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EPR dosimetry with A-type carbonated apatite powder

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In the last decades electron paramagnetic resonance (EPR) has performed important role to dose reconstruction in accident and high-dose applications dosimetry. Hydroxyapatite of calcified tissues (bone, enamel, dentin) and alanine are the principal materials used in these fields, respectively. Retrospective dosimetry is mainly based on measurement of radiation-induced carbonate radicals in biological hydroxyapatites, $Ca_{10}(PO_4)_6(OH)_2$. Carbonate ions are incorporated into hydroxyapatite crystalline lattice of the calcified tissues substituting for both phosphate (site B) and hydroxyl (site A) ions.
EPR spectrum of synthetic carbonated apatites has been widely studied in the literature however few efforts have been made to evaluate the potential dosimetric of these materials. The needed of alternatives materials for reference EPR dosimetry and properties of biological hydroxyapatites raised the investigation of the synthetic carbonated apatite for dosimetric purposes. In this work, the potential use of A-type carbonated apatite (carbonate groups substitute for hydroxyl ions) produced in reproducible conditions is presented. Synthetic samples were characterized by X-ray diffraction, infrared spectroscopy, thermal desorption spectroscopy, induced couple plasma and multiphase carbon analyzer. Analysis of EPR spectra at X-band and Q-band, lowest detection limit, temperature and time effects after irradiation, photons dependence energy and uncertainty of the apatite powder dosimeter are discussed. The A-type carbonated apatite prepared in specific synthesis conditions presents very interesting properties for using in therapy dose level.

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