EFFICIENCY OF KA (3Å) AND NaA (3Å) SYNTHETIC ZEOLITES BASED ON LOCAL GRANITE IN NATURAL GAS DRYING.

Boytemirov Otabek Eshmurodovich, (Senior lecturer, Karshi state technical university)

Norboyeva Malika Normuminovna, (Student at Karshi State Technical University)

ANNOTATION: This paper presents data on the conditions of the Adsorption process for local granite-based zeolites, the natural gas drying rate of NaA (3Å) synthetic zeolite at 28ºC temperatures and various pressures, and the natural gas drying rate of KA (3Å) zeolite at 28ºC temperatures and various pressures.

KEY WORDS: adsorbents, NaA (3Å) synthetic zeolite, KA (3Å) zeolite, Adsorption, desorption.

АННОТАЦИЯ: В данной статье представлены данные об условиях процесса адсорбции для местных цеолитов на основе гранита, скорости осушения природного газа синтетическим цеолитом NaA (3Å) при температуре 28°C и различном давлении, а также скорости осушения природного газа цеолитом KA (3Å) при температуре 28°C и различном давлении.

КЛЮЧЕВЫЕ СЛОВА: адсорбенты, синтетический цеолит NaA (3Å), цеолит KA (3Å), адсорбция, десорбция.

INTRODUCTION: Problems of natural gas drying with various adsorbents are addressed in a number of publications, specifically in works [1-2].

The feasibility of using one or another method of adsorption drying and purification of natural gas depends on many factors, such as plant productivity, gas composition, concentration of C_{5+} hydrocarbons, sulfur compounds, and other impurities, as well as consumer requirements for purified gas [3].

When solving specific practical problems related to gas purification and drying, the main advantages of a specific adsorbent must be taken into account, for example:

- the ability to ensure cleaning of all incoming components in a single system;

- ensuring deep gas drying;

- ease of operation and ability to automate [4].

In the adsorption processes of hydrocarbon gas processing, the first stage of low-temperature technology is a broad gas processing process whose products are liquefied gases such as propane, butane, nitrogen, and helium [5].

There is an opinion that the adsorption process of preparing gas for processing is more metal-intensive and more expensive than, for example, the assimilation process, which is widely used in fields. At the same time, the high degree of moisture removal from the gas and the absence of dust absorption vapors in the dried gas, which can be condensed in pipelines and apparatus during the gas cooling process, make this process reliable.

Regarding the industrial preparation of gas for transportation via main gas pipelines, the primary criterion for selecting the preparation method is the dew point of the gas for moisture and hydrocarbons, which facilitates their condensation and eliminates blockages in the gas pipelines [6].

The main adsorbents used in industry for cleaning and drying and purifying natural gases are:

- active carbon;
- zeolites;
- active aluminum oxide;
- silica gels.

Based on this, a number of technologies for the purification, drying, and treatment of natural gas have been developed and implemented in industry.

RESULT: Method for determining the adsorption capacity and drying degree of adsorbents under dynamic conditions. The conditions for conducting the adsorption process are presented in Table 1.

Table 1

Conditions for the adsorption process

No	Conditions for the adsorption process	Indicator
1.	Adsorption process temperature, ºC	28
2.	Adsorber pressure, MPa	4.7; 5.3; 5.5

3.	Adsorption time, sec.	10-12
4.	Amount of adsorbent in the adsorber, kg	10

Synthetic zeolites KA (3Å) and NaA (3Å) obtained for drying spherical natural gas based on local raw materials, at a temperature of 28ºC and temperatures of 4.7; 5.3; Adsorption drying was carried out at a pressure of 5.5 MPa. In the first stage of these studies, synthetic zeolite NaA (3Å) was used. The efficiency levels of this zeolite for natural gas drying at various pressures are shown in Figure 1.

The results of this graph show that the highest moisture absorption of NaA zeolite in natural gas occurs at a pressure of 5.5 MPa. This can be explained by the fact that with an increase in pressure during the adsorption process, the adsorption capacity of the adsorbent increases, and the partial pressure of water in the gas increases. The dependence of the dew point temperature of natural gas on its moisture content is shown in Table 3.3.

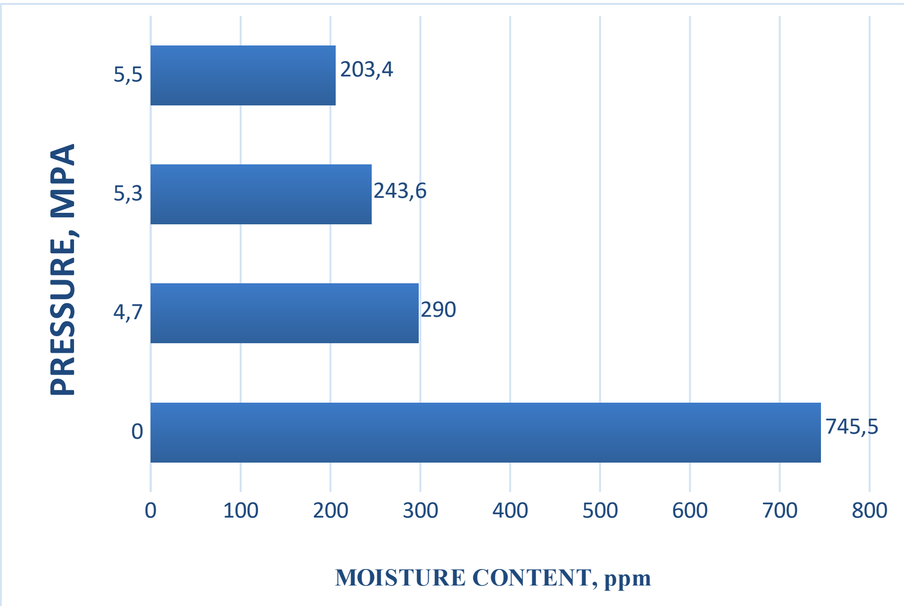

Figure 1. Degree of natural gas drying of synthetic zeolite NaA (3Å) at 28ºC temperatures and various pressures

NaA (3Å) zeolite at 28ºC temperatures and various pressures decreased to 290 ppm at a moisture content of 4.7 MPA, while at pressures of 5.3 and 5.5 MPA, the moisture content was 243.6 and 203.4 ppm, respectively.

The natural gas drying process was carried out using KA (3Å) zeolite. This type of zeolite is a new generation zeolite, and its drying degree is shown in Figure 2.

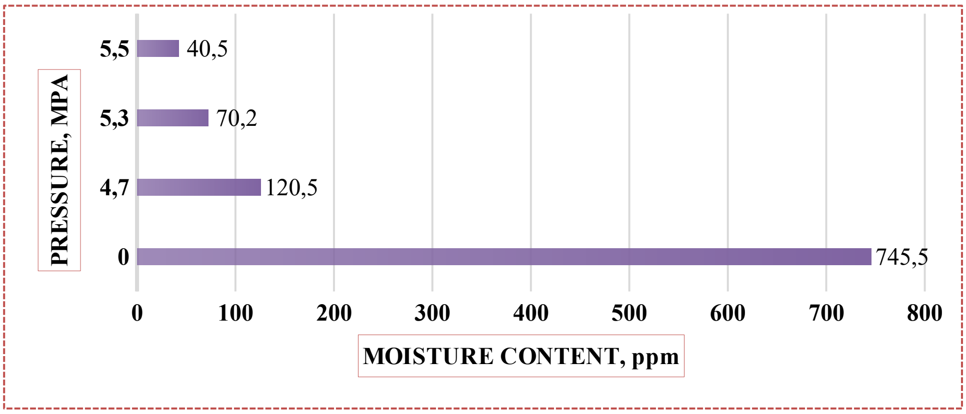

Fig. 2. The degree of natural gas drying of KA (3Å) zeolite at 28oC temperatures and various pressures

KA (3Å) zeolite at 28°C temperature and various pressures decreased to 120.5 ppm with a moisture content of 4.7 MPA, while at pressures of 5.3 and 5.5 MPA, the moisture content was 70.2 and 40.5 ppm, respectively.

CONCLUSION: The degree of natural gas drying of NaA (3Å) zeolite at 28oC temperature and various pressures was 4.7 MPA, while the moisture content decreased to 290 ppm, while at 5.3 and 5.5 MPA pressures, the moisture content was 243.6 and 203.4 ppm respectively, and the degree of natural gas drying of KA (3Å) zeolite at 28oC temperature and various pressures was 4.7 MPA, while the moisture content decreased to 120.5 ppm.

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