Comparative Studies of Activated Carbon-Attapulgite and Zeolite-Attapulgite Composite Adsorbent on Congo Red Adsorption

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Authors	Zhang Weng, Z.Q. Jing, Yu Kong, Wei Shen
Keywords	Activated Carbon (AC), Adsorbent, Adsorption, Attapulgite, Comparative Study, Congo Red, Zeolite

Abstract	This study investigated the adsorption of congo red by activated carbon-attapulgite composite adsorbent (ACA) and zeolite-attapulgite composite adsorbent (ZA) from aqueous solution. All of these two adsorbents have mesopores and macropores structure different from general activated carbon adsorbent with micropores distribution through analysis of mercury porosimeter .The research focused on the effects of adsorption capacity in four aspects: contact time, solution pH, temperature and initial dye concentration. The results indicated that ACA had higher adsorption rate in the first 30 min contact time and ZA had higher removal percentage because of the difference on the pore size and total pore area. There was little difference on removal percentage of ACA and ZA when pH changing from 1 to 13 and the adsorption rate exceeded 94% in all kinds of pH condition. The removal efficiency of congo red on ACA and ZA increased from 92% to 95% with increase of temperature from 293K to323K. The reduction rate of congo red decreased with an increase in the initial congo red concentration for ACA and ZA.These results suggest that all of the two adsorbents is a potential low-cost adsorbent for the dye removal from industrial wastewater.

First page example

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Comparative studies of Activated Carbon-attapulgite and Zeolite-attapulgite Composite Adsorbent on Congo Red Adsorption

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Keywords: comparative studies; activated carbon; attapulgite; zeolite; adsorbent; congo red; adsorption

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Introduction

Various types of dyes are manufactured for printing and dyeing industries from coal tar based hydrocarbons. Color removal from effluent is one of the most difficult requirement faced by the textile finishing, dye manufacturing, pulp and paper industries. Most of these dyes are harmful, when in contact with living tissues for a long time. Congo red is commonly used in textile industry to give wool and silk red color with yellow fluorescence [1].Adsorption is recognized to be one of the most effective and economic process to remove congo red from aqueous solution[2]. Basing on the aforesaid traits of zeolite-attapulgite composite adsorbent on removal of pollution, a new activated carbon-attapulgite composite adsorbent was prepared using activated carbon and natural attapulgite through compounding, granulation and calcination [3,4]. The objective of this study is to evaluate the adsorption capacity of these two kinds of adsorbent on adsorption of congo red. The research focused on evaluating how the process operation parameters of contact time, solution pH, temperature and initial dye concentration.

Materials and Methods

Materials and Instrumentation. The anionic dye, Congo red was obtained from Nanjing Chemical Reagent CO.LTD (chemical formula=$C_{32}H_{22}N_6Na_2O_6S_2$, FW=696.7, Nanjing, China), with analytical grade and it was used without further purification. A stock solution of 1000 mg/L of congo red was prepared by dissolving congo red in de-ionized water and was used to prepare the sorbate solutions of concentrations by appropriate dilution for different experiments performed. The sample of activated carbon-attapulgite composite adsorbent (ACA) and zeolite-attapulgite composite adsorbent (ZA) was obtained from Cikon CO.LTD (Changzhou, China). The intrusion data including pore surface area and pore size distribution of the adsorbent was carried out by using