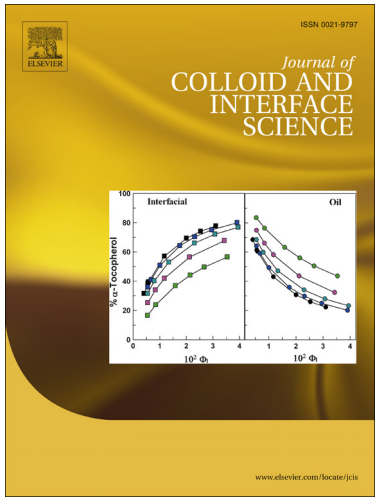

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Synthesis and adsorption characteristics of an immobilized Mn nanoparticle towards methyl orange

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Abstract

Heterogeneous Mn nanoparticles (5–30 nm diameter) is found to be a nanomaterial for the rapid removal of large quantities of toxic dye (methyl orange) from aqueous solution, with wide ranging potential applications. The synthesized materials were characterized with different methods such as FT–IR spectroscopy, CHN elemental analysis, BET, SEM, TEM, ICP–OES and EPR. The contact time to obtain equilibrium for maximum adsorption of methyl orange was 20 min. EPR of Mn ions evidenced that most of the covalently bond active sites of the nano-adsorbent are in the form of Mn(III) ions at the surface. The heterogeneous Mn(III)-Cl ions were found to be effective adsorbent for the removal of methyl orange from solution. The adsorption of methyl orange ions has been studied in terms of pseudo-first-order and pseudo-second-order kinetics, and the Freundlich, Langmuir and Langmuir-Freundlich isotherm models have also been applied to the equilibrium adsorption data. The adsorption process was spontaneous and endothermic in nature and followed pseudo-second-order kinetic model.

Keywords: immobilization, Mn nanoparticle, methyl orange, adsorption.

Introduction

Pollution of the biosphere with toxic dyes and metals has increased dramatically since the beginning of the industrial revolution, and water contamination by the disposal of effluents including organic and inorganic has become worldwide concern for the past few decades [1].

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