

Supplementary Material

Magnetic Nanoparticle-Supported Ionic Liquid Phase Catalyst for Oxidation of Alcohols

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Spectral data of synthesized compounds:

Benzaldehyde, C₇H₆O; (Table 3, entry **10a**):^[1-4] bp 205 °C (lit., 203–204 °C)^[5]; IR (KBr): ν = 3067, 2822, 2735, 1705 cm⁻¹; ¹H NMR (300 MHz, CDCl₃): δ 9.96 (s, 1H), 7.80-7.97 (m, 2H), 7.49–7.68 (m, 3H); ¹³C NMR (75 MHz, CDCl₃): δ 191.6, 136.3, 134.4, 129.7, 128.5; MS (EI): m/z 106 (M⁺). Anal. Calcd. for C₇H₆O (106.04): C, 79.22; H, 5.70. Found: C, 79.24; H, 5.73.

4-Methoxybenzaldehyde, C₈H₈O₂; (Table 3, entry **10b**):^[3,6] bp 250 °C (lit., 249 °C)^[7]; IR (KBr): ν = 3087, 1695, 1604, 1517, 1269, 1156 cm⁻¹; ¹H NMR (300 MHz, CDCl₃): δ 3.91 (s, 3H), 7.04 (d, *J* = 8.6 Hz, 2H), 7.82 (d, *J* = 8.7 Hz, 2H), 9.86 (s, 1H); ¹³C NMR (75 MHz, CDCl₃): 55.4, 114.4, 129.5, 131.7, 164.7, 191.1; MS (EI): m/z 136 (M⁺). Anal. Calcd. for C₈H₈O₂ (136.05): C,

70.57; H, 5.92. Found: C, 70.59; H, 5.95.

2-Methoxybenzaldehyde, C₈H₈O₂; (Table 3, entry **10c**):^[1,8] bp 245 °C (lit., 243-244 °C)^[9]; IR (KBr): $\nu = 3077, 2961, 2734, 1687, 1620, 1544, 1354, 777 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 3.89 (s, 3H) 6.92-7.12 (m, 2H), 7.53 (m, 1H), 7.86 (dd, $J = 7.1, 1.6 \text{ Hz}$, 1H), 10.49 (s, 1H); ¹³C NMR (75 MHz, CDCl₃): δ 55.7, 111.5, 120.5, 124.7, 128.4, 135.9, 161.7, 189.7; MS (EI): m/z 136 (M⁺). Anal. Calcd. for C₈H₈O₂ (136.05): C, 70.57; H, 5.92. Found: C, 70.60; H, 5.90.

4-Methylbenzaldehyde, C₈H₈O; (Table 3, entry **10d**):^[10] bp 206 °C (lit., 207 °C)^[11]; IR (KBr): $\nu = 3049, 2930, 2734, 1689, 1510, 1239, 1077, 780 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 9.89 (s, 1H), 7.77 (d, 2H, $J = 7.6 \text{ Hz}$), 7.33 (d, 2H, $J = 7.6 \text{ Hz}$), 2.44 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): 192.1, 145.7, 133.9, 129.9, 129.5, 21.4; MS (EI): m/z 120 (M⁺). Anal. Calcd. for C₈H₈O (120.06): C, 79.97; H, 6.71. Found: C, 79.99; H, 6.69.

4-Ethoxybenzaldehyde, C₉H₁₀O₂; (Table 3, entry **10e**):^[12] bp 257 °C (lit., 255 °C)^[13], IR (neat, thin film): $\nu = 3355, 2939, 2836, 1611, 1512, 1243, 1110, 814 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 9.60 (s, 1H), 7.55 (t, 2H, $J = 6.9, 1.8 \text{ Hz}$), 6.71-6.74 (m, 2H), 3.76-3.79 (m, 2H), 1.50 (s, 3H); ¹³C NMR (75Hz, CDCl₃): δ 190.47, 163.82, 131.67, 129.55, 114.50, 63.67, 14.35; MS (EI): m/z 150 [M]⁺. Anal. Calcd. for C₉H₁₀O₂ (150.07): C, 71.98; H, 6.71. Found: C, 71.96; H, 6.73.

2-Methylbenzaldehyde, C₈H₈O; (Table 3, entry **10f**):^[14-16] bp 204 °C (lit., 202 °C)^[11]; IR (KBr): $\nu = 3078, 2970, 2844, 2745, 1698, 1451, 1257, 1244, 842 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 10.17 (s, 1H), 7.22 (d, $J = 7.4 \text{ Hz}$, 1H), 7.45 (d, $J = 7.6 \text{ Hz}$, 1H), 7.32 (d, $J = 7.5 \text{ Hz}$, 1H), 7.18 (d, $J = 7.5 \text{ Hz}$, 1H), 2.59 (s, 3H); ¹³C NMR (75 MHz, CDCl₃): 192.6, 140.4, 133.6, 133.2, 132.2, 131.8, 126.3, 19.3; MS (EI): m/z 120 (M⁺). Anal. Calcd. for C₈H₈O (120.06): C, 79.97; H, 6.71. Found: C, 79.95; H, 6.74.

4-Nitrobenzaldehyde, C₇H₅NO₃; (Table 3, entry **10g**):^[17-19] mp 107 °C (lit., 106°C)^[20]; IR (KBr): $\nu = 3079, 2917, 1707, 1547, 1354, 1198, 1227, 1197, 1013, 837 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 8.10 (d, 2H, *J* = 8.8 Hz), 8.37 (d, 2H, *J* = 8.5 Hz), 10.20 (s, 1H); ¹³C NMR (75 MHz, CDCl₃): 190.3, 150.9, 139.7, 130.6, 123.9; MS (EI): *m/z* 151 (M⁺). Anal. Calcd. for C₇H₅NO₃ (151.03): C, 55.63; H, 3.33; N, 9.27. Found: C, 55.65; H, 3.31; N, 9.30.

3-Nitrobenzaldehyde, C₇H₅NO₃; (Table 3, entry **10h**):^[19,21] mp 45 °C (lit., 42-43 °C)^[22]; IR (KBr): $\nu = 3078, 2852, 1701, 1676, 1330, 831 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 10.41 (s, 1H), 8.77 (s, 1H), 8.44 (d, 1H, *J* = 8.1 Hz), 8.27 (d, 1H, *J* = 8.1 Hz), 7.78 (t, 1H, *J* = 7.9 Hz); ¹³C NMR (75 MHz, CDCl₃): 190.2, 149.4, 137.7, 134.5, 130.7, 128.3, 124.1; MS (EI): *m/z* 151 (M⁺). Anal. Calcd. for C₇H₅NO₃ (151.03): C, 55.63; H, 3.33; N, 9.27. Found: C, 55.61; H, 3.36; N, 9.31.

2-Nitrobenzaldehyde, C₇H₅NO₃; (Table 3, entry **10i**):^[23-25] mp 212 °C (lit., 212-213 °C)^[26]; IR (KBr): $\nu = 3072, 2862, 1707, 1541, 1340, 827 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 10.39 (s, 1H), 7.80-8.13 (m, 4H); ¹³C NMR (75 MHz, CDCl₃): 188.5, 150.1, 134.0, 133.5, 131.1, 129.4, 124.7; MS (EI): *m/z* 151 (M⁺). Anal. Calcd. for C₇H₅NO₃ (151.03): C, 55.63; H, 3.33; N, 9.27. Found: C, 55.66; H, 3.35; N, 9.25.

Cinnamaldehyde, C₉H₈O; (Table 3, entry **10j**):^[6,27-28] mp 127 °C (lit., 124-127 °C)^[28]; IR (KBr): $\nu = 3061, 2813, 2742, 1666, 1623, 1495, 1293, 1071 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 9.69 (s, 1H), 6.69 (q, 1H, *J* = 7.5 Hz), 7.39-7.47 (m, 4H), 7.53-7.55 (m, 2H); ¹³C NMR (75 MHz, CDCl₃): 193.9, 153.0, 133.9, 131.3, 129.1, 128.5, 128.4; MS (EI): *m/z* 132 (M⁺). Anal. Calcd. for C₉H₈O (132.06): C, 81.79; H, 6.10. Found: C, 81.82; H, 6.08.

4-Chlorobenzaldehyde, C₇H₅ClO; (Table 3, entry **10k**):^[19] mp 214 °C (lit., 213–214 °C)^[11]; IR (KBr): $\nu = 3095, 2865, 2765, 1687, 1414, 1227, 1033 \text{ cm}^{-1}$; ¹H NMR (300 MHz, CDCl₃): δ 9.92

(s, 1H), 7.79 (d, 2H, $J = 8.3$ Hz), 7.51 (d, 2H, $J = 8.4$ Hz); ^{13}C NMR (75 MHz, CDCl_3): 128.5, 130.5, 134.7, 139.3, 191.5; MS (EI): m/z 140 (M^+). Anal. Calcd. for $\text{C}_7\text{H}_5\text{ClO}$ (140.00): C, 59.81; H, 3.59. Found: C, 59.80; H, 3.62.

2-Pyridinecarboxaldehyde, $\text{C}_6\text{H}_5\text{NO}$; (Table 3, entry **10l**):^[27,29-30] mp 149 °C (lit., 148-151 °C)^[31]; IR (KBr): $\nu = 3112, 1681, 1531, 1467, 1375, 1301, 1257, 1134$ cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ 10.21 (s, 1H), 8.05-8.09 (m, 1H), 7.87- 8.02 (m, 2H), 7.45-7.51 (m, 1H); ^{13}C NMR (75 MHz, CDCl_3): 193.7, 152.5, 149.9, 137.0, 128.6, 122.0; MS (EI): m/z 107 (M^+). Anal. Calcd. for $\text{C}_6\text{H}_5\text{NO}$ (107.04): C, 67.28; H, 4.71; N, 13.08. Found: C, 67.30; H, 4.69; N, 13.07.

Furfural, $\text{C}_5\text{H}_4\text{O}_2$; (Table 3, entry **10m**):^[32-33] bp 164 °C (lit., 162 °C)^[34]; IR (KBr): $\nu = 3110, 1687, 1527, 1457, 1370, 1311, 1251, 1130$ cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ 9.67 (s, 1H), 7.62 (s, 1H), 7.32 (s, 1H), 6.57 (s, 1H); ^{13}C NMR (75 MHz, CDCl_3): 178.0, 153.1, 148.4, 121.4, 112.9; MS (EI): m/z 96 (M^+). Anal. Calcd. for $\text{C}_5\text{H}_4\text{O}_2$ (96.08): C, 62.50; H, 4.20. Found: C, 62.52; H, 4.17.

2-Thiophenecarboxaldehyde, $\text{C}_5\text{H}_4\text{OS}$; (Table 3, entry **10n**):^[27,32-33] mp 197 °C (lit., 197-198 °C)^[35]; IR (KBr): $\nu = 3101, 1722, 1502, 1437, 1360, 1301, 1241, 1141$ cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ 9.92 (s, 1H), 7.60-7.87 (m, 2H), 7.19-7.29 (m, 1H); ^{13}C NMR (75 MHz, CDCl_3): 183.5, 144.4, 136.4, 135.2, 128.9; MS (EI): m/z 112 (M^+). Anal. Calcd. for $\text{C}_5\text{H}_4\text{OS}$ (112.00): C, 53.55; H, 3.59. Found: C, 53.58; H, 3.57.

3,4-dimethoxybenzaldehyde, $\text{C}_9\text{H}_{10}\text{O}_3$; (Table 3, entry **10o**):^[36] mp 46 °C (lit., 42-45 °C)^[36]; IR (KBr): $\nu = 3185, 2831, 1693, 1460, 1347, 1265, 1019$ cm^{-1} ; ^1H NMR (300 MHz, CDCl_3): δ 9.84 (s, 1H), 7.44-7.46 (m, 1H), 7.40 (d, 1H, $J = 2.1$ Hz), 6.97 (d, 1H, $J = 7.9$ Hz), 3.96 (s, 3H), 3.93 (s, 3H); ^{13}C NMR (75 MHz, CDCl_3): 190.9, 154.4, 149.5, 130.1, 126.9, 110.3, 108.8, 56.1, 56.0; MS (EI): m/z 166 (M^+). Anal. Calcd. for $\text{C}_9\text{H}_{10}\text{O}_3$ (166.06): C, 65.05; H, 6.07. Found: C, 65.03;

H, 6.10.

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