

Continuous Homogenous Azeotropic Distillation for Ethyl Acetate/n-Hexane Separation

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Background & Description:

Ethyl acetate and n-hexane, as industrially important organic solvents, are widely used in the textile and chemical industry due to their high solubility. A large amount of wastewater would be produced in the production of chemical products unless a suitable separation method is employed. Since ethyl acetate (boiling point 77°C) and n-hexane (boiling point 69°C) form a minimum-boiling homogenous azeotrope (azeotropic point 65°C) at atmospheric ordinary distillation could not be used to effectively separate the azeotrope, thus continuous homogenous azeotropic distillation (CHAD) is used.

In the CHAD method, an entrainer is added to the distillation causing a change in the vapor-liquid equilibrium, making it possible to separate the azeotropic mixture. In the CHAD column, the bottom product is pure Ethyl acetate and the top product is a mixture of n-Hexane and the entrainer (Acetone). Acetone and the entrainer are then separated in a decanter by adding water, which extracts acetone from the mixture. Then the water/acetone mixture is sent to the entrainer recover column (ERC) that recovers pure entrainer and recycle it back to the Azeotropic Distillation Column (ADC).

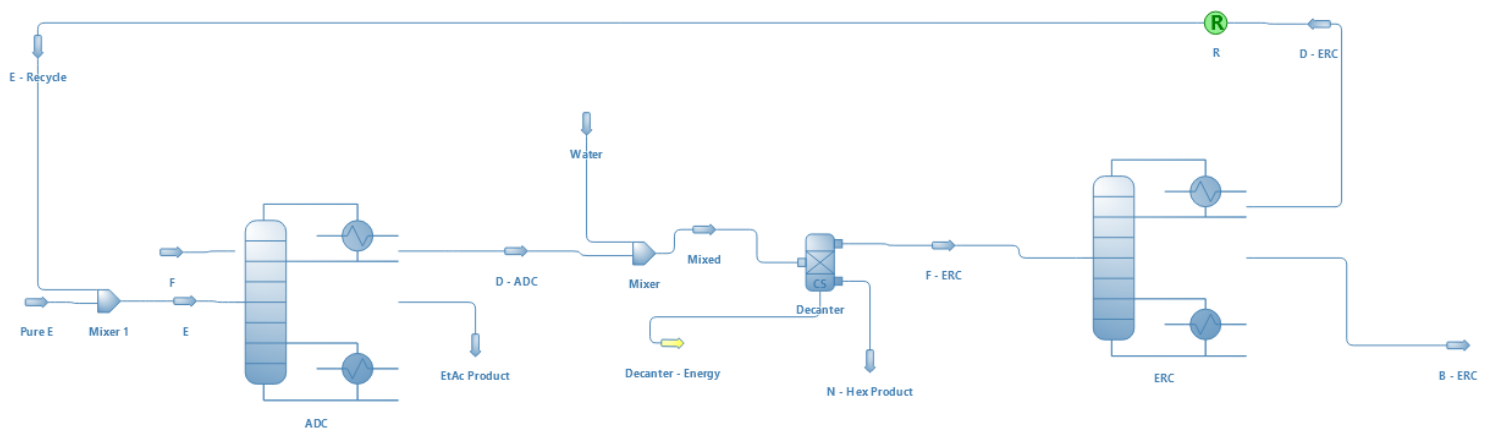


Figure 1. Azeotropic Distillation Flowsheet for Ethyl Acetate and N-Hexane with Acetone as Entrainer.

Results:

Table 1. Streamwise Results for the Ethyl Acetate and N-Hexane Distillation Flowsheet.

Object	EtAc Product	N-Hex Product	F - ERC	E - Recycle	Units
Temperature	80,0	24,8	24,8	56,1	C
Pressure	1,115	1,013	1,013	1,013	bar
Mass Flow	392,34	604,81	20448,8	1264,4	kg/h
Molar Flow	4,45	7,02	1075,00	22,25	kmol/h
Molar Fraction (mixture) / Ethyl Acetate	99,9	0,1	0,01	0,38	%
Molar Fraction (mixture) / N-Hexane	0	99,9	0,006	0,28	%
Molar Fraction (mixture) / Acetone	0,1	0	2,484	95,5	%
Molar Fraction (mixture) / Water	0	0	97,5	3,84	%

Table 2. Columns Specifications.

Object	ADC	ERC	Units
Top Specification	0,907	4,04	RR ¹
Bottom Specification	EtAc = 99,9%	Acetone = 10%	CC ²
Pressure	0,1115	0,1013	MPa
Number of Stages	38	13	-
Feed Stages	E-24 F-26	F-11	-

¹ - Reflux Ratio ; ² - Component Composition.

References:

- (1) Liping Lv, Lin Zhu, Huimin Liu, Hang Li, Shirui Sun ,Comparison of continuous homogenous azeotropic and pressure-swing distillation for a minimum azeotropic system ethyl acetate/N-hexane separation.