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Research Article

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Grafting of chitosan as adsorbent Cr(VI) from water with adsorption-fluidization method

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ABSTRACT

The study of kinetic and thermodynamic properties of adsorption-fluidization on Cr(VI) ions were performed using chitosan grafting, which was called as carboxy methyl chitosan-benzaldehyde (CMChi-B). This compound was synthesized from chitosan which was grafting with chloroacetic acid. The product was carboxy methyl chitosan (CMChi) and was characterized by FTIR spectrophotometer. CMChi which was grafted with a benzaldehyde solution produced CMChi-B and was characterized by FTIR spectrophotometer. Adsorption-fluidization of Cr(VI) ions has been done with the variation of times, temperatures and pHs. Fluidization bed was filled in 200 ml solution of Cr(VI) ions. The results revealed that the adsorption capacity of CMChi-B yield 96.19% or 38.48 mg/g at operation conditions. With the same condition, adsorption capacity of blend silica gel-CMChi-B yield 92.70%. The adsorption-fluidization was not spontaneous process, but it was a regularity process which the type of Langmuir isotherm adsorption with 2^{-1} as the order rate of adsorption.

Keywords: Kinetic, Thermodynamic, Adsorption-fluidization, Carboxymethyl chitosan- benzadehyde, Cr(VI)

INTRODUCTION

Chitin is the abundant material of biopolymer/polysaccharides after the cellulose. Chitin can be obtained from low organism; insect's shell; arthropods, like crustacean (shrimp, crabs, lobster); fungi cell wall; yeast and rodulus mollusks; and cephalopods, including octopuses and squids [1-4]. Chitin can be transformed to chitosan. Chitosan was solved in dilute acetic acid and aqueous solution on pH< 6,5, and then it was dissolved in N-metil morfolin-N-oxide/HOH [5]. Chitosan grafting with chloroacetic acid produced CMChi, and CMChi can be used in biomedical, pharmaceutical, environmental, veterinary, and metal ions adsorbent [6-14].

The availability of clean water is very important for human health, especially for drinking and cooking. High concentration of heavy metal in water is very dangerous for human health. Toxic chemicals effect is caused the physiological changing in humans immediately or cumulatively [15]. For examples, the toxicity effects of chromium (Cr) are caused headache, nausea, vomeeting, carcinogenic and diarrhea [16]. The conventional methods for removal Cr ions from water are reverse osmoses, chemical reactions, and activated carbon adsorption. These methods are high cost, inefficiency, and ineffectively for concentration less than 100 mg/l [17-20]. Cr(VI) waste water removal with membrane or electro dialysis is expensive [21-22], whereas photo catalysis Cr(VI) removal is need a long time [23,24]. The other conventional methods are reduction, hydroxides sedimentation, and ion exchange [25].

Some industries which resulting Cr(VI) in the waste water are galvanizing industry, petroleum complex, stainless steel, waste water from chromium plating, and acid cleaning [25]. The maximum international standard WHO for using of water domestic is 0.05 mg/l, whereas the limit standard concentration for drinking ground water is rejected in 0.05 ppm [15, 26]. CMChi could form chelate with metal ions, whereas, chitosan was used as metal chelating agent, and the harmful metal ions could be removed by the formation of a chelating polymer [14, 27-34]. Grafting