SYNTHESIS OF CHITOSAN/HYDROXYAPATITE NANOCOMPOSITE SCAFFOLDS FOR TISSUE ENGINEERING APPLICATIONS

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgment any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgment is made in the text. Also, I hereby grant to University of Moratuwa the non-exclusive right to reproduce and distribute my thesis/dissertation, in whole or in part in print, electronic or other medium. I retain the right to use this content in whole or part in future works (such as articles or books).

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Name of the supervisor: Prof. S. U. Adikary

Signature of the supervisor: Date:22.08.2023

ABSTRACT

The objective of this research was to extract chitosan from waste Crustacean shrimp shells of the species *Penaeus Monodon,* which is a by-product of the shrimp export industry. Then the extracted chitosan was used to synthesize chitosan/nanohydroxyapatite composite by co-precipitation of nanohydroxyapatite onto a chitosan scaffold. A number of characterization techniques were used to analyze the structure and composition of the extracted chitosan and the synthesized composite. The porous structure of chitosan and the Hydroxyapatite nanoparticles embedded in the chitosan matrix could be observed through scanning electron microscopy. Both scanning electron microscopic images and X-ray diffractograms confirmed the size of the nanohydroxyapatite to be in the range of 2-14 nanometers. From the energy dispersive X-ray analysis, a ratio by weight of 2:1 for Ca:P was obtained confirming the presence of hydroxyapatite in the composite. The thermograms obtained from the thermogravimetric analysis revealed that the decomposition temperature drops with increasing hydroxyapatite loading in the composite which can be attributed to the higher crystallinity and better heat transfer in the composite. The degradation studies revealed that the percent degradation increases with time as well as the HAp loading. The biomineralization study done with simulated body fluid depicts that the Ca concentration of the SBF solution decreases over time, this is due to the uptake of Ca^{2+} ions from the SBF solution to form the apatite layer on the scaffold.

Keywords— chitosan, nanohydroxyapatite, nanocomposites, bone tissue engineering, bioactivity

OBJECTIVES

1. Synthesis of chitosan from locally sourced *Penaeus Monodon* shrimp shells.
2. Synthesis of chitosan/nanohydroxyapatite composite under laboratory conditions.
3. Characterization of the composite for structural properties.
4. Performing in vitro testing for the investigation of bioactivity.

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Hansi Rajapakse

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