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Adsorption of aluminum(III) from aqueous solution using chemically modified sugarcane bagasse

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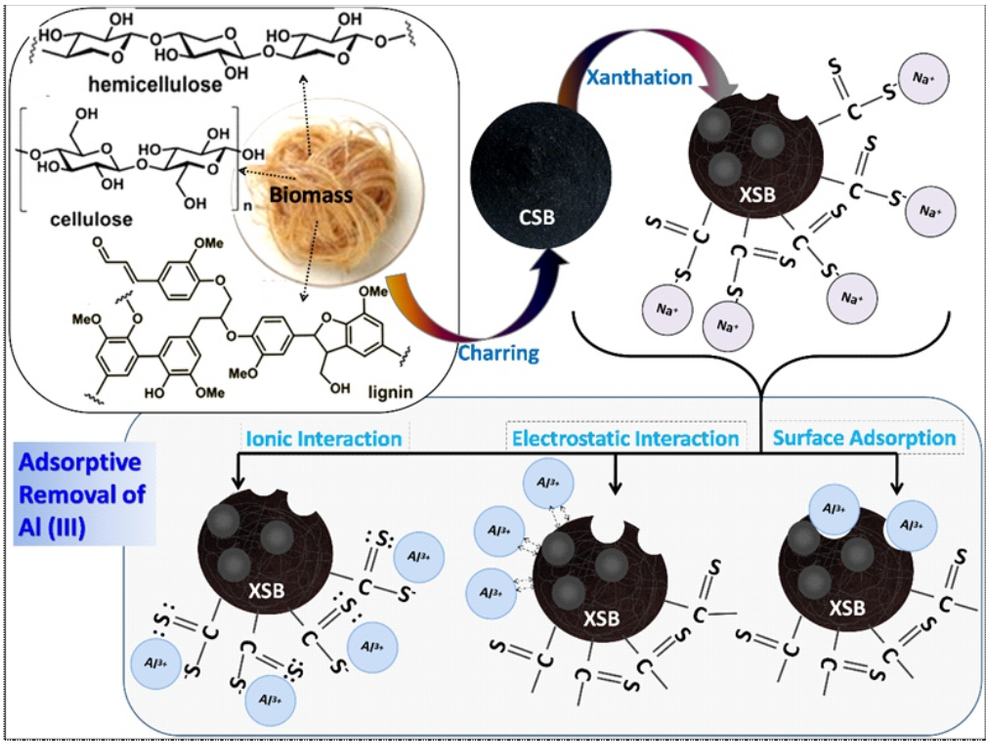
- Charred and xanthated sugarcane bagasse were prepared by chemical modification
- Ion exchange and complexation of Al(III) onto xanthate in XSB drive adsorption
- Langmuir adsorption model revealed monolayer and chemisorption nature
- XSB and CSB exhibited uptake capacity with 83.33 mg/g and 52.83 mg/g at pH 4

Graphical abstract



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Abstract

The primary goal of this study is to prepare charred sugarcane bagasse (CSB) and xanthated sugarcane bagasse (XSB) for the effective removal of Al(III) from contaminated water. The adsorbents were characterized using Field-emission scanning electron microscopy (FE-SEM), energy dispersive x-ray spectroscopy (EDS), and Fourier transform infra-red (FTIR) spectroscopy analysis. The effects of pH, concentration, and contact time were investigated using a batch adsorption model. The percentage removal of Al(III) by charred sugarcane bagasse (CSB) and xanthated sugarcane bagasse (XSB) were found to be 73.83% and 97.72%, respectively, at pH 4. The Langmuir isotherm model is best fitted since the R^2 value is close to unity, and the maximum biosorption capacities of CSB and XSB were determined to be 53.83 mg/g and 83.33 mg/g. The pseudo-second-order kinetic model best fits the experimental data having highest value of correlation coefficient and the adsorption equilibrium was attained in 120 minutes. These findings show that XSB is found to be more efficient bioadsorbent in comparison to other bio-sorbents for the elimination of Al(III) from aqueous solution.

Keywords: Xanthated; Charred; Sugarcane bagasse; Aluminum; Isotherm.

Abbreviation: ATR: Attenuated Total Reflectance, CSB: Charred Sugarcane Bagasse, XSB: Xanthated Sugarcane Bagasse.