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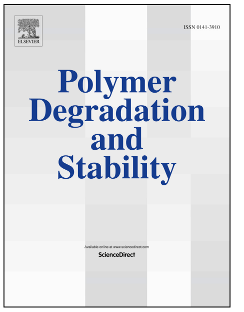

Fully bio-based poly(propylene succinate) synthesis and investigation of thermal degradation kinetics with released gases analysis

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Fully bio-based poly(propylene succinate) synthesis and investigation of thermal degradation kinetics with released gases analysis

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ABSTRACT: One of the most important information about polyesters is their thermal stability and phase transition temperatures. These characteristics give information about the promising behavior of the polyester during processing. In this work, linear bio-based polyester polyols were prepared with the use of succinic acid and 1.3-propanediol (both with natural origin). As a polycondensation catalyst was used tetraisopropyl orthotitanate (TPT), which different amount was employed. The thermogravimetric analysis allowed to observe high thermal stability and one step of the thermal decomposition. This analysis affirmed also that the catalyst content did not influence the thermal degradation characteristics of the prepared polyols. Nevertheless, it has huge importance in the context of thermal degradation kinetics. It was determined with the use of Ozawa, Flynn, and Wall and Kissinger's methods to verifying catalyst impact on the thermal degradation kinetics. Moreover, probable mechanism of the prepared bio-based polyols thermal degradation was proposed based on the QMS results.

KEYWORDS: Poly(propylene succinate); Bio-based polyester polyol; Thermal degradation kinetics; Ozawa, Flynn and Wall method; Kissinger method; Released gases analysis

1. INTRODUCTION

Polyols constitute one of the major components for the polyurethane synthesis. They are usually liquid, reactive substances mostly terminated by the hydroxyl or partially amine groups [1], which are responsible for the reaction with isocyanates [2]. Polyester polyols represent the second most important group (besides polyether polyols) with around 18 % of the polyols global usage [3]. The polyurethane materials obtained with the use of polyester polyols are less resistant to hydrolysis compared to the polyether polyols. However, it makes them more favorable due to the biodegradability [4–6]. Polyurethanes based on the polyester polyols have better thermal and fire resistance than the polyether-based PUR and superior solvent resistance. The greatest value of polyester polyols application is the polyurethane elastomers (ca. 43 %), flexible foams (ca. 15-18 %), adhesives, coating, etc.. Furthermore, polyesters give major possibilities to the biorenewable PUR material obtaining [3].

Currently, readily accessible are the bio-components which allow producing polyester polyols even in 100% consisting from bio-resources [7]. One of the most important bio-based monomer for the