Lab Session 7

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AIM

The goal of the laboratory session is to use Aspen Plus to make P-x-y and T-x-y and perform flash calculations.

METHOD

Approach 1: First we add components H_2, H_2O, CO_2 and CH_3OH and set their properties under properties section.

Approach 2: Using Binary button, we add components CO_2 and CH_3OH, and set temperature to 210^oC, to obtain P-x-y graph as shown in results.

Approach 3: Using Binary button, we add components CO_2 and CH_3OH, and set pressure to 78 bar, to obtain T-x-y graph as shown in results.

Approach 4: Using the data of T-x-y from Matlab and from Aspen Plus, we find error using rms function by importing data in Matlab.

Approach 5: To find mole fraction of each components, we first model the given process flow diagram, and set their properties as given in problem statement.

Approach 6: By setting pressure and temperature as 72 bar and 40^oC for the first case and 78 bar and 100^oC for the second case, we get the desired mole fractions of each components from stream 2 and stream 3.
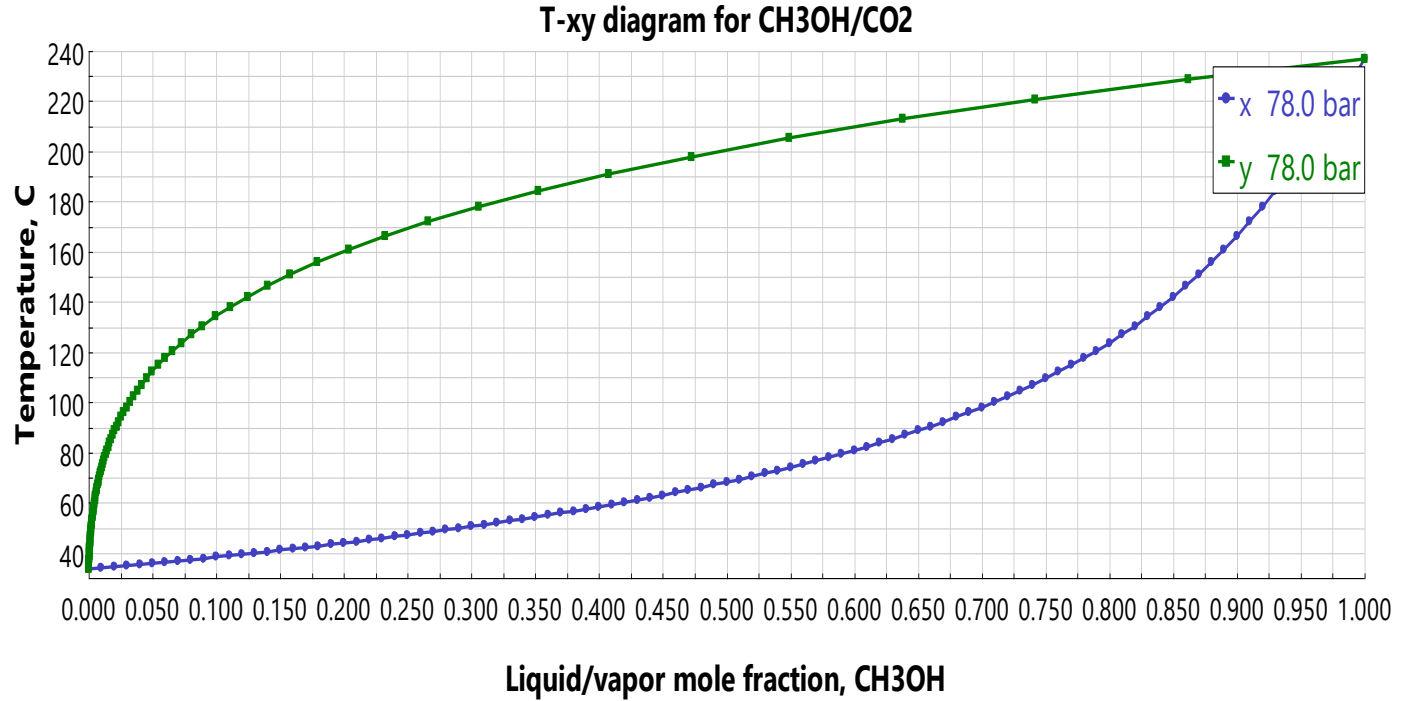
RESULTS AND ANALYSIS

The following P-x-y graph is obtained,

P-xy diagram for CH3OH/CO2

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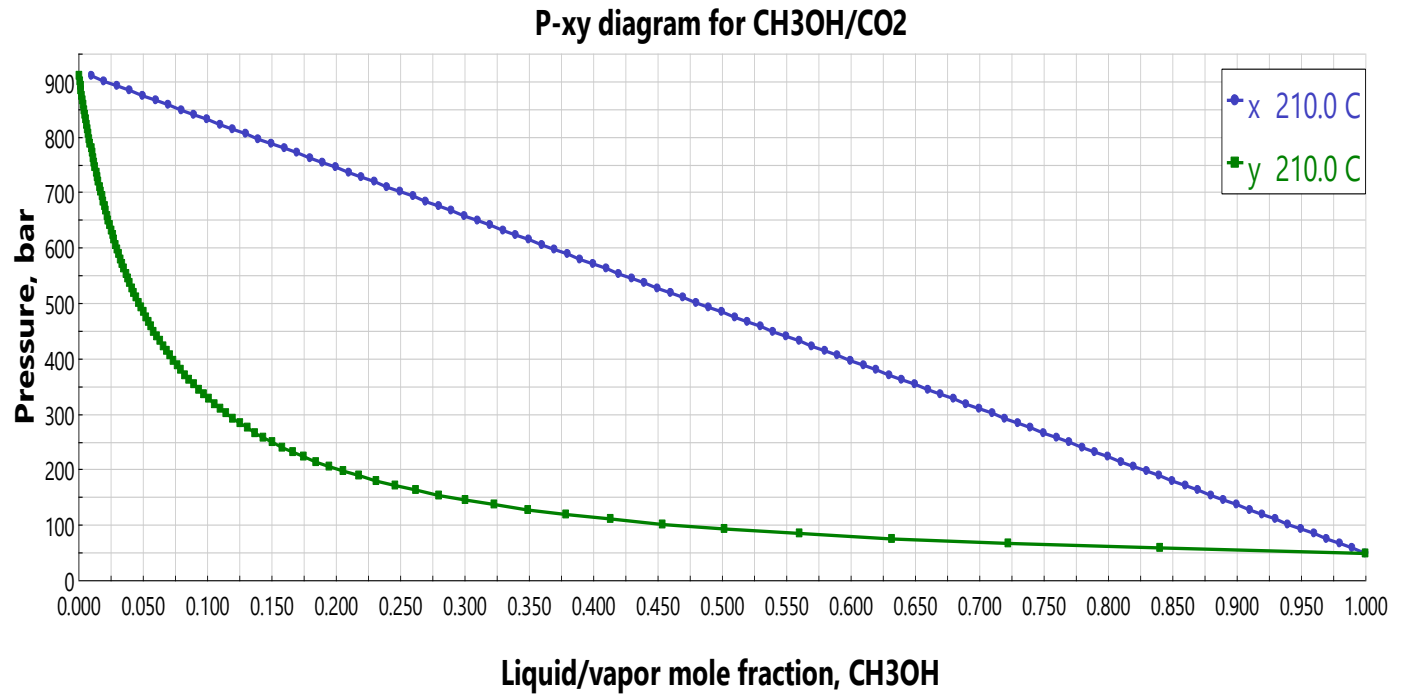
The following T-x-y graph is obtained,

T-xy diagram for CH3OH/CO2

The error calculated using data from Matlab and Aspen Plus is found to be **5.276**.

The following mole fraction is obtained when pressure is **72 bar** and temperature is **40°C**,

Mole Fraction	Liquid Stream	Vapour Stream
H_2	0.00365	0.73172
H_2O	0.39312	0.00040
CO_2	0.21355	0.26595
CH_3OH	0.38967	0.00191

The following mole fraction is obtained when pressure is **78 bar** and temperature is **100°C**,

Mole Fraction	Liquid Stream	Vapour Stream
H_2	0.00363	0.67299
H_2O	0.47368	0.00614
CO_2	0.09057	0.30133
CH_3OH	0.43213	0.01952

CONCLUSION

The P-x-y graph obtained is linear with mole fraction of CH_3OH in liquid phase while it has non-linear relation with mole fraction of vapour phase.
The enclosed area of T-x-y graph shows that CO_2 and CH_3OH are in mixture form.
The error calculated shows that values calculated from Matlab is a little bit different from those calculated using Aspen Plus.
The mole fraction calculated in both the case shows that the moles of CO_2 and H_2 in liquid stream is quite low as compared to vapour stream.

APPENDIX

The following Matlab code is used to obtain root mean square error:

T_aspen= [36.36 38.38 42.78 47.77 53.50 60.21 68.20 75.35 87.02 117.62 166.20];
T_matlab= [36.68 38.92 43.49 48.99 55.12 61.92 70.34 77.88 90.04 121.91 169.61];
error = rms(T_aspen-T_matlab);