GPTMS-modified bredigite/PHBV nanofibrous bone scaffolds with enhanced mechanical and biological properties

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ABSTRACT

Bioceramic nanoparticles with high specific surface area often tend to agglomerate in the polymer matrix, which results in undesirable mechanical properties of the composites and poor cell spreading and attachment. In the present work, bredigite (BR) nanoparticles were modified with an organosilane coupling agent, 3-glycidoxypropyltrimethoxysilane (GPTMS), to enhance its dispersibility in the polymer matrix. The polyhydroxybutyrate-co-hydroxyvaletare (PHBV) nanofibrous scaffolds containing either bredigite or GPTMS-modified bredigite (G-BR) nanoparticles were fabricated using electrospinning technique and characterized using scanning electron microscopy, transmission electron microscopy, and tensile strength. Results demonstrated that modification of bredigite was effective in enhancing nanoparticle dispersion in the PHBV matrix. PHBV/G-BR scaffold showed improved mechanical properties compared to PHBV and PHBV/BR, especially at the higher concentration of nanoparticles. In vitro bioactivity assay performed in the simulated body fluid (SBF) indicated that composite PHBV scaffolds were able to induce the formation of apatite deposits after incubation in SBF. From the results of in vitro biological assay, it is concluded that the synergetic effect of BR and GPTMS provided an enhanced hFob cells attachment and proliferation. The developed PHBV/G-BR nanofibrous scaffolds may be considered for application in bone tissue engineering.

KEYWORDS

Bredigite nanoparticles; PHBV; GPTMS; Electrospinning; Bone tissue engineering

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