Production of ethanol by fermentation of glucose

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Problem Statement: Simulation of ethanol production process by fermentation of glucose using DWSIM.

System of unit: The system of units taken in this flowsheet is C5, mass-flow rate in Kg/hr, pressure in bar and temperature in degree celsius.

Property package: Modified UNIFAC (NIST)

Background and Description: Ethanol is obtained as a result of fermentation of various renewable resources available in nature. Fermentation of glucose ($C_6H_{12}O_6$) is carried out under the action of yeast resulting in the production of ethanol (C_2H_5OH) and carbon dioxide (CO_2) as shown in the following reaction: $C_6H_{12}O_6$ (aq) $\rightarrow$ $2C_2H_5OH$ (l) + $2CO_2$ (g).

This flowsheet contains 2 streams (S-01 and S-02) containing glucose and water as a feed. The feed enters in the mixer where it is mixed. Then feed is heated to 102.97 degree Celsius. In the conversion reactor, the reaction takes place. Ethanol and carbon dioxide are produced. In the flash column carbon dioxide and ethanol are separated. The results are as shown in the table.

Flowsheet:
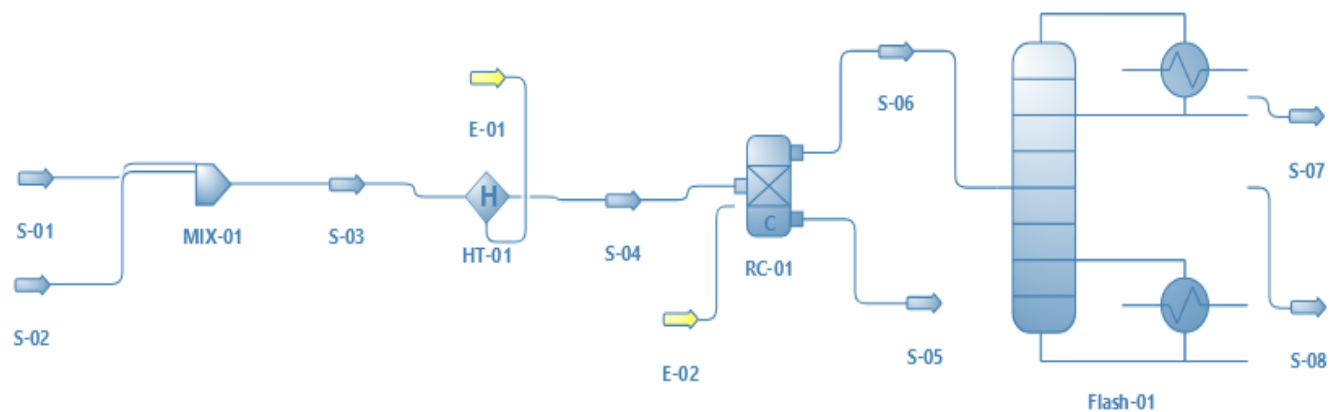
Results:

Object	S-01	S-02	S-03	S-04	S-06	S-07	S-08
Temperature(C)	25	25	42.3	102.97	478.551	55	55
Pressure(bar)	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325	1.01325
Flow-rate(kg/hr)	0.5	0.5	1.0	1.0	1.0	0.61166	0.38834
M.F.(Glucose)	0.5	1.0	0.677	0.677	0.01658	0.00	0.043
M.F.(Water)	0.5	0.0	0.322	0.322	0.11167	0.0375	0.0233
M.F.(Ethanol)	0.0	0.0	0.0	0.0	0.43587	0.26459	0.7168
M.F.(Carbon Dioxide)	0.0	0.0	0.0	0.0	0.43587	0.69789	0.0061

Conclusion: - At given feed of 1 kg/hr, at given parameters; ethanol at 0.27836 kg/hr can be produced.