

CHARACTERISTICS OF BIODEGRADABLE POLY(ESTER-URETHANES) WITH SIDE CHAINS

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Polyesterurethanes (PEU) were obtained according to a two-stage method. The first stage included the synthesis of prepolymers containing isocyanate groups from 2,4- and 2,6- toluylene diisocyanate mixture 80/20 (TDI) and polycaprolacton (PCL) diols, synthesized from ϵ -caprolactone in the presence of butylene glycol. The second stage included the incorporation of a chain extender into the prepolymer. To determine the physical and mechanical characteristics and perform differential scanning calorimetric (DSC) studies, PEU films 200-300 μm thick were used, which had been obtained from a 30% solution of a prepolymer and chain extender in toluene. To incorporate the side chains of the aliphatic structure into the rigid segment of PEU, the product of sunflower seed oil and triethanolamine transesterification was used as the chain extender.

Two series of PEU were obtained. The flexible segment of the first series PEU was formed with PCL diol with $M_n = 2000$. The rigid segment was formed by TDI and the chain extender, whose molar ratio was varied from 2.2:1 to 9.9:8. Thereby, from 10.2 to 32.9 wt.% of side chains was incorporated into the PEU structure.

DSC data testify that, as the side chain concentration in the PEU rigid segment increases, the melting enthalpy (ΔH) tends to decrease from 28.0 to 2.4 J/g, while the endothermic peak connected with this process shifts from 48.2 to 35.4°C. The incorporation of side chains into the rigid segment does not essentially affect the glass transition temperature T_g of PEU, which varies from -50.4 to -60.2°C. The side chains in the rigid segment of PEU decrease its tensile strength, ultimate tensile elongation, and residual elongation at break from 11.4 to 1.7 MPa, from 520 to 240% and from 103 to 4%, respectively.

The second series PEU specimens were obtained, by incorporating PCL diols, with M_n within the range from 600 to 10 000, into the flexible segment. Amorphous specimens can be obtained from PCL diols, with M_n ranging from 600 to 2000, by incorporating the side chains into the PEU structure. It was found that the biodegradable PEU crystallinity could be diminished by incorporating long chains into the flexible segment of the chain.