World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:11, No:01, 2017

Modifiable Poly Methacrylic Acid-Co-Acrylonitrile Microgels Fabricated with Cu and Co Nanoparticles for Simultaneous Catalytic Reduction of Multiple Compounds

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Abstract : We prepared poly(methacrylic acid-co-acrylonitrile) (p(MAc-co-AN)) microgels by inverse suspension polymerization, and converted the nitrile groups into amidoxime groups to obtain more hydrophilic amidoximated poly(methacrylic acid-co-acrylonitile) (amid-p(MAc-co-AN)) microgels. Amid-microgels were used as microreactors for in situ synthesis of copper and cobalt nanoparticles. Cu (II) and Co (II) ions were loaded into microgels from their aqueous metal salt solutions and then converted to corresponding metal nanoparticle (MNP) by treating the loaded metal ions with sodium borohydride (NaBH4). The characterization of the prepared microgels and microgel metal nanoparticle composites was carried out by SEM, TEM and TG analysis. The amounts of metal nanoparticles within microgels were estimated by AAS measurements by dissolving the MNP entrapped within microgels by concentrated HCl acid treatment. Catalytic performances of the prepared amid-p(MAc-co-AN)-M (M: Cu, Co) microgel composites were investigated by using them as catalyst for the degradation of cationic and anionic organic dyes such as eosin Y (EY), methylene blue (MB) and methyl Orange (MO), and for the reduction of nitro aromatic pollutants like 2-nitrophenol (2-NP) and 4-nitrophenol (4-NP) to their corresponding amino phenols. Here, we also report for the first time, the simultaneous degradation/reduction of MB, EY, and 4-NP by amid-p(MAc-co-AN)-Cu microgel composites. Different parameters affecting the reduction rates such as metal types, amount of catalysts, temperature and the amount of reducing agent were investigated.

Keywords : microgels, nanoparticles, catalyst, pollutants
Conference Title : ICESE 2017 : International Conference on Environmental Sciences and Engineering
Conference Location : Zurich, Switzerland
Conference Dates : January 13-14, 2017