

Anhydride production as an additional mechanism of poly(3-hydroxybutyrate)pyrolysis.

ABSTRACT

Anhydrides production is newly proposed as an additional pyrolysis mechanism of a biopolymer, poly(3hydroxybutyrate) (PHB). In spite of many suggestions of multiple degradation mechanisms, simple random chain scission by b elimination has been accepted as an exclusive mechanism of the thermal degradation of PHB. However, a wide range of activation energy value of the degradation and the deviation from the random chain scission statistics have suggested the presence of other kinds of mechanism out of the random scission. To confirm other mechanisms out of the random scission, minor pyrolyzates from PHB were characterized with ¹H/¹³C-NMR, Fourier transform infrared spectroscopy, and fast atom bombardment mass spectrometry. As a result, crotonic anhydride and its oligomers were detected as minor products from condensation reactions between carboxyl groups. The anhydrides production must be one reaction out of the conforming process to the random degradation statistics and contribute to the complexity of PHB pyrolysis. An expected thermal degradation pathway of PHB was proposed.

Keyword: Biopolymers; Pyrolysis; Mechanism; Thermogravimetric analysis (TGA); Recycling.