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Manufacturing and characterization of poly(3-hydroxybutyrate/multi-walled carbon nanotubes nanocomposite scaffold for tissue engineering application

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In this study, regarding the importance of optimal design and unique role of a scaffold in tissue regeneration and repair, a series of poly(hydroxybutyrate) (PHB)/multi-walled carbon nanotubes (CNTs) nanocomposite scaffolds with five different samples concentrations of CNTs (0%, 0.5%, 0.75%, 1.0%, and 1.25% w/v) was prepared by electrospinning for tissue engineering applications. Morphological evaluation of scaffolds by using scanning electron microscopy (SEM) showed that, the addition of CNTs increased the average fiber diameter; for instance, from 210 nm (neat PHB) to 500 nm at 1.0% CNTs. To determine the physico-chemical properties of scaffolds, transmission electron microscopy (TEM) and Fourier transform infrared spectroscopy (FTIR) were used and it showed the presence of CNTs into fibers. The analysis of mechanical properties of the PHB/CNTs composites by using universal testing machine (UTM) revealed great improvement over pure PHB scaffold, so that the tensile strength in presence of only 0.5% CNTs was 5.15 MPa from 2 MPa. The bioactivity of scaffolds were analyzed by placing them in simulated body fluid (SBF) environment and the absorption level of Ca2+ in the SBF solution showed that CNTs increase the bioactivity of scaffolds. The wettability of the scaffolds was evaluated with a conventional sessile drop method. The results of the contact angles of scaffolds surface showed that CNTs treatment increases the surface wettability. The attachment ability and viability of osteosarcoma cell lines MG-63 in the presence of the scaffolds were also investigated. The attachment and proliferation of MG-63 were significantly increased in the PHB/CNTs scaffolds compared with the PHB control. Therefore, the PHB/CNTs composite scaffolds fabricated by electrospinning may be potentially useful in tissue engineering applications .

Biography

Moein Zarei has completed his BS degree in Material Engineering and MS degree in Tissue Engineering from Islamic Azad University, Iran. He has published one paper in a reputed journal and has been serving as an Editorial Board Member of repute.

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