[Scdt] PhD Open Seminar

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Date 2021-11-28 09:35
Priority Normal

Department of Chemical Engineering
Indian Institute of Technology Kanpur

Ms. Vidisha Singh Rathaur (16102282) will deliver her Open Seminar as per the following schedule:

Date: Nov 29, 2021
Time: 9 AM
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Time: Nov 29, 2021 09:00 AM India

Join Zoom Meeting
https://iitk-ac-in.zoom.us/j/96028564676?pwd=T0JSNEY3R3lBTm1NeWtHZXNxb3hoQT09

Meeting ID: 960 2856 4676
Passcode: 391765
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Title:
Effect of different parameters on antibody-antigen binding in sessile droplets and the resultant deposition patterns

Abstract:
Evaporation of antigen laden sessile droplets on antibody immobilized PDMS substrates could be used in place of microwells for detection purposes owing to lesser requirement of analyte and reduced reaction time. To develop such techniques, the effects of different parameters on the reaction efficiency and on the resulting deposition patterns of antigens on the surface after evaporation need to well understood. While the resultant deposition patterns from evaporation of droplets of biological fluids on surfaces are being studied for various biomedical applications, systems where the analyte of interest in the droplet binds to the surface have not been investigated.
The first study reports detailed experimental and theoretical analysis of the effect of antibody (anti-PSA IgG)-antigen (PSA) binding on the internal convection within an evaporating sessile droplet. DLVO analysis was done to get an insight into the different forces that act on the particles and which forces actually govern the flow process and lead to the formation of specific deposition patterns. Marangoni convection was found to be particularly dominant (Ma>106 for all sets) in droplets with antibody-antigen surface reaction and its strength increased as the PSA concentration was increased. The force analysis revealed that the particle-substrate DLVO and surface tension forces were dominant and it was the interplay of these two forces and Marangoni forces that led to the final deposition patterns that were observed in droplets containing microspheres -PSA and microsphere-microsphere1.

The second study reports effect of non-ionic surfactant in droplets containing prostate specific antigen (protein) and polystyrene latex (colloid) on anti-PSA IgG immobilized PDMS, by varying the concentration of Tween-20 in the buffer. Non-ionic surfactants are used extensively in formulations containing proteins (antigens and antibodies) as they stabilize proteins by (a) their preferential adsorption at the interfaces and (b) by formation of complexes with proteins which prevents protein aggregation and interaction with surfaces. This property of non-ionic surfactants can be used in sessile droplets acting as micro-reactors for antibody-antigen binding reactions.

The third study is on the effect of changes in the buffer pH on the capture efficiency of antigens by antibodies and the effect of pH change on deposition patterns. The surface charges present on the antigens vary according to the pH of the buffer and tuning the buffer pH such that the electro-migration of antigens towards the antibodies is increased has shown to increase the capture efficiency in both single and multiple analyte systems. Formation of coffee ring poses an obstacle in several applications such as bioassays, inkjet printing, and cell patterning. For biosensors it is desired to have a uniform deposition of analytes on the substrate for better detection. Various studies have been conducted on how varying the pH of the medium in sessile droplets can be exploited to tune from ring like to homogeneous deposition patterns. Extended DLVO (XDLVO) force analysis between the particles (PSA and polystyrene microspheres) and substrate (PDMS) are done to obtain potential energy versus distance plots for the different pH used in this study.

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All interested are invited to attend.

With best wishes,

Siddhartha Panda
(Thesis Supervisor)

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