UDC 665.75:665.7.03

FEASIBILITY APPLICATION OF DEPRESSANT-DISPERSANT ADDITIVES OF DIFFERENT MANUFACTURERS IN THE PREPARATION OF WAXY DIESEL FUELS

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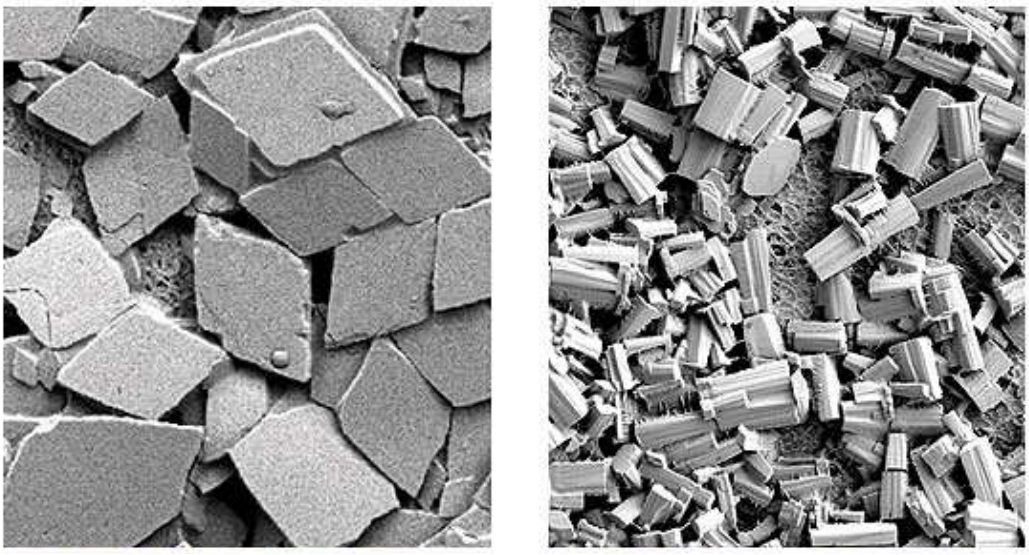
The article presents the results of the analysis of depressant - dispersant additives of different manufacturers in terms of reflecting the technical and economic feasibility of its using in the preparation of waxy diesel fuels. Results of the analysis of depressant-dispersant additives of different manufacturers on indicators displaying feasibility expediency in the preparation of waxy diesel fuels are reflecteded in this article. It is shown that for each diesel fuel it is necessary to select the corresponding additive. The result of this work is the assessment of domestic depressant production expediency for the operating capacities of petrochemical production, which satisfies physical and chemical requirements. It is simple on a way of synthesis and it is low-cost in production as basic components of an additive are products of industrial petrochemical production, i.e. low molecular weight polyethylene, which hasn't found any appropriate application so far.

Introduction. In many industrial applications additives are incorporated in compositions of interest. The additives are generally incorporated to provide a functional effect to the composition. For example, an additive may modify the physical properties of the composition, for example, the additive may modify the viscosity, or melting/boiling point, of the composition. The many different additives can be categorized in different ways based on the chemistry, purpose, etc. One convenient way of categorizing them is to group them as additives used to Aid Handling and Distribution, to Improve Fuel Stability, to Protect Engines and Fuel Systems and additives to Influence the Combustion Process. Some additives may influence more than one category and of course additives can be combined to produce multi-functional additive packages [1].

To increase the yield of diesel fuel the refiner must cut deeper into the crude feedstock, necessitating the use of flow improvers to restore the low temperature performance of the fuel. In cold regions the diesel fuels generally become more viscous than at the normal temperature and this leads to formation of wax crystals.

Of all the ways of improving low temperature properties of fuels and obtaining winter grades of diesel fuels, the most cost effective is the addition of depressant additives which provides the required improvement in the low temperature properties of fuels and increase in the rational use of resources for the winter grades of fuels. Hence, these pour point depressants are added to certain chemicals to prevent the fuel from forming this wax crystal structure. Wax crystals formed at low temperature can block fuel filters. Pipes and hoses can cut off the supply of fuel to the diesel engine. Wax crystals before and after using depressant additives are shown in Figure 1 [2].



a *b*

Fig. 1. Wax crystals: *a* – before using depressant additives; *b* – after using depressant additives

The low temperature operability additives can be categorized as follows:

- Flow improvers;
- Wax anti-settling additives;
- Cloud point depressants;
- De-icing additives.

Depressant-dispersant additives in the preparation of diesel fuels enable to:

- Treat discounted, high paraffin crudes & resids;
- Reduce cost associated with blending cutter stock with high paraffin oils;
- Improve pipeline flexibility by allowing transportation of highly paraffinic oils;
- Reduce heating in fuel distribution system;
- Avoid removal costs of solidified paraffin waxes;
- Reduce pumping costs;
- Upgrade value of resids / heavy fuels.

Clariant Chemicals (Switzerland), BASF SE (Germany), Evonik Industries (Germany), Afton Chemical Corporation (U.S.), Croda International (U.K.), Chevron oronite company LLC (U.S.), Croda International PLC (U.K.), Messina Chemicals (U.S.), Sanyo Chemicals Industries Limited(Japan), Lubrizol Corporation (U.S.), Infineum International Ltd (U.K.), Akzonobel (The Netherlands), and Innospec Inc. (U.S.), etc. are the biggest flow improver producing companies worldwide with a broad product range of fuel additives. Domestic and Russian depressant additives are unfortunately still not used consistently despite the fact that some of them have been widely tested confirming their high efficiency.

Methodology. Depressant additives contribute to the formation of small wax crystals and prevent the formation of spatial framework upon cooling of diesel fuel, which reduces its temperature filterable limit and cloud point The latter are surfactants having in its structure long aliphatic radicals and polar groups [3–7].

In order to identify the most effective additives the analysis of technical and economic indicators (Pour Point, Cold Filter Plugging Point , Cloud Point, Price at the optimum concentration of the account) most well-known and used in the practice of pour-point depressants is made.

Cloud Point (CP) is the temperature at which first crystallization is observed as a haze in a diesel fuel sample. Pour point (PP) is the temperature at which the fuel stops flowing and becomes solid. Cold Filter Plugging Point (CFPP) is the temperature at which the fuel stops flowing through a standard fuel filter. Reaching this temperature will cause handling problems with the fuel through the fuel system.

Results, discussion and conclusion. Table 1 shows the results of analysis of the technical and economic indicators (Pour Point, Cold Filter Plugging Point, Cloud Point, Price at the optimum concentration of the account) best-known and used in domestic refineries of depressants.

Table 1. – The technical and economic indicators most known and used in domestic refineries of depressants

Additive names	Cloud Point, °C	Pour Point, °C	Cold Filter Plugging Point, °C	Optimum concentration, wt.%	Price of 1 liter, USD	Price at the optimum concentration of the account
Dodiflow 8055	-22	-39	-32	0,5	6	3,00
Keroflux 5695	-22	-33	-28	0,3	3,5	1,05
Gunk M2216	-5	-23	-35	0,1	7,8	0,78
Total Stopogel	-5	-23	-39	0,4	5,5	2,20
Jetgo	-5	-14	-27	0,5	4,7	2,35

On the Belarusian refineries they use additives of a series Dodiflow (Clariant) and Keroflux (BASF) in the production of commercial diesel fuel. The main drawback of imported depressants used today in industrial environments is their high cost. According to the table 1 the most effective and economically advantageous depressants are Keroflux 5695 (BASF) with their low cost. These additives have excellent physical and chemical properties.

Research has established the fact that depressant and dispersant additives for diesel fuel may be produced using the polymers of waste products (for example, low molecular weight polyethylene as a pour point

depressant [8]) and dispersing additive (e.g., C-5A). Dispersing additives contribute to the retention of small crystals in the solid phase suspension and facilitate their uniform distribution throughout the volume of fuel.

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