Cuttlefish Bone Derived Hybrid Composite Scaffolds for Bone Tissue Engineering

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Abstract

In recent years, there is a drastic increase in the demand of biomaterials for bone defects which results in newer research on the development of smart biomaterials with enhanced osteogenesis. The controlled and rapid healing of bone repair process is seemingly a matter of interest for biomaterials research. Notably, hydroxyapatite (HAp) and its polymer/metal oxide composites play a significant role in the field of biomaterials research for orthopedics treatment procedures. In this study, hybrid composite scaffolds derived from cuttlefish bone (CFB) for hard tissue engineering has been successfully demonstrated under hydrothermal process. The final cuttlefish bone scaffold product was completely transformed into biomimetic hydroxyapatite crystal structure under optimized hydrothermal condition without any change in the natural channelled structural arrangements. The X-ray diffraction pattern reveals the characteristic hydroxyapatite formation without the presence of any other calcium phosphate/carbonate derivatives. Further, to enhance its biological response, the developed scaffolds were coated with the polymeric mixture of sodium alginate and alumina/zirconia nanoparticles. The elemental analysis of the prepared scaffolds confirms the presence of respective elements such as Ca, P, O and Al/Zr. The *in vitro* biocompatibility study on these composite scaffolds shows excellent biocompatibility against MG63 osteoblasts like cells and cell attachment/proliferation. Therefore, the porous and channelled arrangement of cuttlefish bone derived hydroxyapatite-(alumina/zirconia)-sodium alginate based hybrid composite scaffolds should enhance cell attachment, bone tissue ingrowth that results in rapid healing of bone tissue damage.

Keywords: Cuttlefish bone, hydrothermal, scaffolds, biocompatibility, hydroxyapatite