Semi-Hydrogenation of Poly-Unsaturated Fatty Acid Derivatives in Multiphase Catalysis for Chemical Feedstock Supply

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Abstract

Dwindling fossil resources increase the demand for sustainable alternatives, i.e. oleochemicals.[1] Increasing the degree of saturation to mono-unsaturated fatty acid derivatives paves the way for various chemical reactions like epoxidation. The major part of these reactions depends on mono-unsaturated oleochemicals independent of the terminal functionalization of the molecule to ensure a stable catalyst or a high selectivity to the desired product.[2] Most promising results in terms of heterogeneous catalysis have utilized Pd catalysts at reaction temperatures of 80°C and 75 atm Hydrogen or needed high catalyst loading of 4,94 wt.% with reaction times over 1 hour.[3] This research focuses on an approach that utilizes a multiphasic reaction system which consists of a polar solvent containing a transition metal and a non-polar substrate phase. The non-polar phase only consists of the fatty substrate and is solvent free. Hydrogen at different pressures is provided as gas phase. Intense stirring is key to ensure proper phase interaction.[4] The catalyst shows high activity already at temperatures up to 50°C and high selectivity to the monounsaturated fatty compound in the mixture. Optimization of reaction conditions led to reaction times below 15 minutes. First tests were performed using a mixture of fatty acid methyl esters (FAMEs). After promising results reactions were performed using refined soybean oil that was esterified with methanol. Since the reaction performance is already on a high level, whilst utilizing a multiphasic approach, the separation of the reaction mixture should be the less demanding task which makes this approach more viable for industrial application.

References:

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