

# Pressure Swing Distillation For Separating Pressure Insensitive Minimum Boiling Azeotrope Methanol/Toluene

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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 Toluene can not be separated 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 Chloroform as entrainer and mixer of Methanol and Toluene as feed. The presence of Chloroform alters the relative volatility between Methanol and Toluene and to make Methanol-Chloroform Mixture move toward the top part and Toluene move to the bottom part of the column. The "Extractive distillation" take entrainer and feed and give the pure Toluene as Bottom product and the Top product which has the Methanol and Chloroform are enter to the "Entrainer recovery" column; which separate out Methanol and Chloroform, this recovered Chloroform 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)	1013.25	81.060
Total Stages	36	23
Feed (Kmol/hr) mol% mol% mol%	100 Methanol (50%) Toluene (50%) Chloroform (0.0%)	137.95 Methanol (56.99%) Toluene (0.03%) Chloroform (42.98%)
Feed Stage	32	8
2 <sup>nd</sup> Feed (Kmol/hr) mol%	87.963 Chloroform (99.99%)	
2 <sup>nd</sup> Feed Stage	20	
Top (Kmol/hr) mol% mol% mol%	137.95 Methanol (56.99%) Toluene (0.03%) Chloroform (42.98%)	87.93 Methanol (32.54%) Toluene (0.0%) Chloroform (67.43%)
Bottom (Kmol/hr) mol% mol% mol%	50.01 Methanol (0.0476%) Toluene (99.9%) Chloroform (0.0523%)	50.02 Methanol (99.9%) Toluene (0.0825%) Chloroform (0.0%)

## Reference

<https://pubs.acs.org/doi/10.1021/acs.iecr.6b04939>