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Synthesis and characterization of gum arabic microgels embedding metal based nanoparticles for catalytic reduction of 4-nitrophenol at ambient conditions

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The work presented here describes the successful synthesis and characterization of gum arabic (GA) microgel for *in-situ* metal nanoparticles preparation for further use in the catalytic reduction of 4-nitrophenol (4-NP) to 4-nitroaniline (4-NA). A reverse micellization method was owned to prepare GA based spherical microgels with a high yield of up to 79% in 5-50 μm size range via successful crosslinking by divinyl sulfone (DVS) in gasoline medium. The as-synthesized microgels were used as a template for *in situ* fabrication of nickel (Ni) and copper (Cu) nanoparticles (NPs) using their corresponding salts as metal ion source and $NaBH_4$ as reducing agent. The successful synthesis of the prepared microgels thereafter *in situ* fabrication of nanoparticles was confirmed from fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), x-ray diffraction characterization, thermal gravimetric analysis (TGA), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The Ni and Cu NPs loaded microgels were known as GA-Ni and GA-Cu microgels with nickel and copper NPs respectively. Further, the catalytic reduction characteristics of the prepared GA-Ni and GA-Cu composite microgels towards 4-NP were evaluated. Interestingly, the hybrid microgel show enhanced catalytic activity for the conversion of 4-NP to 4-NA which follows pseudo-first order kinetic rate law as well. A time delay of 8-10 minutes for all different amounts was observed for this catalytic reduction at room temperature 25°C; whereas the reduction interval was reduced to six minutes when of 0.05 g GA-Ni microgels were used.