



The Hague | The Netherlands
20-25 August 2023

Book of abstracts

CONNECTING CHEMICAL WORLDS

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P1-A0138

Synthesis of 2,5-furandicarboxylic acid esters from galactaric acid

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2,5-Furandicarboxylic acid (FDCA) has been extensively studied as monomer for the production of polyesters[1] such as polyethylene furanoate (PEF), considered as one of the most valuable bio-based substitute of the petroleum-derived polyethylene terephthalate (PET). [2] Most of the synthetic processes to FDCA employ glucose and fructose as substrates, with the formation of 5-hydroxymethyl furfural (HMF) as an intermediate.[1] The main disadvantage of this process regards the intrinsic instability of HMF, together with its high market price and its difficult separation and purification, which ultimately lead to the production of humins, drastically lowering the overall reaction yield.[3] Few studies focused instead on the production of FDCA from different substrates. In fact, FDCA can be synthesized starting from aldaric acids, which can be obtained either via oxidation of sugars or directly extracted from citrus peel.[4] From these premises, the present study reports an alternative synthetic procedure for the production of 2,5-furandicarboxylic acid dimethyl ester (FDME) starting from galactaric acid through dimethyl carbonate (DMC) chemistry. Both sulfonic resins and an iron-based Lewis acid showed to promote the one-pot formation of FDME. The pure product was isolated as a white crystalline solid without the aid of any chromatographic techniques with an isolated yield up to 70 %. Finally, on the basis of the different intermediates identified, a possible reaction mechanism was proposed, which highlights the essential contribute of DMC in the product formation.

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Synthesis of 2,5-furandicarboxylic acid dimethyl ester (FDME) from galactaric acid via dimethyl carbonate chemistry

