

Triple effect evaporation of saline solution

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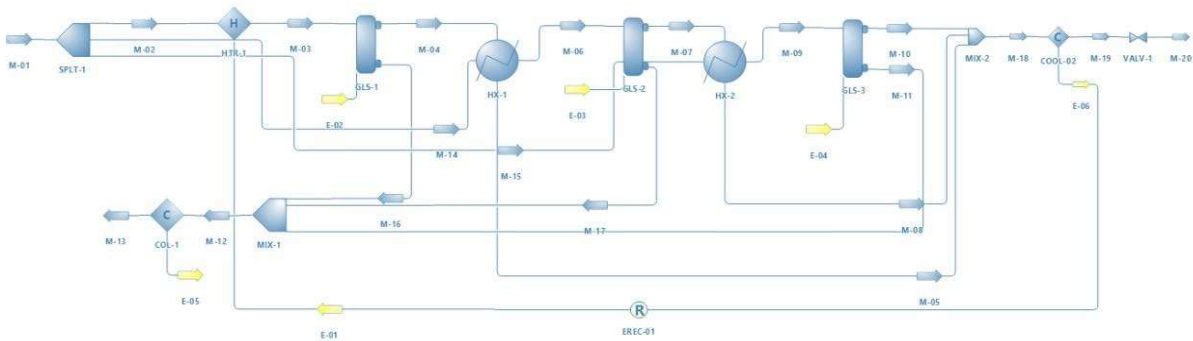
Background & Description:

The feed stream containing 20 mole percent of sodium chloride and 80 mole percent water is fed to a material stream splitter. The feed stream is at RTP. The splitter is used to split the feed stream into 3 parts with molar flow rates of 33.33 mol/sec and similar molar fraction of input stream. The M-02 material stream is fed to the htr-1 to increase the temperature to 380 K. From heater, it goes to the gas liquid separator where vapour phase and liquid phase are separated at 55000 Pa pressure and 380 K temperature. The separated vapour phase has pure water with purity of 99.97%. The stream M-04 is at 380 K, this heat energy is utilised to heat the second stream which was separated initially from the feed stream by the heat exchanger. The temperature of second stream is increased to 365 K and then it is fed to the gas-liquid separator which is operating at 40000 Pa. Due to the decreased pressure, the solution will vaporise at a temperature lower than the boiling point at atmospheric pressure. The vapour phase stream is then passed via a hx-2, which raises the temperature of the third feed stream to 350 K before passing it through the gas-liquid separator, which operates at 30000 Pa. The pure water is again separated, and it is mixed with the water separated by previous gas-liquid separators. The water is then cooled to room temperature and the heat energy extracted from it is utilised in the heater by using energy recycle. The pressure is increased to atmospheric pressure by using an expansion valve. The water with very high salt concentration received as the bottom product of gas-liquid separator is mixed and it is cooled by the cooler. The flowsheet and detailed report of the results has been uploaded on the google drive and link for the same has been provided.

Property package: Raoult's law

System of units: SI

Flowsheet:



Results:

Master Property Table							
Object	M-19	M-13	M-10	M-07	M-04	M-01	
Temperature	298.15	330	350	365	380	298.15	K
Pressure	30000	30000	30000	40000	55000	101325	Pa
Molar Flow	50.2015	49.7985	9.78464	18.9243	21.4926	100	mol/s
Molar Fraction (Mixture) / Sodium Chloride	0.000208114	0.401407	0.000108364	0.0002019	0.000258998	0.2	
Molar Fraction (Mixture) / Water	0.999792	0.598593	0.999892	0.999798	0.999741	0.8	