Abstract of a doctoral thesis

"Synthesis of ecoplasticizers from renewable by-products"

Anna Tracz , Msc, Eng.

Supervisor: Sławomir Boncel, Professor

Since the 1990s, the use of certain "phthalate" plasticizers of poly(vinyl chloride) (PVC) has been gradually restricted. Consequently, European chemical policy aimed at protecting human health and the environment from substances of concern introduced the REACH Regulation (EC) No. 1907/2006 on the registration, evaluation, authorization, and restriction of chemicals. This regulation imposed limitations on the use of phthalic acid esters. As a result, Grupa Azoty Zakłady Azotowe Kędzierzyn S.A. withdrew its main and well-recognized phthalate plasticizer, DEHP, from the market. Since then, efforts have been undertaken to identify new substances that can be implemented in industrial production.

The aim of this industrial PhD dissertation was to develop a novel method of synthesizing alternative eco-plasticizers in the form of dicarboxylic acid esters derived from renewable sources, as well as to investigate their physicochemical properties in processing and application-oriented studies. The innovative method proposed within the project involved the use of protic ionic liquids as catalysts in the synthesis of eco-plasticizers. A key part of the dissertation also consisted in assessing the performance of the obtained products as alternative eco-plasticizers. The new eco-plasticizers are expected to expand the product portfolio of Grupa Azoty Zakłady Azotowe Kędzierzyn S.A.

The literature review provided in the dissertation presents the most relevant issues concerning eco-plasticizers, including the theory and mechanisms of plasticization. A survey of the literature on new, alternative eco-plasticizers, as well as esters and acids of natural origin such as sebacic, adipic, and succinic acids, was carried out. Different methods of esterification using various catalysts were analyzed, and the phenomenon of ionic liquids was described.

Eco-plasticizers with improved physicochemical properties constitute a promising area of research. They may be applied wherever polymer materials plasticized with eco-friendly alternatives are required to exhibit superior properties compared to those obtained with conventional plasticizers. The conclusions drawn from the doctoral project confirm the high implementation potential of the work, as the results obtained surpass those of traditional plasticizers.

Anna Tracz