September 17-22, 2023

8th International Polysaccharide Conference

Graz University of Technology, Austria

www.tugraz.at/events/epnoe2023

REPLACEMENT OF FOSSIL-BASED REAGENTS WITH CELLULOSE: ENHANCING MATERIAL PROPERTIES AND CONTRIBUTING TO THE CIRCULAR BIOECONOMY

Frollini E.

University of São Paulo, São Carlos Institute of Chemistry, Macromolecular Materials and Lignocellulosic Fibers Group, São Carlos, São Paulo, Brazil

* elisabete@iqsc.usp.br

By replacing fossil-based raw materials with renewable ones in the synthesis process, we can generate sustainable and environmentally friendly materials. Using cellulose as a substitute for unrenewable reagents may improve material properties while contributing to the circular bioeconomy. In this scenario, the use of cellulose as a polyol in synthesizing polyurethanes has been considered by us in recent years. The chemical reactions occur without the use of any solvents. Castor oil's primary component, ricinoleic acid triglyceride, is utilized as an extra polyol and an effective dispersant for cellulose. Different polyisocyanates have been considered. The reactions occur in molds, under temperature and pressure, with or without reinforcements, forming composites or non-reinforced materials simultaneously with the syntheses. Lignocellulosic mats and/or short fibers have been used as reinforcements. Materials with excellent impact resistance and flexural properties have been formed, expanding the range of possible applications. In another study, the focus is on the syntheses of polyurethanes using the same reagents mentioned, also without solvents, but considering a process that leads to the formation of films simultaneously with the syntheses. Different castor oil/cellulose ratios have been used in the syntheses in this process, and nanocrystalline and nanofibrillated celluloses have also been used as additives. Properties such as tensile and barrier were evaluated, and the results are promising. With an increase in cellulose in the castor oil/cellulose ratio used as a polyol, there was an improvement in properties, sometimes equaling or surpassing the impact of nanocelluloses used as additives. The approach adopted allows for synthesizing with the simultaneous formation of polymeric materials while reducing reliance on non-renewable resources and may lessen the materials' carbon footprint. This promising avenue warrants further exploration and development to optimize its use and benefits. Ongoing research is focused on utilizing acquired knowledge to manufacture cellulose-based materials capable of sorbing and desorbing metals from polluted water. Funding: grant 2020/13703-3, São Paulo Research Foundation (FAPESP).