

Rapid Synthesis of Eggshell Derived Hydroxyapatite using Microwave Irradiation

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INTRODUCTION

Hydroxyapatite is compositionally similar to the mineral component of bone and is bioactive, biocompatible and bioresorbable. Eggshell is predominantly composed of calcium carbonate, with some substitutional ions such as magnesium and iron. Magnesium increases bioactivity and promotes cell adhesion¹, thus making eggshell a very desirable precursor for the production of calcium phosphates for bone tissue engineering applications.

EXPERIMENTAL METHODS

Calcium hydroxide was formed by the addition of calcined eggshell-derived calcium oxide to deionised water. Dolapix 64 was added followed by the slow dropwise addition of phosphoric acid. Small quantities of ammonium hydroxide were added to maintain a pH of 12.

The solution was irradiated in 10 second pulses at a power of 440 W and cooled in an ice bath between each pulse to ensure that the temperature did not exceed 60 °C. This process was repeated for a total irradiation time of 10 minutes. The product was filtered and dried at 80 °C.

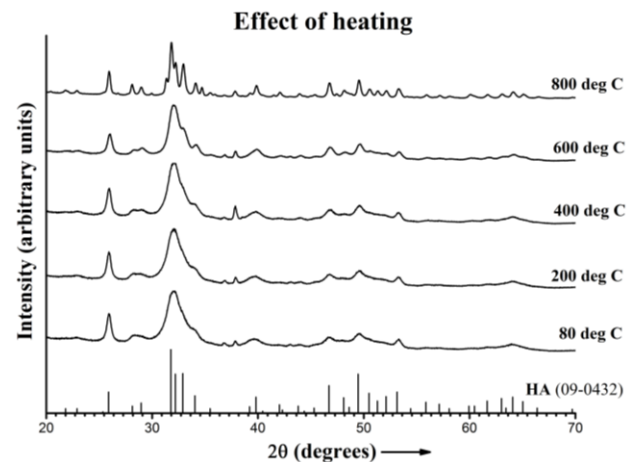
Samples were heated sequentially to 200, 400, 600 and 800 °C.

RESULTS AND DISCUSSION

As can be seen in Figure 1, the XRD data for the synthesised samples match the standard peaks for synthetic hydroxyapatite. Figure 1 also demonstrates the thermal stability of the products at temperatures up to 800 °C.

The broadening of the peaks seen in Figure 1 is indicative of the nanocrystalline nature of the products. Some change in crystallite size was observed for heating at moderate temperatures up to 800 °C. Crystallite sizes were estimated

using the Scherrer equation and determined to be 35 nm for the sample dried at 80 °C with no further heating, and 53 nm for the sample heated to 800 °C.



“Figure 1 shows XRD plots for samples heated to various temperatures.”

CONCLUSION

Nanocrystalline hydroxyapatite was successfully synthesised from avian eggshell biowaste.

REFERENCES

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