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# STUDY OF THE COMPOSITION OF GAS CONDENSATE CAVITATION PROCESSING PRODUCTS

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## ANNOTATION

In this work, it was interesting to study changes in the composition and properties of petroleum products subjected to cavitation treatment and to determine the groups of hydrocarbons and individual compounds that are most susceptible to changes during processing.

**Keywords.** composition of oil, clean fuels, gasoline fraction, fuel.

## INTRODUCTION

The use of cavitation technologies is a promising direction in oil refining to increase the depth of oil refining and teach high-quality fuels at lower costs and at lower temperatures and pressures.

Experimental studies [1,2] have shown that the use of technologies based on the effects of cavitation intensifies the process of destruction of molecules of paraffinic hydrocarbons; leads to a change in the physicochemical composition of oil; allows to increase the yield of light fractions at oil refineries by 5-10%; provides the ability to reduce the sulfur content in oil residues (in fuel oil - from 2.5 to 1.5%), etc. It is also proposed to use the principle of cavitation mixing to obtain wide-fraction diesel fuels directly at the development facilities of gas condensate fields and to obtain environmentally friendly fuels, in particular hydrostabilized fuel oil.

In this work, it was interesting to study the changes in the composition and properties of oil products subjected to cavitation treatment and to determine the groups of hydrocarbons and individual compounds that are most susceptible to changes during the processing.

The object of the study was gas condensate subjected to cavitation treatment in various modes. The work studied the change in the physicochemical properties, fractional, group and individual hydrocarbon composition of the products of cavitation treatment, using physicochemical methods of analysis and the method of capillary gas chromatography on a chromatograph "Chromatek Crystal 5000-2" with software "Chromatek-analyst".

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The change in the composition of the products of cavitation treatment was studied according to the data of chromatographic research, analyzing the changes in the composition of the samples for each recorded indicator (tens of indicators), separating fractions and individual groups of hydrocarbons (HC), the amount of which changes during processing.
The results of processing the primary factual material are presented in summarized tables 1, 2.

Table 1 Change in the number of fractions in samples

| Fraction | ref. sample | №1 | №2 | №3 | №4 | final result |
|---|---|---|---|---|---|---|
| | | 15 minutes | 20 minutes | 30 minutes | 60 minutes | |
| up to 40⁰C | 1,253 | 1,287 | **1,305** | 1,271 | 1,277 | ↑ by 4.2% |
| 40-180⁰C (gasoline fraction) | 14,166 | 14,245 | 14,245 | **14,315** | 14,257 | ↑ by 1,2% |
| 180-240⁰C (kerosene) | 38,897 | **36,939** | 36,967 | 38,535 | 38,499 | ↓ by 5,3% |
| 240-350⁰C (diesel fuel) | 43,183 | **45,092** | 44,998 | **43,255** | 43,357 | hesitation |

Table 2 Change in the group composition and the amount of n-alkanes in the samples

| Group composition | ref. sample | №1 (15 minutes) | №2 (20 minutes) | №3 (30 minutes) | №4 (60 minutes) | final result |
|---|---|---|---|---|---|---|
| $C_7$-$C_9$ | 9,116 | **9,395** | 9,206 | 9,288 | 9,279 | ↑ by 3,1% |
| incl. $C_7$ | 4,274 | 4,401 | **4,421** | 4,335 | 3,348 | ↑ by **3,5%** |
| incl. $C_8$ | 0,452 | **0,465** | 0,463 | 0,460 | 0,459 | ↑ by 2,9 |
| $C_{10}$-$C_{16}$ | 71,736 | 71,431 | 72,165 | 71,919 | **71,310** | ↓ by 0,6% |
| $C_{17}$+ | 19,052 | 19,168 | **18,436** | 18,752 | 19,370 | ↓ by 3,3 |
| incl. $C_{17}$ | 6,659 | 5,208 | 4,678 | **4,621** | 5,233 | ↓ by **30,7%** |
| incl. $C_{20}$-$C_{23}$ | 0,406 | **0,309** | - | 0,429 | 0,353 | ↓by **24,0%** |

The results of studies of changes in the composition of the tested samples showed the following:
- Fractional composition: during processing, the amount of light hydrocarbons and gasoline fraction increases by 4.2% and 1.2%, respectively; the amount of kerosene fraction decreases (by 5.3%); the maximum changes are observed with a treatment duration in the range of 15-30 minutes;
- Group composition: the amount of $C_7$-$C_9$ hydrocarbons increases by 3.1% (maximum changes are 3.5% for $C_7$ hydrocarbons); the amount of hydrocarbons of the composition $C_{10}$-$C_{16}$ and $C_{17}$ + decreases by 0.6 and 3.3%, respectively. In this case, the maximum changes were recorded for hydrocarbons with the composition $C_{17}$ - a decrease by 30%, i.e. hydrocarbons of this composition are most susceptible to destruction with the used processing parameters;

- Individual hydrocarbon composition: an increase in the number of n-alkanes of $C_7$-$C_9$ composition by 2.2%; with the greatest changes for octane (n-$C_8$) - 2.9%. For solid paraffins ($C_{17}$ and above), a decrease in their content was noted with an increase in the duration of treatment. The greatest changes were recorded for n-alkanes of the composition $C_{20}$-$C_{23}$, the amount of which decreases by 24% with a treatment duration of 15 minutes. However, their content in the initial product is small (at the level of fractions%) and their destruction has little effect on the change in the composition of the samples.

When processing oil, one should expect higher effects, given that the content of hydrocarbons subject to the greatest destruction in oils is significantly higher compared to the studied gas condensate. But optimization of processing parameters will be required.

Summarizing the results of experimental studies, the following conclusions can be drawn:

- It has been shown that the treatment of samples leads to an increase in the yield of the lungs, incl. and gasoline fractions (more than 5% in total) due to the destruction of hydrocarbons included in the higher-boiling fractions.
- HCs that are most susceptible to destruction with the rupture of the C-C bond have been identified. Under processing conditions, this is a group of hydrocarbons of the composition $C_{17}$ and n-alkanes of the composition $C_{20}$-$C_{23}$, the amount of which is reduced by 25-30%.

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