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STUDY OF THE MECHANISM OF ACTION OF THE DEPRESSOR ADDITIVE IN DIESEL FUELS BASED ON LOW-MOLECULAR POLYETHYLENE

[1]Fozilov Sadriddin Fayzullaevich
[1]Doctor of Technical Sciences, Professor, Bukhara Engineering Technological Institute, Bukhara, Uzbekistan

[2]Khasanov Bakhrom Buronovich
[2]Lecturer, Bukhara Engineering Technological Institute, Bukhara, Uzbekistan

[3]Ataullaevv Sherzod Nabullaevich
[3]Candidate of Technical Sciences, Associate Professor, Bukhara Engineering Technological Institute, Bukhara, Uzbekistan

[4]Rajabov Rustam Nusratillo o`g`li
[4]Lecturer, Tashkent Institute of Chemical Technology, Uzbekistan, Tashkent

[5]Fozilov Hasan Sadriddin o`g`li
[5]Master, Bukhara Engineering Technological Institute, Bukhara, Uzbekistan

ABSTRACT

The development of our republic today cannot be imagined without the development of the fuel and energy complex. Which, in turn, depends on the received and developed new types of diesel fuel, their consumer and physical and chemical properties. It is especially important to study the properties of fuels in our rapidly changing climatic conditions. To obtain fuel that meets the requirements of the local consumer, it is necessary to change its low-temperature properties, which affect not only the operational, but also the environmental properties of high-quality diesel fuels. Additive depressants are the most common ways to change the low-temperature properties of a fuel. In this work, the goal is to develop technologies for the production and use of qualitatively new, imported-substituted depressants synthesized on the basis of the use of local raw materials, which increase their efficiency [1,2].

KEY WORDS. *diesel, fuels, paraffinic hydrocarbons, oil effluent*

INTRODUCTION

During the production of polyethylene, wastes are formed, some of which are a mixture of ethylene-containing gases, paraffinic hydrocarbons, cyclohexane containing low molecular weight polyethylene and an oil product - an oil effluent from an alkaline column, the so-called yellow oil.

To improve the quality of diesel fuels and improve its low-temperature properties, the use of depressant additives is one of the most effective methods. As depressants for diesel fuels, the use of polymers and copolymers is widely and effectively used. Even in small amounts, the introduction of depressants leads to a significant decrease in the pour point of diesel fuel and a decrease in its viscosity at low temperatures.

With the aim of targeted synthesis of additives and their rational use, the mechanism of action of depressant additives based on low molecular weight polyethylene was studied, which has not only theoretical but also direct practical significance. There are numerous studies and different theories, but there is no generally accepted view on the mechanism of action of depressants.

Since all petroleum products are characterized by features inherent in classical dispersed systems: heterogeneity and dispersion, at present no one doubts the fact that they, including diesel fuels (DF), are representatives of dispersed systems. It is for this reason that today diesel fuel is called fuel dispersed systems (FDS). Various additives have been widely used to improve the quality of TDS for more than 50 years. At the same time, the mechanism of action of additives in TDS is still not clear [1-3].

The cited works do not take into account the adsorption nature of surfactants, namely:

- in the process of filtration, together with paraffin and without adsorption on paraffin, surfactants can be partially released in the form of a dispersed phase, as well as due to heterocoagulation;

- The possibility of joint crystallization of paraffin molecules and molecules of additives;

- Adsorption of inactive compounds present in technical additives.

Thus, the mechanism of adsorption of depressants on paraffin from its dispersions has not yet been established.

METHODS AND OBJECTS OF RESEARCH

This work presents experimental results proving the mechanism of action of additives in TDS based on low molecular weight polyethylene (LMPE). The following facts unambiguously indicate the MIM in TDS solutions with additives: 1) new absorption bands discovered by UV spectroscopy, which are absent in the spectra of individual components; 2) the independence of the kinematic viscosity of the TDS from the concentration of additives of various chemical nature; 3) the specific electrical conductivity of copolymers - depressants, was not the sum of the electrical conductivity of the components selected for their synthesis. It is MMB that probably promote the formation of a copolymer with an unfolded conformation ("rods").

Some physicochemical indicators of diesel fuel and petroleum products, provided for by GOST 305-82 and TU 38.101889-00, are presented in table. 1.

Table 1.
Physicochemical indicators of diesel fuels

The name of indicators		Values of indicators for samples of diesel fuel and petroleum products					
		1	2	3	4	5	6
Cloud point, ^{0}C		-8	-6	-6	-6	+1	+4
Pour point, ^{0}C		-18	-17	-15	-12	-8	+1
Density at 20^{0}C, kg /m^3		814	837	836	838	825	855
Viscosity at 20^{0}C, mm^2/c		2,39	4,12	5,23	5,02	3,97	-
Aniline point,^{0}C		66,8	63,6	67,3	67,4	69,4	76,6
Fractional composition:		Boils away at temperature,^{0}C					
50 %		221	264,9	278	279	280	325
96 %		356	352,7	362	353	375	361
Content of n-paraffins complexed with urea C_p,% masses.		5,9	9,8	2,4	6,8	4,4	8,6
Content n-alkanes from their sum, % masses.	C_{12-15}	58,92	55,25	38,04	45,93	24,72	5,74
	C_{16-21}	35,12	41,36	53,53	48,35	64,91	78,17
	$C_{\geq 22}$	6,13	3,43	8,55	5,78	10,37	16,12
$k_1 = C_{12-15}/C_{\geq 22}$		9,61	15,87	4,44	7,94	2,38	0,35
$k_2 = k_1/C_П$		1,63	1,62	1,85	1,16	0,54	0,041

1 - component of diesel fuel of the Bukhara refinery; 2 - summer diesel fuel of the Bukhara oil refinery; 3 - year old diesel fuel of the Fergana oil refinery; 4 - winter diesel fuel of the Bukhara oil refinery; 5 - component of diesel fuel of the Fergana refinery; 6 - Bukhara diesel fuel of weighted fractional composition.

The efficiency of diesel fuel DP was evaluated by the change in the pour point and cloud point of diesel fuel with an additive content of 0.05-0.5% by weight. The pour point of diesel fuel was determined according to GOST 20287-91. The cloud point DF was determined according to GOST 5066-91. To illustrate the efficiency of DP in diesel fuels, Table 2. data on the maximum change in the pour point of diesel fuel and oil products are presented.

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Table 2
Depressant Effectiveness in Diesel Fuels

DT samples	Maximum pour point depression Δtz (0C) in diesel fuels in the presence of 0,05-0,5 % masses. depressants:					
	DP-NMPE	DP-NMPE-PBOO	DP-NMPE-PBOT	DP-NMPE-PBTO	DP-NMPE-PBTT	BNPZ Keroflux-6100
1	23	28	16	2	26	4
2	29	30	5	8	18	3
3	17	18	1	1	6	4
4	33	25	22	7	16	11
5	29	12	17	2	17	3
6	11	0	2	1	4	2

Comparison of the obtained data shows that the lower the initial pour point of diesel fuel, the higher the effect of reducing the pour point of diesel fuels, and the observed effect does not depend on the chemical structure of the additives.

DISCUSSION

The results obtained suggest that the process of interaction of additives with TDS occurs according to the adsorption mechanism. To confirm this, we investigated the dependence of the surface tension at the TDS phase boundary (σ) on the concentration of various additives based on NMPE (depressant-dispersing and multifunctional). It turned out that with an increase in the concentration of additives, "σ" TDS decreased, and the more, the greater the surface activity of the additives. This, firstly, proved that the investigated additives belonged to the surfactant class, and, secondly, indicated an increase in the stability of TDS in the presence of additives.

RESULT

The effect of depressants appears to be:

- in their ability at the moment of the formation of a dispersed phase in paraffin-containing systems to combine with dispersed particles of solid hydrocarbons by adsorption or introduction into the structure of crystals of solid hydrocarbons;

- in changing the size, shape and structure (molecular structure) of dispersed phase particles, and in some cases in increasing the solubility of solid hydrocarbons;

- in the creation of an energy barrier on the surface of solid phase particles due to repulsive forces of one nature or another, which, under certain conditions, prevent the attraction and coagulation of particles of a dispersed phase [4-6].

CONCLUSION

Thus, the experimental data obtained by us give reason to believe that all additives - NMPE work in the TDS according to a single mechanism. The essence of the mechanism is to increase the stability of the TDS, as evidenced by a decrease in the values of "σ" at its interface in the presence of additives.

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