Professur für Chemische und Thermische Verfahrenstechnik
Campus Straubing für Biotechnologie und Nachhaltigkeit
Technische Universität München

Bachelor's Thesis/ Research Internship/ Master's Thesis

(Experimental)

Measurement of Liquid-Liquid-Equilibrium (LLE) and Vapor-Liquid-Equilibrium (VLE)

Description

Formaldehyde is a feedstock for the production of polyoxymethylene dialkyl ethers (OME), whose use as synthetic fuel is becoming increasingly important. In this process, formaldehyde polymerizes with aliphatic alcohols in an acid-catalyzed manner using equilibrium reactions. Compared to petroleum-based diesel fuels, OME exhibit significantly cleaner combustion. Compared to other synthetic fuels, OME stand out as drop-in capable feedstock in conventional diesel engines.

Figure 1: Vapor-liquid-equilibrium test stand at the CTV laboratory

At the Laboratory for Chemical Process Engineering, research into further improving the fuel properties of OME and the associated manufacturing processes is constantly being conducted. OMEs are purified from the quaternary system of formaldehyde, alcohol, water and OMEs that shows many azeotropes as well as miscibility gaps. Therefore, an accurate model for the liquid-liquid-equilibrium (LLE) as well as the vapor-liquid-equilibrium (VLE) is crucial for subsequent process development. The development of such a model depends on system-specific experimental data that is currently not available.

Within the framework of this scientific work, the phase equilibria in the quaternary system as well as the binary and ternary subsystems are to be measured using established quantitative determination methods and already existing test stands. The latter have to be technically adapted to fit the new system. Lastly, pure substance vapor pressures as well as model parameters are to determined using existing optimization software.

Requirements

- interest and prior knowledge of laboratory analytical work desirable
- prior knowledge in the field of organic chemistry and laboratory experimental work
- high degree of independence and personal responsibility

Tasks

- familiarization with the reaction system and subsequent technical adaptation of the test stands
- planning and execution of LLE and VLE measurements
- simulative optimization of model parameters

Possible start: immediately
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