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Natural polymers supported copper nanoparticles for pollutants degradation

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Abstract

In this report, chitosan (CS) was adhered on cellulose microfiber mat (CMM) to prepare CS-CMM. This was used as host for copper (Cu) nanoparticles preparation. After adsorption of Cue' ions from an aqueous solution of $CuSO_4$, the metal ions entrapped in CS coating layer was treated with sodium borohydride ($NaBH_4$) to prepare Cu nanoparticles loaded CS-CMM (Cu/CS-CMM). Fourier transform infrared spectroscopy, and X-ray diffraction confirmed the formation of Cu/CS-CMM hybrid. Scanning electron microscopy analysis was performed to reveal the morphology of the prepared catalyst. The prepared Cu/CS-CMM was employed as a catalyst for the degradation of nitro-aromatic compounds of 2-nitrophenol (2NP) and 4nitrophenol (4NP) as well as an organic cresyl blue (CB) dye. Remarkably, the turnover frequency in the case of 2NP and 4NP using Cu/CS-CMM reaches 103.3 and 88.6 h(-1), outperforming previously reported Cu nanoparticles immobilized in hydrogel-based catalytic systems. The rate constants for 2NP, 4NP and CB were 1.2 x 10(-3) s-1, 2.1 x 10-3 s-1 and, 1.3 x 10-3 s-1, respectively. Besides, we discussed the separation of the catalyst from the reaction mixture and its re-usability. (C) 2016 Elsevier B.V. All rights reserved.

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