

# Preparation and Physical Characterization of Natural Hydroxyapatite from Eggshells

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Synthetic Hydroxyapatite ( $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ ) is a popular bone replacement material because it has a similar crystal structure (Ca:P ratio fixed at 1.67) to native bone apatite. This resemblance is the origin of the excellent compatibility that HA exhibits with hard tissue and its natural bioactive behavior; enabling it to be incorporated into the body via the same processes active in the modeling of healthy bone. Currently, HA is used in a number of different applications as clinical solutions to bone defects caused by trauma or disease [4].

## 2. MATERIALS AND METHOD

### 2.1 Raw material preparation

Hen eggshells were chosen as the raw material for my experiment. Raw material of hen eggshells were obtained from market. It was cleaned with bistouries and cooked in a pot at 100°C for 1 hour. Then, they were disinfected with 75% ethanol. It was then crushed and turned into the powder of hen eggshells and the powder of hen eggshells were claimed at various temperatures, 200°C, 300°C, 400°C and 500°C for 1 hr.

#### 2.1.1 Preparation Metrology

In my research work, firstly hen eggshells powder was obtained by mechanism. And then hydrothermal method

## ABSTRACT

In this present work, eggshells were converted to Hydroxyapatite (HAP) by a heat treatment method at different temperatures and for different conversion durations. XRF analysis and pH values confirmed that the samples were mainly highly crystalline Hydroxyapatite ceramics and obtained wt% of the sample element. The final product is characterized by XRF. High temperatures and smaller particle will be produced Hydroxyapatite powder with temperature of 200°C, 300°C, 400°C and 500°C. In this research work, to prepare and characterize the Hydroxyapatite from eggshells for bone substitution.

**KEYWORDS:** Natural HAP, eggshells, Calcinations, XRF, pH meter

## 1. INTRODUCTION

Hydroxyapatite (Hap) is a bio ceramic that has been synthesized for applications in bone implants. However, its application in environmental biotechnology areas is increasingly drawing the attention of the researchers, for elimination of fluorides and removal of heavy metals in water and soil decontamination. Particularly, the sorption of Pb by Hydroxyapatite (Hap) has been extensively studied because of its high toxicity for human life [2],[3].

Nowadays due to the ageing Myanmar population, increased dynamism of people's lives and growing life expectancy, there is an increasing clinical demand for bone replacement and repair. The main mineral component of bone tissue is a nonstoichiometric carbonated multi-substituted apatite with calcium to phosphorus ratio (Ca:P) between 1.37 and 1.87 [1].

was applied. An important characteristic of hydroxyapatite was its stability when compared to other calcium phosphates hydrothermally; hydroxyapatite was the most stable calcium phosphate compound under physiological conditions as temperature, pH and composition of the body fluids. In this research work, HA powder was synthesized by a hydrothermal precipitation route, directly poured in an electric furnace oven, in Chemistry Department, Shwebo University, at various temperatures, 200°C, 300°C, 400°C, and 500°C for 1 hr as shown in Fig 1 to 4. In this study, hydrothermal method was used to synthesize HA powders. The synthesis of HA by calcining method as synthesized and heat-treated HA powder was characterized by XRF and pH meter.

## 3. RESULTS AND DISCUSSION

Raw material of hen eggshells powder was synthesized by XRF technique. Pure hydroxyapatite has Ca/P ratio of 1.5 to 2 and pH ratio was 10 to 12. As a result of XRF technique, in this research, eggshell was 21.98 and very rich in calcium, to need necessary reduced calcium and so needed to heat. Firstly, my thesis analyzed, hen eggshells contained by XRF technique as shown in Table [1]. And finally this research was used hydrothermal method and doping phosphate with various temperatures as shown in Table [2] to [5]. The flow diagram of this research work by hydrothermal method analysis was shown in Fig.1.

**Table1: Shown synthesis of hen eggshells powder by using XRF technique**

Sample	Calci m (Ca)(%)	Phoshate (P)(%)	Ca/P ratio	pH value
Sample of hen eggshells	3402	12.44	21.98	6.23

**Table2: The pH value of hen eggshells powder with temperature 200°C**

Sample	Weight of sample (g)	Calcined Time interval in Furnace oven (hr)	pH value
Hen eggshells powder	10	1	7.12

**Table3: The pH value of hen eggshells powder with temperature 300°C**

Sample	Weight of sample (g)	Calcined Time interval in Furnace oven (hr)	pH value
hen eggshells powder	10	1	7.88

**Table4: The pH value of hen eggshells powder with temperature 400°C**

Sample	Weight of sample (g)	Calcined Time interval in Furnace oven (hr)	pH value
hen eggshells powder	10	1	9.56

**Table5: The pH value of hen eggshells powder with temperature 500°C**

Sample	Weight of sample (g)	Calcined Time interval in Furnace oven (hr)	pH value
hen eggshells powder	10	1	10.48



**Figure2: The pH value of eggshells powder with temperature 300°C**



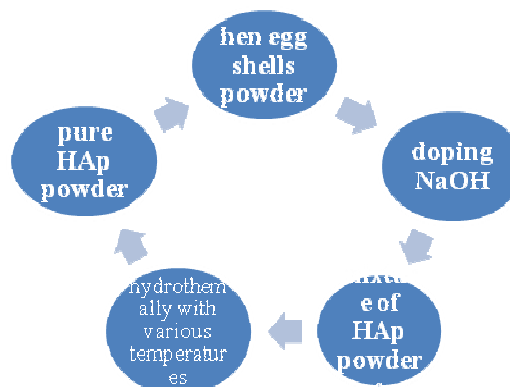
**Figure3: The pH value of eggshells powder with temperature 400°C**



**Figure4: The pH value of eggshells powder with temperature 500°C**



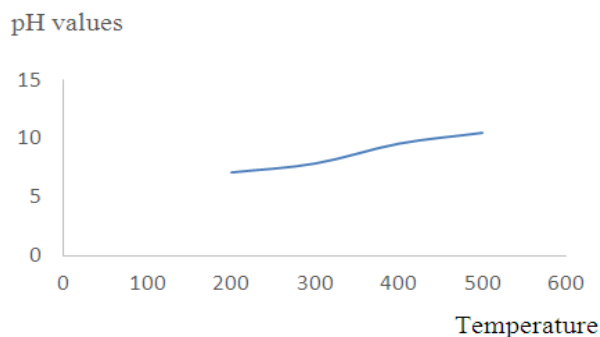
**Figure 1: The pH value of eggshells powder with temperature 200°C**



**Figure5: Shown Hydrothermal method for pure HA powder**

#### 4. CONCLUSIONS

Hydroxyapatite (HA) powder is a calcium phosphate similar to the human hard tissue in morphology and composition. Particularly, it has a hexagonal structure and Ca/P ratio of 1.5 to 2 and pH value is 10 to 12, which is identical to bone apatite. In this research, sample of eggshell were heated at 200 °C and its pH value was 7.12. And then heated at 300 °C in Electronic Oven and its pH value was 7.88. At 400°C heated by 1 hr, the pH value of eggshell powder was 9.56. And finally the sample of eggshell were heated by 1 hr at 500°C and the pH value was 10.48. In conclusion, at 500°C, the sample of eggshell powder was identical to HA powder (hydroxyapatite powder) which similar to human hard tissues and must be used to apply bone substitution, dental substitution, medical drug and requirement of medicine devices.



Different calcinate temperatures and pH values

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