

DESCRIPTION FOR THE GENERAL PUBLIC

Polyurethanes are materials that can be derived from various substrates therefore these materials can be obtained with different chemical structures and characteristics. Polyurethanes possess wide useful properties form those typical of soft elastomers to hard plastics. These materials can be prepared in the form of granulate (for further processing), foam, adhesives, coatings, elastomers etc. and the production of polyurethane is over 14 million tons. Nowadays, thermoplastic polyurethanes are mainly synthesized from components which are derived from non-renewable resources. However, market of polyurethanes are unstable, because resources of petroleum oils are near exhaustion and the prices are instable. Materials often are produced with using organic solvent in the large amount, that are toxic for people and environment. In addition, it is mentioning that the current literature does not present the relationship between the chemical structure and the processability of thermoplastic polyurethane materials.

The main aim of this project is to prepare new bio-based thermoplastic polyurethanes (TPUs) using renewable raw materials. The polyols (based on vegetable oils derivatives), low molecular weight chain extenders (obtained by corn sugar fermentation process) as well as bio-based diisocyanates will be used for the synthesis of TPUs by two methods (i.e. two-step method and by mixing of two different prepolymers). In the present project, it is proposed to prepare thermoplastic polyurethanes using components from bio-based resources. The preparation of materials will be carried out without using organic solvent. Synthesized materials will be new class of materials, which are connected with the actual trends of “green chemistry”.

The presented project is connected with synthesis and performance of novel bio-based thermoplastic polyurethanes synthesized using bio-based monomers. Moreover, the influence of selected bio-based monomers on the morphology, chemical structure, mechanical, thermal and thermomechanical properties will be evaluated for the prepared thermoplastic polyurethanes. The results of the project will contribute significantly to acquiring knowledge about the basic dependencies and facts related to the production, structure and processing of thermoplastic polyurethanes. Therefore, a strong relationship will be established between the chemical structure of thermoplastic polyurethanes and their processing properties. The ability to process thermoplastic materials is one of the most important criteria to be considered in the future production of such materials. Results from this project complete the scientific literature in the field of synthesis and properties of thermoplastic polyurethanes obtained using bio-based monomers.

The chemical structure of obtained TPUs will be examined using spectroscopic methods, i.e. Fourier Transform Infrared Spectroscopy (FTIR), Nuclear Magnetic Resonance (NMR) and XRD diffractometer. The surface morphology will be examined using methods, i.e. scanning electron microscope (SEM) and atomic force microscope (AFM) The selected mechanical properties (e.g. tensile properties, hardness, thermal stability (by Thermogravimetric Analysis, TG), thermomechanical properties (by Dynamic-Mechanical Thermal Analysis, DMTA) will be determined. Also, melt and volume flow index (MFR and MVR) prepared material will be determined, and this parameters are important for thermoplastic polymers from the further processing point of view.