

Development and characterization of novel porous 3D alginate-cockle shell powder nanobiocomposite bone scaffold

ABSTRACT

A novel porous three-dimensional bone scaffold was developed using a natural polymer (alginate/Alg) in combination with a naturally obtained biomineral (nano cockle shell powder/nCP) through lyophilization techniques. The scaffold was developed in varying composition mixture of Alg-nCP and characterized using various evaluation techniques as well as preliminary in vitro studies on MG63 human osteoblast cells. Morphological observations using SEM revealed variations in structures with the use of different Alg-nCP composition ratios. All the developed scaffolds showed a porous structure with pore sizes ideal for facilitating new bone growth; however, not all combination mixtures showed subsequent favorable characteristics to be used for biological applications. Scaffolds produced using the combination mixture of 40% Alg and 60% nCP produced significantly promising results in terms of mechanical strength, degradation rate, and increased cell proliferation rates making it potentially the optimum composition mixture of Alg-nCP with future application prospects.

Keyword: Scaffold; Alginate; Cockle shell powder; Three-dimensional