IRAP047

PCL, PLLA homopolymers and PCL/PLLA blend gamma irradiated investigation by wide-angle x- ray diffraction

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Morphology of biodegradable polymers affects the rate of their biodegradation. A polymer that has high degree of crystallinity will degrade at a slower rate due to the inherent increased stability. In the present work, twin screw extruded films of PLLA and PCL biodegradable homopolymers and 50:50 (w:w) blend were irradiated with gamma rays from Co-60 at doses in the range of 100 to 1000 kGy to investigate the effects of the ionizing radiation on their crystalline structure. Wide-angle X- ray diffraction (WAXD) patterns of non irradiated and irradiated samples were obtained using a diffractometer Rigaku Denki Co. Ltd., Multiflex model, Cu Kα radiation. All PCL samples, non irradiated and irradiated ones, have shown the two strongest reflections at Bragg angles $2\theta = 21.4°$ and $2\theta = 23.7°$ that have been attributed in the literature to the (110) and (200) reflections, respectively. For as extruded non irradiated and irradiated with 100 kGy dose PLLA it was observed broad diffusion peaks corresponding to amorphous polymer. Previous results showed that it was not possible to observe any significant alteration on the crystalline structure by

WAXD of all irradiated samples in the dose range studied up to 100 kGy. Although it had been presented in the literature that PLLA crystallinity decreases with radiation dose up to 80 kGy, it was not possible to observe this fact in this study. Furthermore, it was observed that PLLA crystalinity increases with radiation dose above 100 kGy in the studied dose range. Also this occurrence can be observed for the blend. PLLA as extruded samples are amorphous and undergo crystallization by thermal treatment. PLLA samples annealed under temperature of 140°C during half an hour showed reflections at Bragg angles $2\theta = 16.6°$ and $2\theta = 19.0°$. As described previously in the literature that are attributed to 10_3 (α-form) helices.