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Sodium alginate/hydroxyapatite/graphene nanoplatelets composites for bone tissue engineering

Abstract

Sodium alginate (SA)/hydroxyapatite (HA)/graphene nanoplatelets (GP) bionanocomposite films that possess good biocompatibility for bone tissue engineering are prepared by a simple solution casting process. The prepared nanocomposite films are analyzed by XRD, SEM, EDAX, and FTIR analyses. XRD confirms the presence of hydroxyapatite and graphene nanoplatelets in the nanocomposite. FTIR spectrum confirms the interaction between the matrix and the fillers. The morphology of the fillers and nanocomposite films are observed through SEM images. The inclusion of GP with different concentrations into the biopolymer film improves the tensile strength. As a result, the loading of 0.5 wt% of graphene and 10 wt% of HA in the SA polymer shows high tensile strength when compared to the pure SA and SA filled with HA. Tensile strength gradually decreases when the loading of graphene is increased to 2.5% and 5% in the bionanocomposite film. The tensile strength of the bionanocomposite film with 10% of hydroxyapatite is increased by 17%, whereas the tensile strength of the bionanocomposite film loaded with 10% of hydroxyapatite and 0.5% graphene is increased by 99%. Biological tests, such as swelling, biodegradation tests, and biomineralization tests, confirm the biocompatibility of the nanocomposite films.

Keywords

Bionanocomposite; Graphene nanoplatelets; Hydroxyapatite; Mechanical properties; Sodium alginate