INFLUENCE OF FRACTIONAL COMPOSITION AND THE CONTENT OF PARAFFINIC AND AROMATIC HYDROCARBONS IN THE COMPOSITION OF DIESEL FUEL ON THE DEPRESSANTS' EFFICIENCY

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One of the most important indicators of the quality of diesel fuel (DF), including those that have a significant effect on the effectiveness of the additives, is its composition.

In the case of depressant additives, the fractional composition, as well as the content of aromatic and paraffinic hydrocarbons, have the strongest effect on their effectiveness, is due to the mechanism of these additives action [1]. It is the influence of the fuel composition on the effectiveness of the additives that determines the situations in which the addition of a depressant to diesel fuel does not have the desired effect on the low-temperature properties or received effect is insignificant.

Influence of fractional composition

For the study effect of the diesel fuel fractional composition on the effectiveness of the depressant additives, a series of tests was carried out. The essence of tests was to change the content of narrow diesel fractions (fractions with boiling range of 180–240 °C, 240–300 °C, 300–360 °C) in the diesel fuel composition, subsequent addition of a depressant, and the determination of the low-temperature properties of the blends. According to the test results, it was found that the lightening of the fractional composition of diesel fuel (an increase in the proportion of light fractions and/or a decrease in the proportion of heavy fractions) is impractical if in the future the low-temperature properties of the fuel are planned to be improved by adding depressants.

Influence of aromatic hydrocarbon content

The study of the effect of the aromatic hydrocarbons content in the composition of diesel fuel was carried out on model blends. The blends were obtained by adding pure aromatic hydrocarbons of various structures (toluene, tetralin) to straight-run diesel fuel with the addition of depressants. It was found that the addition of tetralin has a more pronounced negative influence on the effect of depressant for all low-temperature characteristics than the addition of toluene. These results are confirmed by the interaction mechanism of depressants with aromatic hydrocarbons: aromatic hydrocarbons containing side paraffin chains are more susceptible to depressants; with an increase in the number of rings and a decrease in the length of side chains, the susceptibility to depressants decreases. The established effect is explained by the difference in the polarity of these compounds – the dipole moment of tetralin is almost 2 times higher than the dipole moment of toluene, and therefore tetralin more actively interacts with the depressant, thereby suppressing its effect on n-paraffins.

Influence of n-paraffins content

The influence of the n-paraffins content on the depressant additives' effectiveness was studied using the fuel blends obtained by adding heavy n-paraffins (C_{19+}), separated from various diesel fractions, into straight-run diesel fuel with the addition of depressants. The used heavy n-paraffins were obtained by the method [2], their composition was determined using the chromatographic complex Chromatek-Kristall.

According to the research results, it was found that the addition of heavy n-paraffins in concentrations from 0.05 to 0.25 %wt. (depending on the composition of the initial diesel fuel sample) can significantly increase the effectiveness of the depressant additives. The additional decrease in the cold filter plugging point relative to a blend with a depressor additive and without adding heavy n-paraffins is 10–22 °C, and for the pour point – 2–12 °C. The obtained effect also finds its explanation in the mechanism of depressants action, which can begin to act only after the formation of the first n-paraffins crystals. By adding heavy n-paraffins into the blend we not only increase the number of centers of initial crystallization but also, due to heavier n-paraffins, accelerate the process of the formation of the first crystals.

References

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2. *USS 11851-85 "Petroleum. Method of paraffin determination". – Moscow: Standardinform, 2018. – 15 p.*

UNSTEADY BENZENE FRACTION PYROLYSIS SIMULATION

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The main process of olefins production for polymer industry is pyrolysis. However, it is complicated due to formation of coke deposits. This leads to burnout of the coils, as well as a decrease in the yield of target products.

Thus, creation of an unsteady mathematical model seems to be the solution. The model is based on the reaction scheme shown in Figure 1.

At the first stage, the rate constants of all reactions are calculated:

$$K_j = K_{0j} \cdot \frac{P_0}{T^2} \cdot exp\left(\frac{-E_j}{RT}\right), \mathrm{j} \in \{1 \ldots 172\}$$

Then, in order to calculate concentrations changes, the rates of the corresponding reactions are summated, multiplied by component stoichiometric coefficient:

$$\frac{dC_i}{d\tau} = \sum a_{i,j} \cdot K_j \cdot \prod C_j^{a_{i,j}}$$

However, to calculate the concentration of coke, a different formula is used [1]:

$$\frac{dC_{coke}}{d\tau} = K_8 C_{coke} - exp(0{,}023 \cdot C_{coke} - 1) \cdot G^{0.8} \cdot$$

$$\cdot G^{0.8} \cdot (D - 2 \cdot \delta)^{-1.8}$$

The model was used to simulate the pyrolysis of the mixture, the composition of which is presented in Table 1.

Dynamics of target products concentrations during the process was obtained as a result shown on Figure 2.

Decrease in concentration after a peak, is associated with an increase in side processes. This can be seen in Figure 3, where the coke layer thickness increases markedly towards the end.

However, at the moment, the amount of coke expressed in one form or another is the only component that changes over time. In the future, it is planned to create dynamics for the remaining components.

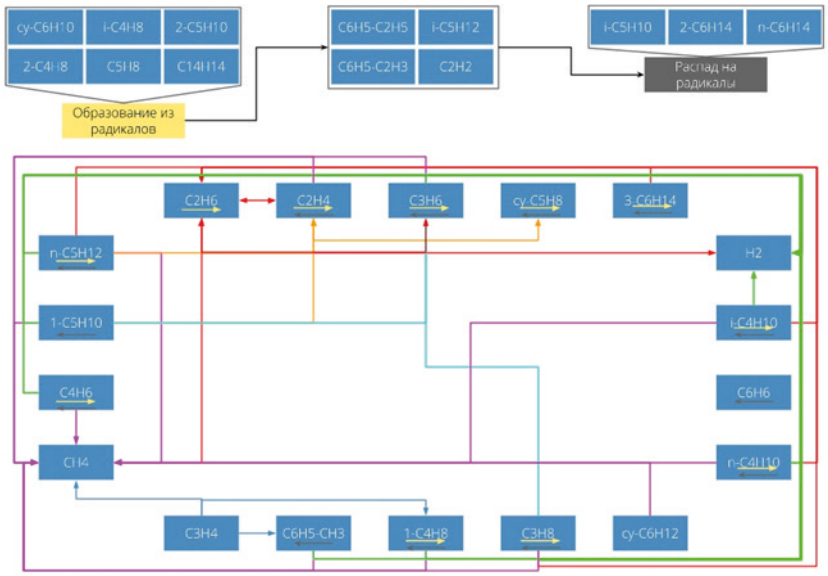

Fig. 1. *Reaction scheme*