Notification No: 541/2023

Date of Award: 22/06/2023

Name of Scholar: Preeti Tiwari

Name of Supervisor: Dr. Najmul Arfin

Name of Department: Centre of Interdisciplinary in Basic Sciences

Topic of Research: "Synthesis, Characterization and Potential Biomedical Applications of Laponite-Polymer Nanocomposites"

Findings

The complete work has been divided into 8 chapters. The chapter-1 deals with the general introduction of clay, polymers, clay-polymer nano-composites and its application in biomedical fields.

Chapter-2 focuses on materials and characterization techniques used in the study. Various techniques discussed in this chapter are UV-Visible spectroscopy, Turbidity meter, Viscosity meter, Fourier Transform Infrared Spectroscopy, Fluorescence spectroscopy, Time Resolve Fluorescence Spectroscopy, Dynamic Light Scattering, Zeta Potential, Small Angle Neutron Scattering , Small Angle X-ray Scattering , Rheology, Differential Scanning Colorimetry , Circular Dichroism , Contact Angle, 3Scanning Electron Microscope, Fluorescence Assisted Flow Cytometry and Confocal Microscopy.

In chapter-3, we have synthesized the one of laponite-polymer nanocomposite i.e. hydrogel made from laponite and Na-carboxymethyl cellulose. The prepared hydrogel was characterized by various techniques such as XRD, DLS, Rheology and SANS. *In-vitro* release study of methylene blue (MB) from prepared gel was done and the kinetics of drug (MB) was studied using various kinetic models.

Chapter- 4 summarizes the behaviour of laponite in water-alcohol binary solvent. It is felt important to study this because our next chapter i.e. chapter 5 deals with laponite in binary solvent. Although few literature are available that discusses the behaviour of laponite in binary solvent however, anomalous behaviour and unexplained results was intriguing and we tried to investigate the observed phenomenon. After studying the structural behaviour of laponite in binary solvent, laponite was used to prepare nanocomposite with zein polymer. Further, chapter-

5 focuses on the complexation of hydrophilic laponite and hydrophobic zein with the detailed characterization of synthesized coacervate.

In chapter-6, we have studied the interaction between zein and curcumin. The study revealed that zein and curcumin interacts via hydrophobic interaction. The knowledge would be helpful during the loading of drugs in zein-laponite coacervates.

In chapter-7, we have discussed the co-delivery of two drugs (hydrophilic cisplatin and hydrophobic curcumin) using laponite-zein coacervate towards MDA-MB-231 breast cancer cell. Various parameters like cytotoxicity of the drug loaded material and the synergistic effect of dual drug towards cancer cell was also discussed.

In chapter-8, we have prepared PVA-chitosan film containing gentamicin loaded zein-laponite coacervate aiming at short-term release system with sustained antibacterial response. Our approach towards preparation of active coating material involves biocompatibility and cost effectiveness.