Refrigerated-Purge Distillation Columns

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Unit System: Pressure- psia; Temperature-°F; Molar Flow- lb-mol/hr; Other-SI

Background

To remove the heat from the condenser of distillation column most of the time in industry cooling water is used because of its less expansive nature. But when the distillate contain low boiling compound then it require a high pressure inside the column;the high column pressure makes the separation between the light- and heavy-key components difficult,which results in high energy consumption.[1]To avoid this, there is one alternative solution named Refrigerated-Purge Distillation Columns.

Refrigerated-Purge Distillation Columns

In Refrigerated-Purge Distillation Columns, We use two column at low pressure than the conventional column. The first column(or a main column)concentrate the useful compound at distillate stream, But still it is not at desirable concentration, There are much amount of the Heavy compounds. And here we use partial condenser which give a most of vapour in the distillate stream; Which enter in the second column which is at the low pressure(here 2 psia lower) and the low temperature(of the condenser)than the first column. In This second column we are able to achieve the desire purity of light-key compound.

Description of Flow-Sheet

Feed contain 5 mol/mol% of useful light-key component are enter to the main column which is similar to the simple distillation column, but here the condenser is partial so the distillate is in vapour form. In this main column we try to achieve the 60 mol/mol% useful light-key component in distillate stream. This distillate stream are feed into the second column, The further condensation of this vapour stream is done inside this second column(which only contain the condenser, known as Stripper column). Top product of this second column 98 mol/mol% light key compound and the bottom product is again recycled near to the top of the first columns.

Result

Table 1: Columns Data

Name	**Column**	**Column**
Total Stage	52	7
Pressure (psia)	22	20
Condenser	Partial Vapour	Total Liquid
Feed (lb mol/hr) (mol/mol%) (mol/mol%) (mol/mol%)	1000 (Acetaldehyde 5 %) (Methylacetate 50 %) (Methanol 45 %)	142 (Acetaldehyde 60 %) (Methylacetate 28 %) (Methanol 12 %)
Feed Stage	10 from top	7 from top
2nd Feed(lb mol/hr) (mol/mol%) (mol/mol%) (mol/mol%)	91 (Acetaldehyde 39 %) (Methylacetate 42 %) (Methanol 19 %)	-
2nd Feed Stage	2 from top	-
Result		
Top(lb mol/hr) (mol/mol%) (mol/mol%) (mol/mol%)	142 (Acetaldehyde 60 %) (Methylacetate 28 %) (Methanol 12 %)	51 (Acetaldehyde 98 %) (Methylacetate 1.8 %) (Methanol 0.2 %)
Bottom(lb mol/hr) (mol/mol%) (mol/mol%) (mol/mol%)	949 (Acetaldehyde 0 %) (Methylacetate 52.5 %) (Methanol 47.5 %)	91.5 (Acetaldehyde 5 %) (Methylacetate 50 %) (Methanol 45 %)

References

[1] William L. Luyben;"Design and Control of Refrigerated-Purge Distillation Columns", Ind. Eng. Chem. Res. 2004, 43, 8133-8140

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