PROCESS DISCRIPTION

Today ethanolamines are produced on an industrial scale by reaction of ethylene oxide with excess ammonia, this excess ammonia being considerable in some cases.

In all conventional processes, reaction takes place in liquid phase, and the reaction pressure must be sufficiently large to prevent the vaporization of ammonia at the reaction temperature. In the current procedure ammonia concentration in water between 50 and 100 %, pressure of 160 atmosphere and the reaction up to 150^{o}C is used.

The flow sheet for production of MEA is as shown in the diagram. Raw materials used are ammonia and ethylene oxide. Aqueous solution of ammonia is mixed with recycled stream of ammonia to get a concentration of 30 % ammonia in water, which is mixed with ethylene oxide and sent to reactor (plug flow reactor). Reaction temperature of 150^{o}C is maintained in the reactor, and a pressure of 160 atmosphere to avoid the evaporation of ammonia and hence to keep ammonia liquid solution to carry the reaction in liquid phase.

REACTOR:

Reaction between ethylene oxide and ammonia is exothermic with release of 125 KJ/mole of ethylene oxide. Hence in order to maintain the reaction temperature heat has to be removed which passing the cooling water the jacket covering the reactor does.
Here in the reactor all the amines are produced i.e. MEA, DEA and TEA. In order to enhance the production of MEA ammonia must be passed in excess to provide the ammonia cal environment. Product distribution of three ethanolamines can be controlled by appropriate choice of ammonia: ethylene oxide ratio. Under appropriate conditions of reaction MEA formed will be 70%, DEA 20% and TEA of 5%. For the safety reasons, ethylene oxide must be metered into ammonia stream; in the reverse procedure, ammonia or amine may cause ethylene oxide to undergo an explosive polymerization reaction.

FLASH:

The product coming out of the reactor is sent the flash to remove excess ammonia used, is recycled. Reactor outlet stream will be having the temperature of 150^{o}C and at the same pressure as in the reactor. Hence at the lower pressure, at one atmosphere ammonia is completely removed. Feed before entering the flash it is passed through a heat exchanger to remove the excess heat present than what is required for the removal of ammonia. It is taken that no water is lost in the flash, only ammonia is removed.

DEHYDRATION TOWER:

In this almost all the water entering in the feed is removed as top product. Only a negligible amount of MEA will be lost because of very large difference in the boiling point of water and MEA. Because of very large difference in the boiling point of DEA and TEA they come down as the feed enters, and hence separation occurs only between Monoethanolamine and Water.

MONO ETHANOLAMINE TOWER:

Amount water present in the feed for this tower which coming from the dehydration tower is very small is in negligible amount. Here in this column Monoethanolamine is taken as top product and mixture of both DEA and TEA coming out as bottom product, further are sent vacuum column for their separation. Monoethanolamine of 99% purity is obtained. Only a small fraction of DEA and water is coming along with the MEA.