

Hydrothermal synthesis of hydroxyapatite powders using response surface methodology (RSM)

ABSTRACT

Hydroxyapatite (HAp)—[Ca₁₀(PO₄)₆(OH)₂] has a similar chemical composition to bone material, making it the main mineral supplement in bone-making. Due to its high biocompatibility, hydroxyapatite is widely used in the repair of bone deficiencies and in the production of dental or orthopedic implants. In this research, hydroxyapatite nanopowder was synthesized using a hydrothermal technique. Fourier Transform Infrared Spectroscopy (FTIR) and transmission electron microscopy (TEM) were used to investigate the chemical structure and morphology of the synthesized hydroxyapatite powder. X-ray diffraction (XRD) was used to evaluate the phase analysis of HAp nanopowder. In addition, bioactivity HAp assessment was conducted by scanning electron microscopy (SEM) attached with Energy Dispersive X-Ray Spectroscopy (EDX) analysis. Response Surface Methodology (RSM) with central composite design (CCD) was used in order to determine the optimal conditions for yield, size, and crystallinity. Three independent variables (pH, temperature, and hydrothermal treatment time) were investigated. The yield was observed to increase in alkaline conditions; pH showed the greatest influence on the yield, size, and crystallinity of the synthesized hydroxyapatite, based on Analysis of Variance. The results of bioactivity evaluation are showed high bioactivity due to the formation of apatite on the surface of the synthesized nanopowder.