Production of Propylene Glycol Monomethyl Ether Acetate through transesterification reaction

Grande Prasanna Lakshmi and A.Natraj

Email: prasanna.venkat66@gmail.com, natraj817@gmail.com

➢ Background

Propylene glycol monomethyl ether acetate (PGMMEA) is an ester produced through transesterification of propylene glycol mono methyl ether with methyl acetate. PGMMEA is used as a solvent in industry with numerous industrial applications due to low toxicity, high solubility and extremely low viscosity when compared to other solvents.

➢ Process description

In the present work, Propylene glycol mono methyl ether (PGMME) stream is mixed with Methyl acetate stream in a mixer to get a uniform composition of feed. The inlet condition of feed is 25 deg celcius and at 4.53 kgf/cm2. Since the process is an equilibrium reaction, the feed is charged in the mole ratio of 3:1 (Methyl acetate to PGMME) to supress the backward reaction. Since it is an endothermic reaction, it needs energy to move forward. The mixture is sent to preheater before charged to the reactor, where it is heated upto 70 deg Celsius. Like a closed energy cycle, this process recovers most of the energy from cooler and uses it for preheater and reactor. Since it is a positive order reaction, plug flow reactor is used to conduct the reaction. Reaction kinetics was taken from the literature. Considering the low boiling points of methyl acetate and methanol, high pressure is maintained to conduct the reaction in liquid phase. Assumed there is no side reaction formation.

The conversion of PGMME is around 73% and it is calculated based on the conversion formula

$$\text{Conversion of } PGMME = \frac{\text{Initial moles of PGMME} - \text{Final moles of PGMME}}{\text{Initial moles of PGMME}}$$

The crude product mixture is sent to distillation column to purify. Since the desired product having high boiling point when compared to the other product and reactants,

three distillation columns were used to separate the final product. The desired product is withdrawn from the third distillation column bottom. The product is cooled to room temperature and the heat removed from the product is used to preheat the feed.

➢ Blocks used

- Mixer (1)
- heater(1)
- Plug flow(1)
- Shortcut column(3)
- Cooler(4)
- Energy recycle block (2)

➢ Results

The various block results for the transesterification process are displayed below.

Object: PFR		
Pressure Drop	0.476517	kgf/cm2
Residence time	11181.3	s
Volume	7	m3
Length	10	m
Temperature delta	50	C.
Heat load	125100	kcal/h

	Object: DC-1	Object: DC-2	Object: DC-3	
Stripping Liquid Molar Flow	53.8407	31.3915	8.40966	kmol/h
Rectify Liquid Molar Flow	38.3674	28.9294	2.3756	kmol/h
Stripping Vapor Molar Flow	47.8006	26.6724	3.95331	kmol/h
Rectify Vapor Molar Flow	57.5512	43.3941	3.95934	kmol/h
Condenser Duty	453863	316203	42043.7	kcal/h
Reboiler Duty	476085	296334	42622.1	kcal/h