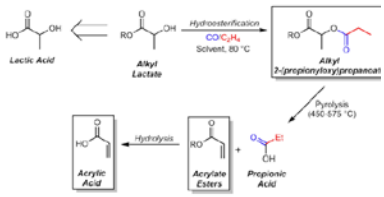

High Yield Synthesis of Bio-based Acrylic Acid and Acrylate Monomers from Lactic Acid

Acrylic esters are currently derived directly from acrylic acid produced from propylene, a by-product of ethylene and gasoline production. Acrylic acid is a key component of polymers such as super absorbents as well as plastics, coatings, adhesives and elastomers. Moving away from petroleum based feedstocks towards a biorenewable starting material is of key interest, as the shift away from petroleum chemical feedstock is an increasing driving force in the global market.

Description of the Invention

A new, sustainable method synthesizes acrylic acid and acrylate esters starting from bio-derived alkyl lactates. The method reacts alkyl lactate with carbon monoxide and ethylene in presence of a palladium catalyst, resulting in catalytic hydroesterification of the alkyl lactates yields alkyl 2-(propionyloxy)propanoates. Pyrolysis of the alkyl 2-(propionyloxy)propanoates yields acrylate esters and propionic acid, and further hydrolysis of the acrylate esters yields acrylic acid. The synthetic method provides quantitative yields of the 2-(propionyloxy)propanoates, making it ideal for scale-up use in industry. The catalytic species can be generated in situ in both in the neat alkyl lactate and in organic solvent from inexpensive and readily available starting materials. This technology provides a viable route from bio-derived lactate esters to acrylic esters via a catalytic, two-step process that takes place at just 80 degrees Celsius, a significant improvement over other methods that require temperatures higher than 250 Celsius.

Features and Benefits

- Bio-renewable lactic acid used as starting material
- Hydroesterification using CO and ethylene in presence of palladium catalyst
- Simple catalytic, two-step process
- Uses inexpensive and readily available feedstocks
- Does not require solvents
- High yield; alkyl 2-propionyloxy propanoate intermediate yields are quantitative Conversion to acrylate and propionic acid via simple pyrolysis
- Relatively inexpensive reactants and low energy costs

Potential Applications

- Bio-derived synthesis of acrylic acid and acrylate esters
- Bio-derived polyacrylic acid and polyacrylate polymers
- Bio-derived propionic acid for animal feed and food preservative

Technology Status

Proof of Concept.

Publications

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IP Status

Patent Pending

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Case Reference

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