

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 (C₆H₆) 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

Nishith Verma has PhD in chemical engineering from the University of Arizona, USA. After completing his Ph.D., he worked for three years with BOC Gases in New Jersey, USA before joining Indian Institute of Technology Kanpur in 1998. He is presently the head of the chemical engineering department and coordinator of Center for Environmental Science and Engineering at IIT Kanpur. He has published more than 60 papers in reputed international journals and holds three patents. His research interests are in adsorption, carbon nanofibers and nanoparticles, environmental remediation, and transport modeling.

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