Heat-Integrated Pressure-Swing Distillation Process for Separation of the Maximum-Boiling Azeotrope Diethyl Amine and Methanol

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PROBLEM STATEMENT:

There are two sequences, LPC–HPC and HPC–LPC, to achieve the separation of Diethyl Amine and Methanol.

➢ OBJECT USED:

1. Distillation column

2. Material Stream

3. Recycle block

4. Valve

➢ DESCRIPTION:

I. **Abstract:**
   The separation of compounds with azeotrope or close-boiling mixture is a rigorous challenging, inevitable and intriguing project for the chemical and petrochemical industries. If the chemical components are dissimilar and the repulsion forces are strong, resulting in the activity coefficient larger than the unity, the minimum-boiling azeotrope is formed. The maximum-boiling azeotrope is formed if the condition is the opposite. The existence of this phenomenon makes the separation inefficiency by using the simple conventional distillation. Several enhanced strategies had been developed to separate azeotropic mixtures such as pressure-swing distillation (PSD), extractive distillation (ED) and homogeneous or heterogeneous azeotropic distillation.

II. Introduction:

There are two sequences, LPC–HPC and HPC–LPC, to achieve the separation of Diethyl Amine and Methanol. So, first flowsheet shows LPC-HPC sequence in which first column is of low-pressure column while second column is of high-pressure column. And another part of flowsheet shows HPC-LPC sequence in which first column is of high-pressure column while second column is of low-pressure column.

III. Flowsheet Description:

The fresh feed is an equimolar mixture of diethylamine (DEA) and methanol (MEOH) with the flowrate of 100 kmol/h and temperature of 320 K, and both product purities of DEA and methanol are specified as 98 mol% at the distillate of LPC and HPC, respectively.
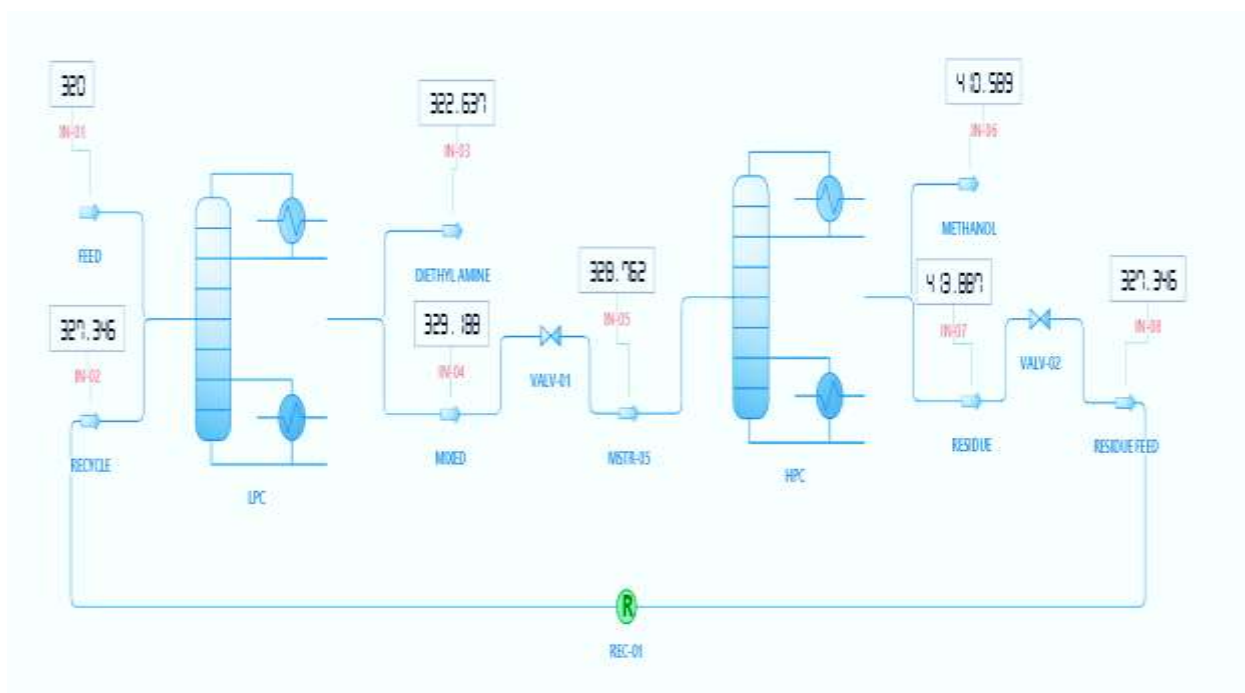
PART - 1

Figure – 1 LPC-HPC sequence

The property table for the flowsheet is given below:

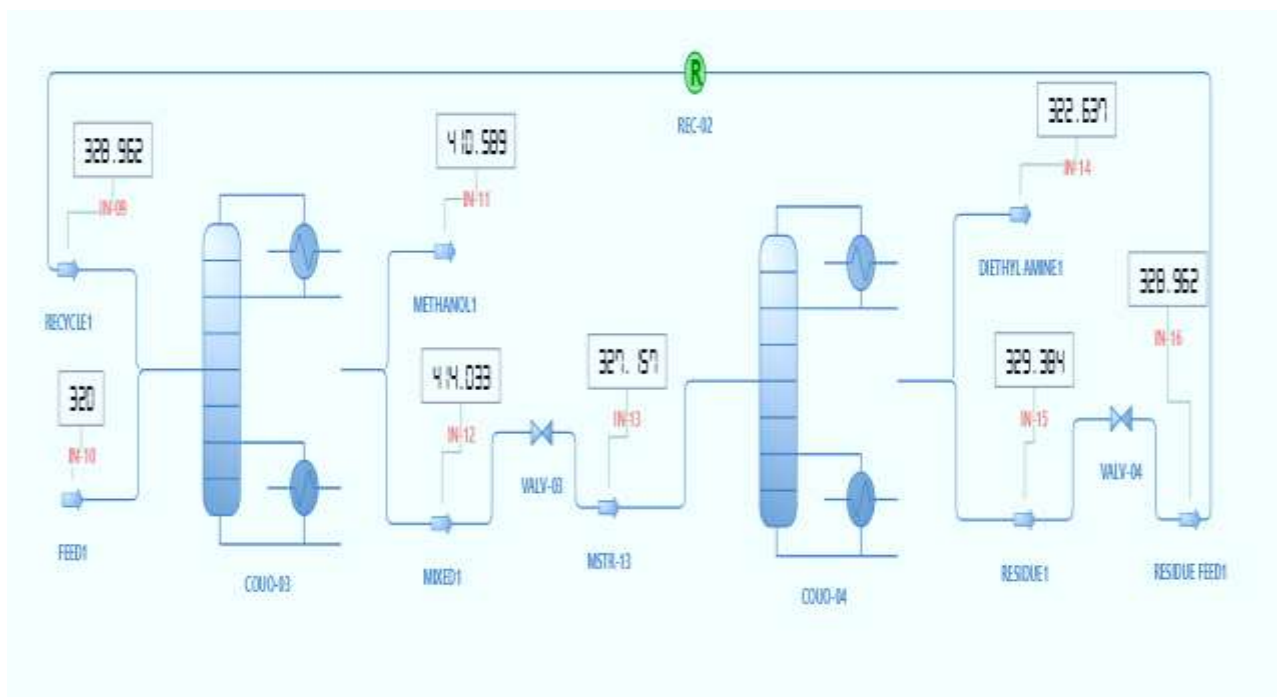| Object	FEED	RECYCLE	MSTR-05	DIETHYL AMINE	METHANOL	
Temperature	320	327.346	328.762	322.637	410.589	K
Pressure	81060	81060	1.01E+06	81060	1.01E+06	Pa
Molar Flow	27.7778	17.56	31.4007	13.9374	13.8407	mol/s
Molar Fraction (Mixture) / Diethylamine	0.5	0.54	0.3071	0.984999	0.0116152	
Molar Fraction (Mixture) / Methanol	0.5	0.46	0.6929	0.015001	0.988385	

PART - 2

Figure – 2 HPC-LPC sequence

The property table for the flowsheet is given below:

Object	FEED1	RECYCLE1	METHANOL1	MSTR-13	DIETHYL AMINE1	
Temperature	320	328.962	410.589	327.157	322.637	K
Pressure	1.01E+06	1.01E+06	1.01E+06	8.11E+04	81060	Pa
Molar Flow	27.7778	21.7498	13.9142	35.7166	13.9667	mol/s
Molar Fraction (Mixture) / Diethylamine	0.5	0.2871	0.0116152	0.56	0.984999	
Molar Fraction (Mixture) / Methanol	0.5	0.7129	0.988385	0.44	0.015001	

➢ REFERENCES:

Heat-integrated pressure-swing distillation process for separation of the maximum-boiling azeotrope diethylamine and methanol by Qingjun Zhang, Meiling Liu, Chenxiaodong Li, Aiwu Zeng