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Synthetic biopolymer nanocomposites for tissue engineering scaffolds

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Abstract

With tissue engineering we can create biological substitutes to repair or replace failing organs or tissues. Synthetic biopolymer-based nanocomposites are of interest for use in tissue engineering scaffolds due to their biocompatibility and adjustable biodegradation kinetics. The most often utilized synthetic biopolymers for three dimensional scaffolds in tissue engineering are saturated poly(α-hydroxy esters), including poly(lactic acid) (PLA), poly(glycolic acid) (PGA), poly(lactic acid-*co*-glycolic acid) (PLGA), and poly(ε-caprolactone) (PCL). To enhance the mechanical properties and cellular adhesion and proliferation, the incorporation of nanoparticles (e.g., apatite component, carbon nanostructures and metal nanoparticles) has been extensively investigated. At the same time, current research is focused on the interaction between stromal cells and biopolymer interfaces. In this review, current research trends in nanocomposite materials for tissue engineering, including strategies for fabrication of nanocomposite scaffolds with highly porous and interconnected pores are presented. The results of the in-vitro cell culture analysis of the cell-scaffold interaction using the colonization of mesenchymal stem cells (MSCs) and degradation of the scaffolds in-vitro are also discussed.

***Keywords*:** Biopolymer; Nanocomposites; Tissue engineering; Scaffolds; Mesenchymal stem cell; Nanoparticles