

Morphology and Degradation of Poly (3-Hydroxybutyrate)/ Nano-Hydroxyapatite Scaffold Used in Tissue Engineering

Mohsen Radmehr¹, Saeed Karbasi PhD², Morteza Sadeghi PhD³, Saeid Nouri Khorasani PhD⁴,
Abbas Saadat MSc⁵

Abstract

Background: Nanocomposites of biodegradable polymers and bioactive ceramics have high biocompatible and mechanical properties and are thus of high importance in bone tissue engineering. Among these nanocomposites, poly (3-hydroxybutyrate)/nano-hydroxyapatite (PHB/nHA) has favorable porosity.

Methods: Nanocomposite scaffolds of PHB/nHA were prepared via solvent-casting and particulate leaching technique. NHA constituted 0-10% of weight of polymers. The porosity of the samples was measured by diffusion method. Scanning electron microscopy (SEM) was used to evaluate the morphology of prepared scaffolds and size of nano-particles in the polymer matrix. Distribution of nHA in scaffold was investigated by energy dispersive X-ray (EDX). Degradation of scaffolds was studied by SEM, Fourier transform infrared (FTIR) spectroscopy, and weighting samples before and after degradation in phosphate-buffered saline (PBS) solution.

Findings: Porosity percentage was not decreased by increasing nHA content. Size of HA particles on wall of scaffold porosity was in nano-scale and distribution of nano particles in polymer matrix was uniform. Type of PHB/nHA scaffold degradation in PBS solution was bulk degradation.

Conclusion: Prepared scaffolds had good interconnectivity. Size and percentage of porosity was acceptable for cell growth, attachment, and seepage in tissue engineering. Therefore, these new PHB/nHA nanocomposite scaffolds may serve as a 3D substrate in tissue engineering.

Keywords: Solvent-casting, Particulate leaching, Poly (3-hydroxybutyrate), Hydroxyapatite, Nanocomposite, Scaffold

¹ MSc Student, Department of Chemical Engineering, School of Chemical Engineering, Isfahan University of Technology, Isfahan, Iran

² Assistant Professor, Department of Medical Physics and Biomedical Engineering, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran

³ Assistant Professor, Department of Chemical Engineering, School of Chemical Engineering, Isfahan University of Technology, Isfahan, Iran

⁴ Associate Professor, Department of Chemical Engineering, School of Chemical Engineering, Isfahan University of Technology, Isfahan, Iran

⁵ PhD Student, Department of Biomedical Engineering, Science and Research Branch, Islamic Azad University, Tehran, Iran

Corresponding author: Saeed Karbasi PhD, Email: karbasi@med.mui.ac.ir