Production of Propylene Glycol and Di-Methyl Carbonate using Propylene Carbonate and Methanol

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➢ Background

Propylene glycol IUPAC name is propane-1,2-diol is a synthetic organic compound with the chemical formula $C_3H_8O_2$. It is a viscous, colorless liquid which is nearly odorless but possesses a faintly sweet taste. Chemically it is classed as a diol and is miscible with solvents like water, acetone and chloroform.

It is produced on a large scale basis and is primarily used in the production of polymers and polyols. It is also being used in food, cosmetic and pharmaceutical industries.

➢ Process description

In the present work, Propylene carbonate (PC) stream is mixed with Methanol stream in a mixer to get a uniform composition of feed. The inlet condition of feed is 40 ˚C and at 1.01325 bar. Since the process is an equilibrium reaction, Feed is charged in the mole ratio of 1.93:1 (Propylene Carbonate to Methanol) to suppress the backward reaction. The feed is being sent to conversion reactor where Di-methyl Carbonate and Propylene Glycol are being formed.

The conversion is around 98% which is being mentioned in reaction page.

The crude product mixture is sent to DC-1 to separate DMC, PG and recycled Methanol. In DC-1 DMC and recyclable Methanol are being separated as distillate and sent to Sep-1 where final product DMC and recycle Methanol are recovered. Bottoms from DC-1 are sent to DC-2. In DC-2 MPG and traces of DMC leaves as distillate and both are separated in Sep-2. Bottoms from DC-2 consist of MPG.

Wherein DMC and MPG streams are separately mixed, cooled and then stored for tanker filling or drumming.

- **Blocks used**
  - Mixer (4)
  - Conversion reactor (1)
  - Distillation columns (2)
  - Seperator (3)
  - Cooler(2)
  - Energy recycle block (1)
- **Results**

Stream results

Feed and Product stream results

Parameters	Units	Methanol	Propylene Carbonate	Propylene Glycol	Dimethyl Carbonate
Temperature	°C	40	40	30	30
Pressure	bar	1.01325	1.01325	1.01325	1.01325
Mass Flow	kg/h	1000	1930.2	1440.14	1410.13
Volumetric Flow	m^3/h	31.209	1.63415	1.5704	15.6536
Molar Flow	kmol/h	1.29083	18.907	18.9243	1.33419
Mass Fraction (Mixture) / MPG		0	0	1	0
Molar Fraction (Mixture) / MPG		0	0	1	0
Mass Fraction (Mixture) / Dimethyl carbonate		0	0	8.48E-08	0.999994
Molar Fraction (Mixture) / Dimethyl carbonate		0	0	7.16E-08	0.999998
Mass Fraction (Mixture) / Methanol		1	0	4.51E-15	2.14E-06
Molar Fraction (Mixture) / Methanol		1	0	1.07E-14	6.02E-06
Molar Fraction (Mixture) / Propylene carbonate		0	1	1.38E-11	1.72E-12
Mass Fraction (Mixture) / Propylene carbonate		0	1	1.86E-11	1.52E-12