An Extractive Distillation System for Methanol-Dimethyl Carbonate Separation Using Phenol as an Entrainer

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Unit System: Pressure-Kpa; Molar Flow-Kmol/hr; Other-SI

Background

Methanol is used as a solvent and as an antifreeze in pipelines and windshield washer fluid. In some wastewater treatment plants, a small amount of methanol is added to wastewater to provide a carbon food source for the denitrifying bacteria, which convert nitrates to nitrogen gas and reduce the nitrification of sensitive aquifers. Methanol is used as a destaining agent in polyacrylamide gel electrophoresis. Methanol is mixed with water and injected into high performance diesel and gasoline engines for an increase of power and a decrease in intake air temperature in The mixer of Methanol and DiMethyl Carbonate can not be seperated out by the simple distillation column because of the less difference between their boiling point and same boiling point behaviour of azeotrope.

Extractive Distillation of Close Boiling Compounds

Extractive distillation is the method of separating close boiling compounds from each other by carrying out the distillation in a multiple columns in the presence of an added liquid or liquid mixture. This Liquid or Liquid mixture is known as extractive agent or entrainer. The presence of the entrainer alter the volatility of compounds and thus the degree of separation is increase with the same numbers of plate. This entrainer must have high boiling point than the compounds which are going to separated

Description of Flow-Sheet

The flow sheet contain total two distillation columns named “Extractive distillation column" and “Entrainer recovery column".Here we use the Phenol as entrainer and mixer of Methanol and DiMethayl Carbonate (DMC) as feed.The presence of Phenol alters the relative volatility between Methanol and DMC and to make Methanol move toward the top part and DMC move to the bottom part of the column.The “Extractive distillation" take entrainer and feed and give the pure Methanol as top product and the bottom product which has the DMC and Phenol are enter to the “Entrainer recovery" column; which separate out DMC and the Phenol, this recovered Phenol are recycled to the “Extractive distillation". Feed rate with the composition of compounds and the other necessary data for the column are shown in the table in Result section with the Top and Bottom products

Result

Name	Extractive Column	Entrainer Recovery
Pressure (Kpa)	101.325	101.325
Total Stages	60	32
Feed (Kmol/hr) mol% mol% mol%	170.5 Methanol (85.33%) DMC (14.67%) Phenol (0.0%)	285 Methanol (0.01%) DMC (8.78%) Phenol (91.21%)
Feed Stage	50	7
2nd Feed (Kmol/hr) mol%	260.04 Phenol (99.99%)	
2nd Feed Stage	5	
Top (Kmol/hr) mol% mol% mol%	145.5 Methanol (99.99%) DMC (0.01%) Phenol (0.0%)	25.04 Methanol (0.04%) DMC (99.80%) Phenol (0.16%)
Bottom (Kmol/hr) mol% mol% mol%	285 Methanol (0.01%) DMC (8.78%) Phenol (91.21%)	260 Methanol (0.0%) DMC (0.01%) Phenol (99.99%)

Reference

https://www.sciencedirect.com/science/article/pii/S0263876217304690