Production of Propylene oxide through hydrogen peroxide method

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A.Introduction

Propylene oxide (PO) is a colorless, highly volatile liquid with a low boiling point and an aromatic ether-like odor. Propylene oxide serves as an important chemical intermediate. It is a building block to a diverse number of products such as polyether polyols, propylene glycols, and propylene glycol ethers. The current production methods for PO in major industries are the chlorohydrin and the hydrogen peroxide processes. Eventhough chlorohydrin method is the traditional method to produce PO, hydrogen peroxide method provides cleaner technology without generating any effluents. Hydrogen peroxide method yields above higher conversion than the former method. The increase in the applications of polyurethane in various industries automotive, furniture, and construction will lead to a significant increase in the consumption of polyols which ultimately increase the market demand for PO.

B. Process Flow Sheet Description

The process involves the reaction of propylene with hydrogen peroxide in a conversion reactor. The reaction is exothermic in nature. The product stream from the reactor is sent to the first distillation column DC-001 through heater and expander to adjust the temperature and pressure. In distillation column large amount of PO is recovered at the top along with small traces of inert propane and unreacted propylene. Unreacted hydrogen peroxide and water is removed from the bottom. Formation of propylene glycol as by product from propylene oxide is not considered in this process. The distillate stream from the first distillation column is sent to the second distillation column DC-002 wherein propylene oxide is recovered as bottom stream with 99.8% (wt%) purity. The second column distillate is sent to another distillation column DC-003 to recover the PO as a bottom product and the remaining inert and unreacted propylene is collected in top to send to flare. Recovered PO from both the columns is mixed and compressed using compressor to store it in liquid form. The bottom stream from the first distillation column is sent

to fourth distillation column where hydrogen peroxide got separated from water. The recovered hydrogen peroxide is cooled and compressed to attain the feed conditions which can be recycled back to reactor.

C. Result

The process flow sheet was simulated for the production of PO using clean technology. Since hydrogen peroxide is not available in the database, it is added using joback method. Excess amount of hydrogen peroxide is used in the reaction to increase the formation of propylene oxide. The conversion of propylene Oxide was assumed to be 96%, based on literature review.

D. Conclusion

In the current work process flowsheet was developed and simulated for production of propylene oxide. In this simulation, hydrolysis of propylene oxide to propylene glycol is not considered. Further work involves incorporation of side reaction, kinetics and distillation column sequencing study.