SYNTHESIS OF METHANOL

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Background:

Formaldehyde, the primarily oxidation product of methanol, is the largest outlet for methanol. Formaldehyde is an important monomer in the plastic industry.

The demand for methanol in India is projected to rise to 322,000 tons by 1994-95 and 350,000 by 2000 A.D. Approximately 50% of the demand will come from formaldehyde, about 25% from DMT, and the balance from drugs, pesticides, and chemicals such as acetic acid, methyl amines, esters, solvents, etc.

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:

$CO + 2H_2 \rightarrow CH_3OH$

$CO + 3H_2 \rightarrow CH_4 + H_2O$

$2CO + 2H_2 \rightarrow CH_4 + CO_2$

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 the methanol as product.

Results that are obtained in the simulation are given below:

OBJECT	**FEED**	**REACTION PRODUCT**	**METHANOL**	**UNITS**
Temperature	298.15	1737.69	298.15	K
Pressure	101325	101325	101325	Pa
Mass flow	0.0325457	0.0325574	0.0221603	Kg/s
Molar flow	3.24999	1.38119	0.854926	Mol/s
Volumetric flow	0.0795078	0.196933	2.53293E-0.5	M^3/s
Mixture density	0.40934	0.165322	874.888	Kg/m^3
Mixture molar weight	10.0141	23.572	25.9207	Kg/kmol
Mixture specific enthalpy	0	4060.07	-1563.1	KJ/kg
Mixture specific entropy	1.15759	4.93441	-4.99066	KJ/kg.K
Mixture molar enthalpy	0	95704.1	40516.8	KJ/kmol
Mixture molar entropy	11.5923	116.314	-129.362	KJ/kmol.K
MIXTURE MOLAR FRACTION				
Carbon monoxide	0.307692	0.030310293	0	
Hydrogen	0.692308	6.740248E-12	0	

Carbon dioxide	0	0.017334284	0	
Methane	0	0.29302109	0	
Methanol	0	0.38364754	1	
water	0	0.2756868	0	

PROCESS DONE IN SIMULATON:

Property package: Raoult's law

Flash algorithm: nested loop (VLE)

ABBREVATIONS:

MSTR-008,019,022,023,025,027 are material stream.

ESTR-003,009,012,016,020,024,029,033 are energy stream.

REC-02 IS Recycle block

G-L Separator is Gas –Liquid Separator

REFERENCE:

NPTEL, synthesis of methanol

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

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