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Foreword

University of Yangon (UY) makes an all-out effort to be a leading higher educational institution in Myanmar as a Flagship university on par with regional counterparts and in line with international trends. UY therefore expands the frontiers of knowledge by developing research culture.

UY created a research-teaching nexus namely Universities' Research Centre (URC-UY) where research informs and enhances teaching agenda. University education is fundamentally about how to solve problems based on data and/or logical thought. Those involved in research are better at imparting these skills to students with inquiring minds. The Korea Foundation for Advanced Studies (KFAS) has been supporting research activities in UY through the Asia Research Centre (ARC-UY). To a researcher in UY, ARC-UY and URC-UY should be seen as two sides of the same coin in much the same way as financial support and research activity should be regarded.

Research is only meaningful if it is communicated, so the research outcomes must be published and contribute to the body of knowledge; even better if research outcomes can be impactful through commercialization or implementation. This journal proudly presents 17 research papers resulted from the outstanding research projects carried out by the academic departments of UY.

I would like to express my appreciation and congratulations on the concerted effort of the researchers who have made a great deal of excellent contribution to this issue. I also would like to to express my heartfelt thanks to Mr. Park In-Kook, President of the KFAS for his continued support to the ARC-UY.

Prof. Dr Pho Kaung
Rector, University of Yangon

Unification of Nano-Hydroxyapatite for Bone Replacement

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Abstract

Hydroxyapatite (HAP) is effectively used as a bio-implant material because it closely resembles bone apatite and exhibits good biocompatibility. Pure HAP has been synthesized in the first stage and SiO_2 doped HAP has been prepared by using a sol-gel method in the second stage by the formula $Ca_{10-x}Si_x(PO_4)_6(OH)_2$. The as-prepared HAP powder and Si substituted HAP powder has been calcined at 800°C. The calcined powder have been pressed into pellet and then sintered at 1000°C and 1100°C. Structural characterization of samples has been performed by using X-ray diffraction (XRD) technique. The molecular vibration of HAP has been observed by Fourier Transform Infrared Spectroscopy (FTIR).

Keywords: molecular vibration; structural characterization; Si doped Hydroxyapatite; XRD; bone replacement

1. Introduction

Hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$, HAP), an important inorganic biomaterial, has attracted the attention of researchers related to biomaterial field. Due to its chemical and structural similarity with the mineral phase of bone and teeth, HAP is widely used for hard tissues repair. As a result, this inorganic phosphate has been studied extensively for medical applications in the formation of powders, composites or even coating. Furthermore, HAP has been studied for other non-medical application. HAP can also be used as biological chromatography supports in protein purification and Deoxyribonucleic acid (DNA) isolation. The chemical structural and morphological properties of synthesized HAP can be modulated by varying method and the conditions of synthesis. Classical methods for HAP powder synthesis include direct precipitation, hydrothermal techniques, hydrolysis as well as solid state reactions and mechano-chemical method. Among these methods, sol- gel technique has attracted much attention recently due to its well-known inherent advantages to generate glass, glass ceramic and ceramics powder. These include homogeneous molecular mixing, low processing temperature, the ability to generate sized particles, thin film and bulk amorphous monolithic solids and thin films. The sol gel process is easily applicable to surface coating and it allows the preparation of high quality HAP thin films on metal substances. Thus, the sol-gel process can be usefully utilized to synthesize both HAP powder and HAP thin film under significantly mild condition. Moreover, doping with (biocompatible or even better bioactive) oxides has been resulted in strong HAP composites. In this study, SiO_2 has been doped in HAP because SiO_2 has been related to bioactivity. Si is related to body's metabolism, clinically proven in studies on bone and collagen weakening, the level of arteriosclerosis, osteoarthritis, aging process etc. $Ca_{10-x}(Si)_x(PO_4)_6(OH)_2$ with x= 0.0, 0.5, 1.0, 1.5 have been synthesized by sol-gel method in this work. The substitution of silicon into the hydroxyapatite bioceramics is excellent biocompatible with living organism.

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