NANOCELLULOSE-BASED ADSORBENT FROM PANDAN LEAVES FOR COPPER IONS REMOVAL FROM WASTEWATER

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Pemilihan sorben pepejal yang baik adalah salah satu masalah terbesar dalam teknik penjerapan dalam penghapusan logam berat. Projek ini menyiasat potensi nanoselulosa yang diperoleh daripada daun pandan sebagai penjerap untuk penyingkiran Kuprum (II) daripada air sisa sintetik. Pengekstrakan nanoselulosa dilakukan dengan menjalankan pra-rawatan kimia dan kaedah hidrolisis asid sulfurik sebelum cantuman dengan akrilamida monomer vinil. Pengimbas mikroskop elektron (SEM), spektroskopi jelmaan inframerah Fourier (FTIR), dan belauan sinar X (XRD) digunakan untuk menilai morfologi dan kefungsian permukaan penjerap, serta kehablurannya. Penyingkiran ion Kuprum (II) telah diperhatikan menggunakan spektrometer serapan atom (AAS), di mana tiga parameter variasi pH, kepekatan awal, dan dos penjerap dikaji sewajarnya. Kelakuan penjerapan Kuprum (II) pada permukaan nanoselulosa dan nanoselulosa yang dicantum telah dinilai menggunakan isoterma model Langmuir dan Freundlich. Keadaan optimum untuk penyingkiran logam didapati pada pH 6, kepekatan logam awal 30 ppm dan dos penjerap 2.2 g/L. Keputusan menunjukkan kapasiti penjerapan maksimum untuk nanoselulosa yang tidak dicantumkan dan dicantumkan adalah masing-masing pada 8.19 mg/g dan 15.22 mg/g. Berdasarkan keputusan, nanoselulosa daripada daun Pandan yang dicantumkan dengan monomer akrilamida menunjukkan prestasi penyingkiran ion Kuprum (II) yang lebih tinggi berbanding sampel yang tidak dicantumkan. Beberapa cadangan untuk kajian lanjut telah dibuat seperti menguji nanoselulosa cantuman yang dibangunkan dalam penyingkiran logam binari, menjalankan kajian dalam penjerapan lajur dan kajian penjanaan semula penjerap berasaskan nanoselulosa.

ABSTRACT

A good selection of solid sorbent is one of the greatest problems in adsorption techniques in elimination of heavy metals. This project investigated the potential of nanocellulose sourced from pandan leaves as an adsorbent for Copper (II) ions removal from synthetic wastewater. Nanocellulose extraction was performed by carrying out chemical pre-treatments and sulphuric acid hydrolysis method before grafting with vinyl monomer acrylamide at grafting duration of 60 minutes and initiator ceric ammonium nitrate (CAN) amount of 0.7g. Scanning electron microscope (SEM), Fourier Transform Infrared (FTIR) spectroscopy, and X-Ray Diffractor (XRD) were employed to evaluate the morphology and functionality of the adsorbent surface, as well as its crystallinity. The removal of Copper (II) ions was observed using an atomic absorption spectrometer (AAS), in which the three parameters of pH variation, initial concentration, and adsorbent dosage were studied accordingly. Adsorption behavior of Copper (II) ions onto surface of nanocellulose and grafted nanocellulose were evaluated using Langmuir and Freundlich model isotherm. The optimal conditions for metal removal were determined to be at pH 6, with an initial metal concentration of 30 ppm and an adsorbent dosage of 2.2 g/L. The results demonstrated a maximum adsorption capacity of 8.19 mg/g for ungrafted nanocellulose and 15.22 mg/g for grafted nanocellulose. Based on the result, nanocellulose derived from Pandan leaves grafted with acrylamide monomer showed higher removal performance of Copper (II) ions compared to ungrafted sample. Several recommendations for further study were made such as testing the developed grafted nanocellulose in binary metal removal, conducting the study in column adsorption and regeneration studies of the nanocellulose-based adsorbent.

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