

References

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LOW-TEMPERATURE PROPERTIES OF GASOIL AND DIESEL OIL FRACTIONS IN COMPARISON

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Diesel fuel oil is a product of direct distillation of oil primarily used in internal-combustion engines. Gas-oil is a product of the distillation of oil or petroleum products sold as an additive in the diesel fraction and as a kind of fuel for boilerhouses and trucks.

In areas with a cold climate, the issue is which fuel is suitable according to this area for its best storage, transportation and operation. To determine the fuel pumping quality under refrigeration we have distinguished a number of indicators: setting point (Tz), cloud point (Tp), filtration temperature limit (Tf).

The aim of this work is the experimental determination of the low-temperature properties of samples of gasoil and diesel fuel oil fractions and their comparison for possible transportation, storage and use in places with low temperatures.

Six samples of diesel fuel oil fractions (DF) and gasoil fractions (GF) were taken as an object of study. Operational characteristics were determined for each sample in the research.

The study was carried out using a low-temperature indicator of petroleum products INPN SX-800.

The operation of the device is based on a change in the optical permeability coefficient of diesel fuel oils with a gradual decrease in sample temperature.

The setting point is explained by the content of high molecular weight paraffin hydrocarbons of a normal structure, which primarily precipitate upon cooling [1]. The dependence of low-temperature properties on the molecular weight of hydrocarbons is established: the more hydrocarbons with a high molecular weight the worse the performance of the fuel. This dependence can be shown on the example of reference data for hydrocarbons of the "Alkanes" class, collected in Table 1 [2].

The data on the low-temperature properties of the samples are shown in Table 2.

When analyzing sample №1, the following data were obtained: Tz = -8.3 °C, Tp = -6.8 °C, Tf = -14.2 °C. The indicators are negative; therefore, the sample relates to diesel fuel fractions.

The obtained values of sample №2 are worse in compared to №1. Positive temperatures Tz = 8.3 °C, Tp = 11.2 °C, Tf = 9.5 °C. The sample is a fraction of atmospheric gasoil.

Table 2. Experimental low-temperature properties of gasoil and diesel fuel oil fractions

Sample number	Tp*, °C	Tz**, °C	Tf***, °C
DFC №1	-6.8	-18.3	-14.2
GC №2	11.2	8.3	9.5
GC №3	10.7	11.3	8.8
DFC №4	-17.5	-24.1	-23.5
DFC №5	-23	-28.1	-24.3
GC №6	12.3	12.4	10.9

Table 1. Reference data on the dependence of setting point on the molecular weight of hydrocarbons

Alkane	Tz, °C
n-ethyl-methylethane	-129.72
n-hexane	-95.32
n-heptane	-90.6

Samples №3 are gasoil fractions, as evidenced by their high setting points. Their use is optimally as additives for diesel fuel oil fractions.

Samples №4 has negative setting points. From the results we see that these are diesel fuel oil fractions.

Sample №5 has the best low-temperature characteristics: $T_z = -28.1\text{ }^\circ\text{C}$, $T_p = -23\text{ }^\circ\text{C}$, $T_f = -24.3\text{ }^\circ\text{C}$. To achieve the greatest result, various additives can

be used. The use of this sample as winter fuel is more appropriate.

Sample №6 is the least suitable for use as automotive fuel.

Thus, in the course of this work, the low-temperature parameters of two fractions, diesel fuel oil and gasoil, were experimentally obtained. It was found that the fractions have significant differences in low-temperature properties, which depends on their hydrocarbon composition.

References

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CATALYTIC SYNTHESIS OF LACTIDE

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Over the last years, the society is increasingly concerned about global environmental situation which includes plastic pollution. The contamination of the Earth with plastic has a negative impact on life.

The development and appliance of able to decompose polymers under specified conditions is a solution to this problem. Biodegradable polymers are materials that are able to break down into innocuous to the environment compounds during certain natural microbiological and biochemical processes. Polylactide, produced from a lactic acid dimer, is one of the most widespread biopolymers [1].

Due to its biocompatibility and sustainability, lactide-based polymers are used in various areas of life, from the production of short-life servicing goods such as disposable tableware, plastic wrap to medical products, such as surgical sutures, pins and capsules for meds [2]. This polymer is widely used due to its bio-compatibility and ecological safety.

Synthesis of lactide, cyclic lactic acid dimer, is an integral part of the polylactide production. Conditions of that processes, such as pressure, temperature and use of catalyst, heavily affect the quality and properties of the derivable monomer.

The purpose of this work is to synthesize lactide from lactic acid in the presence of silica gel catalyst and to study its structure, composition and purity of the monomer obtained.

Lactide synthesis is executed in three stages and includes concentration and condensation of lactic acid, depolymerisation of lactic acid oligomer and purification of raw lactide.

Lactic acid was concentrated and condensed in Heidolph Laborota 4003 Control rotary evaporator in the presence of silica gel, with a particle size of 1 mm, 2 mol. %. Depolymerisation of the lactic acid oligomer was performed on a direct distillation unit under vacuum of 10 mbar. Purification of raw lactide was performed by recrystallization from ethyl acetate. The experimental conditions are shown in table 1.

The molecular weight of the oligomer was determined by the end-group method. The lactide structure was analyzed by Infrared (IR) spectroscopy. The purity of the monomer was evaluated using gas chromatography. Lactide is a substance existing in the form of two optical isomers: *L*-lactide and *D*-lactide. However, the forms of *meso*-lactide and racemic mixture of *L*, *D*-lactides are also known. Depending on its configuration, the substance has a different melting point (T_m). The T_m for *L*- and *D*-isomers is $96\text{ }^\circ\text{C}$, for racemic mixture and *meso*-form is 125 and $54\text{ }^\circ\text{C}$ respectively.

The investigation of obtained monomer structure (data of IR-spectrum) showed next: the absorption band in the area of $3,000\text{--}2,900\text{ cm}^{-1}$ indicates the presence of C–H bonds in the sample, the inten-