Process Intensification of Thermomorphic Multiphase Systems for the Homogeneously Catalyzed Hydroaminomethylation in a Continuously Operated Miniplant

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Abstract

The hydroformylation reaction for the production of aldehydes is one of the largest homogenously catalyzed applications in industry. The combination of hydroformylation and consecutive reductive amination in a tandem-catalytic transformation bears the potential to make the synthesis of (long chain) amines more sustainable. In comparison to the common industrial routes to longer chain amines this hydroaminomethylation (HAM) potentially reduces the amount of by-products significantly (*Figure 1*).

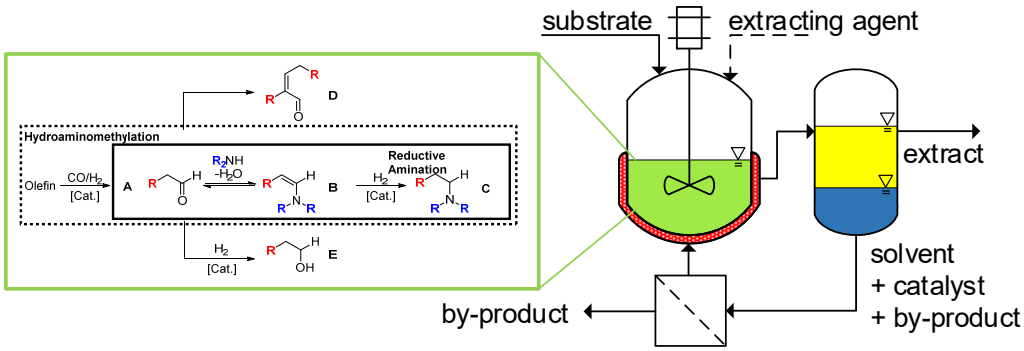

Figure 1: Reaction network of the hydroaminomethylation (HAM) in a continuous miniplant process

In order to set up a potential single step tandem-catalytic HAM process, two prerequisites must be met: First, the recovery & recycle of the homogenous catalyst has to be guaranteed in a continuous process for economic & ecological reasons. Second, the by-product water has to be removed from the process to shift the reaction to the desired product and hence increase the process efficiency. For these reasons a thermomorphic multiphase system (TMS) consisting of dodecane/methanol is chosen to recover & recycle the catalyst. At reaction temperature this TMS forms a monophasic phase, which lowers mass transfer limitations. At lower temperature the TMS becomes biphasic, which allows the recovery of the catalyst and separation of the product from the mixture. To remove the accumulating by-product water from the methanol catalyst phase, organic solvent nanofiltration (OSN) is used. This project is part of the German Collaborative Research Centre/Transregio 63 “Integrated Chemical Processes in Liquid Multiphase Systems” (InPROMPT).