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# Syntheses of Biobased Hybrid Poly(epoxy-hydroxyurethane) Polymers

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**Abstract :** The development of polyurethanes began in 1937 at I. G. Farbenindustrie where Bayer with coworkers discovered the addition polymerization reaction between diisocyanates and diols. Since their discovery, the demand in PU has continued to increase and it will attain in 2016 a production of 18 million tons. However, isocyanates compounds are harmful to human and environment. Methylene diphenyl 4,4'-diisocyanate (MDI) and toluene diisocyanate (TDI), the most widely used isocyanates in PU industry, are classified as CMR (Carcinogen, Mutagen, and Reprotoxic). In order to design isocyanate-free materials, an interesting alternative is the use of Polyhydroxyurethanes (PHUs) by reaction between cyclic carbonate and polyfunctional amines. The main problem concerning PHUs synthesis relates to the low reactivity of carbonate/amine reaction. To solve this issue, many studies in the literature have been conducted to design PHU from more reactive cyclic-carbonates, bearing electro-withdrawing substituent or by using six-membered, seven-membered or thio-cyclic carbonate. The main drawback of all these systems remains the low molar masses obtained for the synthesized PHUs, which hinders their use for material applications. Therefore, we developed another strategy to afford new hybrid PHU with high conversion. This very innovative two-step approach consists in the first step in the synthesis of aminotelechelic PHU oligomers with different chain length from bis-cyclic carbonate with different excess of primary amine functions. In the second step, these aminotelechelic PHU oligomers were used in formulation with biobased epoxy monomers (from cashew nut shell liquid and tannins) to synthesize hybrid polyepoxyurethane polymers. These materials were then characterized by thermal and mechanical analyses.

**Keywords :** polyurethane, polyhydroxyurethane, aminotelechelic NIPU oligomers, carbonates, epoxy, amine, epoxyurethane polymers, hybrid polymers
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