INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Physicochemical interactions of proteins with surfaces mediate the interactions between implant and biological system. Surface chemistry of implants is crucial as it regulates such events at interfaces. The objective of this thesis was to explore the performances of the modified surfaces for such interactions relevant to various biomedical applications. The entire thesis has been divided into five main sections. The first section deals with surface modification via silanization and their in-depth characterization using high end techniques. With the wide range of surface wettability, we aimed to study serum proteins (BSA, FB, and IgG) behavior (i.e. conformations changes and their packing) during protein adsorption from single and binary solutions, which are comprised in the second section of this thesis. The change in surface functionalities resulted in variation in the physio-chemical properties such as roughness, wettability and energy that in turn regulated the protein behavior such as adsorbed mass, secondary structure, and protein orientation during single and competitive protein adsorption. The third section deals with the effect of adsorbed proteins on initial cell adhesion kinetics using mammalian fibroblast cell line (L929). Thereafter, the developed and characterized silanization technique was implemented to biomedically relevant Ti6Al4V surface for its possible application in bone tissue engineering. We also explored the adsorption pattern of cell adhesive fibronectin (FN) protein on these modified surfaces. We have reported that their cell binding motifs (RGD), which are enclosed in turns, gets more exposed on hydrophobic surfaces as compared to hydrophilic surfaces. These findings will help the surface scientists to design biocompatible surfaces with such carefully controlled surface properties for better cell adhesion. The fifth and the final section of the thesis comprise of the synthesis and characterization of the novel peptidomimetics “peptoid” molecules for antifouling applications. These peptoids can be immobilized on the above modified surfaces to impart the additional antimicrobial features.

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