Supporting Information

Palladium(0)-threonine complex immobilized on surface magnetic mesocellular foams: an efficient, stable and magnetically separable nanocatalyst for Suzuki, Stille and Heck cross-coupling reactions

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Experimental

General information

Triblock copolymer P123, 1, 3, 5-trimethyl benzene (TMB), tetraethoxysilane (TEOS), ammonium fluoride (NH_4F), and all other commercially available substances and solvents were purchased from Aldrich and Merck Chemical Companies and used without additional purification.

Fourier-transform infrared (FT-IR) spectra of the nanocatalyst were obtained by a VRTEX 70 model BRUKER FT-IR spectrophotometer in the range of 400 to 4000 cm^{-1}. X-ray diffraction (XRD) patterns measurements were performed at room temperature by using an X'Pert PRO MPD instrument from Panalytical Company under Cu Kα radiation at 40 kV and 30 mA. Thermal gravimetric analysis (TGA) measurements of prepared samples were performed on a DTG-60 Thermal Analysis system with a heating rate of 10 °C min^{-1} in the temperature range of 30–900 °C. Brunauer–Emmett–Teller (BET) specific surface areas and pore size distributions of the nanostructures were determined by N_2 physisorption using an Asap 2020 device from Micromeritics Company. The microscopic morphology of the nanostructure was characterized by the FESEM-TESCAN MIRA3 scanning electron microscopy (SEM). In addition, the analysis of chemical elements on the components of nanostructure was determined using the energy dispersive X-ray (EDS) and wavelength dispersive X-ray (WDX). Also, the Palladium content of the nanocatalyst was determined using inductively coupled plasma-optical emission spectrometry (ICP-OES) (on a 730-ES-Varian device). The magnetoresistance of the nanoparticles was obtained on a vibrating sample magnetometer (VSM, MDKFD, Iran) at a maximum applied field of 25 KOe. ^{1}HMR (300 MHz) spectra was recorded to confirm the structures of the materials with $CDCl_3$ as solvent.

Selected spectral data

2-Methyl-1, 1'-biphenyl, Mp: Oil[1], ^{1}H NMR (300 MHz, $CDCl_3$): δ (ppm)= 7.53-7.48 (m, 2H), 7.47-7.42 (m, 3H), 7.39-7.35 (m,4H), 2.38 (s, 3H).

4-Chloro-1, 1'-biphenyl, Mp: 77-79 °C[2], ^{1}H NMR (300 MHz, $CDCl_3$): δ (ppm)= 7.60-7.56 (m, 2H), 7.56-7.52 (m, 2H), 7.51-7.46 (m, 2H), 7.44-7.40 (m, 1H), 7.38-7.35 (m, 2H).

Butyl 3-(4-methoxyphenyl)acrylate, Mp: Oil[3], ^{1}H NMR (300 MHz, $CDCl_3$): δ (ppm)= 7.67 (d, *J*= 15.6 Hz, 1H), 7.51 (d, *J*= 8.7 Hz, 2H), 6.93 (d, *J*= 8.7 Hz, 2H), 6.35 (d, *J*= 16.0 Hz, 1H), 4.23 (t, *J*= 6.4 Hz, 2H), 3.86 (s, 3H), 1.74-1.68 (m, 2H), 1.52-1.43 (m, 2H), 1.01 (t, *J*= 7.6 Hz, 3H).

Butyl 3-(2-methylphenyl)acrylate, Mp: Oil[4], ^{1}H NMR (300 MHz, $CDCl_3$): δ (ppm)= 8.02 (d, *J*= 16.0 Hz, 1H), 7.60-7.58 (m, 1H), 7.31-7.30 (m, 1H), 7.26-7.20 (m, 2H), 6.40 (d, *J*= 16.0 Hz, 1H), 4.25 (t, *J*= 6.8 Hz, 2H), 2.48 (s, 3H), 1.77-1.70 (m, 2H), 1.53-1.43 (m, 2H), 1.01 (t, *J*= 7.2 Hz, 3H).

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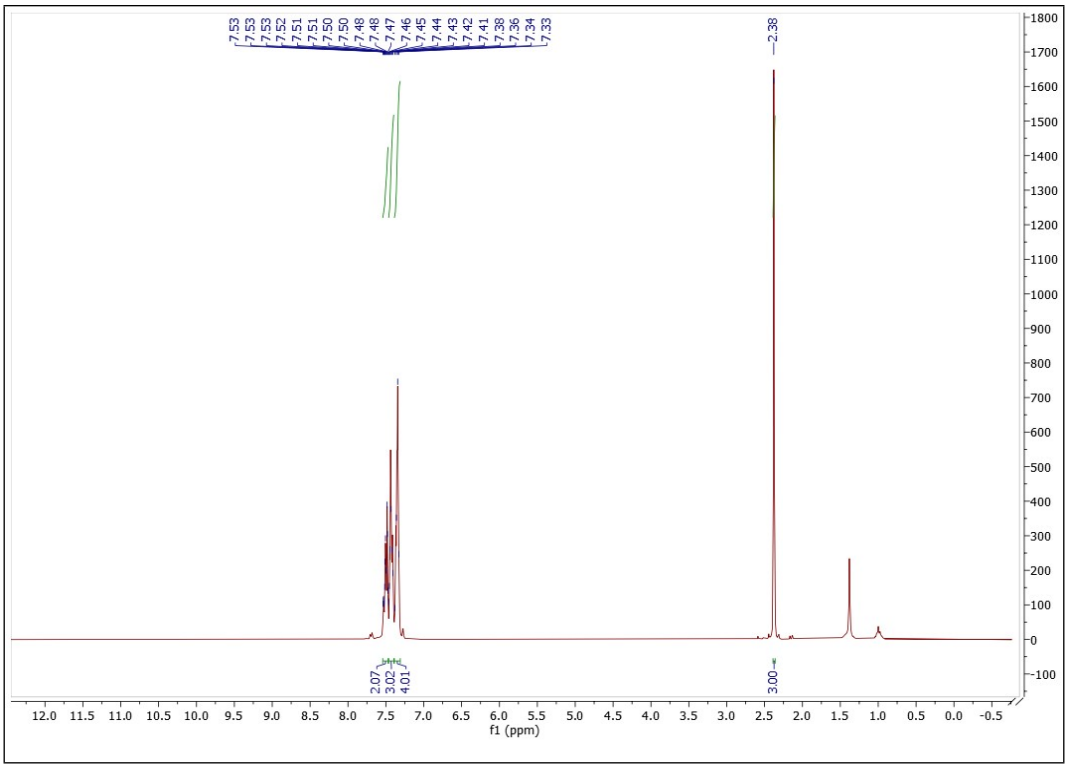
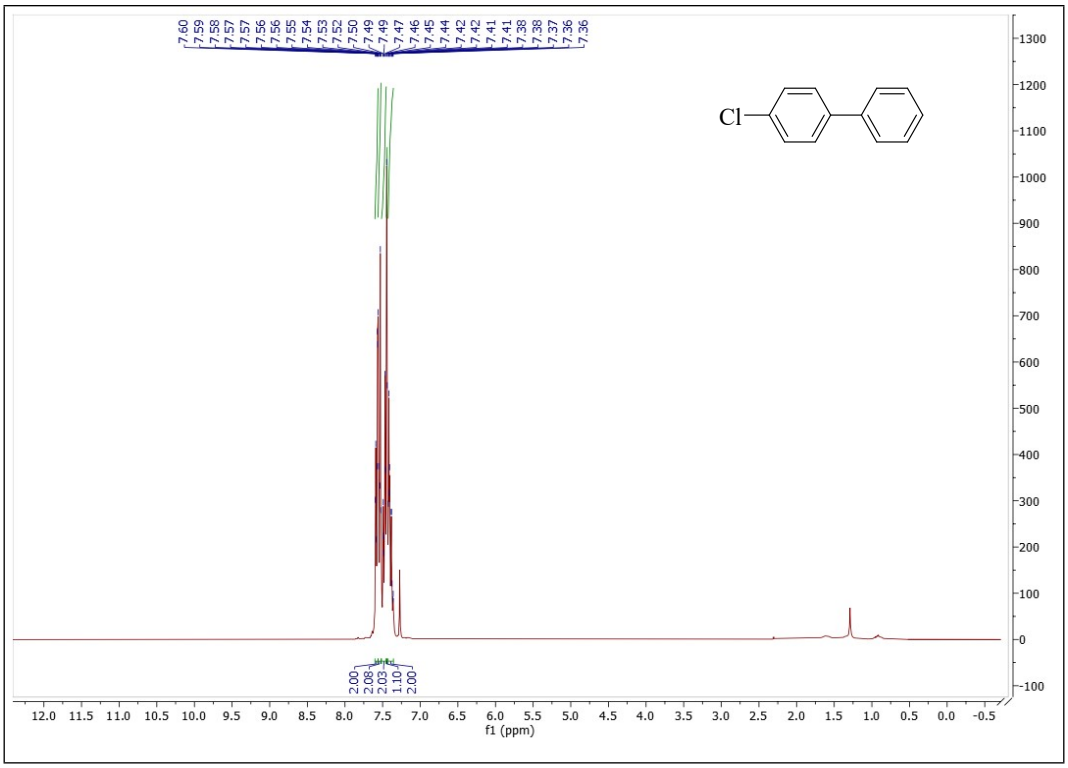
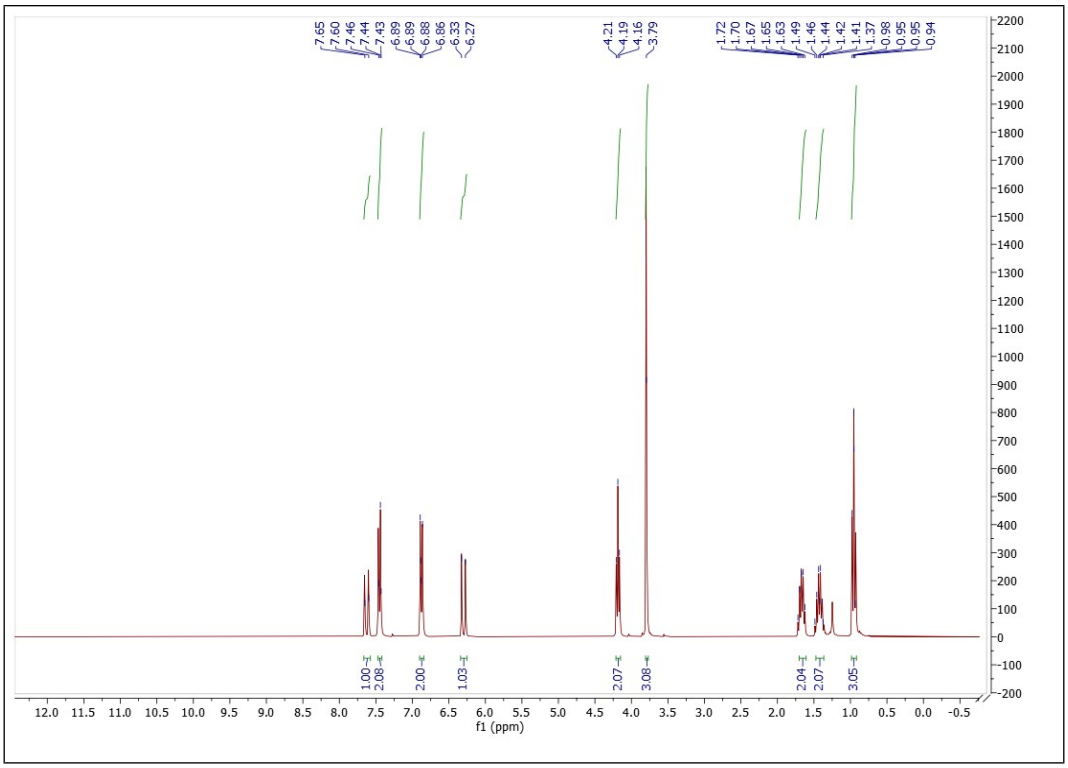
2. M. C. Hong, M. C. Choi, Y. W. Chang, Y. Lee, J. Kim and H. Rhee, *Adv. Synth. Catal.*, 2012, **354**, 1257-1263.
3. A. Ghorbani-Choghamarani, B. Tahmasbi, R. H. Hudson and A. Heidari, *Microporous Mesoporous Mater.*, 2019, **284**, 366-377.
4. D. Liu, C. Zhang, F. Wang, Z. Huang, N. Zhang, H. Zhou and Y. Kuang, *J. Mater. Chem.*, 2015, **3**, 16583-16589.



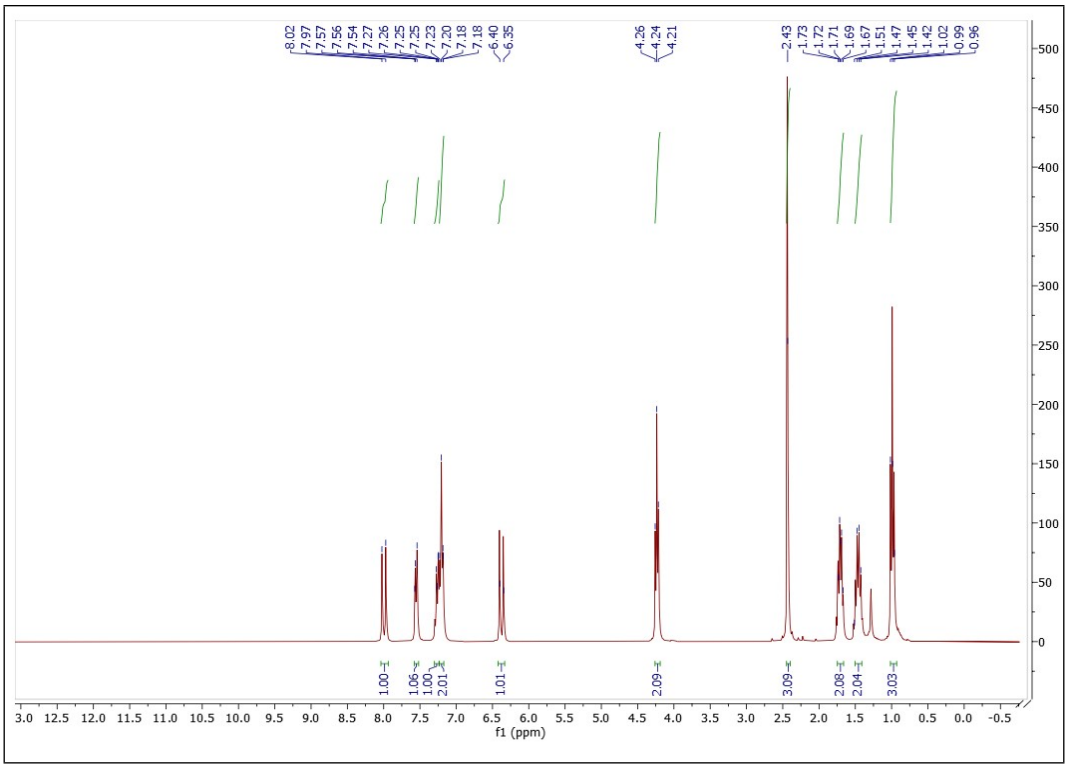
^{1}H NMR spectrum of 2-Methyl-1, 1'-biphenyl, in $CDCl_3$



^{1}H NMR spectrum of 4-Chloro-1, 1'-biphenyl, in $CDCl_3$



^{1}H NMR spectrum of Butyl 3-(4-methoxyphenyl)acrylate, in $CDCl_3$



^{1}H NMR spectrum of Butyl 3-(2-methylphenyl)acrylate, in $CDCl_3$