

Rapid synthesis of nanocrystalline hydroxyapatite from biowaste eggshell via microwave irradiation for tissue engineering applications

Millions of tonnes of eggshell are generated worldwide each year. Some is used as fertiliser but a significant proportion is wasted. Due to the high calcium carbonate content of eggshell, combined with the presence of magnesium, synthetic hydroxyapatite can be produced with properties and composition similar to the natural mineral component of bone. The presence of magnesium increases the bioactivity of the synthesised nanocrystalline hydroxyapatite and is beneficial for in vivo bone remodelling.

Microwave irradiation using a typical household microwave oven was utilised to produce nanocrystalline hydroxyapatite from avian eggshell biowaste. Microwave irradiation increases the reaction rate of synthesis and allows rapid production of apatites with optimised processing variables. Pulsed control of irradiation was used to maintain the temperature below 60 °C and the pH was maintained above 12.

Nanohydroxyapatite produced by this methodology offers a wide range of tissue engineering applications, including as void fillers, bioscaffolds, synthetic biocomposite bone screws, apatite coatings for orthopaedic implants and bioresorbable drug delivery devices.

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