Department of Chemical Engineering, IIT Kanpur

SEMINAR

Speaker: Dr. Amit Kumar Dutta, NIST, USA

Topic : Macromolecule at Solid-Liquid Interfaces

Date : Thursday 23rd February 2012

Place : L-4

Time : 16:00 to 17:00

All are welcome

Tea will be served at 15:45 near L- 4

Abstract:

Engineering a surface for desired properties is very important for many

industrial and medical applications. The rational design of a surface

requires fundamental understanding of the interactions between

macromolecules and solid-liquid interfaces. The mechanical properties of

an adsorbed layer are important factors for assessing the behavior of

surfaces. The goals of the research described here are (i) to develop a

new method to study protein cross-liking, (ii) to control the rheological

properties of a surface for use as a biosensor. Increasing the stability

of proteins and polypeptides via cross-linking is commonly used to

minimize bio-fouling and to increase the life time of enzymes. Determining

the extent of cross-linking, using say glutaraldehyde, is often

accomplished by noting changes in viscosity that require large amounts of

sample at high concentration. Here, we have implemented a highly sensitive

quartz crystal microbalance with dissipation (QCM-D) technique to address

this limitation. On the other hand, to use a surface for sensor

applications, we should be able to control its physico-chemical

properties. We have developed a counter-ion responsive-poly(L-lysin)

(PLL)-based surface, the viscoelastic properties of which can be

reversibly controlled. In principle, this controllable PLL molecule could

be used as an ionic gate for drug delivery.

The second part of my presentation will be on development of a surface

plasmon resonance (SPR) based method to analyze glycosylation of

monoclonal antibody. Current analytical methods for characterizing

glycosylation such as high performance liquid chromatography and mass

spectrometry are capable of rigorously determining composition, sequence,

linkage, and stereoisomerism of glycans. Although powerful techniques,

they are time consuming and require considerable expertise. In this work,

lectins were immobilized on a self assembled monolayer (SAM) of

HS-(CH2)11-(OCH2CH2)6-OCH2-COOH and the interactions between lectins,

concanavalin A (ConA), wheat germ agglutinin (WGA), peanut agglutinin

(PNA), and rituximab were analyzed using SPR. We found that covalent

attachment of ConA to the SAM first followed by adsorption of rituximab

results in reversible binding. In contrast, covalent attachment of

rituximab first, followed by adsorption of ConA resulted in irreversible

adsorption of ConA.

In summary, we have focused our attention on macromolecules at

solid-liquid interfaces and measured the protein/polypeptide-surface

interactions in order to engineer surfaces with particular properties for

specific applications.

About the Speaker

Dr. Amit Kumar Dutta is a NRC postdoctoral research associate at National

Institute of Standards & Technology, Maryland, US since June’10. He

obtained his Master’s Degree from IITD (2004) in Process Engineering and

Design and went on to join Rensselaer Polytechnic Institute, New York for

his PhD where he worked on macromolecule behavior at solid-liquid

interfaces, which he completed in 2010. His main areas of research are

Biophysics and Biosensors.