



SYNTHESIS OF NOVEL BIOPOLYESTERS BASED ON ϵ -CAPROLACTONE AND POLYOL FROM COTTON SEED OIL

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Introduction. Since a few years ago, biodegradable polymers have become of interest as substituting materials from the polluting petrochemical ones. This new biomaterials prepared from natural resources have provided significant opportunities and progress mainly in medicine [1]. Biodegradable polymers (mainly polyesters and polyanhydrides) are useful materials for medical, pharmaceutical applications and as additives in the processing of other polymers [2]. Polyesters play a predominant role as biodegradable plastics due to their potentially hydrolysable ester bonds. Among polyesters, polycaprolactone (PCL) is well known a polymer because of its biodegradability and biocompatibility [3]. Natural oils contain linoleic acid and oleic acids which have a reactive carboxyl group that can be used for ring opening reactions. Furthermore, these fatty acids can produce polyester polyols by chemical modification [4]. The present article focuses on the preparation and characterization of new biodegradable copolyesters from polyols obtained from cottonseed oil and PCL. These biopolymers were synthesized by the bulk ring opening copolymerization of CL with cottonseed polyol (CSP).

Methods. For polyols obtaining an epoxidation and acidic hydrolysis was carried out in a single step reaction using cottonseed oil, acetic acid with stirring in reflux at 85 °C, subsequently H₂O₂ was slowly added and finally H₂SO₄ was added as catalyst. The mixture was reacted for 4 h. For polyol/CL copolymerization ϵ -caprolactone and CSP were reacted in the presence of tin octanoate (0.1 mol%) at 120 °C. The effect of catalyst amount and reaction time was evaluated. The copolymer obtained was characterized by Fourier transformed infrared spectroscopy (FTIR), nuclear magnetic resonance (NMR) and gel permeation chromatography (GPC).

Results. The synthesized polyol shown an hydroxyl index of 284.9 mg KOH g⁻¹. Fig.1 shows the FTIR spectra of pure cottonseed oil and the corresponding polyol were the

disappearing of the C=C stretching signal as well as the C=CH of cottonseed oil can be appreciated, giving place to the appearing of an O-H stretching signal characteristic of polyols. Fig. 2 show the FTIR spectrum of PCL and PCL/Polyol copolymer where the characteristics signals of polyesters can be observed.

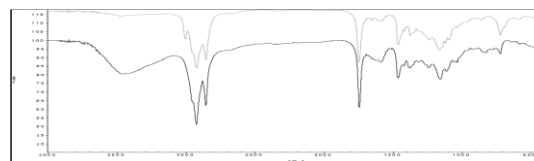


Fig.1 Spectrum FTIR of Cotton Seed Oil and Polyol

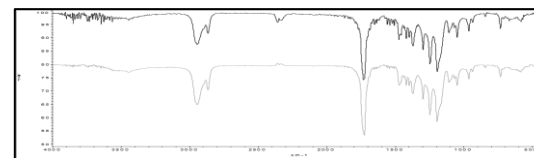


Fig. 2 Spectrum FTIR of PCL and PCL/Polyol

Conclusions. The carbonyl and hydroxyl moieties of cottonseed polyols react with ϵ -caprolactone giving place to a polyester copolymer. This copolymer shown some structural differences compared to PCL based homopolymers, however FTIR spectra of both before mentioned polymers do not show significant differences since they possess the same functional group. On the other hand Polyol/CL based copolymers could have biodegradable properties, because it has been reported that the polymers derived from these monomers are biodegradable character.

References.

1. Ristic´ I., Marinovic´-Cincovic´ M., Cakic´ S., Tanasic´ L. and Budinski-Simendic J. (2013). *Polym. Bull.*
2. Al-Azemi F., Kondaveti L., and Kirpal S. (2002). *Macromolecules*, 35, 3380-3386.
3. Buasri A., Chaiyut N., Iamma K., Kongcharoen K. and Cheunsakulpong K. (2012) *Int. J. Chem. Environ. Enge. Cast Met. Res.*, 6:138-141.
4. Desai S., Anurag L. and Sinha V. (2003). *J. Pol. Res.*, 10: 141-149.