DME as a Global Point-to-Point H_2 Carrier: Process Intensified DME Production - The INDIGO Technology

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Abstract

Studies estimate that by 2050, the European energy market alone will need 550 to 1800 TWh of hydrogen and PtX products annually from which the major part is imported from areas with high renewable energy potential. In the PtX context, dimethyl ether (DME) is a promising product and energy carrier with diverse possible applications in different sectors. DME has a nominal hydrogen storage capacity of 26.1 wt.-%, high gravimetric and volumetric energy density and is environmentally benign. This qualifies DME as a very attractive H_2 carrier for the global envisaged sustainable energy trade. Due to its relatively low vapor pressure of 0.6 MPa at 25 °C, DME is easily liquefied and a promising substitute or blending agent for LPG. Globally, almost 90% of the current annual production of 5 Mt DME is used for LPG blending, predominantly in China. Currently, DME is produced based on fossil feedstock as natural gas or coal. The shift to renewable feedstock from CO_2 and hydrogen will allow emerging pathways for the production of DME to achieve economic competitiveness. PtX processes boundary conditions require advanced strategies matching with the feedstock fluctuations. Focus is hereby put on a process intensification approach based on reactive distillation and its influence on the overall process enhancements. To enable this new process concept, new catalysts are required. Results of a catalyst screening and kinetic measurements incl. kinetic fitting are presented. Finally, a potential estimation of the new DME production pathway will be given.