LOW-TEMPERATURE SEPARATION OF NATURAL GAS

Makhmudov M.J.
Yomgurov S.A.
Bukhara State Technical University
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Transportation of gas through a gas pipeline is accompanied by a change in its pressure and temperature, which may result in the formation of a liquid phase in the system consisting of water and hydrocarbons. There are several technical methods for the simultaneous removal of water (drying) and heavy hydrocarbons C_{5+} (stripping).

The most widely used technologies are: low-temperature separation – obtaining low temperatures by throttling high-pressure gas or in artificial refrigeration units; absorption and adsorption or a combination of both.

The choice of gas processing technology is determined, first of all, by the composition of the raw material, the required depth of drying, the degree of extraction of target components and determines the implementation of comprehensive technical and economic studies in each specific case.

For drying lean gases (gases containing less than 1 g/m^3 of C_3+ hydrocarbons), absorption and adsorption processes are used. If there is condensate in the gas, the gas is processed using low-temperature processes. At the gas cooling stage, water vapor condenses due to a decrease in the equilibrium moisture capacity of the gas [1-2].

Analysis and generalization of accumulated experience in industrial and industrial drying and purification of natural gases allows us to identify preferred areas of application of various technological processes.

The low-temperature separation process is widely used in the gas industry for processing condensate-containing gases in several different process configurations. The main criterion determining the operating mode of LTS field installations is ensuring the reliability of gas transportation. The latter is achieved by deep extraction of condensate from gas [1, 3].

Extraction of moisture and heavy hydrocarbons from gas is carried out by cooling the gas by throttling it (Joule-Thompson effect), as a result of which heavy hydrocarbons and water are condensed, and then the resulting liquid phase is separated in a low-temperature separator. Such units are usually called low-temperature separation units (LTS). To ensure a hydrate-free mode of operation of the LTS unit, a solution of a hydrate formation inhibitor (methanol) is introduced into the gas flow. If a hydrate inhibitor is not introduced, then at the appropriate pressure the degree of cooling is often limited by the hydrate formation temperature.

The technology of low-temperature gas separation is discussed in detail in [4].

The choice of a rational method for separating condensate depending on the pressure and temperature of separation, the composition of the gas and the conditions of its transport are the subject of works [1-2].

The disadvantage of using LTS units is the energy losses associated with gas expansion and the need to recompress the prepared gas. In addition, the LTS process is based on throttling high-pressure gas, so it can be used for a limited period of field development.

An analysis of literary data on the use of the NTS method for the separation of hydrocarbon condensate showed that as the content of hydrocarbons (C_{5+}) in the gas decreases, the NTS effect decreases.

Despite the fact that during the drying and stripping of natural gas at the NTS unit the required water dew point according to STO Gazprom 089-2010 is achieved, vaporous hydrocarbons (C_{5+}) cannot be separated from the gas and are carried away into the gas pipeline. The gas leaving the separator has a low maximum condensation pressure, due to which hydrocarbon condensate is released in the main gas pipeline. Therefore, the use of the low-temperature separation scheme for the simultaneous drying and stripping of natural gas from gas condensate fields is possible only in combination with another method that provides a lower dew point for heavy hydrocarbons (C_{5+}), for example, adsorption [2, 4].

Literature:

1. Махмудов М. Ж. Определение адсорбционной ёмкости синтетического цеолита NaX в динамических условиях по ароматическим углеводородам низкооктанового бензина //Нефтепереработка и нефтехимия. Научно-технические достижения и передовой опыт. – 2020. – №. 7. – С. 13-16.
2. Махмудов М. Ж., Нарметова Г. Р. ИССЛЕДОВАНИЕ СОРБЦИОННОЙ ЕМКОСТИ СИНТЕТИЧЕСКОГО ЦЕОЛИТА NAX ПО БЕНЗОЛУ В ДИНАМИЧЕСКИХ УСЛОВИЯХ ИЗ ЖИДКОЙ ФАЗЫ //НЕФТЕГАЗОПЕРЕРАБОТКА-2016. – 2016. – С. 112-113.
3. Махмудов М. Ж., Нарметова Г. Р. Исследование синтетического цеолита NaX для адсорбционной деароматизации автобензина с целью доведения его до норм Евро-5 //Мир нефтепродуктов. Вестник нефтяных компаний. – 2016. – №. 9. – С. 18-22.
4. Махмудов М. Ж. Определение сорбционной емкости синтетического цеолита NaX в динамических условиях из жидкой фазы по ароматическим

углеводородам бензина //Защита окружающей среды в нефтегазовом комплексе. – 2020. – №. 5. – С. 26-29.