CHE213_SIMULATION_LAB_5

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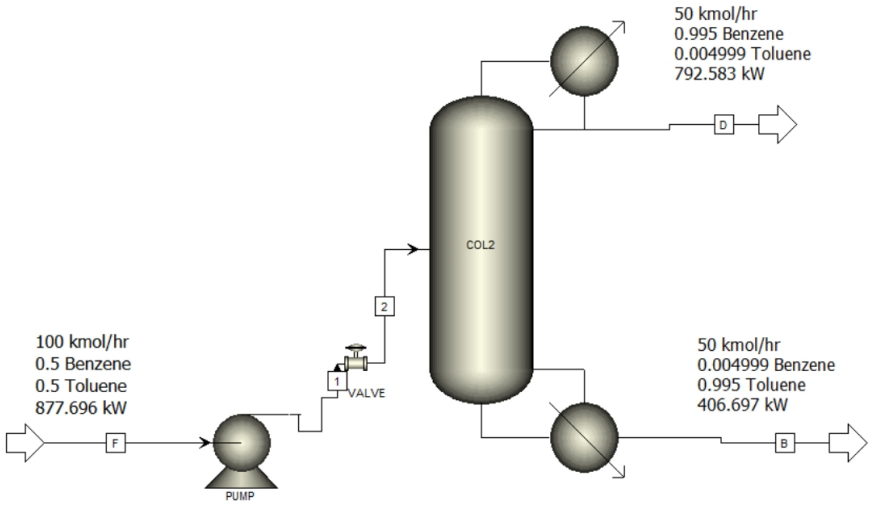
Q1) An equimolar feed stream consisting of Benzene and Toluene enters in a distillation column having a flow rate of 100 kmol/h at 25◦C and 1 atm pressure. This feed is required to fractionate in a distillation column capable of recovering at least 99.5% of the light key component in the distillate and 99.5% of the heavy key component in the bottoms. The distillation column is operated at 1 atm pressure with a 0.01 atm pressure drop on each tray. The distillation column has 3 times the minimum number of trays calculated from DSTWU model (including the condenser and the reboiler) and a total condenser operates at 1 atm pressure. The thermodynamic method used to simulate the distillation column is the Peng Robinson method.

SOLUTION-

I have written the flow rate, composition and enthalpy of feed, distillate and bottom.

Feed temperature= 25◦C Pressure= 1atm



Distillate temperature= 80.25◦C

Bottom temperature= 122.96◦C

Condenser duty= -986.15 kw

Reboiler duty= 1301.12 kw

Reflux ratio=1.3278

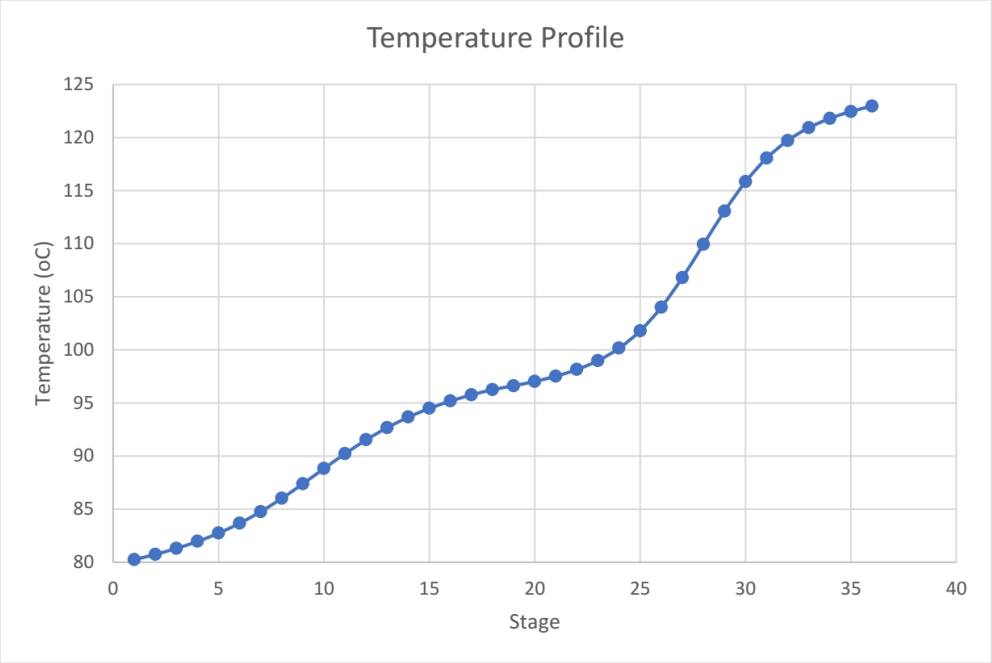
Boilup ratio=2.857

No. of trays =36

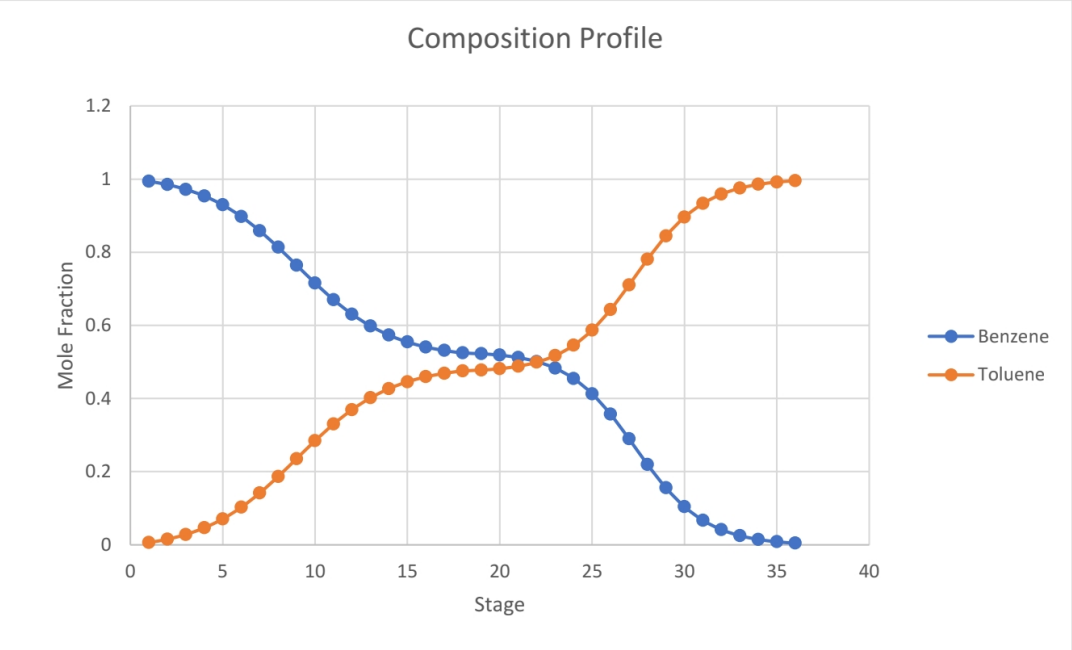
Feed tray no.= 18

PLOTS-

1.From this graph we can conclude that temperature is decreasing as we will move from top to bottom in distillation column.



2.From this graph benzene is decreasing from top to bottom and toluene is increasing .

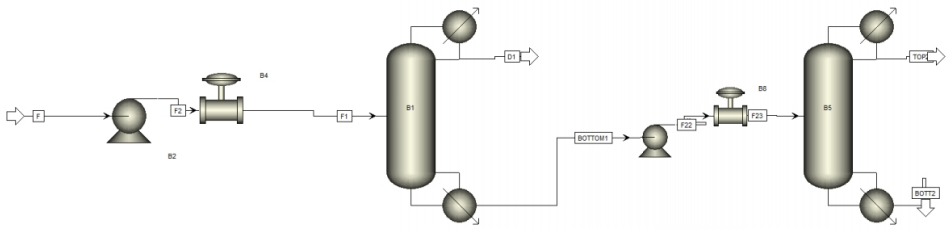


Q2)

Consider the BTX (Benzene-Toluene-Xylene) separation process as shown in Figure 1. The first column recovers benzene as the distillate with toluene and xylene leaving down the bottoms. The second column processes this bottoms to recover toluene up the top and xylene down the bottom. Since the components are aromatic homologues, the Peng-Robinson equation of state is applied for thermodynamic property calculation. Converge the flowsheet in Aspen plus for a fresh feed flow rate of 100 kmol/h containing xC6 = 0.3, xC7 = 0.3 and xC8 = 0.4 with a benzene purity of 99.5 mol%, toluene purity of 99.5 mol%, and xylene purity of 99.9 mol%. The main operating conditions is shown in the figure.

Solution-

Process flowsheet:-



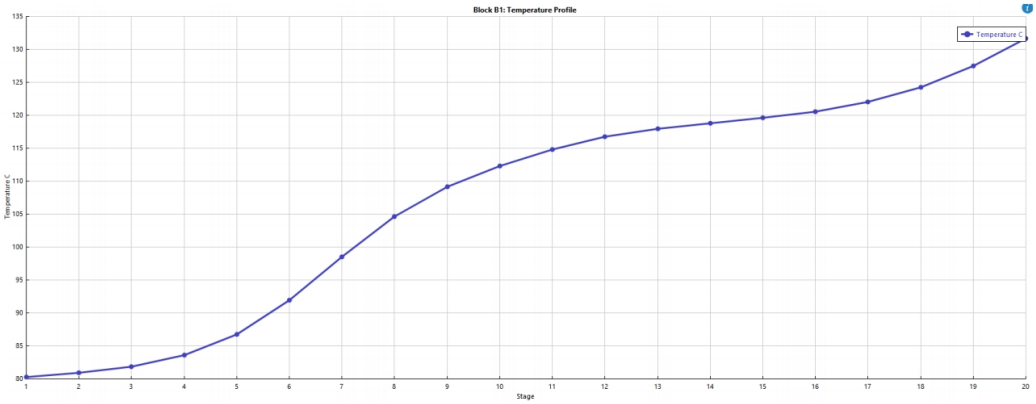
Column 1 results :-

Condenser duty:- -5307.79 KW

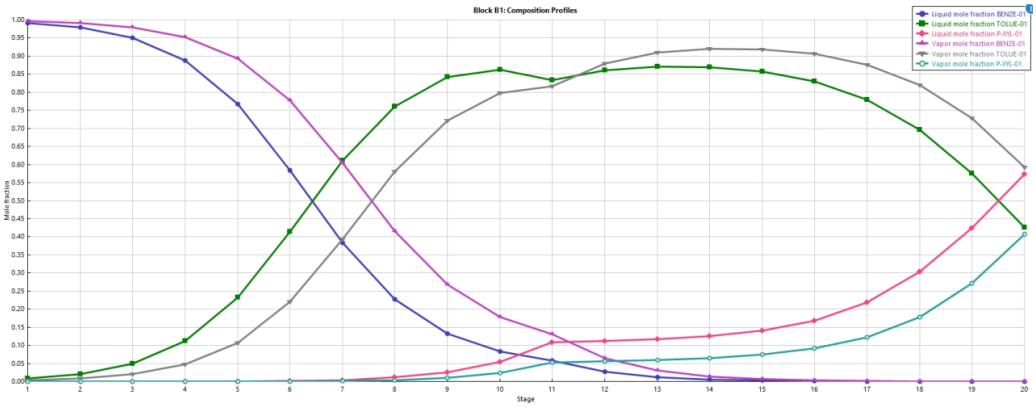
Reboiler duty:- 5735.95 KW

Reflux ratio:- 19.703

Temperature profile:-



Column 1 composition profiles



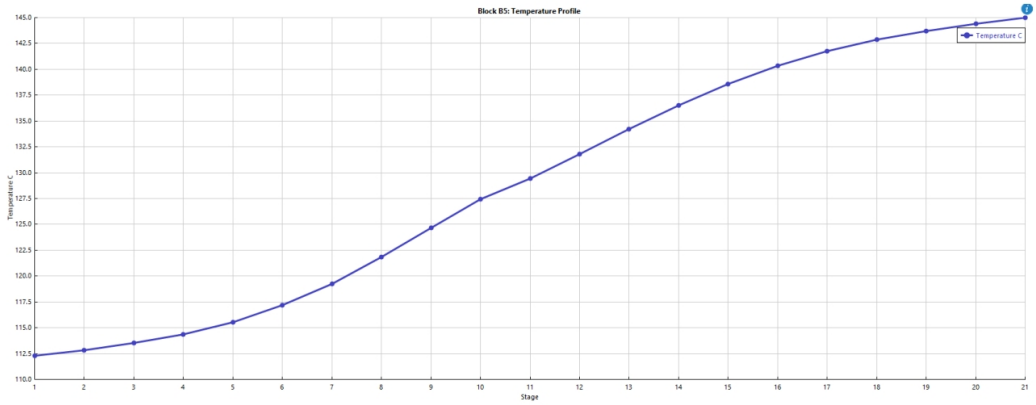
Column 2 results :-

Condenser duty:- -1708.18 KW

Reboiler duty:- 1705.04 KW

Reflux ratio:- 5.218

Column 2 temperature profile



Column 2 composition profiles