Production of Methyl Diethanolamine using Methylamine and Ethylene Oxide

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Background

Methyl diethanolamine (MDEA) is a pure colorless yellow liquid without any inerts. It is completely soluble in water with an ammonia-like odor. MDEA is used for the production of polyurethane foam, textile softeners, Paper chemicals, oil-clothes, heat insulation materials, pharmaceutical products, paint-coatings, Pharmaceuticals, dyes, and Gas scrubbing (CO_2, H_2S removal in natural, refining gas, ammonia hydrogen unit).

Production of Methyl Diethanolamine by reacting Ethylene Oxide and Methylamine. The reaction of the same is given below.

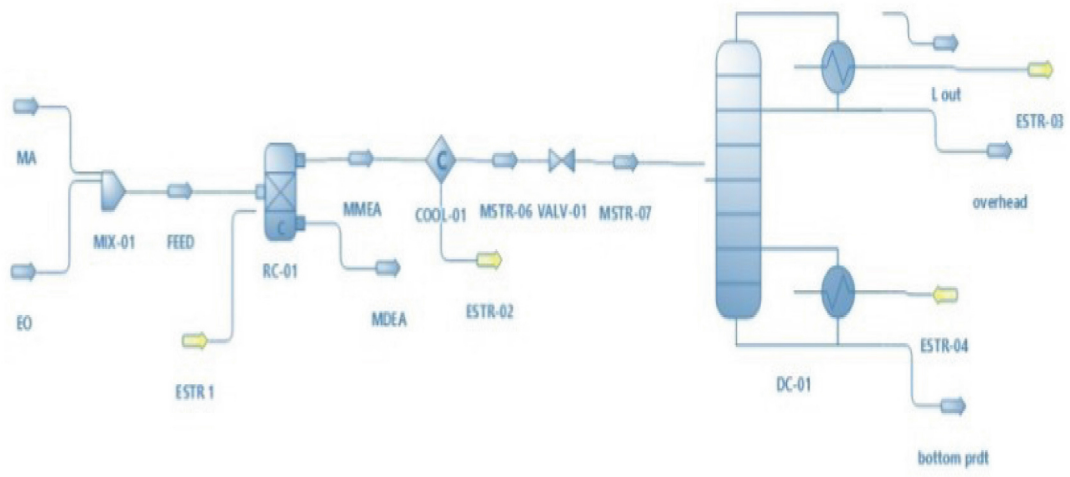
CH_3NH_2 + C_2H_4O ⟶ $CH_3NH(C_2H_4OH)$

Methylamine — Ethylene Oxide — Methyl Monoethanolamine

$CH_3NH(C_2H_4OH)$ + C_2H_4O ⟶ $CH_3N(C2H4OH)_2$

Methyl Monoethanolamine — Ethylene Oxide — Methyl Diethanolamine

The most preferred thermodynamic package is NRTL which is used in the flowsheet.



Production of 83.82 Tons per day of Methyl Diethanolamine

Process description

Methylamine (MA) and Ethylene oxide (EO) feeds were mixed in MIX -01 at operating temperature and pressure of 49.85°C and 20.265 bar respectively. The Mixture is fed into the conversion reactor at an adiabatic condition. In this reactor, Methyl Diethanolamine of 99% purity was obtained and the rest of the unconverted Methylamine (MSTR-05) was further cooled from 248.088 °C to 50 °C at isobaric condition by COOL – 01.

The pressure of this cooled stream was optimized from 20.265 bar to 7 bar by a pressure reducing valve (VALV – 01). The stream MSTR-07 was sent to a methylamine recovery column (DC-01) where 99% of pure methylamine was recovered. Methyl diethanolamine withdrawn from RC-01 and DC-01 were 1330.9986 kg/h and 2161.4235 kg/h respectively. On the whole 83.82 tons per day (TPD) of Methyl diethanolamine was obtained from this process flowsheet without the use of water as a catalyst.

Object	overhead	Bottom prdt	MMEA	MDEA	MA	EO	Unit
Temperature	46.2277	280.955	248.088	248.088	49.85	49.85	°C
Pressure	7	7.5	20.265	20.265	20.265	20.265	Bar
Mass Flow	4923.54	1331	6254.56	2161.44	5833	2583	Kg/h
Molar Flow	158.525	11.1697	169.694	18.1389	187.815	58.6345	Kmol/hr
Volumetric Flow	7.87008	1.77621	362.883	2.71663	9.3869	3.09353	
Molar Fraction (Liquid1)/MA	0.999888	4.0E-06	2.2E-05	2.2E-05	1	0	
Molar Fraction (Vapor)/EO	5.67E-05	0	0	0	0	1	
Molar Fraction (Liquid 1)/ EO	0.000112	2.49E-9	2.5E-09	2.5E-09	0	1	
Molar Fraction (Vapor)/MDEA	3.02E-20	0.44612	0.0658	0.0658	0	0	
Molar Fraction (Liquid 1)/ MDEA	7.94E-16	0.99999	0.99998	0.99998	0	0	