

Research Proposal

BIOPOLYMER/METAL ORGANIC FRAME WORK (MOF) NANO COMPOSITES FOR BIOMEDICAL APPLICATIONS

Polymer nanocomposites are an important category of materials that demonstrate distinct physicochemical properties that are inaccessible with individual components acting alone. These nanocomposites have recently attracted intensive research interest owing to their promising potential for a broad assortment of biomedical applications. The main challenging characteristic of PNCs is the complex interfacial regions between the nanoparticles and polymer matrices. Due to these small scales, large specific surface area is generated that emphasizes the importance of polymer-nanoparticle interactions. Therefore, analyzing the intercalation process among the nanoparticles and polymer bases is mandatory in achieving the desirable properties (e.g., mechanical, thermal, optical, and electric). MOFs are a class of porous materials composed of metal nodes and organic linkers. Their modular nature allows for great synthetic tunability, affording both fine chemical and structural control. With creative synthetic design, properties such as porosity, stability, particle morphology, and conductivity can be tailored for specific applications. Porosity, a defining characteristic of MOFs, is also highly important for guest/ion storage and transport. Moreover, the plethora of multidisciplinary characterization techniques applicable to MOFs allows a multitude of experiments to illuminate underlying determinants of performance and provide key insight for development of next-generation materials. The facile tunability of MOFs also enables their utilization as precursors and templates in creating functional materials with desired chemical composition and unique morphologies. The research proposal is mainly focussed on the preparation of biodegradable polymer nanocomposites using naturally occurring biopolymers (In-situ loading of metal nanoparticles into the polymer matrix) followed by the synthesis of various metal organic frame works (polyoxometalates) and their fabrication into the polymer nanocomposite. The synthesized polymer/metal organic frame work (MOF) nanocomposites will be evaluated for various biomedical applications especially in drug delivery systems.