National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Bone Morphogenetic Protein – 2: Mechanistic Insights into Unfolding and Aggregation and Biomedical Applications
Speaker	: Devi Prasanna Behera (Rollno : 519cy1014)
Supervisor	: Dr. Harekrushna Sahoo
Venue	: Seminar Room, Chemistry Department
Date and Time	: 03 Oct 2024 (11.00 AM)
Abstract	: **The unfolding kinetics of BMP-2 in the presence of extracellular components such as hyaluronic acid (HA) and sulfated hyaluronic acid (SHA) were meticulously investigated, revealing a higher rate of unfolding in the SHA environment. This accelerated unfolding is likely attributed to the binding interaction between SHA and the partially unfolded protein, which further promotes the unfolding process. In subsequent thermal denaturation studies, SHA was identified as a stabilizer at lower temperatures, while HA exhibited a stabilizing effect at elevated temperatures. The aggregation propensity of BMP-2 was examined under both HA and SHA conditions, with distinct aggregation mechanisms observed. While both HA and SHA induces aggregation, SHA primarily facilitated the formation of rapid, amorphous aggregates, whereas HA promoted the development of amyloid fibrils, characterized by a lag phase and sigmoidal kinetics. The size and morphology of these aggregates varied significantly HA led to the formation of larger fibrillar structures, whereas SHA generated smaller, amorphous aggregates. The aggregation pathways were influenced by factors such as viscosity and excluded volume. Specifically, the higher viscosity and reduced protein diffusivity in the presence of HA, along with increased excluded volume, favored the formation of fibrils in the micrometer range. In contrast, the lower viscosity and higher diffusivity of BMP-2 in the SHA environment, coupled with reduced excluded volume, promoted the formation of amorphous aggregates in the nanometer range. To counteract this aggregation, disaggregation strategies utilizing ammonium-based ionic liquids were explored. Small alkyl chain ionic liquids proved most effective in promoting the disaggregation of BMP-2. The intrinsic propensity of BMP-2 for aggregation and unfolding was harnessed to develop a hydrogel, which was mediated through controlled protein unfolding. This hydrogel exhibited excellent biocompatibility and demonstrated significant potential for wound healing applications, particularly in *Drosophila melanogaster.***