Effect of biopolymers on cockle shell biocomposite for bone material applications

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Abstract

The overall objective for this study is to determine the effect of biopolymer types and ratio on producing biocomposites derived from cockle (*Anadara granosa*) shells waste. In this study, two types of biopolymer were used i.e. sodium alginate and carboxymethyl cellulose. These biocomposites are meant for bone material applications. The processes involved in producing the biocomposites were pre-treatment of the cockle shells, synthesis of $CaCO_3$ in aragonite form and finally the formation of biocomposites. All samples have undergone physicochemical and mechanical analyses to determine their crystallinity, purity, functional group, surface morphology, elemental compounds and compressive strength using X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscope (SEM), Electron Dispersive X-ray Analysis (EDX) and Universal testing machine (UTM). The $CaCO_3$-biocomposites have been prepared using different ratio of biopolymer and different types of biopolymers. The physicochemical properties of the biocomposites are not affected by the ratio and types of biopolymers. Yet, the ratio and types of biopolymers have influenced the mechanical properties of biocomposites. The biocomposite with lesser amount of biopolymer has denser structure and greater mechanical strength. Comparison between types of polymers revealed that biocomposite with carboxymethyl cellulose has greater mechanical strength compared to biocomposite with sodium alginate.

1. Introduction

Shellfish aquaculture mainly cockle (*Anadara granosa*) is one of the most important industries worldwide and generates abundant of shell wastes. In Malaysia, marine shells are mostly used in handicrafts industry to produce decorative stuffs like key chains. Shell wastes are mostly dumped without any post-treatment due to high cost of disposal procedure [1,2]. The abandoned shell wastes often cause unpleasant view to the landfills and give out nauseating smell.

In order to minimise the negative impacts on the environment, researchers around the world are studying on the transformation of shell wastes into valuable products. In fact, seashells consist of high composition of calcium carbonate ($CaCO_3$) of more than 95% by weight [3–5]. $CaCO_3$ especially in

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