

Hydroxyapatite for Water Treatment

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Hydroxyapatite (HAp) was prepared from egg shells by various routes using hexane and acetic acid followed by heat treatment. HAp has a wide application in water treatment by removal of metal ions. XRD of the samples showed use of acetic acid followed by high temperature sintering leads to formation crystalline phases of HAp. Strong evidence of CaCO₃ in calcite phase was obtained in other samples.

Keywords: Hydroxyapatite, Water Treatment, XRD

Hydroxyapatite (HAp) having formula Ca₁₀ (PO₄)₆(OH)₂ have a wide application in water treatment. HAp based filter are used for removal of heavy metal ions from aqueous solutions [1]. HAp – Chitosan nanocomposites synthesized by sol-gel method have been used for the removal of Cd⁺² ions in water treatment [2]. HAp has been found in fish bone. Porous structure and crystalline phases of HAp were obtained when heated at 1000 °C. It showed potential in removal of Cr ions from natural river [3]. 3D ordered HAp hollow microspheres were synthesized from soluble bio polymer like polyaspartic acid where initial formation followed by transformation of calcium phosphate spheres were reported [4]. Sintering of HAp and Silica composite nanopowders have led to formation of porous ceramic filters. The water permeated through them was of drinking water quality [5]. Ag₃PO₄/HAP composites were synthesized facilely via in-situ precipitation of Ag₃PO₄ on the

pre-existing HAP nanowires which can be used as water treatment material [6]. Egg shells have been used to synthesize Hap. The egg shells are three layered structure: cuticle, spongy layer and lamellar layer. It consists mostly of Calcium carbonate and small amounts of Calcium phosphate magnesium carbonate and some organic matter. Hydroxyapatite (HAp) are prepared from egg shells in phosphate solution at elevated temperature [7].

The surfaces of the raw eggshells were mechanically cleaned in order to remove the internal crust lining in the shell. Afterwards the eggshells were washed using tap water for about 15 times. The washed eggshells were then subjected to constant stirring for about 15 - 30 minutes. The sample was then placed in an oven at 100°C for constant heating for about 6 hours. The dried sample (15.4077g) is then mixed with 50 ml acetic acid and 100 ml of distilled water with constant stirring of about 3 hours. The sample is then filtered by using Buckner funnel. The residue is then washed with distilled water for 10 times. The sample is then placed in the oven at 100°C for 6 hours. For the thermal treatment of the sample it is placed in the muffle furnace at 150°C for 5 hours. The synthesis routes are tabulated below

Table 1: Synthesis route of Hap from egg shells

Sample	Synthesis route
A	Egg shell + hexane
B	Egg shell + acetic acid (1000 °C , 2hrs)
C	Egg shell + hexane (1000 °C)
D	Egg shell + acetic acid + distil water (100°C, 6hrs)

Proto XRD at Centre of Excellence for Green Energy and Efficient Technology (CoE-GEET) CUJ was used for the XRD studies where monochromatic Cu-K α radiation having a wavelength of 1.54Å was used. The XRD plots of the samples prepared by four different routes given in Fig 1 were indexed from published reports [8]. The peaks in sample A, C and D were of Calcium Carbonate (CaCO $_3$) in calcite phase [9]. Evidence of HAP was obtained in sample B.

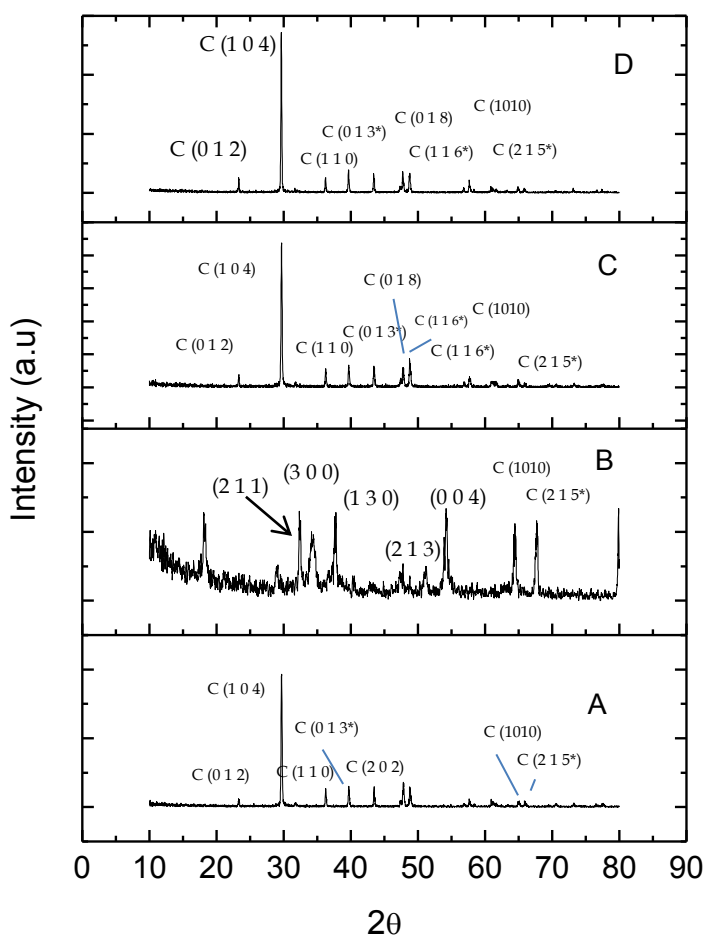


Fig 1 : XRD of HAp synthesized by various routes

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