

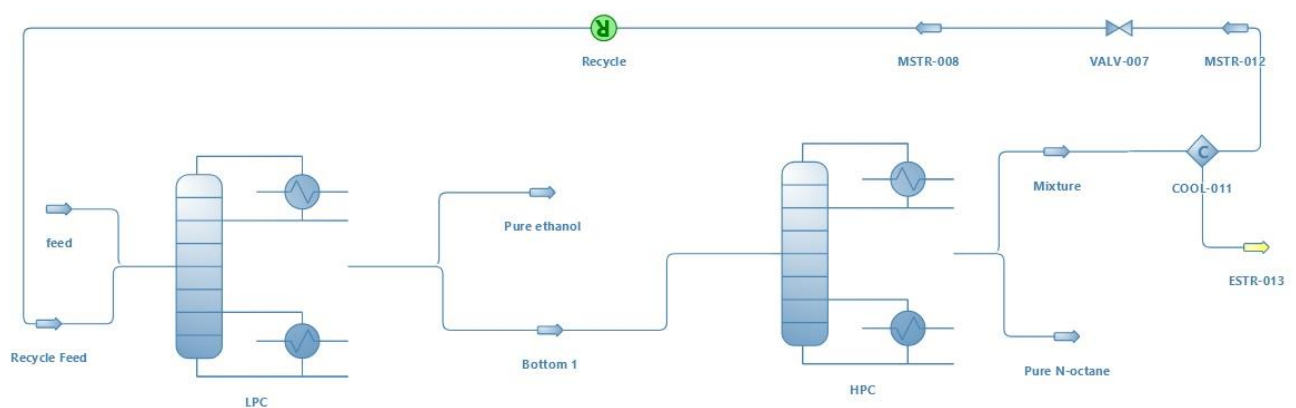
Pressure Swing Distillation of Ethanol and N-Octane Mixture

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Background & Description:

As we know that for separation of Liquid-Liquid mixture conventional Distillation method is used but for separation of azeotropic mixture simple distillation cannot be used. We have to use advance separation techniques like Extractive Distillation, pressure swing distillation, azeotropic distillation for separation of azeotropic mixtures. Azeotrope is generally of two types (1) minimum boiling azeotrope and (2) maximum boiling azeotrope. Here Ethanol and N-octane forms minimum boiling azeotrope which is separated using pressure swing distillation separation method in this flowsheet.

Here in this simulation I have used two components Ethanol and N-octane. The thermodynamic package used in this simulation is "NRTL and Raoult's Law". Here, PSD is carried out into two columns which are operating at different pressure as name suggest one with Low Pressure Column (LPC) and another one is High Pressure Column (HPC). The LPC is operating at 1 atm pressure with number of stages are 20. The main feed is introduced at stage number 9 and Recycle feed is at stage number 6 in LPC. The reflux ratio in LPC is = 2. In LPC, Top product contains pure ethanol and bottom product is mixture of ethanol and N-octane. The HPC is operating at pressure of 4 atm with number of stages are 12. The feed is introduced in HPC at a feed stage number 5. In HPC, The top product contains mixture and bottom product contains pure N-octane. The top product from HPC is then sent to cooler to reduce temperature and to obtain total liquid phase and then its pressure is reduced using valve and recycled feed is introduced in LPC. The results and other necessary parameters are as shown below.



Pressure Swing Distillation Of Ethanol-Noctane Mixture

Results:

Objects	Feed (LPC)	Pure ethanol	Bottom 1 (Feed HPC)	Pure N-octane	Recycle Feed	Units
Temperature	273.15	351.798	373.49	440.721	298.307	K
Pressure	101325	101325	101325	405300	101325	Pa
Mass Flow	18.4768	8.53528	14.4664	9.94153	4.52484	kg/s
Molar Flow	277.778	185.223	154.258	92.5547	61.7031	mol/s
Molar Fraction (Mixture) / Ethanol	0.7	0.999815	0.3	0.1	0.6	
Molar Fraction (Mixture) / N-octane	0.3	0.000184593	0.7	0.9	0.4	

Table 1: Streamwise results for the PSD of Ethanol—N-octane Mixture Flowsheet

References:

https://en.wikipedia.org/wiki/Azeotrope_tables

<http://vle-calc.com/>