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Synthesis of calcon-imprinted magnetic chitosan nanoparticles as a novel adsorbent and its application in selective removal of calcon dye from aqueous solutions

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Abstract

Calcon-imprinted magnetic chitosan (CIMC) nanoparticles (NPs) were successfully synthesized as a novel adsorbent. Epichlorohydrin (ECH) and glutaraldehyde (GA) were used as cross-linkers to synthesize desired calcon-imprinted magnetic chitosan (ECH/CIMC and GA/CIMC) and non-imprinted magnetic chitosan (ECH/NIMC and GA/NIMC) NPs for adsorption and removal of calcon from polluted solutions. Fourier transform infrared spectroscopy (FT-IR) and scanning electron microscopy (SEM) techniques were employed to investigate the characteristics of ECH/CIMC and GA/CIMC. The effect of pH, temperature, adsorbent dosage and initial dye concentration was evaluated. The adsorption isotherm and kinetics were adequately described by Langmuir and pseudo second-order model, respectively. Maximum removal capacity by ECH/CIMC and GA/CIMC was computed as 51.71 and 39.23 mg/g. Thermodynamic parameters were also estimated and results showed that the adsorption of calcon onto CIMC and NIMC was endothermic and that it is a spontaneous and favorable process.

Keywords: Calcon-imprinted magnetic chitosan, Removal of calcon dye, Magnetic chitosan nanoparticles, Glutaraldehyde, Epichlorohydrin

1. Introduction

As international environmental standards are becoming more stringent, the treatment of industrial effluents containing poisonous, deadly and hazardous dyes has became an important issue. Since the presence of dyes can cause considerable damage to human and aquatic life, the removal of those released from many industries such as rubber, textile, clothing, printing, cosmetics, leather and carpet industries before discharge into the environment is of great necessity [1-5]. It is estimated that over 7×10^5 tonnes of dyestuff are produced annually and more than 100,000 commercially available dyes are released into water sources [6-8]. Most dyes are colorful and toxic even at very low concentrations [9]. These colored and