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Light Hydrocarbon Gas Processing Processes

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ANNOTATION: Gases that go under high temperatures and are formed in partially catalytic processes also contain unsaturated gases. The amount of this depends on the quality of the raw material and mainly on the performance of the process. Depending on the catalyst used in the catalytic cracking.

KEYWORDS: gas, which produces ethane, propane, butane, isobutane, sulfur, mercaptans, gas condensate.

I. INTRODUCTION

In the secondary refining of petroleum products, 5-20% of gaseous products are formed in relation to raw materials. 12 million tons per year. In modern oil refineries about 1 mln. t gas / more than 8% by mass / is formed. Pyrolysis produces mainly unsaturated gas.

Even in catalytic processes, significant amounts of gaseous products are formed: 10-20% by mass in catalytic reforming. / including 1-2% mass. hydrogen/; 12-15% mass in catalytic cracking.

The composition of the gases depends on the process in which they are formed. Gases formed in processes under hydrogen pressure (reforming, isomerization, hydrocracking, hydro purification) are mainly composed of saturated gases, and unsaturated gases are negligible. These gases consist mainly of: methane, ethane, propane, n-butane and isobutane.

Gases that go under high temperatures and are formed in partially catalytic processes also contain unsaturated gases. The amount of this depends on the quality of the raw material and mainly on the performance of the process. Depending on the catalyst used in the catalytic cracking.

G30% mass at a temperature of 530-540⁰C in a device for continuous coking of tar. unsaturated gas is formed, the amount of unsaturated gases increases to 50% by mass when the temperature rises to 600⁰ C.

Of particular importance is the oily part of the gases formed during the production process in factories (oil frequency) C₃-C₄ gases, which are used in the process of alkylation of substances to obtain high levels of isobutane and butylene (to obtain a high-octane gasoline component). The dry part of the gases consists mainly of hydrogen, methane, ethane and ethylene. Hydrogen and ethylene in this dry gas are also of particular importance. Hydrogen is mainly used in reforming gases, while other gases contain very little hydrogen. Modern plants produce 3-4.5% by mass of dry gas. It contains approximately: 3% hydrogen; methane -27%; ethylene 27%; The remaining 30% of the mass of ethane consists of C₃-C₄ gases. It should be noted that the composition of the gases varies from plant to plant.

Gases emitted from high-temperature cracking and coking plants are "dry" gases. The gases from the catalytic cracking process are "fatty" gases / 60-75% by mass. There are C₃-C₄ gases.

Processing of exhaust gases in modern plants contributes to improving the efficiency of the plant.

Dry gases are used in some plants to produce hydrogen by conversion, and in some plants as fuel.

Low-quality petroleum products are subjected to pyrolysis, from which a mixture of unsaturated gases is obtained. Unsaturated gases are used as raw materials in the polymerization process. The composition of gases consists mainly of ethylene - dry gases.

Modern plants have two gas separators: one separates saturated gases and the other unsaturated gases.

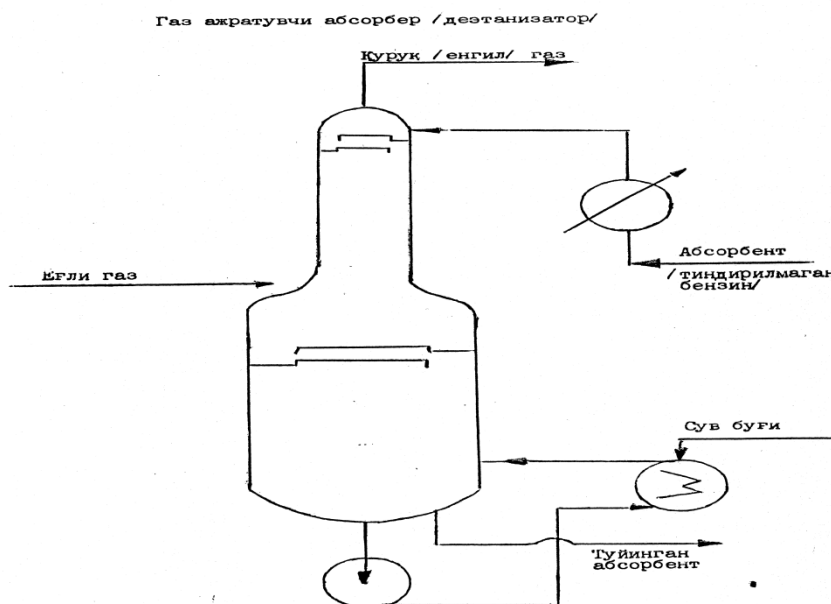


Figure 1. Gas separator (deethanizer)

When cooled to separate gases, if the gas contains moisture, it can combine with a gas molecule to form a hydrate. Therefore, in order to prepare the gases for separation, it is necessary to remove the moisture in them.

Aluminogels are mainly used to dry pyrolysis gases from moisture, along with zeolites or zeolites. Prior to drying the pyrolysis gases, it is necessary to separate the C₄-C₅ gases they contain, otherwise these gases will polymerize on the surface of the drying reagents and slow down the drying process.

In the process of reforming, the raw material is dried in a distillation column in the hydro-cleaning block. The gases returned to the process are dried in special acid-resistant zeolites during the operation of the device. These zeolites are deposited in two adsorbers. Adsorbers work in turn. After 24-36 hours, the saturated zeolites are dried with an inert gas heated to 350⁰C. At this time, the second adsorber is running.

Adsorbers are also activated during regeneration of catalysts in the reactor.

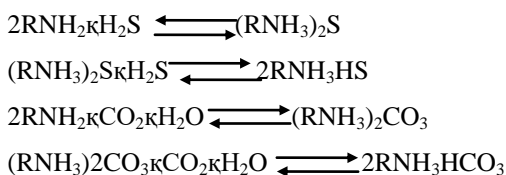
Typically, factory gases are purified from a sulfur compound - H₂S - before processing.

H₂S and CO₂ gases are often found in natural gas extracted from the ground. Their amount varies: less than one percent, sometimes up to several percent. CO₂ is relatively harmless, while H₂S is slightly harmful.

There are several different ways to purify gases from H₂S and CO₂. They are mainly divided into two groups: absorption and desorption methods. The method of absorption is further divided into two: chemical (chemisorption) and physical.

In the chemisorption (chemical) method, the gas reacts with the chemisorbent. Ethanolamines (mono-, di-, tri-), carbonates of alkali metals, iron hydroxide and others are used as absorbents. In the physical method, water, organic solvents - no-electrolytes (N-methylpyrrolidone, sulfolan, methanol, etc.) are used.

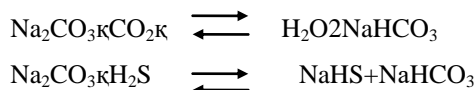
Reactions of H₂S and CO₂with monoethanolami:



A solution of monoethanolamine is 10 to 30%, often 15-20% by mass. mode is used. As the temperature rises, our solvent becomes self-contained and reused.



The solution of carbonate salts of alkali metals (potassium or sodium) is equal to pH9-11. They are alkaline in nature. Therefore, they have the ability to absorb H_2S and CO_2 gases, which have acidic properties.



Among the adsorbents used, zeolites are relatively better. Zeolites also accumulate other sulfur compounds and heavy hydrocarbons in their pores at the same time as H_2S . Typically, regeneration gas is intended to be supplied to the Klaus plant. But regeneration gases also contain hydrocarbons. This causes the hydrocarbons to go away as waste. In addition, at the regeneration temperature ($350-400^\circ C$), heavy hydrocarbons form resinous substances and disable the adsorbent. For this reason, it is advisable to use other adsorption methods, such as a small amount of H_2S remaining after the absorption method.

If the gases are formed in installations operating under high pressure, they are in a liquid state, they are cleaned using an alkaline solution. The gases are purified using 15-30% solutions of ethanolamine.



The ethanolamine solution is poured into two apparatus in the form of two columns, from which gas is passed, then transferred to another, the saturated solution is heated with water vapor, purified from hydrogen sulfide, and restarted. H_2S is used to make sulfuric acid or sulfur. Sometimes a solution of ethanolamine in combination with ethylene glycol is used.

In the process of catalytic reforming, the gases formed in the reactor are separated from gasoline in a high-pressure separator. The pressure in the separator is equal to 3 MPa in the reactor. Therefore, the composition of the gas released in the separator is mainly light - "dry" gases, and 80-85% of it is air. consists of hydrogen gas. Most of the gases remain dissolved in gasoline. Most of them are separated in the next low-pressure separator. The rest is separated in the digestion column.

In other hydrogenation devices, the gases are separated in the same way.

Since the catalytic cracking process is carried out at high temperature and atmospheric pressure, the gases released from the separator are separated into dry and oily gases by a compressor and sent to the next process.

The performance of the first column is aggravated by the fact that the gases released during high-temperature cracking and coking processes contain a significant amount of methane gas.

Therefore, these plants are additionally provided with an absorption column, in which the gases are first purified from methane and ethane in this column.

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