Extended Abstract

Journal of Biopolymers Research

2019

Vol.3 Issue.2

Adsorption of Cu (II) ions from aqueous solution using pyridine-2,6- Di carboxylic acid cross-linked chitosan as a green biopolymer adsorbent.

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Abstract

In this study, Cross linked Chitosan (CCS) has been synthesized by anchoring a bi-functional Ligand, namely Pyridine-2,6-Dicarboxylic acid (PDC) with chitosan through ion exchange. The functionalized biopolymer was characterized by elemental analysis (CHN), spectral (UV visible, FTIR and solid state 13C NMR), thermal (TGA and DSC), structural (powder XRD), surface and morphological (BET and SEM) analyses. The PDC-CCS was employed to adsorb Cu(II) ion from aqueous solutions. The influences of various operating parameters such as PH, temperature, initial concentration of Cu (II) ion and contact time on the adsorption capacity of PDC-CCS have been investigated. The results showed that the maximum adsorption capacity of PDC-CCS for Cu (II) ion was 2185.64 mmolg-1 and that the adsorption capacity rapidly reached equilibrium within 60 min and strongly depends on PH and temperature. Langmuir and Freundlich adsorption models have been applied to describe the equilibrium data. It was shown that the PDC-CCS had given good correlation with both isotherm models and the adsorption kinetics of Cu (II) ion could be best described by the pseudo-second-order kinetic model.

Keywords

Glycan; ABO Blood Group; Clustered Saccharide Patches; ABO Antigens; Glycotopes; Food Antigens; Glycobiology; Lipid Rafts

INTRODUCTION

Many transition and heavy metal cations play an active role in a great number of biological processes, being components of several vitamins and drugs. Pyridinedicarboxylic acids and their derivatives belong to an interesting series of compounds with biological applications [1]. Pyridine-2,6-dicarboxylic acid (dipicolinic acid) is present in nature as an oxidative degradation product of vitamins, coenzymes, and alkaloids and is a component of fulvic acids. It has frequently been cited in the literature as a plant-sterilizing and water-germicidal agent, and an antioxidant for ascorbic acids in foods [2]. Pyridine-2,6-dicarboxylic acid is almost unique to bacterial spores and may constitute as much as 15% of their weight [3]. Pyridine-2,6-dicarboxylic acid is a desirable metal ion ligand because of its low toxicity and amphophilic nature. Pyridine3-carboxylic acid (commonly known as niacin or vitamin B3), which is closely related to pyridine2,6-dicarboxylic acid, is a precursor for the coenzyme NAD and is required in the human diet. Pyridine-2,6-dicarboxylic acid is furthermore related to pyridine-2,3-dicarboxylic acid (quinolinic acid), which also is an intermediate in the tryptophan degradation pathway and is a precursor of NAD [4].

RESULTS AND DISCUSSION

The quasi-reversible, diffusion-controlled (limiting current temperature coefficient values are in the range 1.1–1.4%/deg, and the dependencies of the limiting current on the square root of the mercury column height are linear) polarographic waves of Cu(II), Pb(II), and Cd(II) reduction in the presence of pyridine-2,6-dicarboxylic acid are observed in the wide pH range from 1.5 to 12.0 (Table 3) and allow calculations of the reversible half-wave potential Er 1/2 and, subsequently, the equilibrium characteristics of the systems under investigation.

Conclusion

In solutions with excess of ligand, Cu(II), Pb(II), and Cd(II) form 1:2 complexes with the tridentate dianion of pyridine-2,6-dicarboxylic acid (dipic2−) from weak acids to alkaline solutions. The values of log β2 for Cu(II), Pb(II), and Cd(II) are 16.1, 11.8, and 11.0, respectively. Tenfold excess of pyridine-2,6-dicarboxylic acid reduces the concentration of free Cu(II), Pb(II), and Cd(II) ions from 1 to 11 orders in magnitude, depending on pH and stability constant of the complex formed. The values of the diffusion coefficients for Cu(dipic)2− 2 , Pb(dipic)2− 2 , and Cd(dipic)2− 2 are equal to 5.4 × 10−6, 5.2 × 10−6, and 7.1 × 10−6 cm2 s−1 , respectively.

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