IN-VITRO STUDY OF HYDROXYAPATITE (HAp) SPECIMEN IN SIMULATED BODY FLUID (1SBF) - IN-VITRO ANALYSIS

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ABSTRACT

Hydroxyapatite is identified as a suitable source for bone substitution due its excellent bioactivity and biocompatibility. The strategies for tissue engineering include developing those cells to form the required tissue/organ in-vitro before inserting them into the body. To examine the bone-bonding capability of a material, in vitro technique necessary to be performed over simulated body fluid (SBF) surfaces. Hence, this research aims to study in-vitro of hydroxyapatite specimen to inspect the capability of apatite to form on its surface. The HAp specimens were immersed into simulated body fluid (SBF) prepared based on Kokubo method for 25 days. According to Kokubo, the SBF has inorganic ion concentrations similar to those of human extracellular fluid, in order to reproduce formation of apatite on bioactive materials in-vitro. The simulated body fluid was prepared using the reagents listed in Table 3.1. These reagents were added to 750 ml ultra-pure water in order given in Table 3.1, one by one, after each reagent was completely dissolved. After 25 days of immersion, the specimen then will describe utilizing using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM) equipped with Energy Disperse X-ray (EDX) to figure out the impact of the SBF states on the trademark properties from claiming. That vicinity of functional group of the specimen before and after immersion will be indicated by FTIR. SEM equipped with an EDX was applied to spot the morphologies of the specimen. FTIR spectra show the functional group of HAp specimen ranging from 3000 to 1087 cm^{-1}. From the morphologies shown in SEM, new apatite layer formation was foreseen from their SBF behavior pattern. The formation of major peak of Ca, P, and O show in EDX analysis is confirm the formation of apatite layer.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

In the recent years, due to ageing UK population, increased dynamism of people's lives and growing life expectancy, the clinical demand for bone replacement and repair had growing well (Cox, Ceram). This attracts attention researchers related to biomaterials field to research in deep on synthesis of HAp due to widely used in biomedical application due to its excellent bioactivity and biocompatibility (Pradnya N. et al., 2010).

Hydroxyapatite (HAp) with chemical formula $Ca_{10}(PO_4)_6(OH)_2$ is an important inorganic biomaterial. Because of its chemical and structural similarity with the mineral phase of bone and teeth, it is suitable used for hard tissue repair (Khelendra Agrawal, 2011). To serve the demand on bone replacement, Hap is identified as most suitable bone substitution materials. In fact, it is thermodynamically sable at physiological pH and actively takes part in bone bonding (S. Mondal et al., 2012).

Figure 1.1 shows the hexagonal crystal structure of Hydroxyapatite in unit cell model including the lattice constants, symmetry and atomic positions. P1 is set at the beginning of the configurations before geometry optimization.