

Separation of Ethanol-water using benzene as Entrainer

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Background

EtOH is naturally produced by fermentation of sugars by yeasts or via petrochemical processes. Its chemical formula is C_2H_6O . Ethanol first use was to power an engine in 1826, and in 1876, Nicolaus Otto, the inventor of the modern four-cycle internal combustion engine, used ethanol to power an early engine. Ethanol is mostly used in beverage industry. Other industries in which ethanol is used are paint, pharmaceuticals, etc.

Description

EtOH & water azeotrope mixture (0.87 EtOH and 0.13 H_2O) at 100 Km³/hr and temperature 311K is feed to distillation column at a stage 1. A mixture of EtOH, H₂O and benzene from make-up mixer is also feed to column at stage 5. From bottom of column a stream of ethanol is obtained having 0.99 EtOH at 65.49Km³/hr. A stream from bottom of decanter is feed to second distillation column at stage 1. From the bottom of the second distillation column a stream is obtained having 0.99 mole fraction water at 18.69 Km³/hr. Top products from both the column is feed to a mixture followed through a cooler. The cooled stream is feed to a decanter.

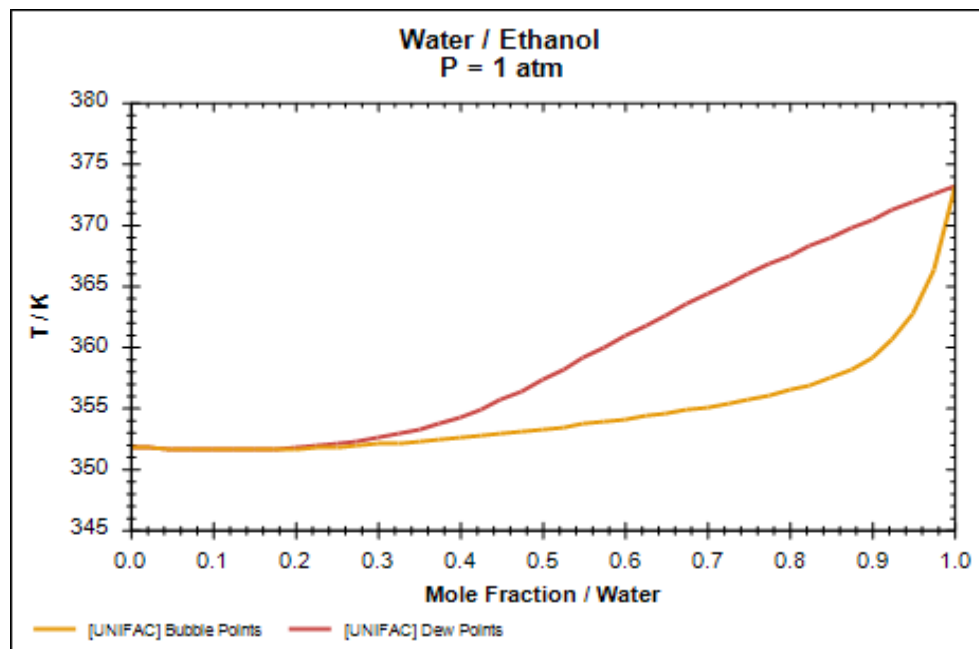


Figure:1

Figure 1 indicates that the feed composition on the left extreme of water in vapor is leaving the bottom product richer in ethanol as compared to feed.

Results

The data is obtained from the flow sheet.

Stream	Water	Ethanol	Benzene	Azeotrope	
Temperature	372.83396	356.46185	298.15	311	K
Pressure	1.1132494	1.1997039	1.97385	1	atm
Molar Flow	18.693181	65.49624	110	100	Kmol/hr
Molar Fraction/Ethanol	0.01	0.999	0	0.87	
Molar Fraction/Water	0.99	0.0000047829	0	0.13	
Molar Fraction/Benzene	0	0	1	0	

References

1. William L.Luyben, I-Lung Chien Design and Control of Azeotropic Distillation Columns.
2. G.J. Prokopakis, W.D. Seider, Feasible specifications in azeotropic distillation, AIChE J. 29 p. 49.
3. Flow sheeting source <http://www.chemsep.com/downloads/index.html>
4. Image Source: Phase Envelope Utility DWSIM