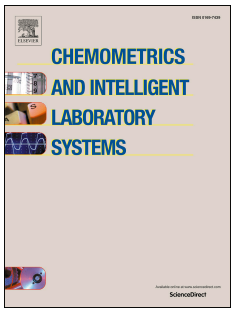
Accepted Manuscript



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O. May Tzuc, A. Bassam, M. Abatal, Y. El Hamzaoui

PII: S0169-7439(17)30604-4

DOI: 10.1016/j.chemolab.2018.02.010

Reference: CHEMOM 3594

To appear in: *Chemometrics and Intelligent Laboratory Systems*

Received Date: 13 September 2017

Revised Date: 18 January 2018

Accepted Date: 21 February 2018

Please cite this article as: O. May Tzuc, A. Bassam, M. Abatal, Y. El Hamzaoui, Multivariate optimization of Pb(II) removal for clinoptilolite-rich tuffs using genetic programming: A computational approach, *Chemometrics and Intelligent Laboratory Systems* (2018), doi: 10.1016/j.chemolab.2018.02.010.

Multivariate optimization of Pb(II) removal for clinoptilolite-rich tuffs using genetic programming: A computational approach

O. May Tzuc[1], A. Bassam[1*], M. Abatal[2], Y. El Hamzaoui[2]

[1]*Facultad de Ingeniería, Universidad Autónoma de Yucatán, Av. Industrias no contaminantes, Mérida, Yucatán, México*

[2]*Facultad de Ingeniería, Universidad Autónoma del Carmen, 24180, Ciudad del Carmen, Campeche, México.*

Abstract

In this study, a genetic programming model was developed to predict and optimize the Pb(II) removal capacity for natural, sodium, and acid-modified clinoptilolite-rich tuffs. Experimental process evaluated the sorption behavior of lead in aqueous solutions using unmodified and modified natural zeolite considering: the contact time, pH value, lead initial concentration, and sorbent dosage. Genetic programming model was trained and tested with the experimental measurements, achieving a fitness of R^2=98%. Sensitivity analysis results showed that the sorbent dosage was the most influential parameter in the process. Based on sensitivity analysis and genetic programming model, a multivariate optimization was conducted to compute the adequate contact time and mass value for a required sorption efficiency. The computational approach presented can perform an assessment with a minimal error. Results indicate that this technique is a promising tool for modeling and optimization of the sorption onto zeolite materials minimizing the time and operation cost. The proposed methodology can be used to take appropriate actions in the removing of this toxic heavy metal from the water. Besides, the computational methodology developed can be implemented in studies corresponding to other sorption processes or similar.

Keywords.- Zeolite materials; sorption process; genetic programming; sensitivity analysis; swarm particle optimization.

*Corresponding author

Email address: baali@correo.uady.mx (A. Bassam)

Preprint submitted to Chemometrics and Intelligent Laboratory Systems *9/13/2017*