Table 1. Ammonia and ammonium ion content in water after sorption with the use of zeolites

Sample of zeolite	Fraction, mm	Concentration after sorption, mg/dm^3	Recovery ratio, %
Kholinsk	less 0.1	32.3	59.2
	0.5–1	33.7	57.5
	1–2.5	33.8	57.6
Chuguevsk	less 0.1	32.9	58.4
	1–1.4	30.2	61.6
Shivyrtuisk	less 0.1	43.0	59.5
	1.5–2.5	58.1	26.2
Sokirnitsk	less 0.1	24.6	73
	0.7–1.5	45.7	43.2

NH_4^+ ion sorption was carried out under static conditions using a magnetic mixer at a speed to 200 r/min. To make the experiment, 2 g zeolite weighed quantity was covered with 200 cm^3 of treated water, the initial NH_4^+ ion concentration of which was 79.2 mg/dm^3. Process of precipitation sorption for each zeolite sample had been carried out for 150 minutes. Having carried out the process of sorption, adsorbate was filtered from sorbent with a help of paper filter "Blue ribbon". Final NH_4^+ ion concentration was identified by photocolorimetric method in accordance with All-Union Standard 4192-82 Drinking water.

Methods used to determine mineral nitrogen-containing substances.

The results of carried out experiments are presented in Table 1.

In the basis of results presented in Table 1, we come to conclusion that using of natural zeolite of Sokirnitsk field is the most effective for NH_4^+ ion removal from water solutions. Though, NH_4^+ ion content in water after sorption with a help of this zeolite considerably exceeds maximum permissible concentration for drinking water. Therefore, it is planning to study sorptions of NH_4^+ using porous zeolite modified with NaCl. This work was carried out according to state order "Nauka" 7.1504.2015.

References

1. *Malanova N.V. Processes of calcium hydrocarbonate removal from groundwater with a help of generator of microbubble treatment and ammonium hydroxide. PhD thesis in Engineering Science. Tomsk: National research polytechnic university (TPU), 2015.– 105 pp.*
2. *Ryabchikov B.E. Modern methods of water treatment for industrial and residential use.– M.: DeLi print, 2004.– 328 pp.*

MATHEMATIC MODEL OF CATALYTIC DIESEL FUEL DEWAXING PROCESS

N.V. Popova, E.V. Frantsina
Scientific supervisor – PhD, Assistant, N.S. Belinskaya
Linguistic advisor – PhD, Assistant, N.S. Belinskaya

National research Tomsk polytechnic university
634050, Russia, Tomsk, 30 Lenin Avenue, nvp5@tpu.ru

In order to correspond with modern demands of technological development and ecology, and to expand the market channels both for domestic and outside consumers, Russian manufacturers pursue the aims of resource efficiency enhancement and operating optimization. Catalytic dewaxing process has a substantial importance as the process for production of winter and summer diesel fuels with improved low-temperature properties.

This study is focused on the mathematical modeling of the catalytic dewaxing process with further optimization and estimation of diesel fuel low-temperature properties. One of the significant problems being solved in this work is the investigation of influence of the feed composition over the main product, i.e. modified diesel fraction composition, low-temperature properties and product yield. The research was conducted with the application of the computer modeling system programmed and designed at the Department of Fuel Engineering and Chemical Cybernetics of Tomsk polytechnic university. The system has the function of reading compositional data and operating conditions in the dewaxing reactor.

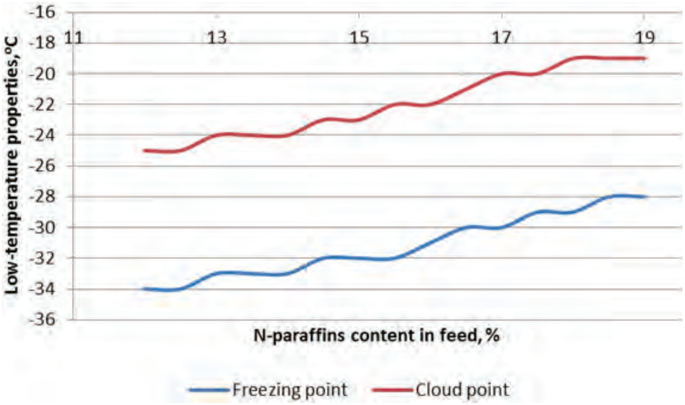

Fig. 1. *Low-temperature properties of the product depending on the content of n-paraffins in feed*

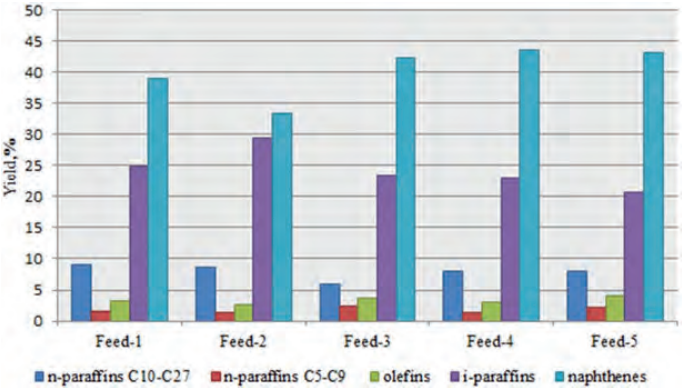

Fig. 2. *The yield of hydrocarbon groups depending on feed composition during the catalytic hydrodewaxing process*

The dewaxing stage implicates the following main reactions: isomerization of n-paraffins C_5-C_{16}, hydrocracking of long-chain molecules of n-paraffins C_{10}-C_{27} [1]. Decreasing of low-temperature properties, such as cloud point T_c and freezing point T_f , may be attained through the reduction of the normal paraffins or low-branched paraffins resulting in formation of iso-paraffins with a lower carbon atom number [2].

The correlation between the feed composition and temperature properties, product composition and yield was estimated with the investigation of five various feed stocks entering the reactor. In addition, the feed flow rate, pressure in the reactor and the flow rate of hydrogen bearing gas were assumed constant while changing the temperature in the reactor.

The graph in figure 1 illustrates the fact that T_c and T_f slightly increase with the growing number of n-paraffin molecules in any feedstock composition. Thus, the freezing point rises from –34 °C to –28 °C, whereas the cloud point rises from –25 °C to –19 °C.

The bar chart in Figure 2 shows the impact of feedstock composition on the yield (wt.%) of hydrocarbon groups in the diesel fraction. The yield of high-molecular n-paraffins ranges from 6 to 9.08%, low-molecular paraffins yield varies from 1.3 to 2.5%, isoparaffins yield – from 20.73 to 29.5%, the yield of naphthenes amounts to 33.4–43.6%.

References

1. *Druzhinin O.A. Destructive hydrogenation processes for the purpose of obtaining of low pour point diesel fuels. Doct.Diss.– Krasnoyarsk, 2009.– P.21.*
2. *Kumar H. Mechanistic kinetic modeling of the hydrocracking of complex feedstocks. Doct. Diss. Texas: A&M Univ, 2006.– P.180.*