Preparation, Characterization and Properties of Crosslinked Chitosan/Palygorskite Resin with Tannic Acid as Template Molecules

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First page example

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Preparation, characterization and properties of crosslinked chitosan/ palygorskite resin with tannic acid as template molecules

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Keywords: Palygorskite, Chitosan, Tannic acid, Template, Resin

Abstract. The chitosan/palygorskite resins with tannic acid (TA) as template molecules (CPRT) were prepared by emulsion cross-linking technology. Palygorskite (PAL), a kind of natural one-dimensional clay, worked as perfect filler in this study to enhance the adsorptive properties and acid resistance of chitosan resin (CR). The effect of PAL and imprinted molecules on pore parameters of the CPRT, such as swelling degree, porosity, and ratio of weight loss, were investigated, and the effects of the initial pH value of the TA solution, contact time and temperature on adsorption capacity of the CPRT were also discussed. The results revealed that the adsorption process was found to be pH dependant with an optimum activity at pH 8.0. In comparison with CR, the adsorptive ability of CPRT increased from 225 to 410 mg/g, and the ratio of weight loss decreased from 18.8 to 6.2 %. The study of adsorption kinetics and isotherms showed that the sorption processes were better fitted by pseudo-second-order equation and the Langmuir equation, respectively.

Introduction

Nature organic matter (NOM) is the main resource of the organic contaminants in surface and ground water, among which tannic acid (TA) in the deprotonated form is a naturally occurring organic substance formed by the decomposition of organic matter. As a water-soluble polyphenolic compound, TA can creates toxicity for aquatic organisms such as algae, phytoplankton, fish and invertebrates. In particular, the presence of TA in drinking water may act as the precursor of carcinogenic disinfection byproducts (DBPs) [1]. Among the current technologies to remove TA from effluents, adsorption is the most common approach due to its simple treatment, high efficiency and optional adsorbents. A number of adsorbents, such as activated carbons, zirconium pillared clay, cationic surfactant modified bentonite clay, and resin have been reported to remove TA, of which clay/chitosan nanocomposites as effective materials has received much attention in view of the enhanced mechanical properties and improved absorbability in comparison with pure chitosan [2].

In this study, the cross-linked chitosan/palygorskite resin with TA as template molecules (CPRT) were prepared to improve the adsorptive selectivity and capacity of chitosan for TA. Palygorskite (PAL), a kind of natural one-dimensional clay with large specific surface area and moderate cation exchange capacity, was introduced into chitosan matrix to improve the acid-resistance, reduce the cost and enhance the adsorption capacity of chitosan resin (CR). The effect of PAL and TA on the absorbability of the template resin was investigated. Compared with CR, CPRT is expected to have improved adsorptive properties as well as acid-resistance.

Experimental

Preparation of CPRT. A certain amount of TA was dissolved in 1 % (v/v) acetic acid solution (40 ml). 2.0 g chitosan and 0.4 g PAL were mixed and ground sufficiently, and then dissolved in above solution. The mixture was agitated at 40 °C by a disperser at 12,000 rpm for 0.5 h to obtain the viscous composite. PCRM was prepared according to the following procedure [3]. The above viscous composite was emulsified by mechanical stirring (400 rpm) in 60 mL liquid paraffin containing 0.10 g