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Development of an antibody functionalized carbon nanotube biosensor for food borne bacterial pathogens

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With increasing reports on bioterrorism and other bio-threats, rapid and real time detection methods for various pathogens are warranted. Attempts have been made to improve electrochemical biosensor performance by incorporating carbon nanotubes (CNTs). The high surface area of CNTs allows both immobilization of antibodies and electrochemical measurements. Polyclonal anti-*Salmonella* antibodies are covalently attached onto CNTs by using diimide activated imidation coupling. CNTs functionalized with antibodies are immobilized onto glassy carbon electrode and the presence of pathogen has been detected by studying the changes in charge transfer resistance and impedance, before and after the formation of antigen-antibody complex. CNTs behave as molecular wires allowing electrical communication between the underlying electrode and the conjugated antigen-antibody complex. Nyquist plots and cyclic voltammograms have been studied and comparisons have been made between glassy carbon electrodes as working-electrode by itself, electrodes immobilized with antibodies and after the formation of antigen-antibody complex. Cyclic voltammeter experiments had a potential scan rate of 100 mVs-1, step height of 1.0 mV and applied potential for -1.0 V to 1.0 V. The electrochemical impedance experiments applied a frequency range of 100 kHz -100 mHz with an AC sine wave amplitude of 10 mV. Amplification in the current density has been observed for CNTs immobilized on the electrode surface and decrease in current density and increased impedance takes place after the antigens binds with antibodies. This technique could be an effective way to sense the formation of antigen-antibody complexes, with the potential to make the detection process rapid as compared to conventional pathogen detection methods.

Biography

Sapna Jain is working as postdoctoral research fellow in the Center for NanoBiotechnology Research, Alabama State University. She received her Ph.D from Indian Institute of Technology, New Delhi, India. She has worked in the area of renewable energy involving catalytic hydrogen production for fuel cells application using steam reforming and partial oxidation of biomass material. Currently she is involved in the evaluation of antibacterial effects of silver-coated carbon nanotubes using ultrastructure, molecular and proteomics studies and also working towards developing rapid pathogen detection techniques using electrochemical impedance spectroscopy.

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