

Purpose:

- Separation of aromatic compounds
- Shortcut distillation calculations
- Rigorous distillation specifications

Problem 1

An effluent stream from a process contains benzene (300 kmol/h), toluene (35 kmol/h) and ethyl benzene (16 kmol/h). The stream is to be separated in three fractions by distillation. The product specifications are:

- 99.8 % of the benzene is to be recovered with a purity of 99.95 mol%.
- 98 % of the toluene is to be recovered and must not contain more than 5 mol% benzene and ethyl-benzene all together.

As the stream is cold (10 °C), it must be heated to 1 °C below the boiling point. The stream pressure is 1.2 bara and the condenser pressure of the first column is 1 bar with a pressure drop of 0.2 bar.

- a) Do the simulation in Hysys (or Unisim). Use a shortcut column to calculate the parameters of the distillation column
- b) What is the required reflux ratio if the first column (benzene column) has 50 stages.
- c) And for the same column, how many plates is required if we accept a reflux ratio of 2.0.