The First Magnetic Nanoparticle-Supported Biguanide Catalyst: Excellent Reactivity Combined with Facile Catalyst Recyclability

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Magnetic nanoparticles (MNPs) are receiving increasing interest in recent years [1-3] owing to their unique properties and potential applications in various fields, such as magnetically assisted drug delivery, magnetic resonance imaging contrast agents, magnetic separation of biomolecules and magnetic nanoparticle-based catalysts [1-2]. Most of these applications require the nanoparticles to be chemically stable since they tend to aggregate and are very susceptible to air oxidation.

In our group, a novel superbase (biguanide)-functionalized Fe3O4/SiO2 magnetic nanoparticles with a core-shell structure was developed, aiming to catalyze organic transformations in aqueous media. The structural, surface, and magnetic characteristics of the nanosized catalyst were investigated by transmission electron microscopy (TEM), powder X-ray diffraction (XRD), vibrating sample magnetometry (VSM), elemental analysis, thermogravimetric analysis (TGA), N2 adsorption–desorption (BET and BJH) and FT-IR techniques. This surface-modified Fe3O4/SiO2 nanoparticles showed a superpara-magnetic property with a saturation magnetization value of 46.44 emu/g, indicating a great potential application in the magnetically separation technology. The prepared nanosystem was found to act as an efficient recoverable catalyst in organic transformations. Also notably, the nanocatalyst was reused for sixteen times without significant degradation in catalytic activity and at the end of the reaction it was easily separated with an external magnet.

REFERENCES