Electronic Supplementary Material (ESI) for New Journal of Chemistry.


## Electronic Supplementary Information…….....

# Diamine-functionalized porous graphene oxide sheet decorated with palladium oxide nanoparticles for the oxidative amidation of aldehydes

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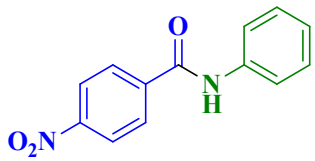
# Table of Contents

# Spectral Data of Representative Products

## 1. 4-nitro-N-phenylbenzamide



Yellow solid

**$^1$H-NMR (400 MHz, $CDCl_3$):** δ 8.55 (s, 1H), 8.32 (d, 2H, J = 8.8 Hz), 8.07 (d, 2H, J = 8.8 Hz), 7.42 (t, 2H, J = 8 Hz), 7.24-7.31 (m, 3H) ppm**. $^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 157.47, 151.00, 149.37, 141.65, 129.50, 129.43, 127.17, 124.11, 121.05 ppm. **HRMS (ES):** Calcd: 242.0691. Found: 243.0741 $[M+H]^+$ and 244.0721 $[MH+2]^+$.

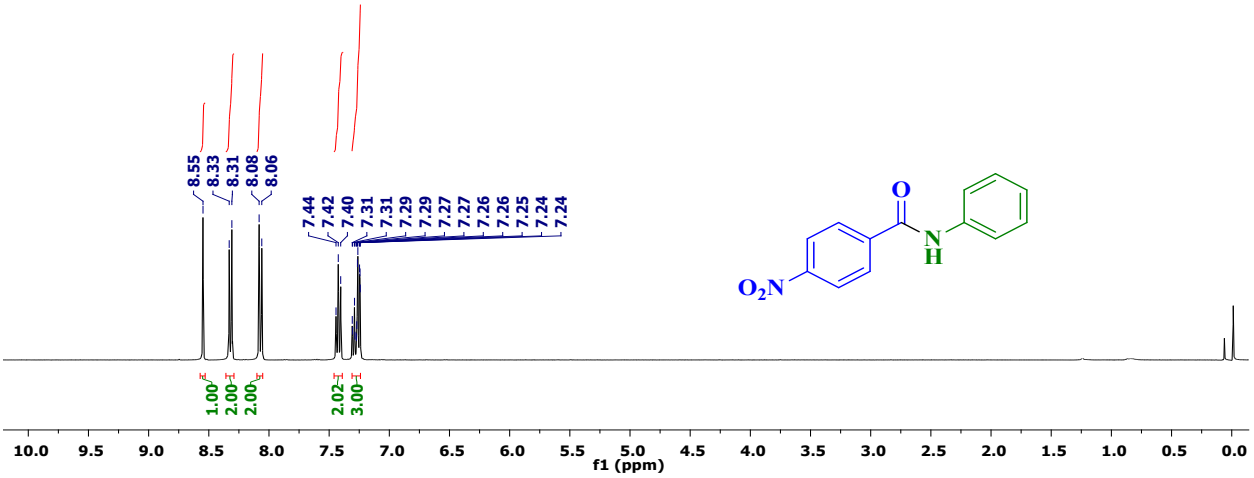



**Fig. S1 (a):** $^1$H-NMR of 4-nitro-N-phenylbenzamide

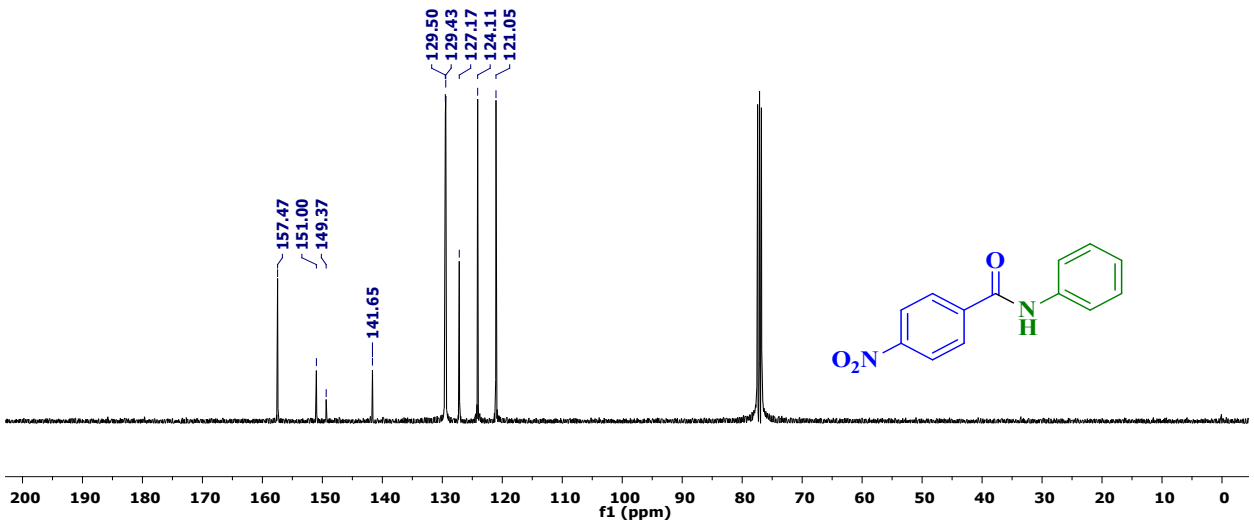
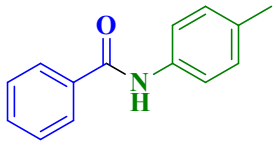



**Fig. S1 (b):** $^{13}$C-NMR of 4-nitro-N-phenylbenzamide

## 2. N-(p-tolyl)benzamide



Orange solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.48 (s, 1H), 7.90-7.92 (m, 2H), 7.46-7.50 (m, 3H), 7.15-7.23 (m, 4H), 2.39 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 159.76, 149.53, 136.42, 135.93, 131.34, 129.89, 128.83, 120.94, 21.15 ppm. **HRMS (ES):** Calcd: 211.0997. Found: 212.1037 $[M+H]^+$ and 213.1048 $[MH+2]^+$.

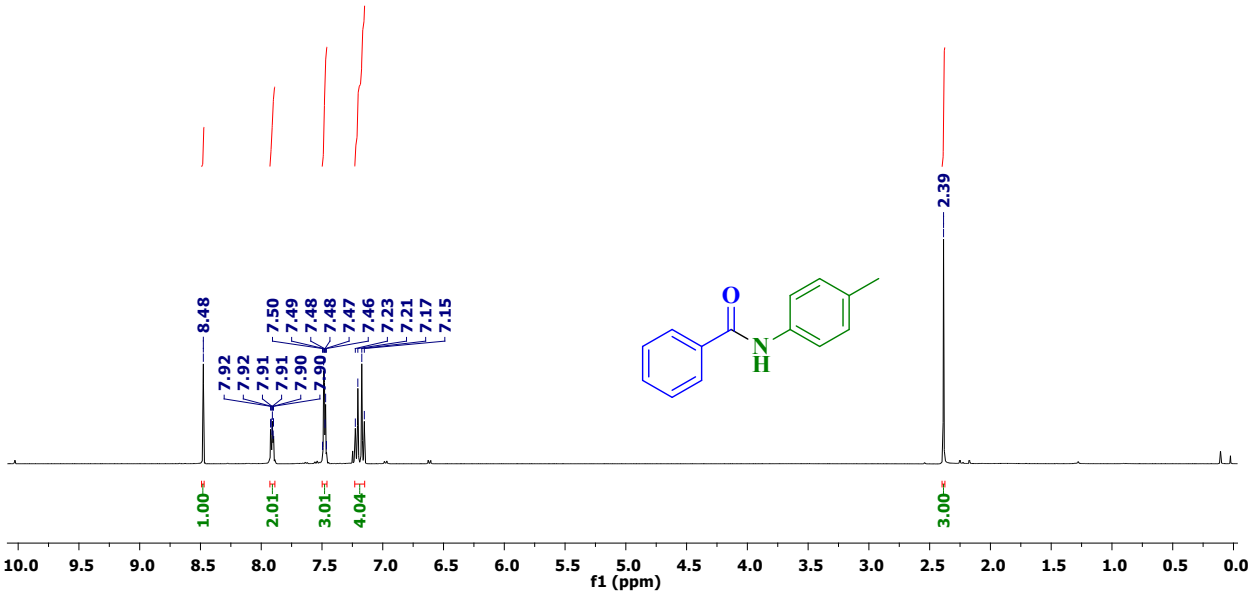



**Fig. S2 (a):** $^{1}$H-NMR of N-(p-tolyl)benzamide

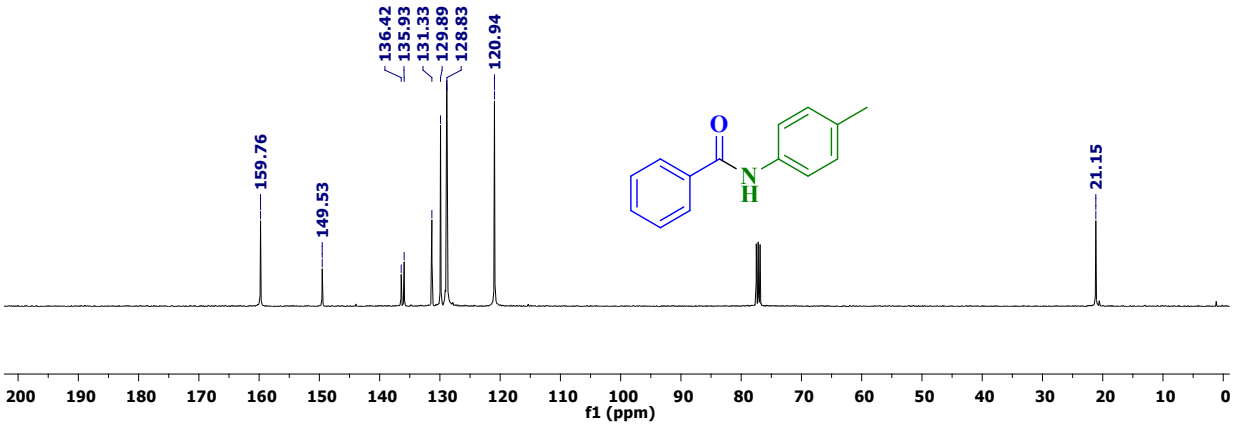
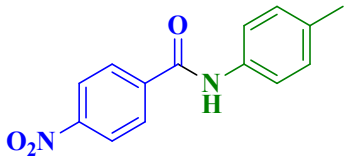



**Fig. S2 (b):** $^{13}$C-NMR of N-(p-tolyl)benzamide

### 3. 4-nitro-N-(p-tolyl)benzamide



Yellow solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.56 (s, 1H), 8.31 (d, 2H, J = 8.8 Hz), 8.06 (d, 2H, J = 8.8 Hz), 7.17-7.24 (m, 4H), 2.38 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 156.46, 149.22, 148.32, 141.85, 137.35, 130.05, 129.37, 124.10, 121.09, 21.20 ppm. **HRMS (ES):** Calcd: 256.0848. Found: 257.0878. $[M+H]^+$ and 258.0898 $[MH+2]^+$.

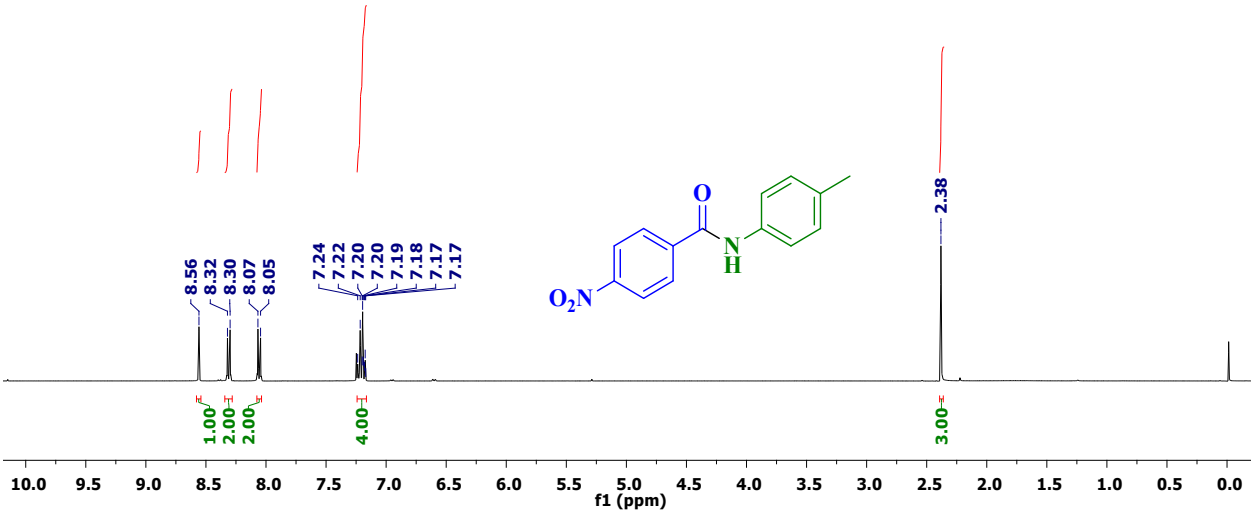



**Fig. S3 (a):** $^{1}$H-NMR of 4-nitro-N-(p-tolyl)benzamide

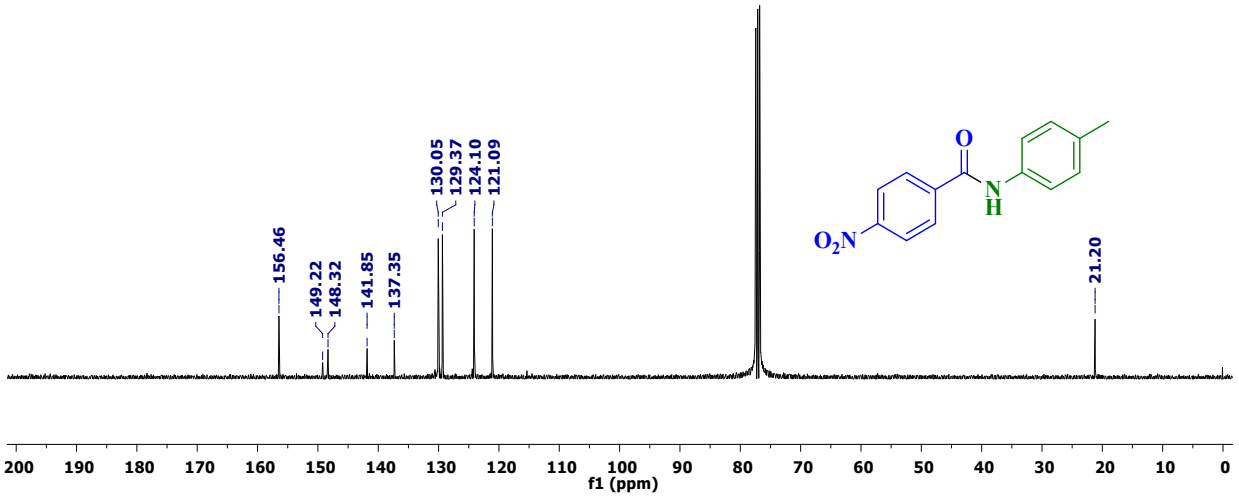
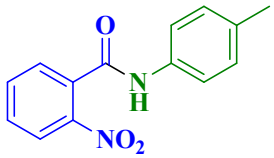



**Fig. S3 (b):** $^{13}$C-NMR of 4-nitro-N-(p-tolyl)benzamide

**4. 2-nitro-N-(p-tolyl)benzamide**



Brown solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.94 (s, 1H), 8.30 (d, 1H, J = 8 Hz), 8.05 (d, 1H, J = 8.4 Hz), 7.72 (t, 1H, J = 8 Hz), 7.57-7.61 (m, 1H), 7.21(s, 4H), 2.38 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 154.93, 149.33, 148.53, 137.11, 133.65, 131.34, 131.10, 129.99, 129.78, 124.61, 121.29, 21.17 ppm. **HRMS (ES):** Calcd: 256.0848. Found: 257.0888 $[M+H]^+$ and 258.0898 $[MH+2]^+$.

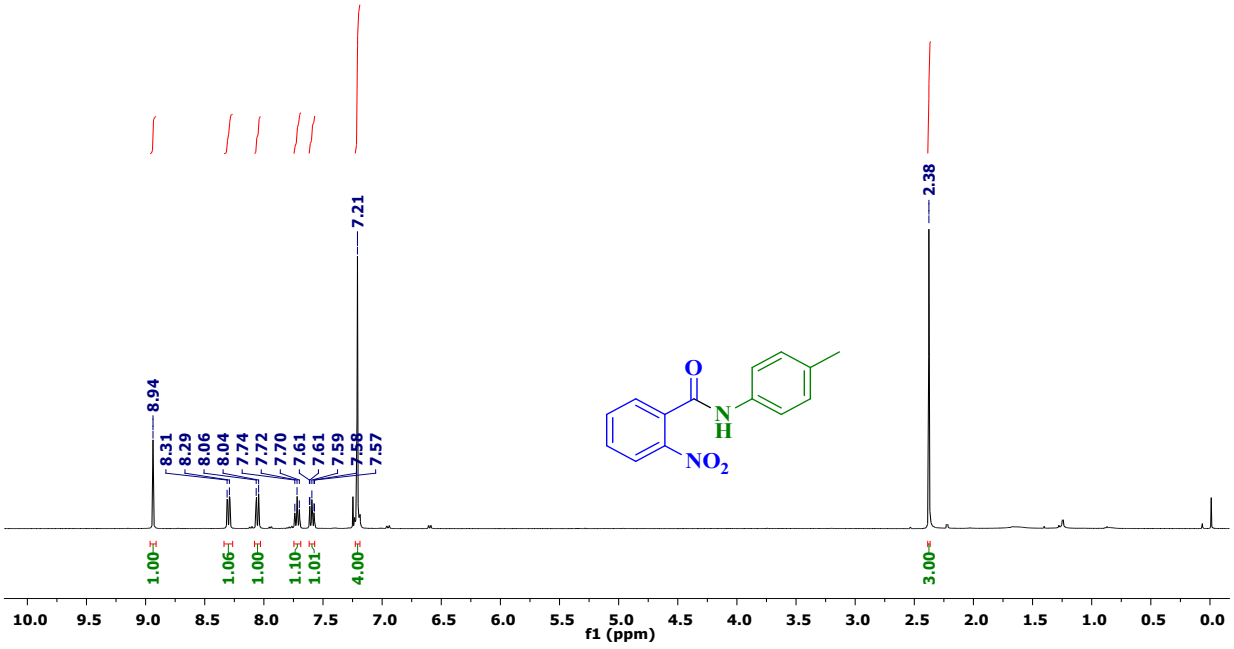



**Fig. S4 (a):** $^{1}$H-NMR of 2-nitro-N-(p-tolyl)benzamide

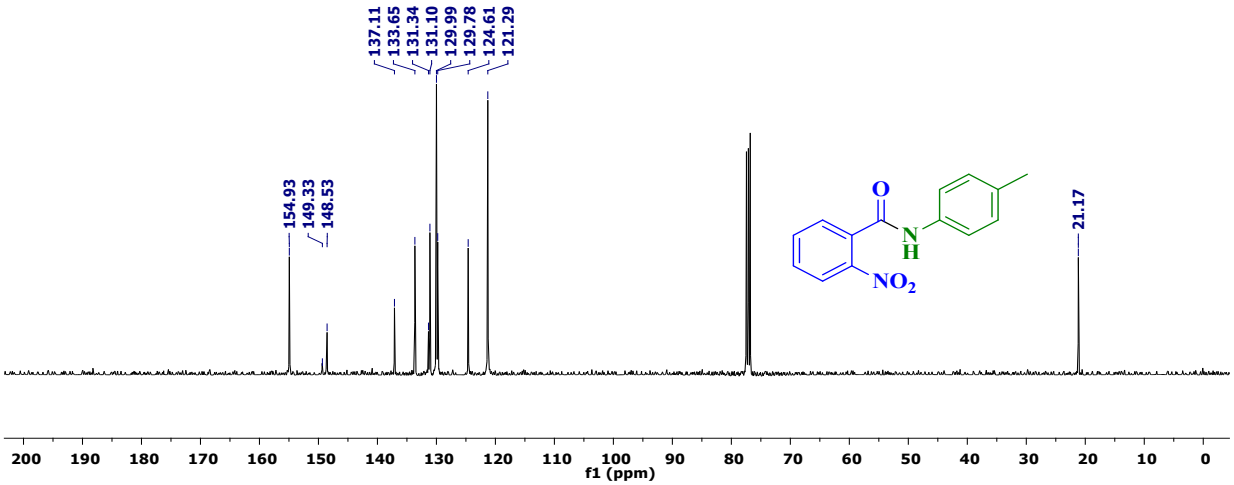
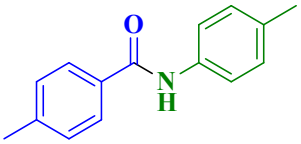



**Fig. S4 (b):** $^{13}$C-NMR of 2-nitro-N-(p-tolyl)benzamide

**5. 4-methyl-N-(p-tolyl)benzamide**



Brown solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.42 (s, 1H), 7.78 (d, 2H, J = 8 Hz), 7.26 (d, 2H, J = 7.6 Hz), 7.11-7.20 (m, 4H), 2.41 (s, 3H), 2.36 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 159.72, 149.70, 141.76, 135.66, 133.85, 129.82, 129.58, 128.79, 120.89, 21.71, 21.09 ppm. **HRMS (ES):** Calcd: 225.1154. Found: 226.1204 $[M+H]^+$ and 227.1194 $[MH+2]^+$.

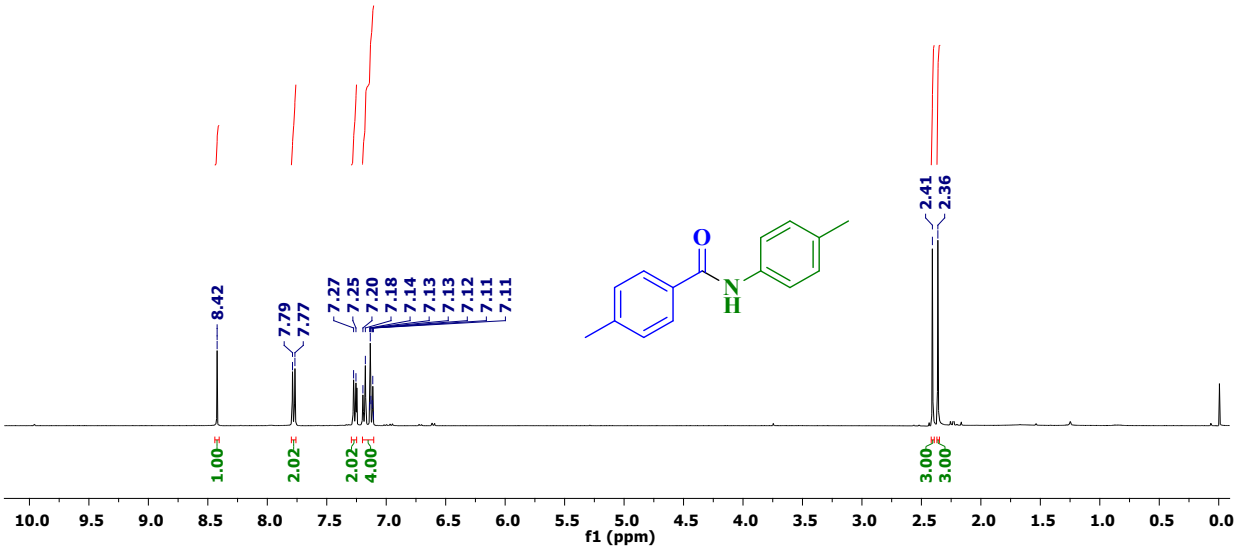



**Fig. S5 (a):** $^{1}$H-NMR 4-methyl-N-(p-tolyl)benzamide

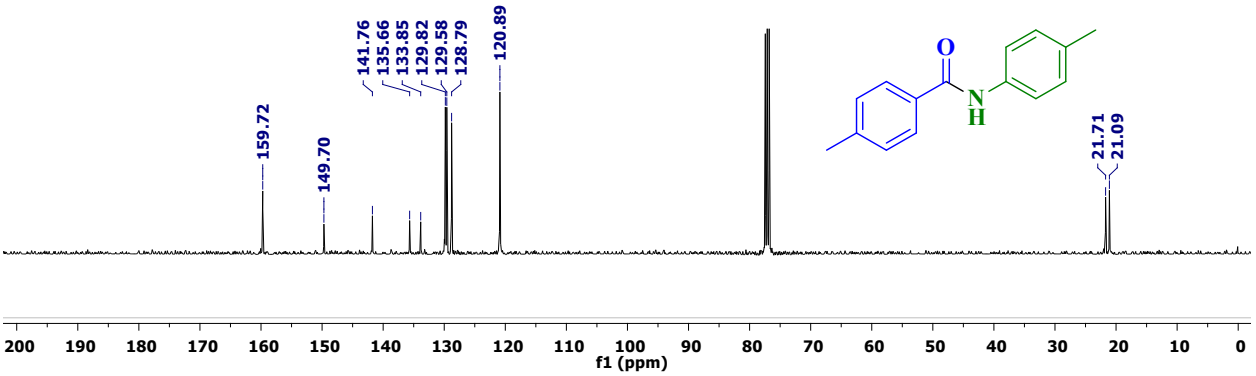
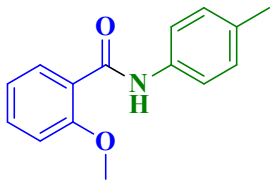



**Fig. S5 (b):** $^{13}$C-NMR of 4-methyl-N-(p-tolyl)benzamide

## 6. 2-methoxy-N-(p-tolyl)benzamide



Orange solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 9.01 (s, 1H), 8.23 (d, 1H, J = 8 Hz), 7.45 (t, 1H, J = 7.6 Hz), 7.23 (s, 4H), 7.08 (t, 1H, J = 7.6 Hz), 6.95 (d, 1H, J = 8.4 Hz), 3.88 (s, 3H), 2.41 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 159.56, 155.79, 150.31, 135.65, 132.70, 129.86, 127.57, 124.97, 121.21, 120.99, 111.23, 55.63, 21.18 ppm. **HRMS (ES):** Calcd: 241.1103. Found: 242.1153 $[M+H]^+$ and 243.1143 $[MH+2]^+$.

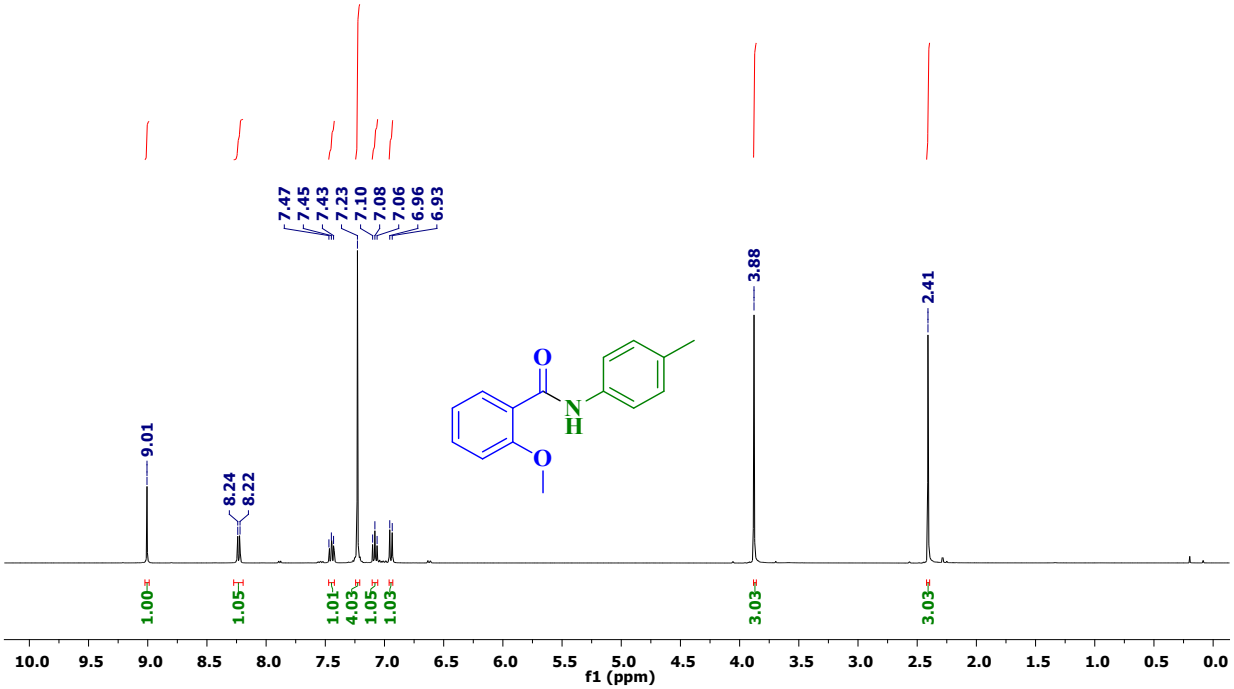



**Fig. S6 (a):** $^{1}$H-NMR of 2-methoxy-N-(p-tolyl)benzamide

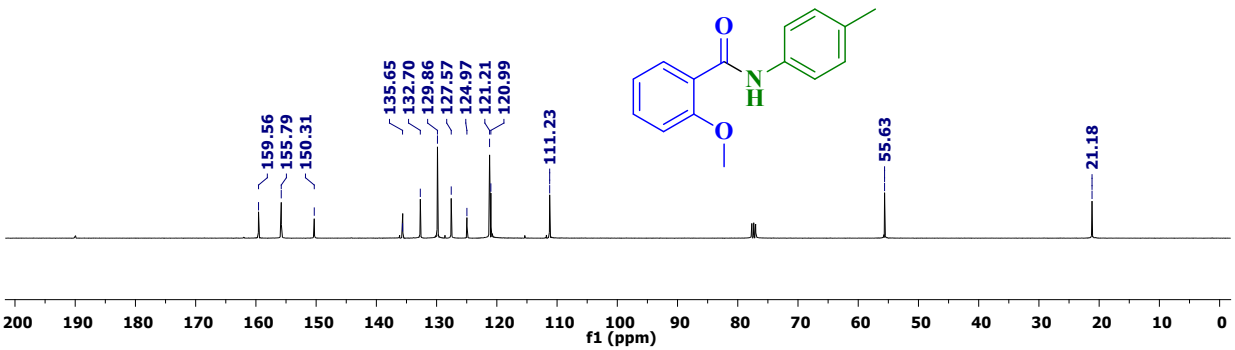
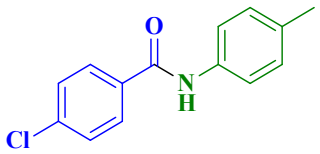



**Fig. S6 (b):** $^{13}$C-NMR of 2-methoxy-N-(p-tolyl)benzamide

**7. 4-chloro-N-(p-tolyl)benzamide**




Brown solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.42 (s, 1H), 7.82 (d, 2H, J = 8.4 Hz), 7.43 (d, 2H, J = 8.4 Hz), 7.12-7.20 (m, 4H), 2.36 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 158.13, 149.09, 137.24, 136.24, 134.89, 131.02, 129.90, 129.91, 129.14, 120.90, 21.13 ppm. **HRMS (ES):** Calcd: 245.0607. Found: 246.0647 $[M+H]^+$ and 247.0637 $[MH+2]^+$.

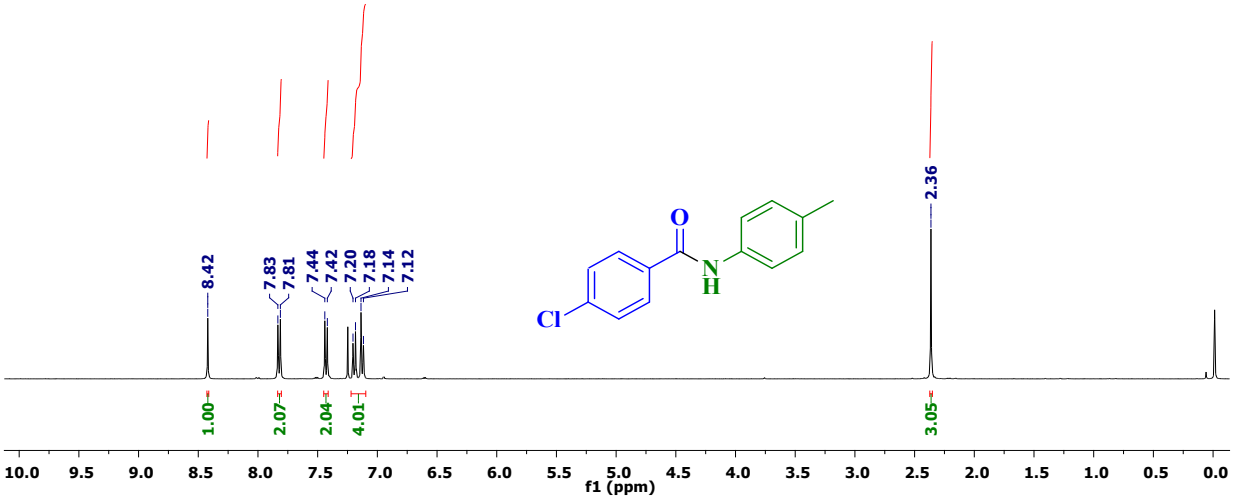



**Fig. S7 (a):** $^{1}$H-NMR of 4-chloro-N-(p-tolyl)benzamide

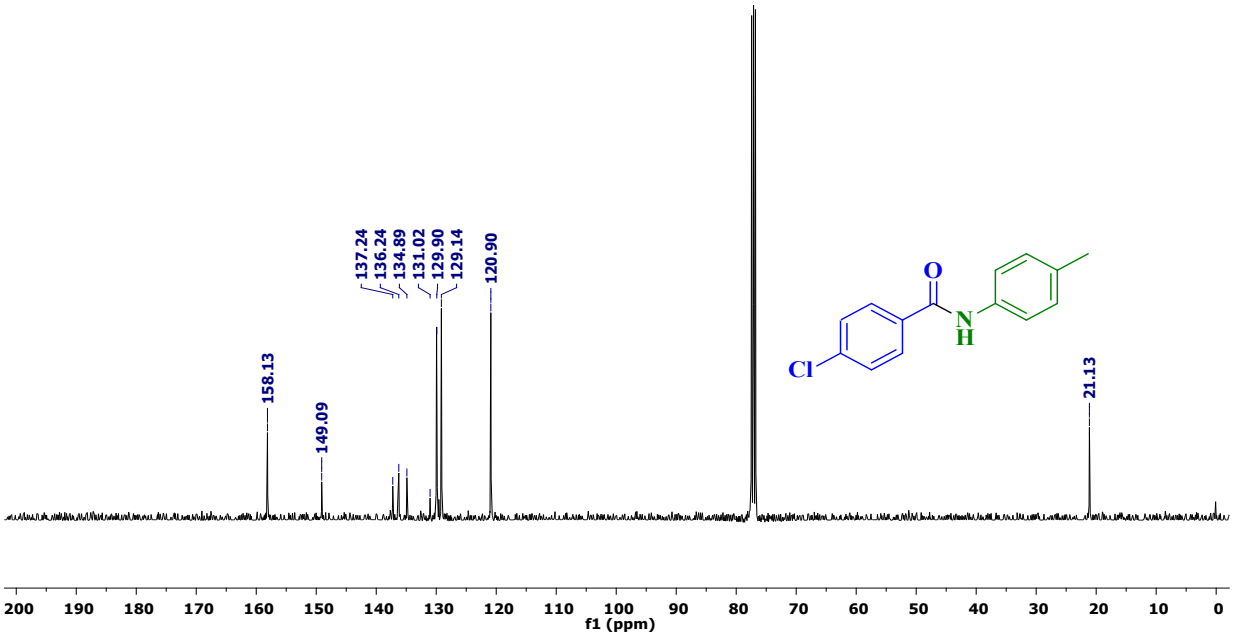
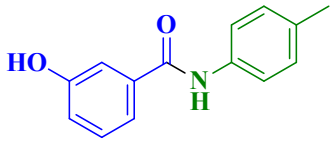



**Fig. S7 (b):** $^{13}$C-NMR of 4-chloro-N-(p-tolyl)benzamide

## 8. 3-hydroxy-N-(p-tolyl)benzamide




Brown solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.33 (s, 1H), 7.40 (s, 1H), 7.30-7.32 (m, 1H), 7.25 (t, 1H, J = 8 Hz), 7.11-7.18 (m, 4H), 6.93 (d, 1H, J = 7.6 Hz), 2.34 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 161.08, 156.84, 148.58, 137.01, 136.42, 130.18, 130.02, 122.02, 121.07, 119.50, 114.61, 21.13 ppm. **HRMS (ES):** Calcd: 227.0946. Found: 228.0996 $[M+H]^+$ and 229.0986 $[MH+2]^+$.

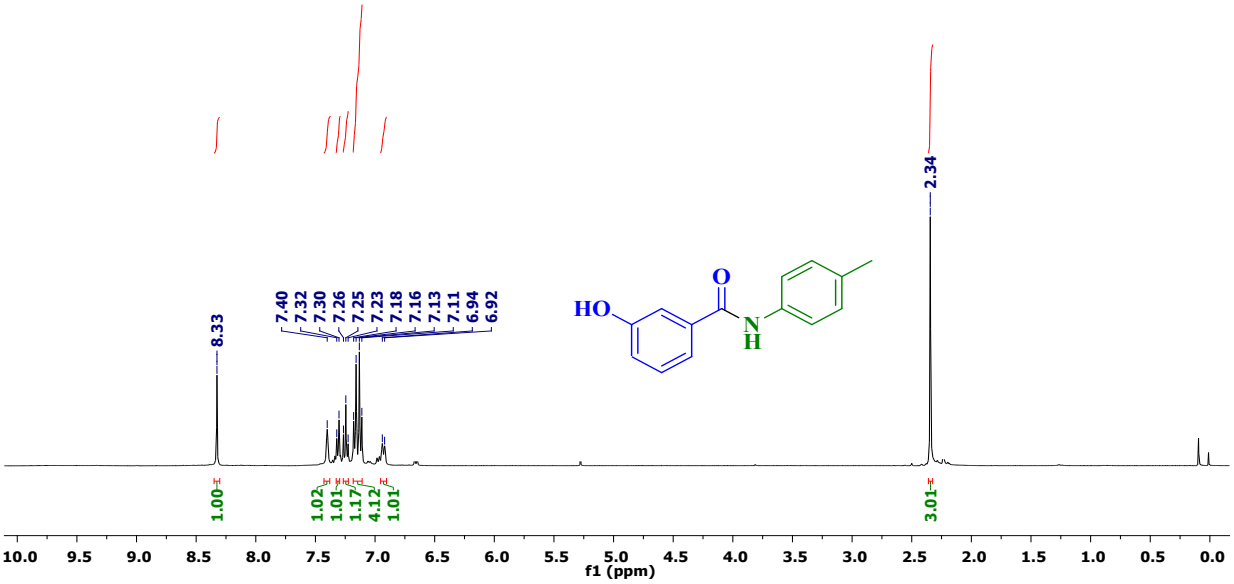



**Fig. S8 (a):** $^{1}$H-NMR of 3-hydroxy-N-(p-tolyl)benzamide

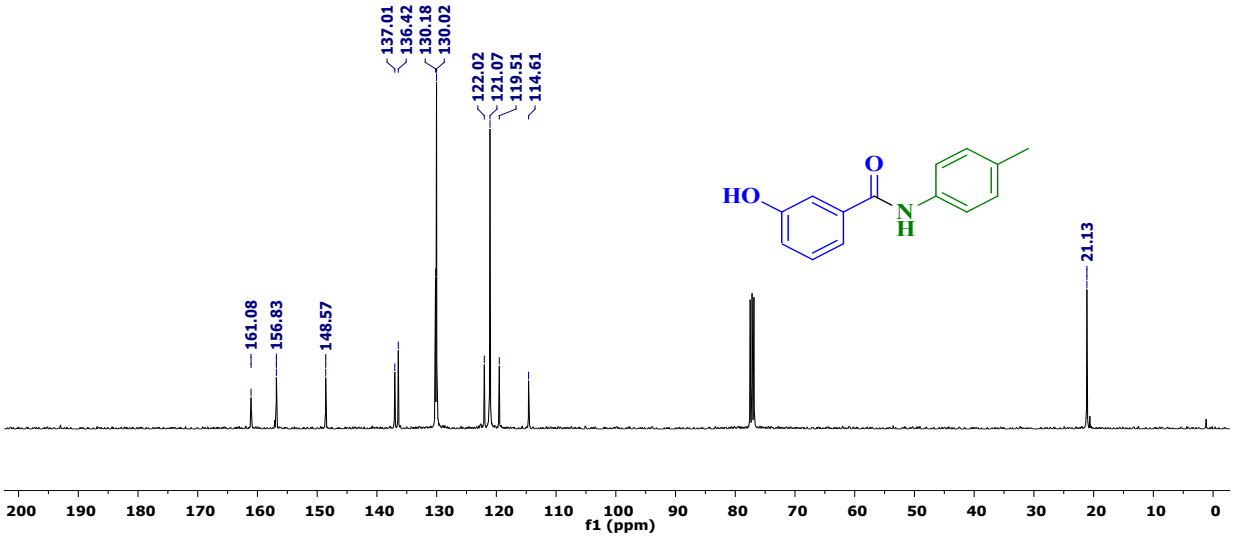
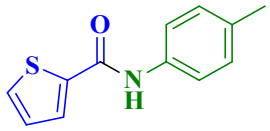



**Fig. S8 (b):** $^{13}$C-NMR of 3-hydroxy-N-(p-tolyl)benzamide

**9. N-(p-tolyl)thiophene-2-carboxamide**




Brown solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.57 (s, 1H), 7.48 (d, 1H, J = 5.2 Hz), 7.45 (d, 1H, J = 3.6 Hz), 7.17-7.19 (m, 2H), 7.11-7.14 (m, 3H), 2.36 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 152.42, 148.89, 143.06, 136.03, 132.07, 130.16, 129.87, 127.83, 121.02, 21.15 ppm. **HRMS (ES):** Calcd: 217.0561. Found: 218.0601 $[M+H]^+$ and 219.0591 $[MH+2]^+$.

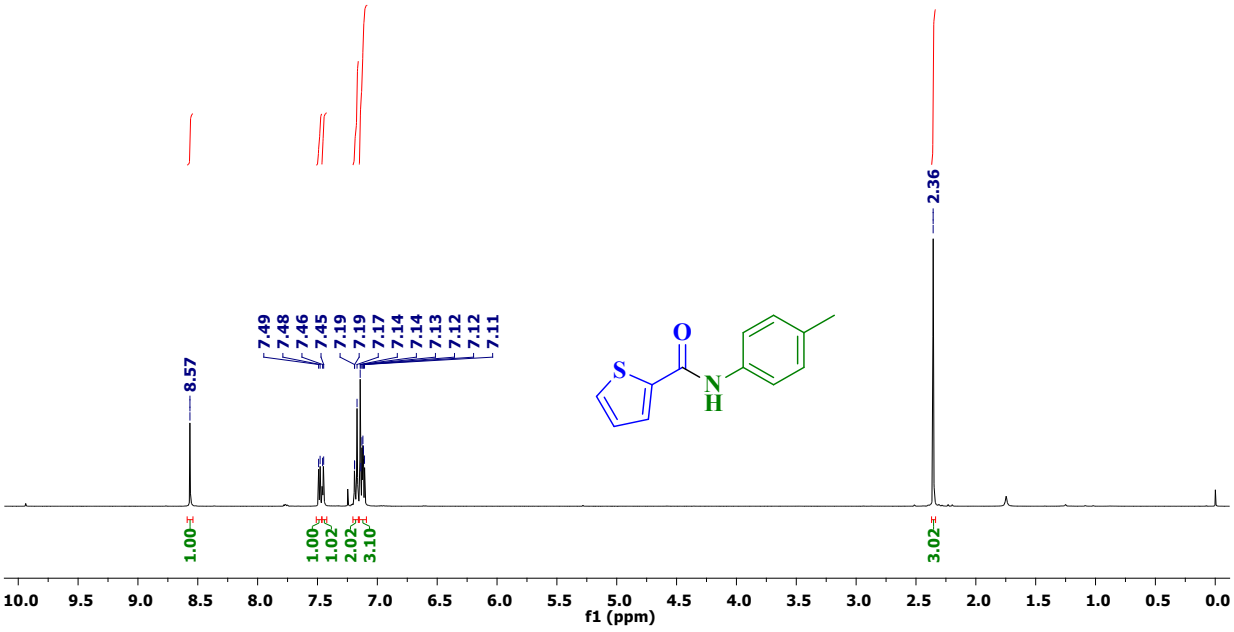



**Fig. S9 (a):** $^{1}$H-NMR of N-(p-tolyl)thiophene-2-carboxamide

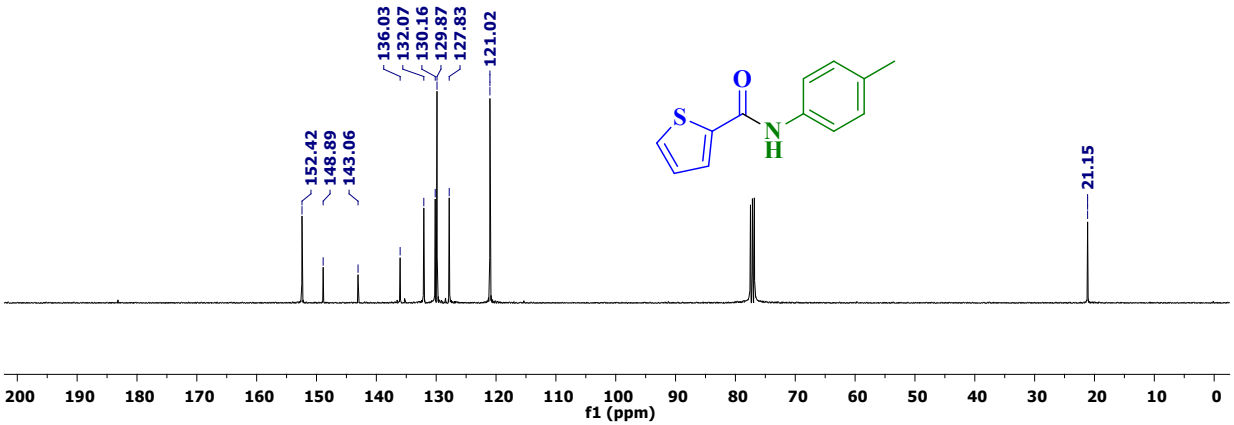
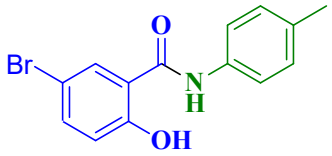



**Fig. S9 (b):** $^{13}$C-NMR of N-(p-tolyl)thiophene-2-carboxamide

**10. 5-bromo-2-hydroxy-4-nitro-N-(p-tolyl)benzamide**




Yellow solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 13.41 (brs, 1H), 8.54 (s, 1H), 7.49 (s, 1H), 7.43 (d, 1H, 8.8 Hz), 7.18-7.24 (m, 4H), 6.92 (d, 1H, J = 8.8 Hz), 2.39 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 160.15, 145.31, 137.50, 135.45, 134.09, 130.12, 121.04, 120.71, 119.23, 110.43, 21.10 ppm. **HRMS (ES):** Calcd: 349.9902. Found: 350.9932 $[M+H]^+$ and 351.9942 $[MH+2]^+$.

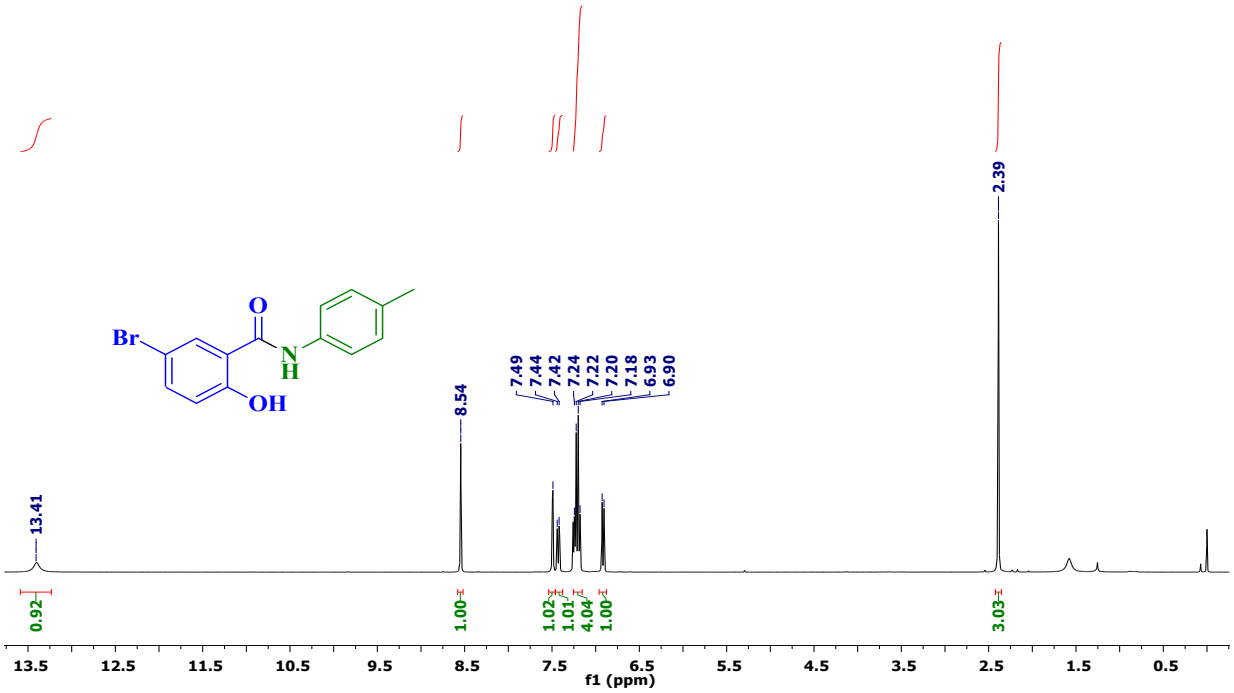



**Fig. S10 (a):** $^{1}$H-NMR of 5-bromo-2-hydroxy-N-(p-tolyl)benzamide

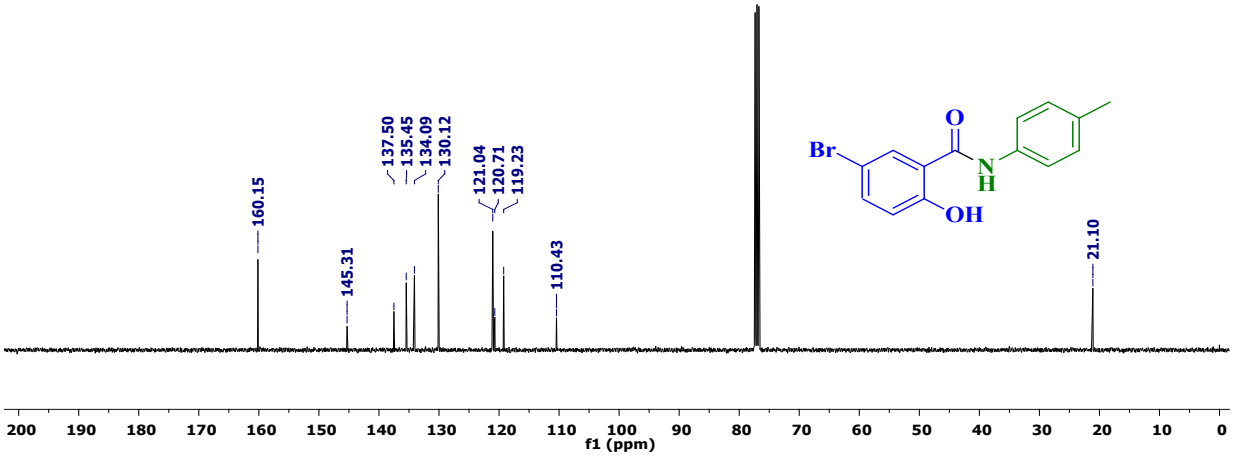
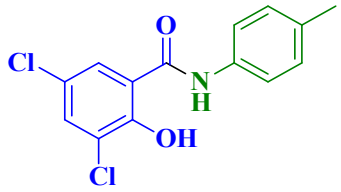



**Fig. S10 (b):** $^{13}$C-NMR of 5-bromo-2-hydroxy-N-(p-tolyl)benzamide

**11. 3,5-dichloro-2-hydroxy-N-(p-tolyl)benzamide**




Reddish Brown solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 14.48 (brs, 1H), 8.55 (s, 1H), 7.43 (d, 1H, J = 2.4 Hz), 7.28 (d, 1H, 2.8 Hz), 7.19-7.23 (m, 4H), 2.38 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 159.22, 156.22, 144.12, 138.26, 132.54, 130.32, 129.64, 123.26, 122.89, 121.13, 120.30, 21.23 ppm. **HRMS (ES):** Calcd: 295.0167. Found: 296.0217 $[M+H]^+$ and 297.0197 $[MH+2]^+$.

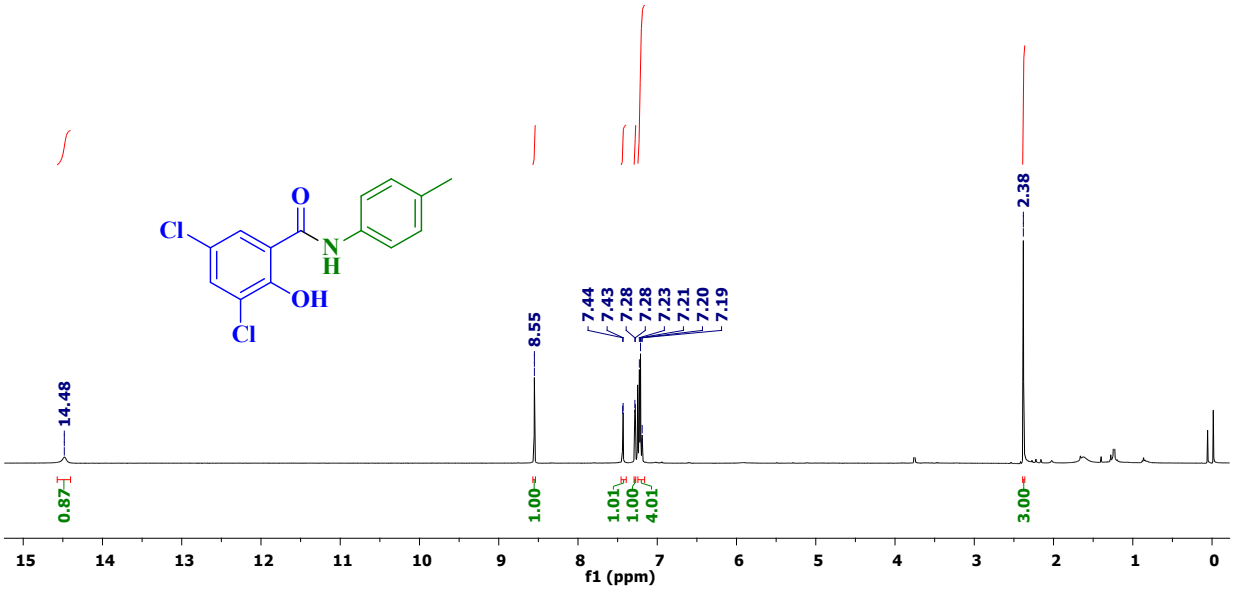



**Fig. S11 (a):** $^{1}$H-NMR of 3,5-dichloro-2-hydroxy-N-(p-tolyl)benzamide

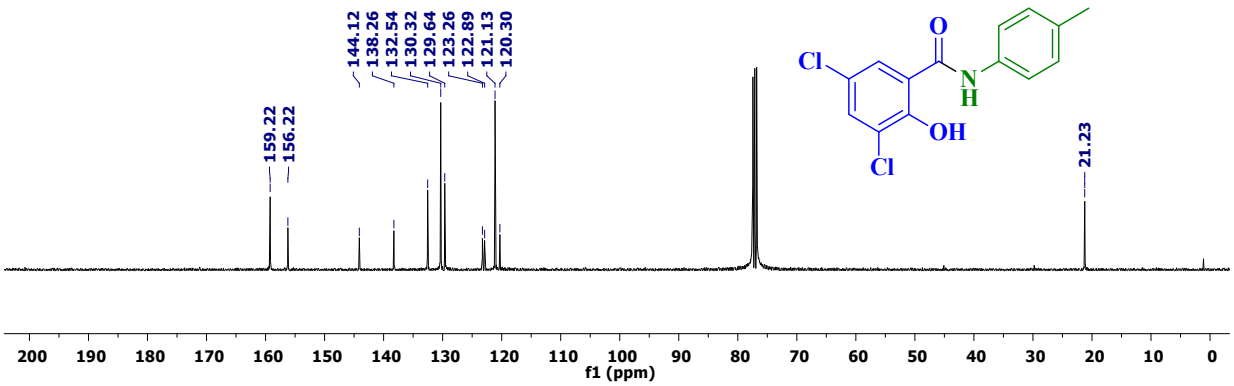
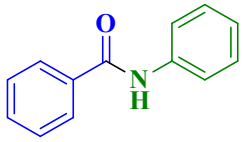



**Fig. S11 (b):** $^{13}$C-NMR of 3,5-dichloro-2-hydroxy-N-(p-tolyl)benzamide

## 12. N-phenylbenzamide



Yellow Solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.46 (s, 1H), 7.87-7.92 (m, 2H), 7.48 (d, 1H, J = 2 Hz), 7.47 (d, 1H, J = 1.6 Hz) 7.37-7.41 (m, 3H), 7.19-7.23 (m, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 160.53, 152.16, 136.29, 131.47, 129.23, 128.90, 128.86, 126.02, 120.95 ppm. **HRMS (ES):** Calcd: 197.0841. Found: 198.0881 $[M+H]^+$ and 199.0871 $[MH+2]^+$.

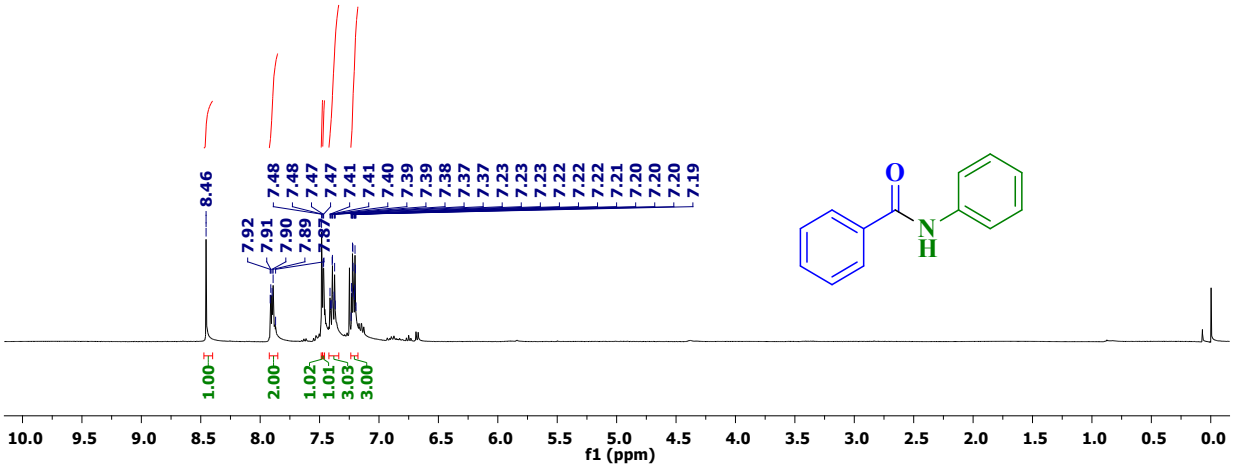



**Fig. S12 (a):** $^{1}$H-NMR of N-phenylbenzamide

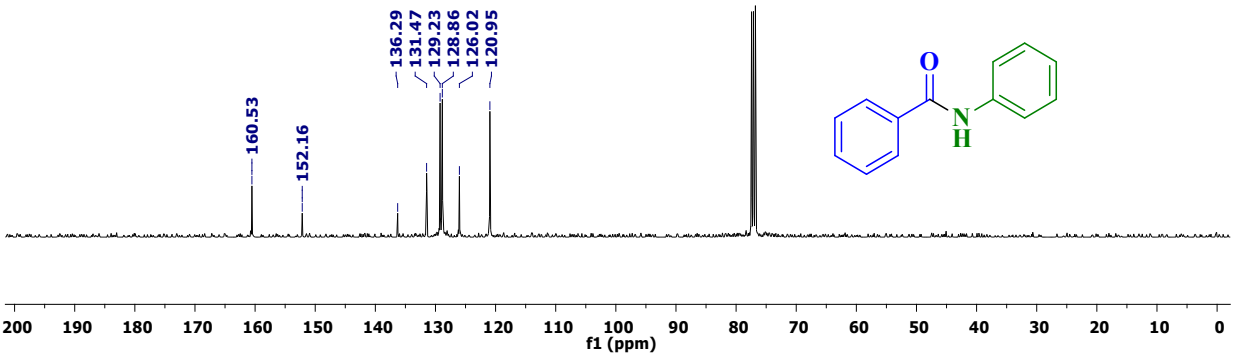
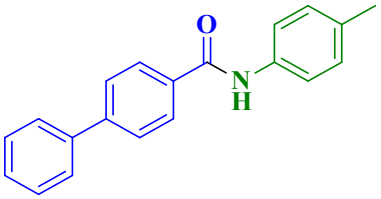



**Fig. S12 (b):** $^{13}$C-NMR of N-phenylbenzamide

**13. N-(p-tolyl)-[1,1'-biphenyl]-4-carboxamide**



Yellow solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.49 (s, 1H), 7.95 (d, 2H, J = 8 Hz), 7.69 (d, 2H, J = 8.4 Hz), 7.64 (d, 2H, J = 7.2 Hz), 7.45 (t, 2H, J = 8 Hz), 7.37 (t, 1H, J = 7.2 Hz), 7.15-7.21 (m, 4H), 2.37 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 159.14, 149.52, 143.91, 140.35, 135.88, 135.36, 129.83, 129.23, 128.93, 127.90, 127.46, 127.21, 120.90, 21.07 ppm. **HRMS (ES):** Calcd: 287.1310. Found: 288.1331 $[M+H]^+$ and 289.1342 $[MH+2]^+$.

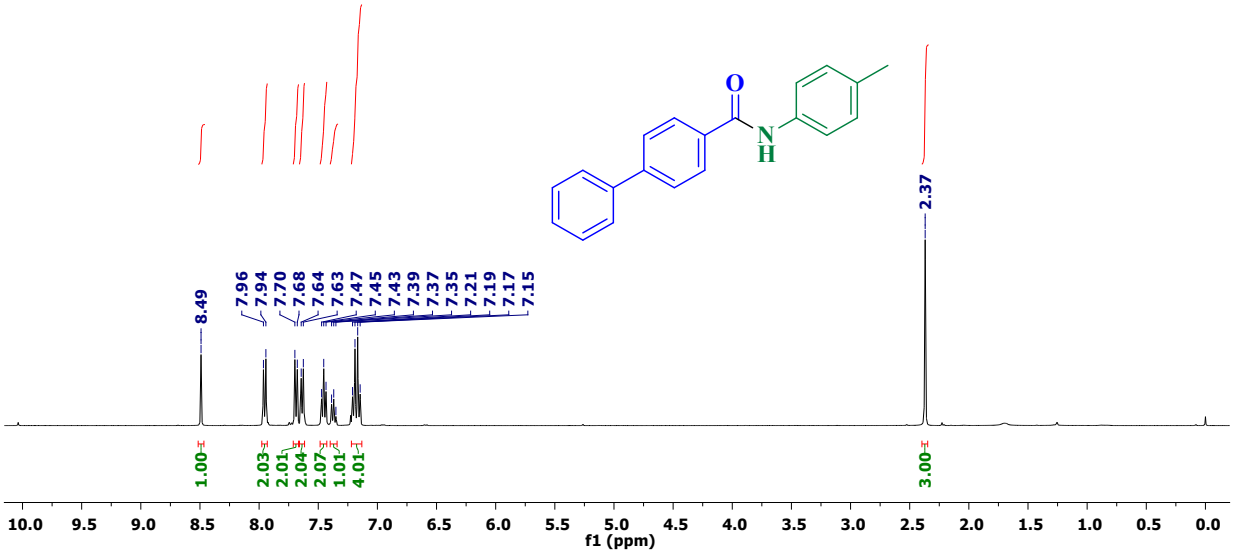



**Fig. S13 (a):** $^{1}$H-NMR of N-(p-tolyl)-[1,1'-biphenyl]-4-carboxamide

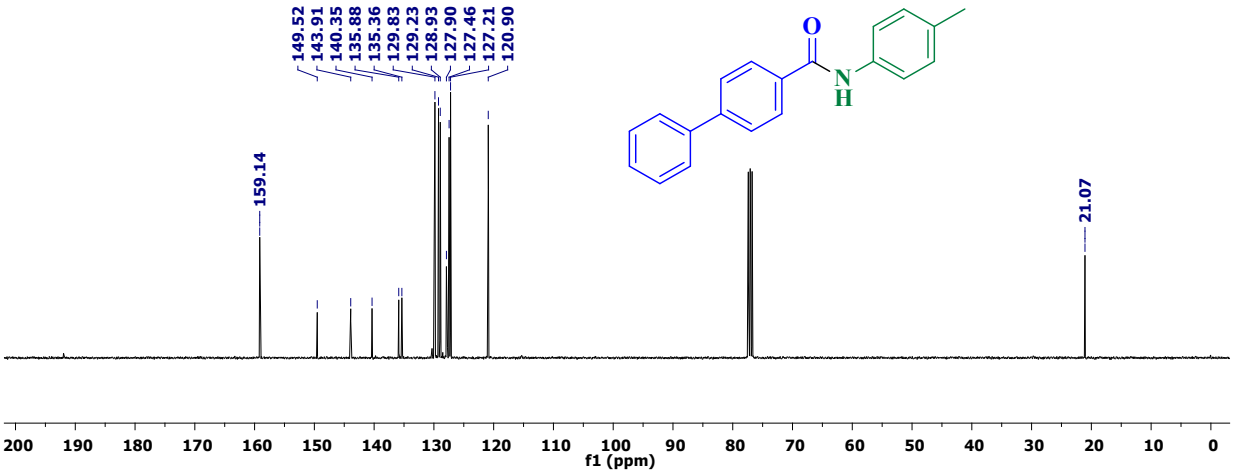
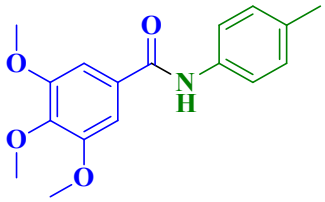



**Fig. S13 (b):** $^{13}$C-NMR of N-(p-tolyl)-[1,1'-biphenyl]-4-carboxamide

**14. 3,4,5-trimethoxy-N-(p-tolyl)benzamide**



Pale Yellow solid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.36 (s, 1H), 7.19 (d, 2H, J = 8 Hz), 7.12-7.15 (m, 4H), 3.94 (s, 6H), 3.91 (s, 3H), 2.37 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 159.10, 153.52, 149.36, 140.84, 135.76, 131.90, 129.79, 120.80, 105.69, 60.99, 56.26, 21.01 ppm. **HRMS (ES):** Calcd: 301.1314. Found: 302.1326 $[M+H]^+$ and 303.1321 $[MH+2]^+$.

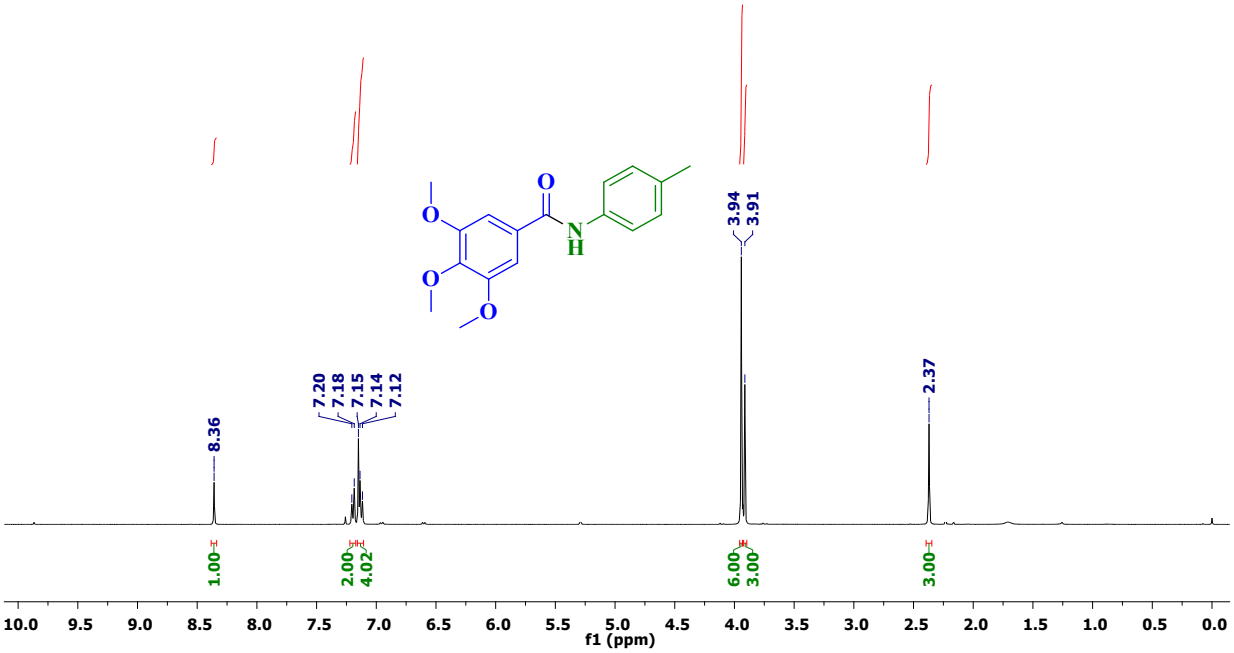



**Fig. S14 (a):** $^{1}$H-NMR of 3,4,5-trimethoxy-N-(p-tolyl)benzamide

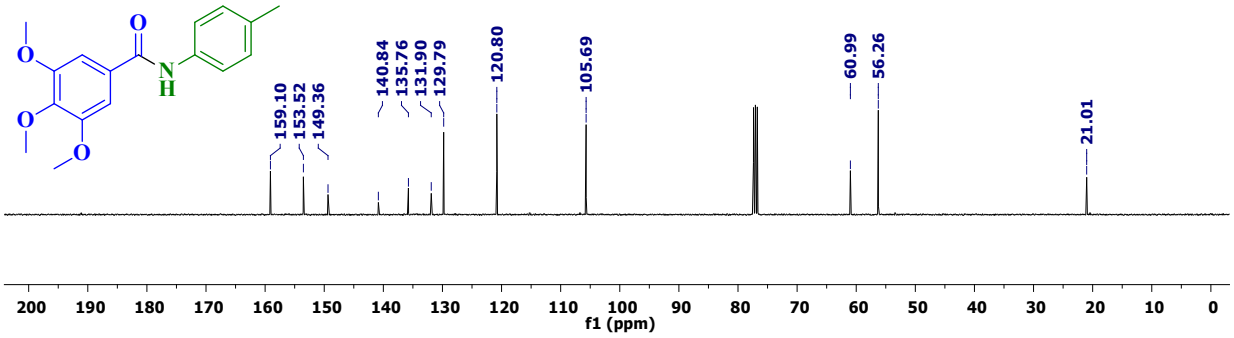
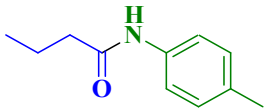



**Fig. S14 (b):** $^{13}$C-NMR of 3,4,5-trimethoxy-N-(p-tolyl)benzamide

**15. N-(p-tolyl)propionamide**



Brownish Liquid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 7.11 (s, 1H), 6.94 (d, 2H, J = 7.6 Hz), 6.59 (d, 2H, J = 8 Hz), 2.22 (s, 3H), 2.17 (t, 2H, J = 8.4 Hz), 1.07-1.12 (m, 2H), 0.97 (t, 3H, J = 7.6 Hz) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 163.95, 141.12, 134.84, 129.78, 120.71, 41.94, 20.42, 19.05, 13.78 ppm. **HRMS (ES):** Calcd: 163.0997. Found: 164.0992 $[M+H]^+$ and 165.0998 $[MH+2]^+$.

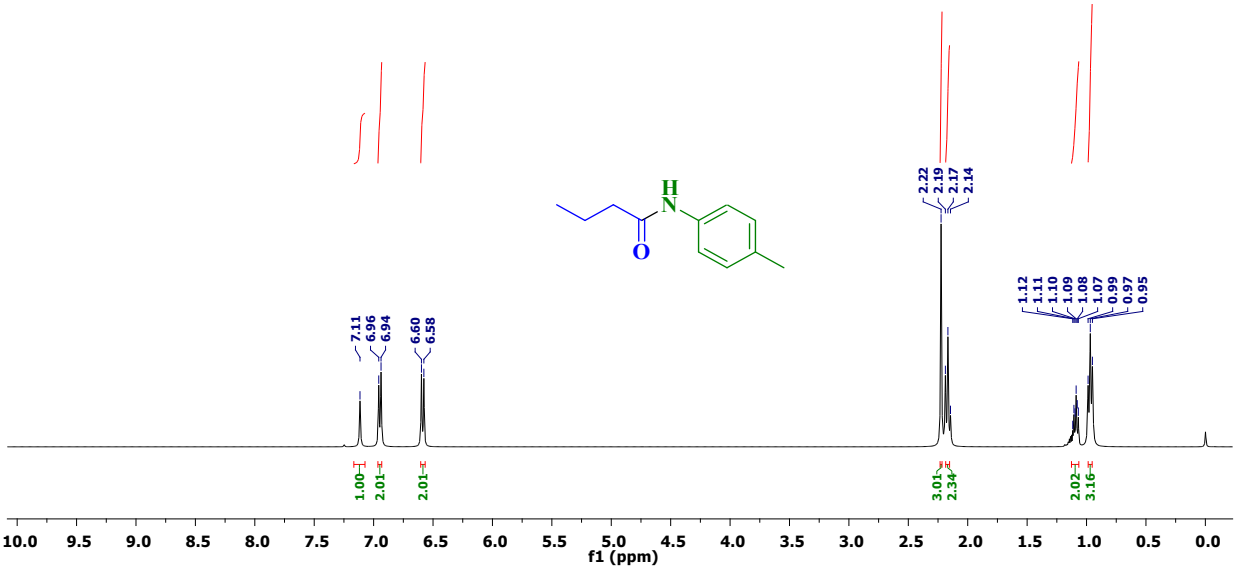



**Fig. S15 (a):** $^{1}$H-NMR of N-(p-tolyl)propionamide

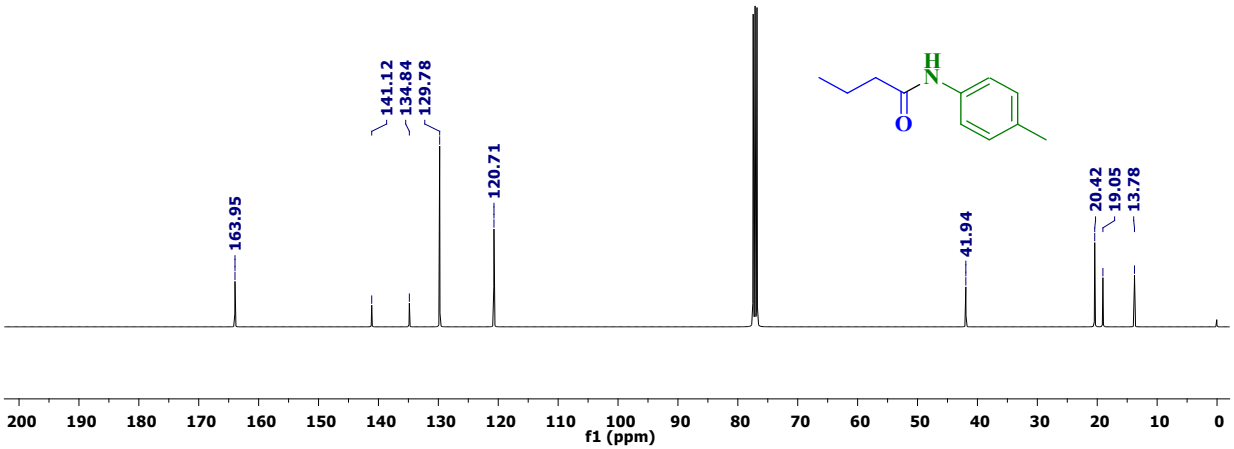
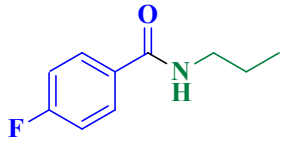



**Fig. S15 (b):** $^{13}$C-NMR of N-(p-tolyl)propionamide

**16. 4-fluoro-N-propylbenzamide**



Yellowish Liquid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.21 (s, 1H), 7.68-7.72 (m, 2H), 7.06 (t, 2H, J = 8.8 Hz), 3.54 (t, 2 H, J = 6.8 Hz), 1.67-1.73 (m, 2H), 0.93 (t, 3H, J = 7.2 Hz) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 165.49, 162.99, 132.70, 129.98, 129.89, 115.81, 115.59, 63.46, 24.11, 11.90 ppm. **HRMS (ES):** Calcd: 181.0903. Found: 182.0908 $[M+H]^+$ and 183.0914 $[MH+2]^+$.

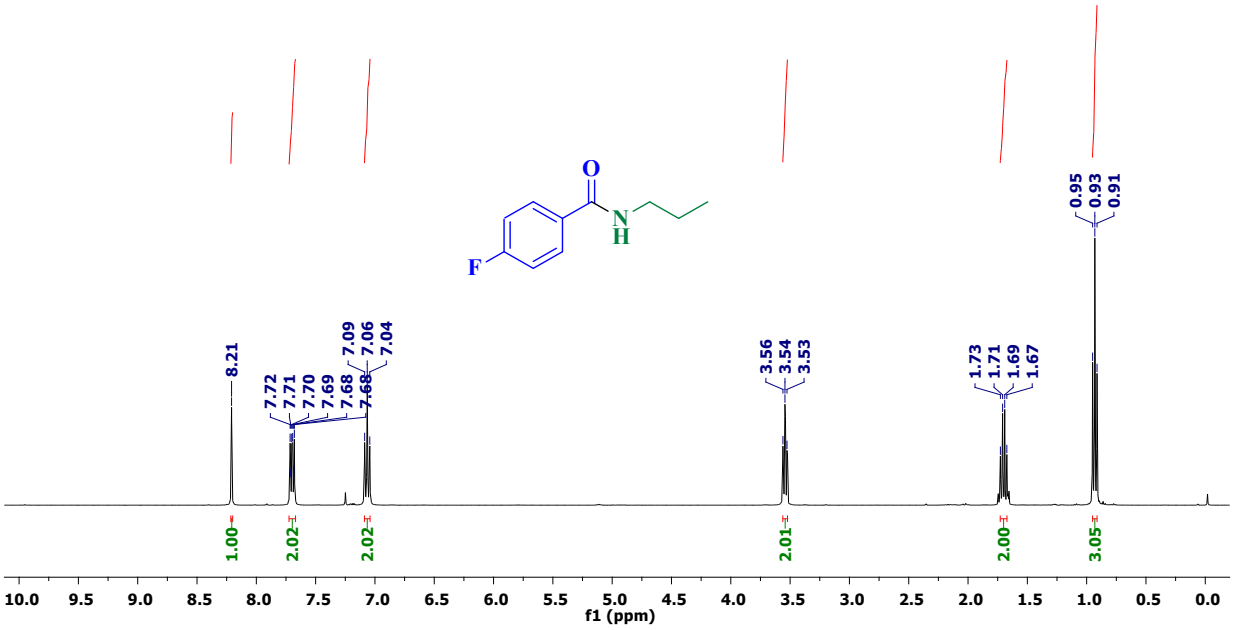



**Fig. S16 (a):** $^{1}$H-NMR of 4-fluoro-N-propylbenzamide

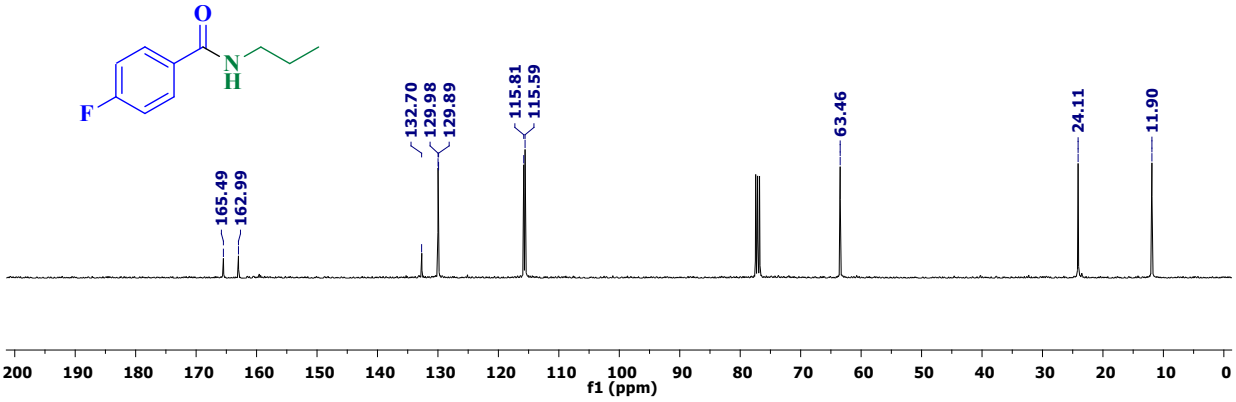
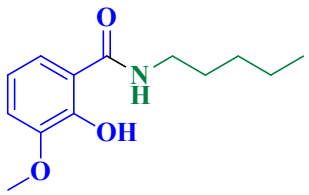



**Fig. S16 (b):** $^{13}$C-NMR of 4-fluoro-N-propylbenzamide

**17. 2-hydroxy-3-methoxy-N-pentylbenzamide**



Yellowish Liquid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.20 (s, 1H), 6.81 (d, 1H, J = 8 Hz), 6.77 (d, 1H, J = 8 Hz), 6.68 (t, 1H, J = 8 Hz), 3.80 (s, 3H), 3.48 (t, 2H, J = 6.8 Hz), 1.56-1.63 (m, 2H), 1.24-1.32 (m, 4H) 0.83 (t, 3H, J = 7.2 Hz) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 164.56, 153.09, 148.73, 122.82, 118.35, 117.43, 113.71, 58.60, 56.00, 30.52, 29.28, 22.43, 14.02 ppm. **HRMS (ES):** Calcd: 237.1365. Found: 238.1358 $[M+H]^+$ and 239.1362 $[MH+2]^+$.

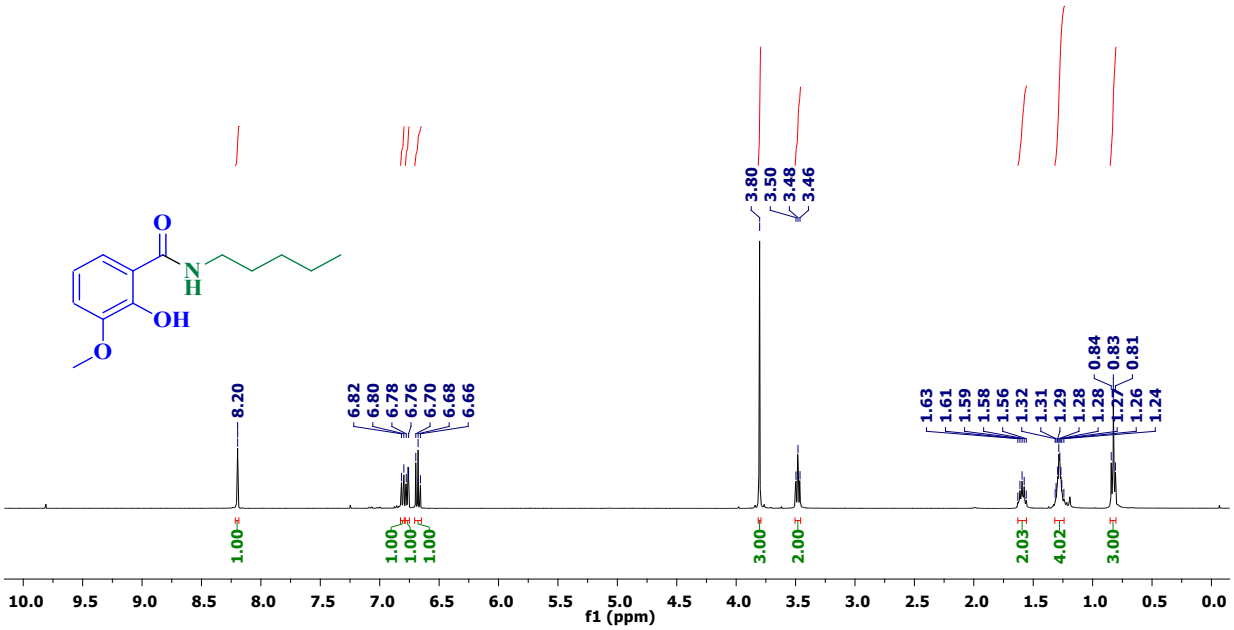



**Fig. S17 (a):** $^{1}$H-NMR of 2-hydroxy-3-methoxy-N-pentylbenzamide

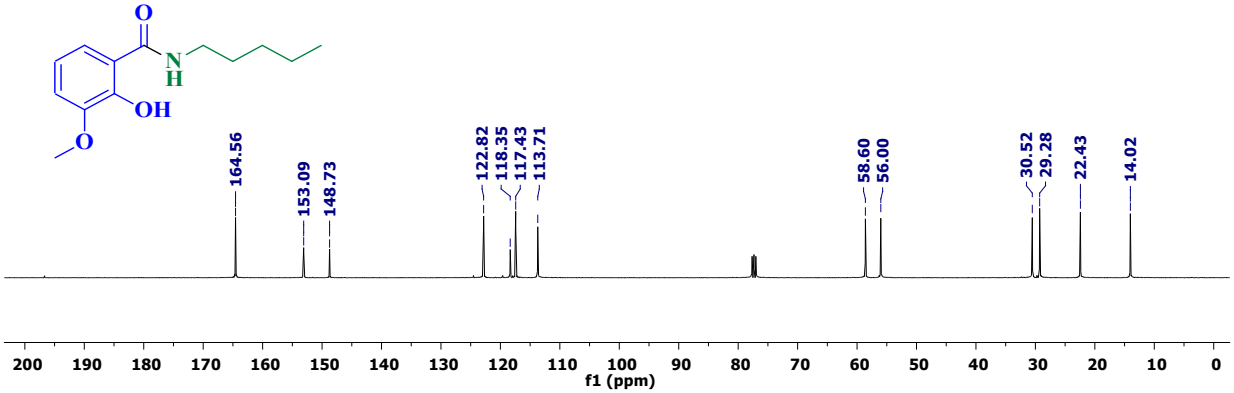
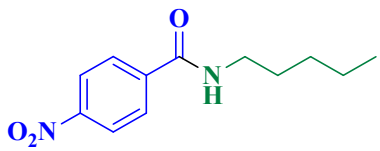



**Fig. S17 (b):** $^{13}$C-NMR of 2-hydroxy-3-methoxy-N-pentylbenzamide

**18. 4-nitro-N-pentylbenzamide**



Yellowish Liquid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.32 (s, 1H), 8.21 (d, 2H, J = 8.4 Hz), 7.86 (d, 2H, J = 8.8 Hz), 3.63 (t, 2H, J = 7.2 Hz), 1.65-1.72 (m, 2H), 1.31-1.33 (m, 4H), 0.87 (t, 3H, J = 6.8 Hz) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 158.49, 148.92, 141.92, 128.75, 123.90, 62.04, 30.48, 29.60, 22.54, 14.10 ppm. **HRMS (ES):** Calcd: 236.1161. Found: 237.1155 $[M+H]^+$ and 238.1167 $[MH+2]^+$.

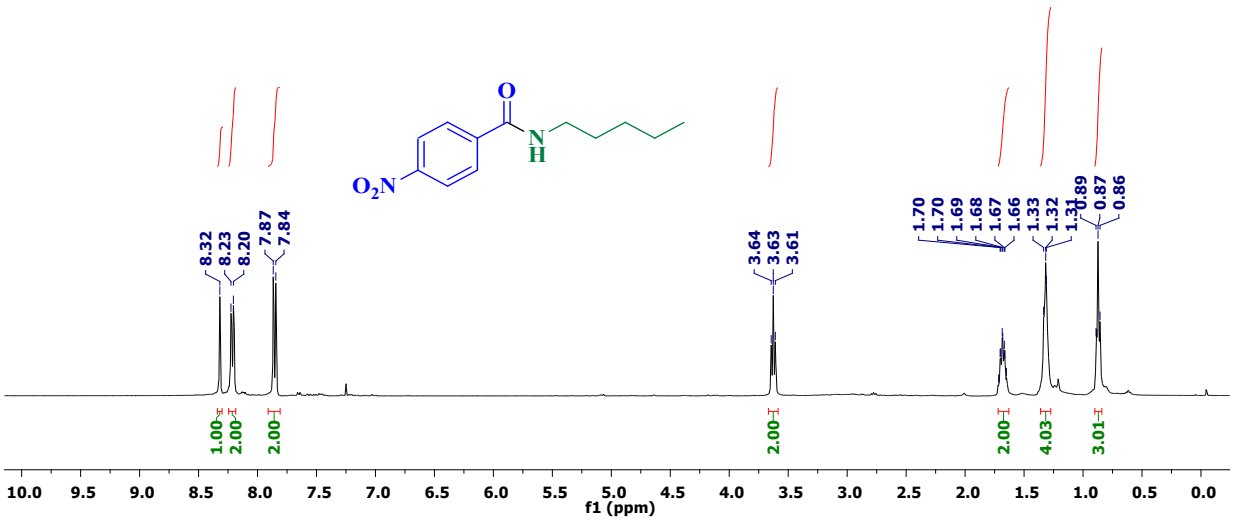



**Fig. S18 (a):** $^{1}$H-NMR of 4-nitro-N-pentylbenzamide

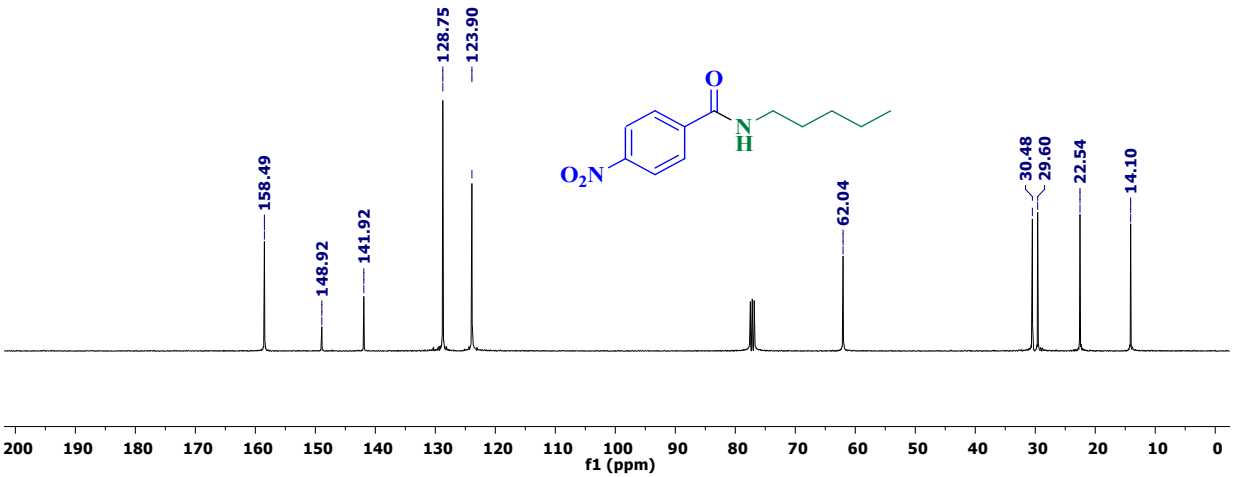
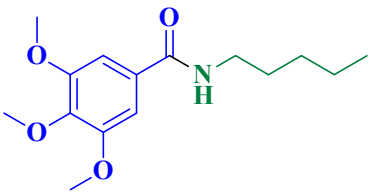



**Fig. S18 (b):** $^{13}$C-NMR of 4-nitro-N-pentylbenzamide

**19. 3,4,5-trimethoxy-N-pentylbenzamide**



Yellowish Liquid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 7.99 (s, 1H), 6.82-6.85 (m, 2H), 3.69-3.76 (m, 9H), 3.39-3.46 (m, 2H), 1.52-1.55 (m, 2H), 1.17-1.19 (m, 4H), 0.75 (s, 3H) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 160.31, 153.31, 139.91, 131.87, 104.88, 61.54, 60.74, 56.04, 40.78, 30.57, 29.47, 22.45, 14.03 ppm. **HRMS (ES):** Calcd: 281.1627. Found: 282.1632 $[M+H]^+$ and 283.1638 $[MH+2]^+$.

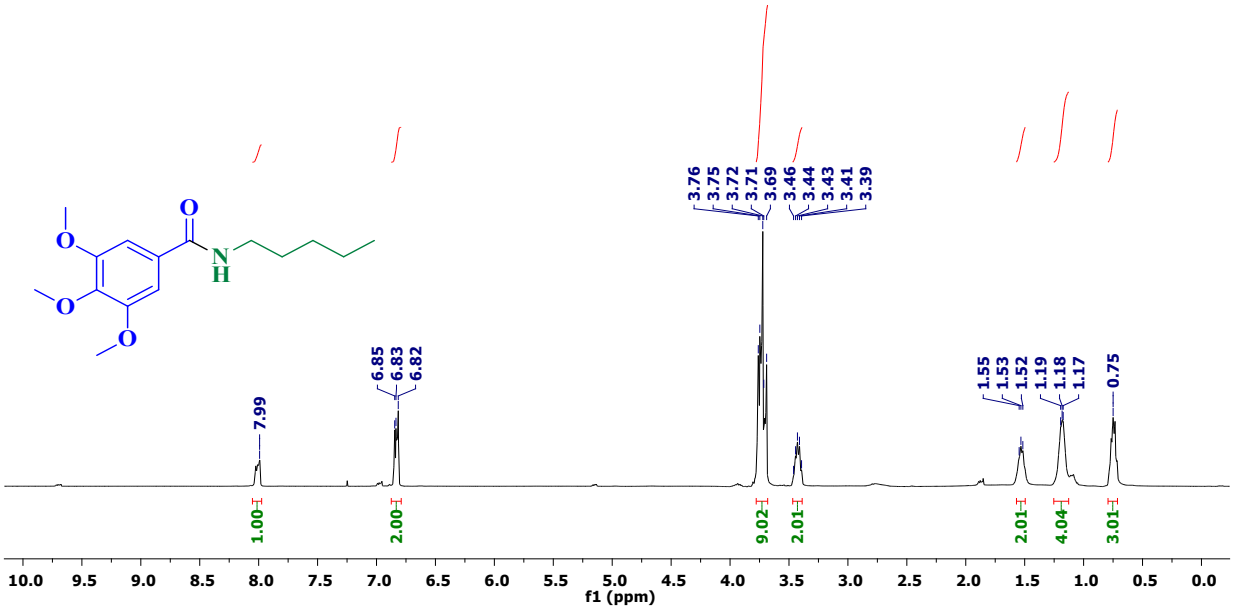



**Fig. S19 (a):** $^{1}$H-NMR of 3,4,5-trimethoxy-N-pentylbenzamide

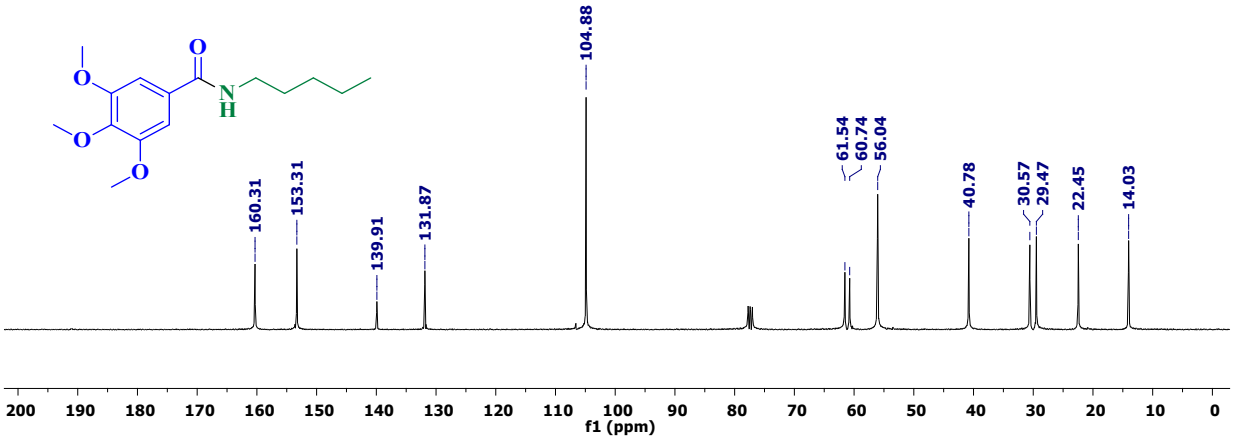
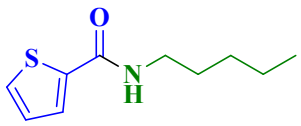



**Fig. S19 (b):** $^{13}$C-NMR of 3,4,5-trimethoxy-N-pentylbenzamide

**20. N-pentylthiophene-2-carboxamide**



Brownish Liquid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.32 (s, 1H), 7.34 (d, 1H, J = 4.8 Hz), 7.25 (d, 1H, J = 3.2 Hz), 7.02-7.04 (m, 1H), 3.53 (t, 2H, J = 6.8 Hz), 1.64 (m, 2H), 1.29-1.34 (m, 4H), 0.88 (t, 3H, J = 7.2 Hz) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 153.99, 142.73, 130.10, 128.57, 127.35, 61.50, 30.63, 29.60, 22.58, 14.13 ppm. **HRMS (ES):** Calcd: 197.0874. Found: 198.0879 $[M+H]^+$ and 199.0881$[MH+2]^+$.

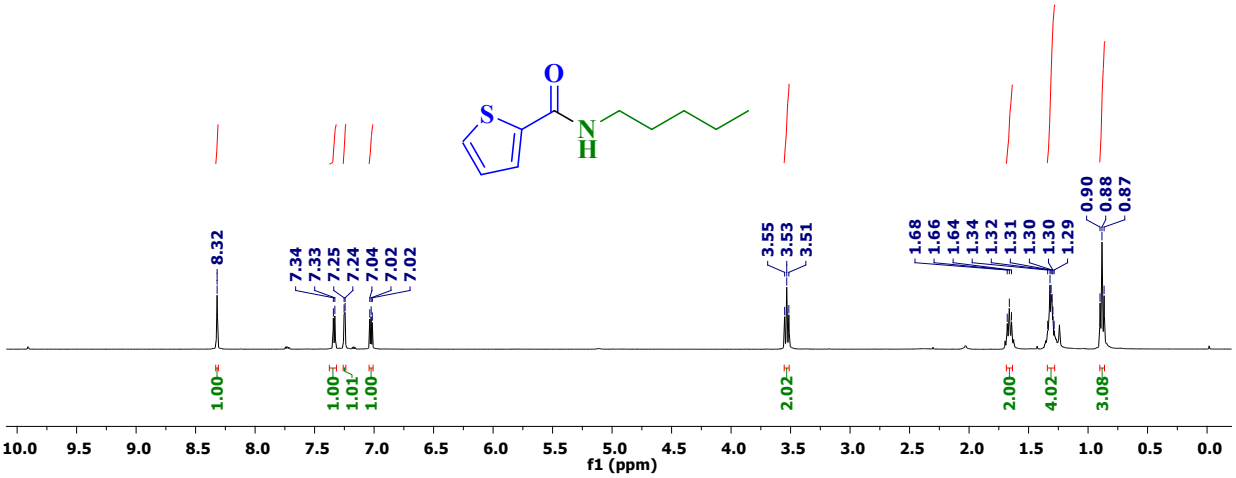



**Fig. S20 (a):** $^{1}$H-NMR of N-pentylthiophene-2-carboxamide

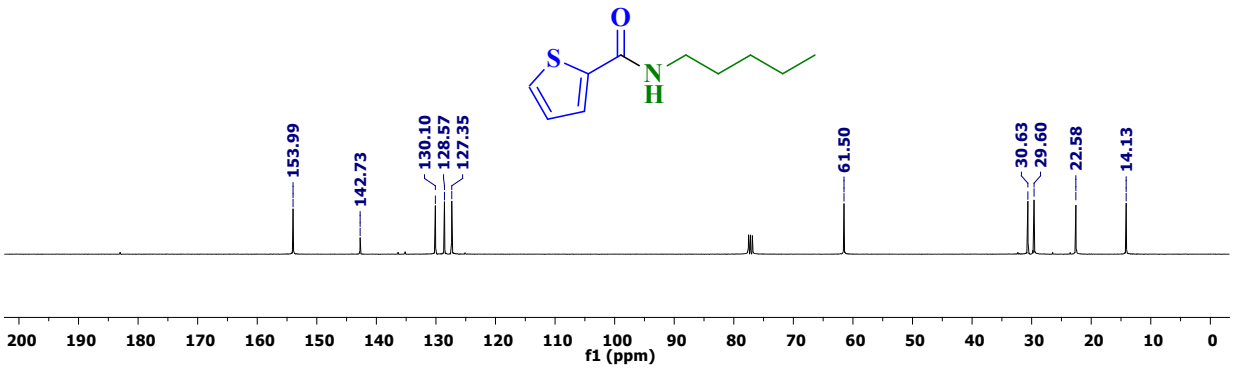
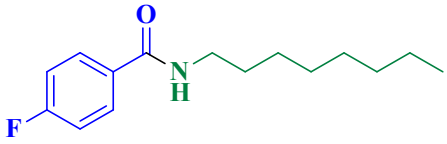



**Fig. S20 (b):** $^{13}$C-NMR of N-pentylthiophene-2-carboxamide

**21. 4-fluoro-N-octylbenzamide**



Yellowish Liquid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.22 (s, 1H), 7.61 (d, 2H, J = 8 Hz), 7.20 (d, 2H, J = 8 Hz), 3.58 (t, 2H, J = 6.8 Hz), 1.67 (m, 2H), 1.27-1.32 (m, 10H), 0.87 (t, 3H, J = 6.4 Hz) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 160.73, 140.69, 133.73, 129.39, 128.02, 61.78, 31.86, 30.96, 29.43, 29.28, 27.37, 22.67, 21.46, 14.10 ppm. **HRMS (ES):** Calcd: 251.1685. Found: 252.1692 $[M+H]^+$ and 253.1697 $[MH+2]^+$.

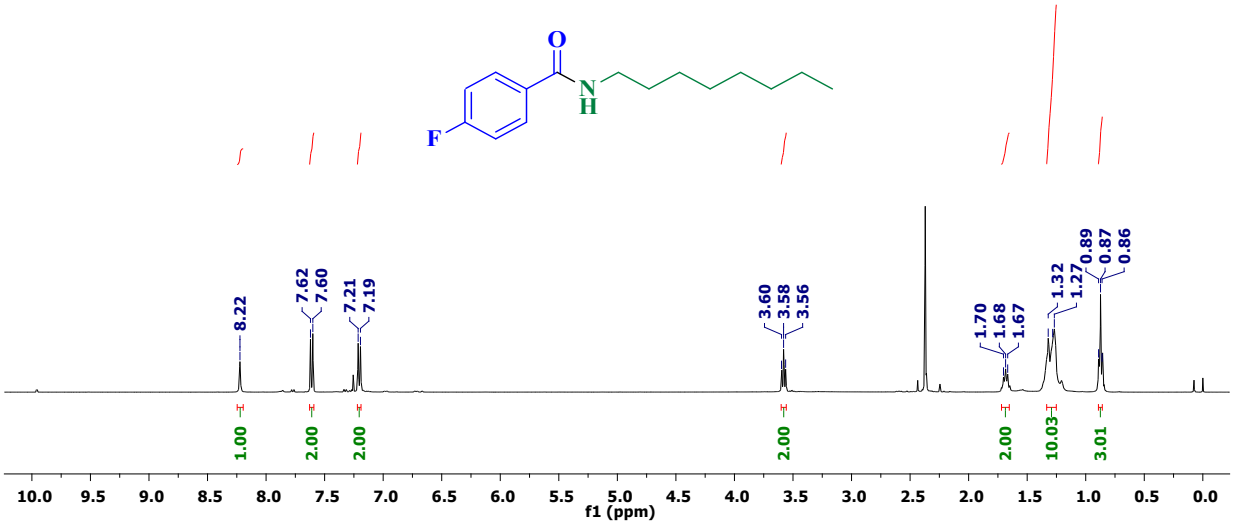



**Fig. S21 (a):** $^{1}$H-NMR of 4-fluoro-N-octylbenzamide

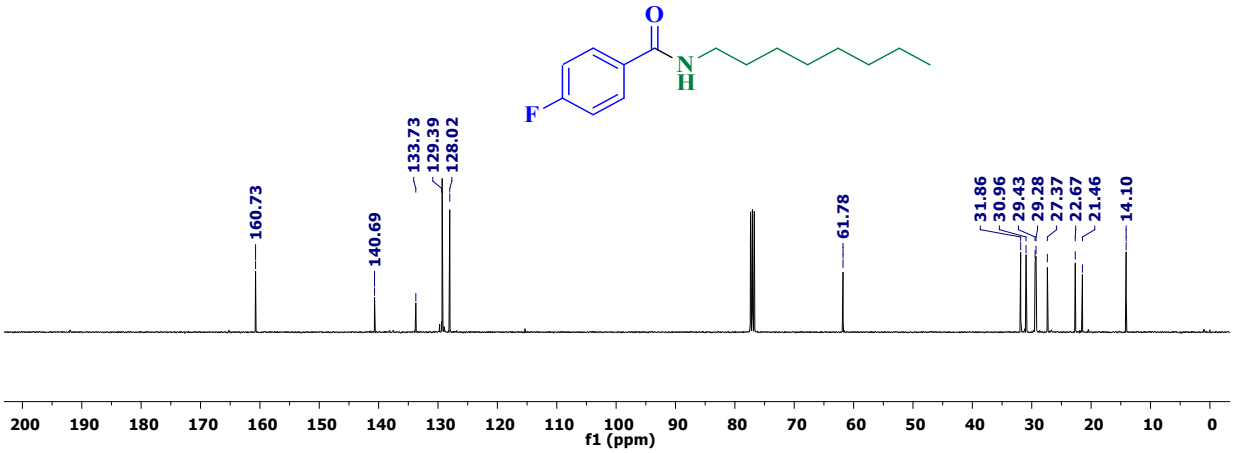
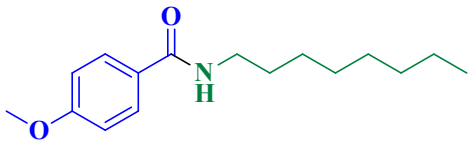



**Fig. S21 (b):** $^{13}$C-NMR of 4-fluoro-N-octylbenzamide

**22. 4-methoxy-N-octylbenzamide**



Yellowish Liquid

**$^{1}$H-NMR (400 MHz, $CDCl_3$):** δ 8.18 (s, 1H), 7.65 (d, 2H, J = 8.8 Hz), 6.90 (d, 2H, J = 8.8 Hz), 3.82 (s, 3H) 3.55 (t, 2H, J = 7.2 Hz), 1.63-1.68 (m, 2H), 1.25-1.30 (m, 10H), 0.87 (t, 3H, J = 6.8 Hz) ppm. **$^{13}$C-NMR (75 MHz, $CDCl_3$):** δ 161.53, 160.18, 129.62, 129.37, 114.02, 61.80, 55.42, 31.94, 31.10, 29.51, 29.36, 27.44, 22.75, 14.19 ppm. **HRMS (ES):** Calcd: 263.1885. Found: 264.1889 $[M+H]^+$ and 265.1893 $[MH+2]^+$.

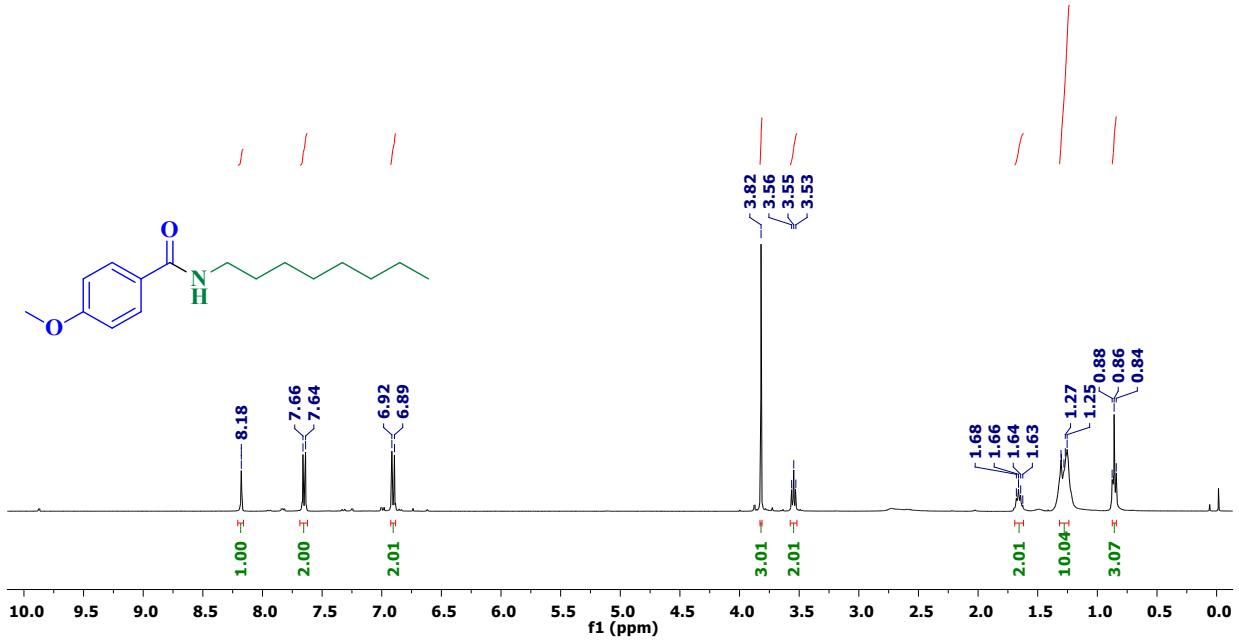



**Fig. S22 (a):** $^{1}$H-NMR of 4-methoxy-N-octylbenzamide

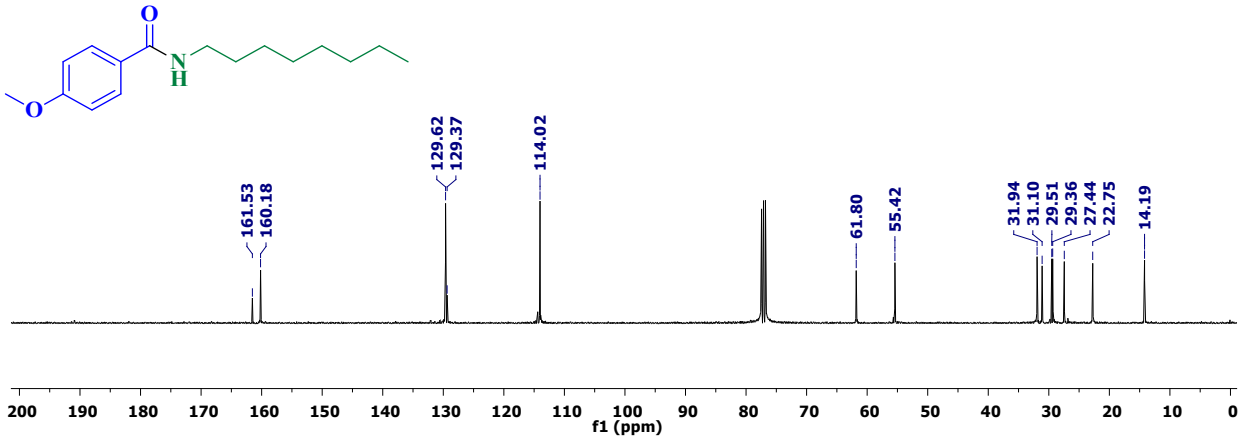



**Fig. S22 (b):** $^{13}$C-NMR of $^{1}$H-NMR of 4-methoxy-N-octylbenzamide

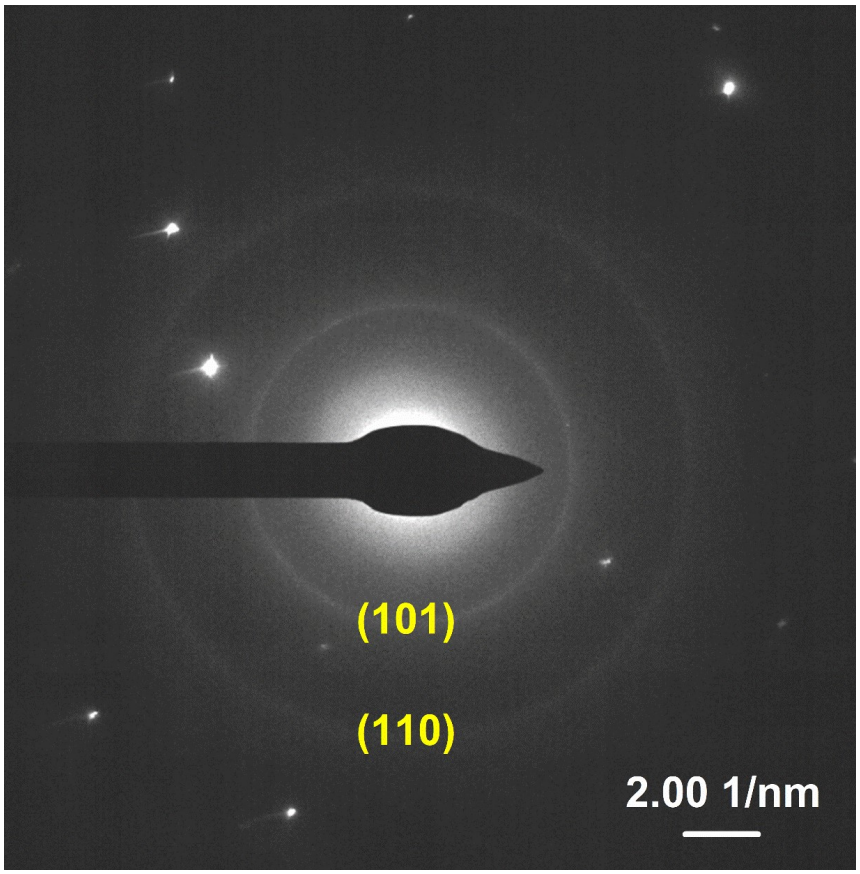
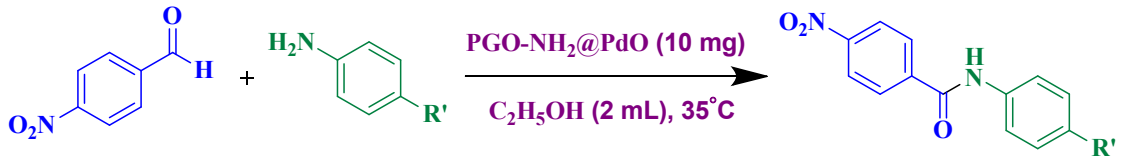



**Fig. S23: SAED pattern of PGO-$NH_2$@PdO nano-catalyst.**

## Calculation of green chemistry matrices




| | 4-Nitrobenzaldehyde | p-Toluidine | Amide derivative |
|---|---|---|---|
| M. Wt. | 151.12 g/mol | 107.15 g/mol | 256.26 g/mol |
| mmol | 1 | 1 | 0.98 |
| amount | 0.151 g | 0.107 g | 0.251 g |

**a) E-factor:**

$$\frac{(Total\ mass\ of\ stoichiometric\ reactant)\ -(Total\ mass\ of}{Mass\ of\ product}$$

$$\text{E-factor} = (0.151 + 0.107) - (0.251)/0.251$$

$$= 0.028$$

**b) Atom Economy (AE):** $[M.W.\ of\ product / \sum(M.W.\ of\ stoichiometric\ reactants)]$ X 100

$$AE = [256.26 / (151.12 + 107.15)] \text{ X } 100$$

$$= 99.22\%$$

**c) Carbon Efficiency (CE):**

$$\frac{[(No.\ of\ moles\ of\ product)(No.\ of\ carbon\ in\ product)]}{\sum[(No.\ of\ moles\ of\ reactant)(No.\ of\ carbon\ in\ reactant)]} \text{ X } 100$$

$$CE = \frac{(0.98\ X\ 13)}{[(1\ X\ 7) + (1\ X\ 6)]} \text{ X } 100 = 98\ \%$$

**d) Process Mass Intensity (PMI):**

$$\frac{\sum(Mass\ of\ stoichiometric\ reactants)}{Mass\ of\ product}$$

$$PMI = \frac{(0.151\ +\ 0.107\ )}{0.251} = 1.028$$

PMI = E-factor + 1 = 0.028 + 1 = 1.028 (Alternatively)

**e) Reaction Mass Efficiency (RME):**

$$\frac{Mass\ of\ product}{\sum(Mass\ of\ stoichiometric\ reactants)} \text{ X } 100$$

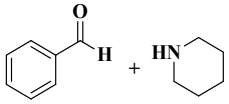
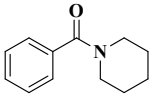
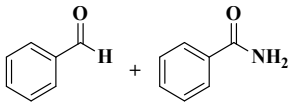
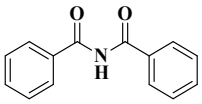
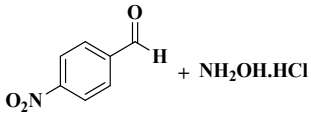
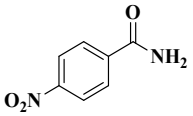
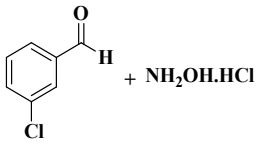
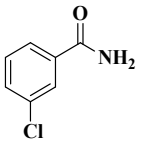
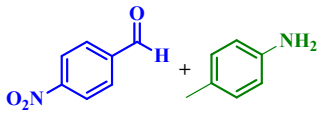
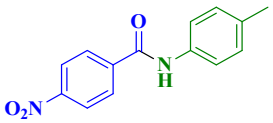
$$RME = \frac{0.251}{(0.151\ +\ 0.107)} \text{ X } 100 = 97.29\ \%$$

**Table S1:** CHNS analysis of GO, PGO-COOH, PGO-COCl, PGO-$NH_2$ and PGO-$NH_2$@PdO.

| Entry | Sample (10 mg) | Nitrogen (wt %) | Carbon (wt %) | Hydrogen (wt %) |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 1. | GO | 0.68 | 60.31 | 4.49 |
| 2. | PGO-COOH | 0.42 | 49.92 | 2.89 |
| 3. | PGO-COCl | 2.49 | 25.89 | 3.39 |
| 4. | PGO-$NH_2$ | 8.67 | 40.03 | 3.74 |
| 5. | PGO-$NH_2$@PdO | 8.54 | 41.23 | 3.15 |

**Table S2:** A comparison of the TON and TOF of PGO-$NH_2$@PdO nano-catalyst with several heterogeneous catalysts previously reported for amide derivative synthesis.

| S. N. | Catalyst (amount) | Reactants | Product | Time | TON | TOF | Ref. |
|---|---|---|---|---|---|---|---|
| 1. | $SiO_2$@APTES@Pd-FFR (20 mg) |  |  | **1.5 h** | **414** | **276** | 1 |
| 2. | [Ru($L_1$)Cl(CO)($PPh_3$)$_2$] (1 mol%) |  |  | **12 h** | **9800** | **817** | 2 |
| 3. | [Ru(L1)(CO)Cl($AsPh_3$)$_2$] ($2.98 \times 10^{-4}$ mol) |  |  | **18 h** | **188** | **10.4** | 3 |
| 4. | [(η$^6$-$C_{10}H_{14}$)-$RuCl_2(C_6H_5NH_2)$] (0.017 g, 5 mol%) |  |  | **5 h** | **19.60** | **3.92** | 4 |
| 5. | **PGO-$NH_2$@PdO (10mg)** |  |  | **20 min** | **445.45** | **1349.85** | This Work |

## References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