The Role of Catalysis for the Energy-Transition
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Homogeneous Catalysis for Feedstock Diversification: From Laboratory to Miniplant Scale

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Abstract

Unsaturated renewables, such as terpenes, oleochemicals, etc. have shown to be promising feedstocks in the synthesis of biobased chemical intermediates in the production of, e.g. polymers, lubricants and surfactants. Homogeneous transition metal catalysis certainly possesses great potential in this regard, considering selectivity, atom economy and mild reaction conditions by selectively attaching various functional groups to C=C double bonds.
In a nutshell: Homogeneously catalysed reactions may contribute to the success of the necessary transformation process of the chemical industry towards feedstock diversification and thus sustainability.
However, for such transformations to become competitive to existing synthesis routes and attractive to be run on a continuous and larger scale, different major challenges remain in the downstream process beyond chemistry: efficient product separation considering sufficient purity, recovery of the precious homogeneous catalyst including recycling, etc., only to name a few. Established concepts already operated in the chemical industry addressing these points are not applicable one-to-one to the conversion of renewables due to their generally higher boiling points, polarity, and the usually very sensitive nature of the applied transition metal catalytic system.
Hence, for all the numerous homogeneously catalysed transformations of renewables towards the synthesis of biobased platform intermediates, novel solutions for sustainable processes must be developed to allow a successful and economically viable transfer on a larger scale.
Some of these concepts developed at TU Dortmund will be highlighted in the present contribution and discussed critically. Among these are thermomorphic solvent (TMS) systems, membrane-assisted separation processes, aqueous biphasic systems and the innovative approach of selective product crystallisation. Additionally, these concepts will be discussed concerning their implementation into continuous miniplant processes.
This contribution aims to highlight the importance of efficient recycling of homogeneous catalysts, to compile the criteria necessary to evaluate those approaches and to stimulate the discussion and further research in this exciting field.

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