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Wallace H. Coulter Foundation
Biomedical Engineering Seminar Series

DR. SUSAN ZHOU is an associate professor at the Department of Chemical Engineering at Worecester Polytechnic Institute (WPI). Dr. Zhou directs the Microfluidics and Biosensors Lab at WPI. Dr. Zhou is an expert in the area of microfabrication and nano-technology for biomedical, energy, and environmental applications, with emphases on microfluidics and biosensors, biomaterials for neuron regenerations, and nanomaterials for drug delivery applications.

Other achieved researches also include C-MEMS platforms for neuron regeneration and carbon dots for brain tumor imaging.

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Sensor Systems for Infectious Disease

ABSTRACT: Clostridium difficile is a frequent cause of infectious colitis, usually occurring as a complication of antibiotic therapy, in elderly hospitalized patients. The diagnosis of C. difficile infection still remains a challenge. Searching for a selective and specific technique for determination of its level in biological samples is crucial for regular clinical tests. The current diagnostic modalities mainly consist of the detection of the C. difficile organisms and of their toxins in fecal samples. However, these methods are often time consuming and require sophisticated equipment. With recent advances in nanotechnology, various nanoparticles in different structures, shapes and composites provide good potential for their application in diagnostics and therapy. Nowadays, electrochemical biosensors based on nanoparticles have attracted extensive interest for sensing the formation of antigen–antibody, because of their fast and precise response, high sensitivity and simple pre-treatment procedures. We applied both bottom-up and top-down approach to develop electrochemical sensor for detecting clostridium difficile toxins. Initially capture antibody was immobilized on gold electrode using conventional amine coupling chemistry. After clostridium difficile toxins were attached on the capture antibody, gold nanoparticle labeled detect antibody as the amplifying probe was used to optimize the immunosensing performance by a sandwich immunoassay. In an alternating approach, A polyurethane (PU) nanospiked gold electrode-based label-free electrochemical immunosensor for Clostridium difficile (C. difficile) toxin B detection was developed. Different from nanomaterials-modified electrode, the PU nanospiked gold electrode was fricated by soft lithography directly. The morphology of the nanospiked electrode was characterized by scanning electron microscope (SEM), and its good electrochemical performance was demonstrated by cyclic voltammetry (CV) as well as differential pulse voltammetry (DPV). Then, the PU nanospiked gold electrode-based immunosensor was developed by fixing anti-toxin B single domain antibody on the electrode surface as the receptor. DPV was used as a detection technology for C. difficile toxin B detection. It revealed that the immunosensor has good specificity, repeatability, and stability. Even in a label-free style, the limit of detection for toxin B was 0.5 pg/mL. With the increase of the concentration of toxin B from 1 pg/mL to 130 pg/mL, a linear relationship was observed between the peak current and toxin concentration. Compared with flat PU electrode-based immunosensor, the detection signal of PU nanospiked gold electrode-based immunosensor was amplified about 6 times. Benefitted from its low cost and simple processing, the PU nanospiked gold electrode-based immunosensor can be used a disposable electrochemical sensor for toxin B rapid detection.

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Through the generous support of the Wallace H. Coulter Foundation the Department of Biomedical Engineering facilitates weekly lectures each year during academic terms. Experts in all areas of Biomedical Engineering are invited to campus to provide a research seminar and to meet with faculty and students and to tour our academic and research facilities.

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9:00AM-10:00AM Room EC 2300