National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Preparation and Characterization of 52S4.6 Bioactive Glass Reinforced Antheraea Mylitta (A. Mylitta) Silk Fibroin and Chitosan Scaffolds for Bone Tissue Engineering
Speaker	: Sambit Ray (Rollno : 517cr1007)
Supervisor	: Prof. Sudip Dasgupta
Venue	: CR Department Seminar Hall
Date and Time	: 24 Nov 2023 (4 pm)
Abstract	: In the present study, 52S4.6 nano-bioactive (NBG), silk fibroin (SF), and chitosan (CH) based composite scaffolds with tailored architectures and properties with improved physicochemical, mechanical, and osteogenic properties were fabricated using the freeze-drying method. 52S4.6 NBG was prepared by acid-mediated sol-gel process.Synthesized NBG exhibited a very narrow size distribution of about 1-2nm primarily because of a high zeta potential of about -40.8 mv with predominating amorphous phase as obtained from XRD data and SAED patternScaffolds were prepared by degumming and dissolving Antheraea Mylitta (*A. Mylitta*) SF and CH at varying compositions of the SF to CH in the form of SF_{90}/CH_{10} to SF_{50}/CH_{50}. Among all the compositions, SF_{80}/CH_{20} scaffold showed superior properties compared to other fabricated composite scaffolds in terms of microstructure, porosity, and mechanical property. The composite scaffold was prepared by the addition of 5-15 wt% 52S4.6 NBG into SF_{80}/CH_{20} scaffold at a fixed solid loading of 23.5 wt%. With the increase in NBG content, the compressive strength of the scaffold increased to 1.31 ±0.16 MPa for $SF_{80}/CH_{20}/NBG_{15}$ composite scaffold from 0.146 ± 0.06 MPa for SF_{80}/CH_{20} scaffold. Further better apatite deposition with controlled swelling and degradation was observed for $SF_{80}/CH_{20}/NBG_{15}$ composite scaffold. In-vitro cell culture showed better flatter morphology of MG-63 cells for $SF_{80}/CH_{20}/NBG_{10}$ and $SF_{80}/CH_{20}/NBG_{15}$ composite scaffolds with a higher number of cell attachments with apatite-like deposition onto the scaffold surface. In addition to in-vitro cell culture, in-vivo bone remodelling showed the new bone formation of the implanted SF_{80}/CH_{20}, $SF_{80}/CH_{20}/NBG_5$, $SF_{80}/CH_{20}/NBG_{10}$, and $SF_{80}/CH_{20}/NBG_{15}$ scaffold compared to control after 3 months at the host-implant interface. All the composite scaffolds demonstrated abundant osteoblast and osteoclast cells along with red blood cells and fibrinous deposits when compared to the control however, better osteoblast and osteoclast cell along with red blood cells was observed for $SF_{80}/CH_{20}/NBG_{15}$.