Synthesis of methanol

Background:

The by far dominating production method of methanol synthesis Is through the synthesis gas process first developed during 1920.A gasmixtureof hydrogen and carbon monoxide (and also carbon dioxide)known as synthesis gas (syngas) is the basis for almost all methanol productiontoday.

The production of methanol basically consists of three main steps syngas preparation, methanol synthesis and methanol purification

Description of flowsheet

The flowsheet used for methanol synthesis consist of a mixer to mix the recycle stream and feed stream, conversion reactor,the cooler to cool the products,separator to separate gases and the liquids and a purifier to purify the methanol.

First the feed consists of H2 and CO in the ratio of 2.25. The reactants are fed along with the recycle of CO and H2 in to the conversion reactor.The reactions that are possible in the conversion reactor are below.

CO + 2H2 => CH3OH

CO + 3H2 => CH4 +

H2O 2CO + 2H2 =>

CH4 + CO2

The products from the reactor are then sent to a cooler unit where the products are cooled. The gases and liquids that are formed due to cooling are separated and these gases are sent to Recycle. H2 &CO are sent into the mixer to mix with feed stream. The liquid products are then sent to a decompressor to decompress them to 14atm. And after decompressing these sent to gas liquid separator to separate gases and liquids. The liquid product are sent to (CS) compound separator to separate methanol form remaining components that are present.

We get methanol as the product.

Results that are obtained in the simulation are below

Object	*feed*	*Reaction product*	*Methanol*	*Units*
Temperature	298.15	2347.64	299.251	K
Pressure	101325	3.04E+07	1.42E+06	Pa
Mass Flow	0.0325457	0.0650915	3.2042	kg/s
Molar Flow	3.25	3.0714	100	mol/s
Volumetric Flow	0.0795186	0.00205341	0.00418728	m3/s
Mixture Density	0.409285	31.6992	765.223	kg/m3
Mixture Molar Weight	10.0141	21.1928	32.042	kg/kmol
Mixture Specific Entropy	1.15682	5.13466	-3.75414	kJ/[kg.K]
Mixture Molar Entropy	11.5845	108.818	-120.29	kJ/[kmol.K]
Mixture Molar Fraction				
Carbon monoxide	0.307692	7.23E-17	0	
Hydrogen	0.692308	0.162791	0	
Carbon dioxide	0	0.0930233	0	
Methane	0	0.27907	0	
Methanol	0	0.27907	1	
Water	0	0.186047	0	

Reference:

NPTEL synthesis of methanol

http://nptel.ac.in/courses/103103029/module3/lec13/3.

html