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INVESTIGATING THE EFFECTS OF DEPRESSANT ADDITIVES ON THE LOW TEMPERATURE PROPERTIES OF PETROLEUM PRODUCTS

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The article is devoted to the study of the low temperature properties of petroleum products and the influence of depressant additives on former. The objects of the study are the summer mark diesel fuel produced by «ПетроКоммерцОйлКазахстан» and depressant additives* of *«AGA», «MANNOL», «FENOM», «CYCLO C-24» brands. Such physical and chemical characteristics of petroleum products as flashpoint, pour point, cloud point, cold filter plugging point and kinematic viscosity of pure diesel fuel at the presence and absence of depressor additives of brands listed above. The best performance among studied additives is shown by «MANNOL» brand additive.

Keywords: paraffin, viscosity, petroleum, depressant additives, pour point.

ДЕПРЕССОРЛЫҚ ҚОСЫМДАРДЫҢ МҰНАЙ ӨНІМДЕРІНІҢ ТӨМЕН ТЕМПЕРАТУРАЛЫҚ ҚАСИЕТТЕРІНЕ ӘСЕРІН ЗЕРТТЕУ

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Мақала мұнай өнімдердің төмен температуралық қасиеттерін зерттеуге және оларға арнаоған депрессорлық қоспалардың әсеріне арналған. Зерттеу объектісі «ПетроКоммерц ОйлКазахстан» өндірген жаздық дизель отыныны және «AGA», «MANNOL», «FENOM», «CYCLO C-24» маркалы қоспалар болы табылады. Мұнай өнімдерінің тұтану, қату, лайлану процессі, сүзу температурасының шектелуі және кинематикалық тұтқырлығын қамтитын негізгі физика-химиялық сипаттамалары келтірілген. Зерттелген маркалар арасында ең жақсысы – «MANNOL» бренді болып табылды.

Негізгі сөздер: парафин құрамы, қоюлығы, мұнай, депрессорлық қоспалар, қату температурасы.

ИССЛЕДОВАНИЕ ВЛИЯНИЯ ДЕПРЕССОРНЫХ ПРИСАДОК НА НИЗКОТЕМПЕРАТУРНЫЕ СВОЙСТВА НЕФТЕПРОДУКТОВ

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Статья посвящена исследованию низкотемпературных свойств нефтепродуктов и влиянию на них депрессорных присадок. Объектами исследования являются дизельное топливо летней марки с «Петро Коммерц Ойл Казахстан» и присадки марок «AGA», «MANNOL», «FENOM», «CYCLO C-24». Приводятся основные физико-химические характеристики нефтепродуктов, включающие температуру вспышки, застывания, помутнения, предельную температуру фильтруемости и кинематическую вязкость в отсутствии и в присутствии депрессорных присадок вышеперечисленных марок. Наилучшей присадкой среди изученных является марка «MANNOL».

Ключевые слова: парафин, вязкость, нефть, депрессорные присадки, температура застывания.

Introduction

The number of automobiles in Kazakhstan with diesel engine is gradually increasing over the last years. One of the main cases of that is that diesel engines are more environmentally friendly and show better performance compared to petrol engines [1]. It is estimated that usage of diesel fuel in Eurasia will increase by 2022 [2]. Increase in diesel fuel demand in the range of 1.9% per year is expected, while demand on petroleum is expected to lower. In countries besides Europe and USA demand on diesel fuel is expected to increase by 4% per year. In Asia, as well as in Kazakhstan, increase in demand of 5% per year is expected [3-4].

Diesel fuel is considered to be one of the most widely used types of fuel. Technological schemes of oil refining are quite complicated, therefore, using additives of various functional purposes is one of the most effective ways to increase operational characteristics of diesel fuel [5]. The amount of additives in oil products by mass usually reaches hundredth and tenth fractions of 1 percent, while for only few types of additives this can reach 1-2% and even higher. Deep modernization of oil refineries is not financially reasonable, while using fuel additives is significantly more efficient. Moreover, additives are easily transported, stored, and most importantly, additives can be introduced into the fuel in any step of technological process of production or usage of the latter. Using fuel additives helps to bring the characteristics of the fuel to desired standards according to certain regulations. Should be noted that usage of additives results in economic benefits and allows to obtain a fuel with required physical-chemical properties without significant costs. Additives help to maintain properties of fuel during transportation, storage and usage.

Of particular note is the fact that additives lower the environmental impact of fuel, while enhancing burning process of the latter. Ability of fuel to flow at low temperatures is one of the major contributors to the efficient engine operation in cold regions. Depressant additives affecting the low temperature properties of fuel are one of the most widely used types of additives. Petroleum products contain a certain amount of paraffin waxes.

At lower temperatures paraffins precipitate as small crystals, while the fuel becomes cloudy and unable to flow properly,

For summer mark diesel fuels cloud temperature and cloud filter plugging point must be below -5°C, while pour point must be below -10°C. Low temperature properties of summer mark diesel fuel produced by «ПетроКоммерцОйлКазахстан» at the absence and presence of the depressant additives of «AGA», «MANNOL», «FENOM», «CYCLO C-24» brands are studied in the article.

For winter mark diesel fuel in regions with temperate climate cloud point must be lower than -25°C, while pour point must be lower than -35°C. For colder regions these values must be lower by 10°C: for Arctic fuel cloud point must be lower than -35°C, pour point must be lower than -55°C and cold filter plugging point must be lower than 45°C.

Materials and research methods

The objects of the research in this paper are the summer mark diesel fuel produced by «ПетроКоммерц Ойл Казахстан» and depressant additives of the following brands: «AGA», «MANNOL», «FENOM» and «CYCLO C-24». The effect of additives on the fuel was studied by analyzing the main low-temperature characteristics of fuels via using physical and chemical methods of research. These methods are strictly regulated by the state standards. These standards define quality requirements for products, labor and service. The following characteristics of diesel fuel were investigated in order to find out the effect of additives on former:

- Pour point (ГОСТ 20287-91);
- Cloud point (ГОСТ 20287-91);
- Cold filter plugging point (ГОСТ 22254-92, fig. 1);
- Kinematic viscosity (ГОСТ 33-2016);
- Flashpoint in closed cup (ГОСТ 6356-75).

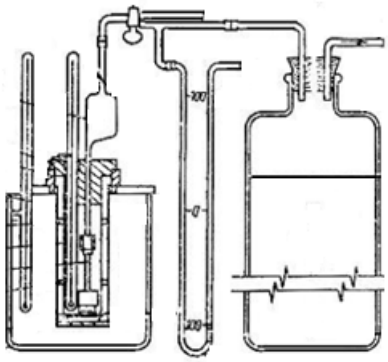

Figure 1 – Layout of a device for investigation of cold filter plugging point

Results and discussions

Cloud point, pour point and cold filter plugging point of pure diesel fuel and the diesel fuel with added «MANNOL» branded depressant additive are shown in table 1.

Table 1 – Cloud point, pour point and cold filter plugging point of pure diesel fuel and the diesel fuel with added «MANNOL» brand depressant additive.

Low temperature properties	Pure diesel fuel	Diesel fuel with «MANNOL» brand depressant additive
Cloud point, °C	-6	-6
Pour point, °C	-12	-35
Cold filter plugging point, °C	-9	-27

From the data in table 1 it can be shown that «MANNOL» branded depressant additive lowers the pour point of the diesel fuel from -12°C to -34°C, while cold filter plugging point lowers from -9°C to -27°C. Nevertheless, cloud point is not changed.

Cloud point, pour point and cold filter plugging point of pure diesel fuel and the diesel fuel with added «CYCLO C-24» branded depressant additive are shown in table 2.

Table 2 – Cloud point, pour point and cold filter plugging point of pure diesel fuel and the diesel fuel with added «CYCLO C-24» brand depressant additive.

Low temperature properties	Pure diesel fuel	Diesel fuel with «CYCLO C-24» brand depressant additive
Cloud point, °C	-6	-7
Pour point, °C	-12	-34
Cold filter plugging point, °C	-9	-10

From the data in table 2 it can be shown that «CYCLO C-24» branded depressant additive lowers the pour point of the diesel fuel from -12°C to -34°C, while cloud point and cold filter plugging point are not changed.

Cloud point, pour point and cold filter plugging point of pure diesel fuel and the diesel fuel with added «FENOM» branded depressant additive are shown in table 3.

Table 3 – Cloud point, pour point and cold filter plugging point of pure diesel fuel and the diesel fuel with added «FENOM» brand depressant additive.

Low temperature properties	Pure diesel fuel	Diesel fuel with «FENOM» brand depressant additive
Cloud point, °C	-6	-6
Pour point, °C	-12	-30
Cold filter plugging point, °C	-9	-9

From the data in table 3 it can be shown that «FENOM» branded depressant additive lowers the pour point of the diesel fuel from -12°C to -30°C, while cloud point and cold filter plugging point are not changed.

Cloud point, pour point and cold filter plugging point of pure diesel fuel and the diesel fuel with added «AGA» branded depressant additive are shown in table 4.

Table 4 – Cloud point, pour point and cold filter plugging point of pure diesel fuel and the diesel fuel with added «AGA» brand depressant additive.

Low temperature properties	Pure diesel fuel	Diesel fuel with «AGA» brand depressant additive
Cloud point, °C	-6	-7
Pour point, °C	-12	-29
Cold filter plugging point, °C	-9	-10

From the data in table 3 it can be shown that «AGA» branded depressant additive lowers the pour point of the diesel fuel from -12°C to -29°C, while cloud point and cold filter plugging point are not changed.

Conclusion

From the overall results of the study it is clear that «MANNOL» branded depressant additive shows the best performance among others. Using this brand of depressant allows to obtain diesel fuel with properties close to that of winter marks.

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