

Production of Acetaldehyde by Dehydrogenation of Ethanol

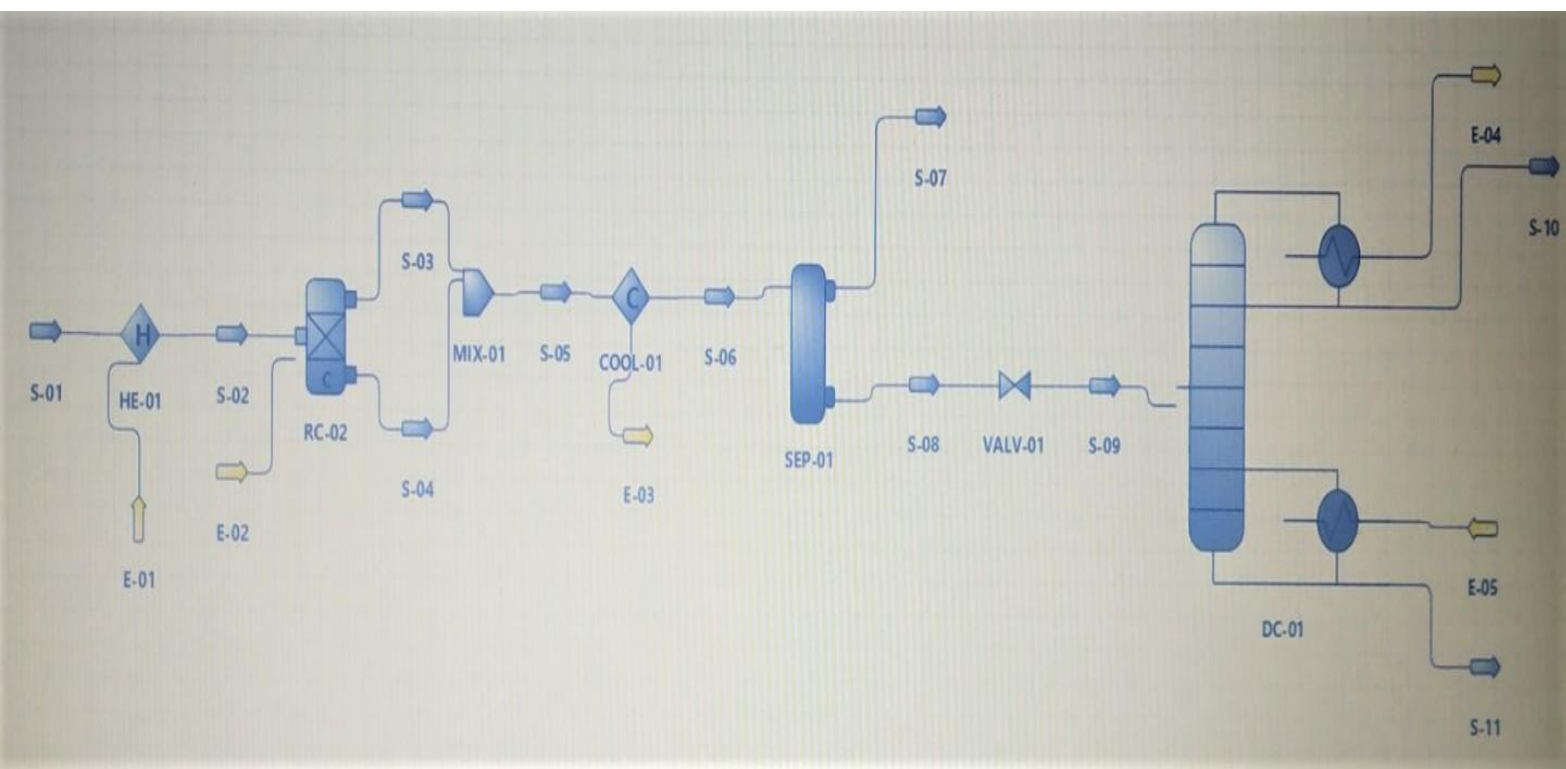
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Background:

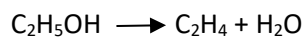
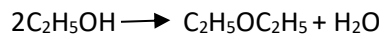
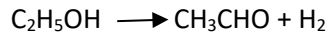
Acetaldehyde is an organic chemical compound with the formula CH_3CHO . It is an industrially important solvent used as an intermediate for the synthesis of a wide range of compounds. On oxidation it forms acetic acid and ethanol on reduction. It is widely used in the manufacture of acetic acid, perfumes, dyes and drugs, as a flavoring agent and as an intermediate in the metabolism of alcohol. Acute exposure to its vapors results in irritation of the eyes, skin, and respiratory tract.

Flowsheet:



Description:

Acetaldehyde is produced by the dehydrogenation of ethanol in the presence of a catalyst at the optimum temperature. The products formed during the reactions are acetaldehyde, water and hydrogen. The reactions occurring are as follows:



Initially a stream of fresh ethanol(S-01) is fed to a heater to raise the temperature of the feed stream to 400°C(S-02).

Then the stream S-02 is fed to reactor. The conversion of ethanol to acetaldehyde in the presence of activated carbon catalyst is 80% which is obtained in the reactor at 400°C. Then the two outlet streams are mixed in a mixer as acetaldehyde is present in both the streams. This combined product stream is then cooled from 400°C to 10°C and pressurized to 5.93 atm. This cooled stream is then sent to the flash separator to separate out hydrogen which is present in gaseous phase. Then the liquid stream is sent through a valve to the distillation column to separate out much pure acetaldehyde.

At the end of the process 99% pure acetaldehyde is collected as stream S-10.

Results:

Results table here:

Master Property Table									
Object	S-11	S-10	S-09	S-08	S-06	S-05	S-02	S-01	
Temperature	124.219	-146.207	10.1177	10	10	400	400	25	C
Pressure	10	1	2.3	5.93462	5.93462	1	1	1	atm
Mass Flow	9407.84	11014.7	20422.6	20422.6	22894	22894	22894	22894	kg/h
Molar Flow	212	250.074	462.074	462.074	896	896	500	500	kmol/h
Molar Fraction (Mixture) / Ethanol	0.464597	8.5645E-13	0.213183	0.213183	0.110491	0.110491	0.99	0.99	
Mass Fraction (Mixture) / Ethanol	0.48231	8.95776E-13	0.222207	0.222207	0.199213	0.199213	0.996065	0.996065	
Molar Flow (Mixture) / Ethanol	98.4946	2.14176E-10	98.5063	98.5063	99	99	495	495	kmol/h
Molar Fraction (Mixture) / Acetaldehyde	0.511877	0.999843	0.775937	0.775937	0.441964	0.441964	0	0	
Mass Fraction (Mixture) / Acetaldehyde	0.50814	0.999993	0.773389	0.773389	0.761983	0.761983	0	0	
Molar Flow (Mixture) / Acetaldehyde	108.518	250.034	358.54	358.54	396	396	0	0	kmol/h
Molar Fraction (Mixture) / Hydrogen	4.6346E-42	0.00015705	8.49866E-05	8.49866E-05	0.441964	0.441964	0	0	
Mass Fraction (Mixture) / Hydrogen	2.10534E-43	7.1878E-06	3.87629E-06	3.87629E-06	0.034869	0.034869	0	0	
Molar Flow (Mixture) / Hydrogen	9.82535E-40	0.039274	0.0392701	0.0392701	396	396	0	0	kmol/h
Molar Fraction (Mixture) / Water	0.0235254	2.02371E-18	0.0107948	0.0107948	0.00558036	0.00558036	0.01	0.01	

