SWEETENING OF NATURAL GAS FOLLOWED BY MANUFACTURING OF LPG

SARTHAK VAIDYA

Department of Chemical engineering,

Datta Meghe college of Engineering, Airoli

MUMBAI UNIVERSITY.

E-mail : sarthakvaidya3@gmail.com

BACKGROUND :

Natural gas is an important element and is widely used. Starting from day to day activities to various process in industries, it is widely utilized. Hence processing of natural gas is very important. Different Natural gas processing plants employs different processes and methods in order to obtain efficient and pure LPG and LNG as final products. Depending upon source, the composition of natural gas can vary. Usually it contains about 75-80% of Methane, 5-10 % of ethane and propane and 0-5% of heavier hydrocarbons. Mainly, every source contains about 1-2 % of CO_2 and H_2S. These gases are also called as ACIDIC GASES. Presence of Acidic gases even in smaller quantities largely effects the calorific values of final product. Hence it is extremely important to reduce the acid gas content from Natural gas stream. This Process is termed as " Gas Sweetening". After sweetening, Natural gas is further processed and separated into LPG and LNG as its final products. Heavier hydrocarbons are more valuable than methane, hence it is extremely important to recover them. Recovery is employed by a series of distillation Process.

FLOWSHEET DESCRIPTION :

A. **Gas sweetening** – Natural gas feed stream maintained at 330K and 60 atm pressure is initially passed through vapor-liquid separator. The feed streamed contained approx. 81% of Methane, 7-8% of ethane and propane and 1-2 % of CO2 and H2S. Heating the vapor stream from the separator, it is sent to acid gas absorber. The solvent used for absorption is a blend of MEA, DEA and water. During absorption, acidic gases and small traces of hydrocarbon gas are also absorbed in solvent. Absorbed solvent stream is further passed to regenerator column for solvent regeneration. The temperature of the stream is raised to about 400K , before entering the regenerator column. Due to heat, acid gases are separated from the solvent and the solvent is cooled and ready for reuse. The acidic gas is either sent to flaring system or is directly emitted into atmosphere.

B. **LPG manufacturing –** The Sweet gas obtained from absorber has extremely high temperatures to about 520K. The sweet gas stream is passed through a series of coolers and heat exchangers (Propane Type), which drops the temperature to 247K. The reduction in temperature leads to condensation of heavier Hydrocarbons. The stream is then flashed onto a series of vapor-liquid separators. Two separators in series are used such that the vapor stream from 1st is the inlet stream to 2nd separator. Final vapor product obtained is Super Saturated Vapors containing about 85% of methane. It is then sent to LNG plant for further processing. The bottom streams from both the separators is then fed to glycol dehydration unit for removal of excessive water. The dehydrated gas is cooled to 300K and sent to LEF column. Here, super saturated vapors containing 85% of Methane is obtained as Distillate and is sent to LNG plant for further processing. The Bottoms stream is sent to LPG column. After rigorous distillation, LPG is obtained as Distillate and Lower aromatic Naphtha is obtained as Bottoms.

PENG ROBINSON thermodynamic model is employed in flowsheet.

Results:

Result table											
Object	S-44	S-43	S-39	S-33	S-29	S-25	S-14	S-13	S-06	NF feed	
Temperature	270	452.357	173.325	290.219	228.98	247.69	579.703	493.356	305.15	330	K
Pressure	22.13	22.13	22.13	51.6614	51.6614	51.6614	3.05001	1.9	60	60	atm
Mass Flow	11381.8	46686	10700.9	82547.4	69103.4	151651	48213.1	24422.7	125495	101880	kg/h
Molar Flow	295.262	295.262	590.524	2979.84	3862.2	6842.04	458.58	458.58	2848.73	4979.14	kmol/h
Volumetric Flow	0.006435	0.011128	0.00919	0.081302	0.256616	0.369595	0.015635	2.65954	0.035072	0.543762	m3/s
MF (Mix) / Carbon dioxide	0.00737	3.52E-16	0.02655	0.006142	0.00974	0.008173	2.41E-24	0.006879	0	0.012	
MF (Mix) / Hydrogen sulfide	0.037939	6.77E-06	0.004278	0.005298	0.003963	0.004544	1.88E-23	0.016718	0	0.008	
MF (Mix) / Methane	4.27E-07	1.22E-20	0.879346	0.174495	0.905001	0.586852	5.32E-24	0.048236	0	0.815	
MF(Mix) / Ethane	0.368373	4.21E-11	0.089312	0.054789	0.055183	0.055011	3.69E-25	0.019269	0	0.079	
MF (Mix) / Propane	0.586312	0.125626	1.83E-06	0.073504	0.023275	0.045151	1.20E-23	0.027325	0	0.068	
MF (Mix) / N-butane	1.97E-07	0.049483	1.30E-12	0.005693	0.000584	0.002809	3.25E-24	0.00283	0	0.0047	
MF (Mix) / Isobutane	4.65E-06	0.037607	9.66E-12	0.004083	0.00054	0.002083	6.92E-25	0.00116	0	0.0033	
MF(Mix) / Isopentane	1.88E-13	0.017034	2.45E-17	0.00235	9.97E-05	0.00108	1.24E-24	0.001049	0	0.002	
MF (Mix) / N-pentane	6.53E-14	0.021612	5.06E-18	0.003347	0.000126	0.001529	1.68E-24	0.001985	0	0.003	
MF (Mix) / N-hexane	1.44E-23	0.005339	0	0.001554	1.54E-05	0.000685	1.32E-24	0.001003	0	0.002	
MF (Mix) / N-heptane	0	0.001056	0	0.000883	3.54E-06	0.000387	7.92E-25	0.000595	0	0.0018	

**** NOTE : MF = Molar fraction , Mix = Mixture ****