of oxygen-containing hydrocarbons decreased by approximately two times, from 0.83 to 0.42 % wt. The content of aromatic hydrocarbons has increased significantly, in particular, the most significant increase is observed for mono-aromatic hydrocarbons – from 9.58 to 37.51 % wt.

The decrease in the content of n-paraffins in the composition of PAF is associated with reactions occurring at the active centers of the catalyst. During the cracking of n-paraffins. hydrocarbons with shorter chain of this class and olefins are formed and isomerization of n paraffins also occurs. Because of the redistribution of hydrogen in olefins, aromatic hydrocarbons and in small quantities n- paraffins are formed.

In addition to hydrogen redistribution aromatic hydrocarbons are formed as a result of transalkylation reactions. Some of them can enter into an alkylation reaction with olefins. Naphthenes were formed by the mechanism of diene synthesis from olefins; after the redistribution of hydrogen aromatic hydrocarbons were formed.

Table 1. The content of hydrocarbon classes in the composition of AF and PAF

No.	Hydrocarbon class	Relative concentration, % wt.	
		AF	PAF
1	N-paraffins	24.93	3.46
2	Iso-paraffins	14.73	16.30
3	Naphthenes	20.85	15.59
4	Olefins	0.04	0.83
5	Alkynes	0.03	0.09
6	Mono-aromatic	9.58	37.51
7	Mono-aro-ma-naphthenes	0.72	2.33
8	Bi-aromatic	1.68	3.65
9	Oxygen-containing	0.83	0.42
10	Unidentified	26.62	19.82

Accordingly processing AF on a zeolite catalyst changes the group composition of the mixture making it possible to improve the physicochemical properties of the product.

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COMPUTER MODELING OF THE HYDROCRACKING PROCESS TAKING INTO ACCOUNT THE DETAILED COMPOSITION OF THE FEEDSTOCKS

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The oil industry, as one of the most important industries, should dynamically develop, easily adapt to the constantly changing market conditions and introducing new scientific achievements. Hydrocracking is a reflection of development, since this process is easy to adapt to any feedstock, which is becoming increasingly heavier in composition, making it difficult to process into valuable petroleum products [1]. The kinetics of hydrocracking determines the course of the entire process. To correctly predict process performance, the reacting components and their reactions should be described in detail according to the detailed composition and detailed scheme of transformation [2, 3].

The aim of the work is to develop a mathematical model of the hydrocracking process taking into account the detailed composition of raw materials.

The mathematical model was developed based on the transformation scheme of the components in-

cluded in the detailed composition of the raw materials, presented in Figure 1.

As can be seen from Figure 1, n-paraffins and n-paraffins C_5–C_{40} are included in the composition of the raw materials individually. For the components presented in Figure 1, thermodynamic parameters such as enthalpy and entropy and were determined, which in turn made it possible to determine the change in the Gibbs energy (ΔG) during the course of reactions with their participation, which was calculated using the following formula:

$$\Delta G = \Delta H - T\Delta S.$$

The accuracy of calculations using the model is provided by taking into account the thermodynamics and kinetics of the process. For the reactions included in the transformation scheme, kinetic parameters such as activation energy and pre-exponential factor were determined; the results are presented in Table 1.

Describing of the feedstock composition in detail, as well as thermodynamics and kinetics of reactions included in the transformation scheme provide sufficient accuracy of the calculations using the model and prediction of the process performance.

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Table 1. Kinetic parameters of the mathematical model

Reaction number	Activation energy, kJ/mol	Pre-exponential factor, 1/s
1	62.4	$1.28 \cdot 10^{20}$
2	51.2	$3.45 \cdot 10^{19}$
3	9.6	$7.41 \cdot 10^{3}$
4	37.7	$6.51 \cdot 10^{2}$
5	35.5	$5.33 \cdot 10^{3}$
6	66.6	$4.28 \cdot 10^{19}$
7	207.5	$4.17 \cdot 10^{18}$
8	80.8	$9.14 \cdot 10^{18}$
9	290.2	$1.66 \cdot 10^{14}$
10	258.4	$1.91 \cdot 10^{11}$

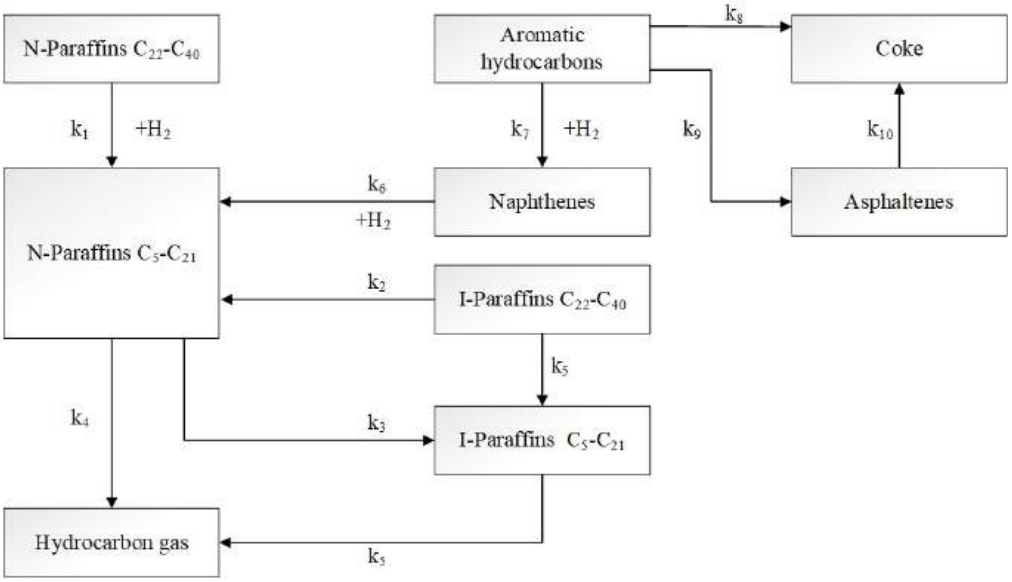

Fig. 1. *The scheme of transformations in the hydrocracking process*

Reference

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ENERGY EFFICIENCY POTENTIAL DETERMINATION FOR THE OIL TREATMENT UNIT

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Many oil producers are making great efforts to improve the energy efficiency of their systems and reduce greenhouse gas emissions. Oil treatment units are increasing in size and becoming more complex, so there is increasing interest in reducing operating costs, which can be reduced by using the pinch analysis method [1]. In this work, pinch analysis methods are used to reduce specific energy consumption at an oil production and treatment unit [2].

The purpose of this work is to determine of the energy efficiency potential for the oil treatment unit.

During the study of the installation, all technological parameters were determined, data extraction was carried out, material and heat balances were calculated, a process flowsheet was compiled in Aspen Hysys software, and an energy flow diagram was compiled, which later made it possible to construct composite curves in Pinch 2.02 software [3].

Using input data extraction, a traditional diagram for the current heat exchange network in the unit was compiled (Figure 1).

Data extraction and the heat exchange system made it possible to synthesize a flow table with the help of which a grid diagram of the existing heat exchange system was constructed (Figure 2).

Extraction of technological data from the existing heat exchange network made it possible to synthesize a stream data table with the help of which a grid diagram was constructed for the existing heat exchange network (Figure 2).

Using a grid diagram, the heat energy recuperation capacity was determined for the current heat

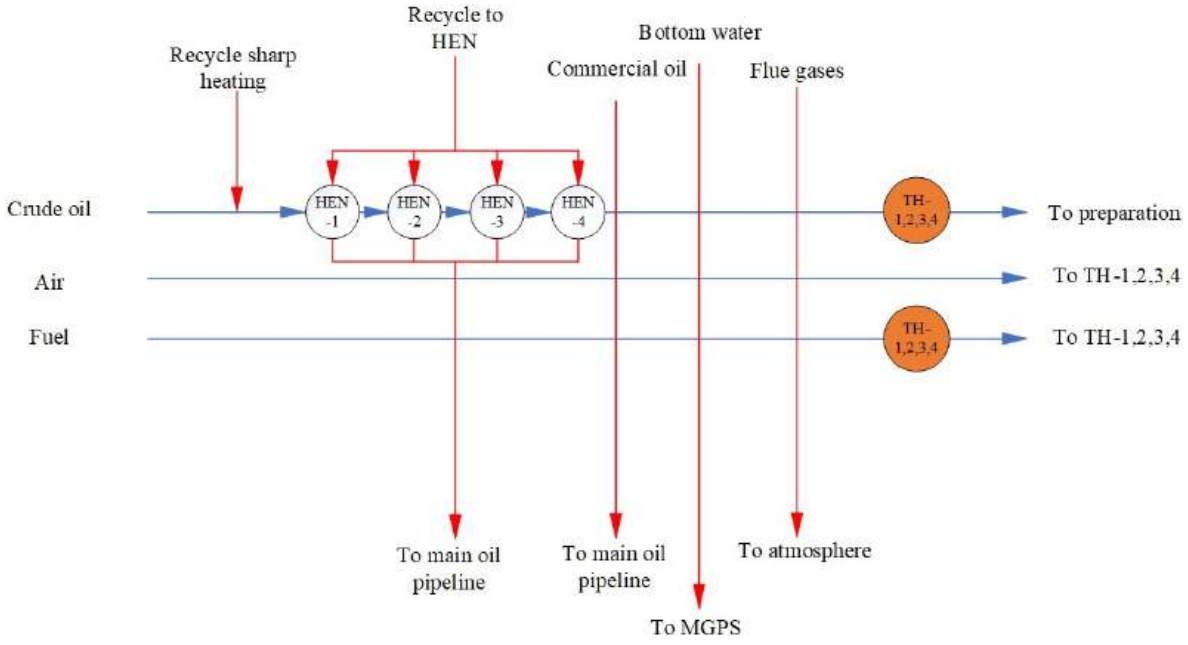

Fig. 1. *Heat exchange network: HEN – heat exchanger; TH – travel heater; MSPS – modular group pumping station*