THERMOGRAVIMETRIC ANALYSIS OF POLYMERS WITH INDANIC STRUCTURE

L. H. Tagle and F. R. Diaz

ORGANIC CHEMISTRY DEPARTMENT, FACULTY OF CHEMISTRY, CATHOLIC UNIVERSITY OF CHILE, P.O.BOX 6177, SANTIAGO, CHILE

(Received October 8, 1991)

The thermal stability of polycarbonates, polythiocarbonates, and polyesters derived from a diphenol with an indanic structure, was studied and compared with the corresponding polymers derived from a diphenol with the same number of carbon atoms but no forming the indanic ring, showing that polymers with an indanic structure degrade at lower temperature due the rigidity of the indanic ring respect to those with an aliphatic structure. Also, the kinetic parameters of the thermal decomposition were determined by using the Arrhenius relationship and a computer program. In the considered range, all the polymers studied degraded in a single stage and the $E$ values increase when the bulk of the side group increases and the rigidity decreases.

Keywords: indanic structure, kinetic parameters, polymers, TG

Introduction

Organic macromolecular systems, like all other substances, may undergo a number of transformations under the effect of heat treatment. These changes are of a chemical or physical character, but simultaneous occurrence of both types of transformations is frequent. However, in polymeric materials the most frequent manifestation of such transformations is the change of mass, which can be observed by dynamic thermogravimetry.

In recent years the applications of polyesters have expanded remarkably, not only as synthetic fibres but also as tyre, films, food containers and, more recently as reinforced thermoplastic material for injection moulding. During the manufacture and the processing of polyesters, they are subjected to high ranges of temperature. These conditions can result in degradation reactions which deteriorate the desired properties of the polymer during processing or in the practical use of the material. For this reason it is important to know the behaviour that
present polyesters and polymers in general, when are heated under controlled conditions, as in dynamic thermogravimetry.

In a previous paper [1], we described the synthesis of polyesters derived from terephthaloyl and adipoyl dichlorides with 1,1,3-trimethyl-3-(4'-hydroxy-phenyl)-6-indanol has diphenol, using phase transfer conditions. Also we synthesized the polycarbonate and polythiocarbonate derived from the same diphenol. The yields and inherent viscosities obtained were low due principally to the rigidity of the diphenol.

On the other hand, we synthesized polymers from a diphenol with the same number of carbon atoms but forming an aliphatic chain bonded to the central atom between the aromatic rings, under the same conditions. However, in this case the yields and inherent viscosities obtained were higher than those obtained for the polymer from the diphenol with an indanic group, and the phase transfer process was more effective, due to the flexibility of the diphenol [1].

As a form to verify the thermal behaviour of the polymers with the rigid diphenol, and continuing our work in the thermal studies of polymers [2, 3], in this work we describe the thermal stability of polymers derived from 1,1,3-trimethyl-3-(4'-hydroxy-phenyl)-6-indanol, which are compared with the thermal behaviour of those derived from the diphenol with the same number of carbon atoms but forming an aliphatic chain bonded to the central atom between the aromatic rings.

**Experimental**

The synthesis of 1,1,3-trimethyl-3-(4'-hydroxy-phenyl)-6-indanol (I), 2,2-bis-(4-hydroxy-phenyl)-4-methyl-pentane (II), the corresponding polyesters with terephthaloyl dichloride (III and V) and adipoyl dichloride (IV and VI), the polycarbonates (VII and IX) and the polythiocarbonates (VIII and X), were described in previous papers [1, 4]. The polycarbonate from II and phosgene (IX) was synthesized under phase transfer conditions according to a procedure described previously [5].

Dynamic thermogravimetry analyses were carried out in a Perkin-Elmer TGS-1 thermobalance with a Perkin-Elmer UU-1 temperature program control. Samples (4–8 mg) were placed in the platinum sample holder and the thermal degradation measurements were carried out between 20° and 650°C at a heating rate of 20 deg-min⁻¹ under nitrogen flow.

**Results and discussion**

The following polyesters, polycarbonates, and polythiocarbonates

*J. Thermal Anal.*, 38, 1992