Selective Adhesion to Protein-Coated Surfaces for Bacterial Cell Enrichment and Separation

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Detection of foodborne and environmental pathogens is becoming increasingly imperative for the maintenance of public health. Rapid detection of these detrimental bacteria may be greatly facilitated by initial enrichment of these contaminants from a larger population of background microflora. The purpose of this project was to develop a novel, inexpensive device consisting of bacterial cells placed directly between protein-coated and blank polydimethylsiloxane (PDMS) surfaces to separate bacterial cells based on their unique adhesive properties (as determined by their surface proteins). Preliminary tests focused on optimizing the protein-PDMS adsorption process, and it was found that fibronectin most effectively adsorbed to plasma-treated PDMS surfaces. Devices were then constructed by: (1) cutting out small circular PDMS surfaces, (2) adsorbing fibronectin overnight to some plasma-treated surfaces, and (3) placing Staphylococcus epidermidis bacteria between combinations of one fibronectin-coated surface and one blank surface. After incubating the bacteria between the surfaces for an hour, each surface was separated and stained to determine the presence and viability of bacteria. Examination of surfaces under a fluorescence microscope indicated that devices with a fibronectin top and blank bottom were highly effective in causing S. epidermidis to adhere to the fibronectin top and thus separate. This project has demonstrated the capability of this relative adhesion platform to effectively enable bacterial transfer to an introduced surface. Upon fine-tuning of these adhesive molecules, this concept holds great potential for the enrichment and separation of target microorganisms based on their unique adhesive signatures.

Awards Won:
Fourth Award of $500