

Ethylene oxide (CH₂—O--CH₂)

Ethylene oxide is a bulk chemical made in large quantities. India has < 5 plants that produce this chemical with a total production < 0.5 million tonnes per annum. Ethylene oxide is used in the commercial manufacture of ethylene glycol, an anti-freeze for vehicles, needed in cold places. Other uses are in the preparation of ethanolamines, ethylene glycol ethers and polyols.

Ethylene oxide is produced by oxidation of ethylene:



What side reactions do you expect to happen in the reactor? *Write them down.*

The side reactions are highly exothermic; their activation energies are higher than that of the main reaction.

Why is temperature control critical in the operation of reactor?

A selectivity of ~ 80% toward ethylene oxide is achieved in the reactor. The residence time in the reactor is ~ few seconds. The reaction occurs at 220-230 °C.

What type of reactor is most suitable for ethylene oxidation? Write the name of the reactor and draw its configuration.

Is the reactor designed for high or low single pass conversion? Why?

Is the reactor operated at high or low pressure? [*Hint: think downstream processing of reactor effluents*].

In addition to the side reactions indicated above, acetaldehyde and formaldehyde also form in the reactor. Downstream of the reactor what steps are to be followed to produce ethylene oxide of 99% purity. List those steps and then draw a block diagram for ethylene oxide production.