

Production of Ethanolamine, Diethanolamine, Triethanolamine by ethylene oxide and ammonia

Sajal Kumar

Department of Chemical Engineering

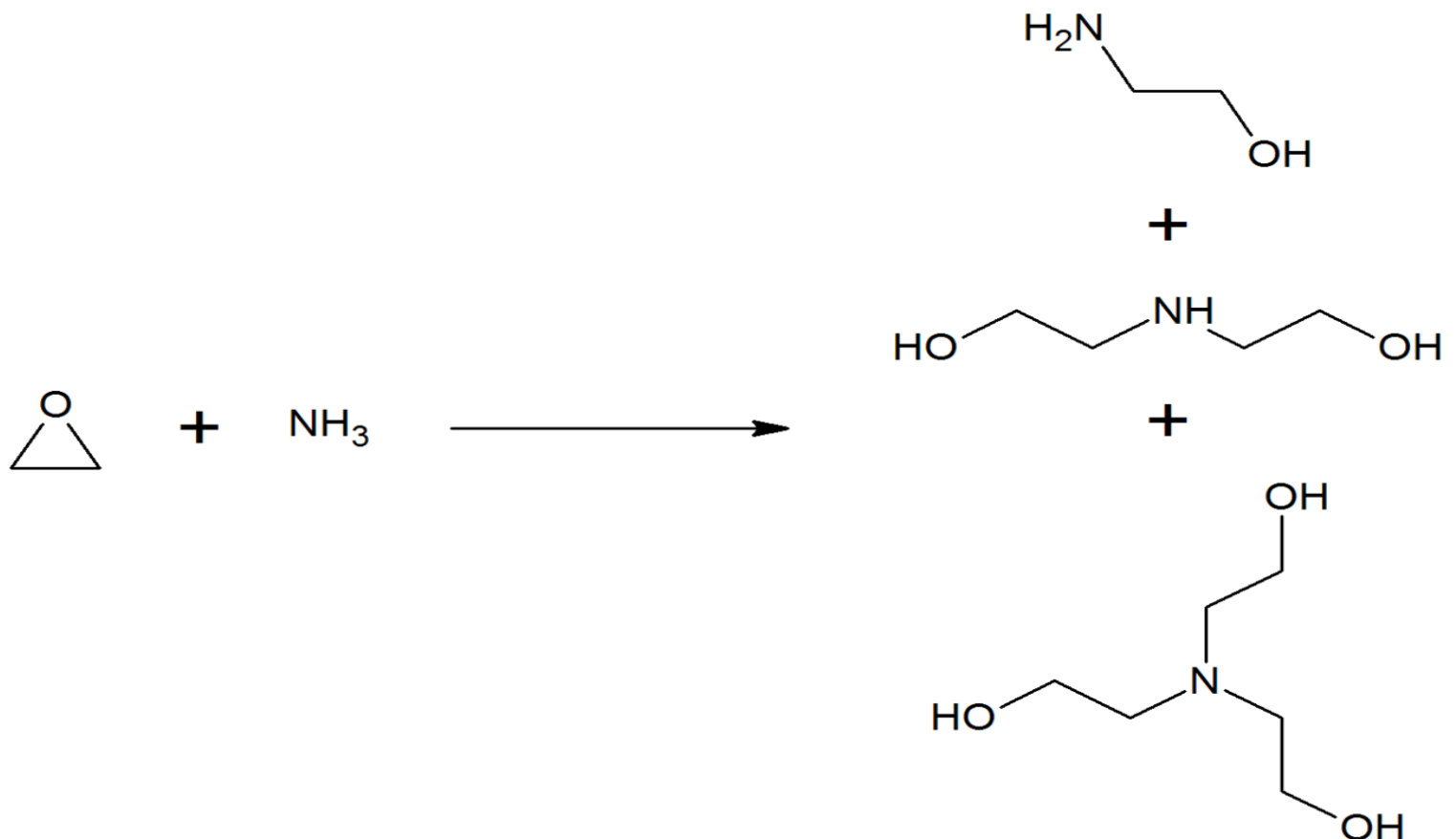
National Institute of Technology Warangal

Email: ksajal@student.nitw.ac.in

Background:

Ethylene oxide and aqueous ammonia are fed to stirred tank reactor which can be operated under a wide range of operation depending on the product distribution. The ratio of the products can be controlled by changing the stoichiometry of the reactant. All these product is having a wide range of application in chemical industries. These are used in detergent manufacturing, in gas purification and used as an intermediate in manufacture of some chemical products.

Reaction:



Description of the flowsheet:

This flowsheet is used for the production of derivatives of alcohol amine, consists of a mixer to mix the recycle stream with the feed streams, compressor and pump to pressurize the feed stream. It consists a continuous stirred tank reactor and coolers for decrease the temperature and a flash tower to separate ammonia from product stream. And a water stripper to separate water. A series of complex column to separate main products from each other. A stream splitter is used to remove a purge stream to avoid the accumulation of water and a recycle block to recycle back unconverted ammonia and ethylene oxide.

Description: Aqueous ammonia is pumped with recycle stream and ethylene oxide is compressed in a compressor and both are mixed in a mixer and then send to a continuous stirred tank reactor. Product stream from reactor is cooled and flashed in a flash tower to remove unconverted ammonia with product stream. The effluent is send to a water stripper to separate water. Product stream is passed through a series of complex column to separate main products. Monoethanolamine is obtained from top of first complex column and bottom is sent to second complex column. Diethanolamine is obtained as a top effluent and triethanolamine is obtained as bottom stream. If it contains further impurities then the bottom of second column is send to third column to separate triethanolamine as top effluent and heavy end at bottom. Stream from water stripper is sent through stream splitter to remove some water as in purge stream. And another stream is mixed with ammonia recycle from flash tower and recycled back using a recycle block.

Result:

Objects	Ammonia	Ethylene-oxide	Ethanol-amine	Diethanol-amine	Triethanol-amine	Purge stream
Temperature (°C)	30	25	170.256	268.084	336.039	36.2768
Pressure (bar)	1	1.01325	1.01325	1.01325	1.01325	1.01325
Mass flow (kg/h)	173.262	660.789	250.549	407.945	156.048	19.6655
Molar flow (kmol/h)	10.1149	15	4.10175	3.88016	1.04598	1.09571

References: Dryden's Outlines of Chemical Technology.