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Abstract: Removal of Cationic Dye from Aqueous Solution by Adsorption on Activated Carbon Developed from *Xanthoxerus Sorbifolia* Bunge Hull

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Key words: *Xanthoxerus sorbifolia* bunge hull; adsorption; methylene blue; isotherm

Abstract: Adsorption of cationic dye, methylene blue (MB) onto *Xanthoxerus Sorbifolia* Bunge hull activated carbon (XSBHAC) developed by zinc chloride solution activation has been investigated. Experiments were carried out as a function of contact time, pH (2.00 and temperature (293, 303, 313 and 323K). Adsorption isotherms were modeled with the Langmuir and Freundlich isotherms. The data fitted well with the Langmuir isotherm. The Langmuir monolayer adsorption capacities of MB adsorbed onto activated carbon were 501.32, 534.54, 588.30 and 593.29mg/g at 293, 303, 313, and 323 K, respectively. The kinetic models were also studied. The rates of adsorption were found to conform to the pseudo second-order kinetics with good correlation. Using the equilibrium concentration constants obtained at different temperatures, various thermodynamic parameters, such as ΔG , ΔH and ΔS , have been calculated. The thermodynamic parameters of system indicated spontaneous and endothermic process.

Introduction

Dyes are colour organic compounds which can colorize the other substances. These substances usually presents in the effluent water of many industries, such as paper, plastics, food, cosmetics, textile, etc. Methylene blue (MB) is selected as a model compound in order to evaluate the capacity of adsorbents for the removal of dye (methylene blue) from its aqueous solutions. Recently numerous approach have been done to develop cheaper and effective adsorbents to remove MB. One of the effective uses of waste biomass in the production of activated carbon. The activated carbon has been produced from variety of biomass such as waste materials (i.e. rice hull [1], peanut hull [2], coconut shells and sawdust [3]).

Xanthoxerus Sorbifolia Bunge usually a tall tree, about 3-6m high, is mainly distributed in Inner Mongolia in China. Its yellow ripe fruit consists of white seed and dark black seed hull (Fig.1). The aim of this study was to evaluate the possibility of *Xanthoxerus Sorbifolia* Bunge hull activated carbon (XSBHAC) for the removal of MB from aqueous solution.



Fig.1-*Xanthoxerus Sorbifolia* Bunge

Experimental

Materials

The *Xanthoxerus Sorbifolia* Bunge's hulls (XSBH) used in the present investigation was obtained from Chifeng city in summer. The XSBH was dried in an oven at 100°C for a period of 24 h, and then ground and screened to get geometrical size 40 mesh. XSBH was developed by zinc chloride solution (50wt%) activation and was mixed at 500°C for 12 h, finally with distilled water to remove residual chemicals until the filtrate became pH=7. The washed sample was dried at 120°C for 24h to prepare the activated carbon. The cationic dye, methylene blue (MB) (C14H18N3SCl) which has a molecular weight of 373.34 was obtained from Tianjin Chemical Co., China with analytical grade that was used without further purification. The stock solutions of MB were prepared in distilled water.

Methods

The adsorption experiments was carried out on a thermostated shaker (SHA-C) operated at 120rpm, 0.05g adsorbent and 50ml MB solution (initial concentration 600mg/l) were used. The

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