



— University of Mosul —
College of Petroleum & Mining Engineering



Technology of natural gas

Lecture 5

Dr. Semaa I. Khaleel

Petroleum and Refining Engineering Department

Email: semaaibraheem@uomosul.edu.iq



— University of Mosul —

College of Petroleum & Mining Engineering



Table 1.8: Sulphur Product Specifications

A sulphur product specifications will normally satisfy the requirements of the major consumers of sulphur such as manufacturers of sulphuric acid, chemicals, fertilizers, etc.:

Purity	99.5% - 99.8% by weight (dry basis)
Acidity (as H_2SO_4)	Less than 0.05% by weight
Moisture	Nil to 1.0% by weight
Ash	Less than 0.1 % by weight
Carbonaceous Matter	Less than 0.15% by weight
Arsenic, Tellurium, Selenium	Commercially Free ^o
Colour	Bright yellow at ambient temperature.

Contents of less than 0.25 ppmw of arsenic and 2.0 ppmw of Selenium and Tellurium are usually considered as 'Commercially Free.

Note: The colour of Sulphur is an important property because it gives an immediate indication of product purity. The sulphur is a bright yellow if the impurity content is less than about 0.02% by weight. Small amounts of carbon (soot) change the bright yellow colour to dull yellow or green; "dark" sulphur in which the yellow colour has a shade of grey or brown usually contains 0.1% - 0.5% by weight of carbon. For sulphuric acid manufacturer, however, sulphur colour is usually less important than ash and heavy metal contents.

These both must be removed so that the water dewpoint and hydrocarbon dewpoint specifications can be met. This is done by several processes. For example, the gas may be chilled by refrigeration to below the dewpoint for both the water and the hydrocarbon so that the water and heavy hydrocarbon condense out.

In this case, glycol is added to the gas stream at the beginning of the process to prevent hydrates or freezing. In another series of processes, the heavy hydrocarbons may be removed by absorption and the water removed by dehydration. The liquid hydrocarbons from the separation facilities and from the hydrocarbon dewpoint control facilities are sent to fractionation facilities for the separating of the hydrocarbons into individual compounds. The acid gas H_2S and CO_2 are sent to a sulphur recovery unit in which the H_2S is reacted with O_2 from air to form elemental sulphur. The recovery level of sulphur is set by governmental authorities. The CO_2 and SO_2 (that part of the H_2S not converted to S) is rejected to the atmosphere.

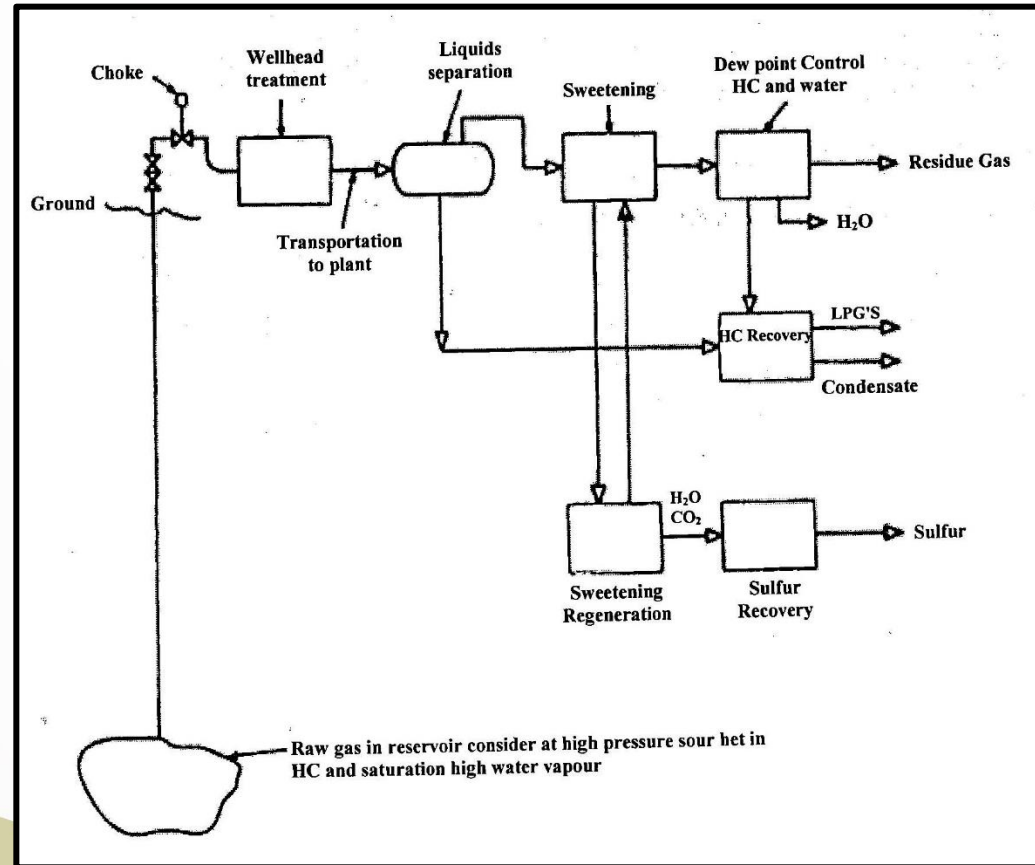


Figure 1.1: Overall Gas Processing Scheme

BBls meaning barrels in oil industry

In the oil industry, following the definition of the American Petroleum Institute, a standard barrel of oil is often taken to mean the amount of oil that at a standard pressure (14.696 psi) and temperature (60 F) would occupy a volume of exactly 1bbl.

Unit of volume for crude oil and petroleum products. One-barrel equals 42 US gallons or 35 UK (imperial) gallons, or approximately 159 liters or 9,702 cubic inches (5.6 cubic feet); 6.29 barrels equal one cubic meter and (on average) 7.33 barrels weigh one metric ton (1000 kilograms).

Chemical and Physical Properties

Natural gas is colorless, odorless, tasteless, shapeless, and lighter than air (Table 1). The natural gas after appropriate treatment for acid gas reduction, odorization, and hydrocarbon and moisture dew point adjustment would then be sold within prescribed limits of pressure calorific value, and possibly Wobbe index (often referred to as the Wobbe number).

Table (1): Properties of Natural Gas

Properties	Value
Relative molar mass	17-20
Carbon content, weight %	73.3
Hydrogen content, weight %	23.9
Oxygen content, weight %	0.4
Hydrogen/carbon atomic ratio	3.0-4.0
Relative density, 15°C	0.72-0.81
Boiling point, °C	-162
Autoignition temperature, °C	540-560
Octane number	120-130
Methane number	69-99
Stoichiometric air/fuel ratio, weight	17.2
Vapour flammability limits, volume %	5-15
Flammability limits	0.7-2.1
Lower heating/calorific value, MJ/kg	38-50
Stoichiometric lower heating value, MJ/kg	2.75
Methane concentration, volume %	80-99
Ethane concentration, volume %	2.7-4.6
Nitrogen concentration, volume %	0.1-15
Carbon dioxide concentration, volume %	1-5
Sulfur concentration, weight % ppm	<5
Specific CO ₂ formation, g/MJ	38-50