Indian Institute of Technology Delhi

School of Interdisciplinary Research (SIRe)

Project Proposal for Ph.D.

SIRe Project Number

2025-01-34

(will be assigned by SIRe)

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)	
Project Title	Preparation, Physico-chemical and structural characterization of recombinant Virus Like particles (VLP's) for drug delivery purposes.
Project Summary (Minimum 500 and maximum 2000 characters)	Self-assembled protein particles serve as valuable nanocarriers with a wide range of industrial and biomedical applications. Virus capsid proteins, whether from infectious or noninfectious sources, can spontaneously form virus-like particles (VLPs), mimicking viral structures and providing insights into the assembly process and key factors influencing their formation. VLPs have broad applications in nanotechnology and biomedicine, including their use as potential vaccines and drug or cargo delivery systems. For effective biomedical applications, VLP size can be adjusted by modifying physicochemical conditions such as ionic strength or through specific point mutations. Variations in VLP size can affect their symmetry and stability, making it essential to evaluate their stability before considering them for vaccine or drug delivery formulations. RNA bacteriophage MS2-derived VLPs have been extensively used in biomedical research as model systems for studying virus assembly, structure-function relationships, vaccine development, and drug delivery. Given their diverse applications, a systematic engineering approach has been employed to develop smaller particles with enhanced serum stability and tissue penetration. Additionally, ensuring the stability of these mini MS2 VLPs is critical for protecting their cargo until it reaches the intended target cell or organ. However, a comprehensive analysis of the stability and denaturant-induced disassembly of MS2 VLPs has not yet been conducted. This project aims to perform a detailed physicochemical characterization, evaluate drug loading efficiency, assess drug delivery potential, and investigate the stability of both wild-type (WT) MS2 VLPs and their "mini" variant containing the S37P mutation (mini MS2 VLP).

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. Tapan K. Chaudhuri	KSBS, IIT Delhi	tkchaudhuri@bioschool.iitd.ac.in
Supervisor 2	Prof. Pramit Chowdhuri	Chemistry	pramitc@chemistry.iitd.ac.in

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

- MSc in Chemistry / Biochemistry/Biophysics
- Prior experience in recombinant DNA Technology, Recombinant protein preparation and characterization, Protein Biochemistry, Biophysical tools etc.

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 fellowship

Role of Faculty Members involved:	
Supervisor-1	Preparation of recombinant virus like particles, Biochemical characterization, drug loading, Drug delivery
Supervisor-2	Biophysical characterization of VLP's, Studying the assembly and disassembly processes of VLP's, Study of stability of VLP's