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Novel bio-based benzoxazines prepared from cardanol

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The growing demand for petrol-based products and their negative impact on the environment forced both academic and industry researchers to find new renewable material for the synthesis of bio-based polymers. Their use is highly desirable, because of their low costs and eco-friendly nature. Among different renewable resources, natural phenols are one of the major and economical resources of natural chemicals. One of such naturally occurring phenol is also cardanol, which is manufactured from cashew nut shell liquid (CNSL). Recently, cardanol was heavily studied as starting material for the synthesis of novel bio-based polybenzoxazine resins. Polybenzoxazines are a newly developed class of thermosetting resins, which possess excellent properties such as high modulus and strength along with high glass transition temperature (T_g). Their main disadvantages are a very high temperature of curing (usually higher than 200 °C) and their low crosslink density, which is surprisingly low considering their high stiffness and T_g. To improve the crosslink density of polybenzoxazines a series of cardanol-based benzoxazine monomers with different amine compounds (aniline, furfurylamine and 4,4´-methylenedianiline) were synthesized, cured and characterized. The pre-epoxidation of cardanol was another approach to achieve a higher crosslink density of the resulting polymer material. It was found out that the introduction of additional polymerizable groups (oxazine, epoxy or furan ring) into benzoxazine molecule increased reaction enthalpy of curing and enhanced thermo-mechanical properties. Therefore, temperature of glass transitions, value of storage modulus and value of crosslink densities of final polymers were all significantly improved.

Biography

Rok Ambrožič is a researcher in the field of chemical engineering, Department of Chemical Engineering and Technical Safety at the University of Ljubljana, Slovenia. He works on design and development of new bio-based polymer materials. Recently he co-authored a paper entitled Synthesis, curing kinetics, thermal and mechanical behavior of novel cardanol-based benzoxazines published in Polymer, which summarizes his final work. He has published 2 peer-reviewed papers and some other reports. At present, he is finalizing his Doctoral thesis, where he is studying about copolymers based on benzoxazine and epoxy resins.

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