UDK 665.753.4; 54-44

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HYDROISOMERIZATION OF DIESEL FRACTIONS OF KUMKOL AND ZHETYBAY OILS IN THE PRESENCE OF A BIFUNCTIONAL CATALYST BASED ON MESOPOROUS ALUMINOSILICATE

• *Синтезирован бифункциональный катализатор на основе мезопористого алюмосиликата для процесса гидроизомеризации дизельных фракций, в которых, в качестве дополнительной кислотной части катализаторов и связующего материала, был использован предварительно активированный бентонит Таганского месторождения. Показано, что независимо от природы исходной нефти оптимальной температурой для гидроизомеризации дизельной фракции Кумкольской и Жетыбайской нефтей является 350 °C, выход изопарафинов составляет 37 и 32 %, соответственно.*

• *Дизельді фракцияларды гидроизомеризациялау процесі үшін мезо кеуекті алюмосиликат негізіндегі бифункционалды катализатор синтезделді,онда катализаторлар мен байланыстырғыш материалдың қосымша қышқылдық бөлігі ретінде таған кен орнының алдын ала белсендірілген бентониті қолданылды. Бастапқы мұнайдың табиғатына қарамастан Құмкөл және Жетібай мұнайының дизельді фракциясын гидроизомерлеу үшін оңтайлы температура 350 °C болып табылатыны көрсетілген, изопарафиндердің шығуы сәйкесінше 37 және 32 % құрайды.*

• *A bifunctional catalyst based on mesoporous aluminosilicate was synthesized for the process of hydroisomerization of diesel fractions, in which, as an additional acid part of the catalysts and a binder, pre-activated bentonite from the Tagan deposit was used. It was shown that regardless of the nature of the original oil, the optimum temperature for hydroisomerization of the Kumkol and Zhetybai oil diesel fraction is 350 °C, the yield of isoparaffins is 37 and 32 %, respectively.*

The development of a new class catalysts for the production of low-pour point diesel fuels using the process of hydroisomerization of higher normal alkanes and their introduction into the oil refining and petrochemical industries is the most important issue for our Republic. The importance of this issue is due to the fact that most of Kazakhstan's oils are highly paraffinic with a normal structure [1-2], which makes it difficult to process them and to produce commodity products with a branched structure, which possess lower pour points.

Currently, in the oil refining industry of our Republic, mainly foreign Pt-containing catalysts based on synthetic zeolites are used. A significant disadvantage of this type catalysts is the diffusion limitations of the transportation of large molecules in their porous system, leading to a decrease in the poly-branched isoalkanes selectivity of the process [3-7]. The solution to this problem can be found by development of catalysts based on mesostructured aluminosilicates, what makes it possible to transform higher normal alkanes which are the part of feed diesel fractions into isomeric hydrocarbons of branched structure [8-14].

It should be noted that the synthesis of mesoporous aluminosilicates is simpler than the synthesis of catalysts based on zeolites, since their synthesis is that the formation of the structure of the material occurs during the sedimentation of hydrated aluminium oxides and silicon on the micelles of the template, which is a surfactant. In the sequel, the template is removed by calcination in air at temperatures of 500-650 °C. As the acidic components of hydroisomerization catalysts, mesostructured aluminosilicates are of interest due to the peculiarities of their structure, since their pore size exceeds the size of most of the molecules contained in the raw material.

The development of such materials has top priority in a number of strategic tasks for the refining of our republic, since, at present, there is no production of low pour point diesel fuels.

Experimental part

On the basis of literature data [8-14], during obtaining of mesoporous aluminosilicates, the method of copolycondensation was choosed by us. On its basis the initial compounds were tetraethoxysilane $(EtO)_4Si$ of Sigma-Aldrich company, and aluminum isopropoxide (i-PrO)3A1 was used as the source of aluminum by AcrosOrganics company. Hexadecylamine was used as a template for the formation of a porous structure. A sample of Al-HMS was prepared with a Si/Al ratio of 20. Synthesized aluminosilicate was mixed with activated bentonite in a ratio, mass. %: Al-HMS(20)/H bentonite – 35/65. The promotion of the catalyst was carried out by the method of impregnation of dried and heat-treated catalysts by the calculated amount of nickel nitrate aqueous solution. The ammount of the incorporated promoter was 5 mass. % from the mass of catalyst.

Adsorption studies were carried out on N_2 adsorption isotherms at 77 K, which were measured on Micromeritics' ASAP-2400 installation after training the samples in vacuum at 1500 °C. These isotherms were

Table 1

Textural characteristics of the Ni/Al-HMS (20) – bentonite catalyst

Catalyst	SSA, m^2/g	D_{pores}, nm	V_{pores}, cm^3/g
Ni/Al-HMS(20) – bentonite	570	4,1	0,8

Table 2

Group hydrocarbon content of Kumkol oil diesel fraction hydroisomerization products on the Ni/Al-HMS(20) – bentonite catalyst, W_{feed} = 1 h^{-1}, P_{H_2} = 3 MPa

№	Hydrocarbon content	Content, mass. %	
		350 °C	450 °C
1	N-paraffins	21,72	20,67
2	Isoparaffins	37,13	19,21
3	Naphthenes	8,91	17,72
4	Olefins	5,02	9,91
5	Cycloolefins	–	5,45
6	Arenes	27,1	21,13
7	Dienes	0,12	1,91
8	Nonidentified	–	4