ABSTRACT:

Biopolymeric Matrices for Inorganic Compounds: Advantages and Challenges in Composite Preparation

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Biopolymeric matrices have emerged as promising platforms for incorporating inorganic functional materials enabling the development of advanced composites for biomedical applications [1]. Natural polymers, including polysaccharides and proteins, offer excellent biocompatibility, biodegradability, and structural similarity to components of the extracellular matrix, making them suitable carriers for inorganic phases with osteogenic, bioactive, or mechanical reinforcement properties [2]. The integration of inorganic compounds into biopolymeric matrices can significantly enhance mechanical strength, bioactivity, and cellular responses, which is particularly relevant for applications in bone tissue engineering, regenerative medicine, and implant coatings.

However, the preparation of such composites also presents several challenges. Achieving homogeneous dispersion of inorganic particles, controlling interfacial interactions between the organic matrix and the inorganic phase, and maintaining appropriate mechanical and physicochemical properties remain key issues.

[1] A.M. Alosaimi et al., Bioengineering 10, 279 (2023).

[2] R.S. Alfinaikh, K.A. Almary and M.A. Hussein, RSC Adv. 15, 4708-4767 (2025).