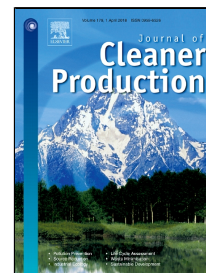


Accepted Manuscript

Experimental and mathematical modeling of Cr(III) sorption in fixed-bed column using modified pine bark

Aline L. Arim, Kévin Neves, Margarida J. Quina, Licínio M. Gando-Ferreira



PII: S0959-6526(18)30406-2
DOI: 10.1016/j.jclepro.2018.02.094
Reference: JCLP 12041
To appear in: *Journal of Cleaner Production*

Received Date: 10 January 2018
Revised Date: 02 February 2018
Accepted Date: 09 February 2018

Please cite this article as: Aline L. Arim, Kévin Neves, Margarida J. Quina, Licínio M. Gando-Ferreira, Experimental and mathematical modeling of Cr(III) sorption in fixed-bed column using modified pine bark, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.02.094

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Experimental and mathematical modeling of Cr(III) sorption in fixed-bed column using modified pine bark

Aline L. Arim^{a,b}, Kévin Neves^a, Margarida J. Quina^a, Licínio M. Gando-Ferreira^{a*}

^a- CIEQPF - Centre of Chemical Processes Engineering and Forest Products, Department of Chemical Engineering, University of Coimbra, Portugal

^b- UNIPAMPA - Federal University of Pampa, Campus Bagé, RS, Brazil

*Corresponding author: lferreira@eq.uc.pt, Tel-351 239798745

Abstract

This work aims to analyse the dynamic behaviour of a fixed-bed column to remove Cr(III) from a synthetic effluent. The adsorbent was prepared by mercerizing pine bark (MPB). The dynamic study of the sorption process was based on the breakthrough curves obtained experimentally and modelled by a mechanistic approach, empirical models and multivariate regression analysis. The experimental results showed that the maximum fraction of saturated bed (FSB) was 0.65 when the inlet concentration was 100 mg/L, the height of the bed (H) 6.5 cm and the superficial velocity (u_0) 14.4×10^{-2} cm/s. The mechanistic model includes equilibrium parameters and the linear driving force (LDF) approach to express the intraparticle mass transport. The prediction of the experimental profiles was very acceptable, and the parameters used are valuable for the further design of fixed-bed column. The fitting through empirical models (Bohard-Adams, Thomas and Yoon-Nelson) are similar or even better than the mechanistic model. Aiming at the optimization of the column operation, a multivariate linear regression model (MRM) was developed based on a full factorial design. Thus, relationships between the variable responses FSB and Δt_{ads} (defined as the difference between the breakthrough time and exhaustion time) and two input variables (H and u_0) were developed. This model was validated and used to predict the optimal operating conditions to maximize FSB (0.65) and minimize Δt_{ads} (133 min). Finally, the regeneration of the adsorbent was assessed using nitric acid. The MPB adsorbent tested demonstrated a good capacity for uptaking Cr(III) from liquid effluents in column configurations.

Keywords: Chromium, biosorption, fixed-bed column, breakthrough curves, full factorial design.

Download English Version:

<https://daneshyari.com/en/article/8097003>

Download Persian Version:

<https://daneshyari.com/article/8097003>

[Daneshyari.com](https://daneshyari.com)