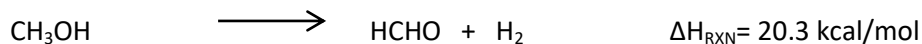


Production of Formalin from Methanol

BACKGROUND

FORMALIN (37 wt% of formaldehyde in water) is majorly produced from methanol. Formaldehyde and urea is used to make urea-formaldehyde resins which is an adhesive use for plywood.

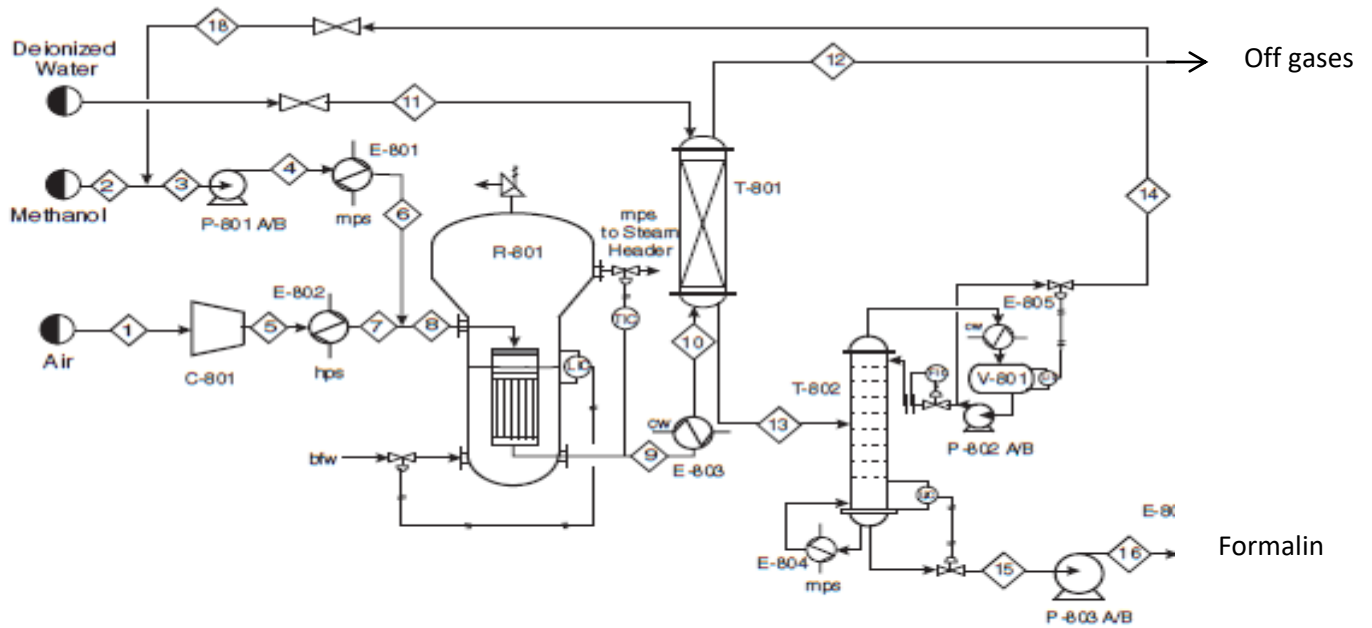
Methanol is oxidized in the presence of air to form formaldehyde and water and some of the methanol is also decomposed to give formaldehyde and hydrogen which is separated by compound separator.



PROCESS DESCRIPTION

Fresh Methanol (stream 2) mixes with recycle methanol (stream 18) in mixer (mixer-001) is pumped by pump (PUMP-001) and then passed through the heat exchanger to vaporised methanol. Stream 6 is at temperature 423.15 K and 314.7 kPa pressure. Fresh air which is mixture of oxygen and nitrogen is available at 25^oC and 1 atm. It is compressed (COMPRESSOR-001) to 300 kPa and is preheated by passing it through heat exchanger (HE-002) to temperature of 200^oC and is mixed with vaporised methanol from stream 6 in mixer (MIXER-003) with is then feed to a reactor. Exothermic reaction occurs in the reactor with is operated at define outlet temperature with energy stream (ESTR-003). Conversion of methanol is around 80% for oxidation reaction and 25% for decomposition reaction. Output of reactor is again given to heat exchanger (HE-003) which decreases the temperature of stream to 360K. Outlet of heat exchanger (stream 10) is mixed with water (stream 1) in mixer (MIXER-004). Then it is given to the compound separator where hydrogen produce during decomposition of methanol is separated along with nitrogen present in air utilizing energy stream (ESTR-004). Some traces of formaldehyde, methanol and oxygen also separated in separator. Now outlet of separator is given to distillation column where separation of methanol from reaction mixture takes place. Condenser and reboiler duties are attached to the column. Heavy component is water and light is methanol. Formaldehyde will follow water as it is associated with it. Top product from column that is distillate is pumped through pump (PUMP-002) which is passed through recycle loop and is given to mixer (MIXER-001). Bottom product is collected and pumped through to higher pressure. Composition of product is around 32 mole% of formaldehyde with some traces of methanol present.

PROCESS FLOWSHEET



RESULTS

PARAMETERS	UNITS	INPUT			OUTPUT	
		METHANOL	AIR	WATER	FORMALIN	OFF GASES
TEMPERATURE	K	303.15	298.15	303.15	297.688	354.28
PRESSURE	Pa	120000	101300	150000	350000	101300
MASS FLOW	Kg/s	0.684632	1.16959	0.039722	1.07958	0.272525
MOLE FLOW	mol/s	21.3667	40.5389	2.20495	46.7847	8.51667
MOLE FRACTIONS						
METHANOL		1	0	0	0.092	0.03447
WATER		0	0	1	0.5941	0
OXYGEN		0	0.21	0	0	0.0446
NITROGEN		0	0.79	0	0	0.8383
FOMRALDEHYDE		0	0	0	0.3138	0.02726
HYDROGEN		0	0	0	0	0.0553

Reference:

Analysis, Synthesis and Design of Chemical Processes. (Fourth Edition), Turton, Bailie, Whiting, Shaeiwitz and Bhattacharya - Appendix B(Information for the Preliminary Design of Fifteen Chemical Processes)