
Magnetic polymer nanocomposite-supported Pd: an efficient and reusable catalyst for the Heck and Suzuki reactions in water

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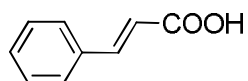
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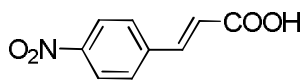
Supporting Information

¹H and ¹³C NMR spectra data of products



trans-Cinnamic acid

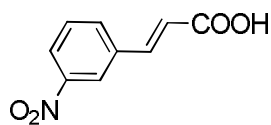
¹H NMR (400 MHz, CDCl₃): δ (ppm) = 11.96 (s, 1H, -COOH), 7.80-7.84 (d, *J* = 16.0 Hz, 1H, =CH), 7.56-7.58 (m, 2H, ArH), 7.42-7.43 (m, 3H, ArH), 6.46-6.50 (d, *J* = 16.0 Hz, 1H, =CH); ¹³C NMR (100 MHz, CDCl₃): δ (ppm) = 167.6, 143.9, 134.2, 130.2, 129.9, 128.2, 119.2.



trans-p-Nitrocinnamic acid

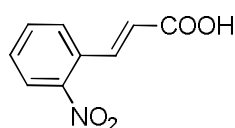
¹H NMR (400 MHz, DMSO-d₆): δ (ppm) = 12.77 (s, 1H, -COOH), 8.23-8.26 (d, *J* = 9.2 Hz, 2H, ArH), 7.98-8.00 (d, *J* = 9.2 Hz, 2H, ArH), 7.69-7.73 (d, *J* = 16.4 Hz, 1H, =CH), 6.74-6.78 (d, *J* = 16.0 Hz, 1H, =CH); ¹³C NMR (100 MHz, DMSO-d₆): δ (ppm)

= 167.6, 148.4, 141.9, 141.2, 129.8, 124.5, 124.1.



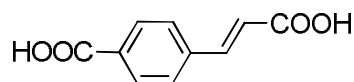
***trans-m*-Nitrocinnamic acid**

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.65 (s, 1H, -COOH), 8.51 (s, 1H, ArH), 8.23-8.25 (d, J = 8.0 Hz, 1H, ArH), 8.17-8.19 (d, J = 8.0 Hz, 1H, ArH), 7.70-7.76 (m, 2H, =CH, ArH), 6.73-6.77 (d, J = 16.0 Hz, 1H, =CH); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 167.2, 148.3, 141.5, 136.1, 134.0, 130.3, 124.4, 122.8, 122.6.



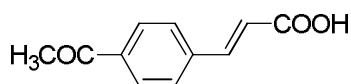
***trans-o*-Nitrocinnamic acid**

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.77 (s, 1H, -COOH), 8.08-8.10 (d, J = 8.2 Hz, 1H, ArH), 7.94-7.96 (d, J = 7.4 Hz, 1H, ArH), 7.86-7.90 (d, J = 15.8 Hz, 1H, =CH), 7.77-7.81 (t, J = 7.5 Hz, 1H, ArH), 7.66-7.70 (t, J = 7.7 Hz, 1H, ArH), 6.54-6.58 (d, J = 15.8 Hz, 1H, =CH); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 167.3, 148.7, 139.3, 134.3, 131.3, 129.8, 129.7, 125.1, 124.2.



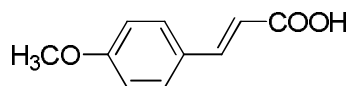
***trans-p*-Carboxycinnamic acid**

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.83 (s, 2H, -COOH), 7.94 (s, 2H, ArH), 7.82 (s, 2H, ArH), 7.62-7.66 (d, J = 16.0 Hz, 1H, =CH), 6.63-6.67 (d, J = 16.0 Hz, 1H, =CH); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 167.3, 166.8, 142.6, 138.3, 131.8, 129.7, 128.3, 121.6.



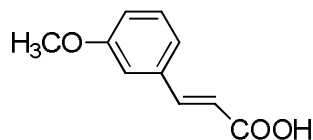
***trans-p*-Acetylcinnamic acid**

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.59 (s, 1H, -COOH), 7.97-7.99 (d, J = 8.0 Hz, 2H, ArH), 7.83-7.85 (d, J = 8.0 Hz, 2H, ArH), 7.63-7.67 (d, J = 16.0 Hz, 1H, =CH), 6.65-6.69 (d, J = 16.0 Hz, 1H, =CH), 2.60 (s, 3H, -CH₃); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 197.4, 167.3, 142.5, 138.5, 137.6, 128.6, 128.3, 121.7, 26.8.



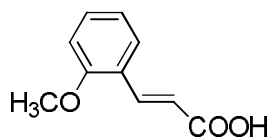
***trans-p*-Methoxycinnamic acid**

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.29 (s, 1H, -COOH), 7.66-7.68 (d, J = 8.0 Hz, 2H, ArH), 7.57-7.61 (d, J = 16.0 Hz, 1H, =CH), 6.99-7.01 (d, J = 8.0 Hz, 2H, ArH), 6.40-6.44 (d, J = 16.0 Hz, 1H, =CH), 3.82 (s, 3H, -OCH $_3$); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 168.4, 161.4, 144.3, 130.5, 127.3, 117.0, 114.8, 55.9.



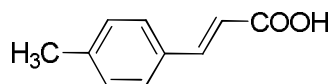
***trans-m*-Methoxycinnamic acid**

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.46 (s, 1H, -COOH), 7.58-7.62 (d, J = 16.0 Hz, 1H, =CH), 7.32-7.36 (t, J = 7.8 Hz, 1H, ArH), 7.25-7.28 (m, 2H, ArH), 6.99-7.01 (d, J = 7.7 Hz, 1H, ArH), 6.57-6.61 (d, J = 16.0 Hz, 1H, =CH), 3.81 (s, 3H, -OCH $_3$); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 168.1, 160.1, 144.4, 136.2, 130.4, 121.3, 120.0, 116.7, 113.4, 55.7.



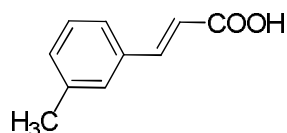
***trans-o*-Methoxycinnamic acid**

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.32 (s, 1H, -COOH), 7.82-7.86 (d, J = 16.0 Hz, 1H, =CH), 7.67-7.69 (d, J = 7.6 Hz, 1H, ArH), 7.39-7.43 (m, 1H, ArH), 7.08-7.14 (m, 1H, ArH), 6.97-7.00 (m, 1H, ArH), 6.49-6.53 (d, J = 16.0 Hz, 1H, =CH), 3.87 (s, 3H, -OCH $_3$); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 167.8, 157.7, 138.7, 131.7, 128.4, 122.4, 120.7, 119.2, 111.7, 55.6.



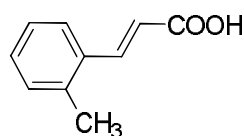
***trans-p*-Methylcinnamic acid**

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 11.1 (s, 1H, -COOH), 7.75-7.79 (d, J = 15.6 Hz, 1H, =CH), 7.45-7.46 (d, J = 5.2 Hz, 2H, ArH), 7.20-7.22 (d, J = 6.0 Hz, 2H, ArH), 6.39-6.43 (d, J = 15.6 Hz, 1H, =CH), 2.39 (s, 3H, CH $_3$); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 167.7, 143.9, 140.1, 131.5, 129.5, 128.2, 118.1, 21.0.



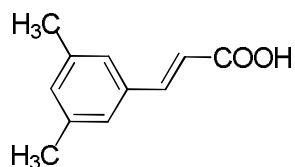
trans-m-Methylcinnamic acid

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.42 (s, 1H, -COOH), 7.55-7.59 (d, J = 16.0 Hz, 1H, =CH), 7.51 (s, 1H, ArH), 7.47-7.49 (d, J = 8.0 Hz, 1H, =CH), 7.29-7.33 (t, J = 8.0 Hz, 1H, ArH), 7.22-7.24 (d, J = 8.0 Hz, 1H, ArH), 6.50-6.54 (d, J = 16.0 Hz, 1H, =CH), 2.33 (s, 3H, CH_3); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 168.2, 144.6, 138.7, 134.7, 131.5, 129.3, 129.2, 126.0, 119.5, 21.4 .



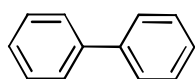
trans- o-Methylcinnamic acid

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.48 (s, 1H, -COOH), 7.82-7.86 (d, J = 16.0 Hz, 1H, =CH), 7.69-7.71 (d, J = 7.2 Hz, 1H, ArH), 7.30-7.33 (t, J = 7.0 Hz, 1H, ArH), 7.22-7.27 (m, 2H, ArH), 6.42-6.46 (d, J = 16.0 Hz, 1H, =CH), 2.39 (s, 3H, CH_3); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 167.61, 141.2, 137.2, 132.9, 130.7, 130.0, 126.49, 126.45, 120.2, 19.3.



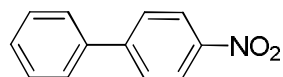
trans-3,5-Dimethylcinnamic acid

^1H NMR (400 MHz, DMSO- d_6): δ (ppm) = 12.40 (s, 1H, -COOH), 7.50-7.54 (d, J = 16.4 Hz, 1H, =CH), 7.29 (s, 2H, ArH), 7.04 (s, 1H, ArH), 6.46-6.50 (d, J = 16.4 Hz, 1H, =CH), 2.29 (s, 6H, CH_3); ^{13}C NMR (100 MHz, DMSO- d_6): δ (ppm) = 168.2, 144.7, 138.5, 134.6, 132.3, 126.5, 126.5, 126.4, 119.3, 21.2.



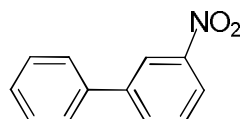
Biphenyl

^1H NMR (400 MHz, CDCl_3): δ (ppm) = 7.54-7.56 (d, J = 8.4 Hz, 4H, ArH), 7.36-7.40 (t, J = 7.2 Hz, 4H, ArH), 7.27-7.30 (t, J = 7.4 Hz, 2H, ArH); ^{13}C NMR (100 MHz, CDCl_3): δ (ppm) = 141.2, 128.7, 127.2, 127.1.



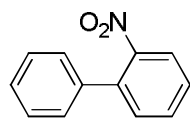
4-Nitrobiphenyl

^1H NMR (400 MHz, CDCl_3): δ (ppm) = 8.29-8.31 (d, $J = 8.8$ Hz, 2H, ArH), 7.73-7.75 (d, $J = 9.2$ Hz, 2H, ArH), 7.63-7.65 (d, $J = 6.8$ Hz, 2H, ArH), 7.44-7.53 (m, 3H, ArH); ^{13}C NMR (100 MHz, CDCl_3): δ (ppm) = 147.6, 147.1, 138.7, 129.1, 128.9, 127.7, 127.3, 124.0.



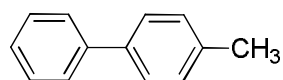
3-Nitrobiphenyl

^1H NMR (400 MHz, CDCl_3): δ (ppm) = 8.40-8.41 (t, $J = 1.6$ Hz, 1H, ArH), 8.15-8.17 (dd, $J = 8.0$ Hz, $J = 1.2$ Hz, 1H, ArH), 7.87-7.89 (d, $J = 7.6$ Hz, 1H, ArH), 7.55-7.60 (m, 3H, ArH), 7.40-7.49 (m, 3H, ArH); ^{13}C NMR (100 MHz, CDCl_3): δ (ppm) = 148.6, 142.7, 138.5, 132.9, 129.6, 129.1, 128.4, 127.0, 121.9, 121.8.



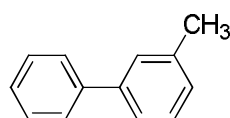
2-Nitrobiphenyl

^1H NMR (400 MHz, CDCl_3): δ (ppm) = 7.80-7.83 (dd, $J = 8.0$ Hz, $J = 1.2$ Hz, 1H, ArH), 7.55-7.59 (td, $J = 7.6$ Hz, $J = 1.2$ Hz, 1H, ArH), 7.37-7.46 (m, 5H, ArH), 7.29-7.31 (m, 2H, ArH); ^{13}C NMR (100 MHz, CDCl_3): δ (ppm) = 141.4, 141.2, 139.7, 138.1, 129.0, 128.8, 128.6, 127.1, 127.0, 125.0.



4-Methylbiphenyl

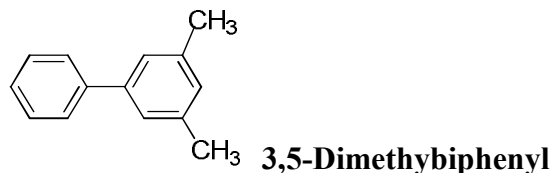
^1H NMR (400 MHz, CDCl_3): δ (ppm) = 7.66-7.68 (m, 2H, ArH), 7.57-7.59 (d, $J = 8.0$ Hz, 2H, ArH), 7.48-7.52 (t, $J = 7.6$ Hz, 2H, ArH), 7.38-7.42 (tt, $J = 7.2$ Hz, $J = 1.2$ Hz, 1H, ArH), 7.32-7.34 (d, $J = 7.6$ Hz, 2H, ArH), 2.48 (s, 3H, CH_3); ^{13}C NMR (100 MHz, CDCl_3): δ (ppm) = 141.2, 138.4, 137.0, 129.5, 128.7, 127.0, 126.9, 21.1.



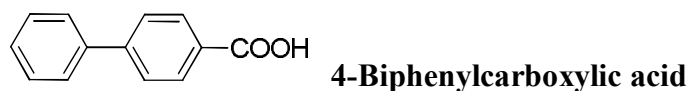
3-Methylbiphenyl

^1H NMR (400 MHz, CDCl_3): δ (ppm) = 7.51-7.53 (m, 2H, ArH), 7.32-7.36 (m, 4H,

ArH), 7.23-7.27 (m, 2H, ArH), 7.07-7.09 (d, $J = 7.6$ Hz, 1H, ArH), 2.33 (s, 3H, CH₃);
¹³C NMR (100 MHz, CDCl₃): δ (ppm) = 141.3, 141.2, 138.2, 128.62, 128.60, 127.93,
127.88, 127.09, 127.07, 124.2, 21.4.



¹H NMR (400 MHz, CDCl₃): δ (ppm) = 7.53-7.54 (m, 2H, ArH), 7.34-7.38 (m, 2H, ArH), 7.25-7.28 (m, 1H, ArH), 7.18 (s, 2H, ArH), 6.94 (s, 1H, ArH), 2.33 (s, 6H, CH₃);
¹³C NMR (100 MHz, CDCl₃): δ (ppm) = 141.4, 141.2, 138.1, 128.8, 128.6, 127.1,
127.0, 125.1, 21.3.



¹H NMR (400 MHz, DMSO-d₆): δ (ppm) = 13.31 (s, 1H, -COOH), 8.03-8.05 (d, $J = 8.4$ Hz, 2H, ArH), 7.80-7.82 (d, $J = 8.4$ Hz, 2H, ArH), 7.73-7.75 (d, $J = 7.2$ Hz, 2H, ArH), 7.49-7.53 (t, $J = 7.4$ Hz, 2H, ArH), 7.41-7.45 (t, $J = 7.4$ Hz, 1H, ArH); ¹³C NMR (100 MHz, DMSO-d₆): δ (ppm) = 167.2, 144.4, 139.1, 130.1, 129.7, 129.2, 128.4, 127.1, 126.9.