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Transport and Reactions in Microfluidic Immunosensors

Siddhartha Panda *

Department of Chemical Engineering, IIT Kanpur, Kanpur-208016, India

Address for Correspondence: Siddhartha Panda; spanda@iitk.ac.in

ABSTRACT: There is a growing interest on microfluidic immunosensors for use as point-of-care diagnostic devices. In typical microfluidic immunosensors, the channel walls are functionalized with antibodies through intermediate linker molecules. The carrier fluid containing the antigens flows through the channels, and the antigens diffuse to the walls as the carrier fluid is convected along the channel. This diffusional transport is critical to enable maximum possible capture of the antigens to effect lower detection limits. The diffusion is governed by the velocity profile, which in turn is governed by the interaction of the carrier fluid molecules with the surface antibodies. This interplay of the coupled phenomena affecting the capture efficiencies, which is an important aspect in the design of microfluidic immunosensors, will be the main theme of the talk. Some experimental results will be presented. Surface engineering (physical and chemical) was used to study the factors affecting these energies (substrates and underlying stack of self assembled linker molecules) and significant tunability of the energies of the surface antibodies was achieved. The effects of the surface engineering on the fluid flow characteristics in pressure driven antibody-functionalized silicon microchannels, and the molecular capture will be highlighted. This knowledge can be utilized to design more efficient microfluidic immunosensors.

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