National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: RSM-CCD optimized hollow mesoporous silica nanospheres encapsulating sorafenib induce mitochondrial membrane potential-mediated apoptotic cell death in non-small cell lung cancer
Speaker	: Subhashree Mohapatra
Supervisor	: Santosh Kumar #2787
Venue	: LS Seminar Hall
Date and Time	: 20 Nov 2024 (16:00 hrs)
Abstract	: Hollow mesoporous silica nanoparticles (HMSNs) are considered appealing nanovehicles for drug delivery due to their exceptional drug loading and release potential. This study plans to synthesize HMSNs using a novel, quick, and economical procedure in co-relation with traditional mesoporous silica nanoparticles (MSNs) and optimize their synthesis by using the RSM-CCD approach. The influence of independent variables, i.e., CTAB (X1), TEOS (X2), and pH (X3), was evaluated by a 3-factorial design and ANOVA. RSM-CCD depicted the best synthesis formulation. CTAB: 0.3 g, TEOS: 3 ml, pH: 11.5. Optimized MSNs and HMSNs were characterized by DLS, XRD, SEM, FTIR, TEM, BET, XPS, and FE-SEM. Subsequently, hemocompatibility analysis revealed excellent compatibility of the nanosamples toward human RBCs. The drug loading efficiency of SF-MSNs and SF-HMSNs was 13.71 ± 0.33 % and 51.31 ± 0.94 %, respectively. A drug dissolution study revealed that sorafenib (SF) was released sustainably, with a cumulative release percentage of 67 % (HMSNs) and 77 % (MSNs) at 72 hours, proving the superiority of SF-HMSNs over sustained release. In-vitro cell culture studies explored the anti-tumorigenic prospects of free and encapsulated SF. Cell cytotoxicity was assessed by MTT assay against A549 cells, indicating enhanced toxicity for optimized SF-HMSNs. The IC50 value substantially decreased from 10.5 to 5.8 µg/ml (a 1.8-fold decrease) after encapsulation. Additionally, in-vitro assays reflected MMP-mediated apoptotic cell death in A549 cells due to increased drug sensitivity and ROS generation. Collectively, these findings suggest that HMSNs are an ideal drug delivery vehicle due to the sustainable release of SF for NSCLC treatment.