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SELECTION OF ADSORBENTS WITH HIGH EFFICIENCY IN DRYING GASES AND STUDY OF THEIR PHYSICO-CHEMICAL PROPERTIES

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ВЫБОР АДСОРБЕНТОВ С ВЫСОКОЙ ЭФФЕКТИВНОСТЬЮ ПРИ СУШКЕ ГАЗОВ И ИЗУЧЕНИЕ ИХ ФИЗИКО-ХИМИЧЕСКИХ СВОЙСТВ

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ABSTRACT: Currently, it is considered important to select adsorbents with high efficiency in drying gases. For this purpose, the following works are being carried out: physical and chemical parameters of NaA (3Å) synthetic zeolite, physical and chemical properties of 3 types of KA (3Å) zeolite were reviewed. and other information is given in the article.

KAYS WORD: Absorption drying, adsorption drying, condensation, membrane method, synthetic zeolite, corrosion resistance.

АННОТАЦИЯ: В настоящее время считается важным подбор адсорбентов с высокой эффективностью осушки газов. С этой целью проводятся следующие работы: рассмотрены физико-химические параметры синтетического цеолита NaA (3Å), физико-химические свойства 3-х типов цеолита KA (3Å). и другая информация приведена в статье.

KAYS WORD: Абсорбционная сушка, адсорбционная сушка, конденсация, мембранный метод, синтетический цеолит, коррозионная стойкость.

Water vapor in gas can be separated by physical methods (adsorption, absorption, membrane, condensation) and chemical methods (using $CaCl_2$) and their hybrid combination methods. Today, oil and gas processing industries use the following traditional and modern gas drying methods [1]:

- Absorption drying;
- Adsorption drying;

• Condensation. Spray cooling of hydrate inhibitors;
• Membrane method. Using elastomers and glassy polymers.
• Chemical method. Using hygroscopic salts. Metal chlorides are usually used.

Absorption and adsorption methods are widely used in the world.

Absorption drying of gases (Glycolic drying)

Drying gases using glycols is one of the most common methods, allowing gases to be dried sufficiently for transmission or use as fuel.

Basic requirements for industrial consumers

In the absorption process, ethylene glycol, diethylene glycol and triethylene glycol are mainly used as absorbers. In desorption cycle drying processes and repeated application of the absorbent, almost no absorbent is consumed. Therefore, any substance capable of separating the absorbent from the extracted component can be used as an absorbent. However, in order to choose an absorber in the industry, a number of the following requirements should be taken into account [2-3]:

• The absorbent must have a high absorption capacity relative to the component to be extracted from the gas. The use of an absorbent with a low absorption capacity leads to an increase in circulation of the circulating solution and an increase in the cost of desorption.

• Absorbent should be easily regenerated during desorption. For this, the component pressure in the absorbing solution must be high at the desorption temperature.

• The selectivity of the absorbing solution should be high, that is, it should absorb the desired component well and not absorb other substances in the gas.

• The absorption and desorption temperatures of the absorber should not have high vapor pressure. Otherwise, the quantitative loss of this absorbent may increase.

• Absorbent should be chemically stable in working conditions, should not change its age and structure. Chemical reactions should not occur between the gas and the absorbent.

• The absorber must be cheap and have a large resource.

• The absorbent should not have a corrosive effect on the equipment of the absorption process.

• The mass transfer coefficient must be sufficiently high.

It served as a basis for choosing effective adsorbents for natural gas drying. In our study, various adsorbents were selected in order to improve the gas purification process at Shurtanneftgaz LLC.

Today, NaA synthetic zeolite with a pore size of 3 Å is used for natural gas drying at Shurtanneftgaz LLC (Fig. 1). Physico-chemical parameters of this adsorbent are presented in table 1.

1 – table

Physico-chemical parameters of NaA (3Å) synthetic zeolite

№	Indicator name	Demand for TSh	Analysis results
1	Granular appearance	Cylindrical	Cylindrical
2	Adsorbent size, mm	2,8±3,	2,8
3	Cumulative density, g/cm^3, calculated relative to absolute dry matter	0.65 is not less	0,94
4	Amount of zeolite phase crystals, %	Not less than 80.0	81,5
5	Moisture absorption capacity, mg/g	Not less than 160.0	205,0
6	Anti-aging strength, %	Not less than 92.0	92,0
7	Mass fraction of water resistance, %	Not less than 96.0	96,0

The composition of NaA zeolite is determined to be $Na_2O*Al_2O_3*SiO_2$. Zeolites of this type are widely used in gas drying, deep cleaning of liquids and gases. The main disadvantage of this type of zeolites is their water resistance and resistance to high pressures compared to new generation zeolites.

1 – picture. Overview of NaA (3Å) synthetic zeolite

Taking into account the above, we have selected new generation adsorbents for gas drying processes.

For the first time in our research, we examined the physicochemical properties of 3 types of KA (3Å) zeolite, which has been widely used in recent years. The obtained results are presented in Table 2.

2 - table

Physico-chemical parameters of KA (3Å) zeolites

№	Indicator name	Spherical 1,6-2,5	Spherical 3-5	Spherical
1	Granule size, mm	1,6-2,5	3-5	1,6
2	The moisture content of gas drying in static conditions, mg/g, is not low	210	210	205
3	The moisture content of gas drying in static conditions, mg/cm^3, is not low	2,0	2,0	2,0
4	Bulk density, g/cm^3	0,70	0,68	0,6
5	The amount of moisture in zeolite, % is not much	1,0	1,0	1,0
6	Mass fraction of total loss, %	0,1	0,1	0,1
7	Moisture absorption capacity, mg/g	230	220	215
8	Anti-aging strength, %	95,0	95,0	94,0
9	Mass fraction of water resistance, %	99,0	99,0	99,0

2 – picture. General view of spherical KA (3Å) zeolite

The comparative analysis of the analysis results of KA (3Å) zeolites shows that spherical zeolite 1.6-2.5 mm in size showed higher results compared to others and NaA zeolite. Among these indicators, we can see that the main requirements for adsorbents

for gas drying are high, such as moisture absorption capacity, resistance to corrosion, and water tolerance mass fraction.

In conclusion, the physico-chemical parameters of adsorbents NaA (3Å) and KA (3Å) zeolites selected as a result of the research were studied. Their parameters such as moisture absorption capacity, corrosion resistance, water tolerance mass fraction were studied and used in natural gas drying at Shurtanneftgaz LLC.

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