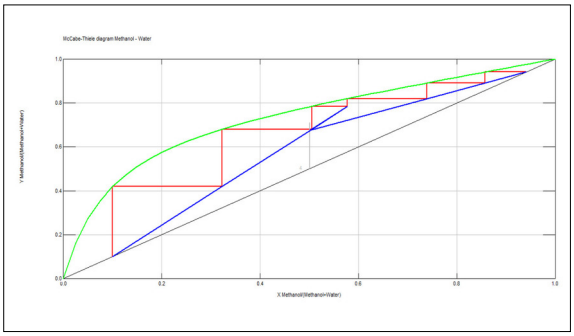
Student	Benjamin Tschan
Examiner	Boris Meier
Subject Area	Energy and Environment

Separation of Methanol-Water Mixture Through Distillation

Composition Estimates

	Methanol	H2O	Sum
Condenser	0.9179	8.208e-002	1.000
1_Main To...	0.8618	0.1382	1.000
2_Main To...	0.7943	0.2057	1.000
3_Main To...	0.7105	0.2895	1.000
4_Main To...	0.5656	0.4344	1.000
5_Main To...	0.5156	0.4844	1.000
6_Main To...	0.4295	0.5705	1.000
7_Main To...	0.2972	0.7028	1.000
Reboiler	8.192e 002	0.9181	1.000

Composition Estimates in each stage of the distillation column with a concentration of almost 92% methanol achieved



McCabe Thiele diagram depicting the 3 operating lines of the system, as well as the concentrations at each stage

Objective: In an effort to pursue clean and alternative fuels, different reactions such as the synthesis of dimethyl ether (DME), have been investigated at the Institute for Energy Technologies. One portion of the process involves separating methanol from water in order to then create the desired DME through the reaction of methanol dehydration. The aim of this project was to investigate the techniques used to separate a 50-50 mol% methanol-water mixture created in the first portion of the synthesis, model the process using ASPEN HYSYS and ChemSep and set the foundation for the eventual build of a lab scale plant, able to handle an incoming flow rate between 1 and 5 Liter/hr to a concentration of, at least, 90% methanol that could then be subsequently used for the creation of DME. Among other examples, the project work consisted of background literature research, an analysis of the process and results, and a comparison of the two modelling programs.

Procedure / Result: The first objective was to conduct background research into various types of separation processes. After it was determined that the separation process use a distillation column, it was followed by a rigorous sizing and modelling to determine if the variables and dimensions proposed would be able to handle the conditions and effectively separate the mixture into two almost pure outgoing flows. These calculations were also backed by material and energy balances and then compared to the results generated by ASPEN HYSYS and ChemSep. Fluid conditions, temperature profiles, number of stages, pressure differentials, tray efficiencies and hydraulic plots were also consulted and checked to make sure the process ran smoothly without any errors. After these results were compared to one another, an actual model along with a proposed P&ID was created, along with sources to potential vendors for the custom builds of the process.