18th National and 3rd International Conference of Iranian Biophysical chemistry

هجدهمین همایش ملی و سومین همایش بین المللی بیوشیمی فیزیک ایران

25-26 Des, 2024, University of Hormozgan

۶-۵ دی ماه ۱۴۰۳، دانشگاه هرمزگان

Biomolecules-incorporated marine bioceramic-based nanomaterials for drug localized delivery

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Abstract

The use of both manmade and natural materials for repairing and reconstructing bodily organs and tissues has a long history dating back to prehistoric times. However, in recent decades, there has been a significant acceleration in their utilization in scientific research and clinical applications. The advanced processing methods and new chemical strategies allow the incorporation of drugs within them or on their functionalized surfaces. In this regard, bioceramics act as local drug delivery systems to treat large bone defects, osteoporotic fractures, bone infections and bone tumours.The importance of understanding implant-tissue interactions on a nanoscale level has led to the widespread use of nanotechnology in the field of biomedical science and engineering. This is supported by the idea that nanostructured materials can be customized and integrated into various biomedical implants and devices. Additionally, natural nanostructured patterns can be observed in biological systems like membranes, viruses, and protein complexes, while intricate architectural designs with interconnected open pores can be found in marine environments. Utilizing naturally-occurring marine skeletons offers promising solutions for advancing research and development in regenerative medicine for dentistry and orthopedics. These materials provide abundant supplies of osteopromotive analogues, biomineralization proteins, and a variety of framework designs and devices. Marine organisms, whether used in their original form or transformed into materials suitable for human implantation, possess unique characteristics such as chemical composition and strong mechanical properties that make them ideal for applications in dentistry and orthopedics.

Key words: Biomulecules, Bioceramic, Drug delivery, Nanomaterial

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