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Polymer composites and supported silver nanoparticles for environmental remediation and catalytic reduction processes

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Biopolymer composites composed of chitosan and polyaniline were prepared for use as adsorbents and as supports for silver-based nanoparticles (Ag-NPs). The free and polymer supported Ag-NPs were structurally characterized using a range of methods such as Fourier transform infrared (FTIR) and NMR spectroscopy, X-ray diffraction (XRD), transmission electron microscopy (TEM), thermal analysis and dye adsorption in aqueous solution. The adsorption properties of the chitosan-polyaniline composites revealed unique structural and adsorption properties with methylene blue according to the relative composition of each component. Composites in the presence and absence of Ag-NPs were evaluated using a dye-based method with a cationic dye (methylene blue) to assess the textural properties and surface accessibility of active adsorption sites of these materials. The catalytic properties of the supported Ag-NPs were studied by examining the catalytic reduction of 4-nitrophenol in the presence of sodium borohydride. A systematic study of the adsorption properties and reaction kinetics was carried out to provide a detailed molecular-level understanding of catalytic pathway for the reduction of 4-nitrophenol to 4-aminophenol in the presence of biopolymer composites containing Ag NPs.

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