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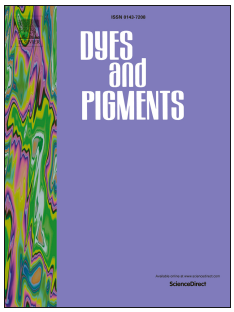

Methyl orange adsorption comparison on nanoparticles: Isotherm, kinetics, and thermodynamic studies

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Methyl orange adsorption comparison on nanoparticles: isotherm, kinetics, and thermodynamic studies

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Abstract

A batch equilibrium system has been used to investigate the adsorption of methyl orange (MO) on NiO or CuO nanoparticles (NPs). The effects of experimental conditions such as initial concentration, agitation time, solution pH and temperature were examined. Langmuir and Freundlich's models were used for determining the adsorption parameters at three different temperatures. It was observed that the Langmuir model fits well with the experimental adsorption data. The pseudo first-order, second-order and intra-particle diffusion models were applied to investigate the kinetic data. The obtained results indicate that experimental kinetics data of NiO and CuO NPs were only well explained by the second-order model. It was found that the adsorption capacities of NiO NPs are higher than that of CuO NPs for each temperature. However, CuO NPs has higher adsorption rate than that of NiO NPs. The thermodynamic parameters (ΔH^o, ΔS^o, and ΔG^o) were determined and their values indicate that the adsorptions of MO on NiO and CuO NPs are endothermic and spontaneous processes. Thermodynamics parameters also confirm that the adsorption of MO is chemical and physical adsorption on the surfaces of NiO and CuO NPs, respectively.

Keywords: Methyl orange, Nanoparticles**,** Isotherm, kinetics, thermodynamics

1. Introduction

Methyl orange (MO) is an acidic anionic mono-azo dye [1-3] commonly and continuously used in textiles, laboratory experiments and other commercial products [4]. This dye is toxic to aquatic life [5]. Increasing heart rate, vomiting, shock, cyanosis, jaundice, quadriplegia, and tissue necrosis in humans can be obtained due to acute exposure to this hazard dye [6, 7]. Therefore, it is essential to remove this dye from wastewaters is generated by industries related