DIRECTIONS OF TRANSFORMATIONS OF STABLE GAS CONDENSATES WITH VARIOUS COMPOSITION ON A ZEOLITE CATALYST

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The production of high-quality motor fuels is the main task by domestic producers of petroleum products.

The quality of the components used in the production of fuels, in particular motor gasolines, varies over a wide range and directly depends on the group composition of the feedstock. In addition, along with the use of traditional feedstock the issue of production high-octane gasoline components from alternative feedstock (associated petroleum gas, gas condensates) by processing it on zeolite catalysts, is becoming increasingly relevant [1, 2].

Based on the foregoing, the authors considered the direction of transformations of hydrocarbons included in the composition of stable gas condensates (SGC) of various compositions on a zeolite catalyst.

A number of tests on a laboratory catalytic unit, using a KN-30 zeolite catalyst, were carried out by a team of authors. The group hydrocarbon composition of the studied SGC samples is shown in Table 1.

Table 1. Group hydrocarbon composition of the studied SGC samples

Substances content, % vol.	SGC sample №1	SGC sample №2
N-paraffins	40.64	33.60
Isoparaffins	38.25	44.40
Naphthenes	19.35	17.09
Aromatic hydrocarbons	0.62	3.09
Olefins	1.14	1.86

The technological parameters of the tests are shown in Table 2.

The group hydrocarbon composition of the obtained products is shown in Table 3. To determine the hydrocarbon composition of SGC samples and obtained products the gas-liquid chromatography method was used.

Analyzing the data of Tables 1 and 3, we can note a general trend for the obtained products – with an increase in the process temperature, a significant increase in the content of aromatic hydrocarbons and a decrease in the content of n-paraffin hydrocarbons are observed. These trends indicate that taking place the cracking reactions, with the subsequent formation of aromatic hydrocarbons from olefins by hydrogen transfer reactions.

At a 375 °C temperature, the content of isoparaffins in the product obtained from SGC №1 increases (relative to the feedstock) much greater than the product obtained from SGC №2. This fact indicates about significant contribution of n-paraffins isomerization reactions at this temperature, however, with increasing process temperature, the contribution of these reactions decreases and the contribution of cracking reactions increases, including the cracking reactions of isoparaffins.

Table 2. Technological parameters of the tests

Parameter	Value	
Temperature, °C	375	425
Pressure, MPa	0.25	
Feedstock space velocity, ml/min	0.33	

Table 3. Group hydrocarbon composition of the products, obtained under varying process temperature

Substances content, % vol.	SGC sample №1		SGC sample №2	
	375 °C	425 °C	375 °C	425 °C
N-paraffins	33.25	25.86	26.45	18.40
Isoparaffins	43.94	38.98	45.34	31.45
Naphthenes	7.74	6.29	6.94	9.01
Aromatic hydrocarbons	10.26	25.25	19.08	37.33
Olefins	4.81	3.62	2.19	3.86

Characteristic of all obtained products is a decrease in the content of naphthenes relative to the feedstock. However, for products obtained from SGC №1, with increasing process temperature a decrease in the content of naphthenes is observed, and for products obtained from SGC №2, an increase in the content of naphthenes is observed, which is probably due to the isoparaffins cyclization reactions content of which in SGC №2 is higher.

References

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STUDY OF PHYSICOCHEMICAL PROPERTIES DYNAMICS OF KAZAKHSTAN AND WEST SIBERIAN OIL VACUUM GAS DURING HYDROPROCESSING

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Nowadays modern oil refining industry is challenged to solve many economic and technology problems. This is caused by both increasing demand for high-quality motor fuels and the growing proportion of high-sulfur heavy oils in the total amount of crude oil extracted and refined in Russia as well as in many other countries of the world. Thus, there is a rapid increase of the importance of hydrocatalytic processes in oil refining.

Hydrotreating is a very important large-tonnage process in modern refineries. Various straight-run fractions and gas oils of secondary origin are hydrotreated. The improving of hydrotreating technology was due to tightening of environmental requirements and laws. This trend was caused, in its turn, by the fact that large amounts of harmful gases and liquids are emitted after the combustion of fuel into the atmosphere [1].

The purpose of the work was to determine the composition and chemical properties of vacuum gas oil obtained during the distillation of fuel oil from Kazakhstan and West Siberian oil mixture. The process of distillation is then followed by further processing on the catalytic cracking facilities with preliminary hydrotreating in the KT-1/1 deep oil production unit.

Therefore, the research object is vacuum gas oil obtained from Kazakhstan and West Siberian

Table 1. Physico-chemical properties of vacuum gas oil

Sample	Sulfur content, wt.%	Kinematic viscosity at 50 °C, mm^2/s	Density at 20 °C, g/cm^3	Molecular weight, g/mol
Non-hydrotreated vacuum gas oil	1.04–1.655	21.942–28.044	0.9014–0.9068	312.3–361.3
Hydrotreated vacuum gas oil	0.078–0.152	24.257–28.888	0.8899–0.8927	338.5–342.1

Table 2. The group composition of vacuum gas oil

Sample	Hydrocarbon type composition		
	Paraffin hydrocarbons, wt.%	Aromatic hydrocarbons, wt.%	Resinous components, wt.%
Non-hydrotreated vacuum gas oil	48.80–52.33	42.73–45.17	4.87–6.92
Hydrotreated Vacuum Gas Oil	56.80–61.53	35.44–40.46	2.38–3.03