Vinyl Chloride Production

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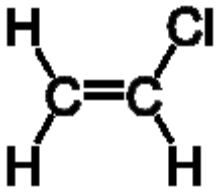
Introduction

Vinyl chloride is an organochloride with the formula $H_2C=CHCl$ that is also called **vinyl chloride monomer** (**VCM**) or **chloroethene**. This colorless compound is an important industrial chemical chiefly used to produce the polymer polyvinyl chloride (PVC).



Process Description:

Vinyl chloride is produced in a two step process from ethylene.

- Ethylene first reacts with Chlorine to produce Ethylene dichloride.
- The purified Ethylene dichloride undergoes selective cracking to form vinyl chloride.

Direct chlorination

EDC (ethylene dichloride) is prepared by reacting ethylene and chlorine In the presence of iron(III) chloride as a catalyst, these compounds react exothermically:

$$CH_2=CH_2 + Cl_2 \rightarrow ClCH_2CH_2Cl$$

This process results in high purity EDC and high yields. Dissolved catalyst and moisture must be removed before EDC enters the vinyl chloride production process

• C_2H_4 and Cl_2 are mixed and sent to the Direct Chlorination reactor.

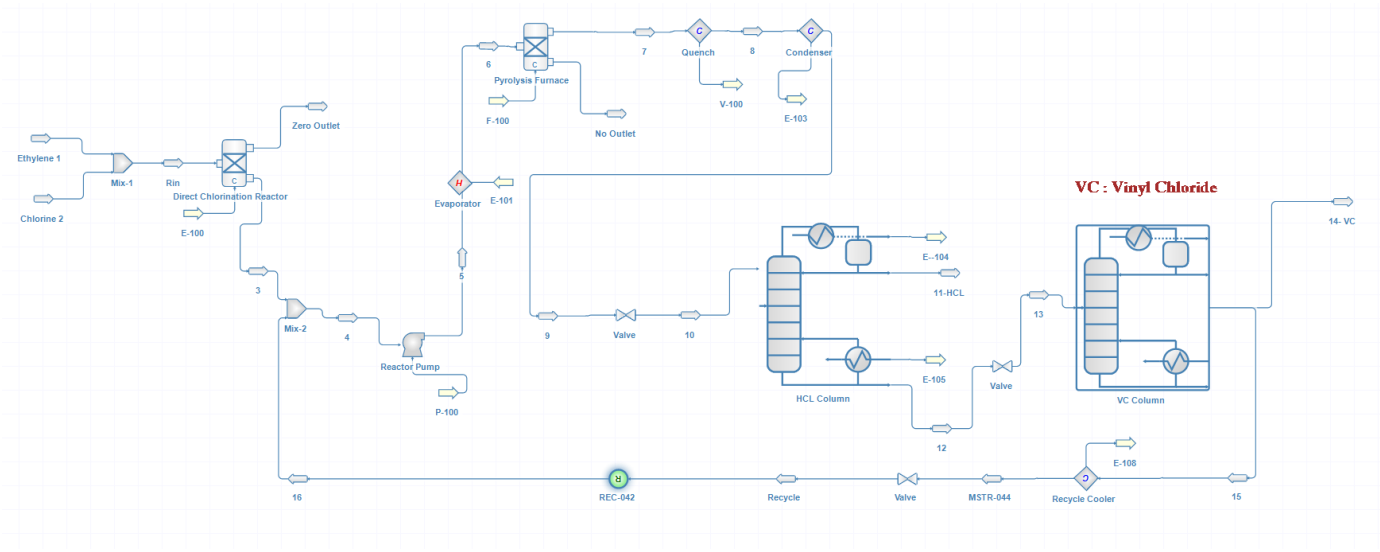
• The conversion in the Direct Chlorination Reactor is assumed to be 100%, while that in pyrolysis reactor is only 60%.

• Further both the columns are assumed to carry out perfect separations, with overhead and bottoms temperatures computed based on dew- and bubble-point temperatures, respectively.

• The products from the pyrolysis furnace are cooled and sent to HCL column where HCL is removed as overhead product and the bottoms, which include Vinyl Chloride and 1,2-dichloroethane are sent to the second distillation column.

• The vapour product from the VC column is Vinyl Chloride and the bottoms are 1,2-dichloroethane and is sent for recycle to increase the production.

Flowsheet:



Stream Results:

Sream Wise Results													
Object	Recycle	9	8	7	4	16	15	14- VC	13	12	11-HCL	10	
Temperature	90	6	170	500	90	90	143.6	32.178	58.2062	91.0263	-24.3186	6	C
Pressure	1.5	26	26	26	1.5	1.5	4.8	4.8	4.8	12	12	12	atm
Mass Flow	105577	263911	263911	263911	263911	105577	105577	100017	205594	205594	58330.4	263911	lbm/h
Molar Flow	1066.88	4266.99	4266.99	4266.99	2666.88	1066.88	1066.88	1600.31	2667.19	2667.19	1599.8	4266.99	lbmol/h
Molar Fraction (Mixture) / Ethylene	0	5.86914E-33	5.86914E-33	5.86914E-33	8.45832E-17	0	0	0	2.69439E-147	2.69439E-147	1.5651E-32	5.86914E-33	
Mass Flow (Mixture) / Ethylene	0	7.02573E-28	7.02573E-28	7.02573E-28	6.32822E-12	0	0	0	2.01609E-142	2.01609E-142	7.02431E-28	7.02573E-28	lbm/h
Molar Fraction (Mixture) / Chlorine	3.38003E-20	7.92971E-16	7.92971E-16	7.92971E-16	1.35334E-15	3.38003E-20	3.38003E-20	2.10699E-15	1.26423E-15	1.26423E-15	7.53555E-18	7.92971E-16	
Mass Flow (Mixture) / Chlorine	2.55689E-15	2.39914E-10	2.39914E-10	2.39914E-10	2.55909E-10	2.55689E-15	2.55689E-15	2.3908E-10	2.39088E-10	2.39088E-10	8.54787E-13	2.39914E-10	lbm/h
Molar Fraction (Mixture) / 1,2-dichloroethane	1	0.25	0.25	0.25	1	1	1	3.95631E-22	0.4	0.4	3.11214E-35	0.25	
Mass Flow (Mixture) / 1,2-dichloroethane	105577	105564	105564	105564	263911	105577	105577	6.26542E-17	105577	105577	4.92699E-30	105564	lbm/h
Molar Fraction (Mixture) / Hydrogen chloride	0	0.375	0.375	0.375	0	0	0	0	1.48346E-111	1.48346E-111	1	0.375	
Mass Flow (Mixture) / Hydrogen chloride	0	58342.1	58342.1	58342.1	0	0	0	0	1.44264E-106	1.44264E-106	58330.4	58342.1	lbm/h
Molar Fraction (Mixture) / Vinyl chloride	3.29579E-21	0.375	0.375	0.375	5.27387E-21	3.29579E-21	3.29579E-21	1	0.6	0.6	2.17689E-10	0.375	
Mass Flow (Mixture) / Vinyl chloride	2.19756E-16	100005	100005	100005	8.79022E-16	2.19756E-16	2.19756E-16	100017	100017	100017	2.17656E-05	100005	lbm/h

Reference: Product-and-Process-Design-Principles-Seider

DWSIM VERSION 5.2