Using watered ethanol as fuel for a heat engine as an analogue of water-fuel emulsions

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Abstract: The advantages and problems of the use of bioethanol fuels, including the E85 fuel, are considered. It is proposed to use propylene oxide as a "trigger" for E85 ethanol fuels, which will significantly facilitate the launch of the cold engine and increase the phase stability of alcohol fuel. This allows the use of bioethanol Fortress 80% about. And above, on the one hand, it reduces the requirements for the moisture content in ethyl alcohol and reduces its production, and on the other, it acts an analogue of water-fuel emulsions.

Keywords: Bioethanol, propylene oxide, phase stability, octane numbers, evaporation.

The use of bio-ethanol fuels is currently gained, although the idea of alcohol fuel is far from Nova. So another Henry Ford on his famous Ford-T car provided a power system for three different fuels: gasoline, kerosene and alcohol. It was still at the dawn of motorization at the very beginning of the 20th century. Henry Ford considered the use of ethanol by a promising direction for American farmers, since the raw material for alcohol was mainly agricultural products and waste of these products [1].

Although today most cars are working on oil fuel, the use of bioethanol is becoming increasingly due to primarily the advantages that alcohol fuel gives. So alcohol fuel is a renewable resource, which can be obtained from almost any vegetable raw materials. Alcohol fuel can significantly reduce harmful emissions with exhaust gases. This applies mainly to CH, CH and NO_X. In addition, the use of bioethanol allows to significantly reduce greenhouse gas emissions CO_2, since it is considered that when combustion of bioethanol is distinguished as much carbon dioxide as it is absorbed by plants from which ethanol was produced during their growth.

An important advantage of alcohol fuel is its high octane number, which reaches 129.5 by the study method and 101.3 by the engine method, respectively [2]. It is clear that the maximum full of these characteristics will be implemented when using 100% alcohol, so actually occurs in

Brazil, where the alcohol fuel is widely used. In more northern latitudes, the use of E100 fuel becomes problematic, since the alcohol evaporates worse than the automotive gasoline, then at a temperature plus, 10^{o}C problems may arise with the engine start. This problem is solved due to the addition of gasoline alcohol or light-boiling hydrocarbon fractions, as a result, such a "starting fraction" and ensures the start of the engine at low temperatures. The most famous alcohol composition is an E85 alcohol fuel (in Russia it is marked as ED75-ED85 according to GOST R 54290-2010) [3]. This alcohol fuel is divided into summer and winter. Summer contains 74% ethanol and 17-6% of hydrocarbons and simple aliphatic esters as a "launcher faction". Winter contains 70% ethanol and 17 - 30% hydrocarbons and simple aliphatic esters as a "starting faction".

To use such fuel as E85, a special car nutrition system is needed to adapt to a specific amount of alcohol in the mixture. In practice, such a system is implemented in FFV cars (Flexible Fuel Vehicle). Today, such cars produced a large number. They can work both on gasoline, alcohol, and on any proportion of alcohol with gasoline and at the same time their price is slightly higher than basic cars.

When mixed alcohol with gasoline, especially in the presence of moisture and at low temperatures, you can encounter solutions between alcohol and hydrocarbon parts. Alcohol and hydrocarbons have low phase stability and the larger the moisture and below the temperature, the lower the phase stability. This problem is solved through the use of ethanol with low moisture content. Typically use bioethanol with a fortress of 98% and even higher. Such dehydration dehydration significantly increases the cost of alcohol.

To solve this problem, we offer not hydrocarbons as a "starting part", but a simple cyclic ester - propylene oxide [4]. Propylene oxide (PO) is a simple cyclic ester with a boiling point of 34.2°C and a density of 859 kg/m^3 at 200°C. Propylene oxide solves at the same time two problems - it is facilitated by starting the engine at low temperatures due to the low boiling point of the "starting part" and preventing the separation of alcohol and the "starting part". Experiments have shown that even when using alcohol with a fortress of 80% vol. bundle does not occur until minus 65°C. Thus, it is possible in alcohol compositions to use even raw alcohol, whose fortress is 88% about., Which will significantly reduce the cost of alcohol [5].

On the other hand, one can intentionally enter water into alcohol compositions in order to obtain an analogue of water-fuel emulsions.

In order to be convinced of this, the speed characteristics of the VAZ-2108 car were removed (sports car with an increased engine compression) during its work on various fuels. The

tests were carried out at the LPS 2020 power stand. The purpose of the test was the determination of power on various types of alcohol fuel. The results are presented in figure 1.

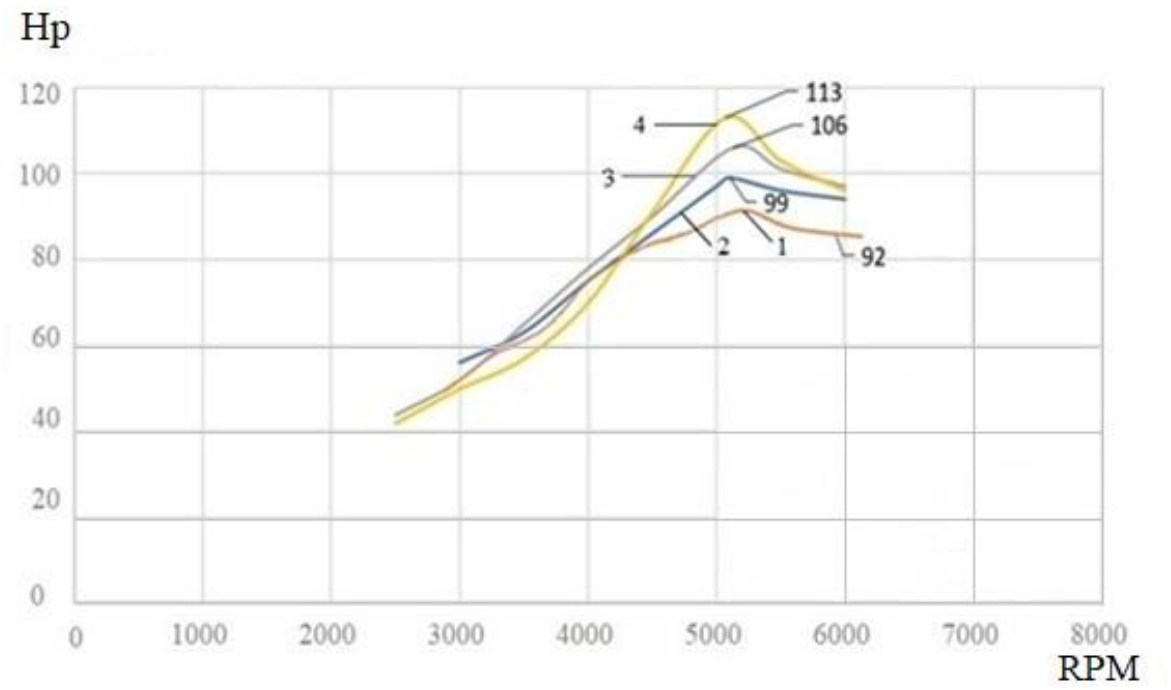

Figure 1. – Speed characteristics of the VAZ-2108 car on various types of alcohol fuel: 1- gasoline AI 98, 2- gasoline AI 98 + 5% propylene oxide, 3-ethanol fortress 95% + 5% propylene oxide, 4- ethanol Fortress 80% + 5% propylene oxide

As can be seen from the figure, we have the following results. First, Po helps increase power. So, on gasoline AI-98 with the addition of 5% Po, the maximum power was 99 l.s., while on the base gasoline AI-98 - only 92 l.s. Secondly, the power on alcohol fuels with the addition of PO turned out to be higher than on high-octane gasoline AI-98. It is clear that the conditions for combustion were not the same, since the settings of the on-board computer changed, taking into account the achievement of the best characteristics for each of the fuels, but the fact that bioethanol fuel can exceed the power of traditional gasoline. Thirdly, the best result in power was achieved on a highly flooded alcohol, with a moisture content of 20%. This finally proves that when using Po as a "starting faction" on water-related problems, you can forget and boldly use the usual ethyl alcohol with a fortress of 95%, while if excessive moisture is in the fuel tanks, it is not scary because it The total amount is unlikely to exceed 20%.

From the traditional point of view, everyone knows that water and fire are ontooganists, that is, the water is extinguished by fire, but experts know that the water introduced into the engine in the desired quantity has a positive effect on the combustion process and contributes to the increase in power and reduce fuel consumption. The question is only on how to submit water into the engine. Some feeds the water separately into the cylinders using special devices for this,

others add water directly into fuel, which in turn requires more and special emulsifiers that prevent separation of water and fuel. Such fuels were called water-fuel emulsions. Water-fuel emulsions are known for both engines with spark ignition and diesel engines. An approximate amount of water introduced into fuel is 10 - 20%. The use of bioethanol fuel, where the alcohol is used as an alcohol with a fortress of 80%, and as a "starting fraction" of propylene oxide, is an excellent analogue of the classical water-fuel emulsion. Only, there will be no problems with the phase stability of fuel, that is, it will not be smeared through the use of PO instead of hydrocarbons as a "launcher faction".

The use of water, if we are talking about classical water-fuel emulsions, gives the following advantages [6, 7]:

1. Reduced intake air temperature.
2. A sharp increase in the detonation fuel resistance (including low-quality and low-fusion).
3. Reducing harmful emissions by 60-80%.
4. Increased power by 15-20% and torque by 25-30%.
5. Reducing fuel consumption.
6. Cleaning inlet, combustion chambers, valves, pistons, turbines and spark plugs.

When water injected in a strictly dosed volume, provided that the water is sprayed with drops of less than 0.1mm, the engine begins to work otherwise. Water has a huge heat capacity, the water cools the collector and intake air, which becomes more densely, and, it means that more oxygen will fall into the engine and more fuel burns completely, and this is a direct path to increasing power. According to studies, the increase in power is 10-15% for gasoline combustion engine and 20-30% for diesel engines. Water, falling into a hot combustion chamber, evaporates and increases in volume of 1700 times, the pair pressure helps to move the pistons, i.e. Perform work, resulting in the engine torque increases. Couple cleans the exhaust manifold, valves, combustion chamber, pistons, turbines from Nagara, It turns out that with the injection of water you constantly wash the engine from the inside. Water injection increases the detonation fuel resistance, it means that you can use cheaper fuel without harm to the engine. Water injection saves fuel. According to some given, fuel consumption is reduced from 10 to 20%, depending on the type and power of the combustion engine.

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