

Supplementary Information

Pd/Cu-free Heck and Sonogashira cross-coupling reaction by Co nanoparticles immobilized on magnetic chitosan as reusable catalyst

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1. General Remarks

1.1 Materials

All chemicals were purchased from Merck Chemical Co. (Germany) and Sigma-Aldrich. The reagents were used without any further purification. All the organic products were known and identified by comparison of their physical and spectral data with those of authentic samples

1.2. Instrumentation and analysis

FT-IR spectra were recorded on a Nicolet-Impact 400D spectrophotometer. ^1H and ^{13}C NMR (400 and 100 MHz) spectra were recorded on a Bruker Avance 400 MHz spectrometer using CDCl_3 as solvent. Elemental analysis was performed on a LECO, CHNS-932 analyzer. Thermogravimetric analysis (TGA) was carried out on a Mettler TG50 instrument under air flow at a uniform heating rate of $5\text{ }^\circ\text{Cmin}^{-1}$ in the range 30-600 $^\circ\text{C}$. The TGA instrument was re-calibrated at frequent intervals with S3 standards; the accuracy was always better than $\pm 2.0\%$. The scanning electron microscope measurement was carried out on a Hitachi S-4700 field emission-scanning electron microscope (FESEM). The transmission electron microscopy (TEM) was carried out on a Philips CM10 Transmission Electron Microscope operating at 100 kV. The Co content of the catalyst was determined by a Jarrell-Ash 1100 ICP analysis. X-ray diffraction (XRD) powder patterns were obtained using an X'PERT MPD, with Cu $K\alpha$ radiation (40 kV, 30 mA). Magnetic measurements were done by vibrating sample magnetometer (VSM) in the range 0.0001-50 emu. The reaction progress was followed using Sigma-Aldrich TLC Plates, Silica matrix. Reaction yields were analyzed by gas chromatography (GC, BEIFEN-3420, detector type: FID, TCD equipped with NukolTM capillary GC column, size \times I.D. 30 m \times 0.25 mm, d_f 0.25 μm). 2,3-Dimethylnaphthalene as was used as internal standard. The gas flow rate of 2 mL min^{-1} ; and oven temperature at 80 $^\circ\text{C}$ for 15 min and then increased to 170 $^\circ\text{C}$.

1. Characterization of products















