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EFFECTIVE USE OF PHYTOGENOUS FUEL FOR SUPPLYING COMBUSTION MOTORS OF AGRICULTURAL MACHINERY

Given are an analysis of the problems and perspects of use of phytogenous fuel of various kinds and methods of its effective use for supplying combustion motors of for agricultural machinery.

Key words: *fuel and energy resources, biological raw materials, diesel motor, diesel fuel of mineral, biodiesel, bioethanol.*

Introduction. With the increasing demand for energy, the rapid growth of internal combustion motors (ICM) and increasing environmental requirements, more attention is paid to the search for new efficient, non-polluting energy sources. Among the alternative sources of energy that actually used for power and mobile products have significant commercial potential , biofuels have a special place . Biofuels for mobile energy (biodiesel and bioethanol) can replace a significant amount of oil. The advantages of biofuels is to increase energy security, reduce greenhouse gases and toxic substances, and the development of regional economy [1]. With undeniable positive impact on the environment biodiesel has a number of technological shortcomings - complications motor starting in winter outages exhaust valves , reducing the life of the fuel system , polymerization motor oil and more. Therefore, the efficient use of fuels of plant origin for diesel ICM for the reduction of negative factors on the motor is urgent questions of our time.

Analysis of recent research and publications. At the international agricultural interior SIMA 2013 the company introduced a tractor VALTRA T133 Dual Fuel, which works on biogas as well as on diesel fuel. In the "biogas" about 83% of the energy produced from biogas and 17% of diesel fuel or biodiesel. A small amount of diesel fuel required for ignition of biogas in cylinders of internal combustion motors. Gas cylinders are in a safe place on the frame of the tractor. In the "diesel" motor works like a traditional diesel motor. Features tractor Valtra T133 Dual Fuel Biogas-similar to standard tractors. Cost of biogas is 40% lower than the equivalent amount of diesel fuel.

One of the main disadvantages of biodiesel is the high kinematic viscosity, which greatly reduces the temperature range of use.

The purpose of research is to improve the technical and economic performance of machine-tractor aggregates for the use of motor fuels of plant origin for ICM. Research Methodology.

Research Methodology. Summary of scientific-technical literature, research and development, diagnostic, prognostic analysis of efficiency of ICM during bench testing and maintenance.

The results of research. Comparison of physic-chemical properties of biodiesel and diesel fuels of mineral (Table 1) shows that the main parameters that hinder the implementation of biodiesel is its high viscosity, causing reduced supply pipelines, deteriorating process of mixing during sputtering formed large drops of fuel and reduced length torch fuel needed more time for evaporation, there is incomplete combustion and intensive fouling on the details of cylinder-piston motor [2]. Besides biodiesel has a lower specific heat of combustion, leading to increased fuel consumption and higher maximum temperature filter that restricts the use of biodiesel at low temperatures.

In the laboratory, mobile power, production and use of biofuels NSC "IMEA" experimental batches produced biodiesel from rapeseed, linseed, soybean, mustard and sunflower oils, and set their basic properties. Studies have shown that the best physical and mechanical properties of a biodiesel derived from linseed oil. According

to the physical and mechanical properties using biodiesel from rapeseed oil effectively at temperatures higher plus 10 °C.

Table 1

Physical and mechanical properties of diesel and biodiesel fuels

Specifications	Diesel fuel (summer)	Biodiesel fuels
Cetane number, min	45*	51*
Density, kg/m ³	860*	860-900**
Kinematic viscosity mm ² / s	3,0-6,0*	3,5-5**
Mass fraction of sulfur,% max	0,288*	0,001**
Flash point in closed crucible, ° C, min	40*	120**
Maximum filtration temperature, ° C, max	-5*	+5**
Koksovanist 10% residue,% max	0,3	0,3
Ash content,% max	0,01	0,02
Content,%		
Carbon C	87	77,4
Hydrogen H	12,6	12,3
Oxygen O	-	10
Lower specific heat of combustion, MJ/kg	42,5	37,1-38,0

* DSTU 3868 [3]; **DSTU 6081 [4].

To effectively utilize and expand the temperature range of use biodiesel designed and manufactured its two-stage heating system (Fig. 1), which allows to maintain biodiesel at low temperature and it provides a more complete combustion, increases the life of the crankcase oil, allows the use of refined oil for the motor.

According to the scheme start the diesel motor on diesel fuel is contained in a supporting capacity. Motor warm up to operating temperature 75-80 ° C, during this time in mainly fuel tank through a tubular heat exchanger heated biodiesel and after reaching operating temperature, the motor switches to it. To ensure the quality of fuel filter in the fuel line of his warm, low pressure and 45 ° C. To ensure better dispersion and increase the speed and completeness of combustion of biodiesel further heated to 140-170 ° C in the area between the injection pump and injectors. The proposed scheme is implemented on tractors PMZ-6AKL with motor D-65N and MTZ-82.40 with motor D-243.

Dependence of the specific consumption of the D-65N temperature of biofuels at 70% load shows that the minimum cost of biofuels achieved fuel injection temperature of 115-120 ° C (Fig. 2).

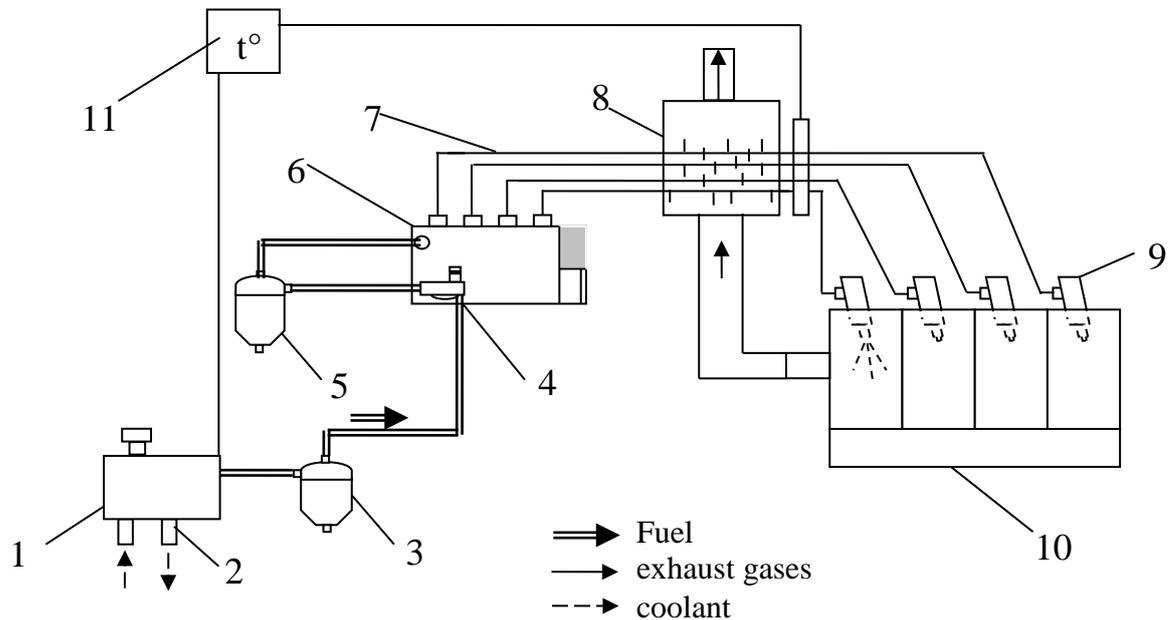


Fig. 1. Scheme 2-phasic heating fuel for tractor motors: 1 - fuel tank, 2 - heat exchanger, 3 - prefilter, 4 - booster pumps, 5 - fine filter, 6 - fuel feed pump pressure, 7 - high pressure fuel lines, 8 - heating chamber, 9 - injector motor 10 - motor 11 - unit temperature control.

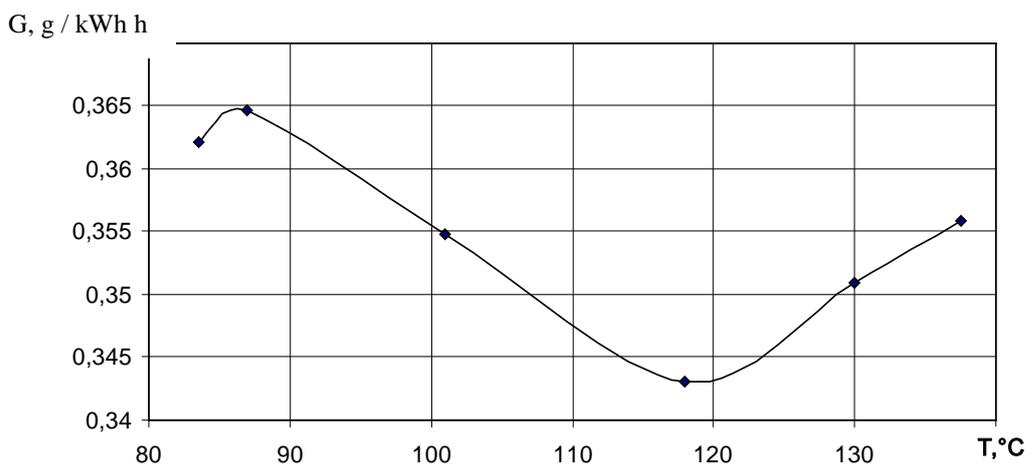


Fig. 2. Dependence of the specific consumption of the D-65N temperature of biofuels in the fuel injection into the motor cylinder at 70% load.

The production test the effectiveness of the system 2-phasic heater tractor JUMZ-6AKL with motor D-65N conducted on the performance of manufacturing

operations pre-cultivation unit PCC-4 and packing of crops with ringed-spurs roller ZKKSH-6 (Table 2). The results of the production tests showed that the lowest cost of biodiesel is achieved by heating it to a temperature of 110-125 ° C, which coincides with the results of bench tests. (Research conducted with head of laboratory Chuba V.V.)

Conducted study to determine the performance and exhaust emissions of a diesel motor tractor JUMZ-6AKL with motor D-65N for mixtures with a share of biodiesel 20, 25, 50 and 75% (Table 3). Research conducted on brake stand-CI-5543-HOSNYTY that created constant 100% load according to the requirements of GOST 17.2.2.05 [5]. Studies indicate that 20-75% mixture of methyl ester with diesel fuel at 100% load diesel saves diesel fuel within 16,6-73,0%, and reduces the amount of harmful emissions 9,5-14,2%. Application of 20-50% mixtures requires additional regulation of fuel supply. Emissions reduced: carbon monoxide (CO) is 6.8% - 24.2% carbon dioxide (CO₂) by 6.5% - 11.1% hydrocarbons (CH) 4.7% - 5.2% . Emissions of nitrogen oxides (NO) with a 20% mixture does not change.

Table 2

Performance fuel aggregates on the basis of tractor-JUMZ 6AKL during manufacturing operations for use heater

#	Category of operation	Load factor of tractors motor	fuel type			
			mineral diesel		Biodiesel	
			Temperature range, °C	Fuel consumption, kg/ha	Temperature range, °C	Fuel consumption, kg/ha
1	Chance of cultivation KPS-4	0,60-0,70	70-80	5,61	60-70	6,12
					80-90	6,07
			100-110	5,58	90-100	6,06
					100-110	6,02
			120-140	5,55	110-125	5,69
		130-135	6,09			
2	packing of crops ZKKSH-6	0,55	50-55	1,63	50-55	1,69
			70-80	1,62	80-90	1,64
			90-100	1,58	100-110	1,61

Hourly fuel consumption (mixtures) at 100% load diesel motor D-65N.

Indexes	Bio-0%	Bio - 10%	Bio - 20%	Bio - 25%	Bio - 50%	Bio - 75%
Fuel consumption, kg/h	11,9	12,3	12,4	12,45	12,55	12,8
Specific fuel consumption, g/kWh	257	265,66	267,81	268,9	271,05	276,46
Okysyd monoxide (CO),% vol.	0,799	0,744	0,691	0,686	0,594	0,605
Carbon dioxide (CO ₂),% vol.	9,73	9,1	8,62	8,57	8,65	8,96
Total of hydrocarbons,%	0,193	0,184	0,178	0,18	0,185	0,183
Nitric oxide (NO),%	0,188	0,166	0,188	0,199	0,244	0,265
Oxygen (O ₂),%	7,66	9,68	9,75	9,89	8,32	8,25

Determination of parameters of diesel motor D-21A tractor HTZ-2511 10% resolving supply bioethanol with diesel fuel carried by brake stand-CI-5543-HOSNYTY. Submission of ethanol was conducted in an air collector using jet set in the special device (Fig. 3).

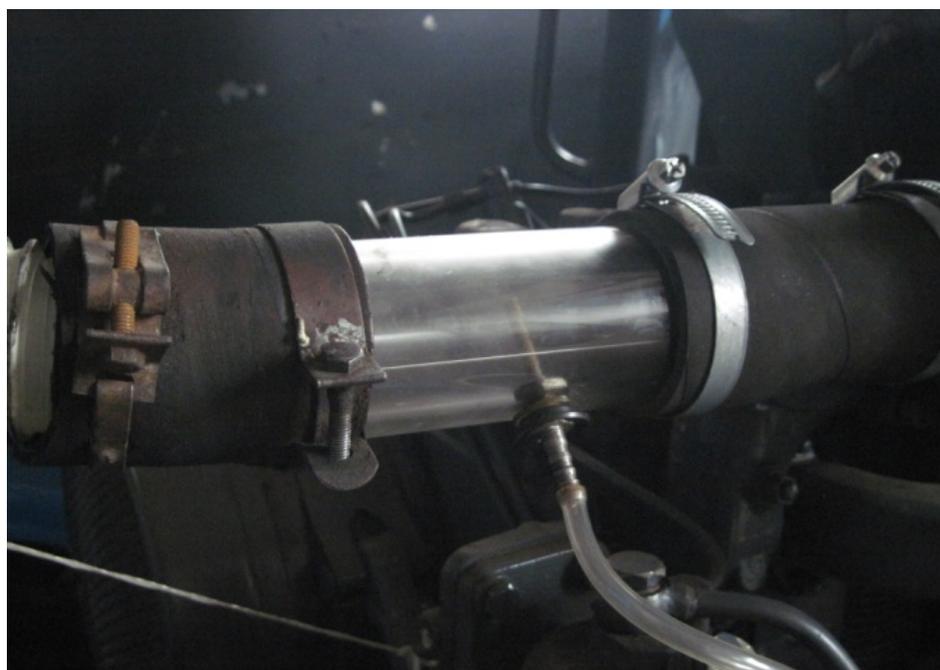


Figure. 3. Submission of ethanol in air manifold diesel motor D-21A

The test results (Table 4) showed the feasibility of adding 10% ethanol in diesel motor intake manifold. It does not appreciably affect the nature of his work and reduces emissions of carbon monoxide (CO) by 25%, carbon dioxide (CO₂) by 13%,

the content is not burned hydrocarbons (CH) remained almost the like on diesel fuel, increasing the concentration of nitrogen oxides (NO) due to the presence of additional oxygen in a molecule of ethanol.

Table 4.

Indexes of emissions in the exhaust gases of diesel motor D-21A for filing separate ethanol with diesel fuel at 100% load capacity.

Indexes	100% diesel	Bioethanol 10% diesel-90%
Okysyd monoxide (CO),% vol.	0,38	0,282
Carbon dioxide (CO ₂),% vol.	9,56	8,29
Total of hydrocarbons,%	0,15	0,143
Nitric oxide (NO),%	0,106	0,185
Oxygen (O ₂),%	10,13	18,79

Conclusions

1 Testing machine and tractor aggregate during cultivation bench test results confirmed that biodiesel heating before injection to a temperature of 110-125 °C reduces fuel consumption by 7% due to better combustion and spray it, while also decreasing emissions of nitrogen for 7 8%.

2 Bench tests showed that a mixture of 20-75% methyl ester with diesel fuel at 100% load diesel D-65 D saves diesel fuel within 16,6 -73,0%, and reduces the amount of harmful emissions by 9.5 - 14.2%. Application of 20-50% mixtures requires additional regulation of fuel supply. Emissions reduced: carbon monoxide (CO) is 6.8% - 24.2% carbon dioxide (CO₂) by 6.5% - 11.1% hydrocarbons (CH) 4.7% - 5.2%. Emissions of nitrogen oxides (NO) with a 20% mixture does not change.

3 Bench tests indicated the desirability adding 10% ethanol in diesel motor intake manifold. It does not appreciably affect the nature of his work and reduces emissions of carbon monoxide (CO) by 25%, carbon dioxide (CO₂) by 13%, the content is not burned hydrocarbons (CH) remained almost the like on diesel fuel, increasing the concentration of nitrogen oxides (NO) due to the presence of additional oxygen in a molecule of ethanol.

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Анотація

Третьяк В.М., Ботьбут В.С., Ганженко О.М., Мазуренко А.М.

Ефективність використання пального рослинного походження для живлення двигунів внутрішнього згорання сільськогосподарських машин

Наведений аналіз проблем і перспектив застосування пального рослинного походження різних видів та методи його ефективного використання для живлення двигунів внутрішнього згорання сільськогосподарських машин.

Ключові слова: *паливно-енергетичні ресурси, біологічна сировина, дизельний двигун, дизельне паливо, біодизель, біоетанол.*

Аннотация

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Эффективность использования топлива растительного происхождения для питания двигателей внутреннего сгорания сельскохозяйственных машин

Приведен анализ проблем и перспектив применения топлива растительного происхождения различных видов и методы его эффективного использования для питания двигателей внутреннего сгорания сельскохозяйственных машин.

Ключевые слова: топливно-энергетические ресурсы, биологическое сырье, дизельный двигатель, дизельное топливо, биодизель, биоэтанол.