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THE USE OF BIOFUELS IN ENERGY AIC

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For the development of domestic production of biofuels is an important global trend in the consumption of fuel resources, which is moving toward becoming more active use of biofuels, primarily ethanol and biodiesel. The current level of technology development allows almost any engines use gasoline with 10 percent ethanol and diesel with percent biodiesel content.

Key words: motor fuel, biofuel, bioethanol, biodiesel, petroleum, commodity gasoline.

Introduction. In the baseline scenario of development of Ukraine for 2030 and growth in demand for oil expected to smooth demand and gradual development to support the use of biofuels [1]. Expected natural increase in the share of diesel transport, replacing traditional petroleum liquefied and compressed gas for vehicles with high annual mileage, the use of mixtures of gasoline with bioethanol and appearance of cars with hybrid drive (with methane-diesel engines as well as engines that consume mixtures high in biofuels). The volume of demand for gasoline in 2030 will increase to 6.3 mln. Tons, diesel fuel - up to 10.1 mln. Tons, and for kerosene (kerosene) - to 1.0 mln. Tons. However, today the market biofuels in Ukraine is underdeveloped, while bioethanol is the only one for which there is public support for the legislative framework for the use of fuel ethanol. Thus, under Article 2 of the Law of Ukraine "On alternative fuels" [2] introduced gradually increasing regulations specified proportion of the production and use of biofuels and blended fuels the engine. Under the Act [2], CMU redesigned 7 distilleries for bioethanol production Ukraine and planned redevelopment is 5-distilleries, as under the legislation of Ukraine, the simultaneous production of ethyl alcohol and ethanol forbidden food.

Table 1. **Project dynamics of production and consumption of biofuels in the 2010-2030 biennium. Mln. Tons (according to the Decree of Cabinet July 24, 2013 №1071-p)**

Type of biofuels	2010	2015	2020	2025	2030
Bioethanol	<0,1	0,3	0,6	0,8	1,1
Biodiesel	~0	~0	<0,1	0,3	0,8
However, the consumption of biofuels	<0,1	0,3	0,6	1,1	1,9

To ensure the implementation of the Law [2] by investment funds in productive activities for the production of ethanol and bio-components produced 7 distilleries complete with total capacity of 103.6 ths. Tons per year. In particular, Naumovskiy distillery - 9500 tons / year; Ivashkivskyy distillery - 11,600 tons / year; Gaysinskiy distillery - 10,600 tons / year; Bar alcohol plant - 11,000 tons / year; Chervonenskiy plant food products - 7100 tons / year; Khorostkiv sugar-refineries

MPD GP "Ukrspirt" - 47400 tonnes / year; Luzhanska MPD GP "Ukrspirt" - 6400 tons / year. The total production capacity of bioethanol and components of alternative motor fuels listed distilleries in 2014 was about 150 000 t / year [2].

Problem. For the development of domestic production of biofuels is an important global trend in the consumption of fuel resources, which is moving toward becoming more active use of biofuels, primarily ethanol and biodiesel. The current level of technology development allows almost any engines use gasoline with 10 percent ethanol and diesel with 7 percent biodiesel content. Consumption of mixtures with a higher content of biofuels depends on the type of motor vehicle and may require replacement of elements of the engine and fuel system.

Analysis of recent research and publications. By 2020 global demand for biofuels (bioethanol, biodiesel) will be about 10% of total motor fuel consumption. This is supported by official state programs adopted in different countries. The EU aims for 2020 to switch to at least 10 percent biofuel blends; Canada plans do2015 g. Use fuel with 10 percent ethanol content, and the US - with 15 per cent. Brazil, where the proportion of ethanol consumption now exceeds 25% of the total consumption of motor fuels, aims to 2013-15 biennium. A switch to fuel with 5 percent biodiesel content.

The purpose of research. Ukraine has a great potential of bioethanol and biodiesel from rapeseed and soybean (rapeseed and soybean biodiesel), straw cereals (cellulosic ethanol), as well as substandard wheat, corn, and so on. Especially valuable raw material for bioethanol production in Ukraine is a sugar beet (extremely high level of yield from 1 ha of crops) and tsukryste sorghum (compatible with plant drought in parts of southern Ukraine). This potential is caused by the presence of suitable agricultural land, favorable climate, increasing yield potential, the ability to reduce costs by utilizing economies of scale and the possibility of closer integration of Ukraine with the European economic and technological space. Given these factors, Ukraine could become an important participant in the European market of biofuels, grow the appropriate crops and actively develop its own production.

Results. Ukraine has significant potential biomass available for energy - about 24 million tons. / Year. Biomass utilization technologies are at the beginning of its development in Ukraine and have good prospects for commercialization in the near future, especially in the world of increase in the cost of natural gas. Biomass makes it possible to produce electricity in addition to heat and liquid (biodiesel and bioethanol) and gaseous (biogas) fuels from biomass. The production of energy from biomass in most cases there is a direct replacement of natural gas (100%). For comparison, the production of electricity from renewable replaced only 17% of natural gas consumption in Ukraine since about 17% of electricity is generated by burning natural gas [3]. Another export-oriented trend in biofuel sources in Ukraine is the development of biodiesel. When using biodiesel in blends with petroleum diesel fuel (B30 - B95) can be obtained the following environmental benefits of diesel automobile engines [3]: - emissions of sulfur dioxide and sulfur can be reduced by about 30%; - Biodiesel does not contain aromatic compounds polluting the environment; - Harmful effects on humans exhaust is much lower

than with petroleum diesel fuel; - Biodiesel is biodegradable in the environment for 25-30 days, while 1 kg of mineral oil products can contaminate almost 1 mln. Liters of drinking water and destroy it all flora and fauna; - In biodiesel exhaust volume of toxic organic compounds is only 10% and 20% of particulate matter, carbon dioxide and carbon monoxide emissions of only 10% compared to petroleum diesel fuel; - Disadvantages are more 10% level of nitrogen oxides in exhaust gases of levels for diesel oil and possible impact on microbial resistance biofuel storage, due to its organic origin (from vegetable oils) and excessive water content; - Additional disadvantage is the reduction in engine power up to 5% with B30 up to 12% at V70, which leads to raise fuel consumption by 5% and 10%, respectively. From an economic point of view today in Ukraine technology [26]: a) the market price (including VAT) selling diesel at gas stations - 960,15 USD / t; b) the cost of production of biodiesel from rapeseed oil - 714,24 USD / t; c) production cost of biodiesel from sunflower oil - 746,93 USD / t; d) the cost of biodiesel production from soybean oil - 1143,3USD/ton. According to comparative data: - biodiesel from rapeseed oil produced in Ukraine, the price can be competitive in the export price of 1150 USD / ton to the cost of petroleum diesel fuel in most developed EU countries, given that Europe excise tax on imports of biodiesel - not available , while the high cost of petroleum diesel explained 50-70% excise duty on the import of oil to Europe; - Biodiesel from soybean oil will be at a price - uncompetitive and biodiesel from sunflower oil have worse environmental performance compared to biodiesel from rapeseed oil (tab. 2).

Table 2. **Environmental Specifications blends of biodiesel with petroleum diesel.**

Type biodiesel	Contents biodiesel oil diztoplive	Increase concentration Nox	Decrease concentration Cox	Decrease smoke emission / hard part
Sunflower biodiesel	30% (B30)	+ 10,0%	– 3,0%	–
Sunflower biodiesel	70% (B70)	+ 21,0%	– 41,0%	–
Rape biodiesel	5% (B5)	0%	– 3%	-3%
Rape biodiesel	10% (B10)	-2%	– 7%	-5%
Rape biodiesel	30% (B30)	-10%	-20%	-10% / (-42%)
Rape biodiesel	100% (B100)	-15%	– 40%	-19%

Consider the impact of some physico-chemical characteristics of biodiesel, definable standard EN 14214: 2004, the parameters of the diesel and its ecological and performance. Increased compared with diesel fuel density by 10% and kinematic viscosity of 1.5 times contribute to a slight increase (14%) and long range fuel torch diameter droplets sprayed fuel, which can lead to increased biodiesel falling on the walls of the combustion chamber and the barrel cylinder. Smaller values of compressibility biodiesel lead to an increase actual angle of fuel injection and maximum pressure in an atomizer. The high cetane number of biodiesel and 51 more delay period helps to reduce inflammation and less "tough" job engine. The increased almost 3 times, the flash point of biodiesel in closed crucible 120 C or more for high fire safety. Oxygen (10%) in the molecule methyl ester operates in the following areas. The presence of oxidant molecule directly

into the fuel combustion allows to intensify the process and ensure a higher temperature in the cylinder diesel engine, on the one hand, promotes effective indicator and engine efficiency, and with another - leads to some increase nitric oxide NO2 in the exhaust gases. Less carbon fate (-77%) in the molecule of biodiesel leads to the reduction of its NCV by 13-15% and increase the hours and specific effective fuel consumption. To maintain the specified engine when switching to biodiesel fuel equipment required adjustment (focusing rail high pressure fuel pump to re-establish the increase in fuel cyclic presentation) [4,5,6]. The use of biodiesel allows for reduction of harmful emissions of exhaust gases. For diesel engines vortex chamber (peredkameroyu) and direct injection reduction respectively is: C - 12 (10)% SnNm - 35 (10)%, RM (solids) - 36 (24)%, soot - 50 (52) %. Slight increase in emissions can be offset N02 series of measures: reducing the actual angle of fuel injection, exhaust gas recirculation. When using diesel engines on biodiesel must pay attention to the following. Before operating the engine on biodiesel must be washed filter coarse and fine clean fuel. Because of the increased aggressiveness of biodiesel fuel hoses should be replaced and gaskets are made of a material resistant to biofuel and biodiesel thorough removal that gets on coatings. In some cases, need more frequent replacement of engine oil due to the potential dilution of biodiesel entering into it. Perhaps a slight increase in noise and smoke during cold starting at low temperatures requires the use depressor additives. It is necessary to control the water content in biodiesel (due to its large water absorption) to avoid the risk of microbial growth, formation of peroxides and the corrosive effects of water, including the elements fuel system [4,5,6,7,8]. The driving force of the AIT is energy consumption by the internal combustion engine makes a power tool torque which by means of transmission is transmitted to the driving wheels and creates a traction force. Torque engine also consumes to drive the working machine through the drive shaft.

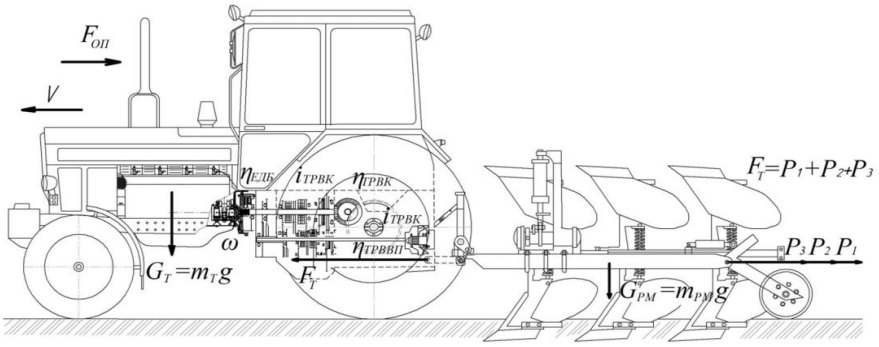

Fig. 1. Diagram MTA.

When using biodiesel decreases the effective efficiency of the engine. The ratio of diesel fuel and biodiesel is inversely proportional to their net calorific value and effective efficiency of the engine at the appropriate kind of fuel [4,5,6,7,8]. When complete combustion of fuel in the cylinder the maximum effective efficiency of the engine will be determined by the actual ratio of net calorific value of biodiesel and diesel fuel. Found that while working on biodiesel dynamic engine tractor generally deteriorating. Quantitatively this process was evaluated using tractor unit consisting HTZ- 221 engine MD-19 and G plow IPT 4.1.35. During the experiments, the engine consistently worked to clean SE, pure methyl ester and

mixtures of these components -50: 50, 60:40, 70:30 and 80:20. DP, and mixtures of these components came directly to the fuel pump motor with tank mounted on tractor fuel tank measurement. The study was conducted under the following conditions: air temperature +33,5 ° C; DP temperature - 30,0 ° C; METAL temperature of 30,0 ° C; DP- density of 0.823 g / cm3; IU density - 0.867 g / cm3; Soil - 1.39 g / cm3; soil moisture - 16.5%; set plowing depth - 24 cm. With tachometer determined the minimum, maximum and idle speed turns steady motion mode, arable MTA. Increasing the number of IU fuel increases the dispersal of arable unit (Fig. 2). If the tractor engine on pure GP this value was 4.8 pp, in the case of a mix 50:50 it grew to 5.5 s, ie 16.6% pa. When the ME engine on pure arable MTA acceleration time increased to 7.2 seconds, more than a mixture of DMI and, accordingly, PA 28.5 and 50.0%. Curves acceleration tractor unit, where the tractor worked pas mixtures other than 50:50, enter the interval between the lines 1 and 2 (Fig. 2).

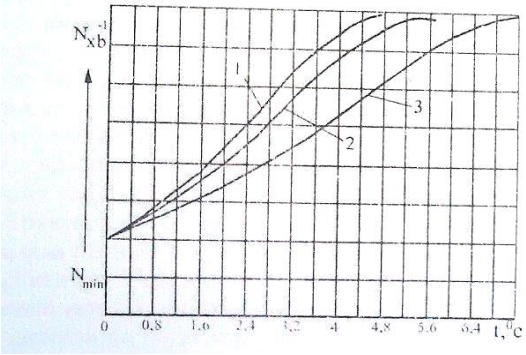

Fig. 2. Curves MTA acceleration when the engine tractor HTZ-121 on different fuels: 1 GP; 2 SE blend of IU in the proportion of 50:50; 3 ME.

The object for pilot studies served MTA consisting tractor HTZ-121 with dual tires "23.1 Y26, central clutch SP-16 and two cultivators KPS-4 eighth harrows BZTS-1.0. These laboratory and field studies conducted for cultivation plowed fields. Experimental field broke into two credits section length of 250 m each. Working speed unit limited power capabilities of the tractor and the dynamics of its vertical vibrations. during the course of the study were recorded: the passage unit record area density of soil track tractor working width MTA ; height difference fuel levels in the tank measuring before and after the experiment [4,5,6,7,8]. during a measurement tractor engine worked at DE, and during the second - a mixture of SE and ME at 50:50. Both measurements carried out during the operation of the unit in the same field. as the results of operational and technological assessment (Table 3), performance units when the engine tractor as the DP, and the biodiesel almost identical. The resulting difference of these indicators are statistically insignificant. Almost identical is the maintenance and other technical indicators, except in specific fuel consumption. When the engine on biodiesel were 2.75% more [4,5,6,7,8].

Table 3. **Operational and technical performance of the MTA.**

Indicator	The value for the MTA during operation	
	In diesel	In biodiesel
Working width, m	7,7	7,7

Working speed, km / h.	7,2	7,1
Productivity ha / year.		
- basic	5,54	5,54
- alternate	4,1	4,15
- operational	3,93	3,88
Labor, people. hr. / hectare	0,24	0,24
Cultivated area, ha	33,5	25,1
Fuel consumption, l / ha	3,89	4,00
Operational and technological factors:		
- the use of alternating time	0,74	0,75
- the use of operating time	0,71	0,7
- the reliability of the process	0,96	0,96
- the use of working strokes	0,87	0,86

Thus, the direct-injection diesel with vegetable oils can not be used for a long time because they do not burn completely degrade the quality of diesel oil by mixing promote the formation of coking products that cause deposits on injectors, pistons and piston rings. In peredkamernyh vyhrekamernyh diesel and prolonged use of vegetable oils pas seemingly zdayetsya possible because extra oil is heated before ignition, which promotes better mixing of air and combustion povnishomu.

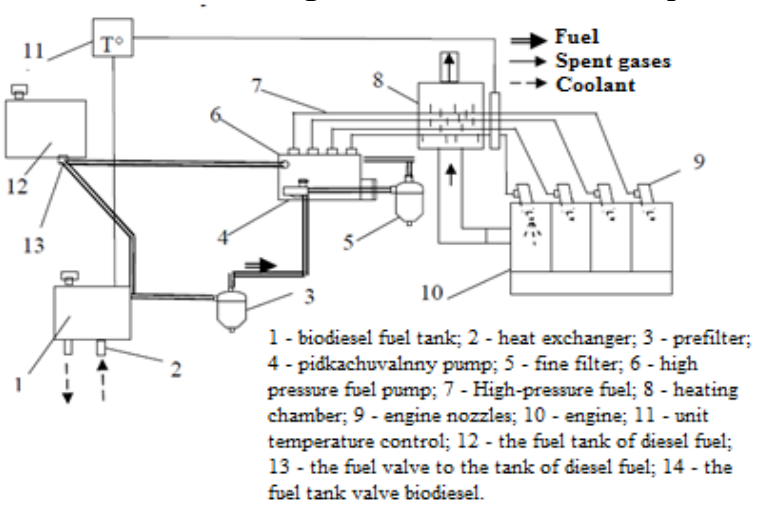

Fig. 3. Scheme of two-stage heating biodiesel.

Laboratory tests of the engine, the use of biodiesel, performed in accordance with GOST 23734-98 and GOST 18509-88 by engine braking through the drive shaft brake stand CI-5543. Along with the performance, with gas analyzer determined 325FA02 change the concentration of CO, SnNm, NOx in the exhaust gases. As a criterion for assessing the impact of temperature on the operational performance of the engine set change specific fuel consumption [4,5,6,7,8]. Experimental studies show that angle spray nozzle when the temperature of the fuel from 10 to 100 °C increased from 21.2 °C to 29.7 °C, ie 40%, however, has not reached the cutting angle of diesel fuel, whose value does not depend on the temperature of the fuel. Established that with increasing temperature from 20 to 95 °C decreases the kinematic viscosity of biodiesel, achieving values of kinematic viscosity of diesel fuel is only possible at temperatures biodiesel at 30-40 °C higher than diesel fuel

(pic .4). Reducing the density of fuel in the above temperature range is proportional to temperature and growth is around 7%. With increasing temperature, fuel and when changing engine load (Figure 4) specific fuel consumption varies according to the parabolic function that is optimum - minimum value response function for the investigated temperature range and power is at a temperature of 117.4 ° C and a load of 33.2 kW load 33.2 kW.

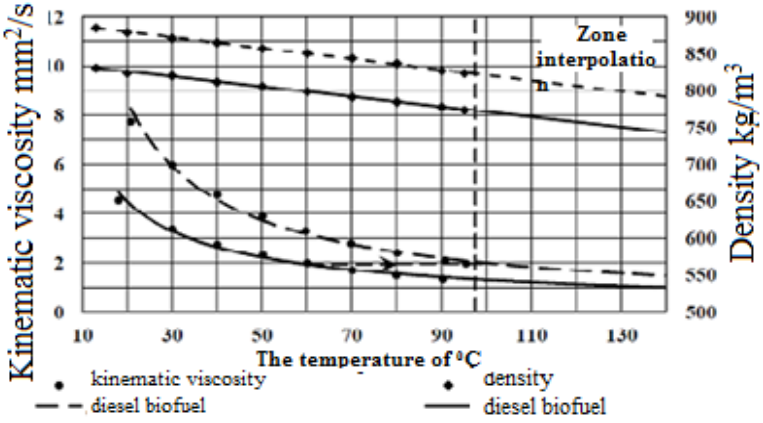

Fig. 4. Effect of temperature on the kinematic viscosity and density fuel.

Analysis of the surface response shows that with increasing temperature, the specific consumption of biodiesel gradually decreases and reaches its minimum value, respectively: 318 g / (kW h.) On boot engine 37 kW; 329 g / (kW h.) On boot engine 28 kW and 386 g / (kW h.) When loading 19 kW engine in the temperature range from 115 to 120 ° C. With further increase in temperature is excessive biodiesel diameter reduction drops and long range spray torch, causing reduction of turbulent zavyhryuvan fuel-air mixture and utvoryuvannya zones of excessive concentration of fuel and lack of air. As a result, decreases the speed and completeness of combustion of biodiesel, which increases its cost. The regression equation for determining the hourly fuel consumption MTA [4,5,6,7,8].

$$G = 8{,}6702 + 0{,}0745 + 0.0315\ fg\ CB \qquad (1)$$

where fg - traction resistance unit,%; KB - biodiesel content in the fuel mix,% S - level opening the overflow channel system for heating fuel line pressure,%. By increasing the content of biodiesel in the fuel mix is an increase in fuel consumption associated with a decrease in the total calorific mixtures with increasing concentration of biodiesel in it. If you change the concentration of biodiesel from 0 to 100%, an increase hourly fuel consumption by 14.37%. Production testing of the AIT based tractor cue-14102 engine D-245 during the autumn field works at ambient temperature close to 0 °C showed that the use of heating fuel to the optimum temperature range before injection to the engine cylinder, received overruns fuels for tilling the soil at 8,58%, while disking to 9.02% compared to diesel fuel (the difference between the net calorific value of diesel fuel and biodiesel amounted to 8.25%). The use of two-stage heating will increase the cost-effectiveness of the use of biofuels in diesel 633.6 USD. / T. The use of biodiesel at the MTA, at the standard annual load shows that the annual cost-effectiveness of transferring one MTA for diesel biofuel is about 57 thousand. UAH. / Year; return fuel system modernization, with capital investments to 20

thousand. USD. less than 1 year. In diesel engines with direct injection maybe some design changes pistons, cylinder heads and nozzles for longer use of vegetable oils as fuel. Known constructive solution adaptation diesel fuel systemy 4-240 to run on fuel with Supplements of roslynnyh oils.

Conclusions. The current level of technology development allows almost any engines use gasoline with 10 percent ethanol and diesel with 7 percent biodiesel content. Consumption of mixtures with a higher content of biofuels depends on the type of motor vehicle and may require replacement of elements of the engine and fuel system. By increasing the content of biodiesel in the fuel mix is an increase in fuel consumption associated with a decrease in the total calorific mixtures with increasing concentration of biodiesel in it. If you change the concentration of biodiesel from 0 to 100%, an increase hourly fuel consumption by 14.37%.

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ИСПОЛЬЗОВАНИЕ БИОТОПЛИВ В ЭНЕРГЕТИКЕ АПК

Уминский С.М., Макарчук В.И.

Ключевые слова: моторное топливо, биотопливо, биоэтанол, биодизель, нефтепродукты, товарний бензин.

Резюме

Для развития национального производства биотплива является важным мировой тренд в потреблении топливных ресурсов, который двигается в сторону активного использования биотплива,в первую очередь биоэтанола и биодизеля. Современный уровень развития технологий позволяет практически любым двигателям потреблять бензин с 10-процентным

содержанием этанола, а также дизельное топливо с 7-процентным содержанием биодизеля.

USING ENERGY BYOTOPLYV IN AGRIBUSINESS

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Summary

For the development of national production biotpliva is an important global trend in the consumption of fuel resources, which is moving towards the active use biotpliva primarily bioethanol and biodiesel. The current level of technology development allows almost any engine consumes gasoline with 10 percent ethanol content, as well as diesel fuel with percen t biodiesel.