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Sustainable Synthesis of Bio-based Non-Isocyanate Polyurethane (NIPU)

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PURPOSE OF THE ABSTRACT

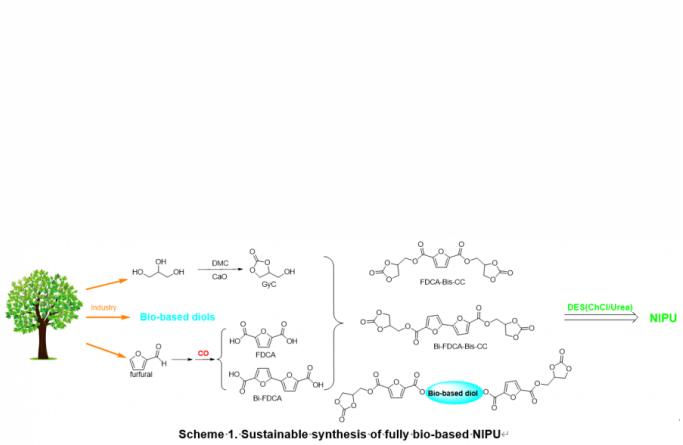
The large use of fossil resources has caused many concerns related to environmental issues and the energy crisis due to the rapid depletion of fossil feedstocks. Therefore, using the renewable biomass to partially replace fossil resources for versatile industrial applications has become more and more attractive. [1-2] Hydroxymethylfurfural (HMF), 2,5-furandicarboxylic acid (FDCA) and glycerol are high-value bio-based platforms derived from renewable sources. Their renewable character combined with an appropriate functionality explain why many researchers both from academia and industry consider these molecules promising to produce high added value bio-based molecules. [3]

Polyurethanes (PUs) are the 6th most widely used polymers, but the use of the toxic isocyanates for their syntheses has aroused increasing healthy and environmental concerns. [4] Recently, new and safer PUs, called Non-Isocyanate PolyUrethanes (NIPUs), have become a promising alternative to replace conventional PUs. Three main routes are reported for the synthesis of NIPUs, 1) AB-type azide condensation, 2) the transurethane reaction, and 3) aminolysis of cyclic carbonates. [5] An overview of different routes for the synthesis of NIPU drew our attention to the green synthesis of cyclic carbonate (CC) compounds and the aminolysis reaction. Presently, the main focus concerns the reaction between bio-based carbonates and amines, which offers an interesting strategy towards renewable NIPU. Although 5CCs are the least reactive than their 6CC analogues, they are easier to synthesize and mostly used. Due to the nature of bio-based compounds and green routes towards CCs, 5CCs seem to be the best choice. [6]

In the past decades, researchers have explored greener chemical sources and new routes to synthesize polymers, in order to match the novel Green Chemistry concepts and the industrial development. Based on my past and our group previous works about NIPU, we decided to design a sustainable synthesis of bio-based NIPU (Scheme 1)

During this talk, we will disclose how FDCA can be synthesized from the abundant, bio-based monofunctional furfural. Next, the use of FDCA as a building block for the construction of bis-cyclic carbonates will be presented so as their use as intermediates for the elaboration of NIPUs after an aminolysis reaction. Of note, we will reveal how DESs can play both the role of a solvent and a catalyst in the synthesis of NIPUs.

FIGURES



Scheme 1. Sustainable synthesis of fully bio-based NIPU

FIGURE 1

Scheme 1

Scheme 1. Sustainable synthesis of fully bio-based NIPU

FIGURE 2

KEYWORDS

Biomass | Non-Isocyanate Polyurethane (NIPU) | FDCA | DES

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