ucts. Thus, given that it is a source of Al (aluminum) and Si (silicon) for the production and synthesis of zeolite, the progress of research is obvious [3].

There are seven main regions in Russia where coal reserves and production are concentrated, two of which are the Krasnoyarsk Territory and the Kemerovo Region. [1, 3] Several power plants have been installed in the country, 59 in total in operation, the largest of which is located in Surgut and has a capacity of 5.597 MW (megawatts) [2].

One of the main residues from thermal energy production concerns coal ash, which is characterized as solid waste from energy production [1–3]. In Russia, about 20 million tons of ash and slag waste are generated annually, consisting of fly ash and hydraulic ash [2, 3].

The use of waste for the production of municipal goods is widely considered today as a solution to reduce the amount of waste sent to landfills, which, unfortunately, is not followed in Russia [2].

It is known that part of the ash is used in the country in the production of clinker used for the production of cement in the construction industry, the rest is dumped in ash dumps or used to cover depleted mine shafts. Coal ash has a wide variation in ash composition, from 47 % to 65 % silica (SiO_2) and 16 % to 29 % aluminum or dialuminum trioxide (Al_2O_3), with some ash being considered a good attraction for zeolite production [1–3].

Within the framework developed, various types of coal ash and materials for zeolite synthesis will be analyzed and experimental developments carried out for zeolite synthesis will be selected. Subsequently, the synthesis will be optimized to increase the yield of the synthesized zeolite and an evaluation of the capacity of the material will be performed. The synthesized zeolite will then be used either for environmental purposes, to separate oil and water produced during oil production, or for catalytic purposes to create a catalyst to improve the purification of light olefins in heavy feedstock.

Thus, for the purpose of ecological use of raw materials, adsorption applications in oil and water separation and catalysis, the use of coal ash for the synthesis of zeolites is a promising application, which in the future can be realized for the synthesis of fluid catalytic cracking (FCC) catalytic catalyst by adding rare metals. to zeolite, restructuring of the molecular structure and the possibility of subsequent use as a catalyst.

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STUDY OF LOW-TEMPERATURE PROPERTIES OF DIESEL FUEL AND THEIR RELATIONSHIP WITH ITS HYDROCARBON COMPOSITION AND PHYSICOCHEMICAL PROPERTIES

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Important performance characteristics of diesel fuel are cloud point (CP), pour point (PP) and cold filter plugging point (CFPP) [1]. The study of the hydrocarbon composition of the fuel and the identification of the relationship with its low-temperature properties is one of the main tasks.

The purpose of this work is to analyze the hydrocarbon composition and physicochemical properties of diesel fuel samples and evaluate their effect on low-temperature characteristics.

Samples of diesel fuel of various hydrocarbon composition were taken as the object of study. For each sample, the hydrocarbon composition

Table 1. Physical and chemical properties of diesel fractions

Properties	DF № 1	DF № 2	DF № 3	DF № 4	DF № 5	DF № 6	DF № 7
10 % diesel fraction boiling point temperature, °C	187	186.5	187.5	196	191.5	187	190
90 % diesel fraction boiling point temperature, °C	301.5	299.5	302	358	318	300.5	319
latitude of the fractional composition, ºC	114.5	113	114.5	162	126.5	113.5	129
CP, °C	–26.4	–25.9	–26.4	–3	–16.1	–24.6	–16
CFPP, °C	–27.4	–27	–27.2	–6.4	–20.2	–26.2	–20.5
PP, °C	–33.2	–33.7	–32.4	–14.3	–23.2	–33.5	–23

Table 2. Group composition of samples of diesel fractions

Hydrocarbon content, wt. %	DF № 1	DF № 2	DF № 3	DF № 4	DF № 5	DF № 6	DF № 7
paraffins	49.74	62.58	58.72	63.46	62.60	63.58	58.49
n-paraffins	18.71	40.23	41.00	45.34	39.78	40.95	33.15
Iso-paraffins	31.03	22.35	17.73	18.12	22.83	22.64	25.34
n-paraffins / iso-paraffins	0.60	1.80	2.31	2.50	1.74	1.81	1.31
naphthenes	21.47	10.72	13.51	17.91	7.60	13.68	14.80
arenas	24.85	16.90	26.55	17.03	22.38	19.35	26.52
Resin	3.94	9.80	1.21	1.60	7.41	3.39	0.19
Total	100	100	100	100	100	100	100

and physicochemical properties were determined. The study was carried out using an INPN SX-800 low-temperature indicator of petroleum products and the method of chromato-mass spectrometry. The results of the study are presented in tables 1 and 2.

When analyzing the tables of the results obtained, the following conclusions can be drawn:

1. Sample DF № 4 has the worst low-temperature properties, for which PP=–14.3 °C and CFPP=–6.4 °C. This is due to the fact that this fraction is characterized by a high content of paraffins (63.46 % wt.), the highest normality coefficient of paraffins – 2.50, the widest fractional composition of 162 °C and the highest 90 % diesel fraction boiling point temperature – 358 °C .

2. Sample DF№1 has the best low-temperature properties (PP=–33.2 °C and CFPP=–27.4 °C). The sample is characterized by the lowest content of paraffins (49.74 % wt.) and the lowest coefficient of normality of paraffins – 0.6, the highest content of naphthenes (21.47 % wt.), low 90 % diesel fraction boiling point temperature (301.5 °C) and a narrow fractional composition of –114.5 °C.

3. Thus, the determining factors affecting the low-temperature properties are: the content of paraffins, naphthenes, the coefficient of normality of paraffins. Naphthenes prevent the co-crystallization of n-paraffins due to steric hindrance due to the cyclic structure, which helps to reduce the pour point.

4. The narrower the fractional composition and the lower the boiling point of 90 % of the fraction, the better its low-temperature properties.

References

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