INVESTIGATION THE EFFECT OF HETEROATOMIC COMPOUNDS IN DIESEL FUEL ON THE EFFECTIVENESS OF DEPRESSORS

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The use of diesel fuel (DF) of Winter and Arctic brands is growing every year; therefore, to increase production volumes, it is necessary to introduce depressor additives (DA) into the fuel composition. N-paraffin crystals form in DF due to sorption on the surface of nuclei or joint co-crystallization. DA prevent the enlargement of these n-paraffin crystals. The content of heteroatomic compounds of sulfur (HTS) and nitrogen (HTN) plays an important role in determining the quality of petroleum fuels [1]. Therefore, the identification of influence patterns of heteroatomic compounds on the low-temperature properties of DF and the effectiveness of DA is one of the significant tasks.

The purpose of this work is to assess the effect of the content of individual heteroatomic compounds in the composition of DF on the effectiveness of the DA. The object of the study are two commercial DF, a DA, heteroatomic sulfur compounds such as: dibenzothiophene (DBT), 4,6-dimethyldibenzothiophene (DMDBT) and nitrogen compounds such as: para-phenylenediamine (PD), indole (I), as well as their mixtures.

In accordance with the methods presented in [2], low-temperature properties (LTP) were determined such as: cloud point (Cp), cold filter plugging point (CFPP) and pour point (Pp). Sulfur and nitrogen compounds were introduced into the samples in concentrations of 25.0 mg/kg and 12.5 mg/kg, respectively, so that the content of total sulfur and nitrogen met the requirements of the standard [2].

The changes in the low-temperature properties of mixtures DF-1 and DF-2 with a DA when adding heteroatomic sulfur and nitrogen compounds relative to a mixture of DF with an additive are shown in the Figures 1, 2.

Based on the Figure 1, 2 it can be seen that for sample DF-1 the greatest negative effect is: in relation to Cp, the addition of DBT has an effect; in relation to CFPP, the addition of DMDBT has an effect; in relation to Pp, the addition of FD has an effect. For sample DF-2, the greatest negative effect is: in relation to Cp, the addition of DMDBT and I has an effect; in relation to CFPP, the addition of PD has an effect; in relation to Pp, the addition of all heteroatomic compounds considered has an effect.

According to the data obtained as a result of the study, it can be concluded that the added heteroatomic compounds similarly affect the Pp of individual samples under study. So, for a sample DF-1 Pp increases by 2 °C and 3 °C, and for the DF-2 sample by 10 °C. It has been experimentally established that the introduction of HTS and HTN worsens the effectiveness of DA. It is worth noting that the greatest decrease in the effectiveness of the DA is observed with the introduction of heteroatomic nitrogen compounds.

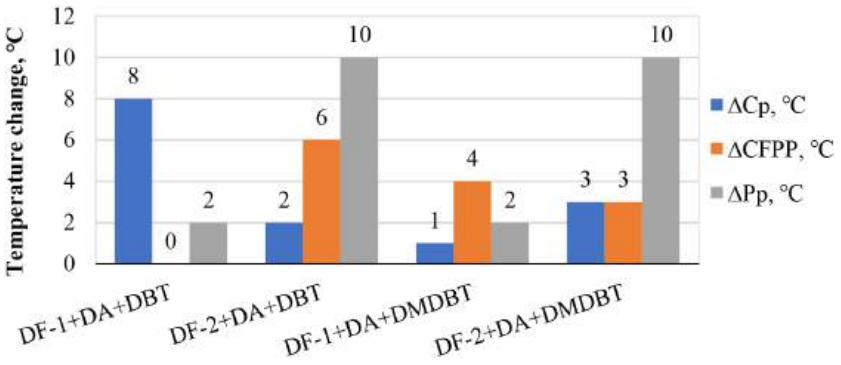

Fig. 1. *Changes in the LTP of mixtures of DF with an additive when adding HTS*

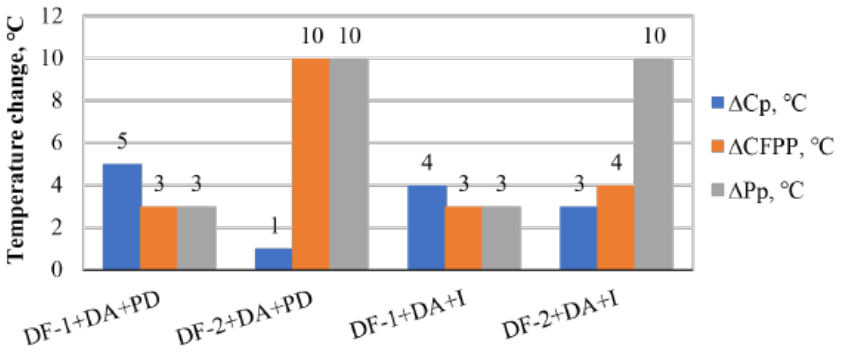

Fig. 2. *Changes in the LTP of mixtures of DF with an additive when adding HTN*

References

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A CONVENIENT WAY TO GROW COPPER SULFATE CRYSTALS

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As we known, solubility of solids depends on temperature. Than more temperature, then better solubility. When saturated solutions are cooled, supersaturated solutions are formed. They are unstable, and when exposed to them, excess solute precipitates. By changing the conditions, it is possible to obtain different crystal forms and quantities.

EXPERIMENTS

We selected copper sulfate $CuSO_4$ as the object of our research.

The crystal was grown in two steps:

STEP 1

- A saturated solution was prepared at 100 °C
- Filtered it out of impurities
- Left to cool to room temperature.

As a result, many crystals up to 5 mm in size were obtained. We took several small crystals. They will be the centers of crystallization in step 2 (Picture No. 1).

Copper sulfate precipitates from the solution in the form of a crystallohydrate $CuSO_4 \cdot 5H_2O$ [1].

STEP 2

- A saturated solution was prepared at 100 °C
- Filtered it out of impurities
- The crystal from step 1 is placed in a hot solution as the center of crystallization (Picture No. 2)
- The solution was covered with glass from above
- The solution was cooled to room temperature
- Then the solution was opened and left overnight

As a result, after 12 hours, only one large crystal crystallized from the solution. The crystal size is 5×22 mm (Picture No. 2)

CONCLUSION

We see that in the presence of the crystallization center, one large crystal is formed. Many small crystals are formed without a crystallization center. This means that the size and number of crystals formed depends on the crystallization conditions.