Ethylene Oxide Production

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Abstract:

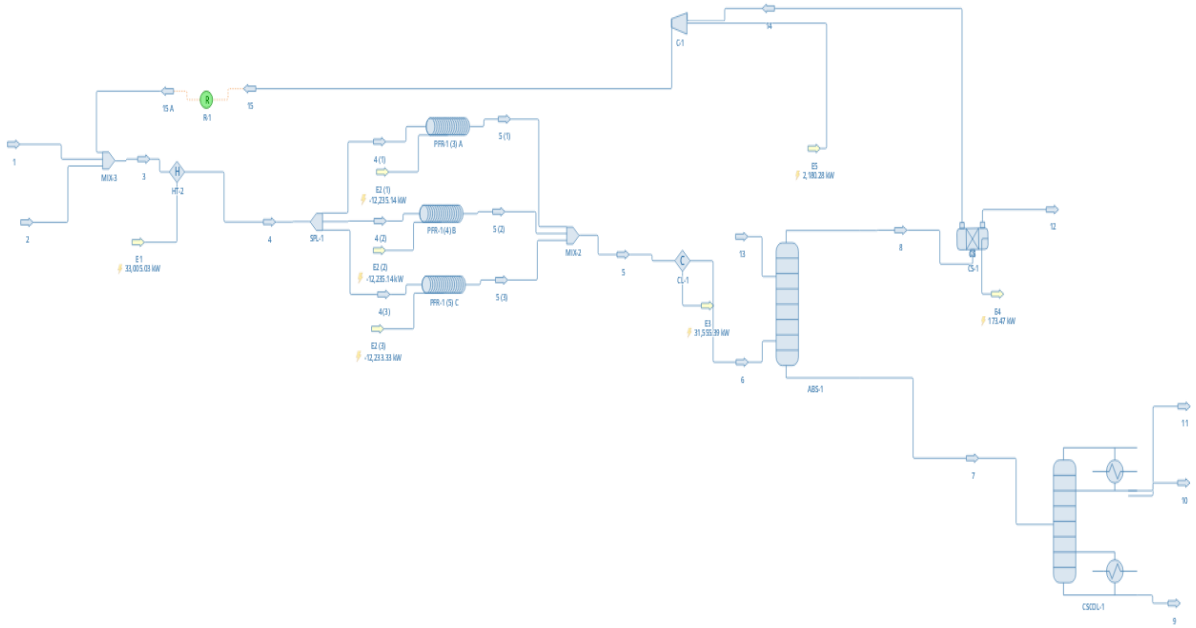
Ethylene oxide is a chemical used to make ethylene glycol (the primary ingredient in antifreeze). It is also used to make polyethylene oxide, and both the low-molecular-weight and high-molecular-weight polymers have many applications including as detergent additives. it is rarely shipped outside the manufacturing facility but instead is often pumped directly to a nearby consumer. The first two streams are Ethylene and oxygen they connected to a mixer which also have recycle stream came from co_2 removal, then stream 1,2 and 3 with heater connected becomes stream 4 goes to steam splitter and then to the reactor is (Plug Flow Reactor-PFR), we use three reactors for this process then one more mixer settler connects stream 5 should have to cool down, hence we add one cooler to cool down the fluid then we get stream no 6 which move forward to absorption tower where Ethylene oxide absorbed into water. The overhead vapor from the absorber (containing typically <100 ppm of EO) is sent to the carbon dioxide removal unit comprising of a two-column absorber/stripper unit where a portion of the carbon dioxide is removed using hot potassium carbonate solution and purged from the system. This stream is sent to a stripping column where the majority of EO is sent overhead and condensed. The dissolved gases are vented from the overhead reflux drum and a 99.5% EO stream is produced as overhead product. The bottom stream from the stripping column contains water and trace amounts of EO. This stream is

cooled and may be recycled back to the absorber. From this process simulation we try to show how the ethylene oxide production plant works in real life application.

Thermodynamic Package:

- Global model of Modified UNIFAC (Dortmund) (and Raoult's Law as local model for absorption tower)

Flow Sheet :



Result:

Object	1	2	3	4	4 (1)	4 (2)	4 (3)	5	5 (1)	
Temperature	50	50	55.1087	224.6	224.6	224.6	224.6	224.6	224.6	C
Pressure	22	22	22	22	22	22	22	21.2198	21.2198	bar
Molar Flow	334.676	365.285	16275.7	16275.7	5425.49	5425.49	5424.68	16149.5	5383.42	kmol/h
Molar Flow (Mixture) / Oxygen	0	365.285	1195.48	1195.48	398.512	398.512	398.452	830.33	276.791	kmol/h
Molar Flow (Mixture) / Methane	1.0131	0	9727.03	9727.03	3242.51	3242.51	3242.02	9727.03	3242.51	kmol/h
Molar Flow (Mixture) / Carbon dioxide	0	0	833.841	833.841	277.961	277.961	277.919	993.14	331.063	kmol/h
Molar Flow (Mixture) / Ethylene	333.663	0	4463.79	4463.79	1488	1488	1487.78	4131.74	1377.32	kmol/h
Molar Flow (Mixture) / Ethylene oxide	0	0	0.010626	0.010626	0.003542	0.003542	0.003542	252.409	84.1404	kmol/h
Molar Flow (Mixture) / Water	0	0	55.5008	55.5008	18.5012	18.5012	18.4984	214.8	71.6034	kmol/h

Object	5 (2)	5 (3)	6	7	8	9	10	11	
Temperature	224.6	224.6	68.5	65.313	42.9421	155.5	34.4122	34.4122	C
Pressure	21.2198	21.2198	21.2198	21	20	5.5	4.9	4.9	bar
Molar Flow	5383.42	5382.61	16149.5	7404.44	15745	7146.07	248.364	10.008	kmol/h
Molar Flow (Mixture) / Oxygen	276.791	276.749	830.33	0.103958	830.231	9.72E-20	0.000254	0.103705	kmol/h
Molar Flow (Mixture) / Methane	3242.51	3242.02	9727.03	1.11783	9725.93	8.81E-19	0.002823	1.11501	kmol/h
Molar Flow (Mixture) / Carbon dioxide	331.063	331.014	993.14	2.20292	990.932	5.76E-19	0.110726	2.09222	kmol/h
Molar Flow (Mixture) / Ethylene	1377.32	1377.11	4131.74	1.77499	4129.96	6.33E-19	0.018175	1.75683	kmol/h
Molar Flow (Mixture) / Ethylene oxide	84.1404	84.1279	252.409	252.376	0.032531	0.191462	247.246	4.9384	kmol/h
Molar Flow (Mixture) / Water	71.6034	71.5928	214.8	7146.87	67.9292	7145.88	0.98566	0.001828	kmol/h

Object	12	13	14	15	15 A	
Temperature	42.9421	25	42.9421	55.9043	55.9043	C
Pressure	20	21	20	23	23	bar
Molar Flow	169.668	7000	15575.3	15575.3	15575.2	kmol/h
Molar Flow (Mixture) / Oxygen	0.015363	0	830.216	830.216	830.209	kmol/h
Molar Flow (Mixture) / Methane	9.73E-07	0	9725.93	9725.93	9725.85	kmol/h
Molar Flow (Mixture) / Carbon dioxide	157.199	0	833.733	833.733	833.726	kmol/h
Molar Flow (Mixture) / Ethylene	4.13E-07	0	4129.96	4129.96	4129.92	kmol/h
Molar Flow (Mixture) / Ethylene oxide	0.021909	0	0.010622	0.010622	0.010622	kmol/h
Molar Flow (Mixture) / Water	12.4316	7000	55.4976	55.4976	55.4972	kmol/h

References

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