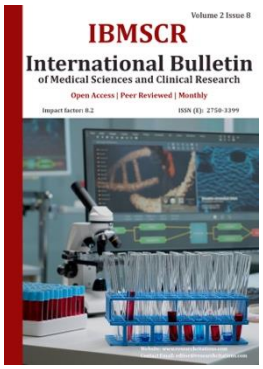

PREVENTION OF THE FORMATION OF GAS HYDRATES USING UNCONVENTIONAL APPROACHES

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Abstract. Today, the demand for solid, liquid and gaseous energy resources in the world is growing every year. Among these resources, natural gas occupies a special place, since hydrocarbon raw materials, in particular natural gas, have a high economic efficiency in relation to other energy resources, their production, processing, transmission and storage of which is compared to other natural resources. This article presents a description of the main physicochemical properties of natural gases and modern technologies for their drying.

Keywords: natural gas, inhibitor, dew point, gas drying, gas hydrates, hydrogen sulfide, carbon monoxide, mercaptan, glycol, absorbent, adsorbent, absorption, adsorption

Due to the constantly increasing operational costs of gas production and the serious disadvantages of methanol as an antihydrate reagent, the problem of finding alternative hydrate-forming inhibitors to methanol has become especially relevant. It should be said that in recent years, local researchers have repeatedly tried (and to some extent successfully) to solve the above problem, but this direction of work, unfortunately, did not bring any outstanding practical results in the practice of the domestic gas industry [1].

In the last 10-15 years, foreign experts have tried to re -, detail and in-depth analysis of the problem of reducing operational costs in order to prevent the formation of hydrates, resulting in a number of stimulating results. During intensive searches, economically useful antihydrate reagents of two different classes were found [2-3]:

1) kinetic inhibitors of hydrate formation, that is, the mass fraction in the aqueous phase, about 0.5% (no more than 1.0%), prevent the formation of hydrates. When "pressing" the hydrate region of the phase diagram, a period of several hours for a day or more was determined, at least enough time to successfully protect nitrate formation in gas collection systems;

2) disperant reagents that allow multiphase transportation of products from gas condensate and gas oil wells in the gas hydrate formation mode (in this case, the formed hydrates are transferred along with the gas-liquid flow and are not deposited in pipes inside the field, i.e. risk of formation) gas hydrate plugs are almost completely destroyed in industrial communications.

Abroad, these new antihydrate reagents have already been patented, as well as to some extent successful industrial tests, mainly on the unloading lines of wells of offshore oil and gas fields and with use in other areas.

Some peptide compounds were originally proposed as kinetic inhibitors. However, the compounds of this class have proven not effective enough in terms of preventing hydrate formation (according to the results of industrial tests in the North Sea), since here it is

necessary to very deeply invade the gas hydrate region of the phase diagram (about 7-10 hours). In connection with this situation, a consortium of dozens of companies interested in the practical use of the results obtained was formed to search for more effective kinetic inhibitors and finance industrial testing. Soon after, with subsequent laboratory studies, sufficiently effective water-soluble polymer compounds (e.g. polyvinylpyrrolidone (PVP)) were found. There are positive results of PVP tests. Further research led to the discovery of more efficient antihydrate polymers, notably polyvinyl pyrrolidone and caprolactamic sopolimers. They are currently being tested [4].

It is possible to note the possible advantages of the use of kinetic inhibitors of hydrate formation in relation to industrial collection systems of Northern Gas and gas condensate deposits, as well as marine deposits in the CIS [5-7]:

- to prevent the formation of hydrates, the operation reduces the cost by at least a few times (compared to methanol, the consumption of new inhibitors reduces their cost to the order of magnitude only by increasing the order of magnitude);
- a significantly higher level of environmental friendliness of the new technology and (PVP-type reagents are absolutely harmless to the environment, now they are used in the perfumery and cosmetic industries; of course, there are relevant certificates on the full safety of such reagents for the environment and people);
- there is no need to restore waste solutions (they can be poured without any punishment by environmental organizations to absorb rays through special Wells);
- the existing methanol distribution and injection systems can be retrofitted for use in the introduction of kinetic inhibitors at practically no serious cost;
- the cost of transporting inhibitors is significantly reduced by the amount of SEZ (due to the fact that the specific consumption of antihydrate reagents is reduced by about two orders).

As for new types of dispersant reagents designed to prevent hydrate deposition during multiphase transport of gas condensate and oil wells (we note once again that in this case the process of hydrate formation is not obtained, which is especially important for deep conditions), for which foreign specialists have proposed some surface-active substances with a very complex chemical structure (since 1989) [8].

Laboratory and industrial tests of a number of high-performance dispersants were successfully carried out, which showed the main possibility of multi-phase transportation of oil and gas condensate well products. According to a number of scientists, a detailed comparison of the old (70-80 years) internal developments in this direction with the new proposals of French specialists can be interesting and instructive to clarify the reasons why some promising domestic proposals were never actually applied technologically at that time.

References:

1. Elmurodov E. Y. GAS DRYING AND CONTROL OF HYDRATE FORMATION //Models and methods in modern science. – 2024. – T. 3. – №. 2. – C. 100-102.
2. Элмуродов Э. Ю. ПЕРСПЕКТИВЫ РАЗВИТИЯ ПЕРЕРАБОТКИ ПРИРОДНОГО И ПОПУТНОГО ГАЗА В УЗБЕКИСТАНЕ //Молодые ученые. – 2024. – Т. 2. – №. 5. – С. 106-107.

3. Makhmudov M., Nematov H., Rizayev S. MECHANISM OF ABSORPTION OF H2S, CO2 AND OTHER SULFUR COMPONENTS BY AN AQUEOUS SOLUTION OF MDEA //Universum: технические науки. – 2023. – №. 12-8 (117). – С. 63-65.
4. СТО Газпром 089-2010. Газ горючий природный, поставляемый и транспортируемый по магистральным газопроводам. Технические условия. — М.: ОАО «Газпром», 2010. — С. 15.
5. Муртазаев Ф. И., Махмудов М. Ж., Наубеев Т. Х. ОПРЕДЕЛЕНИЕ БЕНЗОЛСОДЕРЖАЩЕЙ ФРАКЦИИ АВТОМОБИЛЬНОГО БЕНЗИНА ХРОМАТО-МАСС-СПЕКТРОМЕТРИЧЕСКИМ МЕТОДОМ //Universum: технические науки. – 2021. – №. 11-4 (92). – С. 49-51.
6. Махмудов М. Ж., Ёмгуров С.А. АДСОРБЦИОННЫЕ СПОСОБЫ ОЧИСТКИ И ОСУШКИ ГАЗОВ // Бюллетень педагогов нового Узбекистана. – 2023. – Т. 1. – №. 5. – С. 72-75.
7. Makhmudov M.J., Yuldashev T.R. Cleaninng of Natural from Sobe Component. Journal of Siberian Federal University. Engineeng & Technologies 2023. 16(3): P. 296 - 306.
8. Юлдашев Т.Р. Основа оборудования, используемого в процессе очистки газоабсорбционной технологии. Москва. “Universum” технические науки. випуск 5 (110). 6 часть. 2023. 20 - 24 с.