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Supporting Information

Silver-Catalyzed [3+2] Domino Reaction: An Efficient Strategy to Synthesize Imidazole-5-carbaldehydes

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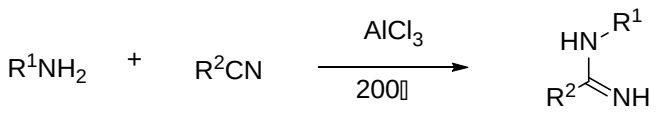
A、General consideration

All reactions were performed at 120℃ in sealed tube otherwise noted. Analytical thin layer chromatography was carried out using silica gel GF254, visualized under UV light (at 254 nm). Proton NMR (^{1}H) were recorded at 400 MHz, and Carbon NMR (^{13}C) at 100 MHz NMR spectrometer. Multiplicities are abbreviated as: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet.

B、General procedure

Synthesis of 1a according to the following procedure:



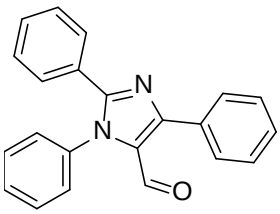
The amine (20 mmol) is mixed with the nitrile (20 mmol) in a 100 mL, wide-mouthed flask, and, during about 10 minutes, 2.7 g (20 mmol, calculated as $AlCl_3$) of a freshly opened sample of powdered, anhydrous aluminum chloride is added in portions with thorough stirring. The mixture is then heated at 200 °C for 30 minutes, and, while still molten, is poured slowly into a thoroughly stirred mixture of 0.6 ml of concentrated hydrochloric acid and 50 mL of water. After the addition of 0.6 g of activated carbon, the suspension is stirred while being externally cooled in running water and is then filtered. The filtrate is poured in a steady stream into a stirred solution of 6.6 g of sodium hydroxide in 36 mL of water. The flocculent precipitate is collected on alkali-resistant paper in a 12 cm Büchner funnel with the aid of suction, washed with water, broken up thoroughly, and air-dried at room temperature to constant weight. Recrystallization from toluene provided **1a-t**, generally in a yield higher than 90%.

Synthesis of 3a according to the following procedure:

A 25 mL-schlenk tube was charged with a stirring bar, and added N-phenylbenzimidamide (**1a** 0.25 mmol), phenyl-propynal (**2a** 0.3 mmol), AgOTf (5 mol %), AcOH (5 mol %), DMSO+H_2O (2 mL). The reaction was allowed to stir at 120℃ under O_2 atmosphere for 10h. The solvent was removed and the crude product was separated by column chromatography (eluted with petroleum ether : ethyl acetate=8:1) to give a pure sample of **3a**.

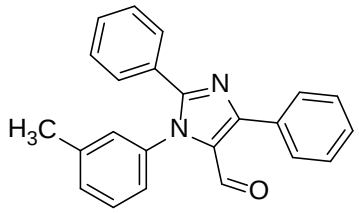
C. Analytical data for 3a-3y.

1,2,4-triphenyl-1*H*-imidazole-5-carbaldehyde (3a 78%)



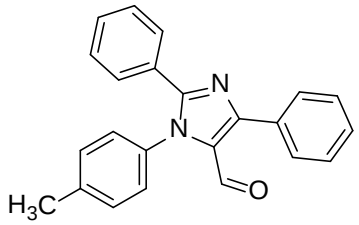
White solid, m.p. 179-180℃. 63.3mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.83 (s, 1H), 7.91 (d, J = 8.0 Hz, 2H), 7.54-7.44 (m, 8H), 7.34-7.30 (m, 3H), 7.28 (t, J = 6.8 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.7, 153.9, 151.5, 136.7, 132.3, 129.7, 129.5, 129.4, 129.4, 129.3, 128.8, 128.7, 128.6, 128.3, 127.9. IR (KBr) 2833, 1665, 1469, 771, 692 cm^{-1}. ESI-MS m/z (%) 325 (100) $[M+H]^+$; Anal. Calcd for $C_{22}H_{16}N_2O$ C, 81.46; H, 4.97; N, 8.64; Found: C, 81.08; H, 4.99; N, 8.69.

2,4-diphenyl-1-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde (3b 71%)



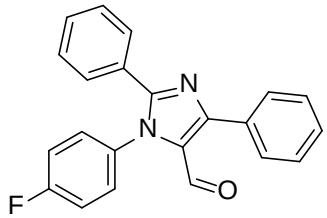
Yellow solid, m.p. 136-139℃. 60.1mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.79 (s, 1H), 7.91 (d, J = 8.0 Hz, 2H), 7.53-7.47 (m, 5H), 7.35-7.26 (m, 5H), 7.12 (d, J = 6.5 Hz, 2H), 2.38 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.6, 153.6, 151.3, 139.6, 136.6, 132.4, 130.3, 129.7, 129.5, 129.3, 129.2, 128.6, 128.4, 128.3, 124.90, 21.3. IR (KBr) 2821, 1667, 1469, 782 cm^{-1}. ESI-MS m/z (%) 339 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{18}N_2O$ C, 81.63; H, 5.36; N, 8.28; Found: C, 81.27; H, 5.39; N, 8.33.

2,4-diphenyl-1-(*p*-tolyl)-1*H*-imidazole-5-carbaldehyde (3c 69%)



Yellow solid, m.p. 150-153℃. 58.4mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.82 (s, 1H), 7.91 (d, J = 6.8 Hz, 2H), 7.54-7.48 (m, 7H), 7.34-7.20 (m, 5H), 2.45 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.6, 153.7, 151.4, 139.3, 134.0, 132.3, 130.1, 129.6, 129.4, 129.3, 129.2, 128.5, 128.2, 127.5, 21.3. IR (KBr) 2823, 1655, 1457, 809 cm^{-1}. ESI-MS m/z (%) 339 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{18}N_2O$ C, 81.63; H, 5.36; N, 8.28; Found: C, 81.92; H, 5.33; N, 8.22.

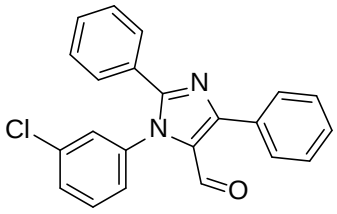
1-(4-fluorophenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde (3d 70%)



Yellow solid, m.p. 138-140℃. 59.9mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.85 (s, 1H), 7.87 (d, J = 6.8 Hz, 2H), 7.53-7.45 (m, 6H), 7.35-7.26 (m, 4H), 7.17 (t, J = 8.4 Hz 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.6, 163.9, 161.4, 154.3, 151.8, 132.8, 132.1, 129.8, 129.7, 129.6, 129.4, 129.4, 129.3, 128.7, 128.6, 128.5, 128.4, 116.5, 116.3. IR (KBr) 2830, 1664, 1432, 815 cm^{-1}. ESI-MS m/z (%)

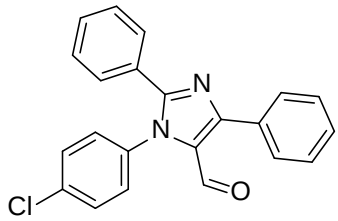
343 (100) $[M+H]^+$; Anal. Calcd for $C_{22}H_{15}FN_2O$ C, 77.18; H, 4.42; N, 8.18; Found: C, 76.87; H, 4.45; N, 8.22.

1-(3-chlorophenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde (3e 72%)



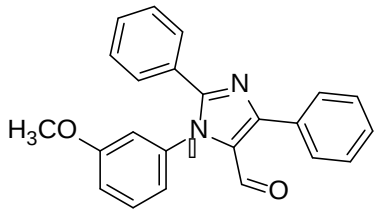
Red solid, m.p. 112-115℃. 64.6mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.84 (s, 1H), 7.87 (d, J = 8.0 Hz, 2H), 7.54-7.46 (m, 7H), 7.42-7.30 (m, 4H), 7.24 (d, J = 8.0 Hz , 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.5, 154.4, 151.6, 137.9, 134.9, 132.1, 130.2, 123.0, 129.6, 129.4, 129.3, 128.7, 128.4, 128.2, 127.0, 126.2, 120.2, 118.1. IR (KBr) 2829, 1661, 1457, 773 cm^{-1}. ESI-MS m/z (%) 359 (100) $[M+H]^+$; Anal. Calcd for $C_{22}H_{15}ClN_2O$ C, 73.64; H, 4.21; N, 7.81; Found: C, 73.35; H, 4.23; N, 7.86.

1-(4-chlorophenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde (3f 71%)



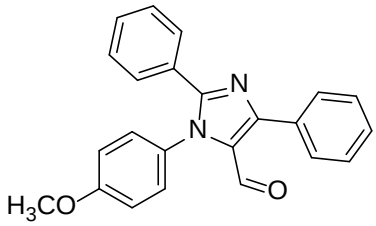
Yellow solid, m.p. 139-141℃. 63.7mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.84 (s, 1H), 7.87 (d, J = 6.4 Hz, 2H), 7.51-7.41 (m, 8H), 7.36-7.34 (m, 3H), 7.24 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.6, 154.5 151.7, 135.3, 135.2, 132.1, 129.9, 129.5, 129.4, 129.4, 129.3, 129.1, 128.7, 128.5, 128.4, 127.0, 121.4. IR (KBr) 2827, 1661, 1457, 773 cm^{-1}. ESI-MS m/z (%) 359 (100) $[M+H]^+$; Anal. Calcd for $C_{22}H_{15}ClN_2O$ C, 73.64; H, 4.21; N, 7.81; Found: C, 73.32; H, 4.23; N, 7.85.

1-(3-methoxyphenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde (3g 70%)



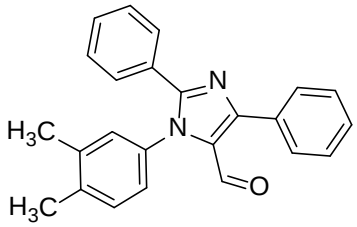
White solid, m.p. 123-124℃. 62.0mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.81 (s, 1H), 7.93 (d, J = 9.6 Hz, 2H), 7.53-7.47 (m, 5H), 7.39-7.26 (m, 4H), 7.04 (d, J = 6.8 Hz 1H), 6.93 (d, J = 6.8 Hz 1H), 6.86 (t, J = 2.4 Hz 1H), 3.79 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ179.5, 160.2, 153.5, 137.6, 132.3, 130.1, 129.7, 129.4, 129.3, 129.2, 128.6, 128.3, 120.2, 115.1, 113.7, 55.5. IR (KBr) 2833, 1661, 1471, 773, 694 cm^{-1}. ESI-MS m/z (%) 355 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{18}N_2O_2$ C, 77.95; H, 5.12; N, 7.90; Found: C, 77.66; H, 5.15; N, 7.94.

1-(4-methoxyphenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde (3h 72%)



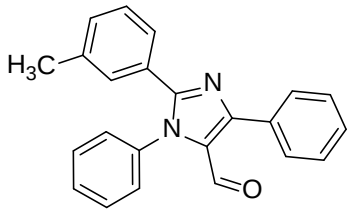
Yellow solid, m.p. 107-109℃. 63.8mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.85 (s, 1H), 7.95 (d, J = 6.8 Hz, 2H), 7.54-7.50 (m, 5H), 7.37-7.26 (m, 5H), 7.01 (d, J = 8.8 Hz 2H), 3.90 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.7, 159.9 153.7, 151.6, 132.4, 129.6, 129.4, 129.3, 129.2, 129.2, 128.9, 128.6, 128.3, 114.5, 55.5. IR (KBr) 2833, 1669, 1465, 817 cm^{-1}. ESI-MS m/z (%) 355 (100) $[M+H]_+$; Anal. Calcd for $C_{23}H_{18}N_2O_2$ C, 77.95; H, 5.12; N, 7.90; Found: C, 77.61; H, 5.16; N, 7.95.

1-(3,4-dimethylphenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde (3i 73%)



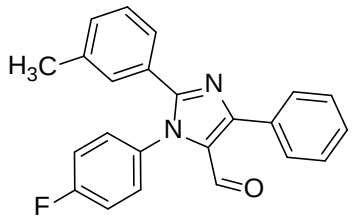
Yellow solid, m.p. 147-150℃. 64.3mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.78 (s, 1H), 7.94 (d, J = 7.2 Hz, 2H), 7.52-7.46 (m, 5H), 7.32-7.09 (m, 4H), 7.06 (d, J = 8.0 Hz 2H), 2.34 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.7, 153.4 151.2, 138.0, 138.0, 134.2, 132.5, 130.4, 129.5, 129.4, 129.2, 129.1, 129.0, 128.8, 128.6, 128.2, 125.0, 19.8, 19.6. IR (KBr) 2837, 1661, 1460, 803 cm^{-1}. ESI-MS m/z (%) 353 (100) $[M+H]^+$; Anal. Calcd for $C_{24}H_{20}N_2O$ C, 81.79; H, 5.72; N, 7.95; Found: C, 81.42; H, 5.75; N, 7.99.

1,4-diphenyl-2-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde (3j 83%)



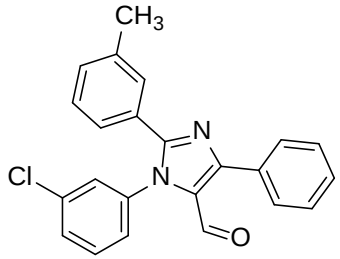
Yellow solid, m.p. 108-111℃. 70.2mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.82 (s, 1H), 7.91 (d, J = 7.2 Hz, 2H), 7.51-7.43 (m, 7H), 7.33 (d, J = 7.2 Hz, 2H), 7.15-7.10 (m, 3H), 2.27 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.5, 153.8 151.6, 138.1, 136.8, 132.3, 130.5, 130.2, 129.5, 129.3, 129.2, 128.6, 128.5, 128.0, 127.9, 126.1, 21.3. IR (KBr) 2852, 1662, 1459, 782 cm^{-1}. ESI-MS m/z (%) 339 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{18}N_2O$ C, 81.63; H, 5.36; N, 8.28; Found: C, 81.33; H, 5.39; N, 8.31.

1-(4-fluorophenyl)-4-phenyl-2-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde (3k 80%)



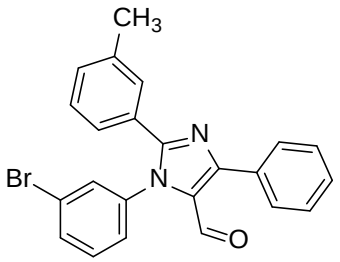
Yellow solid, m.p. 107-109℃. 71.3mg . ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.84 (s, 1H), 7.86 (d, J = 6.4 Hz, 2H), 7.51 (d, J = 6.8 Hz, 3H), 7.44 (s, 1H), 7.31-7.26 (m, 2H), 7.16-7.09 (m, 5H), 2.29 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.6, 163.8 (J = 240 Hz), 154.3, 152.0, 138.3, 132.2, 130.6, 130.2, 129.7, 129.6, 129.5, 129.3, 128.7, 128.5, 128.4, 128.1, 126.1, 116.4(J = 30 Hz), 21.3. IR (KBr) 2835, 1663, 1465, 813, 762 cm^{-1}.ESI-MS m/z (%) 357 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{17}FN_2O$ C, 77.51; H, 4.81; N, 7.86; Found: C, 77.23; H, 4.83; N, 7.89.

1-(3-chlorophenyl)-4-phenyl-2-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde (3l 77%)



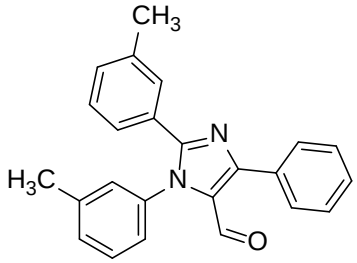
Yellow solid, m.p. 112-115℃. 71.8mg . ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.83 (s, 1H), 7.87 (d, J = 9.2 Hz, 2H), 7.52-7.37 (m, 5H), 7.35 (t, J = 2.0 Hz 2H), 7.23 (d, J = 8.0 Hz 1H), 7.21-7.07 (m, 3H), 2.30 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.4, 154.3, 151.8, 138.3, 138.0, 134.8, 132.1, 130.8, 130.2, 130.1, 129.5, 129.5, 129.4, 128.7, 128.4, 128.2, 128.2, 128.2, 126.3, 126.1, 21.3. IR (KBr) 2826, 1667, 1454, 773 cm^{-1}. ESI-MS m/z (%) 373 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{17}ClN_2O$ C, 74.09; H, 4.60; N, 7.51; Found: C, 73.77; H, 4.62; N, 7.54.

1-(3-bromophenyl)-4-phenyl-2-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde (3m 75%)



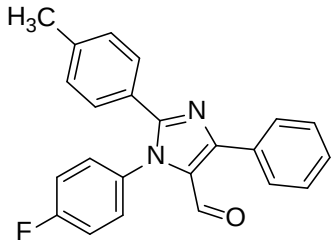
Yellow solid, m.p. 139-141℃. 78.2mg . ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.83 (s, 1H), 7.86 (d, J = 7.2 Hz, 2H), 7.63 (d, J = 7.2 Hz, 1H), 7.53-7.46 (m, 5H), 7.35 (t, J = 8.0 Hz, 1H), 7.28 (d, J = 8.4 Hz, 1H), 7.18-7.07 (m, 3H), 2.30 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.4, 154.4, 151.9, 138.4, 138.1, 132.5, 132.1, 131.0, 130.8, 130.4, 130.3, 129.5, 129.4, 128.7, 128.5, 128.3, 128.2, 126.7, 126.1, 122.5, 21.3. IR (KBr) 2833, 1670, 1457, 773, 734, 698 cm^{-1}. ESI-MS m/z (%) 417 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{17}BrN_2O$ C, 66.20; H, 4.11; N, 6.71; Found: C, 66.46; H, 4.12; N, 6.74.

4-phenyl-1,2-di-*m*-tolyl-1*H*-imidazole-5-carbaldehyde (3n 83%)



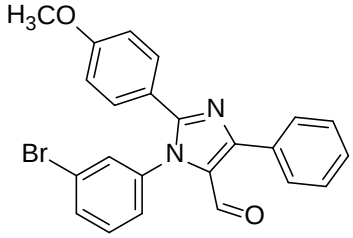
Yellow solid, m.p. 112-115℃. 73.1mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.80 (s, 1H), 7.93 (d, J = 6.8 Hz, 2H), 7.51-7.46 (m, 4H), 7.37 (t, J = 8.0 Hz, 1H), 7.31 (d, J = 7.6 Hz, 1H), 7.14-7.09 (m, 5H), 2.38 (s, 3H), 2.28 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.5, 153.5, 151.5, 139.4, 138.0, 136.6, 132.4, 130.4, 130.2, 130.0, 129.4, 129.2, 129.0, 128.7, 128.6, 128.5, 128.3, 127.9, 126.0, 124.9, 21.3. IR (KBr) 2834, 1666, 1455, 773, 738, 694 cm^{-1}. ESI-MS m/z (%) 353 (100) $[M+H]^+$; Anal. Calcd for $C_{24}H_{20}N_2O$ C,81.79; H, 5.72; N, 7.95; Found: C,81.44; H, 5.75; N, 7.99.

1-(4-fluorophenyl)-4-phenyl-2-(*p*-tolyl)-1*H*-imidazole-5-carbaldehyde (3o 78%)



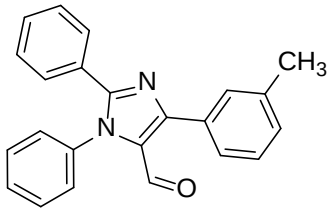
Yellow solid, m.p. 152-155℃. 69.5mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.82 (s, 1H), 7.86 (d, J = 6.0 Hz, 2H), 7.53-7.47 (m, 3H), 7.36-7.28 (m, 4H), 7.17-7.08 (m, 4H), 2.32 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.5, 163.8 (J = 250 Hz), 154.4, 151.9, 140.1, 133.0, 132.2, 129.7, 129.6, 129.4, 129.3, 129.2, 129.1, 128.6, 128.4, 125.7, 126.1, 116.4 (J = 20 Hz), 21.3. IR (KBr) 2827, 1680, 1469, 773 cm^{-1}. ESI-MS m/z (%) 357 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{17}FN_2O$ C, 77.51; H, 4.81; N, 7.86; Found: C, 77.21; H, 4.83; N, 7.90.

1-(3-bromophenyl)-2-(4-methoxyphenyl)-4-phenyl-1*H*-imidazole-5-carbaldehyde (3p 80%)



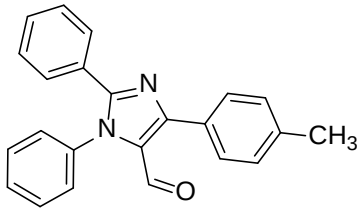
Yellow solid, m.p. 128-130℃. 86.7mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.80 (s, 1H), 7.86 (d, J = 9.6 Hz, 2H), 7.64 (d, J = 8.0 Hz, 1H), 7.51-7.49 (m, 4H), 7.42 (d, J = 8.8 Hz, 2H), 7.36-7.27 (m, 2H), 6.82 (d, J = 8.8 Hz, 2H), 3.79 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.2, 160.9 154.3, 151.6, 138.2, 132.5, 132.1, 131.0, 130.8, 130.4, 129.4, 129.4, 128.7, 128.3, 126.7, 122.6, 120.6, 113.9, 55.3. IR (KBr) 2833, 1665, 1463, 771 cm^{-1}. ESI-MS m/z (%) 433 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{17}BrN_2O_2$ C, 63.75; H, 3.95; N, 6.47; Found: C, 63.58; H, 3.93; N, 6.51.

1,2-diphenyl-4-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde (3q 68%)



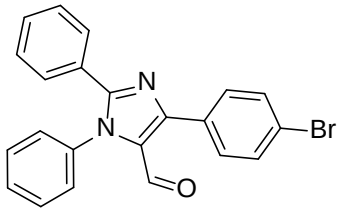
Yellow solid, m.p. 134-136℃. 57.5. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.84 (s, 1H), 7.72 (t, J = 8.0 Hz, 2H), 7.49-7.38 (m, 6H), 7.33-7.28 (m, 6H), 2.46 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.7, 154.1 151.4, 138.4, 136.8, 132.1, 130.1, 130.1, 129.7, 129.3, 129.3, 128.7, 128.5, 128.5, 128.3, 127.9, 126.7, 21.4. IR (KBr) 2842, 1665, 1446, 812 cm^{-1}. ESI-MS m/z (%) 339 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{18}N_2O$ C, 81.63; H, 5.36; N, 8.28; Found: C, 81.48; H, 5.40; N, 8.34.

1,2-diphenyl-4-(*p*-tolyl)-1*H*-imidazole-5-carbaldehyde (3r 68%)



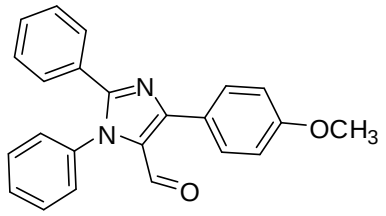
Yellow solid, m.p. 162-163℃. 57.5mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.81 (s, 1H), 7.81 (d, J = 8.4 Hz, 2H), 7.48-7.45 (m, 5H), 7.33-7.25 (m, 7H), 2.44 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.6, 154.0 151.4, 139.4, 136.8, 129.6, 129.5, 129.3, 129.3, 129.2, 128.9, 128.8, 128.5, 128.3, 127.9, 21.4. IR (KBr) 2825, 1674, 1465, 773, 692 cm^{-1}. ESI-MS m/z (%) 339 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{18}N_2O$ C, 81.63; H, 5.36; N, 8.28; Found: C, 81.86; H, 5.31; N, 8.23.

4-(4-bromophenyl)-1,2-diphenyl-1*H*-imidazole-5-carbaldehyde (3s 75%)



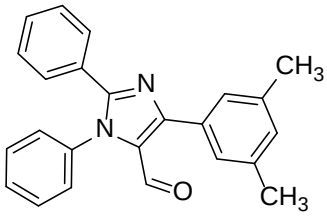
Yellow solid, m.p. 147-149℃. 75.6mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.75 (s, 1H), 7.89 (d, J = 8.8 Hz, 2H), 7.65 (d, J = 8.4 Hz, 2H), 7.50-7.44 (m, 5H), 7.34-7.28 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.2, 151.7 151.4, 136.4, 131.7, 131.3, 130.9, 129.8, 129.5, 129.2, 128.7, 128.6, 128.3, 127.9, 123.8. IR (KBr) 2833, 1666, 1457, 773, 692 cm^{-1}. ESI-MS m/z (%) 403 (100) $[M+H]^+$; Anal. Calcd for $C_{22}H_{15}BrN_2O$ C, 65.52; H, 3.75; N, 6.95; Found: C, 65.83; H, 3.73; N, 6.91.

4-(4-methoxyphenyl)-1,2-diphenyl-1*H*-imidazole-5-carbaldehyde (3t 60%)



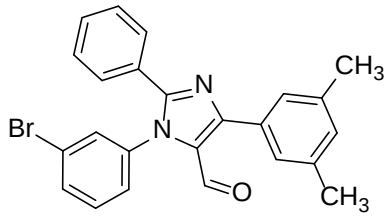
Yellow solid, m.p. 156-159℃. 53.2mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.78 (s, 1H), 7.90 (d, J = 8.8 Hz, 2H), 7.48-7.45 (m, 5H), 7.33-7.25 (m, 5H), 7.05 (d, J = 8.8 Hz, 2H) 3.88 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.5, 153.6 151.3, 136.7, 130.8, 129.6, 129.3, 129.3, 128.8, 128.3, 128.2, 127.9, 124.9, 114.0, 55.4. IR (KBr) 2829, 1663, 1457, 812 cm^{-1}. ESI-MS m/z (%) 355 (100) $[M+H]^+$; Anal. Calcd for $C_{23}H_{18}N_2O_2$ C, 77.95; H, 5.12; N, 7.90; Found: C, 77.62; H, 5.16; N, 7.94.

4-(3,5-dimethylphenyl)-1,2-diphenyl-1*H*-imidazole-5-carbaldehyde (3u 73%)



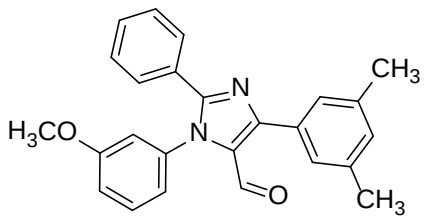
Yellow solid, m.p. 168-171℃. 64.3mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.85 (s, 1H), 7.49-7.45 (m, 7H), 7.32-7.25 (m, 5H), 7.12 (s, 1H), 2.41 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.8, 154.7, 151.6, 138.3, 136.9, 132.1, 131.0, 129.7, 129.4, 129.3, 129.3, 129.3, 128.9, 128.6, 128.3, 127.9, 127.4, 21.4. IR (KBr) 2829, 1664, 1457, 773 cm^{-1}. ESI-MS m/z (%) 353 (100) $[M+H]^+$; Anal. Calcd for $C_{24}H_{20}N_2O$ C, 81.79; H, 5.72; N, 7.95; Found: C, 81.45; H, 5.76; N, 7.99.

1-(3-bromophenyl)-4-(3,5-dimethylphenyl)-2-phenyl-1*H*-imidazole-5-carbaldehyde (3v 66%)



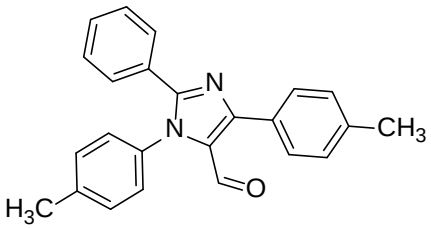
Yellow solid, m.p. 159-160℃. 71.2mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.85 (s, 1H), 7.62 (d, J = 8.0 Hz, 1H), 7.49-7.45 (m, 5H), 7.36-7.26 (m, 5H), 7.12 (s, 1H), 2.41 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.7, 155.0, 151.6, 138.3, 138.1, 132.4, 131.9, 131.2, 131.0, 130.3, 129.9, 129.3, 128.5, 128.4, 127.3, 126.7, 122.5, 21.3. IR (KBr) 2832, 1661, 1463, 764 cm^{-1}. ESI-MS m/z (%) 431 (100) $[M+H]^+$; Anal. Calcd for $C_{24}H_{19}BrN_2O$ C, 67.83; H, 4.44; N, 6.49; Found: C, 66.12; H, 4.47; N, 6.45.

4-(3,5-dimethylphenyl)-1-(3-methoxyphenyl)-2-phenyl-1*H*-imidazole-5-carbaldehyde (3w 63%)



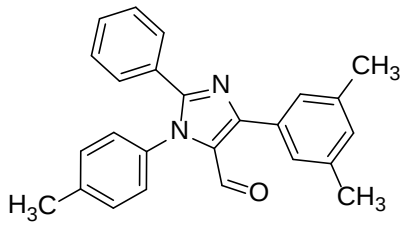
Yellow solid, m.p. 153-155℃. 60.2mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.83 (s, 1H), 7.51 (d, J = 8.8 Hz, 4H), 7.38-7.27 (m, 4H), 7.11 (s, 1H), 7.03 (d, J = 10.0 Hz, 1H), 6.92 (d, J = 8.4 Hz, 1H), 6.85 (t, J = 2.4 Hz, 1H), 3.78 (s, 3H), 2.41 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.7, 160.1, 154.5, 151.4, 138.2, 137.8, 132.1, 131.0, 129.9, 129.6, 129.2, 128.9, 128.3, 127.3, 120.1, 115.0, 113.7, 55.5, 21.3. IR (KBr) 2829, 1664, 1457, 773 cm^{-1}. ESI-MS m/z (%) 383 (100) $[M+H]^+$; Anal. Calcd for $C_{25}H_{22}N_2O_2$ C, 78.51; H, 5.80; N, 7.32; Found: C, 78.19; H, 5.83; N, 7.36.

2-phenyl-1,4-di-*p*-tolyl-1*H*-imidazole-5-carbaldehyde (3x 82%)



Yellow solid, m.p. 166-168℃. 72.3mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.79 (s, 1H), 7.80 (d, J = 8.4 Hz 2H), 7.47 (t, J = 6.4 Hz 3H), 7.35-7.25 (m, 6H), 7.06 (d, J = 8.0 Hz, 2H), 2.43 (s, 3H), 2.30 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.5, 154.1, 151.6, 139.8, 139.3, 137.0, 129.3, 129.3, 129.3, 129.2, 129.0, 128.4, 127.9, 127.0, 126.0, 120.1, 21.4, 21.3. IR (KBr) 2817, 1668, 1466, 850 cm^{-1}. ESI-MS m/z (%) 353 (100) $[M+H]^+$; Anal. Calcd for $C_{24}H_{20}N_2O$ C, 81.79; H, 5.72; N, 7.95; Found: C, 81.43; H, 5.76; N, 8.00.

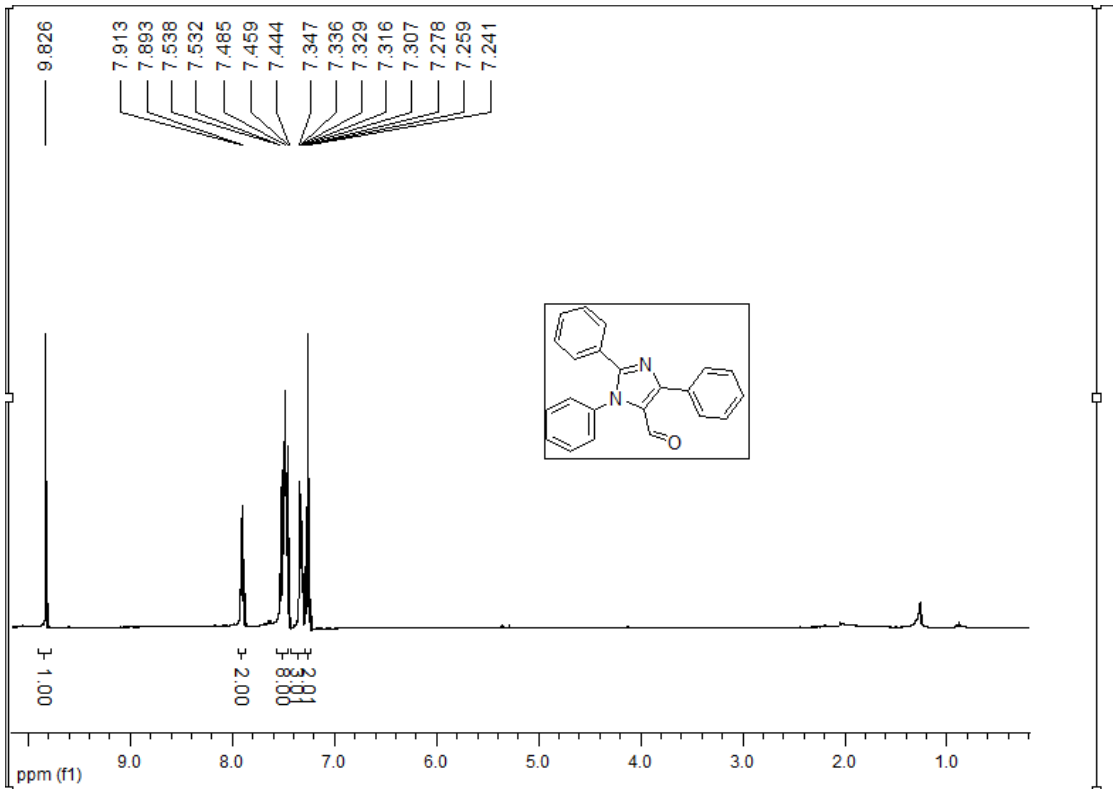
4-(3,5-dimethylphenyl)-2-phenyl-1-(*p*-tolyl)-1*H*-imidazole-5-carbaldehyde (3y 73%)

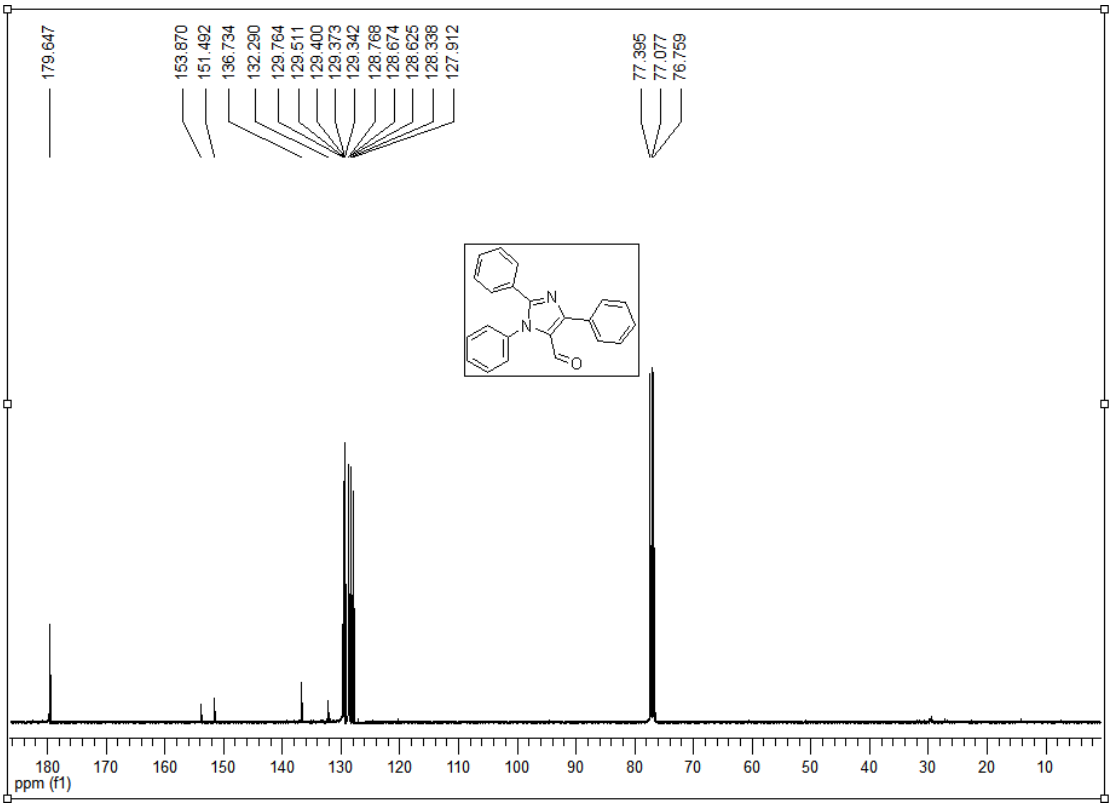


Yellow solid, m.p. 175-178℃. 66.9mg. ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.82 (s, 1H), 7.47 (d, J = 6.8 Hz, 5H), 7.35 (d, J = 8.0 Hz, 2H), 7.31 (d, J = 4.0 Hz, 2H), 7.11 (s, 1H), 7.06 (d, J = 8.4 Hz, 2H), 2.40 (s, 6H), 2.30 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 179.7, 154.8, 151.7, 139.9, 138.2, 137.1, 132.2, 131.0, 129.2, 129.2, 129.1, 129.0, 128.5, 127.9, 127.3, 126.0, 21.3. IR (KBr) 2831, 1663, 1457, 773 cm^{-1}. ESI-MS m/z (%) 367 (100) $[M+H]^+$; Anal. Calcd for $C_{25}H_{22}N_2O$ C, 81.94; H, 6.05; N, 7.64; Found: C, 81.57; H, 6.08; N, 7.69.

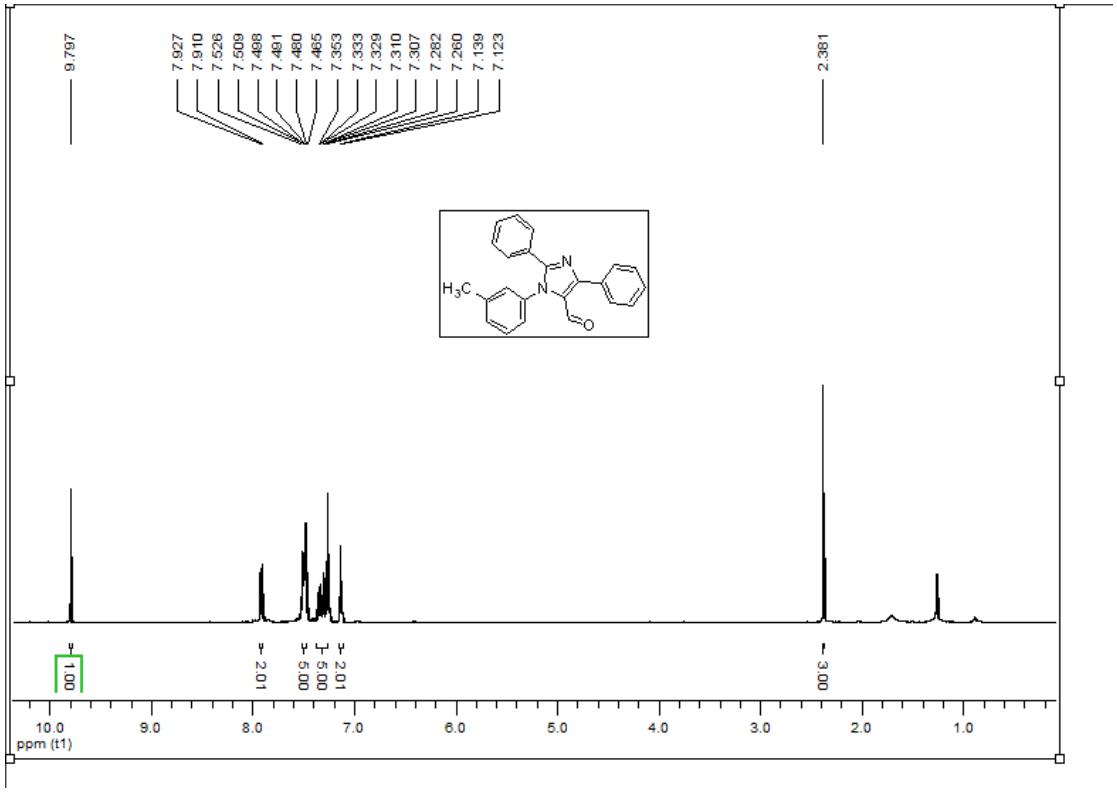
D. NMR spectra

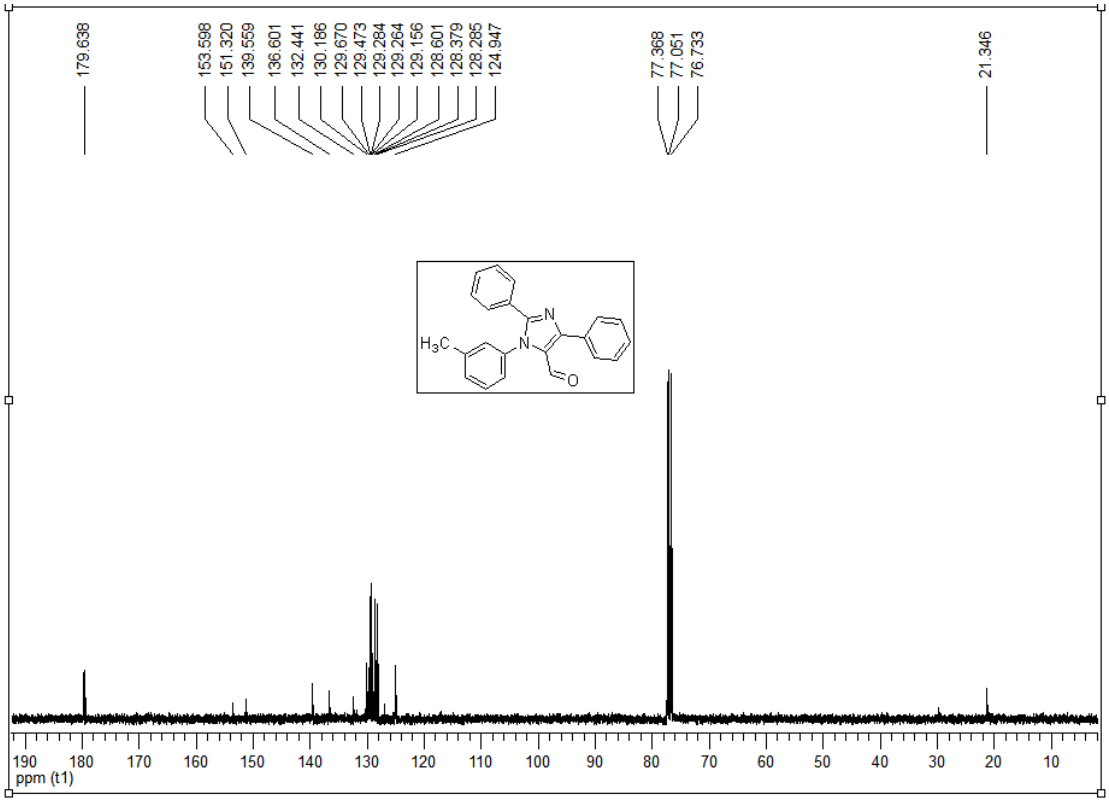
3a 1,2,4-triphenyl-1*H*-imidazole-5-carbaldehyde



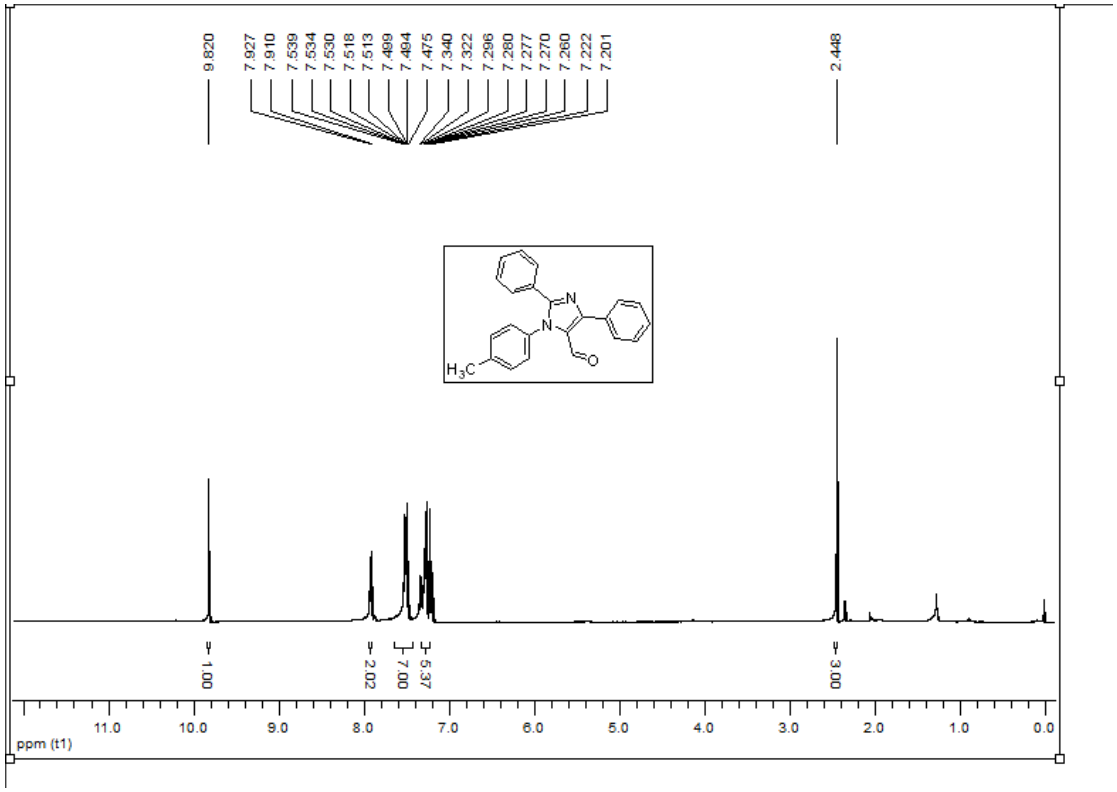


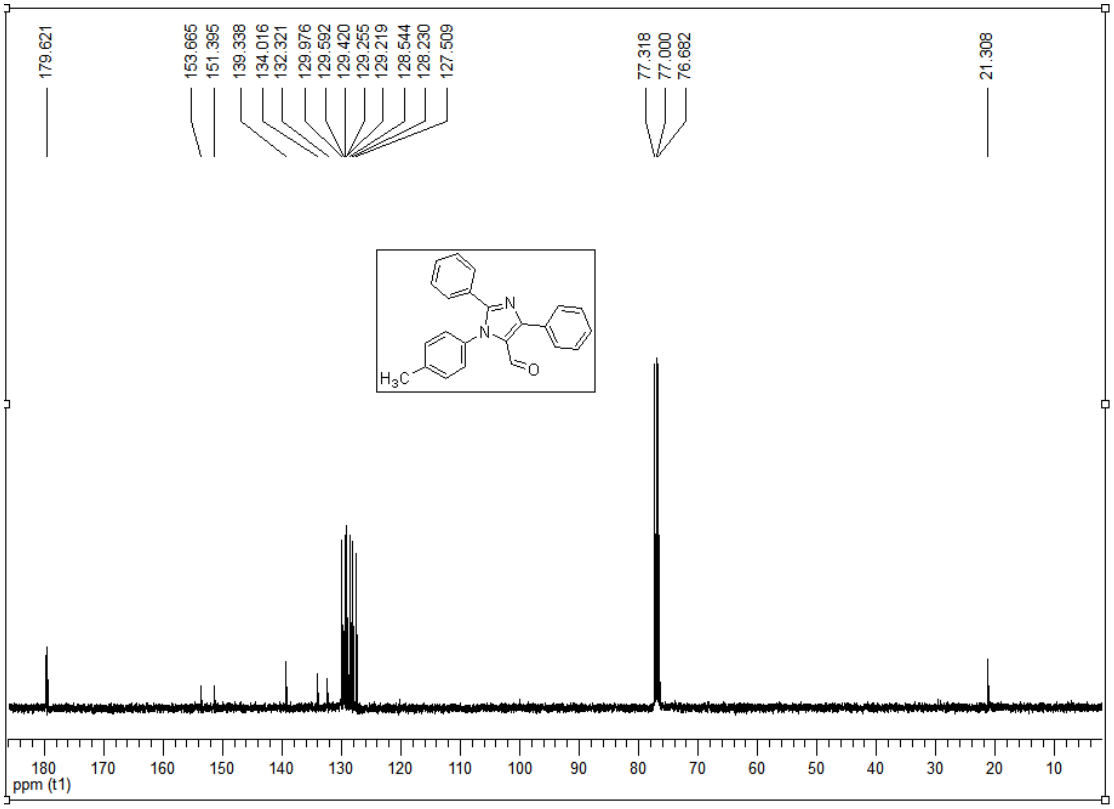
3b 2,4-diphenyl-1-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde



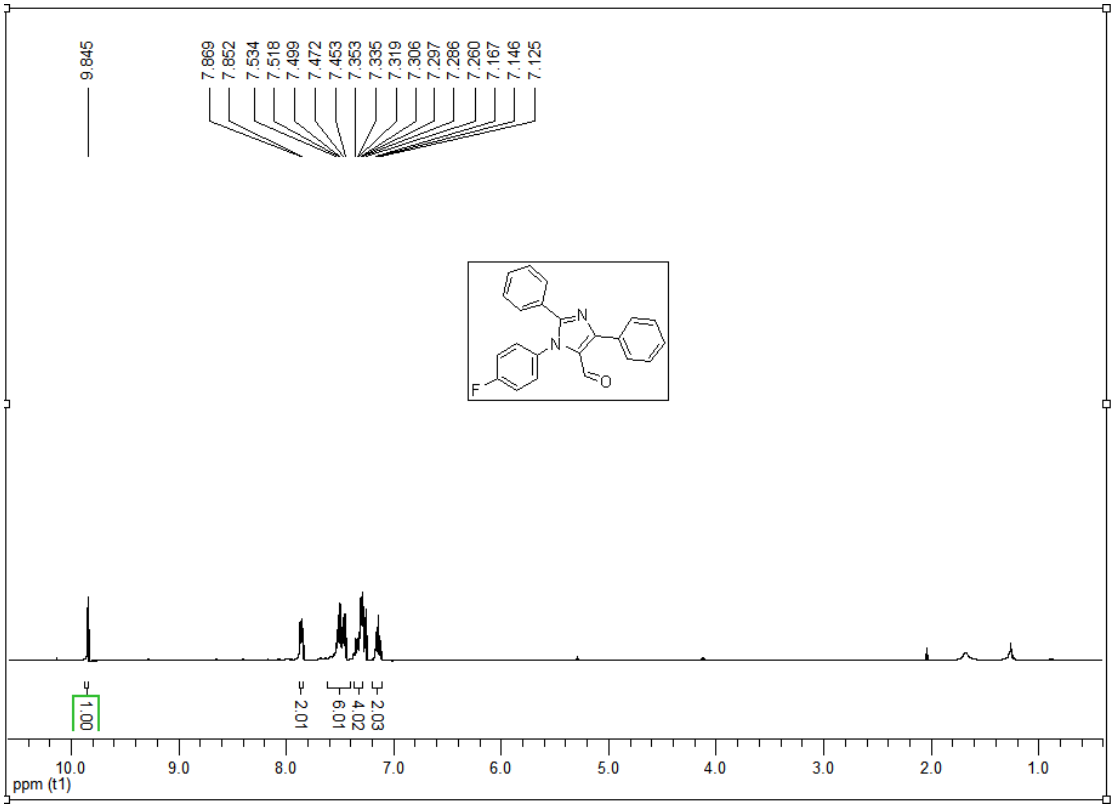


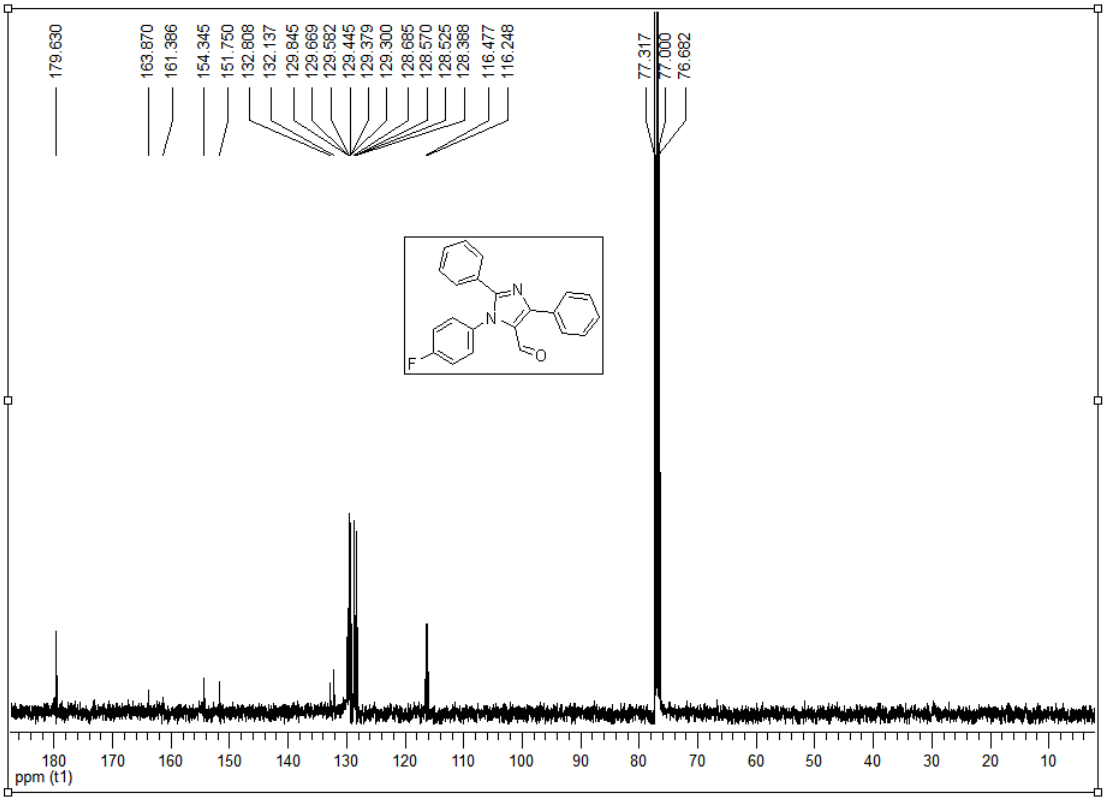
3c 2,4-diphenyl-1-(*p*-tolyl)-1*H*-imidazole-5-carbaldehyde



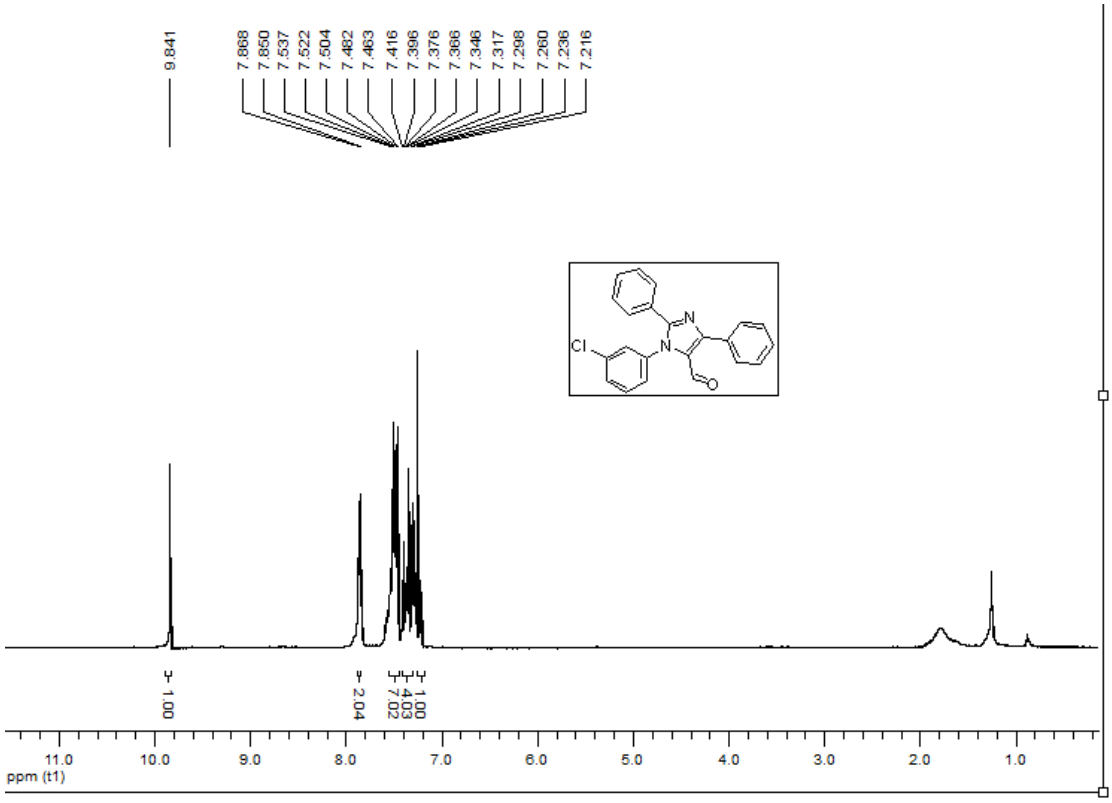


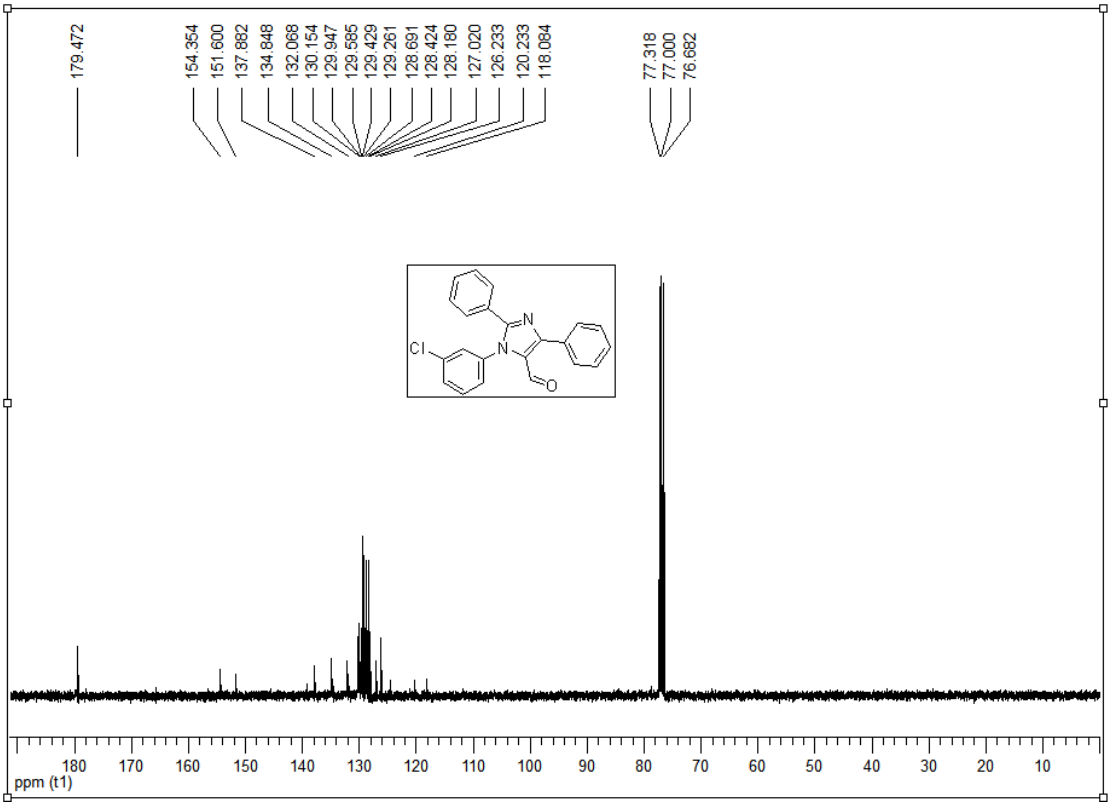
3d 1-(4-fluorophenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde



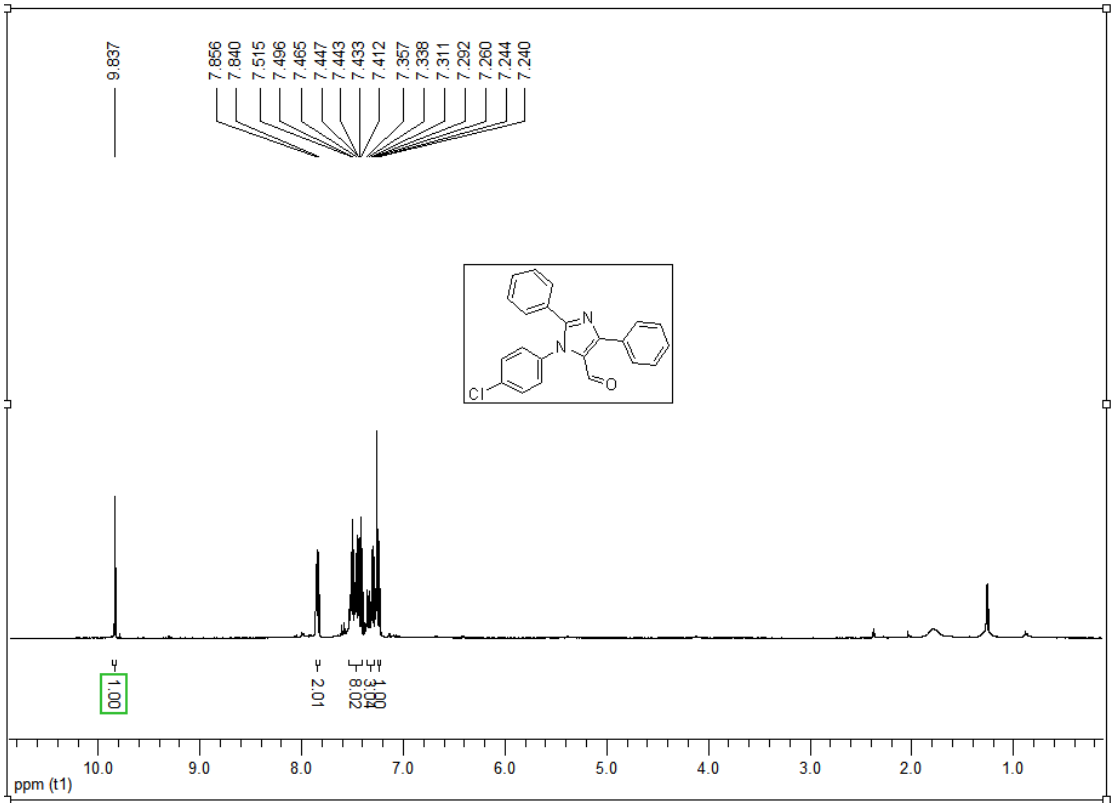


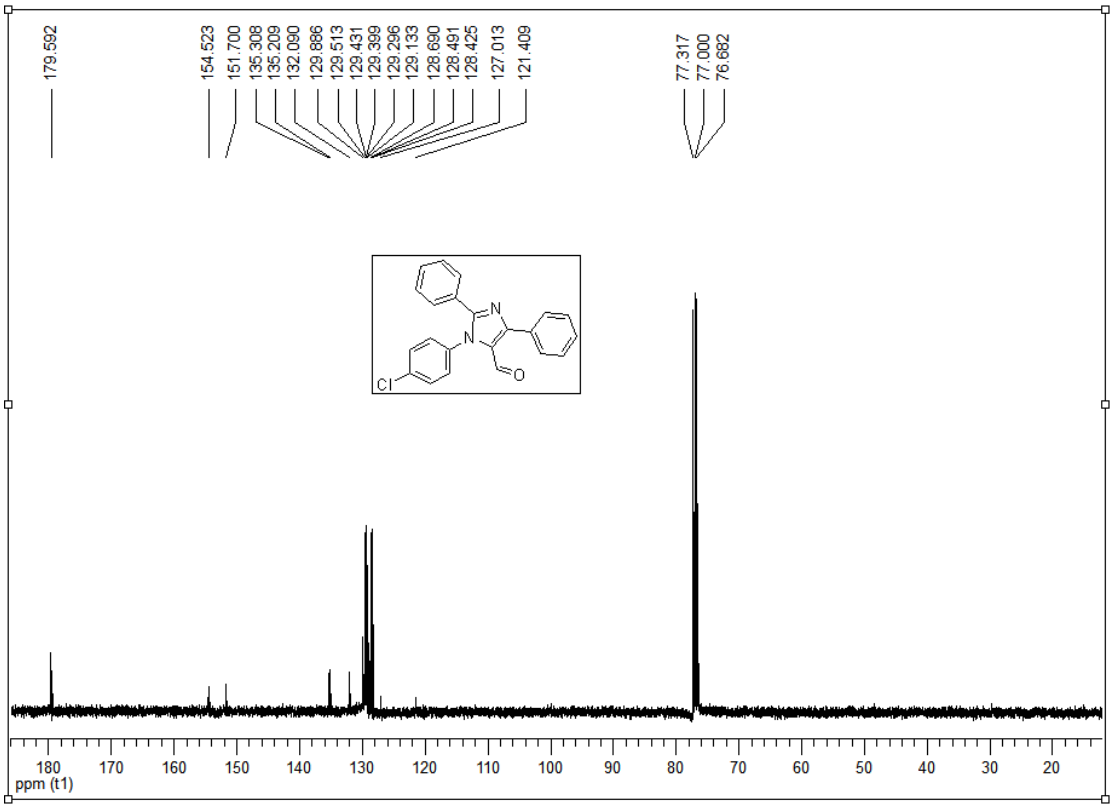
3e 1-(3-chlorophenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde



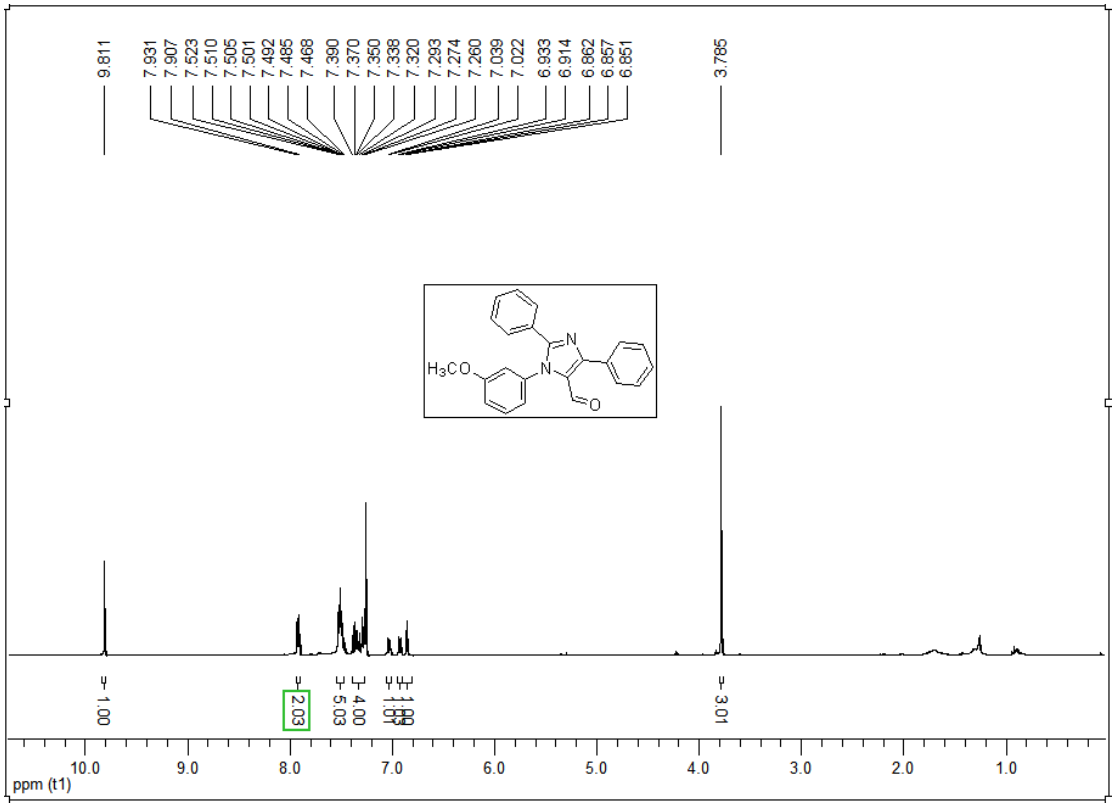


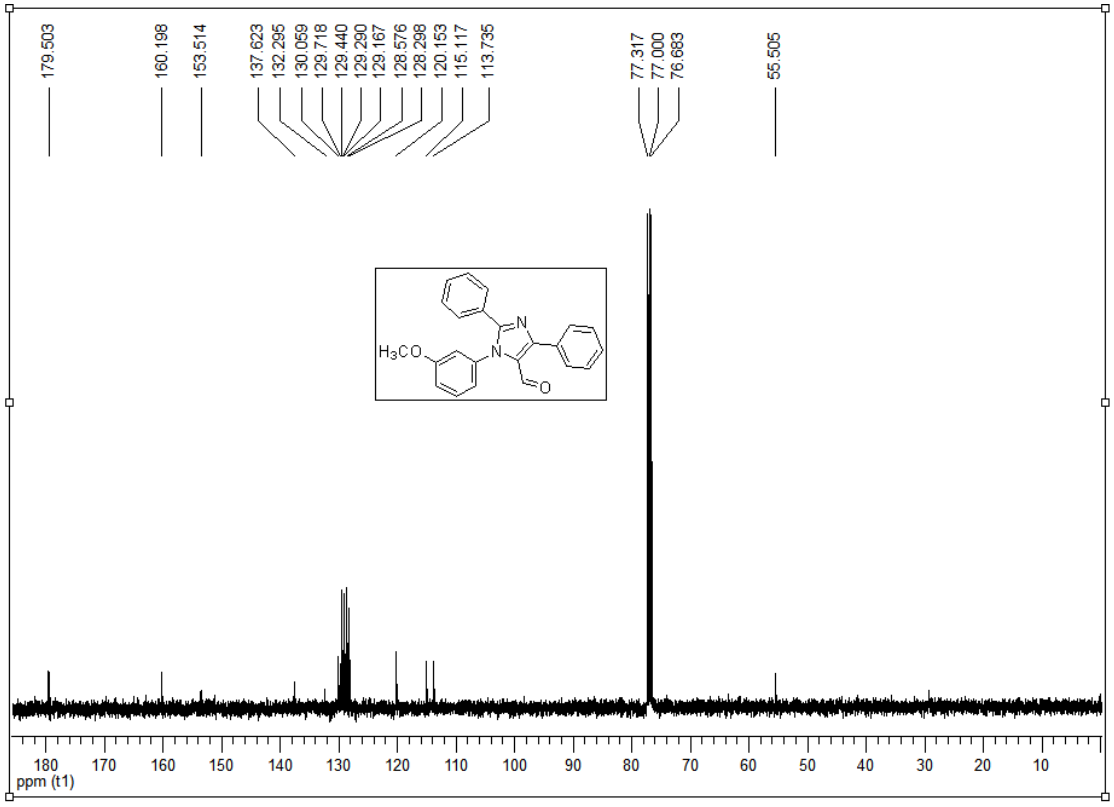
3f 1-(4-chlorophenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde



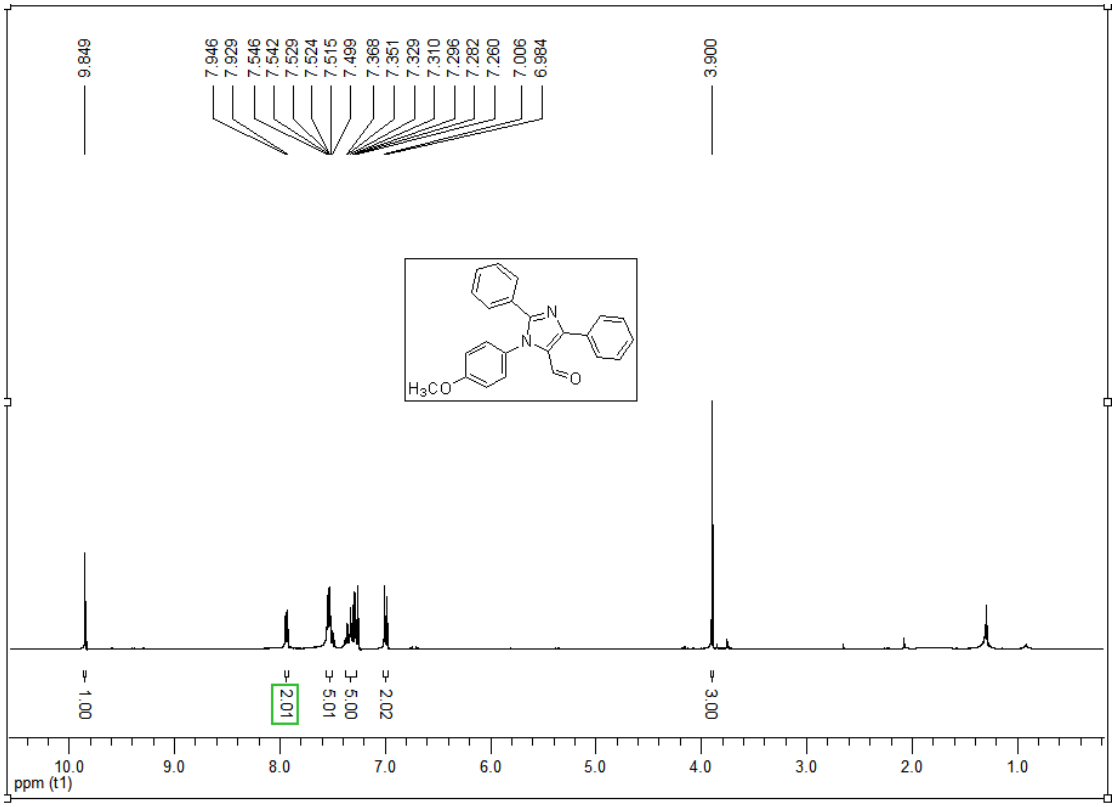


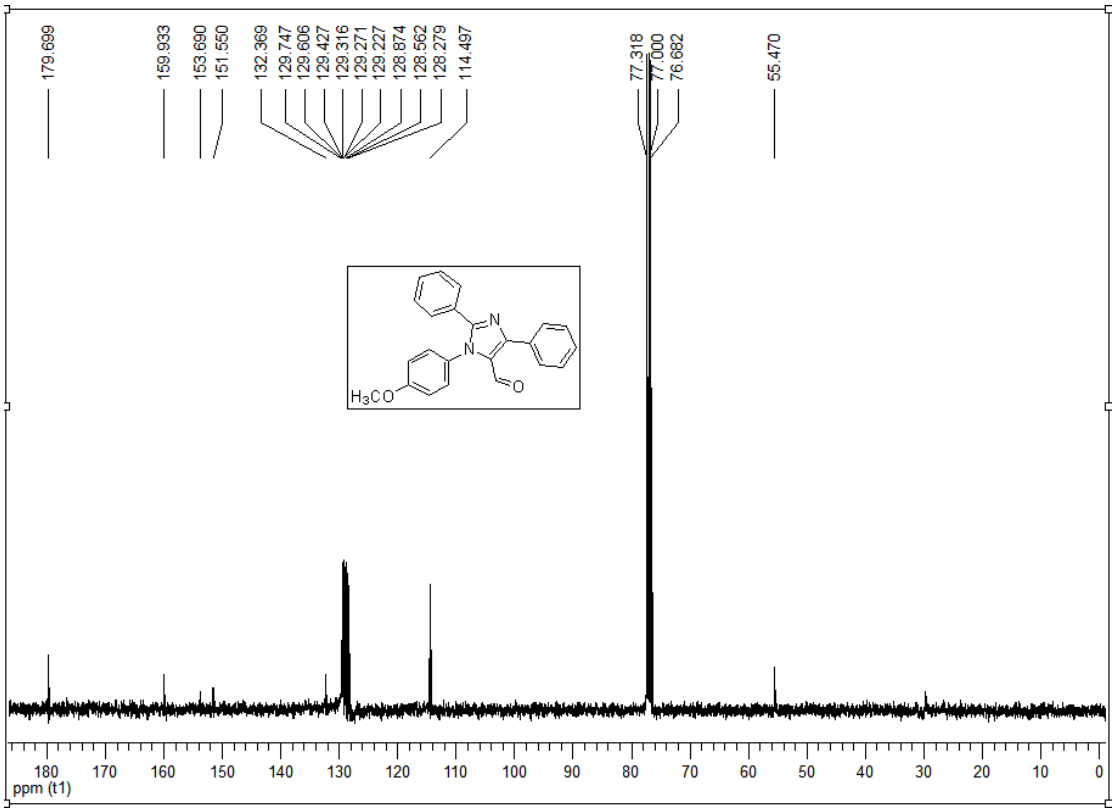
3g 1-(3-methoxyphenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde



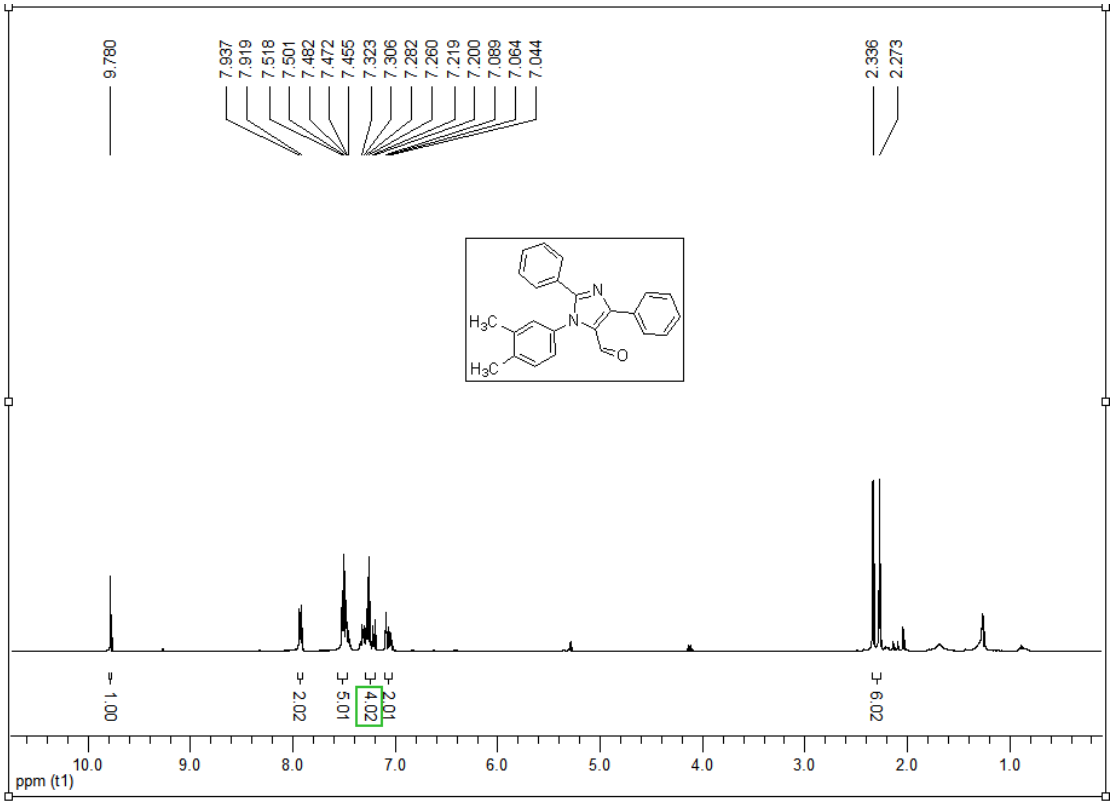


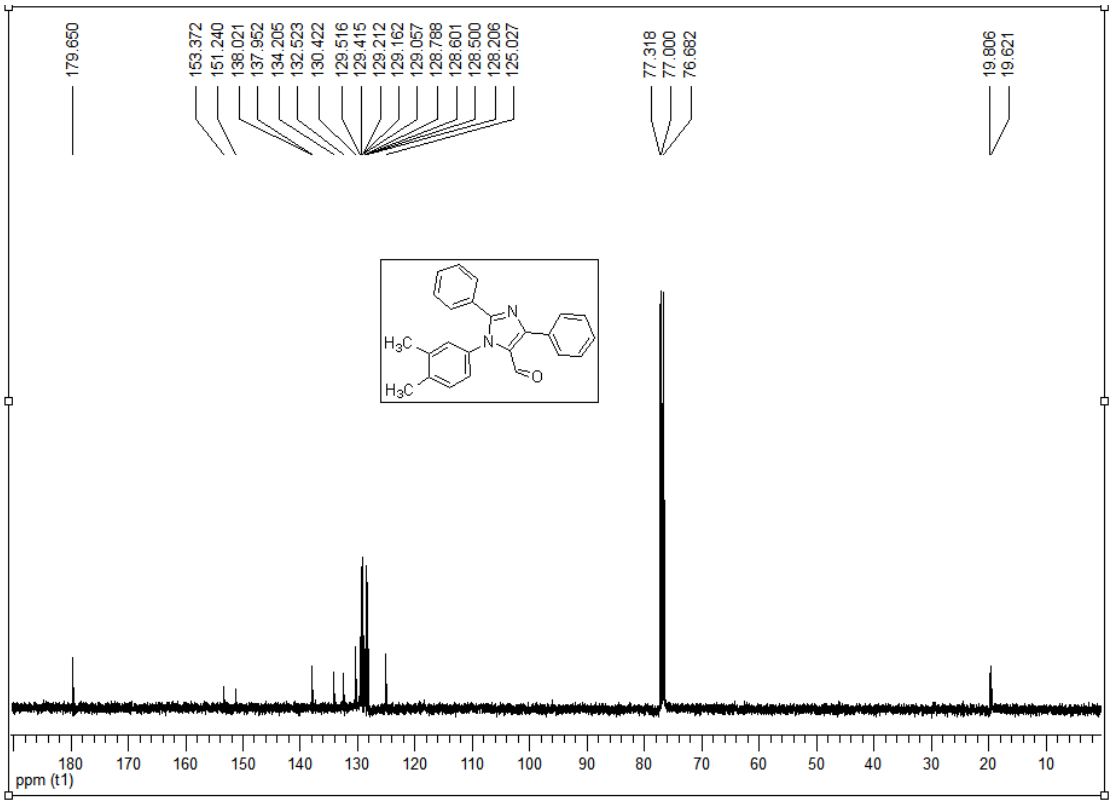
3h 1-(4-methoxyphenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde



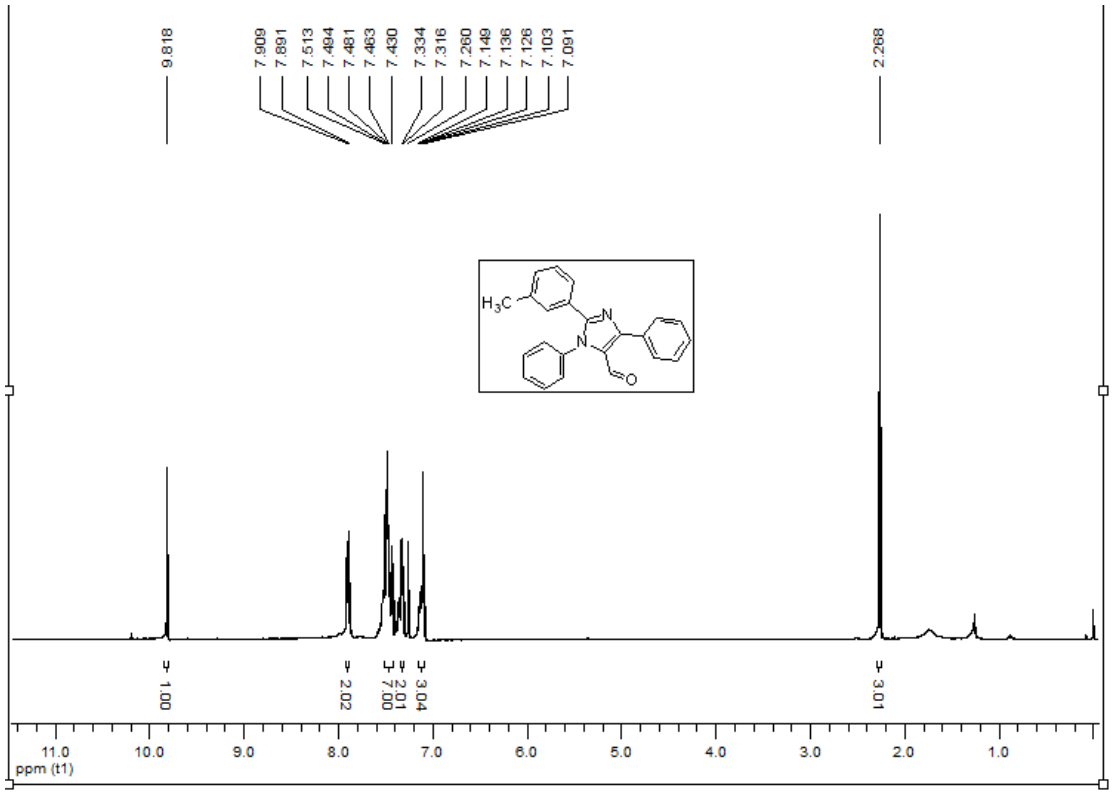


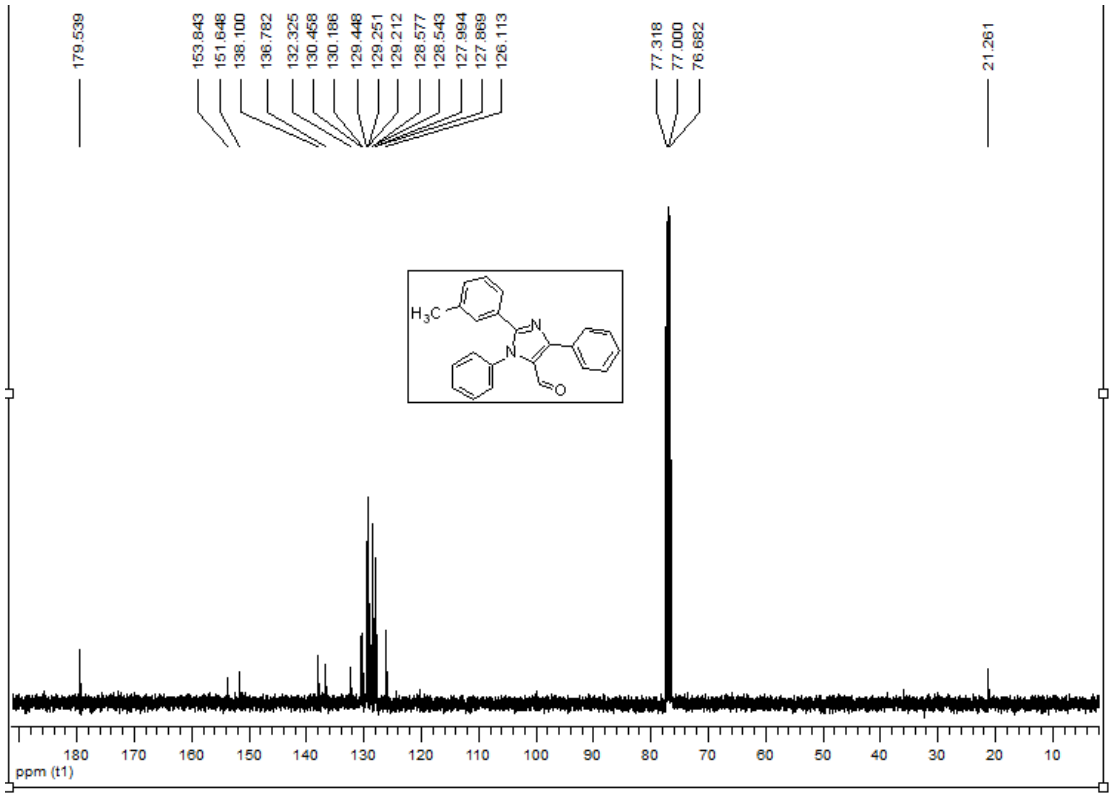
3i 1-(3,4-dimethylphenyl)-2,4-diphenyl-1*H*-imidazole-5-carbaldehyde



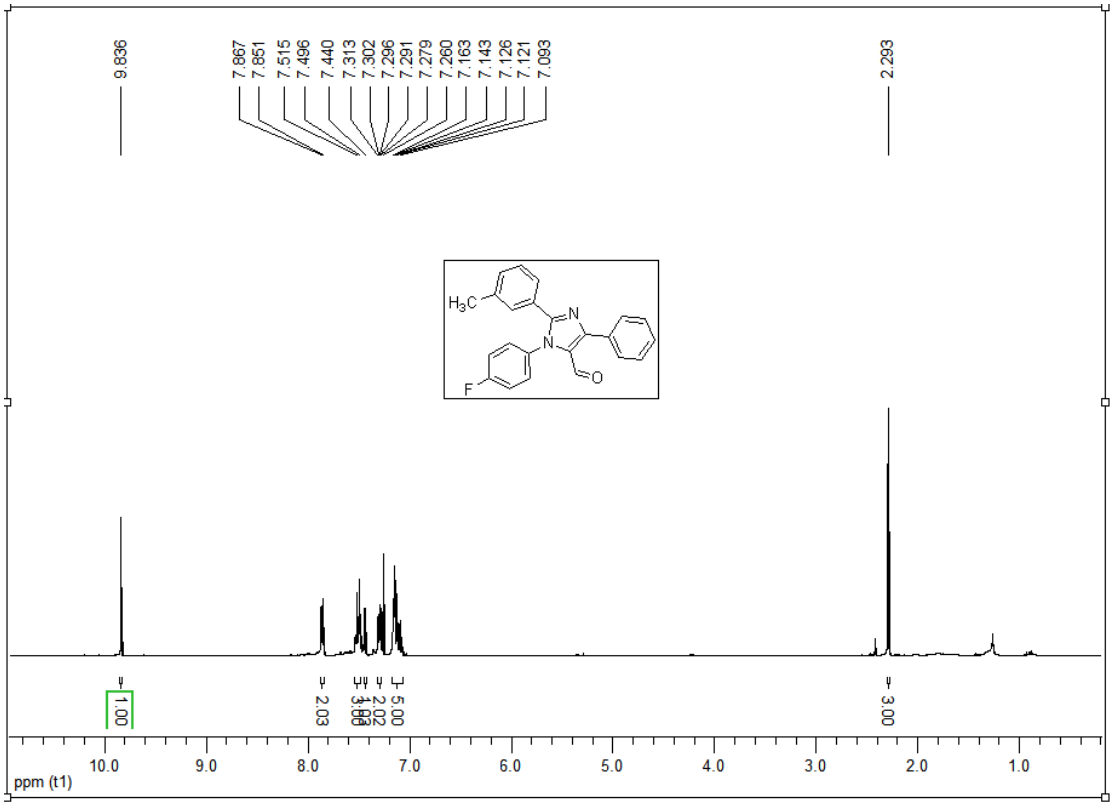


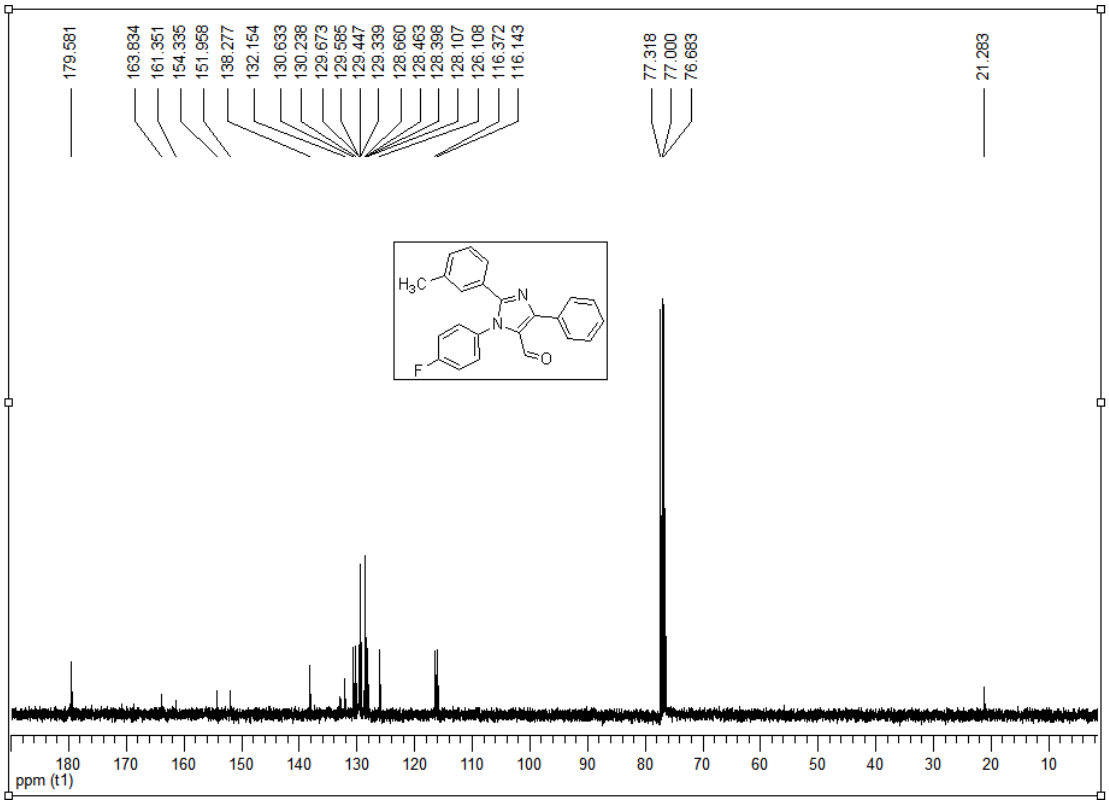
3j 1,4-diphenyl-2-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde



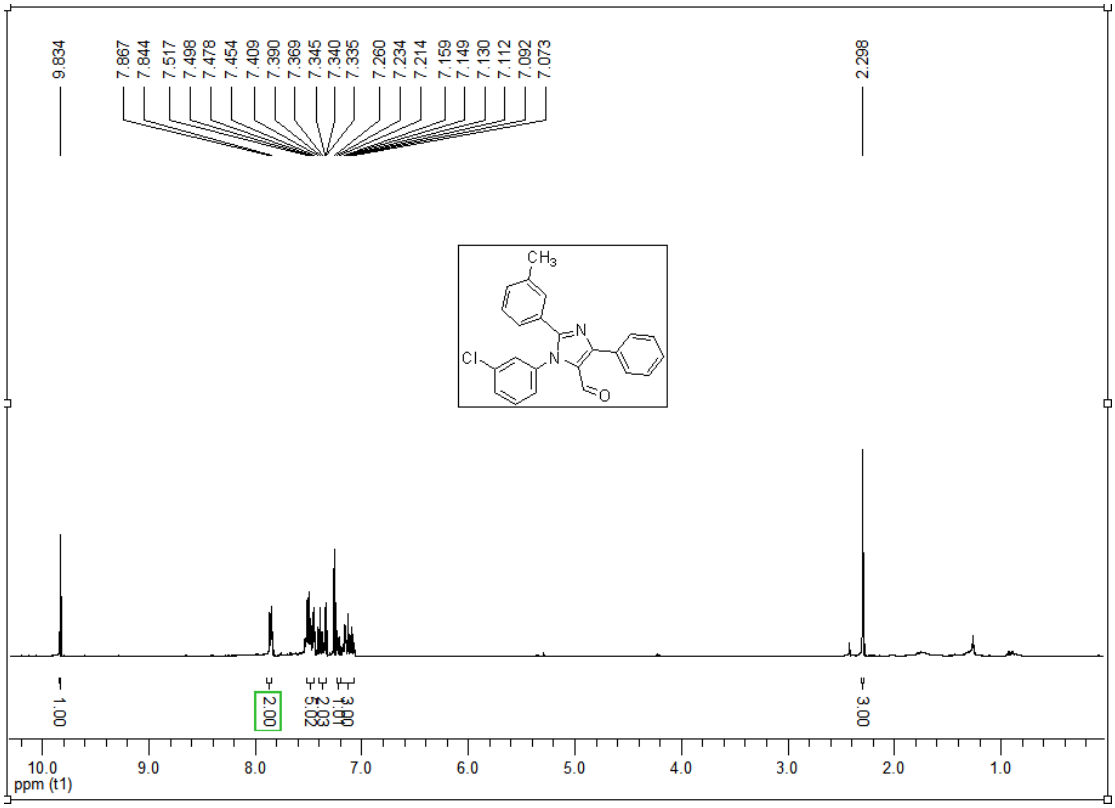


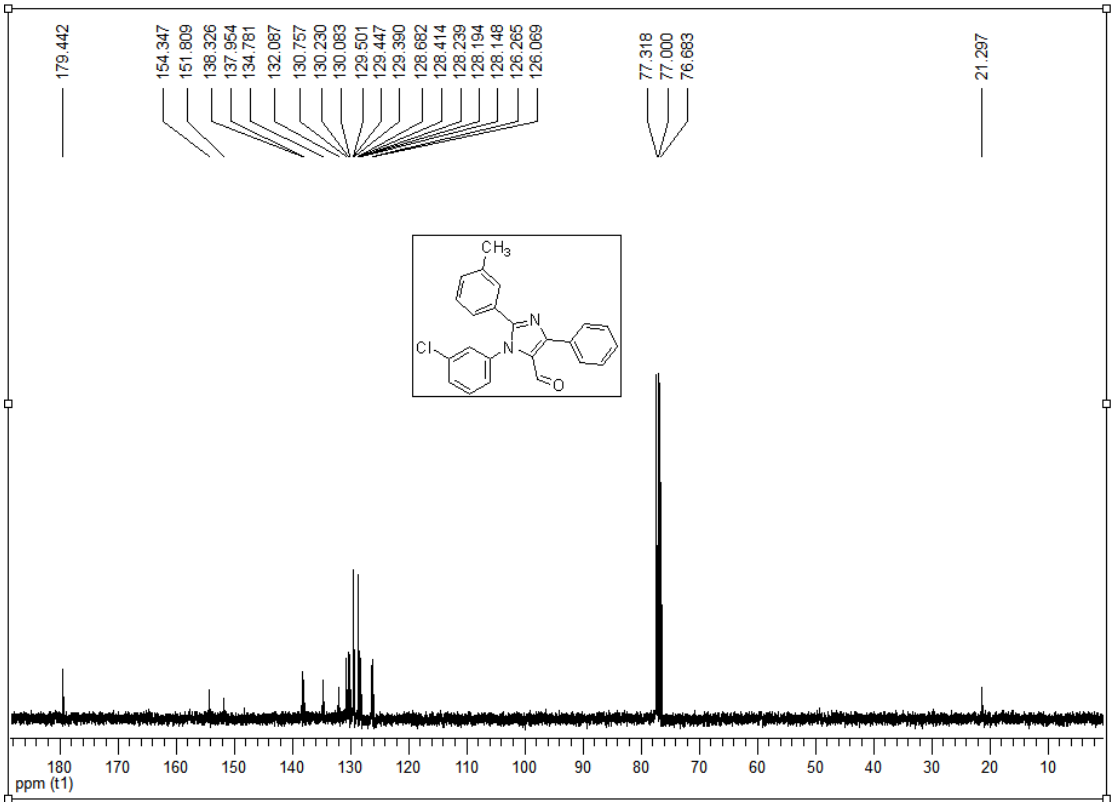
3k 1-(4-fluorophenyl)-4-phenyl-2-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde



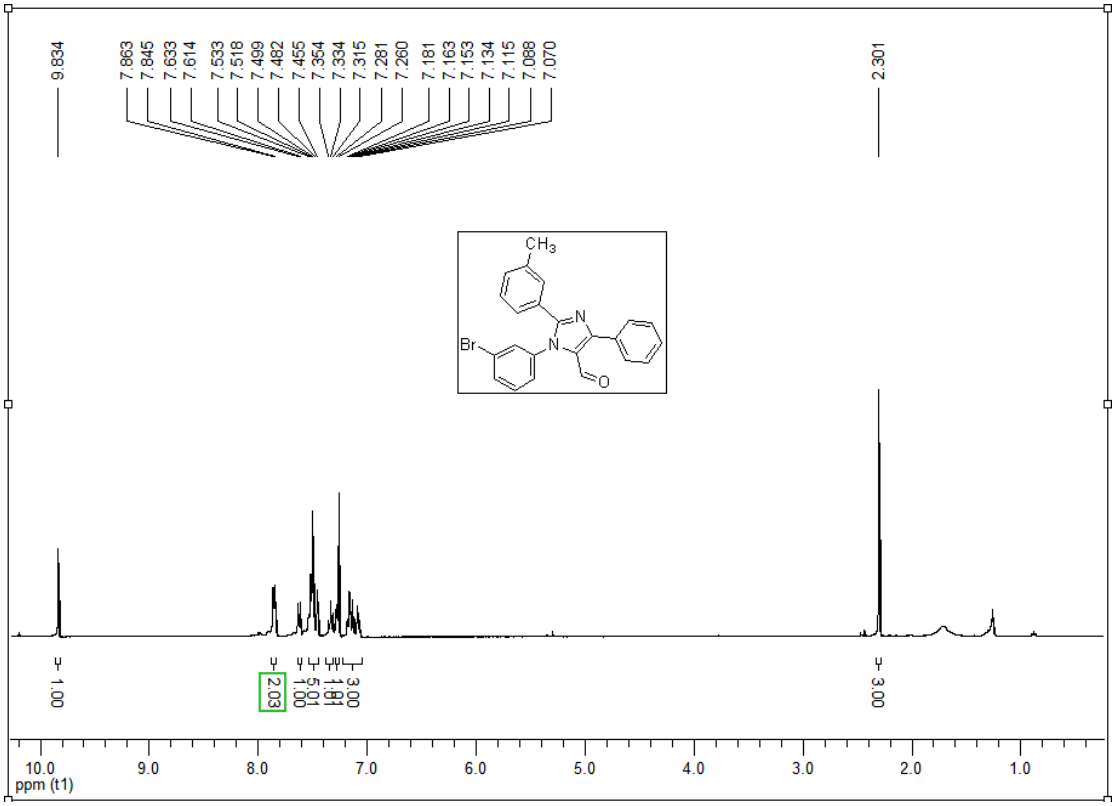


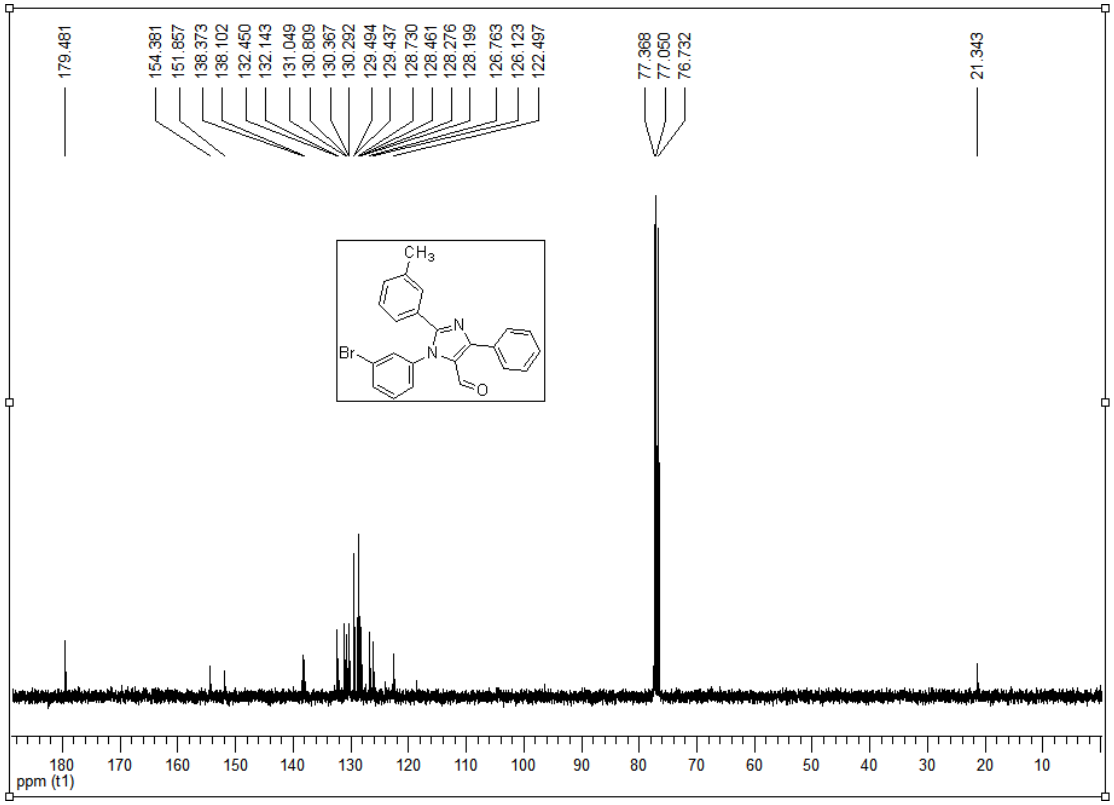
3l 1-(3-chlorophenyl)-4-phenyl-2-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde



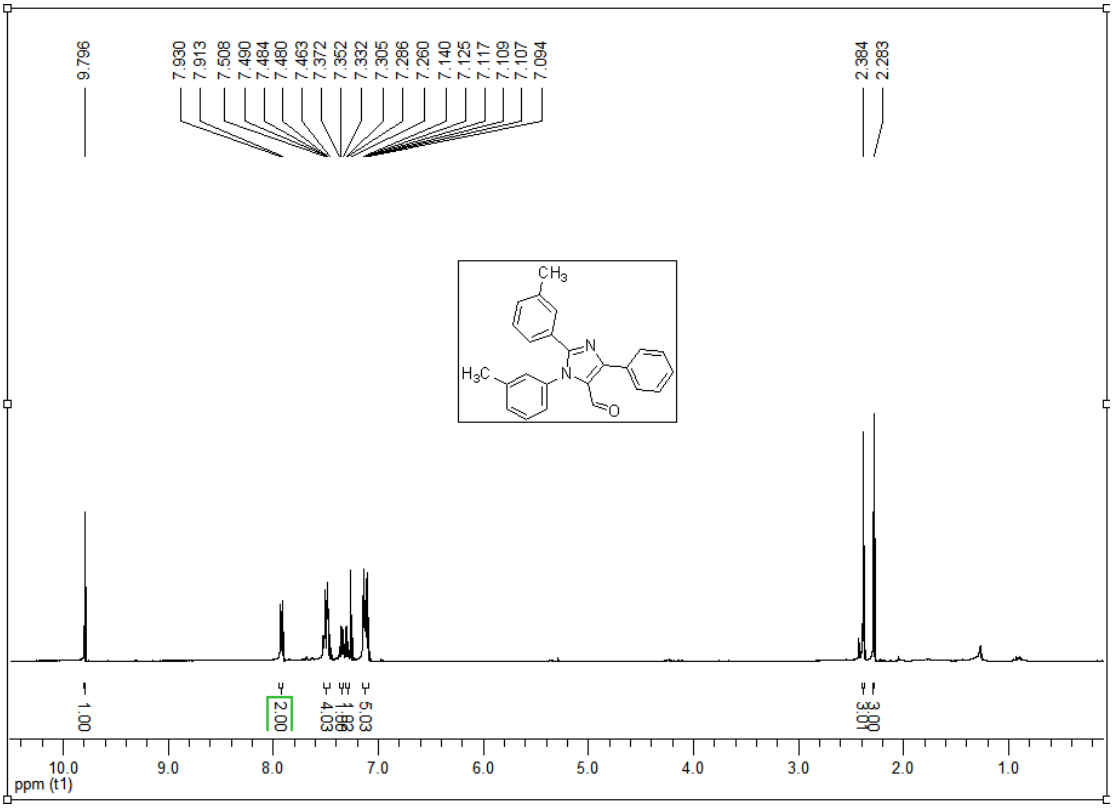


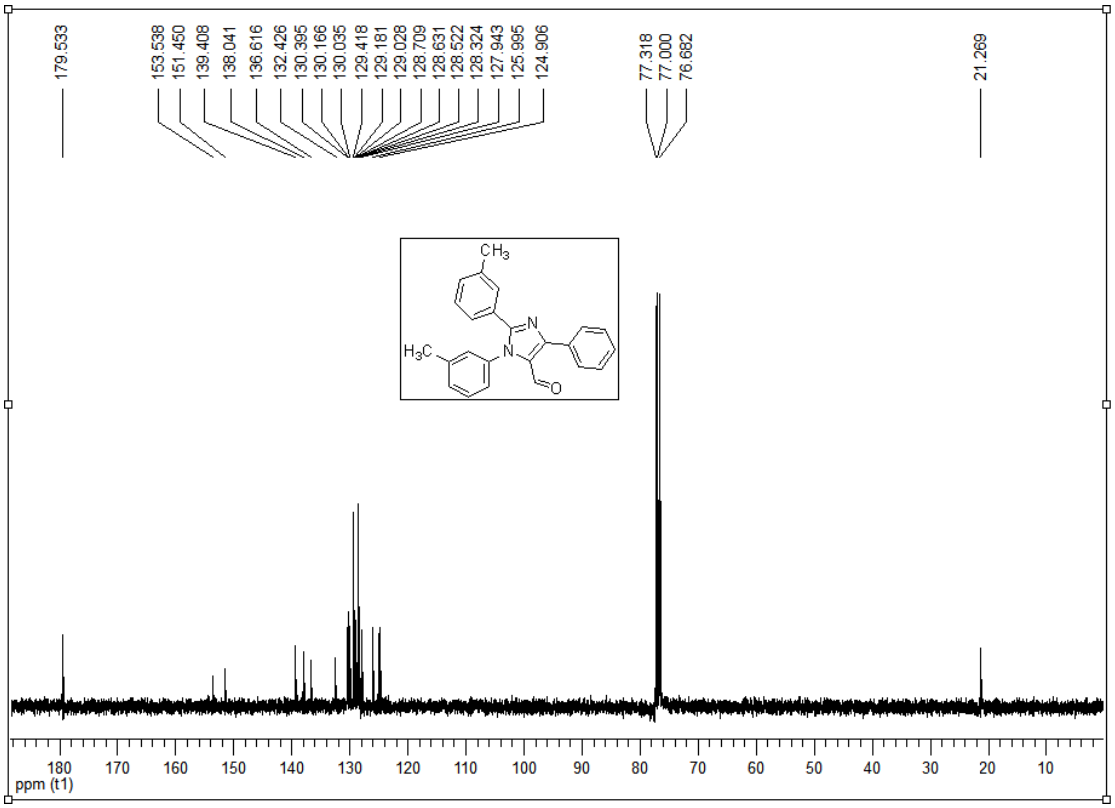
3m 1-(3-bromophenyl)-4-phenyl-2-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde



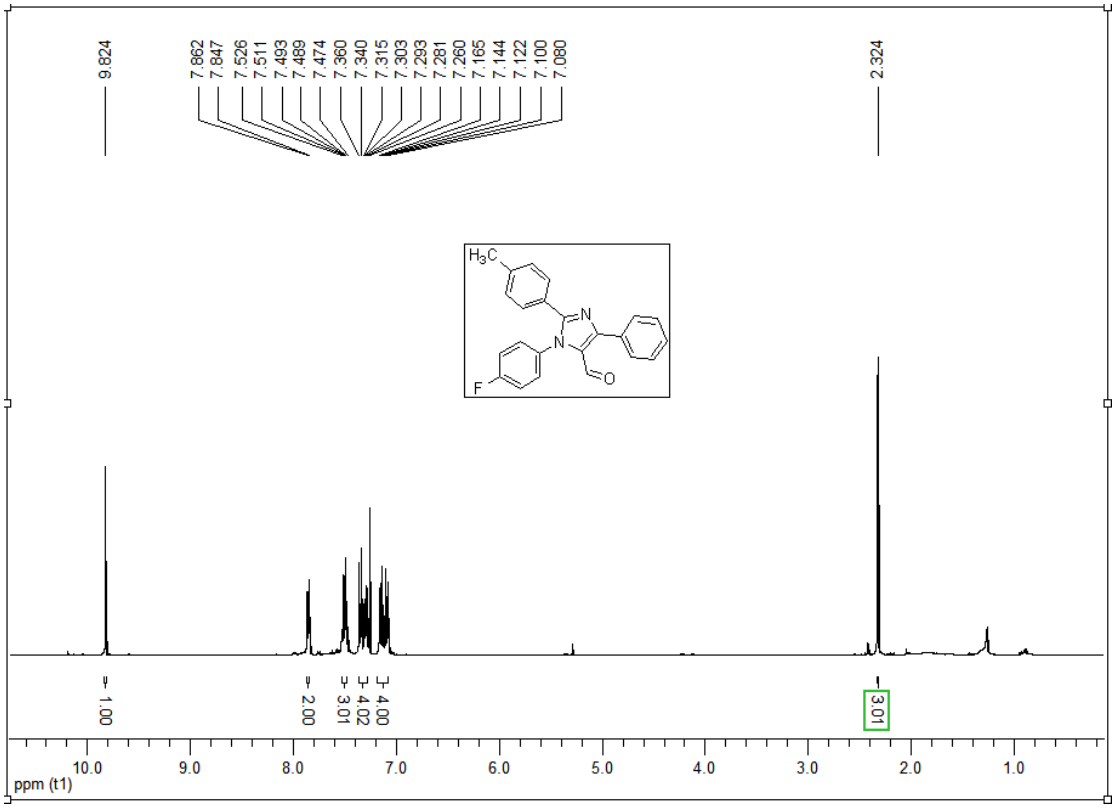


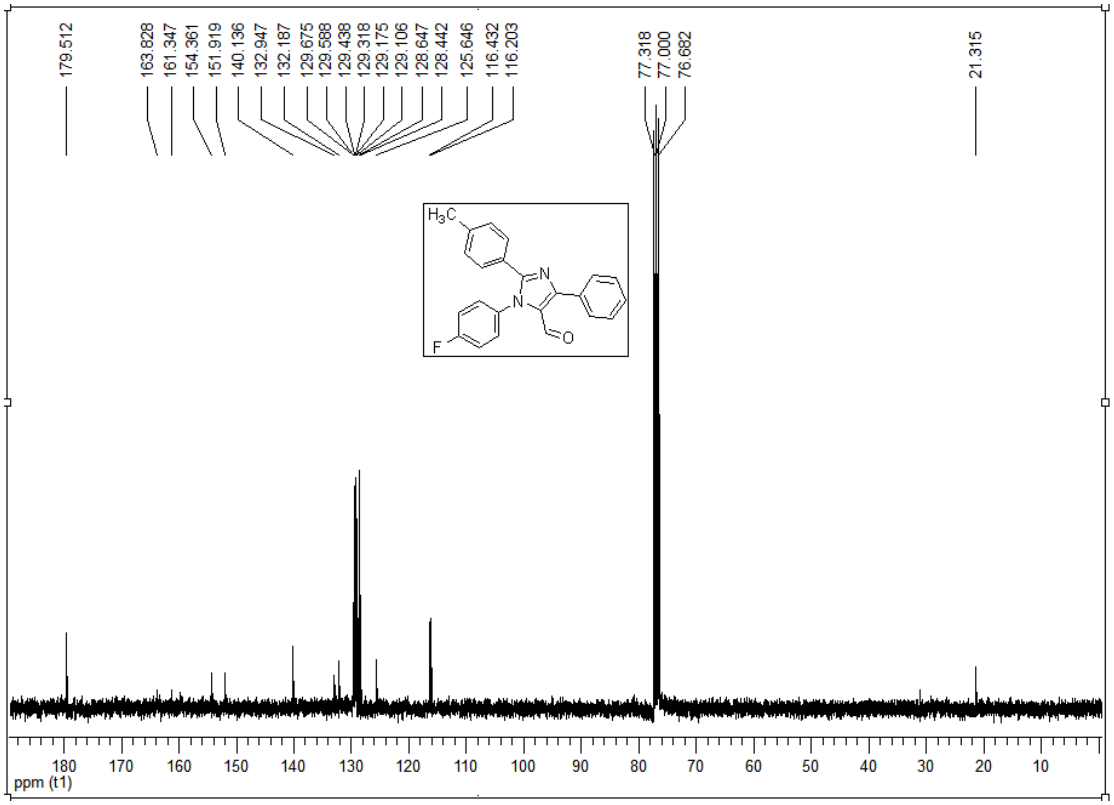
3n 4-phenyl-1,2-di-*m*-tolyl-1*H*-imidazole-5-carbaldehyde



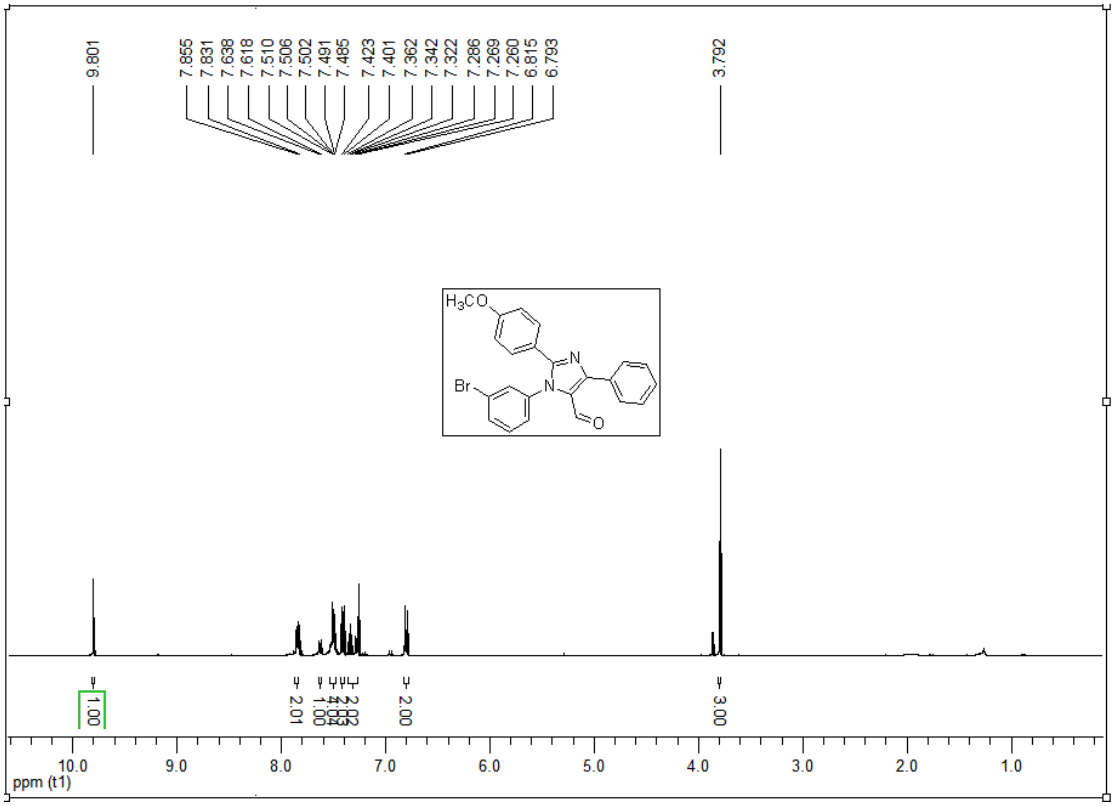


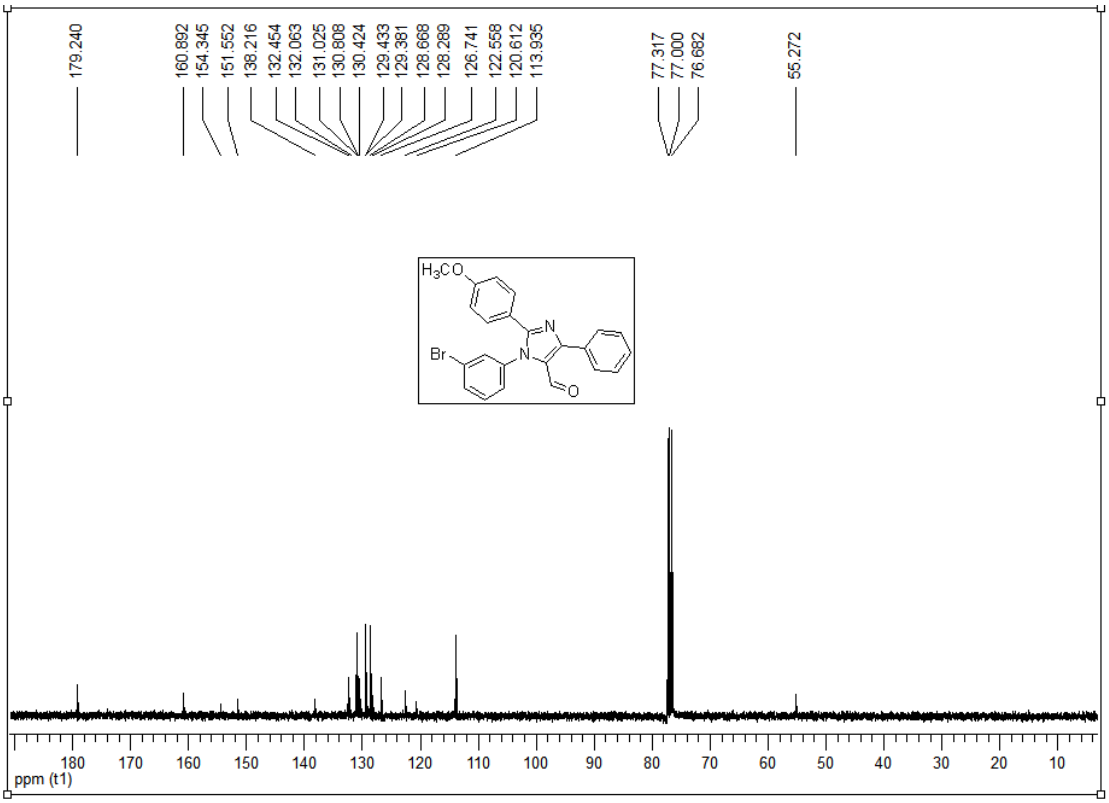
3o 1-(4-fluorophenyl)-4-phenyl-2-(*p*-tolyl)-1*H*-imidazole-5-carbaldehyde



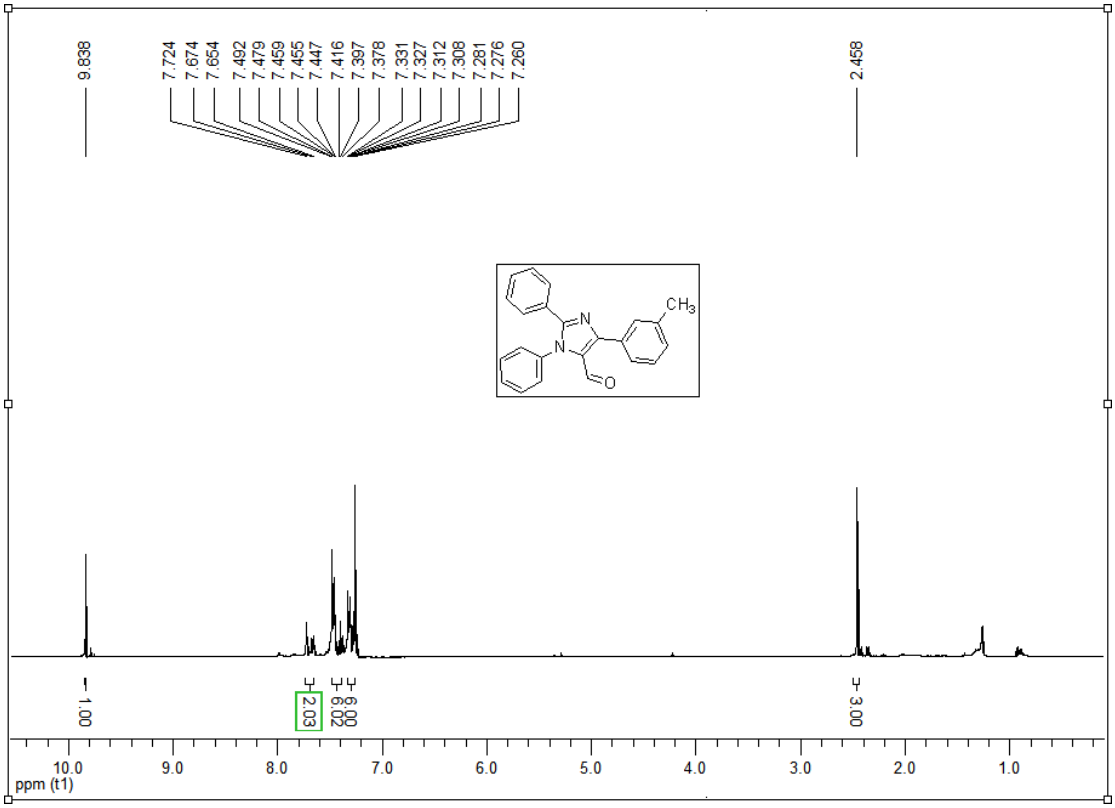


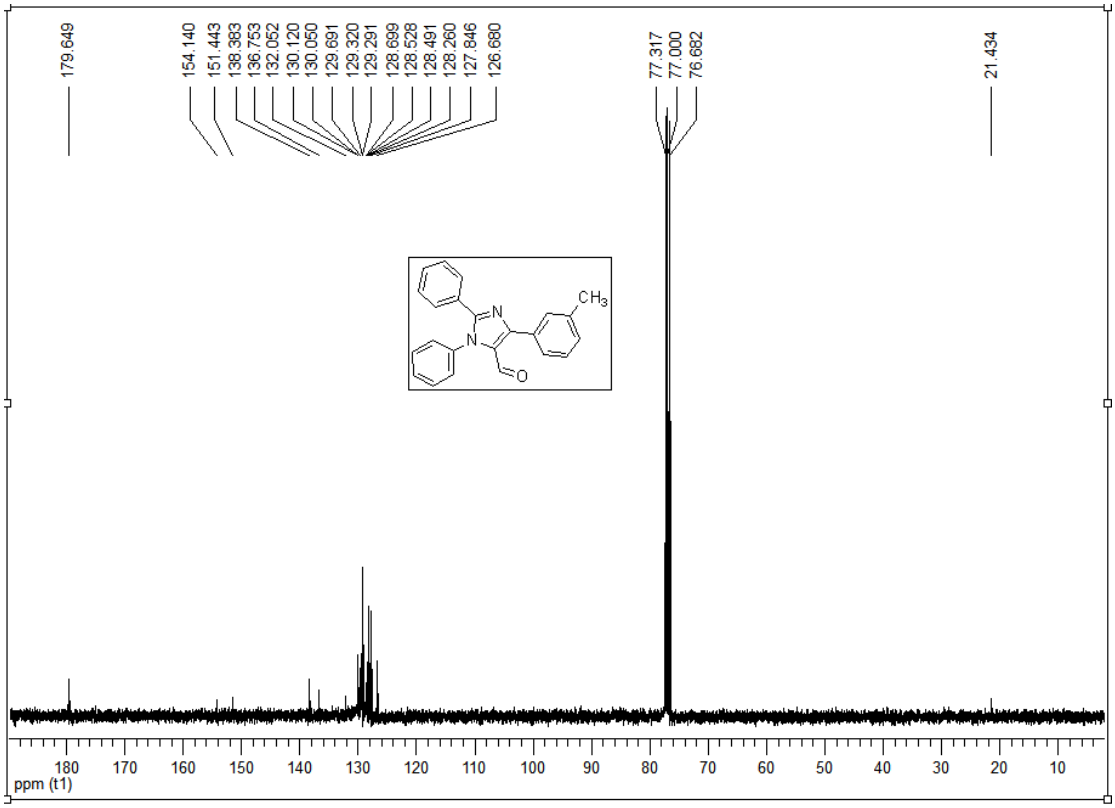
3p 1-(3-bromophenyl)-2-(4-methoxyphenyl)-4-phenyl-1*H*-imidazole-5-carbaldehyde



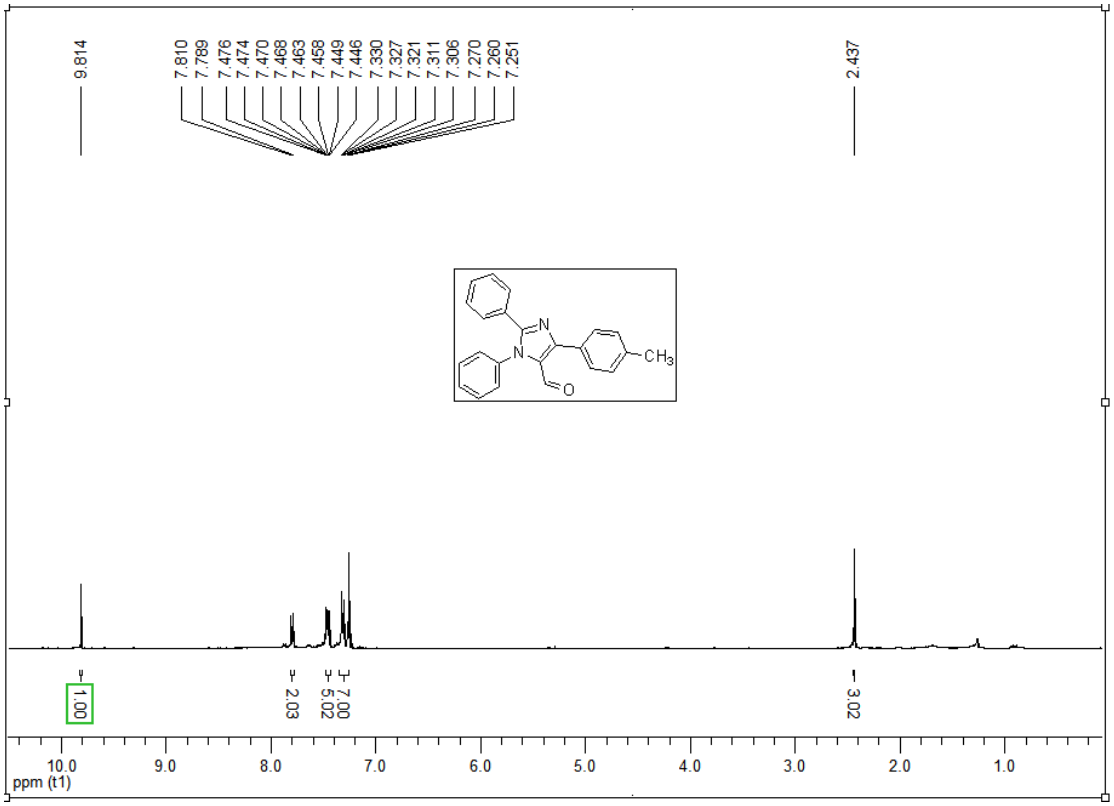


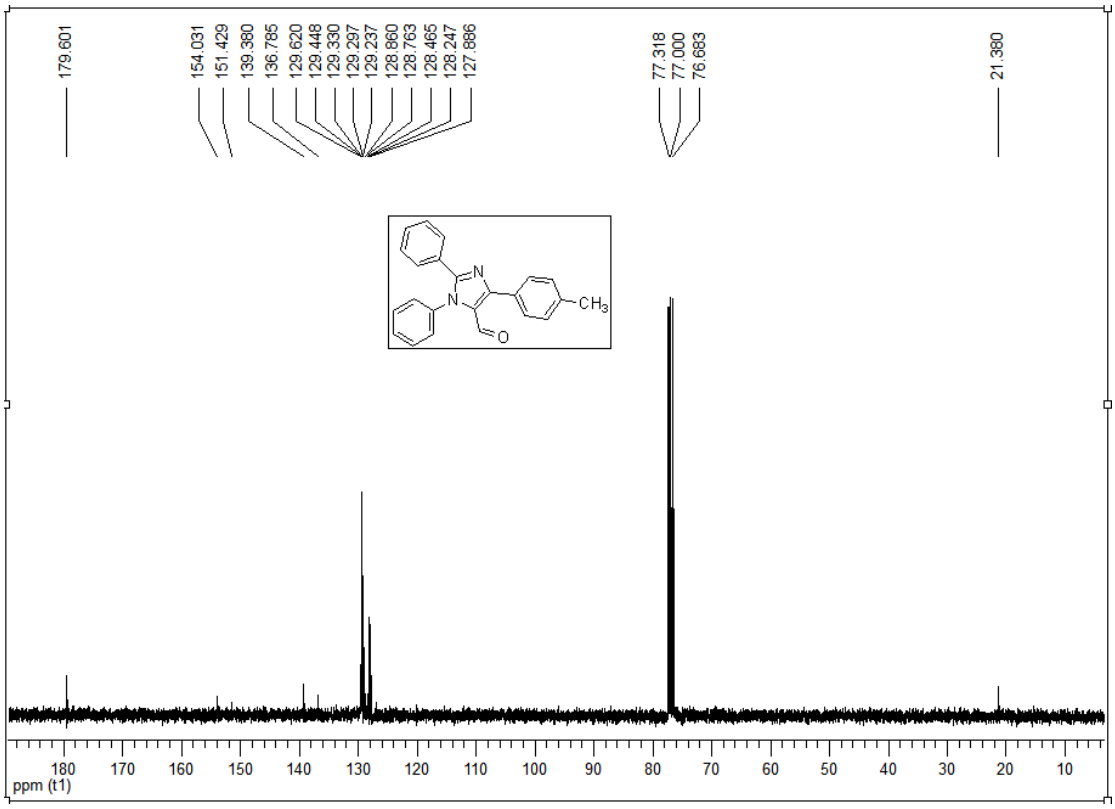
3q 1,2-diphenyl-4-(*m*-tolyl)-1*H*-imidazole-5-carbaldehyde



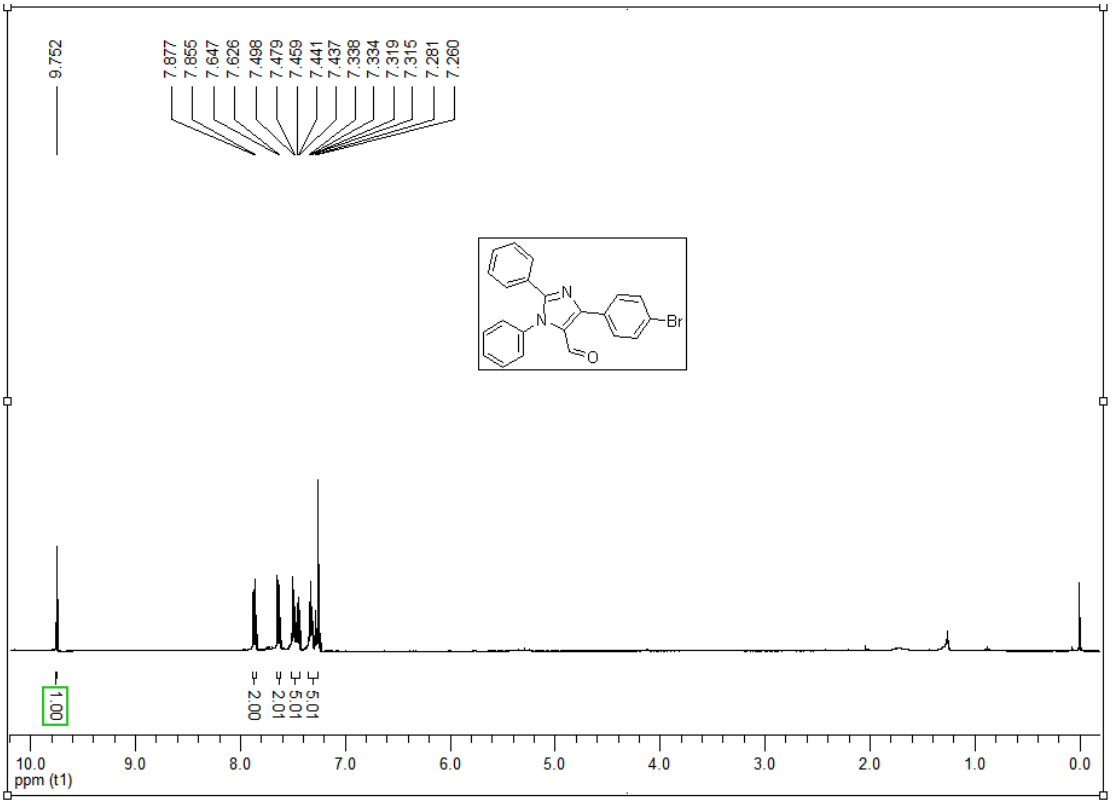


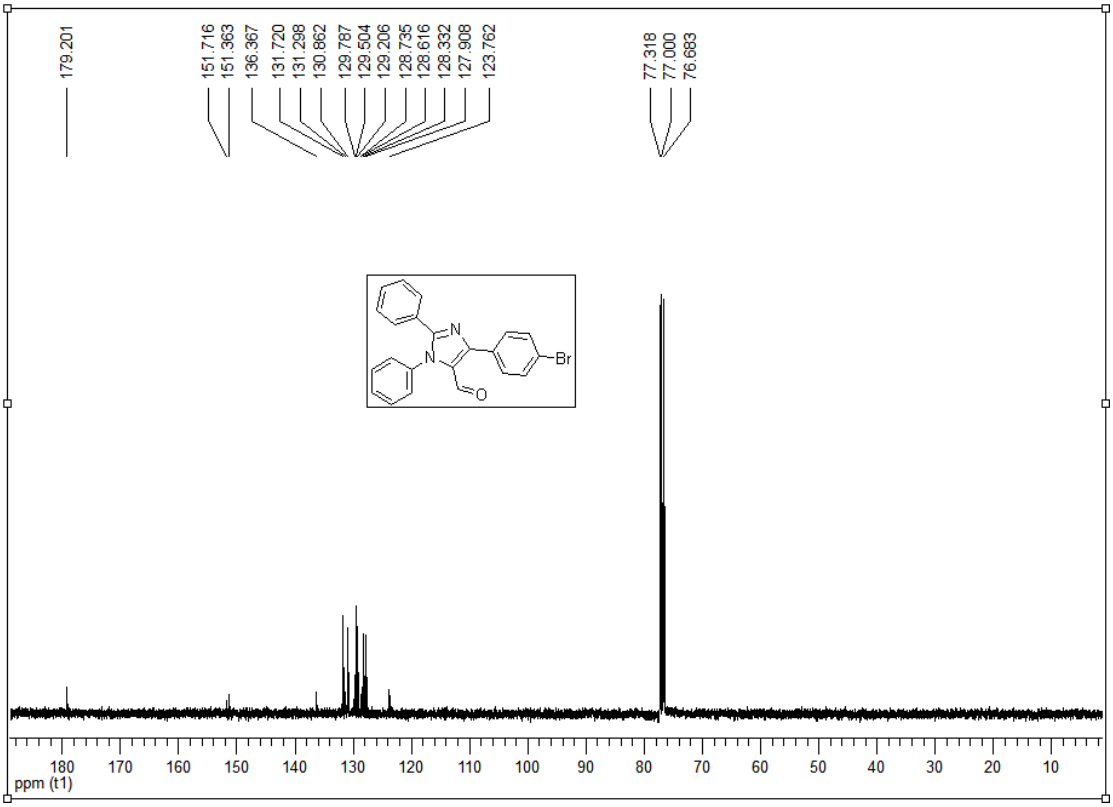
3r 1,2-diphenyl-4-(*p*-tolyl)-1*H*-imidazole-5-carbaldehyde



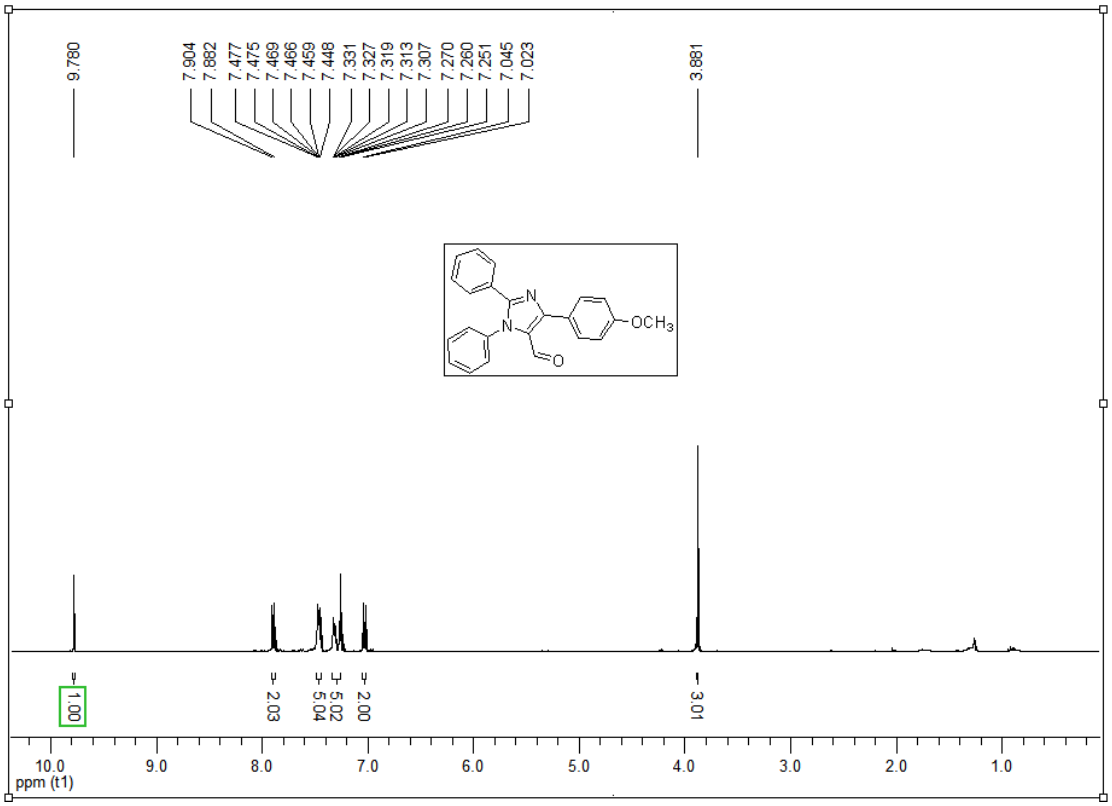


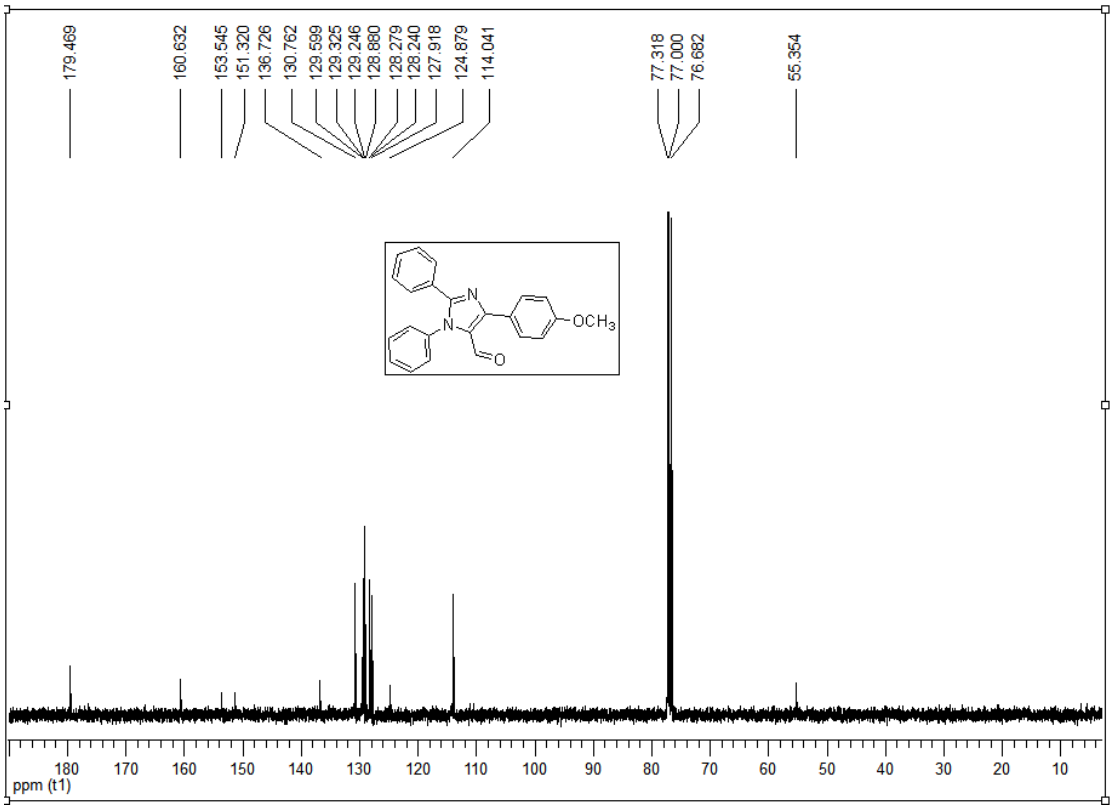
3s 4-(4-bromophenyl)-1,2-diphenyl-1*H*-imidazole-5-carbaldehyde



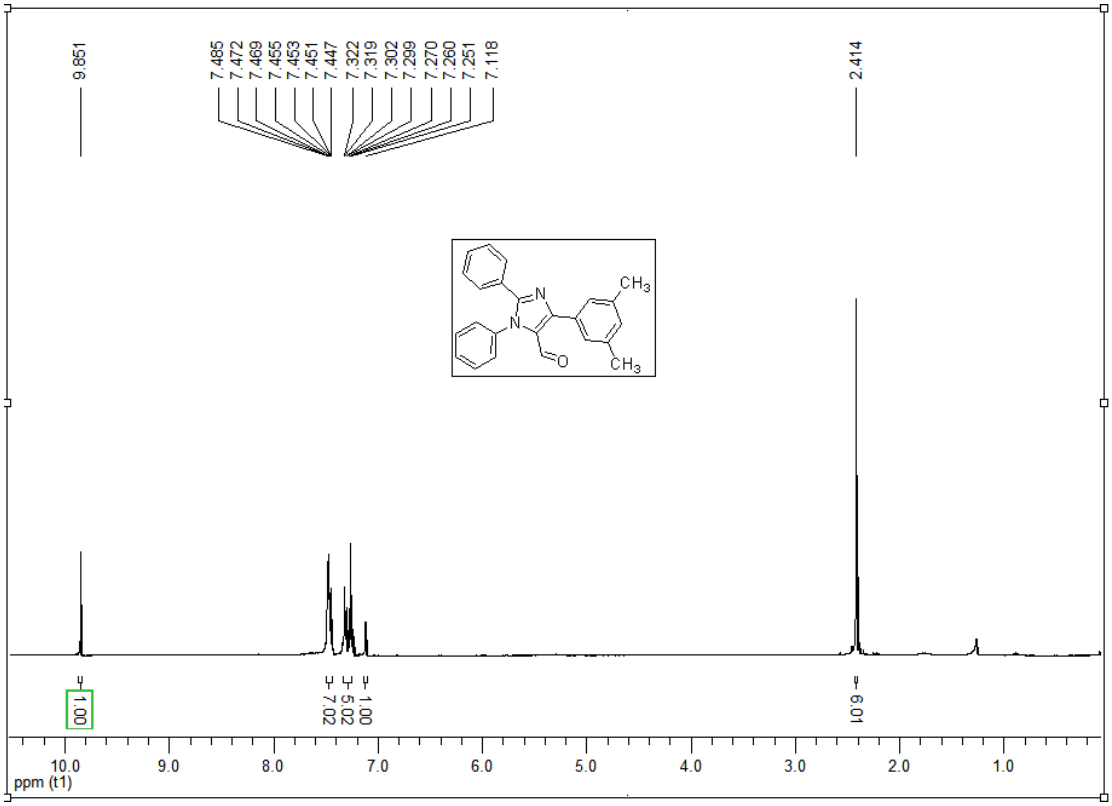


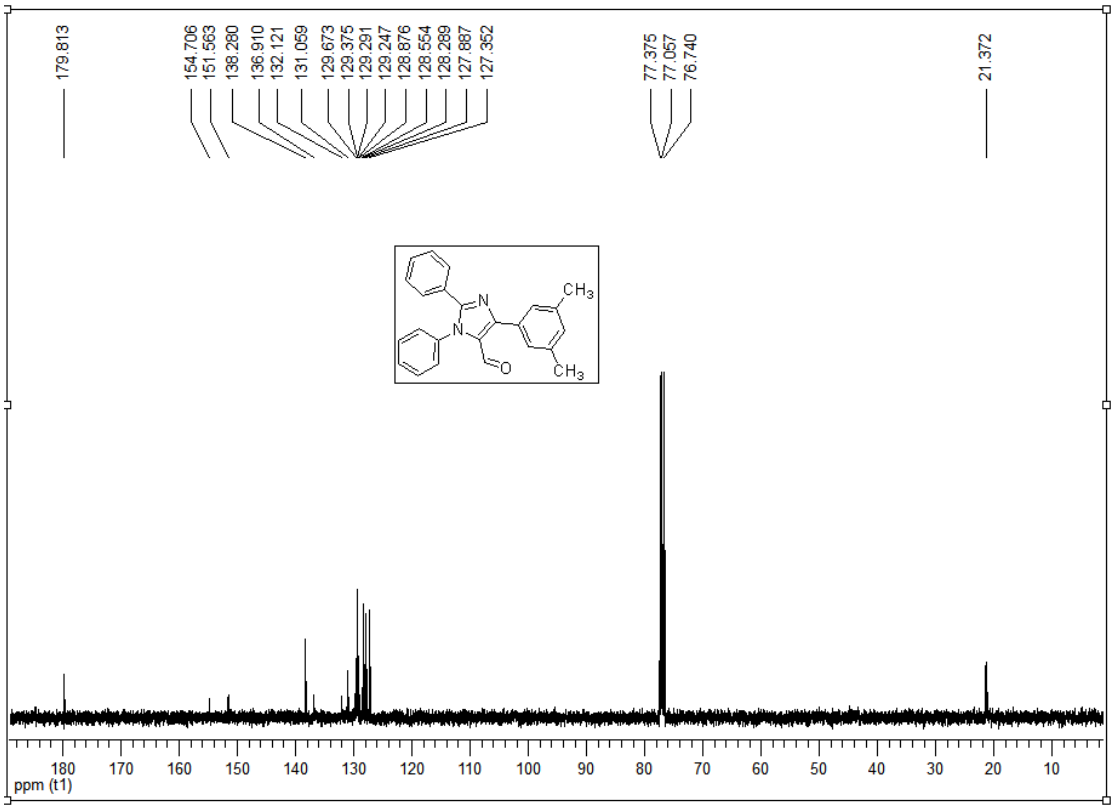
3t 4-(4-methoxyphenyl)-1,2-diphenyl-1*H*-imidazole-5-carbaldehyde



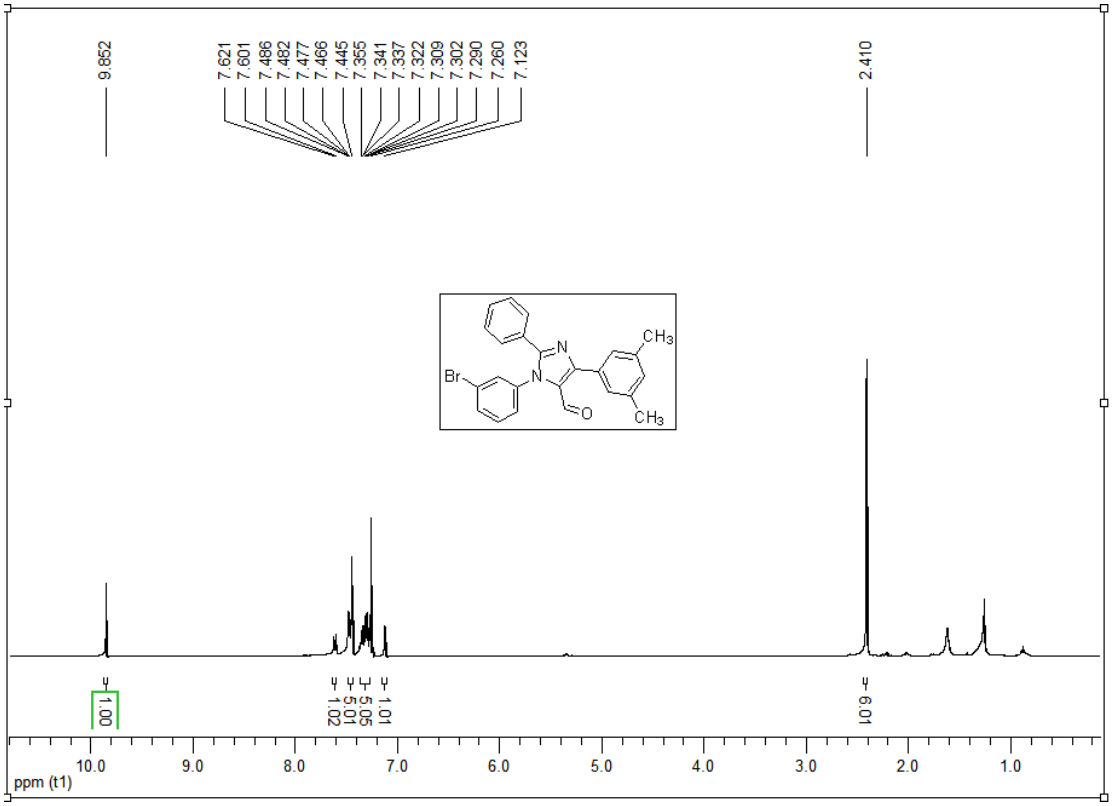


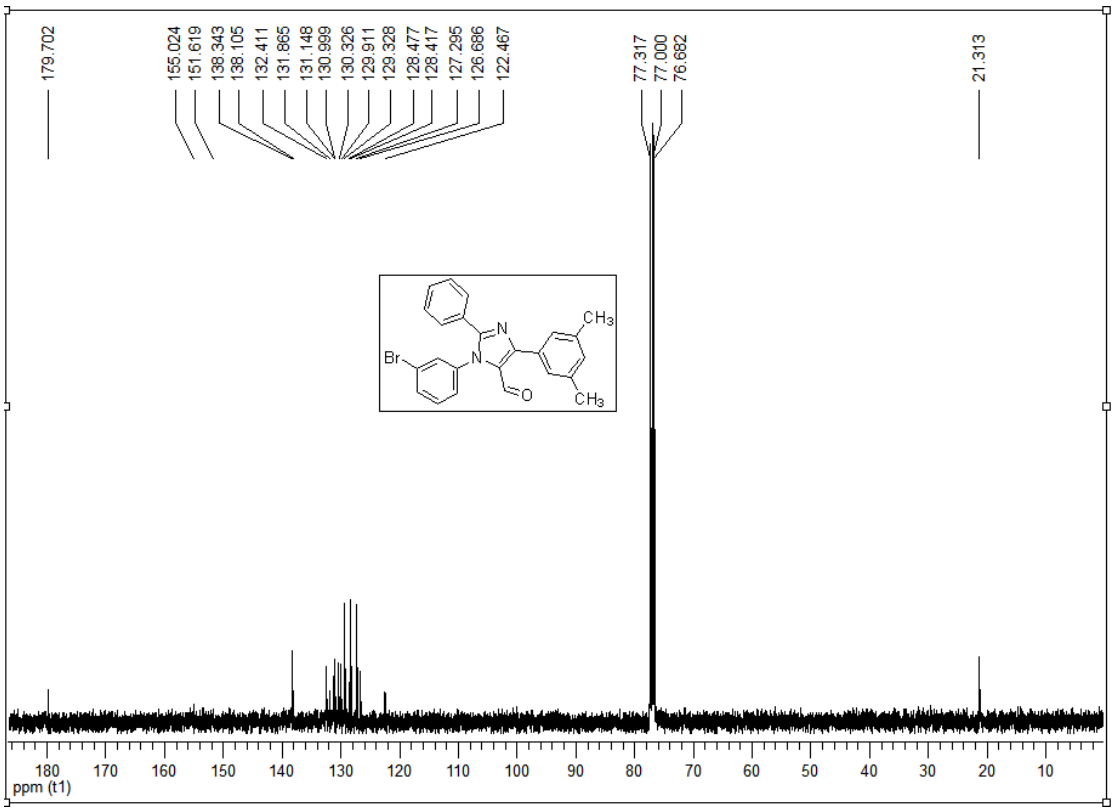
3u 4-(3,5-dimethylphenyl)-1,2-diphenyl-1*H*-imidazole-5-carbaldehyde





3v 1-(3-bromophenyl)-4-(3,5-dimethylphenyl)-2-phenyl-1*H*-imidazole-5-carbaldehyde





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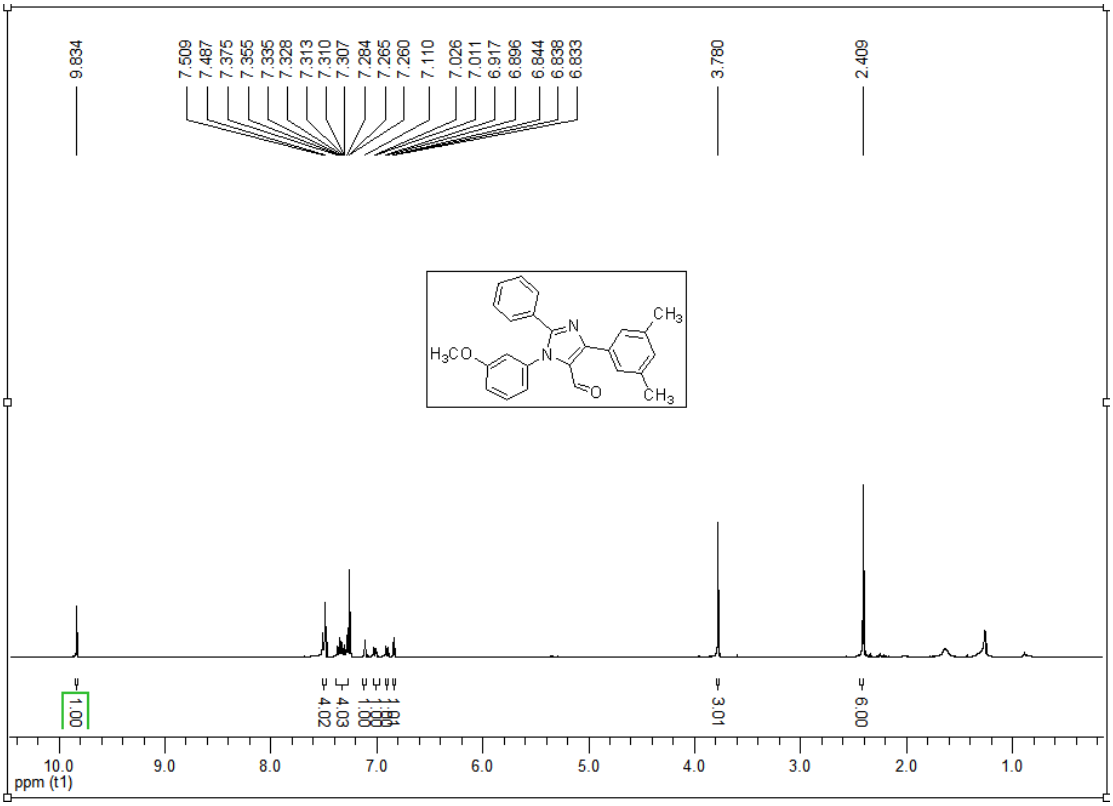
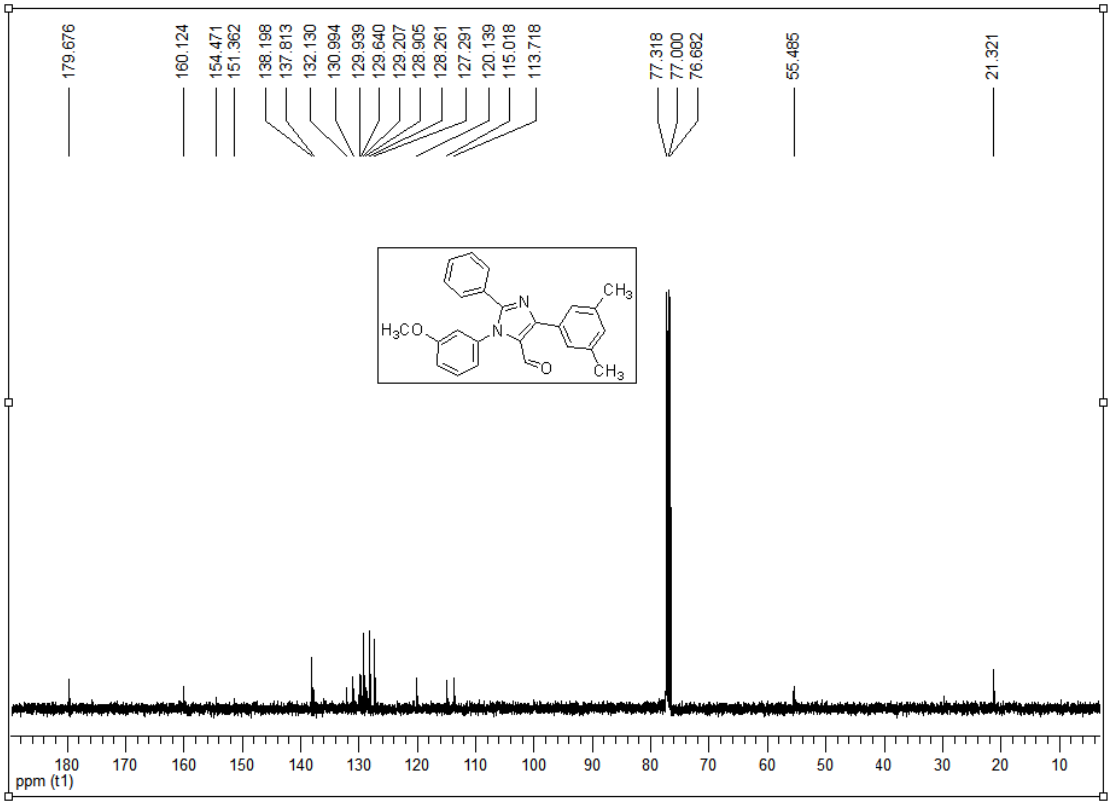
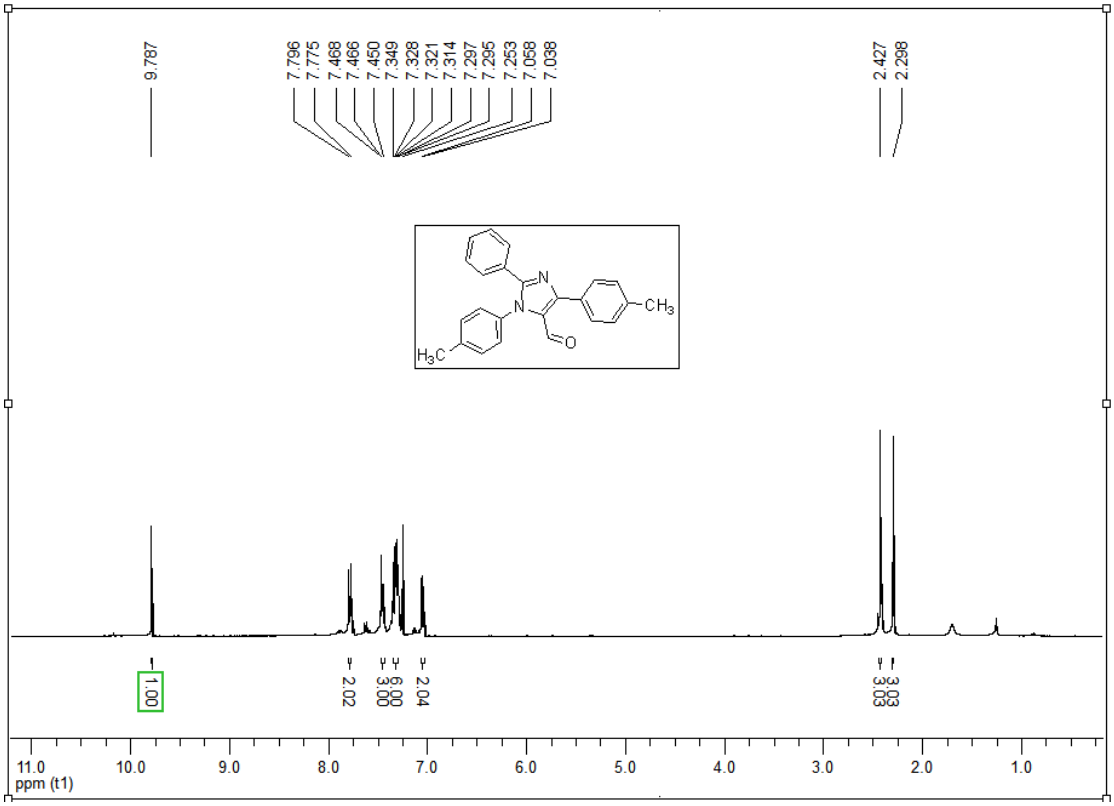
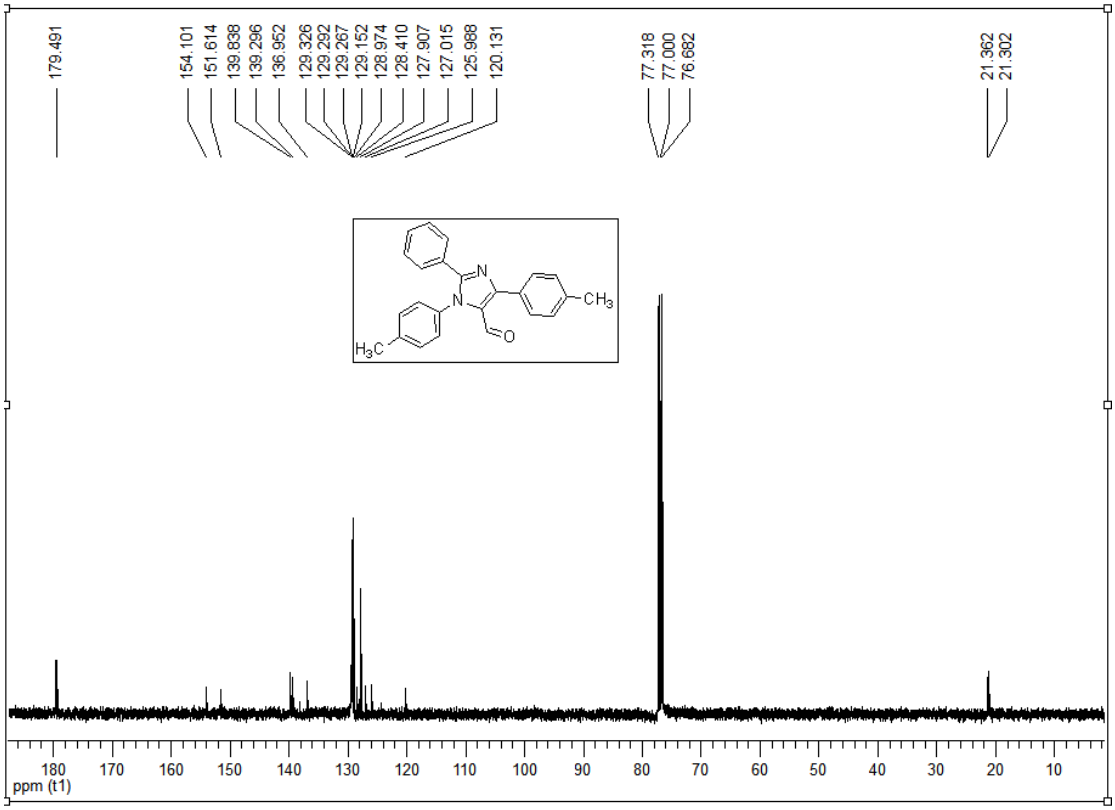
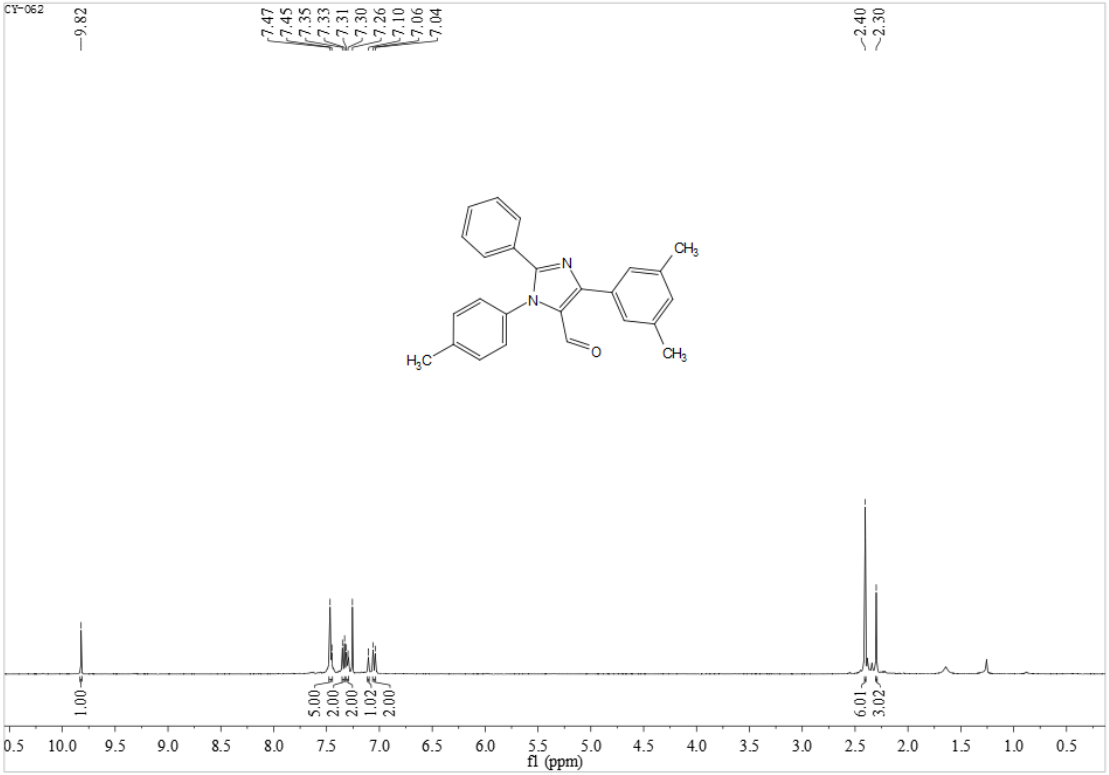
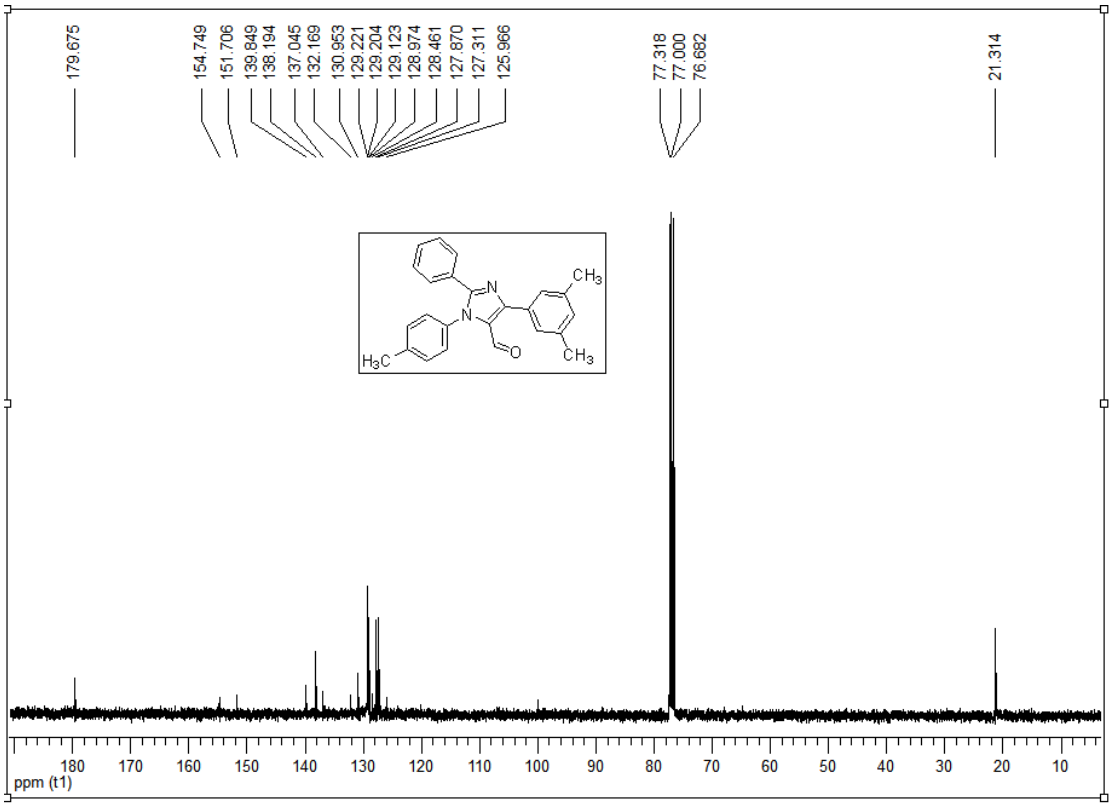




3x 2-phenyl-1,4-di-*p*-tolyl-1*H*-imidazole-5-carbaldehyde





3y 4-(3,5-dimethylphenyl)-2-phenyl-1-(*p*-tolyl)-1*H*-imidazole-5-carbaldehyde