

Title: Structural characterization, optical properties and in vitro bioactivity of mesoporous erbium-doped hydroxyapatite

Author/Authors: Ammar Z. Alshemary, Muhammad Akram, Yifan Goh, Mohammed Rafiq Abdul Kadir, Ahmad Abdolahi, Rifaqat Hussain

Abstract: We report the successful synthesis of mesoporous erbium doped hydroxyapatite (Er-HA, $\text{Ca}_{10-x}\text{Er}_x/3 \cdot 3(\text{PO}_4)_6(\text{OH})_2$) by using a rapid and efficient microwave assisted wet precipitation method. Characterization techniques like X-ray diffraction (XRD), Fourier transform infra-red (FTIR), X-ray fluorescence spectrometer (XRF), Brunauer, Emmett and Teller (BET) and transmission electron microscopy (TEM) were used to determine lattice parameters, particle size, degree of crystallinity, elemental composition, surface area and morphology of Er-HA. Results confirmed the formation of crystalline Er-HA having crystallite size of 25 nm with spherical and rod like morphology, while the TEM analysis confirmed the mesoporous nature of the particles. Optical spectra of Er-HA contained seven electron transitions, whereas blue shift in the energy band gap (E_g) was observed upon increase in Er^{3+} content. The photoluminescence (PL) spectra contained green and red emissions. In vitro bioactivity study conducted in SBF revealed that the incorporation of Er^{3+} ions into HA structure lead to the faster discharge of Er^{3+} ions resulting in intense growth of apatite grains on the surface of the Er-HA pellets with Ca/P ratio of 1.72.