



Contents lists available at ScienceDirect

## Journal of Hazardous Materials

journal homepage: [www.elsevier.com/locate/jhazmat](http://www.elsevier.com/locate/jhazmat)



# Application of zeolite prepared from Egyptian kaolin for the removal of heavy metals: II. Isotherm models

Hanan S. Ibrahim<sup>a</sup>, Tarek S. Jamil<sup>a,\*</sup>, Eman Z. Hegazy<sup>b</sup>

<sup>a</sup> National Research Center, Water Pollution Control Department, Ekbehouth Street 33, Dokki, Cairo 12311, Egypt

<sup>b</sup> King Abdul Aziz University, Chemistry Department, Jeddah, Saudi Arabia

### ARTICLE INFO

#### Article history:

Received 25 May 2010

Accepted 29 June 2010

Available online 23 July 2010

#### Keywords:

Zeolite

Egyptian kaolin

Adsorption isotherms

### ABSTRACT

In this study, the adsorption behavior of zeolites A and X, which are prepared from very cheap local Egyptian clay (kaolin), with respect to  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Cr}^{+2}$ ,  $\text{Ni}^{+2}$  and  $\text{Zn}^{2+}$  has been studied. The batch method has been employed, using metal solutions ranging from 100 to 400 mg/L. The distribution coefficients ( $K_d$ ) and adsorption percent were determined for the adsorption system as a function of sorbate concentration. In the uptake evaluation part of the study, adsorption ratios of metal cations on zeolites A and X match to Langmuir, Freundlich, and Dubinin–Kaganer–Radushkevich (DKR) adsorption isotherm data. Also, every cation exchange capacity for metals has been calculated.

According to the equilibrium studies, the selectivity sequence can be given as  $\text{Pb}^{2+} > \text{Cd}^{2+} > \text{Cu}^{2+} > \text{Zn}^{2+} > \text{Ni}^{2+}$ . It was found that the uptake depend on hydrated ion diameter.

This study may attract more interest due to the presence of large reservoirs of very cheap kaolin in Egypt from which both zeolite types were prepared.