Kem-107.121 Process Simulation II

Exam: 10.12.2004 time: 9-12

Theory (max. 1 h) Answer in Finnish, Swedish or English

1. How physical properties are calculated in a simulator
2. Calculation of distillation column dimensions
3. Explain shortly:
   a) Gibbs reactor
   b) Fuzzy model
   c) UNIFAC

Simulation:

4. The future fuel component dimethyl ether can be produced with following reactions:

i) $2CH_3OH \rightarrow CH_3\text{-}O\text{-}CH_3 + H_2O$
ii) $CH_3OH + CH_4 \rightarrow CH_3\text{-}O\text{-}CH_3 + H_2$
iii) $CH_3CH_2OH \rightarrow CH_3\text{-}O\text{-}CH_3$

Analyze which one of the route you would choose from the thermodynamic point of view at 250 °C and 15 bar. Let the program determine the reaction phase.

5. Calculate the condensation curve for the reactor outlet vapor for reaction (i). In which temperature the vapor starts to condense and when the entire vapor is condensed. Feed of methanol to the reactor is 300 kmol/h, at 250 °C and 15 bar.

6. The dimethyl ether from reaction (i) has to be separated from water and methanol by distillation. The column has 10 theoretical stages and is at 10 bar and the feed is to the 10^{th} tray. The flow rate of all distillate components is equal to the flow rate of dimethyl ether in the column feed. The column reflux ratio on a mole basis is 4. Design a distillation column (diameter and height for valve trays).

The feed of methanol to the reactor is 300 kmol/h, 250 °C and 15 bar.

Maximum points:	theory:	1-3	2p/each
	Simulation	4	3p
		5	3p
		6	4p
	Exercises:		4p (100% attendance)
	TOTAL:		20p