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RECEIVING MIXED FUEL FOR POWER AIC

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The design of installation for mixed gasoline has been presented, the technique of operational trials of controlled group of vehicles on an experimental batch of mixed gasoline and commercial gasoline has been worked out.

Key words: hydrodynamic radiator, operational trials, mixed gasoline, trade gasoline.

Introduction. The problem of mixed gasoline production at present is relevant to developed European countries. Most countries, like Ukraine have shortage of oil and extend the practice of using mixed gasoline. Worldwide, about 85% alcohol is used for technical purposes, including 80% as a biofuel, which in its properties is almost not inferior to gasoline. Thus fuel bioethanol world market is growing by 20 ... 25% and, according to experts, the production and use of ethanol by 2020 will reach 120 billion liters per year [1, 2]. For Ukraine, a viable option is ethanol produced from grain raw material or molasses (withdrawal of sugar production). Today Ukraine really has 81 distillery with total capacity of 63.2 million tons a year, much of which is idle (according to the association "Ukrspirt" capacity utilization ratio in 2005 was 44%). With the presence of raw materials there are no problems - our distilleries can convert quickly enough for different species that vary depending on market conditions (wheat, rye, barley, maize [1,2,3]. The most common type of biofuel is ethanol fuel (ethanol) obtained by distillation of any substance containing starch (potatoes), sugar (sugar beet or cane) or cellulose (wood chips, straw, cotton husk, etc.). Mostly such grains as: rice, maize, wheat, rye and rapeseed are used for distillation.

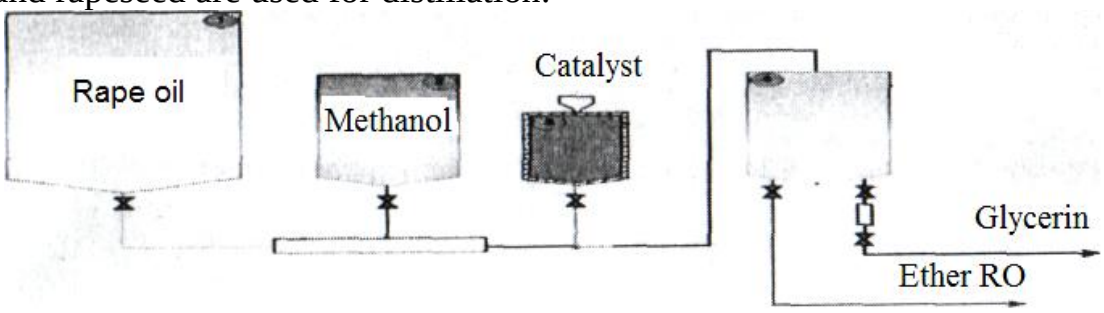

Fig.1. The scheme to obtain bioethanol from rapeseed oil.

Ethanol is obtained by microbiological (fermentation under the action of yeast enzymes or bacteria) or synthetic (ethylene hydratation obtained by product of oil in the presence of a catalyst) methods. Many countries on the production and use of biofuels play a significant part in the country all used motor fuel for use which are special adapters [1,3]. The leader of this is Brazil, which in 2000 brought the ethanol content in gasoline to 20% through technology "Deep Flex." This technology allows directly in front of dressing the car to choose the type of fuel -

gasoline or alcohol. The engine adapts automatically to the type of fuel, and no matter where ratios is used for oil gasoline, ethanol or a mixture thereof. Germany sold special device «Flex-Tex» to upgrade any car in order to use a mixture of ethanol and gasoline. For example, the cars "Volkswagen" are equipped by this system, and supplied to Russia [1, 3, 4].

Problem. The problem of mixed gasoline production at present is relevant to developed European countries. Most countries, like Ukraine have shortage of oil and extend the practice of using blended gasoline. Worldwide, about 85% alcohol is used for technical purposes, including 80% as a biofuel, which in its properties is almost not inferior to gasoline. Thus fuel bioethanol world market is growing by 20 ... 25% and, according to experts, the production and use of ethanol by 2020 on the planet will reach 120 billion liters per year [1,2,3].

Analysis of recent research and publications. For Ukraine, a viable option is ethanol produced from molasses or grain raw material (withdrawal of sugar production). Today Ukraine has 81 distillery with total capacity of 63.2 million tons a year, much of which is idle (according to the association "Ukrspirt" capacity utilization ratio in 2005 was 44%). With the presence of raw materials there are no problems - our distilleries convert quickly enough for different species that vary depending on market conditions (wheat, rye, barley, corn). December 22, 2005 the Verkhovna Rada of Ukraine adopted the Law of Ukraine "On amendments to some laws of Ukraine (relative to stimulate the production of motor gasoline mixtures)," which provides for the introduction of the term "ethanol" defines, the conditions of licensing of these products production and provides for the establishment of specific excise duty on motor gasoline mixtures with additives based on bioethanol, content of which is from 2 to 5%. Apparently, the potential for biofuel production in Ukraine, exists and it is quite high [1,2,3]. Bioethanol in most cases is a kind of additive to gasoline. This mixture of ethanol and gasoline is marked by letter E (ethanol) and the number that indicates its share in the fuel. The most common brands E5, E7. Use of such fuels does not require to make changes to the design of the gasoline engine, but the brands E85, E95 and E96 with ethanol content of respectively 85.95 and 96% - require special modification of the power supply system and ignition of the car. Use of ethanol can not only reduce oil dependence of state and emissions of carbon dioxide from exhaust, but also increase the detonation resistance (octane) of petrol used and to lower content of toxic aromatic hydrocarbons (Table 2). The use of ethanol in motor gasoline composition entails a number of difficulties in the organization of production, storage, transportation and use of gasoline-ethanol fuels. This is due to phase instability (separation during storage) of gasoline with ethanol additive, corrosion activity relative to metallic materials and aging of rubber products as in vehicle fuel systems so in gas stations, as well as a tendency of fuels to the accumulation of deposits on inlet valves and fouling in the combustion chamber (table 3). Bioethanol as fuel is neutral as a source of greenhouse gases. It has a zero balance of carbon dioxide as in its production by fermentation and further combustion it is released as much CO2, as much this was due to the atmosphere used for its

Table 1. **Parameters of ethanol compared with gasoline**

Fuel	Density, kg / l	Heat-conducting ability (20 °C) MJ / kg	Viscosity (20°C) mm2 / s	The octane number	Flashpoint (°C)	Fuel equivalence
Gasoline	0,76	42,7	0,6	92	< 21	1
Bioethanol	0,79	26,8	1,5	> 100	< 21	0,65

Table 2. **Physical and chemical properties of the gasoline with ethanol additive**

Indicator	Gasoline	Gasoline + 10% bioethanol
Detonation stability (octane number)		
by the motor method	83,3	85,6
on research method	92,6	95,4
Saturated vapor pressure, kPa	37,3	45,1
Losses from evaporation,%	0,45	0,5
Corrosion activity (change in mass of lead plate), g / m^2	0,55	0,7

production plants. Oxygen contained in ethanol oxygen, allows to burn better fuel hydrocarbons, 10% ethanol content in gasoline allows for a more complete burn of fuel hydrocarbons, 10% ethanol content in gasoline can reduce exhaust of particulates up to 50% of CO , emissions by 30%.

Table 3. **Formation of deposits in the engine when using ethanol**

Gasoline	The part of the ethanol volume%	The deposits on 1 valve mg	Thief in the combustion chamber in a cylinder mg
Ai-92	0	76	404
Ai-92	5	90	366
Ai-92	10	97	406
Ai-92 + 0.04% cleaner	10	5	460

The purpose of research: Mixed gasoline with ethanol is promising for gasoline engines. Currently the main sources are oil, natural gas and coal but reserves of these sources are depleted quickly and energy got through them gets constantly more expensive. In addition, at the burning of fossil fuels, a large number of compounds hazardous to people is emitted in the air the concentration of carbon dioxide that increases the greenhouse effect quickly increases.

Results of researches. Blended gasoline is produced by emulsification of low octane gasoline (type A-76) with ethanol. As a result of this process the octane

number (adequate mix of gasoline A-92, A-93, A-95) increases depending on the percentage of ethanol is usually added from 8 to 20% by weight. The component of rough emulsion [3,4,5] comes in to the nozzle under pressure 0.6…1.0 MPa. As a consequence of stream clamping at output edge of nozzle vacuum is set equal to the saturation pressure of one of the components of mixing at a given temperature. The flow of environment boils and creates hidrodyspersed emulsion 5...10 microns. The resulting crude emulsion is sent to the antechamber, where it is turned into a stable narrow stream, which occupies the entire cross section of pre-chambers [3,4,5]. When flowing out of this stream in the mixing chamber, as a result of an increase in cross-sectional area of the channel, the flow of the emulsion breaks away from the walls and forms a free leak with a free outer limit. Between the wall of the channel and the stream limit complex intense vortex fluid motion is formed. In the vortex zone high longitudinal pressure pulses from 0 to 10 thousand atmospheres that crush emulsion particles take place [3]. The average integrated value of pressure is equal to pressure of saturated easily evaporating component, due to this in the zone of stream separation gas phase is formed, as a result of continuous accounting across the mixing chamber homogeneous gas-liquid two-phase flow is formed [3,5,6]. In the next flow motion in the mixing chamber, its speed decreases and pressure increases when reaching the pressure, greater than the saturation pressure at a given temperature of the mixture which is in a state of two-phase the avalanche-formed condensation of gases is formed. This forms spector of oscillations of different physical nature including ultrasound, contributing to break new gas bubbles, which in turn explode and give rise to new variations, there is avalanche-formed process of gas bubbles explosion, causing strong ultrasound field, jump of condensation is accompanied by a jump in pressure and density [3,6,7]. In this emulsion processing at the output device is a homogeneous monodisperse with a size pieces 0,1 ... 0,4 mm. Hydrodynamic radiation converts the energy of turbulent flooded fluid current into energy of acoustic waves. Work of hydrodynamic radiator is due to generate excitations in liquid medium in the form of a velocity field and types in the interaction of coming out of the nozzle current with obstacle of appropriate shape and size or with involuntary alternating leakage of current. These excitations form opposite effect on the basis of current in the nozzle, by installing self-oscillating mode. The mechanism of sound radiation by excitations may vary depending on the design of hydrodynamic radiator, which is different from the design of gas-stream emitters for air, while the hydrodynamic emitters are called liquids whistles. [7] Pulsation of cavitation field creates variable velocity fields and pressure that excite vibrations in bending rods on their own frequency, which contributes to radiation, increases its intensity [6,7]. Ultrasound provides a highly dyspersed (average particle size of micron and micron), uniform and chemically pure suspension. For the formation of ultrasonic dyspergiration cavitation is necessary. Fragmentation of substance take place under the action of shock waves arising when slamming cavitation cavity. Dyspergiration begins at intensity ultrasound, mixing a certain threshold meaning. The value of which is several watts/cm^2, depending on the

cavitation strength of fluid, and the nature and magnitude of the interaction forces between the individual parts. The degree of cavitation typical to its leaking and impact can change at variation of gas in liquid, hydrostatic pressure, which opens up the ability to control cavitation. In the cavitation region there are strong hydrodynamic excitation like a strong pulse compression (microshock waves) and micro streams created by pulsating bubbles. In addition, slamming of bubbles is accompanied by a strong local heating of the substance and evolution of gases containing ionized atmospheric and components. As a result, the chemical in cavitation is subject to intense field influences. Relying on the experience a hydrodynamic unit for production of mixed gasoline in terms of the agricultural sector has been developed [5.8]. Schematic diagram of the pilot plant for the production of mixed gasoline is shown in Figure 1. In order to obtain mixed gasoline with ethanol in terms of filling stations, transport companies, oil enterprises agribusinesses, farms a small-sized installation was developed. Completeness - hydro stations, jet pump dispenser, emulsifier, test equipment, connecting hardware. As hydropower a plant USZH-01PS is used. Inkjet pump ejector of dispenser type.

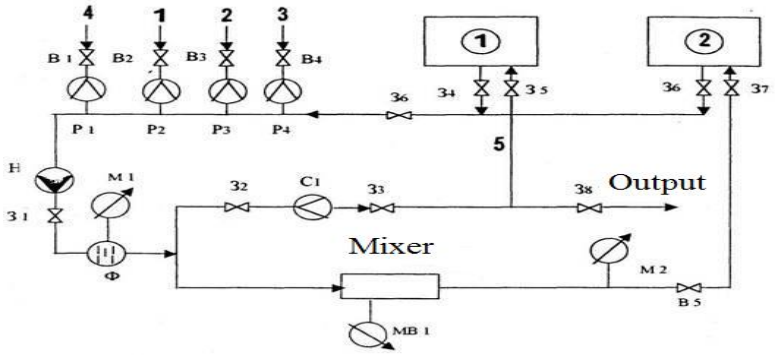

Fig.2. Apparatus for preparing mixed gasoline:1- petrol 1, 2- petrol 2, 3- petrol 3, 4 -CAR, 5-line of petrol return; 1- capacity of 1, 2 capacity 2, M1, M2 to pressure gauges on the pump after mixing; f- filter C1 counter, MO manovakuumetr, P CAR level control in tanks, P1 ÷ Z8- valve, B1 ÷ V5- valve, P1 ÷ R4- measurers, H pump.

Emulsifier is a monoblock consisting of twenty parallel-connected, hydrodynamic cavitators, two distribution manifolds, valves and measuring instrumentation (pressure gauges, thermometer). Technology of obtaining hydrodynamically active mixture is based on the dosage and dispersion of ethanol with petrol of petroleum origin. The amount of ethanol in these mixtures is 8-22% (depending on the octane number of gasoline mixed). The process of obtaining of mixed gasoline consists of the following stages: preparation of raw materials (ethanol); dosing and dispersion of ethanol in gasoline stream; input analysis and determining of product quality; final analysis and certification of the finished product. To assess the effectiveness of the installation the method and program of bench and performance testing of gasoline engines of various brands of cars has been composed. The purpose of field trials of controlled vehicles on an experimental batch of mixed gasoline and commercial gasoline: - Comparison of actual performance properties of mixed and

commercial gasoline in a real operation of vehicles; - Assess the impact of gasoline on traction-speed and dynamic properties, environmental performance and fuel efficiency of vehicles in real life; - Assess the impact of mixed gasoline on the reliability and dependability of engines and other units and systems of vehicles in real life; - Assessment of the impact of long working hours for cars with mixed gasoline on resource performance of engines and their systems, as well as physical and chemical properties of motor oil; - Assess the impact of mixed gasoline on ecological safety of drivers and passengers; - Determine whether the content of harmful substances in the air of the passenger cabin or car interior is correspondent to requirements of applicable standards; - Determining the characteristics of operation cars with mixed gasoline. While carrying out the performance tests we define physical-chemical properties (including anti-knock properties for the motor by ISO 511 and ISO on research by 8226) of all samples of mixed gasoline and most marketable gasoline samples, using which the vehicles test are carried out. This is determined by matching the physical-chemical properties of samples of mixed and commodity fuel to requirements TU 00149943.501-98 "Petrol with high end boiling" and GOST 2048-77 (only commodity gasoline). Physico-chemical properties of the samples of mixed and commodity gasolines A-76 and A-92 are determined by standard methods in accordance with the requirements of TU 00149943.501-98 and ISO 2048. Determining of the actual fuel consumption of cars of controlled group by the performance of the transport work on mixed and commodity gasoline is carried out by the static processing of forms for registration of vehicles, fuel and lubricants and implementation of transport work. Samples of fuels: -mixed high-octane gasoline by TU 00149943.501-98 "Gasoline with higher boiling end point", containing 92% of commodity gasoline A-76 and 8% of high octane oxygen-containing additives according to TU U 18.475-98. - mixed low octane gasoline by TU 00149943.501-98 "Petrol with high boiling end point", which contains 50% of commodity gasoline A-76, 42% stable gasoline (with condensate) and 8% of high octane oxygen-containing additives according to TU U 18.475-98 .-product gasoline A-76 and A-92 according to GOST 2084-77 and TU 00149943.501-98 "Petrol with high boiling end point."

Table 4. **The test results for samples of gasoline A-92**.

Name of indicators	The rate under the sun for products	In fact, the test results obtained	HT to test method
. Detonation stability: - the octane number by research method	≥92,0	93,1	GOST 8226-89 TU 00149943.501-98
- The octane number by motor method	≥82,0	85,0	GOST 511; ГОСТ 2177-82
. Fractional composition: early distillation temperature ^{0}C	≥30,0	40,0	TU 00149943.501-98
10% of gasoline is distilled at a temperature of ^{0}C,	≤75,0	53,0	TU 00149943.501-98

50% of gasoline is distilled at a temperature of ^{0}C	≤120,0	91,0	TU 00149943.501-98
End of boiling gasoline, ^{0}C	≤215,0	200,0	
The residue in the flask,%	≤1,5	0,8	
Balance and loss,%	≤4,0	1,5	
3. Vapor Pressure, kPa,	≤79,9	60,2	GOST 1756-85
4. Number, mg KOH per 100 ml petrol	≤3,0	0,68	GOST 2084-85
5.Concentration of actual resins in mg per 100 cm^3 petrol: - on-site of consumption	10,0	4,3	TU 00149943.501-98.
6. Mass fraction of sulfur,%	≤ 0,05	0,05	GOST 19121-98
7. Test on copper plate	Maintains	Maintains	GOST 6321-96
8. Content of water soluble acids and alkalis	Absence	Absence	GOST -6307--98
9. Content of mechanical impurities and water	Absence	Absence	00149943.501 98
10. Color	Colorless, pale yellow	Colorless, pale yellow	00149943.501 98
11. Density at 20^{0}C kg / m^3	Not standardized	≤746,0	GOST 3900-85

To conduct field trials under each contract the controlled group of vehicles of the company explorer is created, which should include in its membership at least 5 trucks, buses, or at least 5 cars. Preferably the group of controlled cars must include 3 of the vehicle designed to run on high-octane gasoline (A-92, A-93), 5 cars designed to run on gasoline A-76. Table 4 shows the results of test samples and comparison of compliance U00149943.501-98 for gasoline A-92. Car Mixture gasoline A-92 by the main controlled indicators of quality meets the requirements of TU 00149943.501-98.

Conclusions. Mixed gasoline with ethanol was tested under conditions of ordinary use on cars in the controlled group during all seasons. Average mileage reached 16,000 km. According to the results of tests encouraging results compared to gasoline trade were obtained, namely: - engine output increased to 2.5% while reducing fuel consumption up to 3%; - emissions reduced by 26,3%, CmHn - on 4,5%, NOx - 5.7%; - start of the engine is reliable and easy at zero temperature, "normal" - with negative (to -25^{0}C) ambient temperature; - reliability of the engine is not reduced; - frequency of oil change in case, is not reduced their physical and chemical properties do not deteriorate. Summarizing the results of the research it can be noted that the method of testing of mixed gasoline allows you to compare actual performance properties of mixed and commodity gasoline in a real operation

of vehicles, assess the impact of mixed gasoline in traction and speed and dynamic properties, environmental performance and fuel efficiency of cars, assess the impact of long working hours cars on the mixed gasoline on resource performance of engines and their systems, physical and chemical properties of engine oil. Developed hydro-dynamic system can be used in agricultural production for production of mixed gasoline.

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ПОЛУЧЕНИЕ СМЕСЕВОГО ТОПЛИВА ДЛЯ ЕНЭРГЕТИКИ АПК

Уминский С. М., Житков С.С.

Ключевые слова: гидродинамический излучатель, эксплуатационные испытания, смесевой бензин, товарный бензин.

Резюме

Представлена конструкция установки для получения смесевого бензина, разработана методика эксплуатационных испытаний контрольной группы автомобилей на испытываемой партии смесевого бензина и товарных бензинах.

TECHNOLOGY OF RECEPTION MIXED FUEL

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Key words: a hydrodynamical radiator, operational tests, gasoline, commodity gasoline.

Summary

The design of installation for reception of the mixed gasoline is developed, the technique of operational tests of under inspection group of automobiles on a researched party of the mixed gasoline and gasoline is submitted.