In situ Formation of Methyl Methacrylate / Hydroxyapatite – Based Polymer Composites through a Sequential Bulk-Suspension Polymerization

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The polymeric materials synthesized in this work are characterized by presenting in its composition hydroxyapatite (HAP) homogeneously dispersed into polymeric matrices of poly(methyl methacrylate), PMMA. The HAP [$Ca_{10}(PO_4)_6(OH)_2$], the main constituent of calcified tissues, is a versatile inorganic material used in several applications, such as, adsorption of proteins, bone reconstruction, prosthesis, treatment of osteoporosis, due to its good biocompatibility and high capacity for osseointegration [1-4]. Polymerization reactions have been carried out in a sequential bulk-suspension process in order to obtain polymer composites based on methyl methacrylate (MMA) / ethyl acrylate (EA) / hydroxyapatite (HAP) and MMA / vinyl acetate (VAc) / HAP *in-situ*, showed that polymer particles with good morphology can be obtained as a result of the proper dispersion of HAP fragments into the thermoplastic matrices of the poly(methyl methacrylate) – PMMA, poly(methyl methacrylate-*co*-ethyl acrylate) – PMMAAE and poly(methyl methacrylate-*co*-vinyl acetate) – PMMAVAc, as shown in Fig. 1. It was observed that the microparticulated hydroxyapatite with average particle diameter equal to 50 micrometer was successfully dispersed into the spherical polymer particles (presenting average diameter ranged from 100 micrometer to 250 micrometer). Analyses of X-ray diffraction showed, in all synthesized materials (PMMA / HAP, PMMAAE / HAP and PMMAVAc / HAP composites), that the final polymeric materials exhibit characteristic peaks of pure HAP [2θ = 25.94, 31.79, 32.24, 32.97, 34.15, 39.87, 46.76, 49.47 and 53.20, corresponding to the reflections (002), (211), (112), (300), (202), (310), (222), (213), (004), respectively] with an intensity proportional to the fraction HAP incorporated, which was determined through thermogravimetric measurements in the range from 1 wt.% to 20 wt.%. It was also observed that the polymeric composites exhibited similar thermal degradation profiles, presenting only one significant weight loss and complete degradation in the temperature range from 250 °C to 450 °C, which indicates that these materials possess good thermal stability.

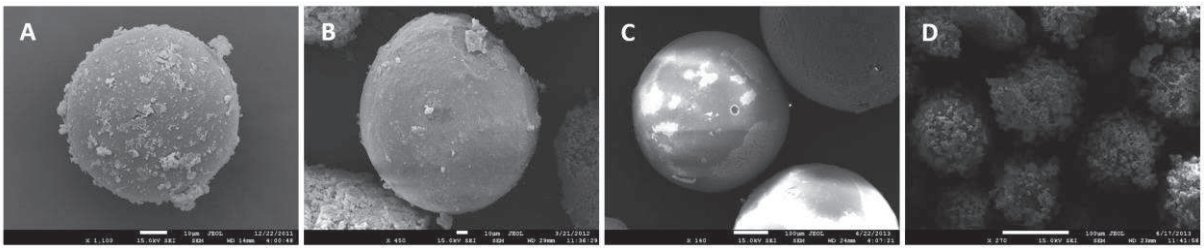

Fig. 1: MEV of Polymer particles. (A) PMMA; (B) PMMA / HAP 5 wt%; (C) PMMAVAc / HAP, 95 wt% of MMA and 10 wt% of HAP and (D) PMMAVAc / HAP, 90 wt% of MMA and 10 wt% of HAP.

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