# MICROSTRUCTURE CHARACTERIZATION AND MECHANICAL PROPERTIES STUDY FOR PVA-HYDROXYAPATITE COMPOSITE DERIVED FROM MACKEREL FISH BONE

HUI YING YOW, SIEW WEI PHANG*

School of Engineering, Taylor's University, Taylor's Lakeside Campus,
No. 1 Jalan Taylor's, 47500, Subang Jaya, Selangor DE, Malaysia
*Corresponding Author: SiewWei.Phang@taylors.edu.my

## Abstract

The aim of this work is to synthesize biocomposite scaffolds by embedding natural hydroxyapatite (HAp) particles derived from Mackerel fish bones in poly(vinyl alcohol) (PVA) as well as to characterise the properties of the composites. The composites of HAp and PVA have proven mechanical properties and osteoconductivity that allow it to be used as bone graft substitutes in BTE applications. In this work, mackerel fish bone is selected as the natural source to extract HAp because fish bone is inexpensive and does not provoke religious conflicts, while mackerel fish can be easily accessed in this region. To fabricate HAp/PVA composites scaffolds, the simple and inexpensive solution casting technique is selected. The HAp particles extracted from Mackerel fish bones are calcinated and grinded to produce <200 µm of particles. Pure PVA is plasticised by glycerol and water in 97 ºC for 1 hour. The HAp/PVA composites are prepared using solution-based technique varying HAp from 2.5 phr to 30 phr in thin films as it can successfully create uniform dispersion of HAp in the PVA blend. Fourier transform infrared absorption spectra (FTIR) and thermogravimetric analysis (TGA) have proved the interaction between PVA matrix and HAp particles are due to the strong intermolecular hydrogen bonding and $[HO]-Ca^{2+}-[OH]$ linkage. The results also show an improvement in mechanical properties of the composites with the increase in the loading of HAp particles to 5 phr to the resultant composites. Higher HAp contents in the composites such as 10, 20 and 30 phr resulted in agglomeration and deterioration of mechanical strength. By comparing the composites and human cancellous bones, the mechanical properties were similar. In conclusion, 2.5HAp/PVA and 5Hap/PVA composites with uniform microstructure and enhanced mechanical properties have the potential to act as an effective biomaterial for the replacement of human cancellous bones.

Keywords: Poly(vinyl alcohol), Hydroxyapatite, Solution Casting, Bone Tissue Engineering