



Sequestration of Cu(II) and Ni(II) from wastewater by synthesized zeolitic materials: Equilibrium, kinetics and column dynamics

Bhavna A. Shah^{a,*}, Chirag B. Mistry^a, Ajay V. Shah^b

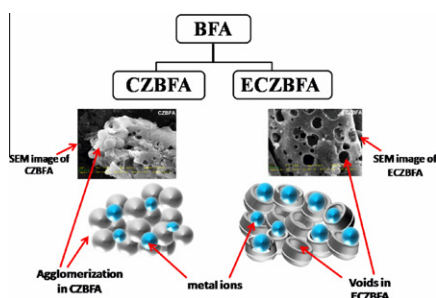
^a Department of Chemistry, Veer Narmad South Gujarat University, Surat 395 007, Gujarat, India

^b Science and Humanities Department, Vidyabharti Polytechnic Trust, Umrakh, Bardoli 394 345, Surat, Gujarat, India

HIGHLIGHTS

- ▶ Bagasse fly ash: an agricultural waste used for synthesis of zeolitic materials.
- ▶ ECZBFA sorbent shows higher uptake capacity for Cu(II) and Ni(II) than CZBFA and BFA.
- ▶ The Langmuir isotherm was found to be best fitted model.
- ▶ The sorption was physisorption and endothermic in nature.
- ▶ Sorption studies by column.

GRAPHICAL ABSTRACT



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ABSTRACT

In the present study, the use of low cost zeolitic materials (CZBFA and ECZBFA) derived from bagasse fly ash (BFA), has been investigated as a substitute of expensive methods for the sequestration of Cu(II) and Ni(II). The BFA and zeolitic sorbents were well characterized by XRF, FTIR, PXRD, and SEM instrumental methods, which proves the chemical constituents, functional groups and morphology of the sorbents. The metal sorption capacities of synthesized zeolitic and native material were determined by batch and column studies. The batch sorption studies were carried out by different operational parameters and optimize it to get maximum sorption capacities. The monolayer sorption capacities of ECZBFA calculated from Langmuir isotherm was 93.72 mg g^{-1} and 91.17 mg g^{-1} for Cu(II) and Ni(II) respectively. The equilibrium data are in a superior way fitted by Langmuir isotherm than that of Freundlich, Dubinin–Radushkevich and Temkin isotherms. Different thermodynamic parameters were evaluated and it was found that the sorption was spontaneous and endothermic in nature. Kinetic studies have been performed to understand the mechanism of sorption and pseudo-second-order kinetic model better fitted the data. The breakthrough capacities found for Cu(II) and Ni(II) sorbates are 43.15 mg g^{-1} and 49.10 mg g^{-1} respectively on ECZBFA during column operation.

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1. Introduction

The augmented alertness is now necessary due to harmful effects of heavy metals on human health, living organism and especially on environment over past few decades [1,2]. There are many industries such as electroplating, mining operation and tanners, photography industries, mining and metallurgical

engineering, nuclear power operations, battery manufacturing, leather and steel industries has led to a significant accession of heavy metal pollutants into the environmental body [1]. Heavy metals such as lead, cadmium, copper, nickel, chromium, zinc and mercury or their compounds have been recognized as hazardous pollutants [1].

Copper and nickel are of particular interest because of their toxicity and extensive use in the various industrial application purposes. Large amounts of copper bearing waste are formed through electronic equipments and components, chemical and mechanical

* Corresponding author. Tel.: +91 98255 46020; fax: +91 02622 225458.

E-mail address: bhavna606@gmail.com (B.A. Shah).