



Adsorption of congo red using ethylenediamine modified wheat straw

Zhanwu Wang^{a,b}, Pan Han^{b,c}, Yubin Jiao^b, Dan Ma^b, Chanchan Dou^b, Runping Han^{b*}

^aChina University of Geosciences, No. 388 Lumo Road, Wuhan, 430074, PR China

^bDepartment of Chemistry, Zhengzhou University, No 100 Kexue Road, Zhengzhou, 450001, PR China

Tel.: +8637167781757; Fax: +8637167781556; email: rphan67@zzu.edu.cn

^cCollege of Henan Architectural Professional Technology, No 199 Zhongyuan Road, Zhengzhou 450007, China

Received 5 May 2010; accepted 15 October 2010

ABSTRACT

The natural wheat straw (NWS) was modified by ethylenediamine and the modified wheat straw (MWS) was used as adsorbent for removal of congo red (CR) from aqueous solution. Analysis of FTIR and nitrogen element showed that amino group was introduced to NWS. A batch system was applied to study the behavior of CR adsorption on MWS. Experiments were carried out as function of pH, adsorbent dosage, contact time and dye concentration. The equilibrium adsorption data were analyzed by Langmuir, Freundlich, Redlich–Peterson models and Koble–Corrigan. Redlich–Peterson and Koble–Corrigan models provided the best correlation. The adsorption capacities from Langmuir model were 68.6 mg g^{-1} at 293 K. Adsorption kinetic data were fitted using the pseudo-first-order kinetic model, pseudo-second-order kinetic model, Elovish model and intraparticle diffusion model. The results showed that the Elovish model was best to fit the kinetic process, which suggested that ion exchange was one of main mechanism. The effective diffusion parameter D_i values indicated that the intraparticle diffusion was not the rate-controlling step. The thermodynamics parameters of CR/MWS system indicated the spontaneous and endothermic process. MWS had higher capacity for removal of CR. It was implied that MWS may be suitable as adsorbent material for adsorption of CR from aqueous solutions.

Keywords: Adsorption; Wheat straw; Ethylenediamine; Congo red; FTIR

*Corresponding author