



## Adsorption of methylene blue from aqueous solutions onto sintering process red mud

Luyi Zhang<sup>a</sup>, Huayong Zhang<sup>a,\*</sup>, Yonglan Tian<sup>a</sup>, Zhongshan Chen<sup>a</sup>, Lu Han<sup>b</sup>

<sup>a</sup>Research Center for Ecological Engineering and Nonlinear Science, North China Electric Power University, Beijing 102206, China

Tel./Fax: +86 10 80799258; email: bjecology@gmail.com

<sup>b</sup>Industrial Systems Engineering, University of Regina, 3737 Wascana Parkway, Regina, Saskatchewan S4S 0A2, Canada

Received 27 September 2011; Accepted 6 February 2012

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### ABSTRACT

The adsorption behavior of methylene blue (MB) dye from aqueous solutions onto sintering process red mud (SRM) and its hydrochloric acid-activated product (ASRM) was investigated in a batch system. The results showed that equilibrium was reached after a contact time of 60 min for both adsorbents. The optimum pH for MB adsorption was 10.0 for SRM and 9.0 for ASRM. The removal of the dye increased with increasing initial dye concentration and adsorbent amount, whereas it decreased with increasing ionic strength. The effect of temperature on adsorption was also investigated; the adsorption of MB on SRM and ASRM samples was spontaneous and followed an endothermic process, based on the analysis of thermodynamic parameters, including enthalpy ( $\Delta H$ ), entropy ( $\Delta S$ ), and free energy ( $\Delta G$ ) changes. The adsorption of MB followed pseudo-second-order kinetics, with a coefficient of correlation  $\geq 0.9999$ . The adsorption process was better described by the Langmuir isotherm model than Freundlich model, with a maximum sorption capacity of 51.7 mg/g and 61.8 mg/g for SRM and ASRM, respectively. This study demonstrates that ASRM has superior adsorbing ability for MB than SRM and can be used as an alternative adsorbent in dye removal treatment.

*Keywords:* Sintering process red mud; Acidification; Methylene blue; Adsorption

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\*Corresponding author.