UNIVERSITI TEKNOLOGI MARA

NANOFIBROUS BIO-INORGANIC HYBRID STRUCTURES FORMED THROUGH SELF-ASSEMBLED PEPTIDE (FEFEFRFR)

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In the name of Allah, the most Beneficent, the most Merciful. Peace and blessing be upon the Prophet Muhammad SAW.

Alhamdulillah, finally my research project Nanofibrous Bio-Inorganic Hybrid Structures Formed Through Self-Assembled Peptide (FEFEFRFR) comes to an end after much struggling through the hardship, the ups and downs in order to complete my degree in Bachelor of Chemical Engineering (Hons.)

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ABSTRACT

The purpose of this research is to investigate the morphology of nanofibrous hybrid formed through self-assembled peptide (FEFEFRFR). It is also carried out to synthesize the HAp and characterize its properties of nanoparticles. HAp is used because of its crystallographic structure that commonly found in natural bond as an inorganic compounds with excellent biocompatibility, bioactivity and osteoconductivity. The peptide used is a sequence of Phenylalanine, Glutamic Acid and Arginine. This combination is made by considering the advantages of diversity in the body of amino acid residues to have a peptide with the special characteristics to be able to combine with HAp nanoparticles to form nanofibrous with large surface area and stronger structure. The methods to synthesize HAp known as precipitation method. The experimental work is carried out at first by synthesized of HAp before making it into supersaturated of HAp then the supersaturated HAp nanoparticles is mineralized with self-assembled peptide (FEFEFRFR). Then, the mineralized nanofibres is tuned by using three different media: distilled water, sodium perchlorate salt and sodium iodide salt. There are several equipment's will be used to characterize the nanoparticles for the HAp nanoparticles without mineralization with peptides and with the mineralization with peptides namely Powder X-Ray Diffraction (XRD) to identify the phase of crystalline material which resulted in the high degree of the crystallinity, Fourier Transform Infrared Spectroscopy (FT-IR) to characterize the functional group of HAp nanoparticles showed the most characteristic chemical groups which are PO₄³⁻, OH-, and CO₃²⁻, Inductive Coupling Plasma (ICP) to detect the presence of [Ca2+] ion with concentration of 4mM and Geology microscope to observe the surface morphology. The structure of elongated fibre is observed in distilled water, sodium perchlorate salt while amourphous structure in sodium iodide salt.

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CHAPTER 1

INTRODUCTION

1.1 RESEARCH BACKGROUND

Nanofibrous Bio-inorganic is a hybrid structures with combination of biomaterials of organic components which is peptide for ordering and supporting the functional inorganic materials such as HAP nanoparticles to align within them into higher-order structures. These hybrid structures are one of the advance nanotechnology that has many applications been found in electronics, photonics, catalysis, and tissue engineering (Tao He, 2010). In bone tissue engineering, this nanofibrous recently used as an artificially designed scaffolds which provide an extracellular matrices to multiple criteria or mimics one of the natural ECM a biomimetic scaffold for facilitate cell recruiting/seeding, adhesion, proliferation, differentiation and neo tissue genesis for tissue formation in biomedical applications (Ma, 2008).

In recent years, nanostructured biomaterials can be made the by several preparation of fabrication methods that can be in form of 3D scaffolds in bone tissue engineering. The commonly used techniques include melt-plotting, template synthesis, phase separation, electrospraying, electrospinning, and the newly methods have been used called as electrohydrodynamic printing. A variety of structures is applicable to produce via these methods that can be random or ordered form. For instance, by using fibers that can be obtain from electrospinning electrospraying or fibers obtained from electrospinning can produce particles to rise to non-ordered structures with random orientation which is not favourable for clinical applications. However, for certain properties need to have a good biomaterials control, such as porosity and other mechanical properties, it is applicable to use this type of ordered structures owing to its possibility that can interfere the cells behaviour. This make it possible when using electrospinning or electrohydrodynamic printing that have aligned structures (Gardin Chiara, 2012).

This study is carried out to identify the great potential of Nanofibrous Bio-inorganic with the special characteristics of peptide by using the body structure of amino acid residues which