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Biosorption of heavy metal by immobilized and dead fungal cells: A comparative assessment

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Heavy metal concentrations in soil treated with industrial wastewater of Gwalior (M.P), India were determined. The analysis of test samples revealed high levels of Cu. An A.lentulus and four bacterial spp. were isolated from sample and were characterized on the basis of morphological, cultural and biochemical characteristics. MICs of Cu (II) for each isolate were determined. All the strains isolated from sample harbored resistance to copper. Heavy metal resistant fungi were isolated from an electroplating industrial effluent samples that uses copper for plating. These isolates were tested to evaluate their applicability for heavy metal removal from industrial wastewaters. Initially the physico- chemical parameters of the sample were analyzed. The optimum condition of pH, biomass concentration and heavy metal concentration were determine for microbial growth on biosorbents and correlated with heavy metal removal. The observed condition was applied for the biosorption process in immobilized and dead fungal cells. The biosorption of immobilized cells of A. lentulus was 89% of Cu whereas the dead cells of A. lentulus were 74%. Experimental results reveal that all the immobilized isolates have potential application for the removal of Cu2+ from industrial wastewater than the dead fungal cells. On to the surfaces of immobilized biomass were performed static and dynamic adsorption studies of Cu2+ ions at fixed pH and ionic strength of the aqueous metal ion solutions. The adsorption data were applied to Langmuir and Freundlich isotherm equations and various static parameters were calculated. The dynamic nature of adsorption was quantified in terms of several kinetic constants such as rate constants for adsorption.

Keywords: Heavy metal, fungal sorption, optimization, dead fungal cells, immobilization.

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Immobilization of biomolecules from aqueous solution by carbon micro and carbon nanofiber

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Immobilization of biomolecules on carbon support has many applications, for example, in the development of biocatalyst and biosensor, and wastewater treatment. In this study, the phenolic resin precursor based carbon activated fibers (ACFs) and carbon nanofibers (CNFs) were used for the immobilization of a number of biomolecules such as glucose oxidase (GOx), bovine serum albumin (BSA), and YQEH, a laboratory synthesized protein. These biomolecules used for the adsorption study had different structures, isoelectric points (IP) and number of amino acids. CNFs were prepared by impregnating ACFs with nickel nitrate using anionic SDS surfactant to achieve the mono dispersion of Ni ions in solutions followed by calcinations, reduction and catalytic chemical vapor deposition (CVD) using benzene (C_6H_6) as a carbon-source. The metal particles on the tip of CNFs were removed by ultra-sonication in acidic medium to open up the tips and provide increased number of sites for adsorption. The prepared materials were directly used as adsorbents for biomolecules, with no further post-treatment required. The prepared ACFs and CNFs were characterized by several analytical techniques such as atomic absorption spectroscopy (AAS), scanning electron microscopy (SEM), transmission electron microscopy (TEM), Fourier transform infrared (FTIR), BET surface area and pores-size distribution (PSD) analyzers. The adsorption capacities of the prepared materials in this study were found to be 32 mg/g for GOx, 103 mg/g for BSA, and 38 mg/g for YQEH. These data reveal that the prepared ACFs and CNFs are potential adsorbents for biomolecules.

Keywords: Activated carbon fibers, carbon nanofibers, surfactant, immobilization, adsorption, protein.

Biography

Shiv Singh is pursuing his Ph.D. from Indian Institute of Technology Kanpur in Chemical Engineering. He has published 3 international papers and 3 national papers in reputed journals. He has written one international book related with Environmental science and engineering.

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