Thermodynamic modelling of CatLiq® biomass conversion process

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Introduction


Raw Material: DDGS (Dried Distilled Grain with Solubles), a byproduct in first generation ethanol production.

Process conditions: 280-350 °C and 225-250 bar, in the presence of homogeneous (K2CO3) and a heterogeneous (Zirconia) catalyst.

Products: Main components are bio-oil, H2O, CO2, and water-soluble organic compounds.

Capacity: 10-20 L/h of wet biomass pilot plant with fixed-bed reactor.

Aim

Measurement and Prediction of bubble point pressures of selected model system to investigate phase boundaries of the CatLiq® process.

Experiment

The experimental study was carried out in a mercury free JEFRI-DBR high pressure PVT phase behavior system using composition of (7.0% CO2 + 84.8% H2O + 0.1% Ethanol + 0.1% Acetic acid + 8.0% Octanoic acid) as a model system for CatLiq® process.

Thermodynamic model

The results were correlated with PSRK model proposed by Holderbaum and Gmehling, which is predictive Soave-Redlich-Kwong EOS with the modified Huron-Vidal first-order (MHV1) mixing rule of Michelsen coupled with the UNIFAC model.

Results

Bubble point Pressure at 40°C

Conclusion

Experimental and predicted data shows that the capability of the PSRK model is reasonably good in predicting the phase behaviour of such a model system for CatLiq® process.

This modelling work is useful for the CatLiq® process design, development and optimization, which provides a general thermodynamic approach on how to model biomass conversion processes.

References


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