Tetrahydrofuran/Water Pressure Swing Azeotripic Distillation

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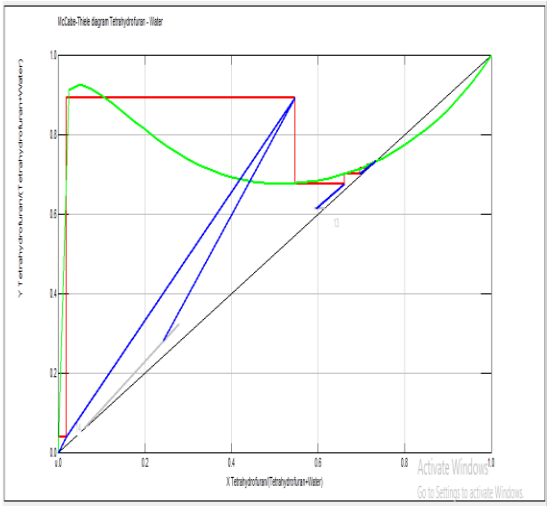
Background:

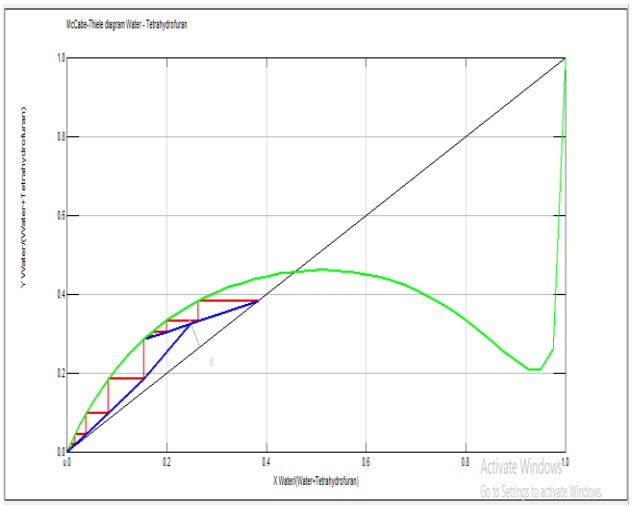
Simulations were performed to obtain highly pure tetrahydrofuran (THF) with over 99.9 mole% from the mixture of THF and water. Pressure swing distillation (PSD) was used since the azeotropic point between tetrahydrofuran and water can be varied with pressure. A commercial process simulator, PRO/II with PROVISION release 8.3, was used for the simulation studies. The Wilson liquid activity coefficient model was used to simulate the low pressure column, and the Peng-Robinson equation of state model was added to correct the vapour phase non-idealities for the modelling of the high pressure column.

Description of the Flowsheet:

The water pressure swing azeotropic distillation process involves the separation of tetrahydrofuran (THF) and water mixer and to form desired water product and tetrahydrofuran product. Herein no side products produce during the process. Here mixer of raw materials fed up in the heat exchanger1 (H/E1) with 2000kmol/h at 308K and 1 atm pressure. The outlet of H/E1 fed up to the distillation column1 (DC1) and top product of DC1 fed up to the H/E2 through the pump. Bottom product of DC1 further fed up in the H/E1 and outlet of the H/E1 having 0.99999 water.

From the H/E2 the material fed into the distillation column2 (DC2) and top product of DC2 fed up to the DC1 with 276.68 kmol/h. bottom product of DC2 fed into the H/E2 and outlet of H/E2 having .09999 THF.





Results:

DC1 Distillate	
Object	COUO-006
Molar Flow	397.88 kmol/h
Molar Fraction water	0.26680275
Molar Fraction THF	0.73319725

DC1 Bottom	
Object	COUO-006
Molar Flow	1880.7739 kmol/h
Molar Fraction water	0.99999
Molar Fraction THF	1E-06

DC2 Distillate	
Object	COUO-015
Molar Flow	276.68 kmol/h
Molar Fraction water	0.38367431
Molar Fraction THF	0.61632569

DC2 Bottom	
Object	COUO-015
Molar Flow	121.20422 kmol/h
Molar Fraction water	1E-05
Molar Fraction THF	0.99999

Conclusion and Recommendation:

This work illustrates that open source simulator serves as a good platform for carrying out process development flowsheeting with ease. However, during the simulation it's examined that process has sensitivity towards temperature and pressure.

Unit of System used:

THF/ Water	
Temperature	k
Pressure	Atm
Molar Flow	Kmol/h
Volumetric Flow	m3/s

References:

Flowsheet Source: http://www.chemsep.com/downloads

H.E. Roscoe and W. Dittmar, J. Chem. Soc., 12, 128 (1859).