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Synthesis, characterization and biocompatibility evaluation of bone cement composite reinforced with squid bone (*Sepia Officinalis*)

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Abstract

Calcium phosphate ceramics have limited mechanical properties and are brittle and fragile, with a very low degradation rate in the body. On the other hand, the brittle nature of calcium phosphate ceramics limits their use alone. The bone of the common cuttlefish (*Sepia officinalis*) is primarily composed of a mineral compound known as calcium carbonate. Calcium carbonate, by itself, does not possess desirable mechanical strength and cannot be directly used to enhance the mechanical properties of cement. Additionally, the main mineral components of bone are derived from calcium phosphate compounds. In this project, the conversion of calcium carbonate obtained from the bone tissue of fish into calcium phosphate, the main mineral component of body bone, was carried out using a hydrothermal method. Finally, the compressive strength and biocompatibility of the cement were evaluated using MTT toxicity testing. Based on the results of XRD, SEM, and FTIR, it was shown that natural aragonite from squid bone was hydrothermally converted into hydroxyapatite. SEM images of composite samples showed that hydroxyapatite was well mixed with poly-caprolactone. The results obtained from the biocompatibility test showed that the bone cement composite reinforced with squid bone did not have toxic properties. Besides, the results of compressive strength tests showed that adding hydroxyapatite powder to bone cement could improve the mechanical properties of the composite. The results showed that increasing the percentage of hydroxyapatite powder improves the compressive strength and decreases the injectability of bone cement. Accordingly, this composite can serve as an appropriate alternative for use in the repair and reinforcement of weak and damaged bones.

Keywords: Hydroxyapatite, Hydrothermal treatment, Bone cement, Compressive strength, S*epia Officinalis*

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