

EFFECT OF GAMMA RAYS ON THERMAL PROPERTIES OF BIODEGRADABLE ALIPHATIC POLYESTERS BLENDS

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Introduction

Poly(L-lactic acid) (PLLA) and poly(ϵ -caprolactone) (PCL) have been received much attention due to their biodegradability in human body as well as in the soil, biocompatibility and non toxicity⁽¹⁻³⁾. They are considered environmentally friendly as these polymers are converted to CO₂ and H₂O when in contact with soil that contains microorganisms⁽⁴⁻⁶⁾. Biodegradable poly(L-lactic acid) and poly(ϵ -caprolactone) blends films of various compositions were obtained using a twin screw extruder. PLLA/PCL blends and also homopolymers were irradiated with gamma rays from Co-60 at doses in the range of 25 to 100 kGy to investigate the effect of the sterilization processing by ionizing radiation on the thermal properties of the samples. Thermogravimetry (TG) was performed in inert and oxidative atmosphere for irradiated and non-irradiated samples in the temperature range from 25 to 600 °C, heating rate 10 °C/min, in order to evaluate the influence of different doses of gamma radiation on the thermal stability of the blends. Differential scanning calorimetric (DSC) curves of non-irradiated and irradiated blends were obtained in inert atmosphere in the same temperature range and heating rate, to correlate events that occur during heating process such as oxidation, degradation or depolymerization.

Results and Discussion

Tg curves of non irradiated and irradiated PCL and PLLA homopolymers and 50:50 blend obtained in dynamic atmosphere of air and nitrogen are presented in Fig. 1 and Fig. 2, respectively.

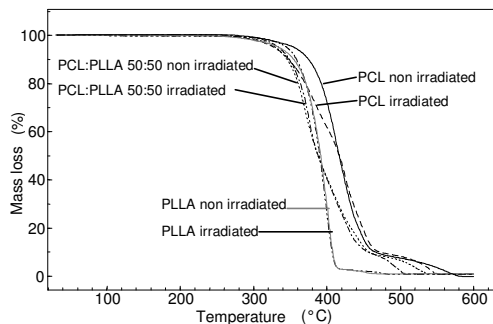


Figura 1. TG curves for irradiated and non irradiated PCL and PLLA homopolymers and PCL:PLLA 50:50 in air.

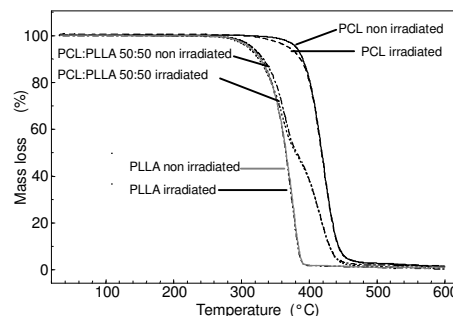


Figura 2. TG curves for irradiated and non irradiated PCL and PLLA homopolymers and PCL:PLLA 50:50 in N₂.

All irradiated and non irradiated homopolymers and blend thermally degrade in more than one step in air. Under inert atmosphere PCL and PLLA present only one step of thermal degradation. The 50:50 blend showed two steps. It was not observed a DSC exothermic peak due to oxidative processes during heating in inert atmosphere of all samples. Although in the literature PCL crosslinking increases with increasing doses of high energy radiation and the irradiation of PLLA homopolymer causes mainly chain-scissions at doses below 250 kGy⁽⁷⁾, it seems that PCL suffered main-chain scission and PLLA was not affected by the dose range studied.

Conclusion

It could be observed the influence of gamma radiation on PCL. PCL is more thermally stable than PLLA and blend. PLLA was not affected by gamma radiation in the dose range studied.

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