Indian Institute of Technology Delhi

School of Interdisciplinary Research (SIRe)

Project Proposal for Ph.D.

SIRe Project Number

2025-01-04

(will be assigned by SIRe)

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)	
Project Title	Long-lasting antibacterial and cytocompatible coatings on 'any' polymeric surfaces to prevent biomaterial associated infection
Project Summary (Minimum 500 and maximum 2000 characters)	Biomaterials associated infections caused by pathogenic bacteria are one of the major leading clinical issues, prevention and/or treatment of which still remain a challenging task. Long lasting, non-leaching infection resistant antimicrobial coatings with impressive cytocompatibility offer a step towards addressing this problem. In this particular proposal, we would like to implement a novel strategy for constructing highly antibacterial as well as cytocompatible mixed polymer brushes onto polymeric surface irrespective of the nature of polymers, i.e., on the surface of both biodegradables such as PLA, PCL etc. and non-degradable polymeric surface like PE, PP, PU etc. The mixed brushes are proposed to be a combination of poly(3-dimethyl-(methacryloyloxyethyl) ammonium propane sulfonate) and poly((oligo ethylene glycol) methyl ether methacrylate) with varying chain length of ethylene glycol unit. Creation of hydroxyl groups on the polymeric surface via PLASMA treatments and converting them to ATRP initiating moiety have been planned, that will be exploited to grow polymeric mixed brush using SIATRP. The newly created surface will be evaluated for their bacterial efficacy against both various pathogens for prolonged period of time. Moreover, the cytocompatibility of mixed brush modified surfaces will also be assessed, since antibacterial surfaces usually suffer from cytotoxicity. Soft, hydrophilic and neutral zwitterionic brushes may completely suppress the bacterial growth without compromising its cytocompatibility. An added advantage will be the creation of anti-infective brushes on 'any' polymeric surface owing to the versatile nature of PLASMA treatment process, thus broadening the scope of polymeric biomaterials for widespread applications ranging from implants to biomedical devices.

Ph.D. Supervisors
(Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)

Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
Supervisor 1	Prof. Sampa Saha	DMSE	ssaha@mse.iitd.ac.in;
Supervisor 2	Prof. Dinesh Kalyanasundaram	CBME	dineshk@cbme.iitd.ac.in

Project requirements (Student qualifications, experience required, etc)
***The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)**

- Student should have master degree in any one of the disciplines: Chemistry (M.Sc.), Pharmaceutical Sciences (M.Pharma), Polymer science and engineering (MTech./M.Sc) etc.
- Preference will be given to the students having their own fellowship.

Source of fellowship/funding and project number
(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Candidate with his/her own fellowship /Institute assistantship

Role of Faculty Members involved:	
Supervisor-1	Synthesizing polymer brushes and anchor them to polymer surface used for biomedical implant
Supervisor-2	Assess the biomedical property of the modified surfaces