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Investigation of addition of calcium phosphate ceramic to multilayer scaffold for bone applications with improved mechanical properties: Fuzzy logic analysis

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ABSTRACT

In this study, combining an excellent intrinsic property of polylactic acid (PLA) with the unique properties of three-dimensional (3D) printing technique and coating of chitosan-hydroxyapatite (CHI-HA) is used with electrospun nanofibers for the regeneration of hard tissues. This study aims to fabricate a microstructural scaffold with a PLA base by 3D fused deposition modeling (FDM) technique. High surface-to-volume ratio, high porosity, flexibility in surface performance, and exceptional mechanical performance are just a few of the characteristics that the small-diameter fibers display. Utilizing an examination from a scanning electron microscope (SEM), the morphological research is carried out. Besides, the biological reaction of the scaffolds is studied in phosphate buffer saline (PBS) and simulated body fluid (SBF). The samples are examined for wet and dry biological behavior, by SEM. Moreover, mechanical analyzes, including compressive strength and porosity, are performed on the samples and the results are evaluated in existing number models. Besides, the fuzzy modeling technique is used to forecast the properties of samples before fabricating and examining them. The results generally show that the presence of HA nanoparticles improves mechanical and biological properties. Specifically, the obtained results show that the sample with 10 wt% of HA is capable of suitable mechanical, chemical, and biological properties compared to other samples.

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