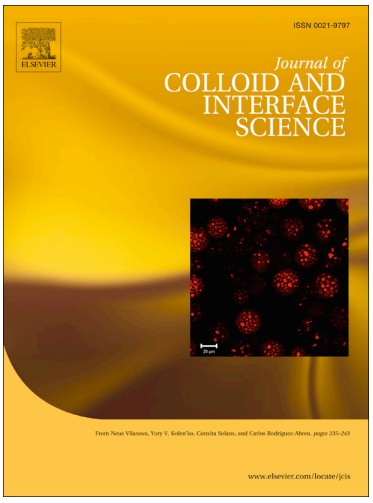

Regular Article

Fixed-Bed Column Performances of Azure-II and Auramine-O Adsorption by *Pinus Eldarica* Stalks Activated Carbon and Its Composite with Zno Nanoparticles: Optimization by Response Surface Methodology Based On Central Composite Design

Maryam Jafari, Mahmood Reza Rahimi, Mehrorang Ghaedi, Hamedreza Javadian, Arash Asfaram

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Maryam Jafari [a], Mahmood Reza Rahimi [a,*], Mehrorang Ghaedi [b,*], Hamedreza Javadian [c], Arash Asfaram [b]

[a] *Process Intensification Laboratory, Chemical Engineering Department, Yasouj University, Yasouj 75918-74831, Iran*
[b] *Department of Chemistry, Yasouj University, Yasouj, 75918-74831, Iran*
[c] *Universitat Politècnica de Catalunya, Department of Chemical Engineering, ETSEIB, Diagonal 647, 08028 Barcelona, Spain*

Abstract

A continuous adsorption was used for removal of azure II (AZ II) and auramine O (AO) from aqueous solutions using *Pinus eldarica* stalks activated carbon (PES-AC) from aqueous solutions. The effects of initial dye concentration, flow rate, bed height and contact time on removal percentage of AO and AZ II were evaluated and optimized by central composite design (CCD) at optimum pH=7.0. ZnO nanoparticles loaded on activated carbon were also used to remove AO and AZ II at pH=7.0 and other optimum conditions. The breakthrough curves were obtained at different flow rates, initial dye concentrations and bed heights and the experimental data were fitted by Thomas, Adams–Bohart and Yoon–Nelson models. The main parameters of fixed-bed column including its adsorption capacity at breakthrough point (q_b), adsorption capacity at saturation point (q_s), mass transfer zone (MTZ), total removal percentage (R%), and empty bed contact time (EBCT) were calculated. The removal percentages calculated for AZ II and AO II were in the range of 51.6-61.1% and 40.6-61.6%, respectively. Bed adsorption capacity (N_0) and critical bed depth (Z_0) were obtained by BDST model.

Keywords: Auramine O; Azure II; Breakthrough curves; Central composite design; Modeling; PES-AC.

1. Introduction

Auramine O (AO) is a yellow cationic dye with solubility in water and ethanol and is extensively used in industries such as paper, textile, leather, and carpet [1-3]. Azure II (AZ II), a cationic metachromatic thiazine dye, is also soluble in water and ethanol [4] and is widely used in coloring cotton and silk [5]. Discharging of industrial wastewater into environment causes several problems for various organisms particularly the generation of carcinogenic, mutagenic, allergenic and toxic hazards; thus, these problems need to be resolved before discharging waste streams into environment [6-8].

* Corresponding authors at: Process Intensification Laboratory, Chemical Engineering Department, Yasouj University, Yasouj 75918-74831, Iran. Tel/Fax: +98-74-33221711. E-mail address: mrrahimi@yu.ac.ir (M. R. Rahimi) and at: Chemistry Department, Yasouj University, Yasouj 75918-74831, Iran. Tel/Fax: +98 74 33223048. E-mail address: m_ghaedi@mail.yu.ac.ir; m_ghaedi@yahoo.com (M. Ghaedi).