HPA decorated Halloysite Nanoclay An efficient catalyst for the green synthesis of Spirooxindole derivatives

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Abstract

A novel heterogeneous catalyst, HPA@HNTs-IMI-SO₃H, was designed and synthesized based on functionalization of halloysite nanotubes with ionic liquid and subsequent incorporation of heteropolyacid. The structure of the catalyst was studied and confirmed by using SEM/EDX, FTIR, XRD, ICP-AES, TGA, DTGA and BET. Moreover, the catalytic activity of HPA@HNTs-IMI-SO₃H was investigated for promoting ultrasonic-assisted three-component reaction of isatines, malononitrile or cyanoacetic esters and 1,3-dicarbonyl compounds to afford corresponding spirooxindole in high yields and short reaction time. The reusability of the catalyst was also studied. Notably, the catalyst could be recovered and reused for three reaction runs. However, reusing for fourth reaction runs led to the decrease of the catalytic activity. Considering leaching test results, that observation was attributed to the leaching of heteropolyacids, which can be induced by ultrasonic irradiation.

Keywords: halloysite, hybrid, ionic liquid, nanocatalyst, spirooxindole