NANOFIBROUS BIOINORGANIC HYBRID STRUCTURES FORMED THROUGH SELF-ASSEMBLED PEPTIDE (FKFSFEFEFKFK)

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ABSTRACT

Self-assembling peptides have gained a lot attention as its abilities been revealed in which can spontaneously experience self-organization into well-ordered structures. Consequently, it promotes another road for the creation of biological materials.In past years,traditional therapeutic strategies for injuries requiring bone regeneration resulting from donor-site morbidity and patient discomfort have led to the exploration of a variety of peptide-based and other bone regeneration.Since this revelation, different classes of short peptides have been fabricated with wide applications which include bone regeneration, reparative medicine, tissue designing, and drug delivery. This project involves discovering how nanofibrous bioinorganic hybrid structures can be formed through self-assembled peptide specified (FKFSFEFEFKFK). One of the ultimate goal is to observe the morphology and characterize the nanofibrous hybrid structures formed.This is done by synthesizing and characterizing the hydroxyapatite (HAp) at the first place.Then, followed by mineralization of HAp with the self-assembled peptide (FKFSFEFEFKFK) resulting nanofibrous hybrid structures to be formed. These structures are then analysed using sodium iodide and distilled water as their parameters on structural component. Several equipment and tools were involved such as Fourier Transforms Infrared spectroscopy (FT-IR), X-ray diffractor (XRD), Inductive Coupling Plasma (ICP) and Geology for characterization purposes.Also,the application of nanofiber hybrid structures for biomimicry of bone recovery will be further discussed in next section. Upon completion of these project, the finding may be useful to solve problems regarding fabrication of biomaterial and address the role of self-assembled together with HAp as inorganic material on biomineralization.

CHAPTER 1

1.1 BACKGROUND STUDY

Nanofibrous organic–inorganic hybrid structures is said to be exist when inorganic nanocomponents are framed or collected inside the aligned organic nanofibrous matrix. This is considered critical materials as their applications able to discover in electronics, photonics, catalysis, and tissue engineering. They not just give a way to support and requesting the functional inorganic materials, for example, nanoparticles, additionally can serve as building blocks in order for further self-assemble into higher-order structures. There are several regular ways to deal with the synthesis of the nanofibrous organic-inorganic hybrid structures which incorporate polymer templating, electrospinning, biotemplating and directional freezing. As an obvious reality, the nanofibrous organic-inorganic mixture structures are vital building block in characteristic mineralized biomaterials. One of the best cases is the mineralized collagen fibrils constituting the extracellular network (ECM) of bone. Bone is made of cells inserted in ECM, which is progressively sorted out from proteins, including sort I collagen and non-collagenous proteins (NCPs, for example, bone sialoprotein (BSP), and calcium hydroxyapatite (HAP, Ca^{10} $(PO^4)^6(OH)$ ^{2}). The collagen atoms (~1.5 nm wide and 300 nm long) are self-assembled into more extensive (up to 200 nm wide) and more (a few µm long) fibrils in a side-to-side and go to tail arrange, which are further progressively self-assembled to shape much more extensive and longer collagen strands (up to a few tens µm wide and long). HAP is found inside the gaps and grooves of the collagen fibers with its c-pivot specially along the collagen strands.

Hydroxyapatite (HAp) is known as one of the developing most bioceramic, which is generally utilized as a part of different biomedical applications, for the most part in orthopedics and dentistry because of its nearby similarities with inorganic mineral component of bone and also teeth. It has remarkable biocompatibility and unique bioactivity.