

Studies in the Removal of Anionic Dye (Bromocresol Purple) From Acidic Solution Using Chemically Crosslinked Chitosan Beads

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Abstract

Chitosan was prepared by deacetylation of chitin from giant snail shells. The chitosan was used to prepare glutaraldehyde chitosan beads with varying degrees of crosslinking densities of 0.8 and 0.4. These materials including the uncrosslinked chitosan were applied for the removal of anionic dye, bromocresol purple from aqueous solution at pH 4. The adsorption capacity of these materials depended on adsorbent (dye) dosage, contact time, crosslink densities and pH. FTIR analysis of this material was also carried out. The result obtained from the adsorption showed that chitosan removed 91.20%, glutaraldehyde chitosan 0.8 and 0.4 removed 71.64% and 53.30% of the dye respectively. The percentage removal of the dye was of the order: chitosan > glutaraldehyde chitosan 0.8 > glutaraldehyde chitosan 0.4. FTIR reveals that the uncrosslinked chitosan shows a band at 3480cm^{-1} which is due to the OH stretching and the band at 1632cm^{-1} which is assigned for the NH bending of the amino group NH_2 . The absorption of Glutaraldehyde chitosan at 2387.19cm^{-1} and 2352.7cm^{-1} are due to NH_3^+ stretching and the absorption at 1409cm^{-1} represent the -CH bending of $-\text{CH}_2$ in glutaraldehyde. The absorption at 1604cm^{-1} for glutaraldehyde chitosan is owing to $(\text{CH}_2)_3\text{HC}=\text{N}$ - stretching which is a characteristic absorption for Chitosan crosslinking with glutaraldehyde as a result of the reaction of glutaraldehyde with NH_2 group in chitosan to form a crosslink. Results obtained were evaluated with the use of adsorption isotherms – Langmuir and freundlich adsorption isotherm. The chitosan data fitted best with the Langmuir model while the glutaraldehyde chitosan 0.8 and 0.4 data fitted best with the freundlich model, these were predicted by the highest correlation coefficient- R^2 value. The R^2 value are regarded as a measure of the best fit of experimental data on the isotherm model. This indicates that adsorption of chitosan proved uptake onto homogenous adsorbent surface while that of glutaraldehyde chitosan proved uptake onto heterogeneous adsorbent surfaces.

Keywords: Chitosan, Glutaraldehyde chitosan, Anionic dye, adsorption isotherm; Langmuir and freundlich isotherm

1.0 Introduction

Chitosan is a nitrogenous polysaccharide that is made up of acetylglucosamine units. This polymer has the basic chemical structure: β -(1-4)-2-acetamido-2-deoxy-D-glucose unit which is the main alkaline deacetylation product of chitin [1]. Chitosan is a non-toxic, biodegradable and biocompatible polymer which has very interesting physical and mechanical properties [2]. It is currently being explored intensively for its application in several fields such as pharmacy, biomedicine, agriculture, food industry and biotechnology [2]. However, since the vast majority of chitosan samples are only soluble in acid media due to the molecular weight of this polymer, its applications are limited. In order to influence chitosan solubility in physiological media, improve its physical and mechanical properties and widen its applications, chitosan derivatives had been synthesized [2]. The development of new applications for chitosan and its

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