Acetaldehyde production by liquid phase hydration of acetylene

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Background and Description:

Acetaldehyde is found in various plants, vegetables, smoke, gasoline and diesel exhaust. This substance is widely used in the manufacture of acetic acid, perfumes, dyes and drugs, as a flavouring agent and as an intermediate in the metabolism of alcohol.

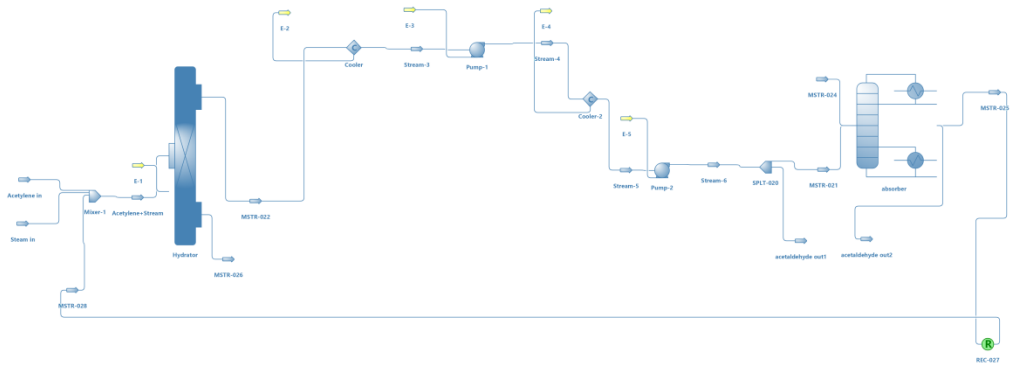
Reaction involved:

$C_2H_2 + H_2O \rightarrow CH_3CHO$

Process:

The process initially involves passing acetylene and steam streams into a hydrator. The thermodynamic property used is Raoult's Law for accuracy. The products are passed through a series of coolers and pumps, thereafter passing it through an absorber. Major product (acetaldehyde) is collected and rest is recycled to the hydrator for further conversion.

Flowsheet:



Results:

Master Property Table						
Object	**acetaldehyde out2**	**acetaldehyde out1**	**Steam in**	**Acetylene+Stream**	**Acetylene in**	
Temperature	317.364	349.152	700	350.857	188.426	**K**
Pressure	101325	101320	3.89523E+07	101325	101325	**Pa**
Mass Flow	0.970602	43.0709	18.0422	46.3128	25	**kg/s**
Molar Flow	53.8699	1003.11	1001.49	2038.78	960.162	**mol/s**
Volumetric Flow	0.000980575	28.7395	0.149632	51.4508	0.0401093	**m3/s**
Mixture Density	989.829	1.49866	120.577	0.900136	623.297	**kg/m3**
Mixture Molar Weight	18.0175	42.9371	18.0153	22.7159	26.0373	**kg/kmol**
Mixture Specific Enthalpy	-2360.65	67.5035	785.639	-133.128	-817.33	**kJ/kg**
Mixture Specific Entropy	-7.43455	0.278951	-1.0905	-0.0874293	-4.14399	**kJ/[kg.K]**
Mixture Molar Enthalpy	-42533	2898.41	14153.5	-3024.12	-21281	**kJ/kmol**
Mixture Molar Entropy	-133.952	11.9774	-19.6456	-1.98604	-107.898	**kJ/[kmol.K]**

PROPERTIES TABLE			
Hydrator	**Water: Conversion**	95.4084	**%**
Hydrator	**Acetylene: Conversion**	100	**%**
Hydrator	**acetaldehyde synthesis: Extent**	100	**%**

Master Property Table						
Object	**E-5**	**E-4**	**E-3**	**E-2**	**E-1**	
Energy Flow	0.309054	10	0.154595	100	-137298	**kW**

So, according to this flowshhet, we get Acetaldehyde as our desired product.