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Unique pathway to platform chemicals - 2,5-furandicarboxylic acid and muconic acid from sugar diacids

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PURPOSE OF THE ABSTRACT

The shift from fossil-based polymers to sustainable plastics requires efficient methods for producing renewable monomers. Diacids derived from carbohydrates are especially intriguing monomers for polyesters or polyamides. We present here the production of two biobased diacids, 2,5-furandicarboxylic acid (FDCA) and muconic acid using aldaric acids as starting material (Fig. 1). Aldaric acids, or sugar diacids, are available from waste streams like citrus peels or sugar beet pulp via biochemical [1] or chemical oxidation [2].

The most common route to 2,5-furandicarboxylic acid (FDCA) proceeds via dehydration of glucose or fructose to 5-hydroxymethylfurfural (5-HMF) and consequent oxidation to FDCA. One drawback of this route is the low yield of 5-HMF due to its instability and formation of humins. Our technology avoids these issues; aldaric acids are highly stable and the subsequent aromatization to FDCA can be carried out using commercial heterogeneous solid acid catalysts up to 80% FDCA yields [3]. Esterification of the aldaric acid prior to the aromatization facilitates the reaction and further polymerization of FDCA to polyethylene furanoate.

Deoxydehydration of aldaric acid to muconic acid is achieved by changing from an acid catalyst to a rhenium catalyst under otherwise similar conditions. Muconic acid is used in lubricants, plastics, carpets and textiles, and moreover, it is a starting material for biobased polyamides, adipic acid and terephthalic acid. Using rhenium catalysts, muconic acid yields over 80% have been obtained [4].

FIGURES

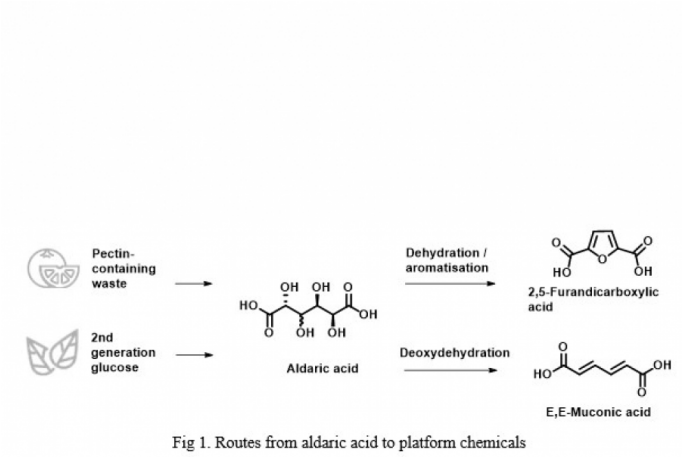

Fig 1. Routes from aldaric acid to platform chemicals

FIGURE 1

Routes from aldaric acid to platform chemicals

Figure 1

FIGURE 2

KEYWORDS

Dehydration | Aromatisation | Deoxydehydration | Sugar di-acids

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