Hydroxyapatite has received considerable attention in medical field especially as bone substitute due to resemblance of chemical composition and crystal structure of human bone. In this work, HA powder was fabricated from waste eggshells. The eggshells stock solution was mixed with di-ammonium hydrogen solution and subjected to microwave heating at 8, 10 and 12 min to investigate the effect of different irradiation time on the characteristics of HA powder formed. The microwave heating offers significant advantages. The synthesized powders showed mainly HA phase and the presence of impurities of betatricalcium phosphate (β-TCP) and calcium oxide (CaO) when the exposure time was prolonged. The synthesized HA powders were characterized using X-ray diffraction (XRD) to examine the phase analysis. In conclusion, the production of HA powder is fast and environmental-friendly.

**Keywords:** β-TCP, Biomaterials, Calcium phosphate, Eggshells, Radiation synthesis, Waste materials.

**INTRODUCTION**

Several methods have been studied with the used of different range of chemical reactants as calcium and phosphate precursor such as wet chemical method or precipitation [1], sol- gel technique [2] and hydrothermal process [3]. However, these methods provide some disadvantages. For example, hydrothermal process requires several heat-treatment steps which are a costly procedure [4] while precipitation is considered as a complicated process and several parameters need to be considered cautiously [5]. Meejoo et al. synthesized needle-shaped nano-HAp about 50 nm in diameter and 200 nm in length by microwave irradiation technique [5]. Prabakaran et al. has successfully produced a stoichiometric HAp by precipitation route using eggshells and orthophosphoric acid as calcium and phosphate precursors respectively [6]. Padmanabhan et al. produced hexagonal nanorod HAp using sol-gel method at calcination temperature of 300-700 °C where higher calcination temperature exhibited larger crystallite size and crystallinity [7]. Microwave radiation is comparatively a new approach to synthesis HA. It offers significant advantages including rapid, facile and shorter synthesis time, easy reproducibility, efficient energy transformation and heating throughout the volume [5,8].

The eggshells are one of the richest calcium sources consisting about 94% of calcite, 1% of magnesium carbonate, 1% of calcium phosphate and other 4% is organic matter and other minerals. The eggshells represent 11% of the total weight of the hen eggs [4,9]. According to the Federation of Livestock Farmer’s Associations of Malaysia (FLFAM), in 2010, Malaysia alone has produced about 8.57 billion unit of eggs [10]. Since eggshells represent 11% (~ 60.0 g per egg) of the weight, it is approximately 57000 tons waste is produced. This waste enhances microbial activity in environment which contributes to environment pollution [9]. Nevertheless, only few works have been reported on microwave radiation synthesis of HA from waste materials. In this present work, an investigation has been carried out to synthesize HA from eggshells via microwave-assisted wet chemical method. The effect of different microwave exposure time on the characteristics of HA powder produced will be studied. This work proposed to provide a simple, cost-effective and reproducibility method for production of HA. The crystalline phases of the HA ceramic powder were analyzed using XRD.