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ТАБИИЙ ГАЗНИ АДСОРБЦИЯ УСУЛИДА ҚУРИТИШ ТЕХНОЛОГИК СХЕМАСИНИ ИШЛАБ ЧИҚИШ

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Неъматов Х.И
Қўзиев Ш.Х.
[1]*Қарши муҳандислик-иқтисодиёт институти*

Аннотация

Ушбу мақолада табиий газни қуритиш технологик схемаси ишлаб чиқилган бўлиб, ушбу технологик схемага асосан бир адсорберда табиий газни қуритиш жараёни борса, бу вақтда бошқасида иссиқ газ ёрдамида регенерация ва қиздирилмаган газ ёрдамида совутиш жараёни компрессор ёрдамида циркуляция ҳосил қилиш орқали амалга оширилади.

Калит сўзлар

табиий газ, адсорбция, силикагел, регенерация, десорбция, қуруқ газ, сепаратор, компрессор

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РАЗРАБОТКА ТЕХНОЛОГИЧЕСКОЙ СХЕМЫ ОСУШКИ ПРИРОДНОГО ГАЗА МЕТОДОМ АДСОРБЦИИ

Неъматов Х.И
Қўзиев Ш.Х.
Каршинский инженерно – экономический институт

Аннотация

В данной статье разработана технологическая схема осушки природного газа, согласно этой технологической схеме, если осуществляется процесс осушки природного газа в одном адсорбере, то в другом осуществляется процесс регенерации с использованием горячего газа, а в процессе осушки с помощью неотогретого газа осуществляется путем создания цикла с использованием компрессора.

Ключевые слова

природный газ, адсорбция, силикагель, регенерация, десорбция, сухой газ, сепаратор, компрессор

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DEVELOPMENT OF A TECHNOLOGICAL SCHEME FOR DRYING NATURAL GAS BY ADSORPTION

Nematov X.I.
Kuziev.SH.X.
Karshi Engineering Economics Institute

Annotation

In this article, a technological scheme for drying natural gas has been developed, according to this technological scheme, if the process of drying natural gas is carried out in one adsorber, then the regeneration process using hot gas is carried out in the other, and in the drying process using unheated gas is carried out by creating a cycle using a compressor.

Keywords

natural gas, adsorption, silica gel, regeneration, desorption, dry gas, separator, compressor

Natural gas mined in the fields is not considered a pure product. Because it retains many impurities in its composition, which in turn can negatively affect gas transport devices and pipes.

Mixtures can vary. If we see on the example of mechanical particles contained in natural gas, they fall into different mechanisms (for example, gas drive aggregates, compressors, etc.), which drive into gas transport main pipelines.k.), increasing the degree of corrosion of these devices. This in turn leads to a sharp increase in costs and a decrease in economic efficiency.

However, mechanical particles are not the only impurities that damage technological processes. No less damage from them can also be caused by water. Therefore, the problem of drying gases is also one of the pressing problems facing modern engineering.

Natural gas is said to be a mixture of gases formed by the decomposition of various organic substances under the ground. Natural gas is considered one of the main fossils that is actively used in industry and agriculture. Under the ground, natural gas (or, in industrial terms, in stratified conditions) can be in a gaseous state or in a "gas cap" in an oil and gas field, or in a mixture state with oil or water in gas wells. Sometimes, under certain conditions, natural gases do not occur in a gaseous state, but also in a solid state in a crystalline form.

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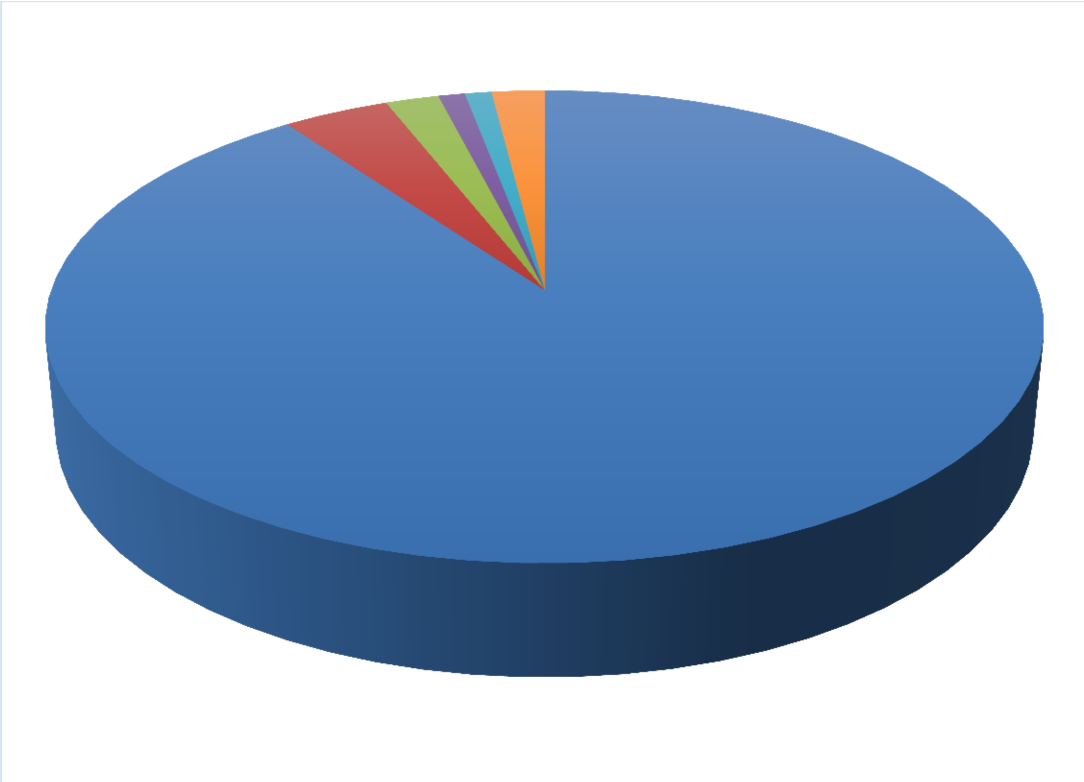
Natural gas contains up to 98% methane, and at the same time its homologues, ethane, propane, butane, also make up a low gas content. Is gas, hydrogen sulfide, and helium are also occasionally found in the gas.



Composition of natural gas

Methane (CH_4) is a colorless and odorless gas that is lighter than air.

Ethane (C_2H_6) is a colorless and odorless substance that is slightly heavier than air. A combustible substance, but not used as a fuel.

Propane (C_3H_8) is a colorless and odorless toxic gas. It has a very useful property: propane moves to an easy liquid state under a pressure not too high, making it easy to clean and transport from impurities.

Butane (C_4H_{10}) is close in properties to propane, with only a relatively high density. Twice as heavy as air.

Is gas (CO) is a colorless and odorless gas. Unlike other components of natural gas (except helium), is gas does not burn. Is gas is a gas with the lowest level of toxicity.

Helium (ge) is a colorless, very light (second only to hydrogen among the lightest gases) and odorless gas. Inert, does not interact with any substance under normal conditions. Does not burn. Harmless, however, has the effect of making it as unconscious as other inert gases at high pressure.

Hydrogen sulfide (H_2S) is a colorless gas with a pungent odor. Very poisonous, even in very low concentrations, it can incapacitate nerve organs.

Ethylene (C_2H_4) is a colorless gas with a pleasant smell. It is close in properties to ethane, but less flammable than it and has a small density.

Acetylene (C_2H_2) is a rapidly combustible and explosion – hazardous gas. There is a risk of exploding when compressed at high levels. It is not used in farming due to its explosive property. Used only in welding work.

The density of natural gas in the gaseous state is 0.75 kg at $1m^3$. In the crystalline state, however, its density can reach 400 kg at $1m^3$. Natural gas can spontaneously ignite at 650^0S. 5-15% in the air can explode in concentrates. Also known is the specific heat of combustion of natural gas, which averages 35 mDj / m.

In this article, a technological scheme for drying natural gas is developed, according to which the process of drying natural gas in one adsorber is carried out, while at this time the process of regeneration using hot gas in another and cooling using unheated gas is carried out by forming circulations using a compressor (Figure 2).

In this method, for regenerating and cooling silica gel in adsorber, the gas is taken from the dried gas line and sent through the furnace in case of desorption, and directly to the adsorber using a compressor in cooling. The gas from the adsorber is cooled in a refrigerant and passed through a separator and sent to a line of non-dried gases.

The disadvantage of this method lies in the application of a compressor to circulate this gas during the silica gel cooling process using an unheated gas. In adsorber, heat gas is cooled in the refrigerator. Connecting the compressor and the ventilator of the refrigerator will require significant costs.

In addition, as the adsorbent expires over time, the quality of the sbabli gas drying process decreases Ham, so that the adsorbent often has to be regenerated and cooled. It is possible to significantly reduce the cooling time of silica gel in the compressor circuit.

One of the main tasks of primary gas preparation is to reduce low energy costs. In this proposed technological scheme, energy consumption is carried out during the silica gel cooling process. In addition, there is also the task of increasing the silica gel working period by reducing the cooling time at the end of operation.

These above problems were solved as follows: while a natural gas drying process is carried out in one adsorber at the same time, unlike the traditional method, which involves a regeneration process by compressing heated gas in the second, after silica gel regeneration, the second adsorber is connected parallel to the first adsorber and silica gel is cooled using raw gas at the expense of

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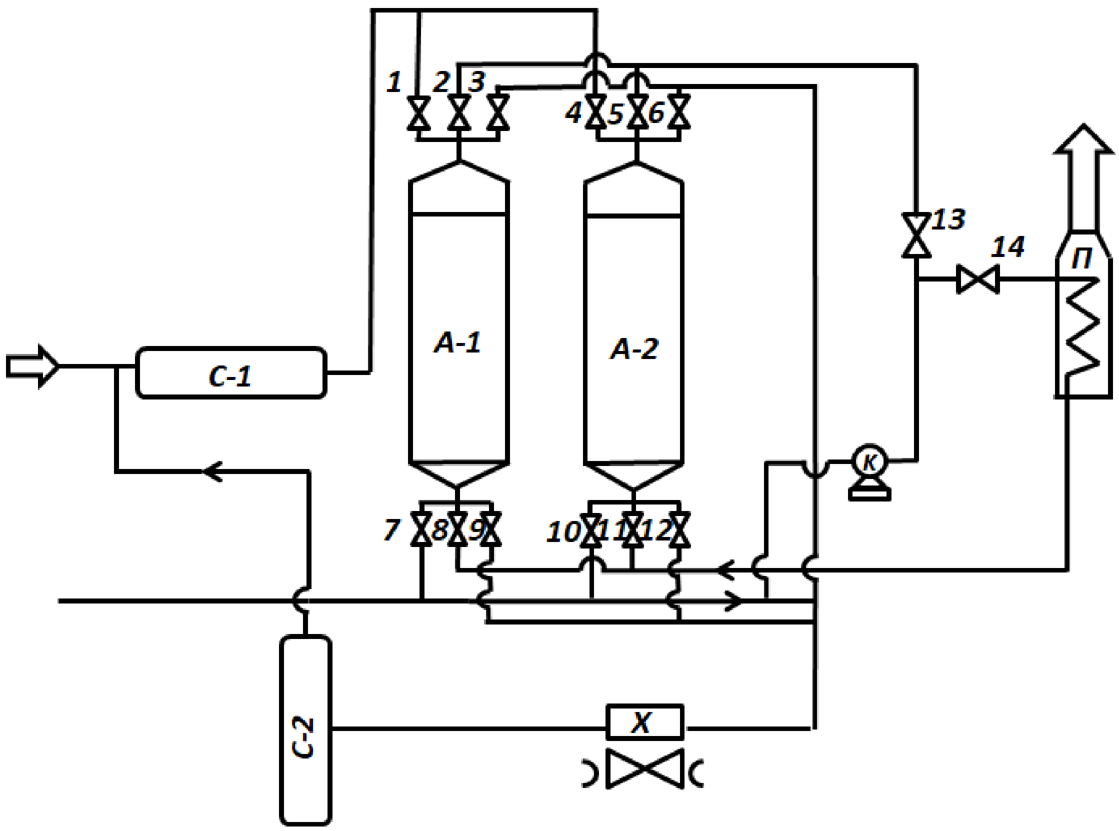
In addition, the raw material gas consumption is 20% of the drying gas consumption. In this case, the technical result occurs at the expense of a negative phenomenon, that is, more precisely, it is formed at the expense of hydraulic resistance. Hydraulic resistance arises at the expense of the loss of pressure as the drying gas flows through the silica gel layer in one of the adsorbers. In other words, the pressure drop at the inlet and outlet is applied to create circulation when passing unheated gas through another adsorber for cooling.

To carry out this method, in the gas drying scheme, excess pressure is needed, which is sufficient for gas circulation in the regeneration and cooling lines. During the initial operation of the well, the gas pressure will be sufficient. However, in the intermediate and recent period of the exploitation period, the pressure of the gas coming out of the mining wells begins to decrease, and therefore this method cannot be used.

Compression compressor stations (SKS) are used in the gas collection collector when compressing natural gas from a well and transferring it from the gas primary preparation scheme during intermediate and final operation stages of the field. In this case, the gas driving units of the SKS act as a compressor for gas circulation for regeneration and cooling.



Technological scheme for drying natural gas using silica gel: 1-14 – input and output cranes; s-1 and S-2 – separators; a-1 and A-2 – adsorbers; X-Air Cooler; K-compressor; P-oven

The use of this method leads to an increase in economic costs due to gas compression when cooling silica gel. In addition, in the implementation of this method, a refrigerant is necessary to cool the gas after the adsorber.

In Figure 2, the technological scheme of gas drying is presented according to the above method. On the example of this method, let's consider the technological scheme of drying gas with two adsorbers.

The technological scheme includes an A-1 and a-2 adsorber in its intake, a natural gas separator s-1, a compressor K, a gas heating furnace P, a refrigerant X, a regenerating gas separator S-2, a gas drying line, a regenerating line, cooling and control valves.

The first filter-separator s-1 to be given when wet feedstock gas is sent to the device, and purified from liquid hydrocarbons, water, and mechanical particles above 1 μm in size. This filter-separator is equipped with a balance adjuster, and all the retained fluids are sent to the drainage system. After that, natural gas is directed to one of the A-1 or a-2 adsorbers using 1 or 4 open Control Valves. In adsorbers, the gas flow passes through the silica gel layer and is cleaned of vapor moisture and sent to the dried gas line using 7 or 10 control valves.

In the Adsorber and drying line, the gas pressure ranges from 5.0 to 7.5 MPa, the temperature ranges from 10 to 30^0S, and the gas consumption per hour ranges from 150 to 300 thousand. M3 makes up na. The pressure of the gas at the inlet from the adsorber is between 0.03 and 1.0 MPa higher than the pressure at the outlet from the adsorber.

At this point, it is worth noting that for cleaning adsorbent hot gas products with a cold gas stream (usually obtained from a purified and dried gas line), more gas is consumed, and through this the amount of purified gas is reduced for the next technological process.

In the heat-free desorption mode, the amount of gas required to purify adsorbents is calculated through the following formula:

$$\boldsymbol{Y}_{\text{пр}} = \boldsymbol{K} * \boldsymbol{Y_o} \ (\boldsymbol{P}_{\text{пр}}/\text{P}_\text{o})$$

Here: , – volumetric consumption and pressure of the cleaning gas;, – volumetric consumption and pressure of the purifying gas; K – excess gas coefficient, according to the indicators obtained based on the results of the study, is equal to 1.1-1.2.

To regenerate with heated gas, the gas is taken from the dried gas line using a compressor K and sent to the oven using 14 control valves, in which it is heated to a temperature of 180-200⁰S. It is then sent to the adsorber using 8 or 11 Control Valves, the silica gel is heated and released from the adsorber and sent to the cooler using 3 and 6 Control Valves. In the refrigerator, gas cooled to a temperature of 50os passes through the S-2 separator and joins the S-1 separator gas drying line.

Control valves 1, 4, 9 or 12 are opened to cool the silica gel. If the silica gel in the A-2 adsorber needs to be cooled, then 4,12,9 control valves open. Because of the high input pressure in the A-1 adsorber, the gas passes through the A-2 adsorber through the 4 control valve, cooling the silica gel in the A-2 adsorber using 12,9,7 control valves and circulating the dried gas output lines. After cooling the A-2 adsorber 4,9,12 control valves close. To cool the A-1 adsorber, 1,9,12 control valves are opened, and from 3 to 7 thousand m^3 of non-dried gas is circulated for 3-4 hours. The quality of dried gas is not affected in this. Because the unheated gas passes through the regenerated silica gel layer during cooling and is dried until it joins the dried gas line at its exit.

Conclusion: this proposed method significantly increases the economic efficiency in the process of drying gases. At the same time, this method is quite simple and does not require excessive additional equipment.

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