145.3, 145.1, 137.9, 134.3, 132.9, 130.1, 129.2, 128.5, 128.4, 126.7, 124.7, 123.3, 118.0, 116.7, 112.7, 76.7, 38.9, 20.9; m/z (ESI); 358 $[M+H]^+$.

3-(1-(naphthalen-2-yl)-2-nitroethyl)-2-phenylimidazo[1,2-a]pyridine (4r):



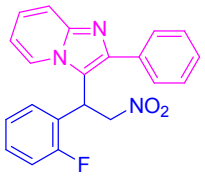
Semi solid; IR: v_{max} 3043, 2955, 2923, 2854, 1634, 1550, 1502, 1371, 1236, 923, 780, 730 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.97-8.04 (m, 1 H), 7.89-7.94 (m, 1 H), 7.81-7.84 (m, 1 H), 7.74-7.78 (m, 1 H), 7.60-7.69 (m, 3 H), 7.51-7.56 (m, 2 H), 7.35-7.48 (m, 5 H), 7.11-7.22 (m, 1 H), 6.70 (dt, J_1 = 5.8 Hz, J_2 = 1,1 Hz, 1 H), 6.19-6.25 (m, 1 H), 5.19 (dd, J_1 = 9.1 Hz, J_2 = 5.13 Hz, 1 H), 5.07 (dd, J_1 = 6.1 Hz, J_2 = 8.1 Hz, 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 145.5, 145.1, 134.6, 134.3, 130.9, 130.7, 129.5, 129.4, 128.6, 128.5, 127.4, 126.3, 125.3, 125.1, 124.7, 123.2, 121.9, 118.0, 116.3, 112.9, 74.8, 37.1; m/z (ESI); 394 $[M+H]^+$. HRMS calcd for $C_{25}H_{20}O_2N_3$: 394.15500, found: 394.15495.

3-(1-(2-bromophenyl)-2-nitroethyl)-2-phenylimidazo[1,2-a]pyridine (4s):



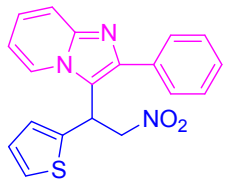
Semi solid; IR: v_{max} 3034, 2915, 2858, 1553, 1521, 1427, 1336, 730, 715 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.87 (d, J = 7.0 Hz, 1 H), 7.67 (d, J = 9.0 Hz, 1 H), 7.61-7.65 (m, 1 H), 7.43-7.47 (m, 2 H), 7.35-7.42 (m, 3 H), 7.22-7.26 (m, 1 H), 7.13-7.19 (m, 2 H), 7.08-7.12 (m, 1 H), 6.82-6.87 (m, 1 H), 5.71 (dd, J_1 = 5.8 Hz, J_2 = 3.8 Hz, 1 H), 4.97 (dd, J_1 = 9.6 Hz, J_2 = 4.9 Hz, 1 H), 4.84 (dd, J_1 = 8.7 Hz, J_2 = 5.8 Hz, 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 145.4, 144.7, 134.8, 134.6, 133.8, 129.8, 129.5, 128.9, 128.5, 128.3, 128.1, 124.9, 124.3, 122.9, 117.8, 115.9, 113.0, 74.2, 39.8; m/z (ESI); 422 $[M+H]^+$.

3-(1-(2-fluorophenyl)-2-nitroethyl)-2-phenylimidazo[1,2-a]pyridine (4t):



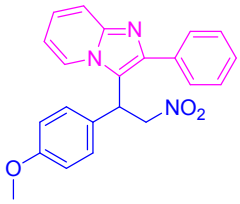
Semi solid; IR: v_{max} 3040, 2927, 2859, 1546, 1511, 1423, 1369, 747, 717 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$+DMSO): δ 7.76-7.86 (m, 1 H), 7.55-7.71 (m, 5 H), 7.39-7.54 (m, 3 H), 7.23-7.37 (m, 3 H), 7.06 (dt, J_1 = 5.8 Hz, J_2 = 0.9 Hz, 1 H), 5.93 (t, J = 7.9 Hz, 1 H), 5.24-5.41 (m, 2 H); ^{13}C NMR (75 MHz, $CDCl_3$+DMSO): δ 161.2, 157.9, 144.2, 143.9, 133.5, 129.2, 129.1, 128.3, 127.4, 124.0, 123.8, 122.8, 122.2, 122.0, 116.7, 115.4, 115.1, 114.9, 112.0, 73.9, 32.9; m/z (ESI); 362 $[M+H]^+$.

3-(2-nitro-1-(thiophen-2-yl)ethyl)-2-phenylimidazo[1,2-a]pyridine (4u):



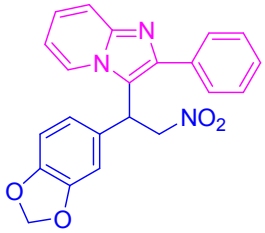
Semi solid; IR: v_{max} 3049, 2931, 2858, 1540, 1509, 1424, 1355, 747, 715 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.80 (d, *J* = 6.9 Hz, 1 H), 7.68 (d, *J* = 9.0 Hz, 1 H), 7.63-7.66 (m, 2 H), 7.39-7.48 (m, 3 H), 7.20-7.26 (m, 2 H), 6.96-7.00 (m, 1 H), 6.88-6.91 (m, 1 H), 6.75-6.80 (m, 1 H), 5.81 (t, *J* = 7.6 Hz, 1 H), 5.11 (dd, J_1 = 7.6 Hz, J_2 = 5.5 Hz, 1 H), 4.94 (dd, J_1 = 7.5 Hz, J_2 = 5.6 Hz, 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 145.3, 139.6, 133.8, 129.0, 128.6, 128.5, 127.4, 125.8, 125.1, 124.9, 123.4, 118.0, 116.2, 112.8, 76.3, 35.6; m/z (ESI); 350 $[M+H]^+$

3-(1-(4-methoxyphenyl)-2-nitroethyl)-2-phenylimidazo[1,2-a]pyridine (4v):



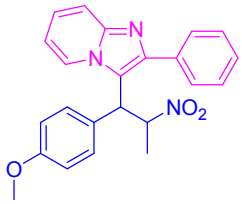
Semi solid; IR: v_{max} 3031, 2924, 2853, 1552, 1505, 1431, 1367, 744, 712 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.72 (d, *J* = 7.0 Hz, 1 H), 7.66 (d, *J* = 9.0 Hz, 1 H), 7.60-7.64 (m, 2 H), 7.38-7.46 (m, 3 H), 7.17-7.22 (m, 1 H), 7.10 (d, *J* = 8.7 Hz, 2 H), 6.85 (d, *J* = 8.7 Hz, 2 H), 6.72 (t, *J* = 6.9 Hz, 1 H), 5.54 (t, *J* = 7.6 Hz, 1 H), 5.02 (dd, J_1 = 8.1 Hz, J_2 = 5.0 Hz, 1 H), 4.92 (dd, J_1 = 7.5 Hz, J_2 = 5.6 Hz, 1 H), 3.76 (s, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 159.2, 145.1, 145.0, 134.2, 129.1, 128.5, 128.4, 127.9, 127.7, 124.7, 123.3, 117.9, 116.8, 114.7, 112.7, 76.7, 55.2, 38.6; m/z (ESI); 374 $[M+H]^+$.

3-(1-(benzo[d][1,3]dioxol-5-yl)-2-nitroethyl)-2-phenylimidazo[1,2-a]pyridine (4w):



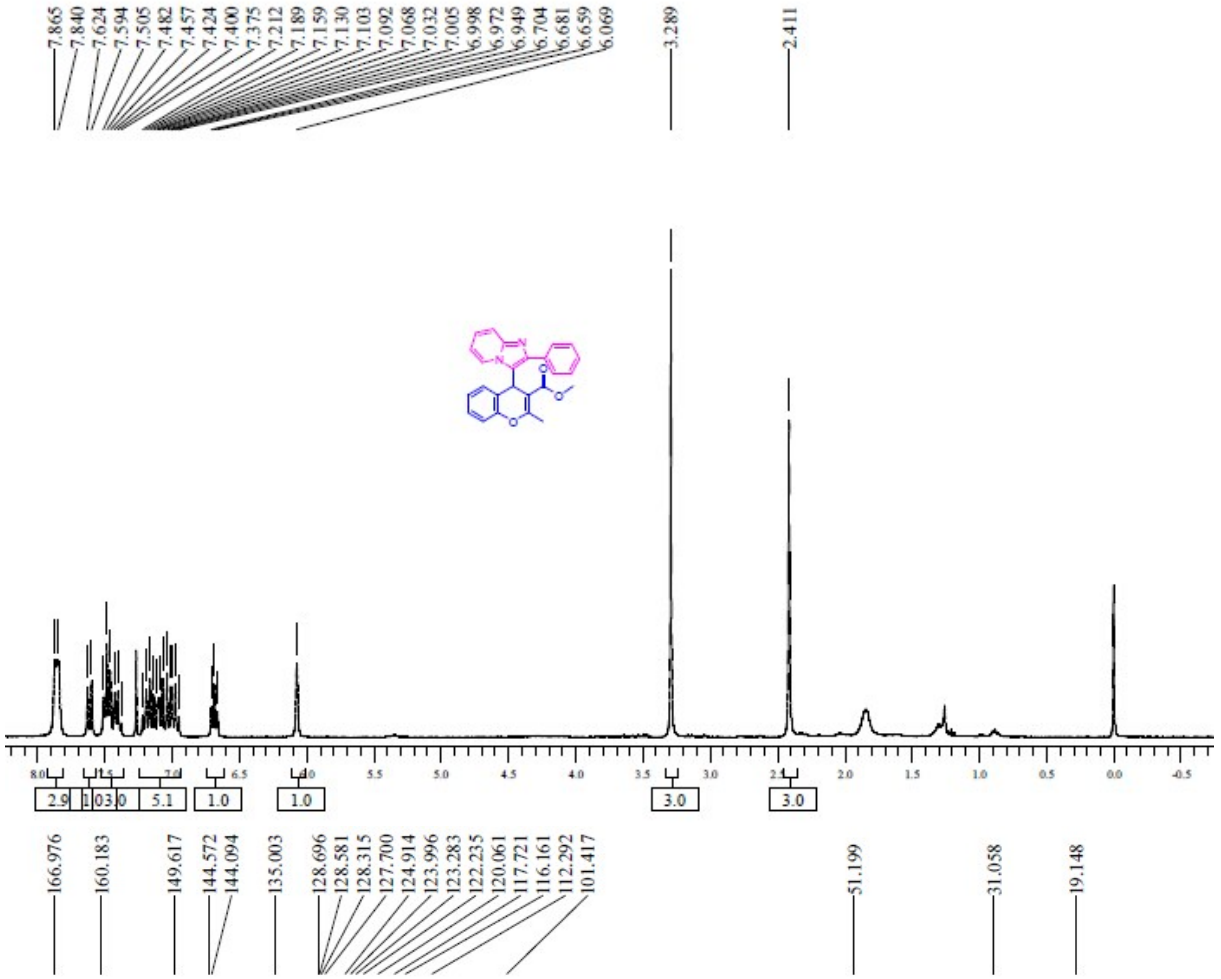
Semi solid; IR: v_{max} 3029, 2933, 2857, 1552, 1522, 1440, 1353, 745, 706 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 7.75 (d, *J* = 6.9 Hz, 1 H), 7.67 (d, *J* = 9.0 Hz, 1 H), 7.59-7.63 (m, 2 H), 7.39-7.48 (m, 3 H), 7.19-7.24 (m, 1 H), 6.73-6.77 (m, 2 H), 6.66-6.69 (m, 1 H), 6.64 (d, *J* = 1.7 Hz, 1 H), 5.92 (s, 2 H), 5.48 (t, *J* = 7.6 Hz, 1 H), 4.98 (dd, J_1 = 7.9 Hz, J_2 = 5.2 Hz, 1 H), 4.89 (dd, J_1 = 7.3 Hz, J_2 = 5.8 Hz, 1 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 148.7, 147.4, 145.0, 134.2, 129.6, 129.2, 128.5, 124.8, 123.3, 119.9, 117.9, 116.6, 112.8, 108.8, 107.4, 101.4, 76.7, 39.1; m/z (ESI); 388 $[M+H]^+$.

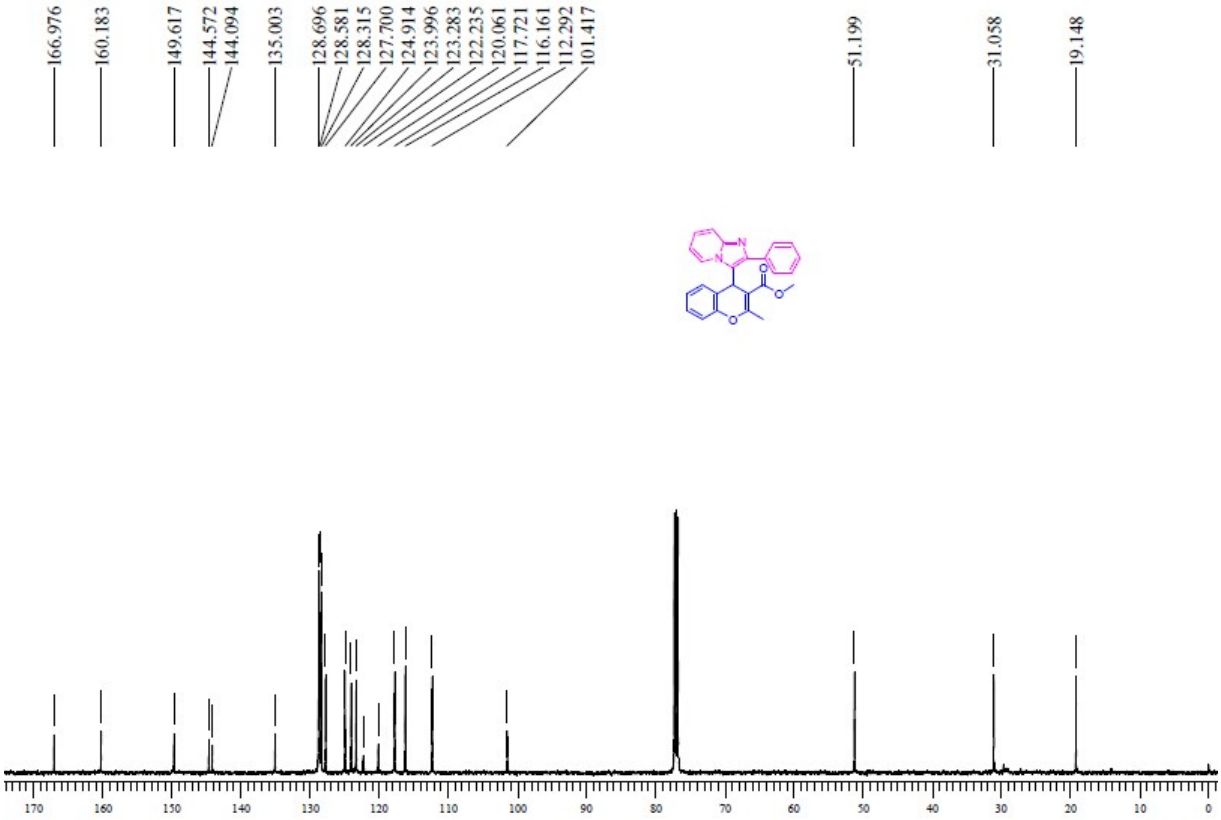
3-(1-(4-methoxyphenyl)-2-nitropropyl)-2-phenylimidazo[1,2-a]pyridine (4x):



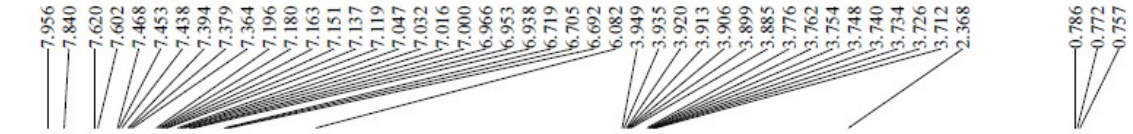
Semi solid; IR: v_{max} 3034, 2931, 2865, 1558, 1517, 1438, 1360, 741, 709 cm^{-1}; ^1H NMR (300 MHz, $CDCl_3$): δ 8.09 (d, *J* = 7.0 Hz, 1 H), 7.85 (d, *J* = 7.0 Hz, 1 H), 7.72-7.76 (m, 2 H), 7.67 (d, *J* = 7.6 Hz, 1 H), 7.56-7.62 (m, 3 H), 7.41-7.54 (m, 6 H), 7.16-7.23 (m, 4 H), 7.09 (d, *J* = 8.7 Hz, 2 H), 6.78-6.85 (m, 5 H), 6.73-6.78 (m, 1 H), 5.49-5.60 (m, 2 H), 5.37 (d, *J* = 11.1 Hz, 1 H), 5.04 (d, *J* = 10.8 Hz, 1 H), 3.76 (s, 3 H), 3.75 (s, 3 H), 1.55 (d, *J* = 6.6 Hz, 3 H), 1.32 (d, *J* = 6.7 Hz, 3 H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 159.1, 159.0, 145.4, 145.1, 144.9, 144.7, 134.9, 134.3, 129.7, 129.2, 129.0, 128.7, 128.5, 128.3, 128.1, 127.7, 124.7, 124.5, 123.4, 123.2, 118.2, 118.1, 117.9, 117.4, 114.6, 114.4, 112.9, 112.5, 84.2, 83.5, 55.2, 55.1, 45.4, 44.1, 19.5, 19.4; m/z (ESI); 388 $[M+H]^+$.

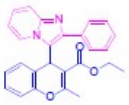
1H and 13C NMR Spectra of compound 4a

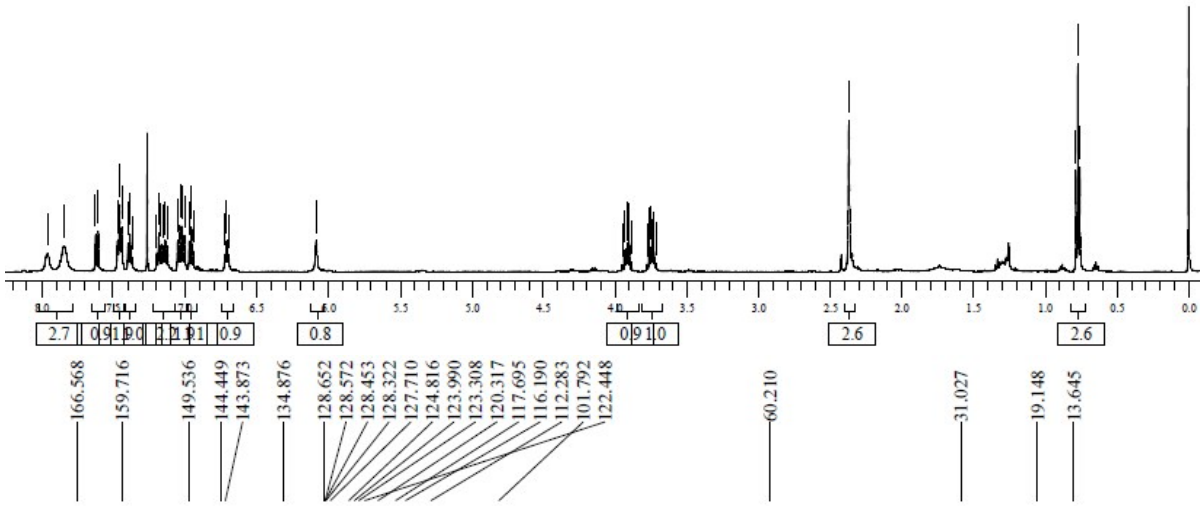


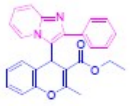


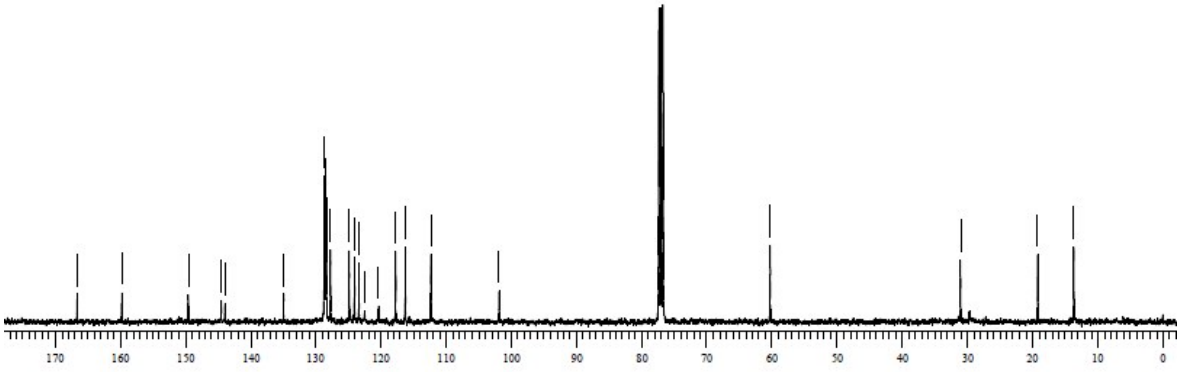
1H and 13C NMR Spectra of compound 4b



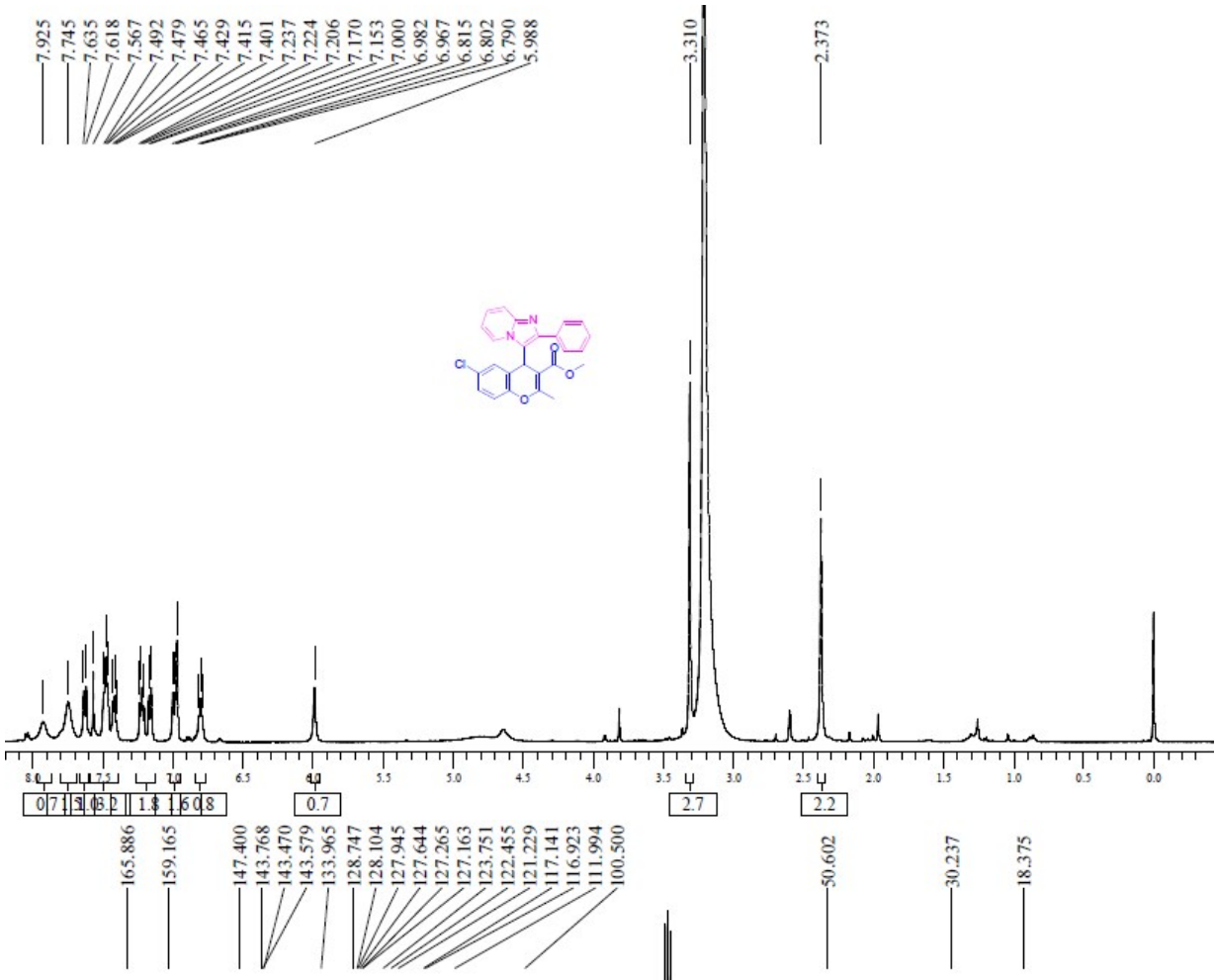


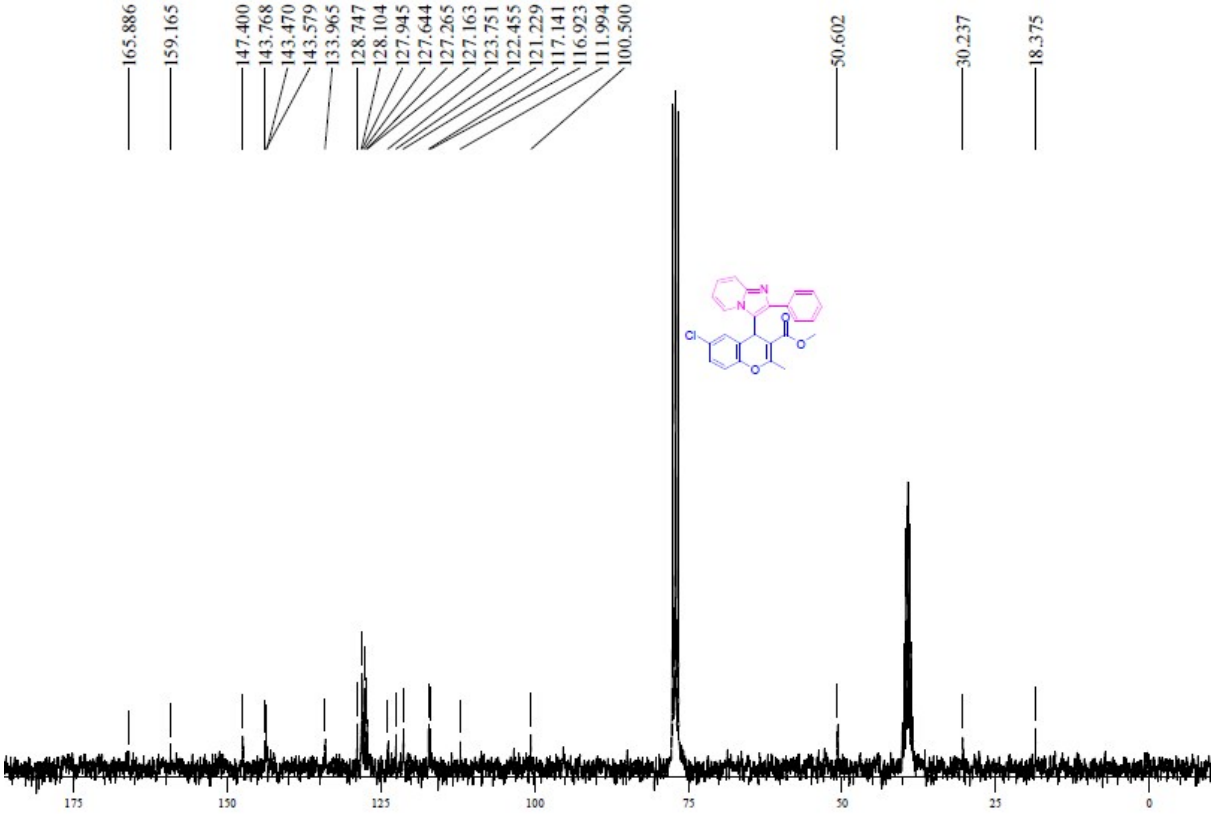




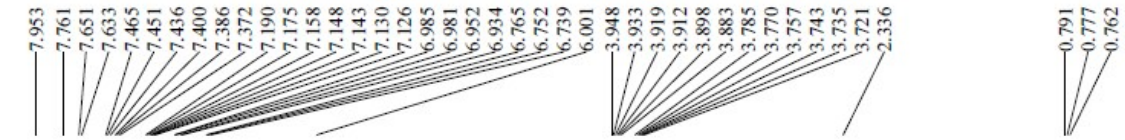


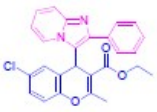
1H and 13C NMR Spectra of compound 4c

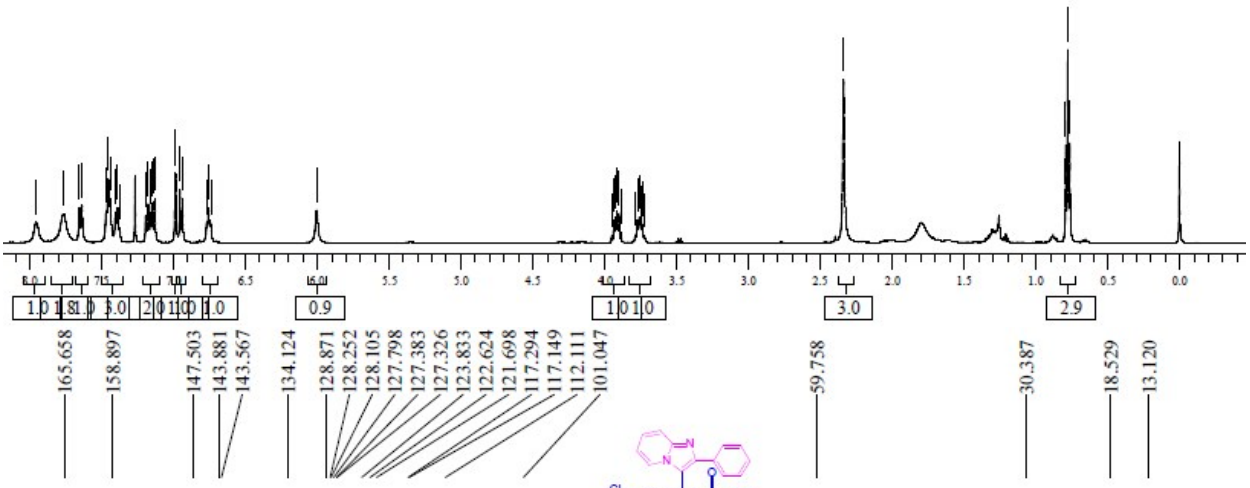


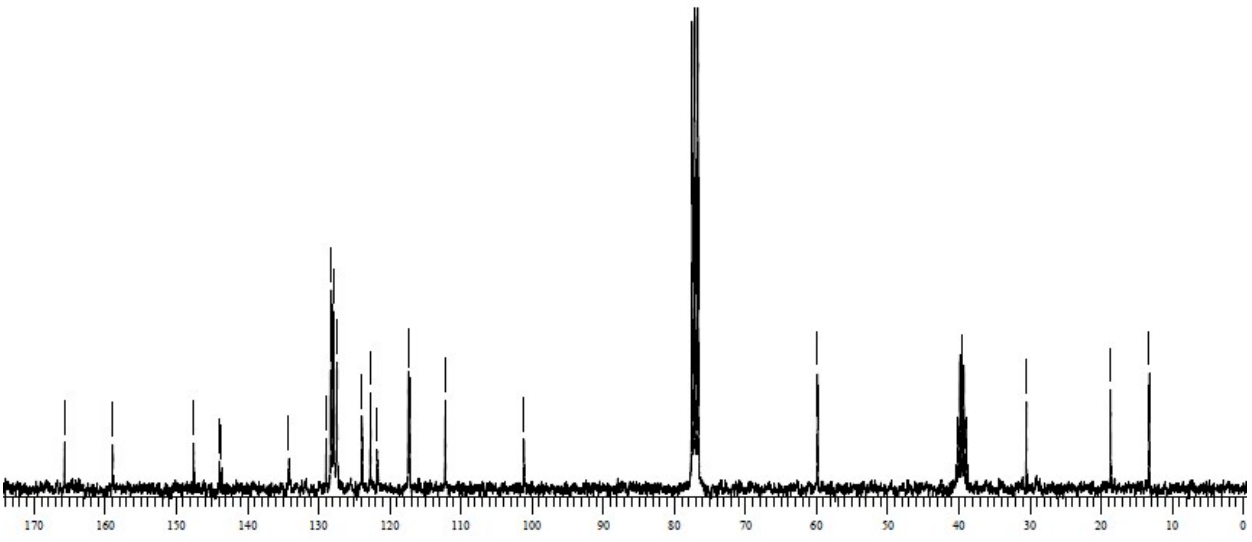


1H and 13C NMR Spectra of compound 4d

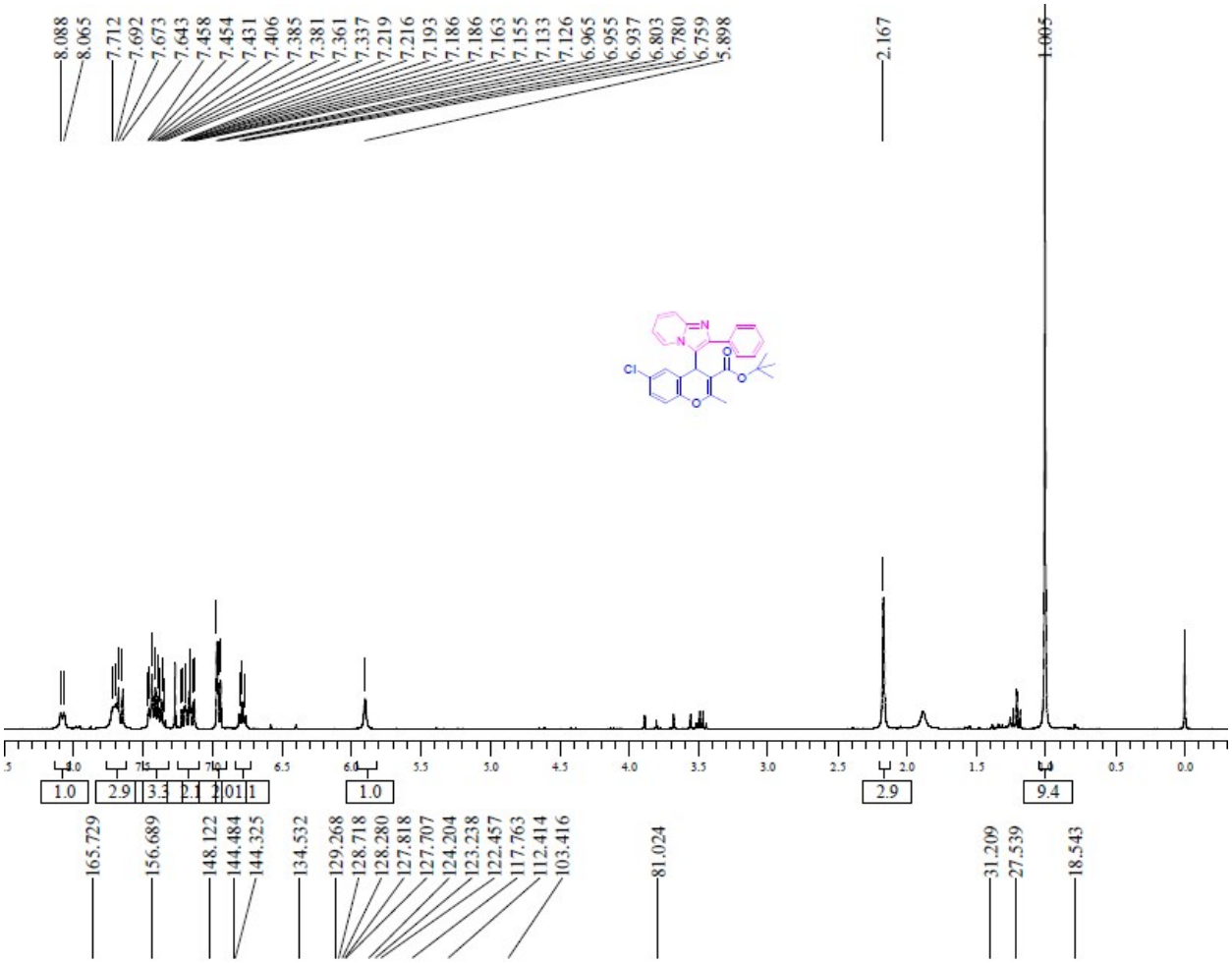


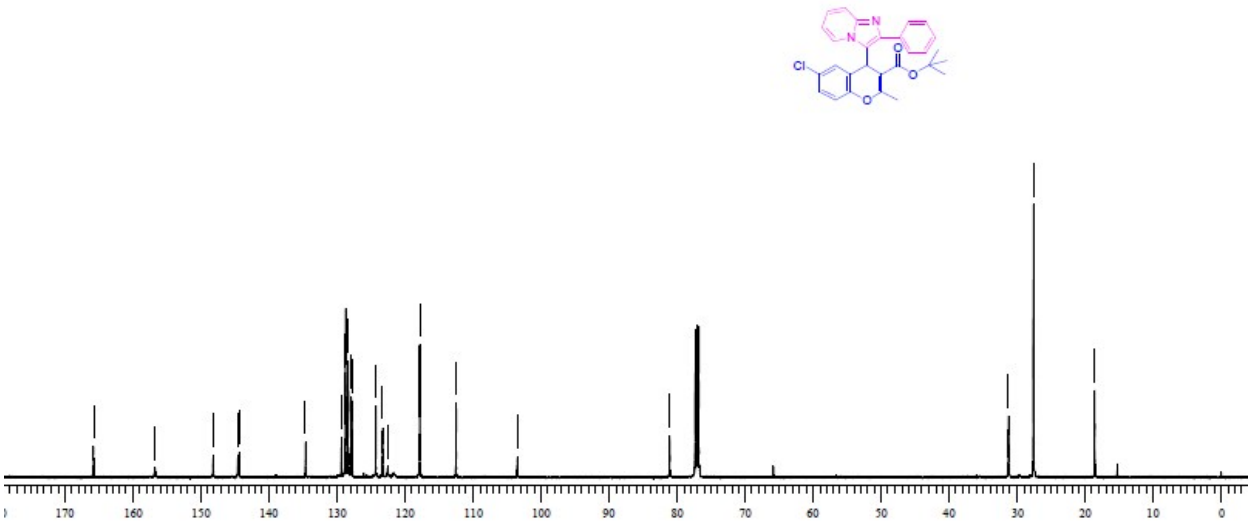




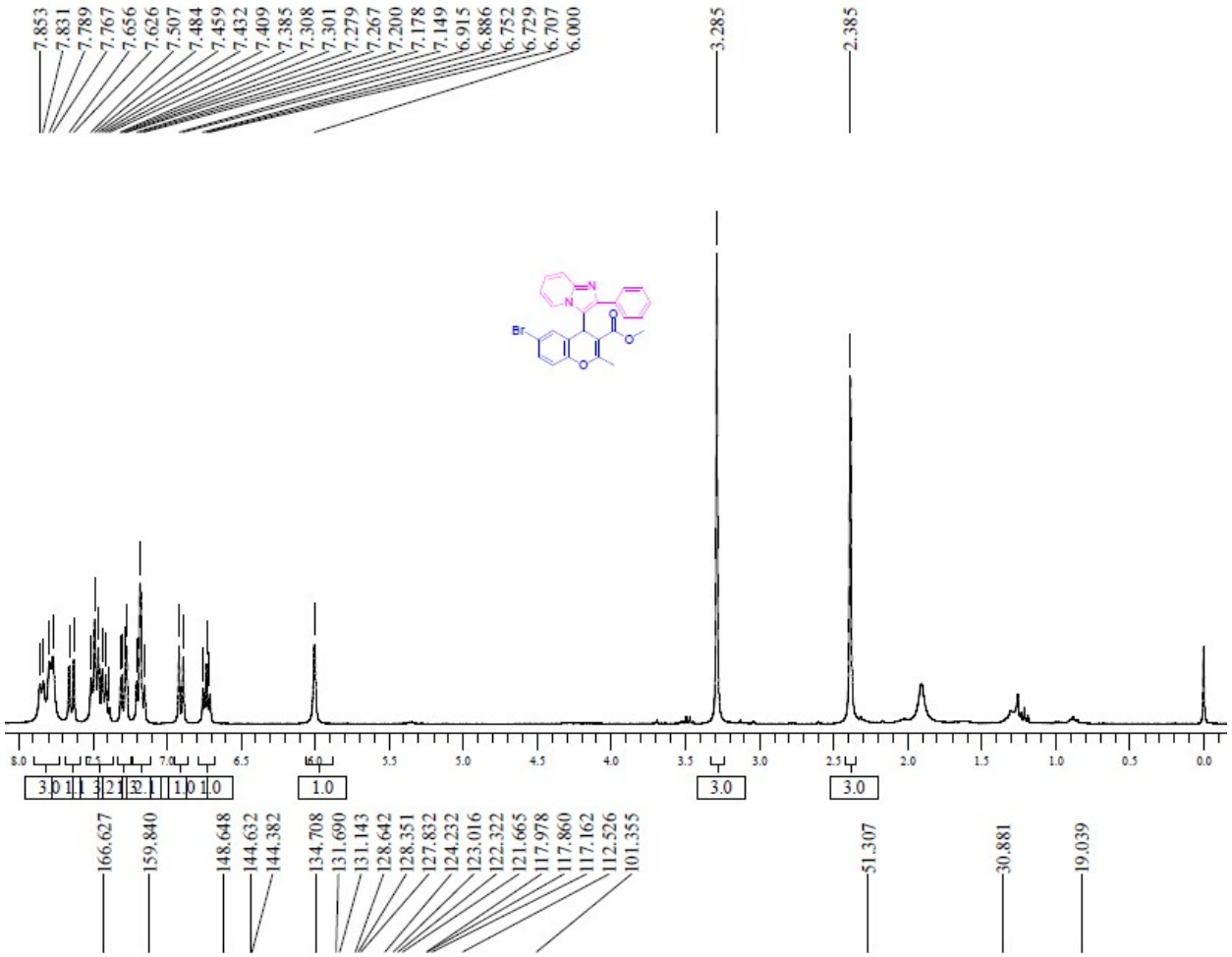


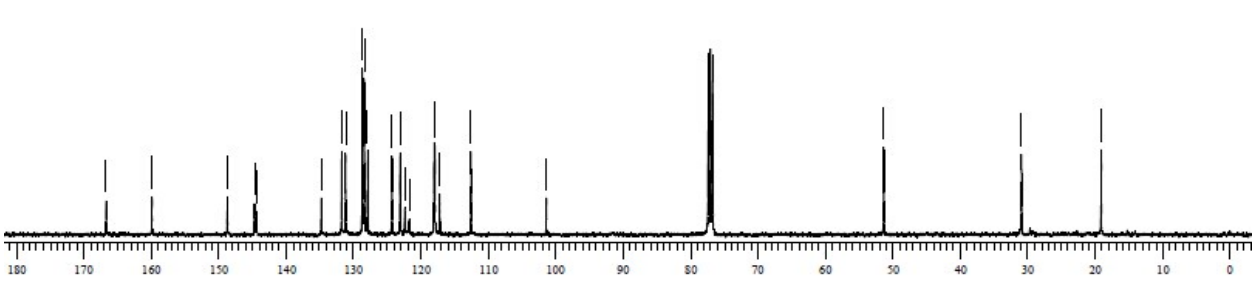
1H and 13C NMR Spectra of compound 4e



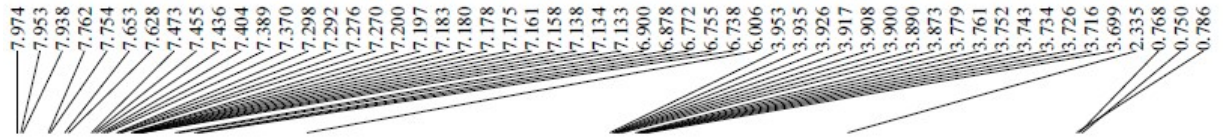


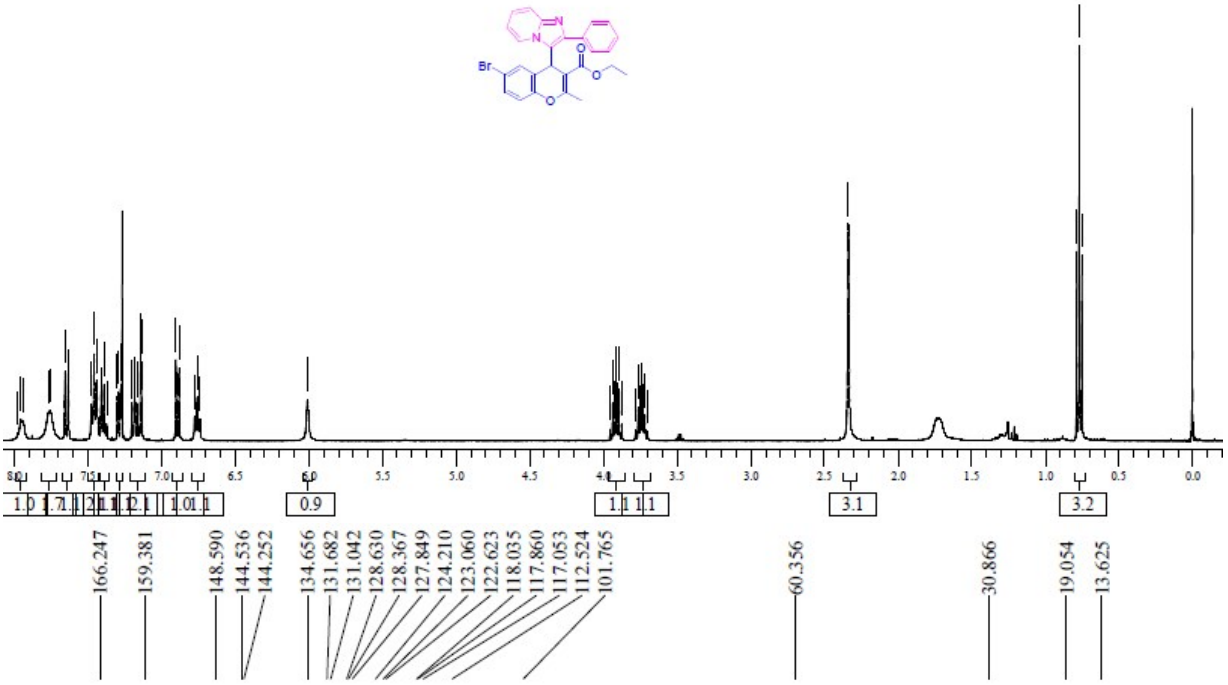
1H and 13C NMR Spectra of compound 4f

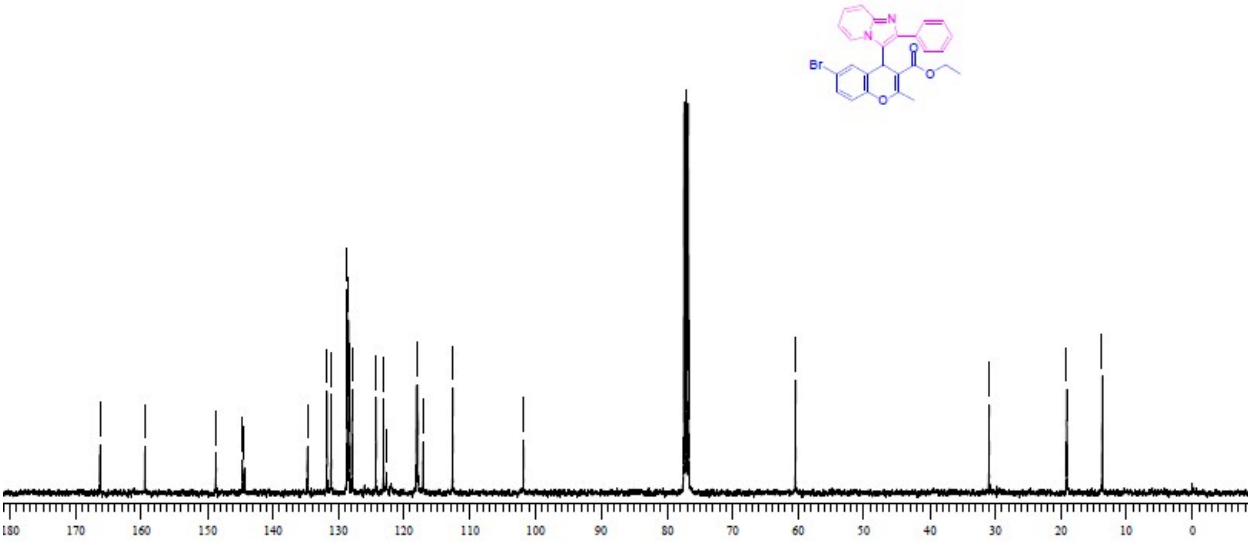




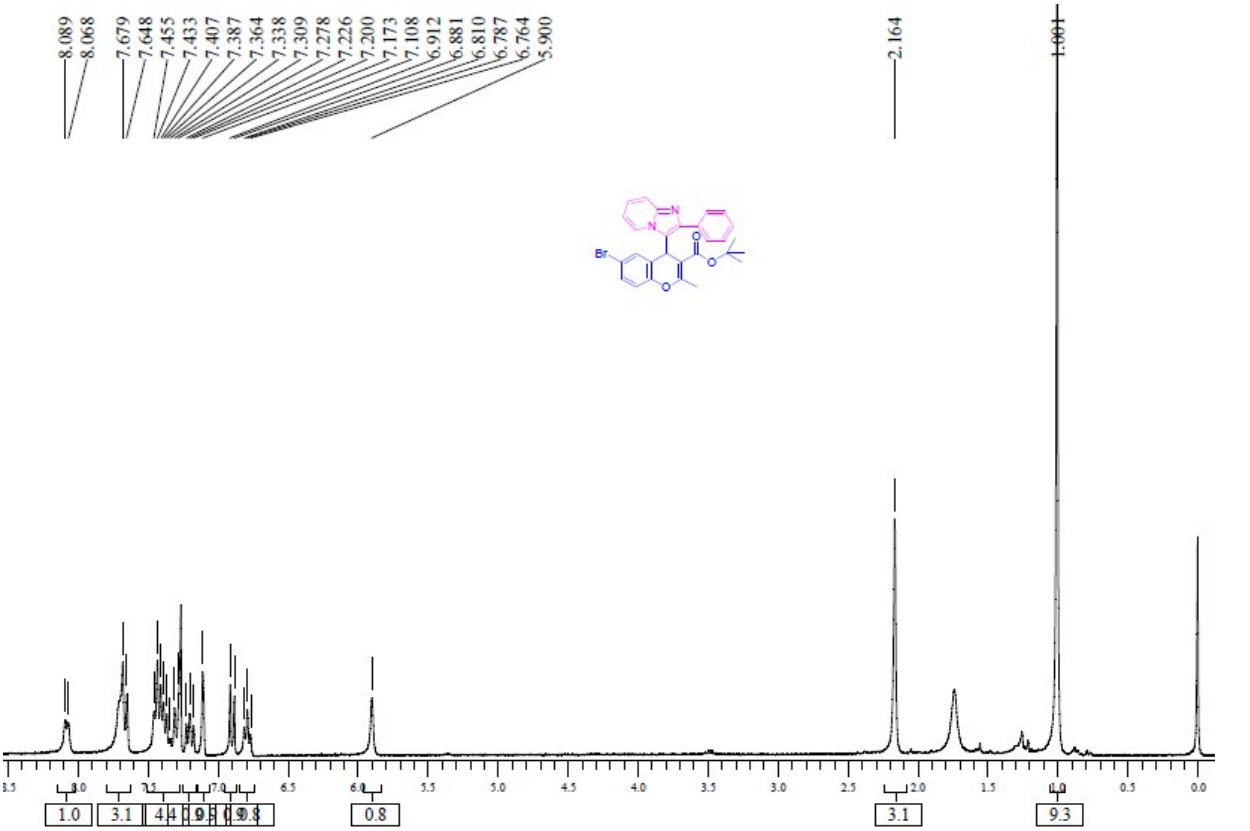
1H and 13C NMR Spectra of compound 4g

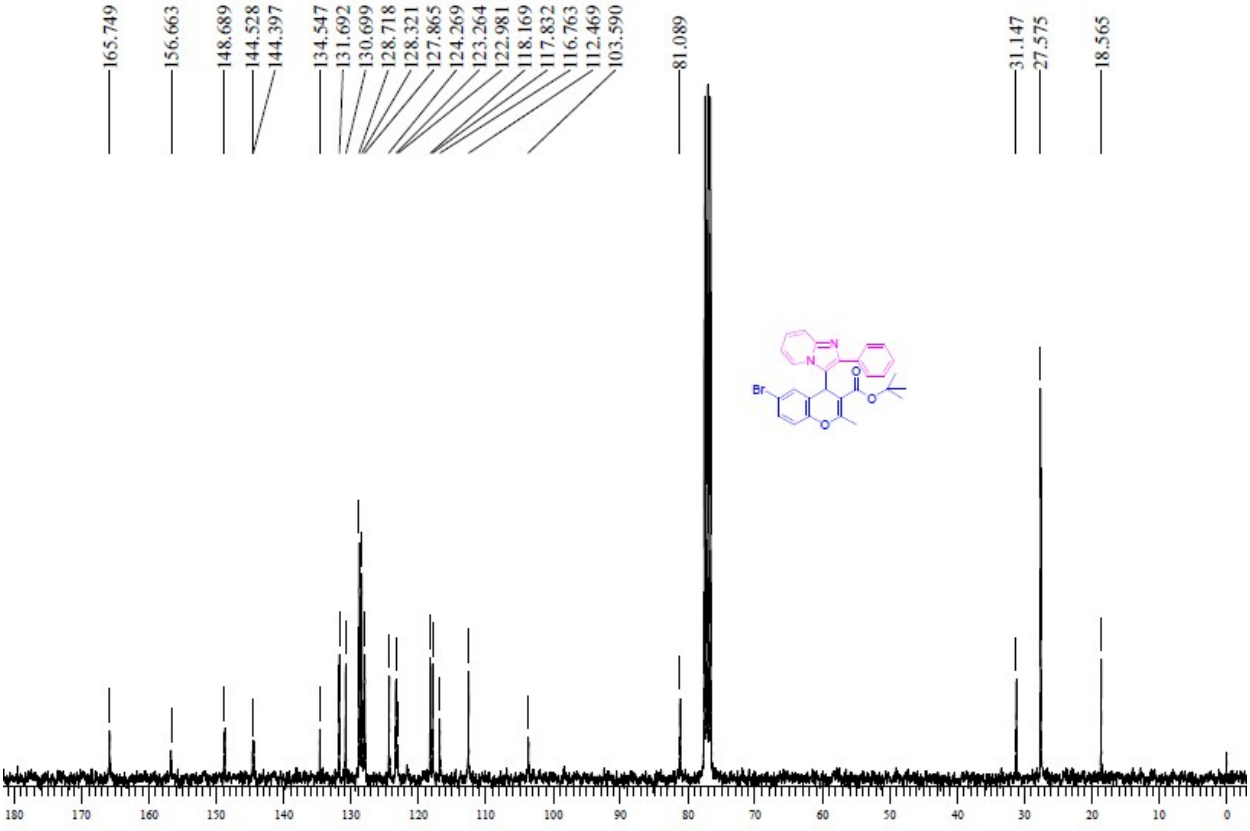




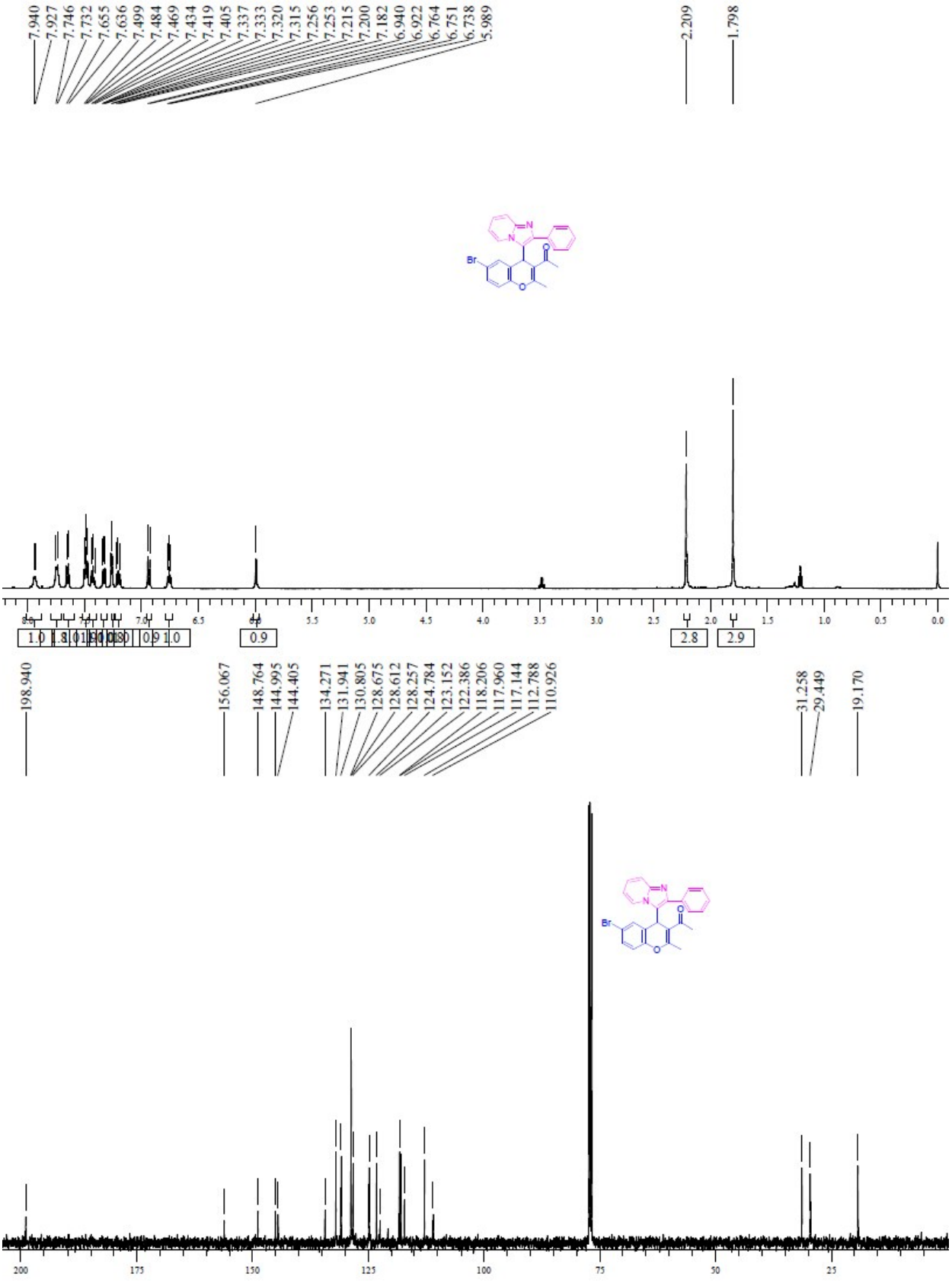


1H and 13C NMR Spectra of compound 4h

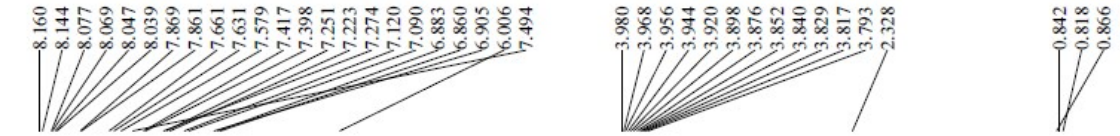


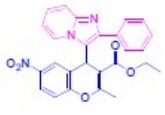


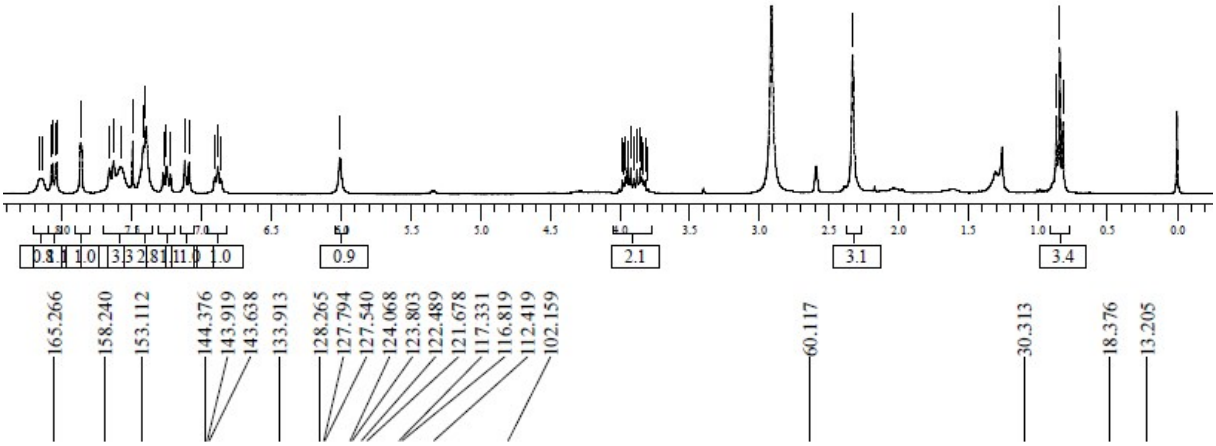
1H and 13C NMR Spectra of compound 4i

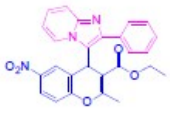


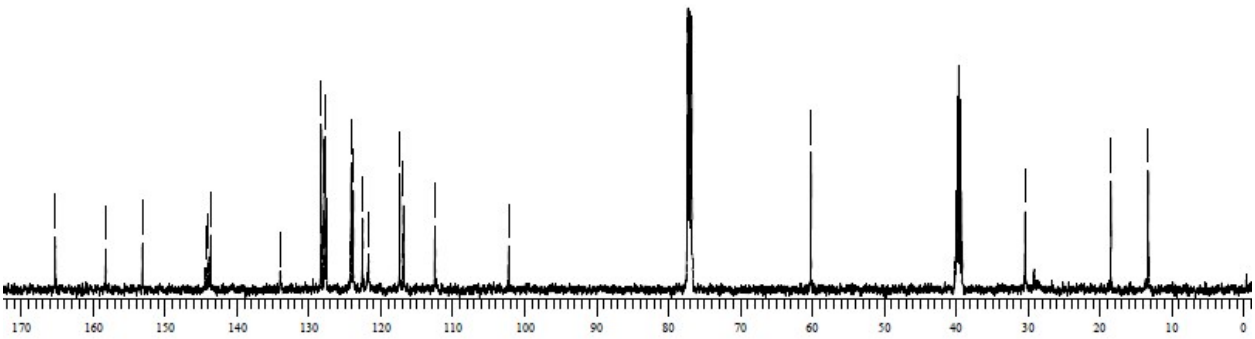
1H and 13C NMR Spectra of compound 4j



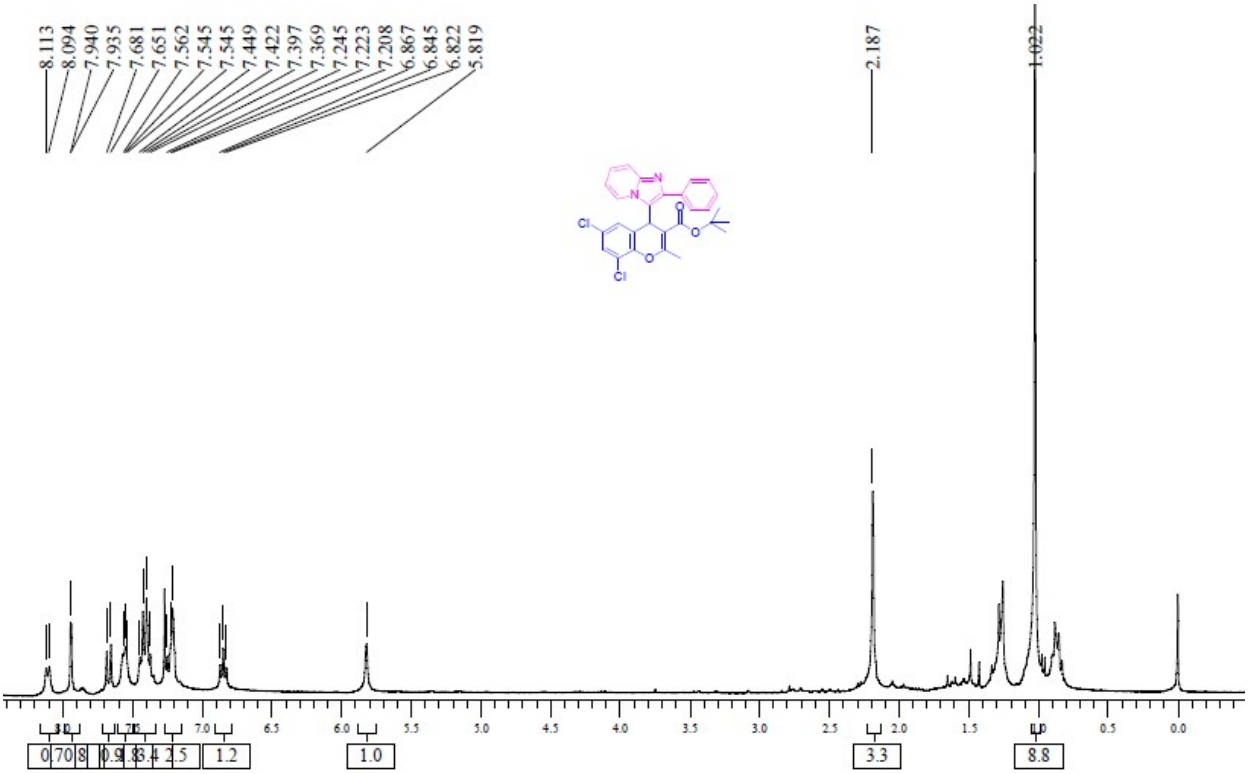


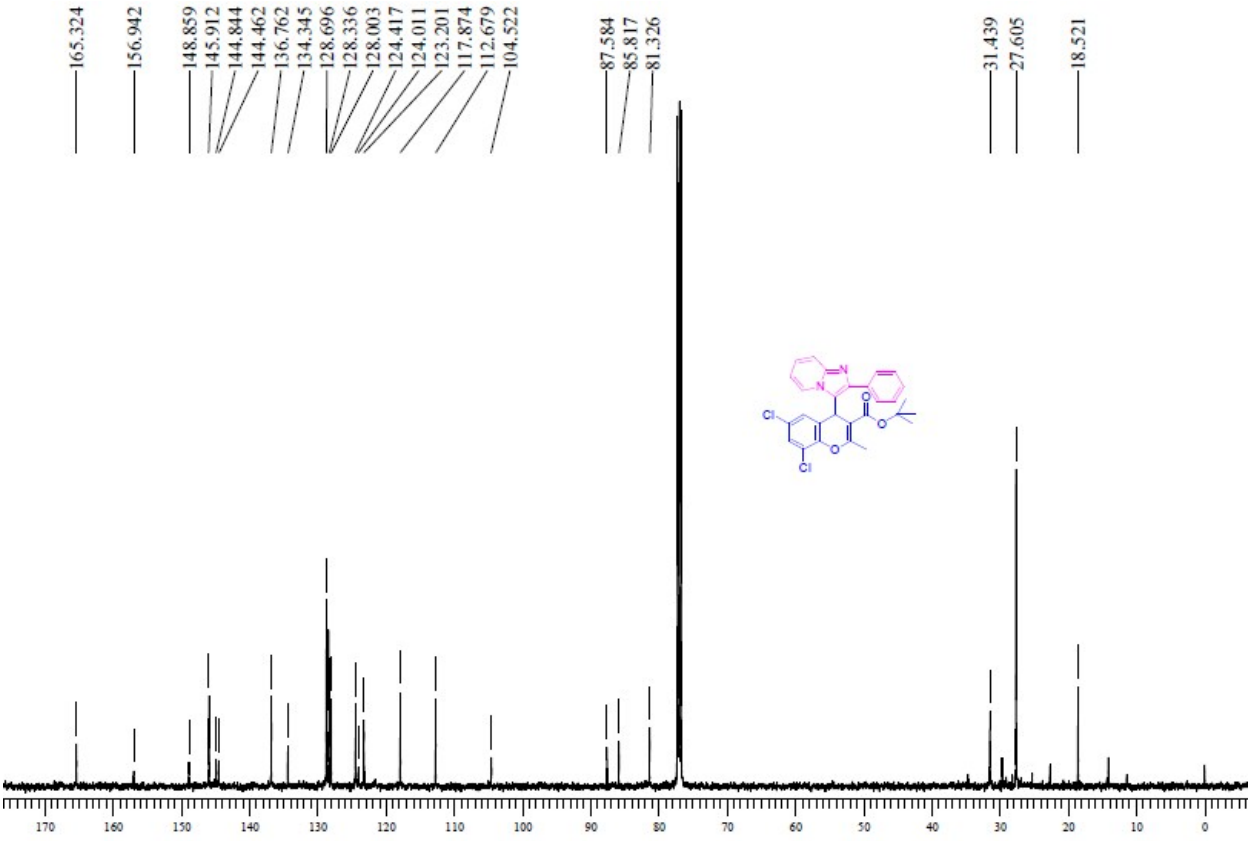




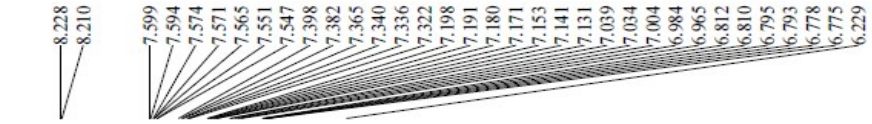


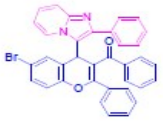
1H and 13C NMR Spectra of compound 4k

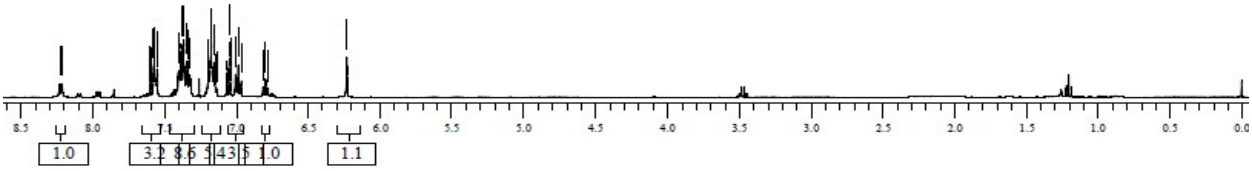


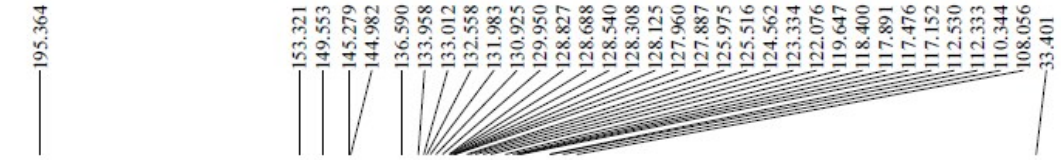


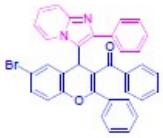
1H and 13C NMR Spectra of compound 4l

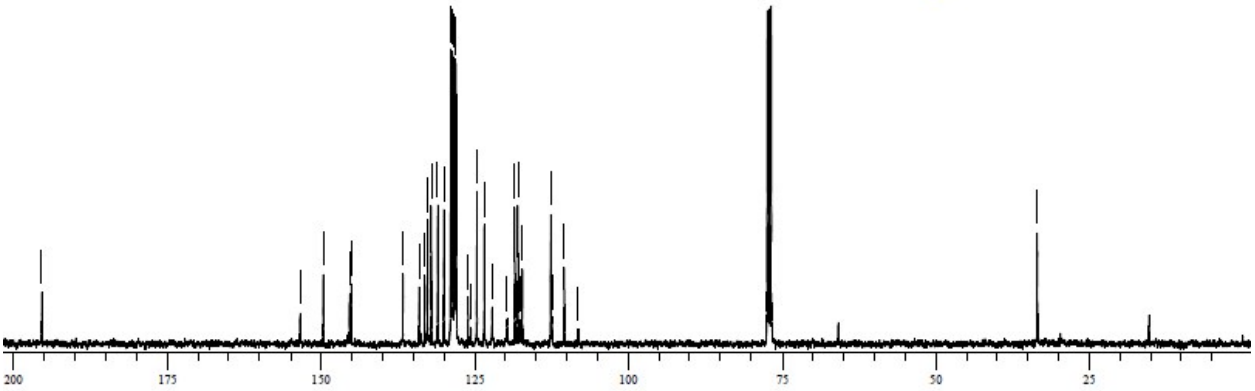




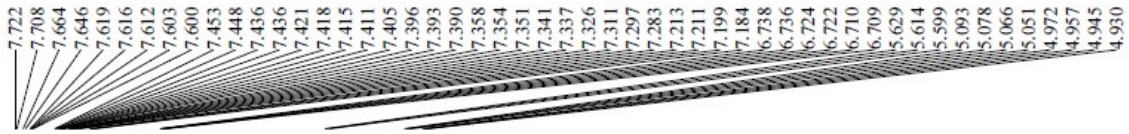


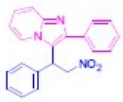


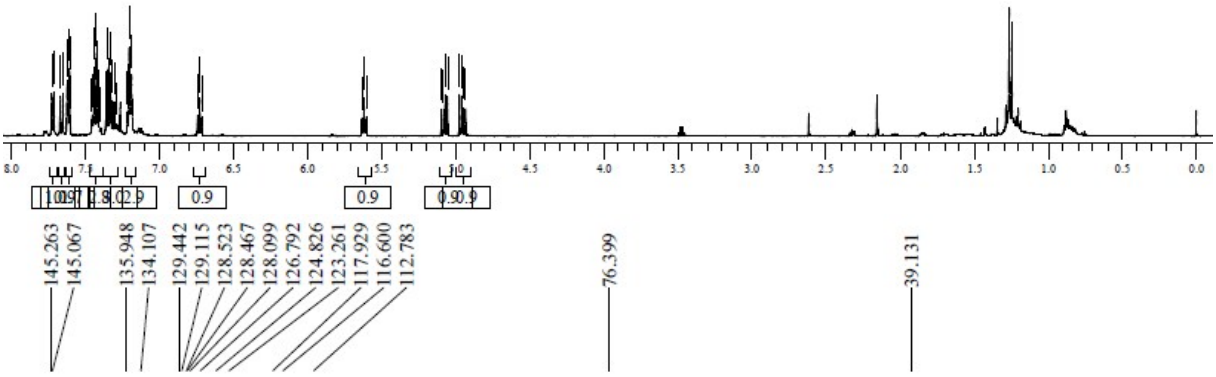


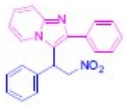


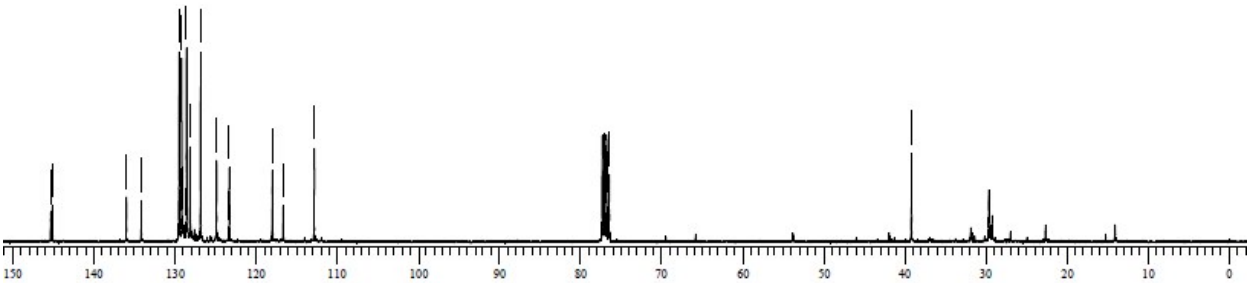
1H and 13C NMR Spectra of compound 4m



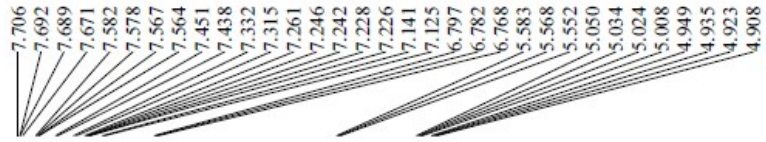


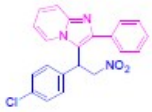


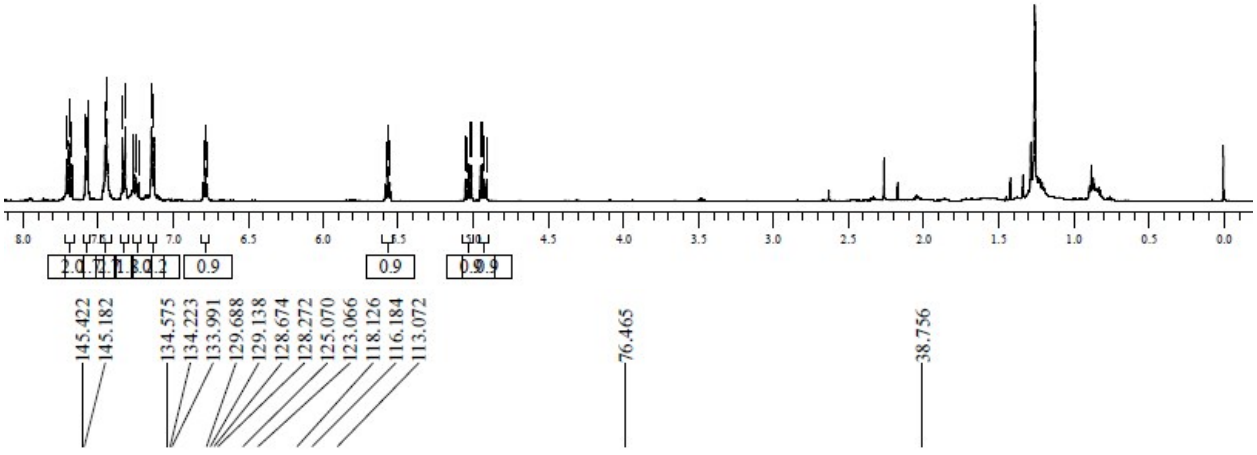


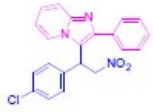


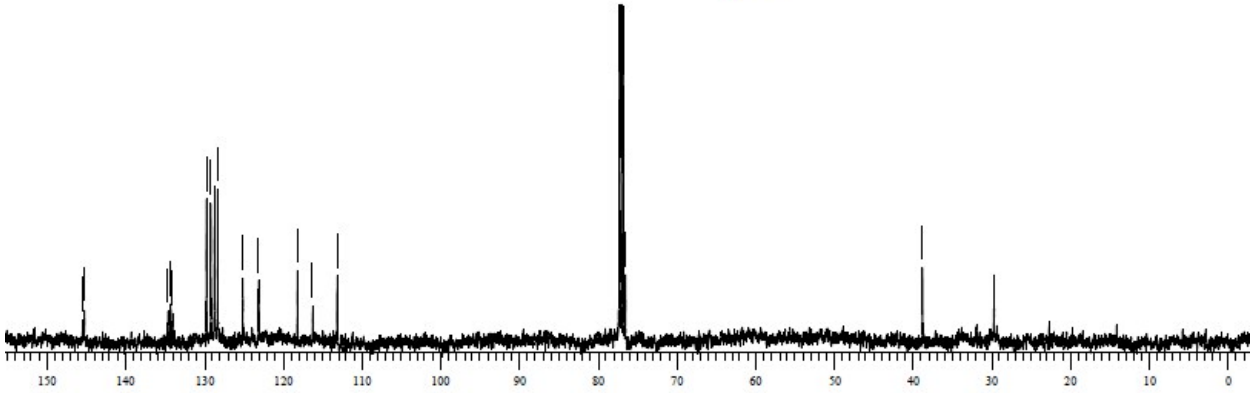
1H and 13C NMR Spectra of compound 4n



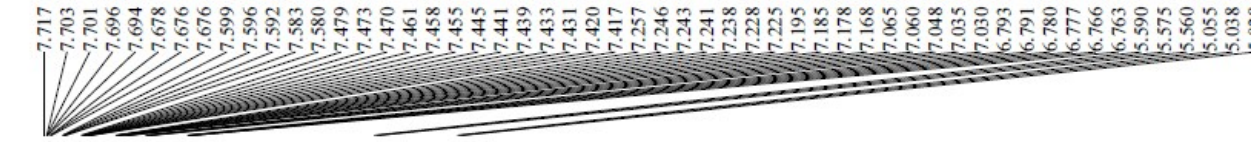


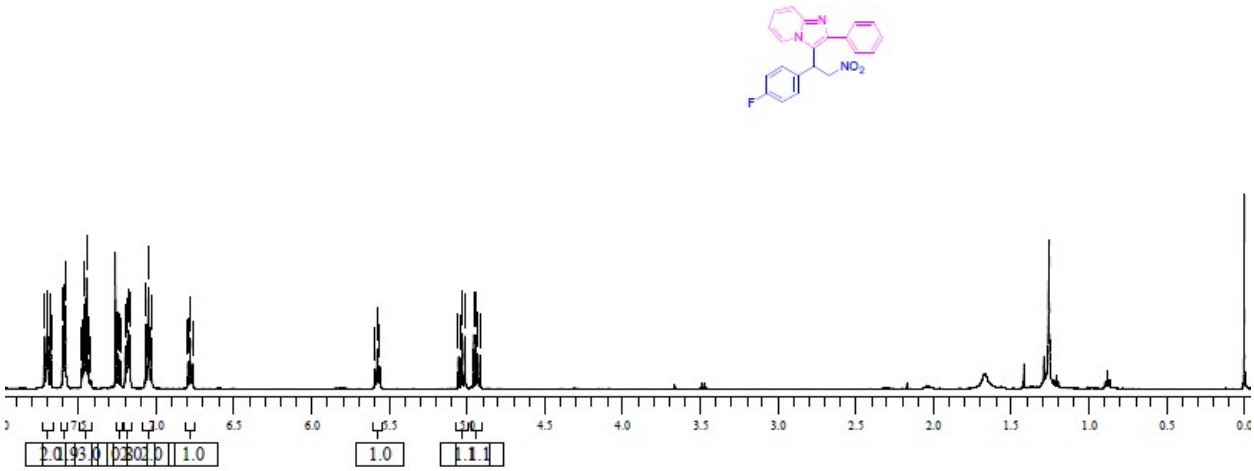


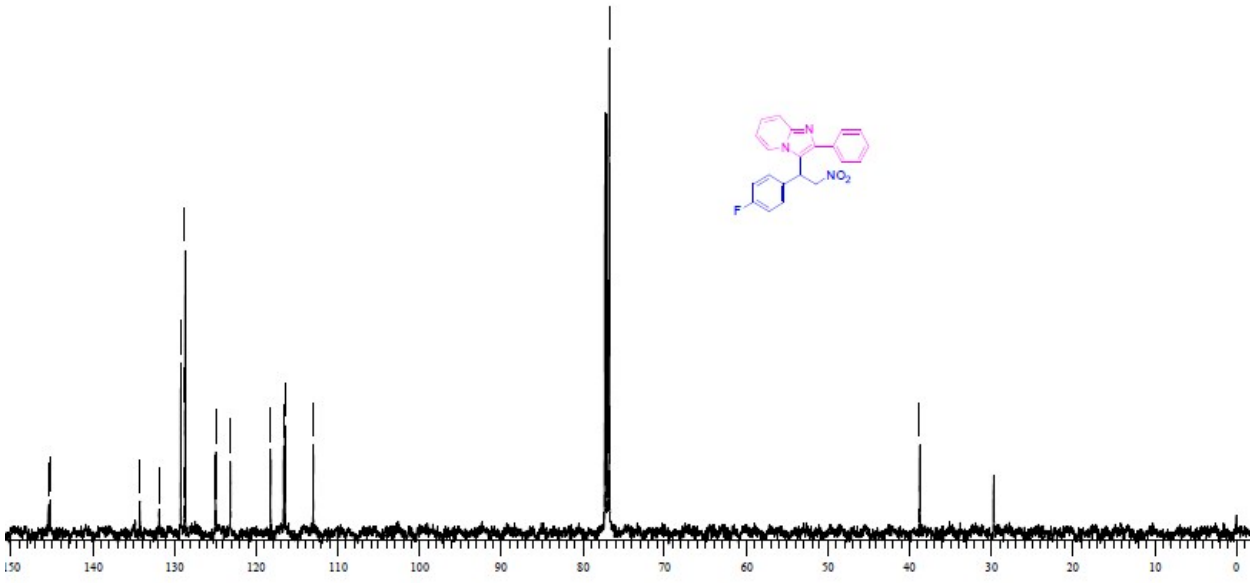




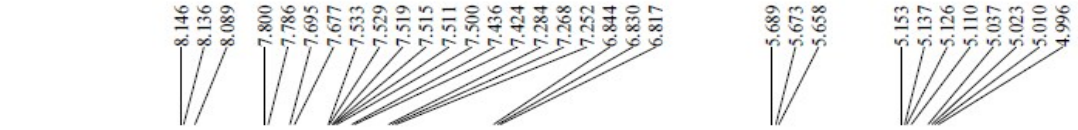
1H and 13C NMR Spectra of compound 4o

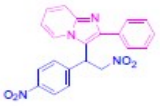


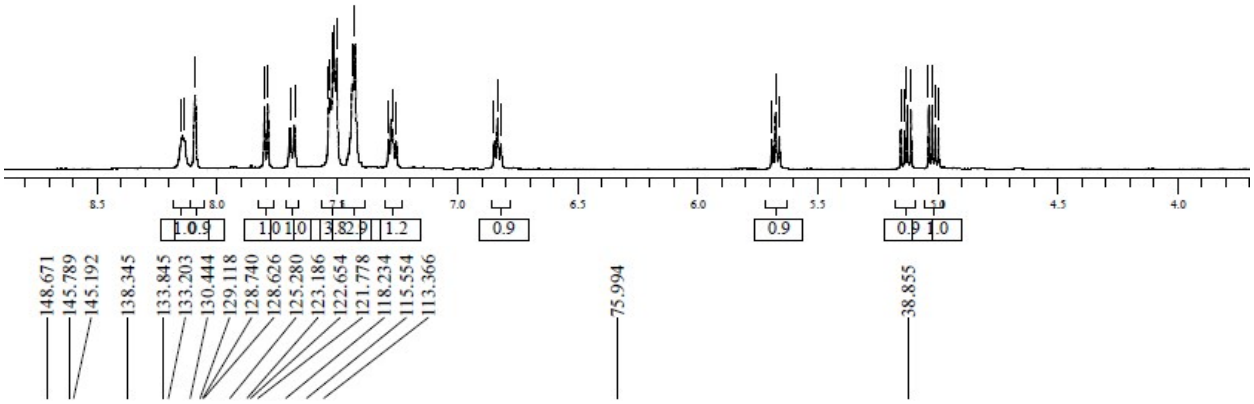


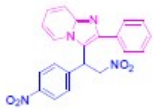


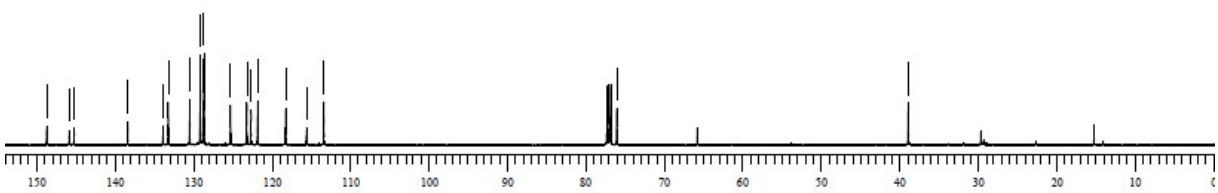
1H and 13C NMR Spectra of compound 4p



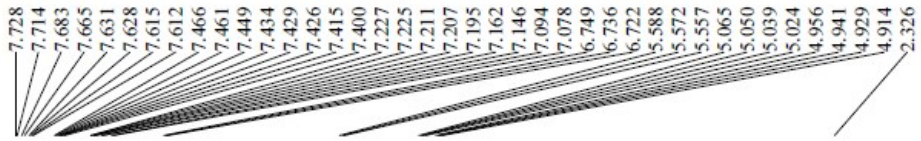


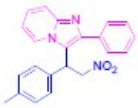


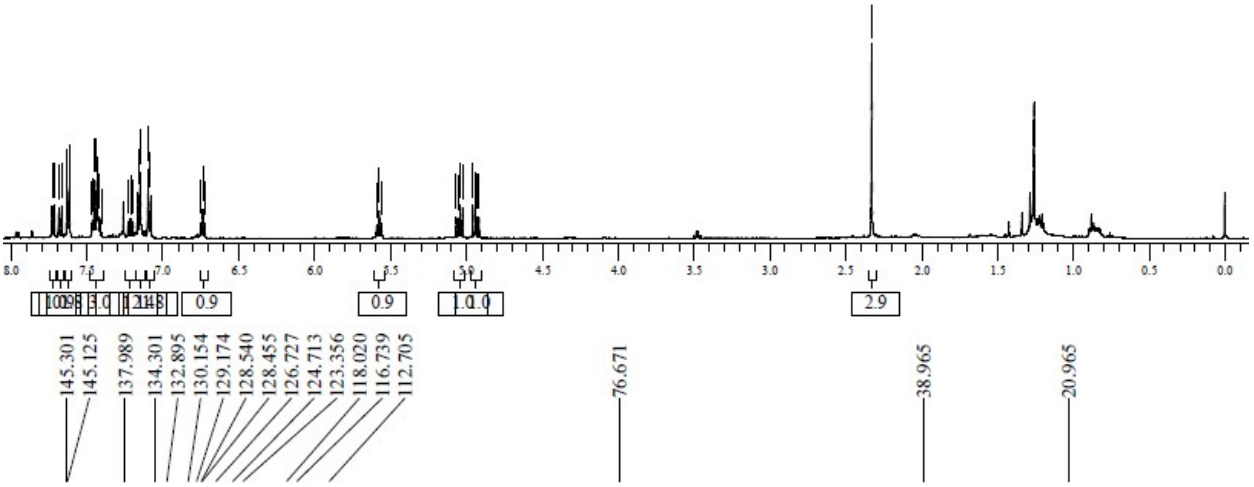


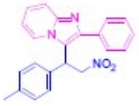


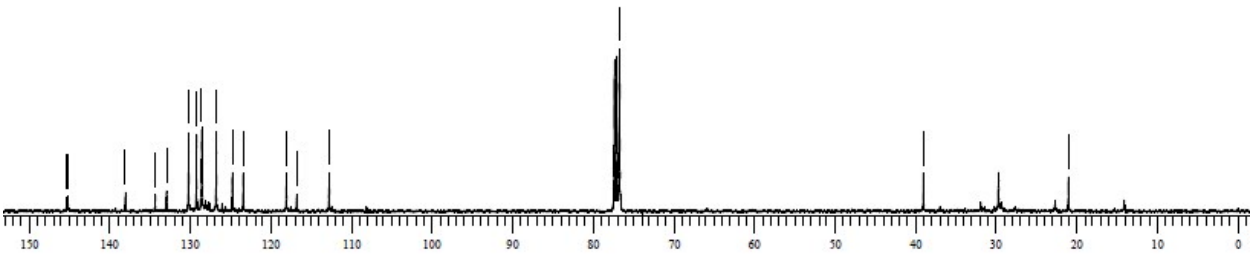
1H and 13C NMR Spectra of compound 4q



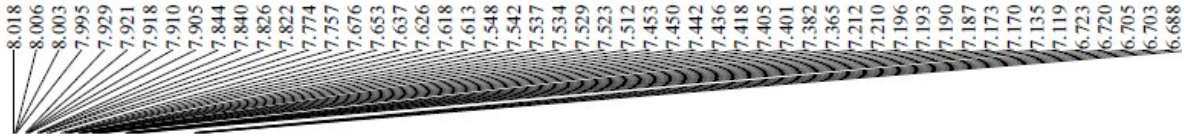


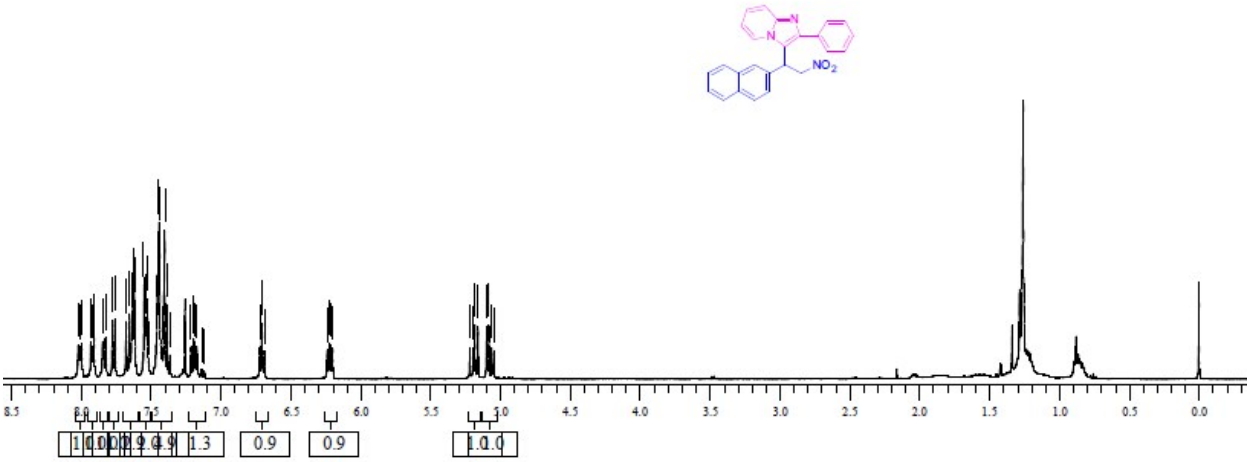


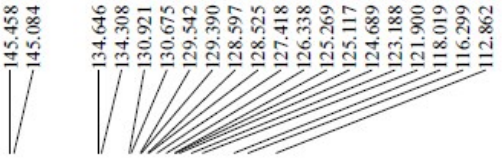


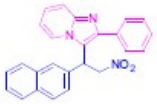


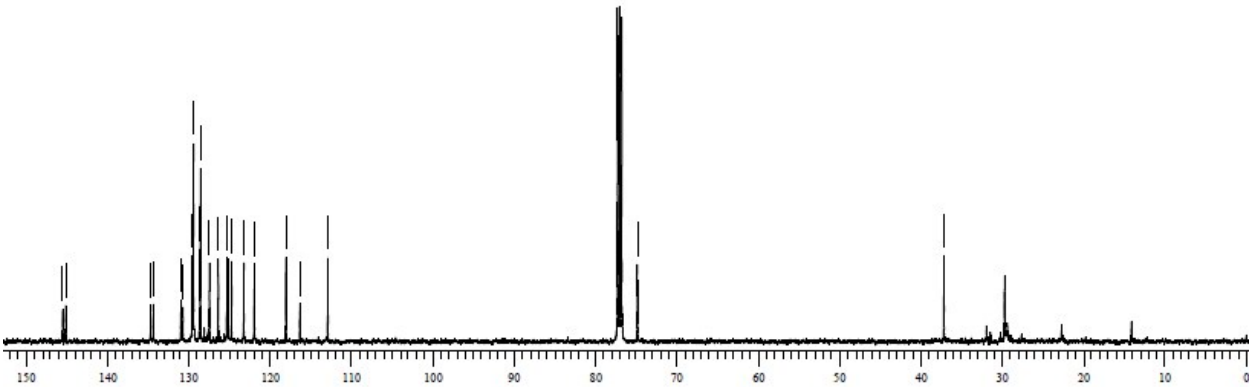
1H and 13C NMR Spectra of compound 4r



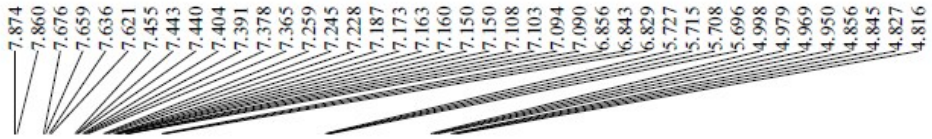


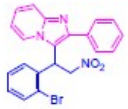


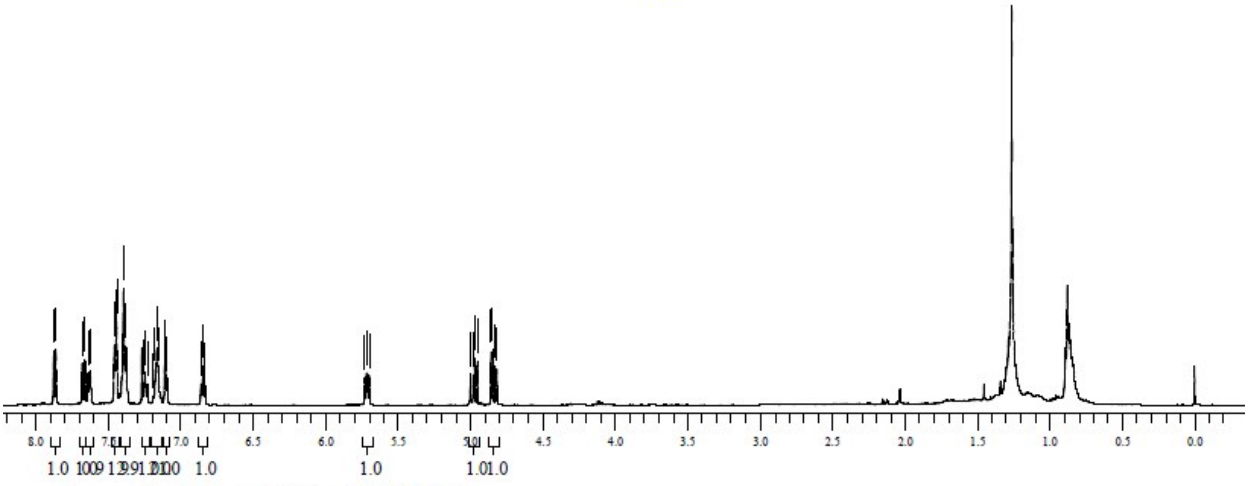


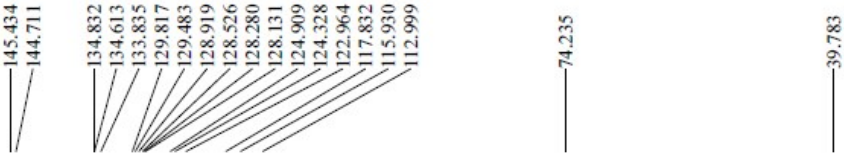


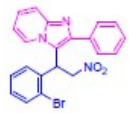
1H and 13C NMR Spectra of compound 4s

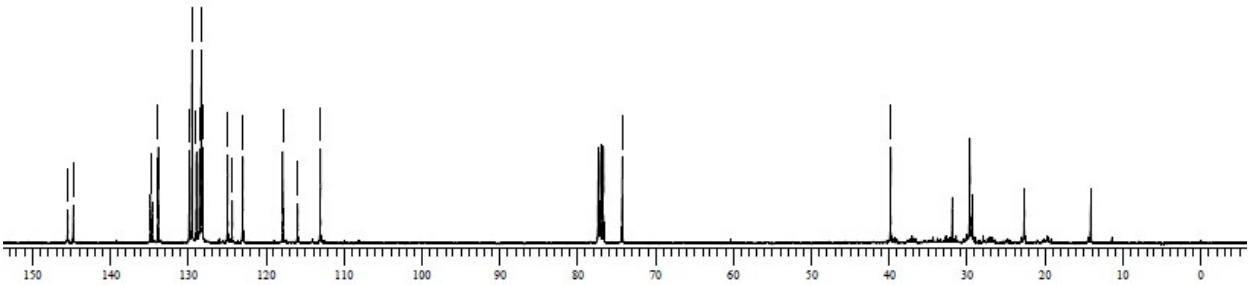




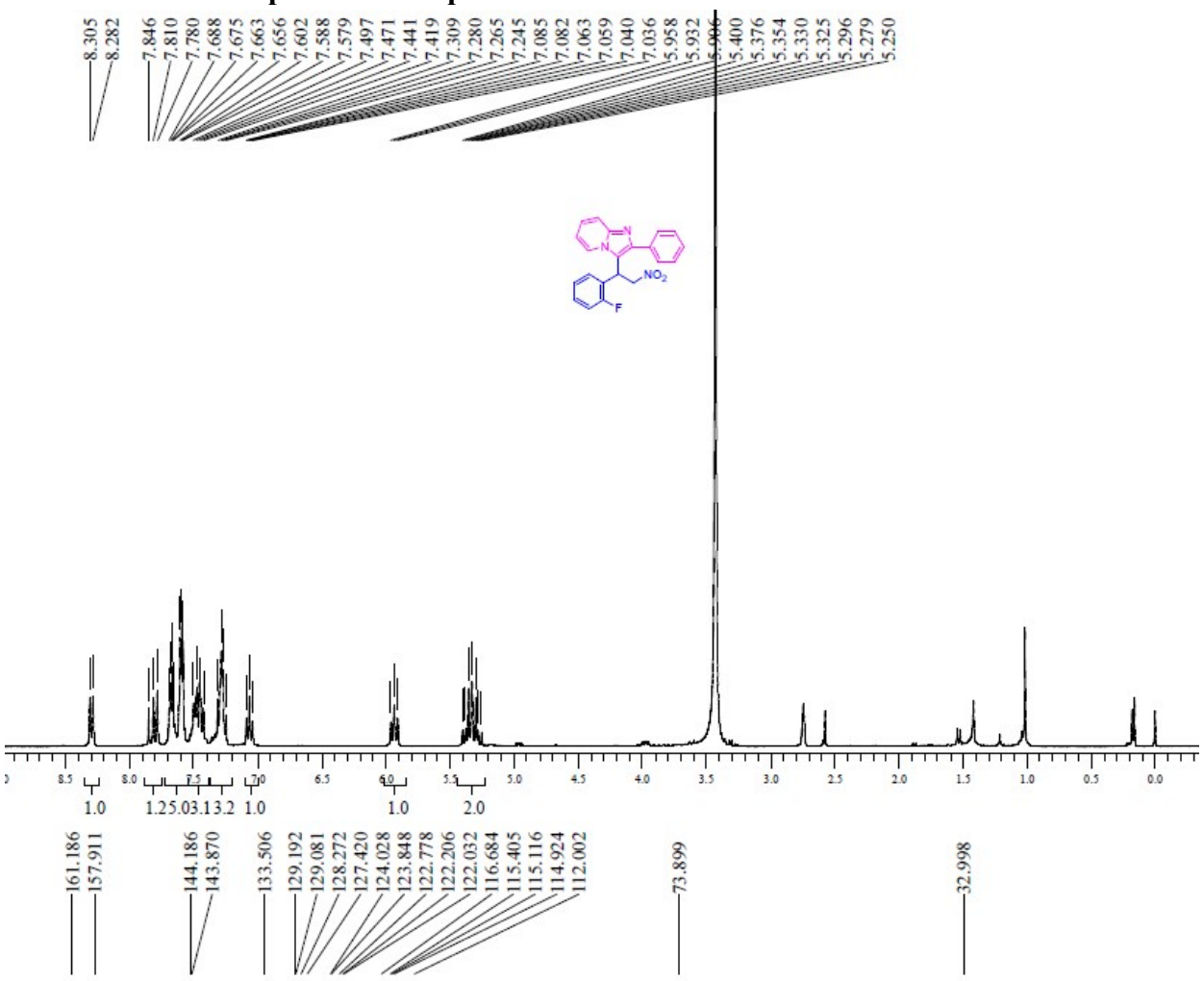


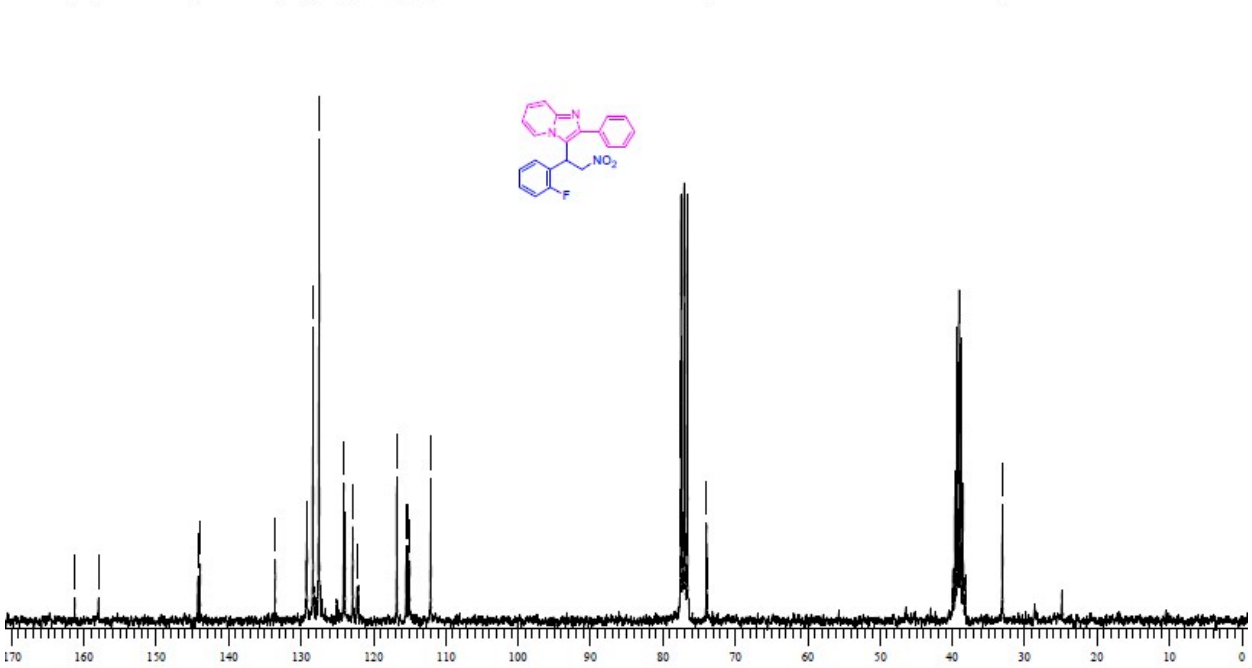




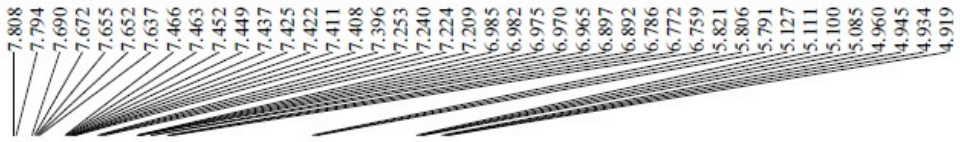


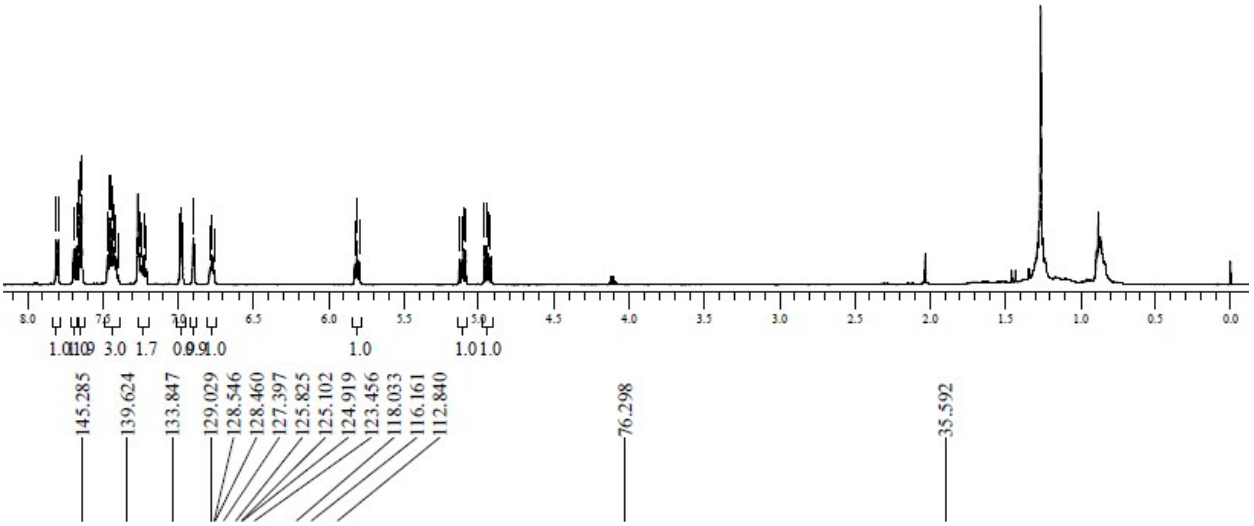
1H and 13C NMR Spectra of compound 4t

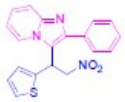


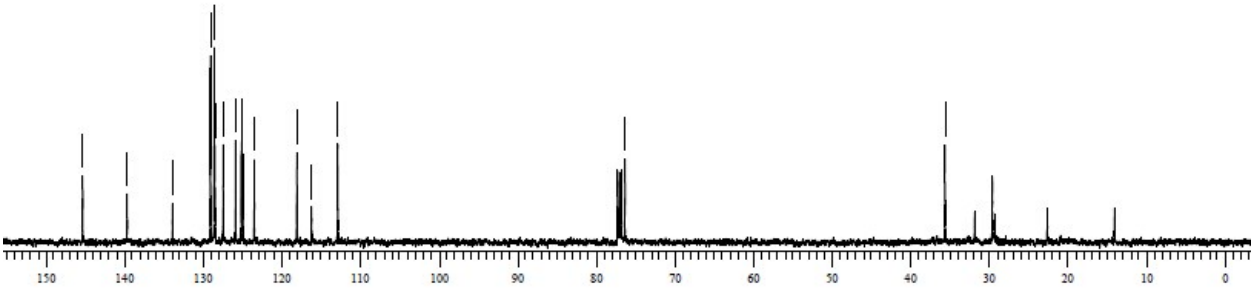


1H and 13C NMR Spectra of compound 4u

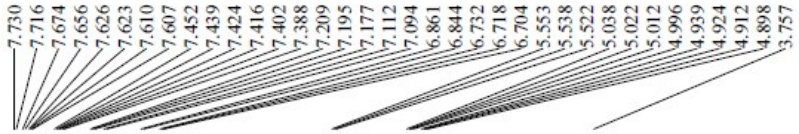


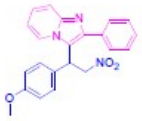


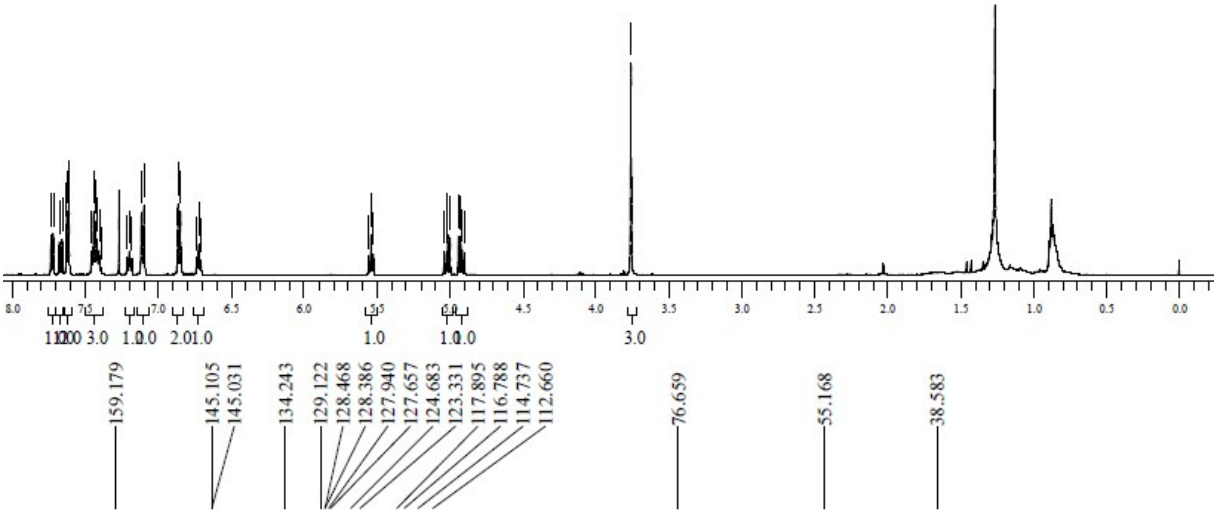


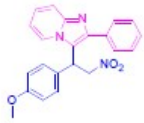


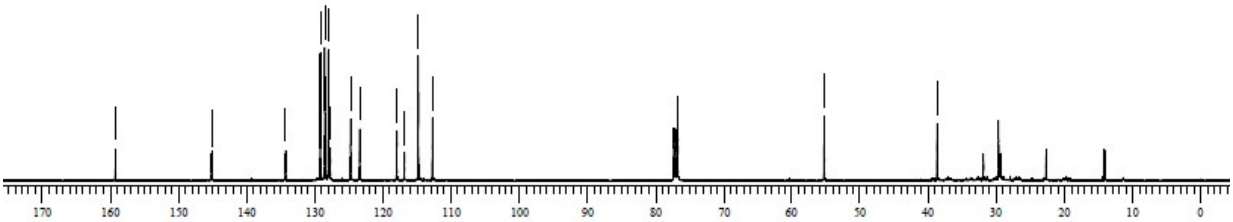
1H and 13C NMR Spectra of compound 4v



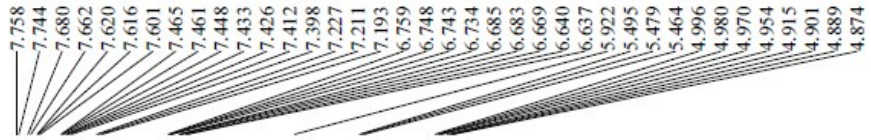


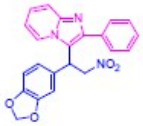


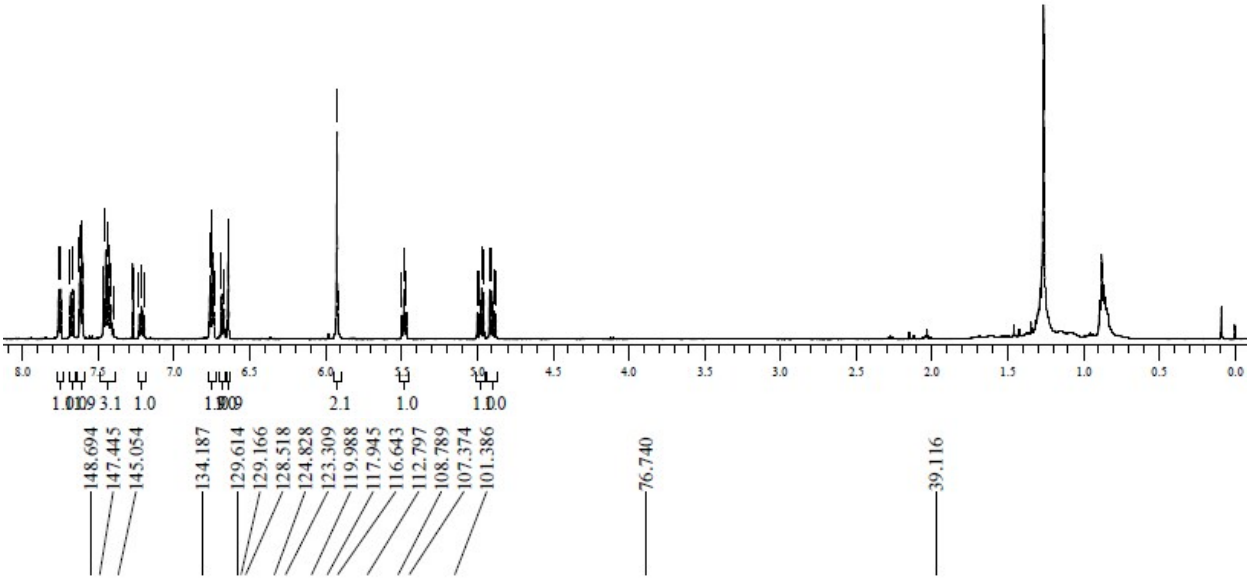


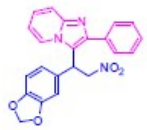


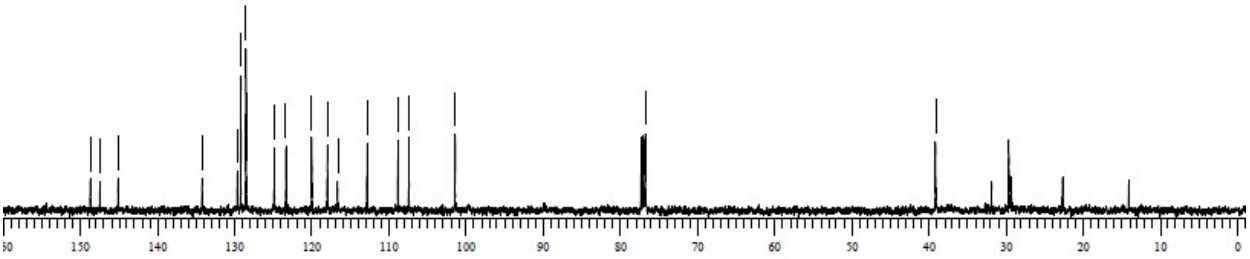
1H and 13C NMR Spectra of compound 4w











1H and 13C NMR Spectra of compound 4x