

PROCESSING BIODIESEL FROM VEGETABLE OILS

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Implementation of projects to build plants to produce biodiesel will solve the great economic problem - increasing regulatory defined particle production and use of biofuels and blended fuels the engine. Biodiesel is not harmful to the environment. The development of its resource base in areas adjacent to the plant leads to the development of agriculture sector, this increase cultural land use, proper crop rotation, the use of modern techniques and technologies in agricultural production.

Key words: renewable energy, diesel engine, motor fuel, biofuel, bioethanol, biodiesel, petroleum.

Introduction. A significant increase in world prices for mineral fuels, reducing its stocks, problems with transportation are forced to seek alternatives sources of fuel that are as close to its customers. Fuel can be obtained not only from oil. One of the main solution of this problem is the development of renewable energy-based synthetic fuel by processing biological materials vegetable and plant oils. Various options for making research work conducted in this area for over half a century, and, to date, have intensified as the basis of the latest scientific research, oil reserves on Earth will end after 50 years. Important is the fact that the transition to biodiesel requires no additional conversion engine and other vehicle systems. Another major cause for the increased interest in biodiesel is the environment [1]. Biodiesel, studies have shown that when released into water without harm to plants and animals. In addition, he exposed almost completely biodegradable in soil or water. Number of carbon dioxide in the combustion products of biodiesel equal to the amount of gas that was consumed from the atmosphere sowing crops from seeds which produce fuel. In addition, the cake obtained during the production of vegetable oil, used as feed for livestock that allows better utilize biomass plants. In the combustion of biodiesel less carbon monoxide, soot. Biodiesel compared to conventional diesel fuel contains almost no sulfur, is characterized by a high lubrication feature. Contribute to this particular chemical composition and high oxygen content [2]. Production of biodiesel can be carried out in developed agricultural regions of the country, which is characteristic of a stable economic situation. A significant advantage of synthetic fuels is that the enterprise in receipt can be placed in close proximity to major customers. Thus, the creation of new enterprises for the production of synthetic fuels the shortage of oil is justified. Thus for the construction of such an enterprise must select the area that will receive the best economic benefit by reducing costs of cultivation and delivery of raw materials, finished products transportation, proximity to other resources, labor, energy and transport.

Problem. Ukraine to enter the global market associated with the formation of a competitive national economy requires a radical change in territorial and sectoral structure of regional economic complexes, increasing the share of manufactures highly processed raw materials, reduce dependence on energy imports, create new industries for their own needs in consumer goods. Addressing these challenges requires extremely implementation of innovative approaches to study the deployment of new productions. 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 [3]. 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 [4].

Analysis of recent research and publications. According to Article 2 of the Law of Ukraine "On alternative fuels" [5] introduced gradually increasing regulations specified proportion of the production and use of biofuels and blended fuels the engine. Because the actual volume of fuel production in the bioenergy Ukraine in 2010 was made more than 30 times less than the project level, as part of the updated 2013 baseline "Energy Strategy of Ukraine till 2030" provides for the transition to the use of gasoline with 10% ethanol to in 2020 and 15% ethanol - to 2030, and the transition to the use of diesel fuel with biodiesel content of 7% by 2030. [5]. It is assumed that more active development of biodiesel will start only in 2020 due to lower cost of production. 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, aSShA - 15 per cent.

The purpose of research: 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. Recent studies in different countries show that through the use of biofuels obtained from various sources, can reduce emissions of carbon monoxide by 8-10%, soot - 50%, sulfur - up to 98%, hydrocarbons and carbon oxides - by 30-34 %. Thus, energy is the main instrument for reducing environmental harm human life energy processes. International competitiveness of Ukrainian producers of biofuels (solid biofuel, bioethanol, biodiesel, biogas) based on: -valued annually renewable raw material base biomass is currently used by more than 10%; -valued global growth, and particularly the European demand for biofuels, as a result of state environmental programs of the European Union, USA and Japan for programs decrease harmful influence the functioning of modern industrial and public technology infrastructures on the environment (Kyoto Protocol on "greenhouse effect").

Results. The technology of biofuel (mainly rapeseed, soybean or palm oil) is based on the effect of changes in their physical and chemical characteristics by multivariate pulse energy impact. Traditional technology of biofuel for diesel engines based on the reaction of esterification of vegetable oils and methyl (ethyl) alcohol and methyl esters. Most suitable for biofuel is rapeseed oil. Theoretically you can use sunflower oil, but this high pour point oil, which affects winter on vehicle operation. Oils contained in the seeds and fruits of sunflower, canola, soybeans and other oilseeds are oxidized hydrocarbons, mainly triglycerides, close to heat to combustion of diesel fuel. Oil removed from the oilseed by squeezing and extraction (hexane or trichlorethylene) and refined methods of neutralization, freeze or filtration. The seeds of rape contains 35-50% fat, 19-31% for well-balanced amino acid composition of protein, 5.7% fat. The content of fat and the amount of fat and protein is superior to soy, but inferior to sunflower and mustard. Vegetable oils are unstable and have high viscosity and koksuemist. These shortcomings could be partially remedied if translate them into methyl or ethyl esters. The basic technology of methyl esters in developed countries based on tryhlitsyrydiv esterification of vegetable oil with methanol using basic or acidic catalyts. If the acid catalyst reaction time is about 1- 45 hours, if basic, 1- or 8 hours (depending on temperature and pressure), and in the initial period of the reaction proceeds slowly because of the two-phase nature of methanol / oil and polarity connections . The reaction of esterification of rapeseed oil ethyl alcohol runs the following mechanism (Fig. 1) [4,5,6].

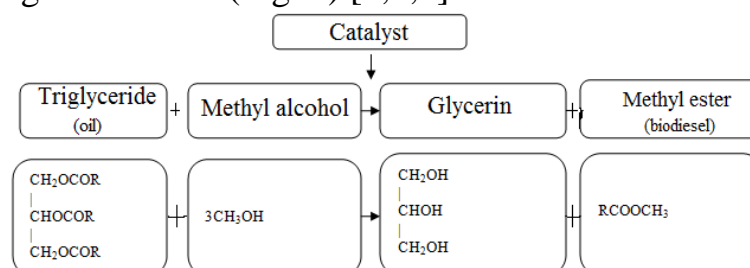


Fig.1. Eterifikatsiyi reaction scheme, which is the basis for the production of biodiesel.

There is a problem removing catalyst and the saponification products for purity of the resulting product. Its essence lies in the decomposition of molecules trihletsyrydu four components - glycerol and three fatty acid compound, followed by fatty acid molecules alcohols (ethanol, butanol etc.) .Oliynny ether has the following advantages over vegetable oil: lower molecular weight resulted in a leveling 'viscosity ester and a number of other indicators - largely prevents the formation and the formation naharovidkladen on the details cylinder-piston, it enables the use of diesel oil in the air without conversion. However, compared to diesel soot - and smolovidkladennya are increased, there is low air storage stability, the negative impact on motor oil. In addition, significantly increasing the cost of production of oil ether [5, 6]. The physical properties of the fuel affect the dynamics of jet fuel and cutting quality. Ceteris paribus affect viscosity, surface tension and density. When the viscosity increases dalekobiynist jet fuel. reducing the proportion surround mixing and leads to falling on the walls of the combustion

chamber more fuel. With a decrease in viscosity fuel consumption average diameter of the drops decreases and becomes more uniform cut. However, the angle of the jet fuel increases and decreases dalekobiynist. The higher the surface tension, the more stable drops to external forces and the more its size. The lower the surface tension, the thinner and smoother cutting fuel that helps accelerate the mixing and combustion. Improving the physical and chemical characteristics of biological diesel fuel offered by its multi-pulse energy processing. As the impacts of energy use mechanical, acoustic, thermal and electromagnetic effects. To prevent loss oszdkiv at elevated temperatures fuel based on vegetable oils is recommended to add modifiers - dysperhentы (alkenylyantarnoho anhydride reaction products with alcohols and amynoslyrtemy) and antioxidant additives. You can use the quality of diesel fuel blends of vegetable oils and their esters with alcohols (ethanol, butanol, etc.). As esters of vegetable oils is co-between fuel oil and alcohol. However, modern diesel engines can run on fuels such short time [6,7,8,9]. In the reaction of transesterification of oils fats react with methyl (ethyl) alcohol in the presence of a catalyst (alkali), resulting in the formation of esters and hlitserolova phase 56% glycerol, 4% methanol, 13% fatty acids, 8% water, 9% of inorganic salts, 10% esters. Material balance reactions obtaining biodiesel to receive a 1000 kg (1136 liters) of biodiesel required 50 kW thermal energy and 25 kW of electricity, 1040 kg (1143 liters) rapeseed oil, 144 kg (114 l) 99.8% methanol, 19 kg of potassium hydroxide (88% KOH), 6 kg auxiliary filter material, 105 kg of water. This comes in addition to biodiesel, about 200 kg of crude glycerine and 117 kg of water, after purification of biodiesel. From seed rape (technical varieties with high erucic acid content of 40-60%) of 1 ha of crops (on average 3 tons), will receive about 1 ton of oil. Then the oil is subjected to esterification with methyl alcohol which results in approximately 1,000 kg rapeseed oil methyl ester (COME). The main technological stages of obtaining biodiesel is shown in Figure 2.

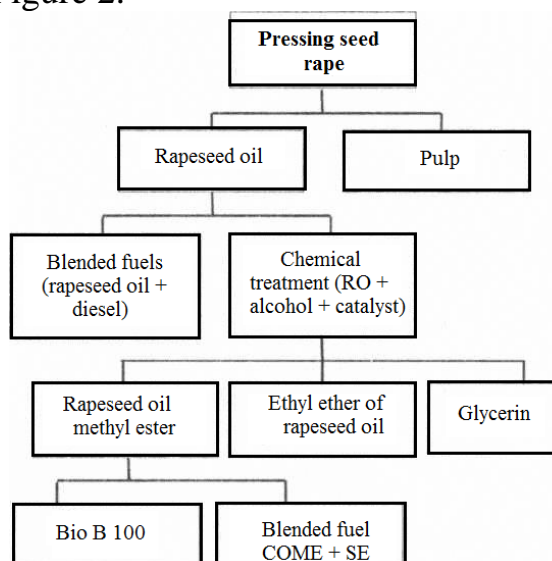


Fig. 2. Scheme of production of rapeseed oil and motor fuels based on it. Stage processing usually involves one of the known physical or chemical processes of refining, which results in cleaning oil from impurities, phosphatides, FFA further trans esterification process, it is the end product of biodiesel.

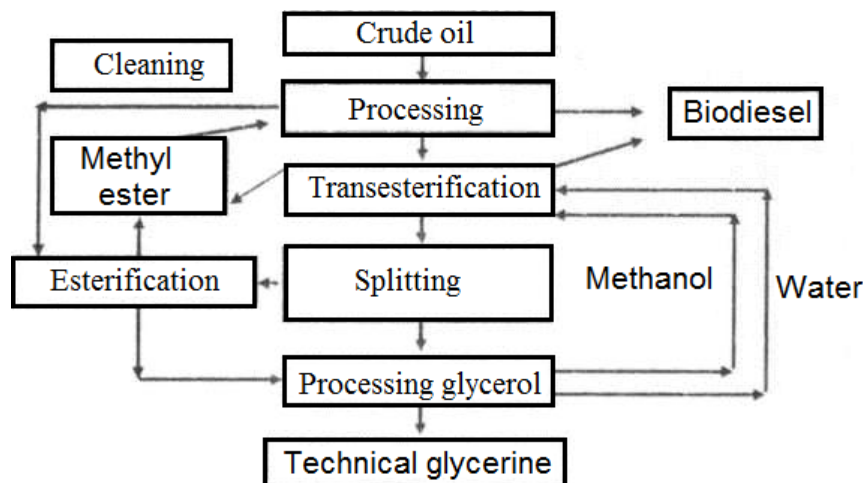


Fig. 3. Technological stages of biodiesel production.

Ukrainian enterprises are interested in increasing production and exports of rapeseed oil, but only limiting factor is the massive export of rapeseed from Ukraine. Today, rapeseed oil produced the largest oil metallurgical plants Ukraine with their own elevators seed capacity of 100 ths. Tons, which began the production of oil from sunflower, rapeseed, soybean and flax - Vinnytsia OZHK Chernivtsi OZHK, Nijinsky OZHK, Pology OZHK, Odessa OZHK with a production capacity of 10 thousand. tons of rapeseed oil per year and more than 100 small enterprises. New direction is the establishment of the Western Ukraine small specialized companies for the production of biodiesel directly from rapeseed, ie several cycles: obtaining first rapeseed oil and its processing to rapeseed biodiesel (UNIDO project in the village. Luke Sambir rayon factory PP "Oliyar" with. Stavchany Pustomiti). Plants produce about 25 tons of biodiesel per day (5 th. Tons per year). Farmers have new Italian line worth 450 thousand. Dollars processes rapeseed oil for biodiesel. The plant processed almost a thousand tons of rape every day in the presence of excess raw materials, as in Lviv in 2014 was planted more than 50 thousand. Hectares of winter rape, most of which was exported. Figure 3. shows the structure of material flow in large-complex commercial biodiesel production, based cluster may be an association of legal entities. The features of the existing and prospective technologies of large-biodiesel in the EU are: - pressing extraction method of processing oilseeds (rape); - The distribution phase "biodiesel - glycerin water" and "glycerine - water" in the field of centrifugal forces (separator); -perehid on fixed heterogeneous catalyst during the reaction of "methanol - triglycerides" instead of a homogeneous catalyst; - Search process parameters for reactions on an industrial scale "ethanol - triglycerides" instead of "methanol - triglycerides." Fig. 4 shows the structure of material flow in a closed (light-duty) cycle of production and consumption of biodiesel in a single legal entity - closed (light-duty) cycle of production and consumption of biodiesel. The features and hardware technology using closed (light-duty) cycle biodiesel production are: pressing method of processing oilseeds (rape); -distribution phase "biodiesel - glycerin (washing) water" in the field of gravitational forces (fluff) in reactors; -use homogeneous (alkali) catalyst.

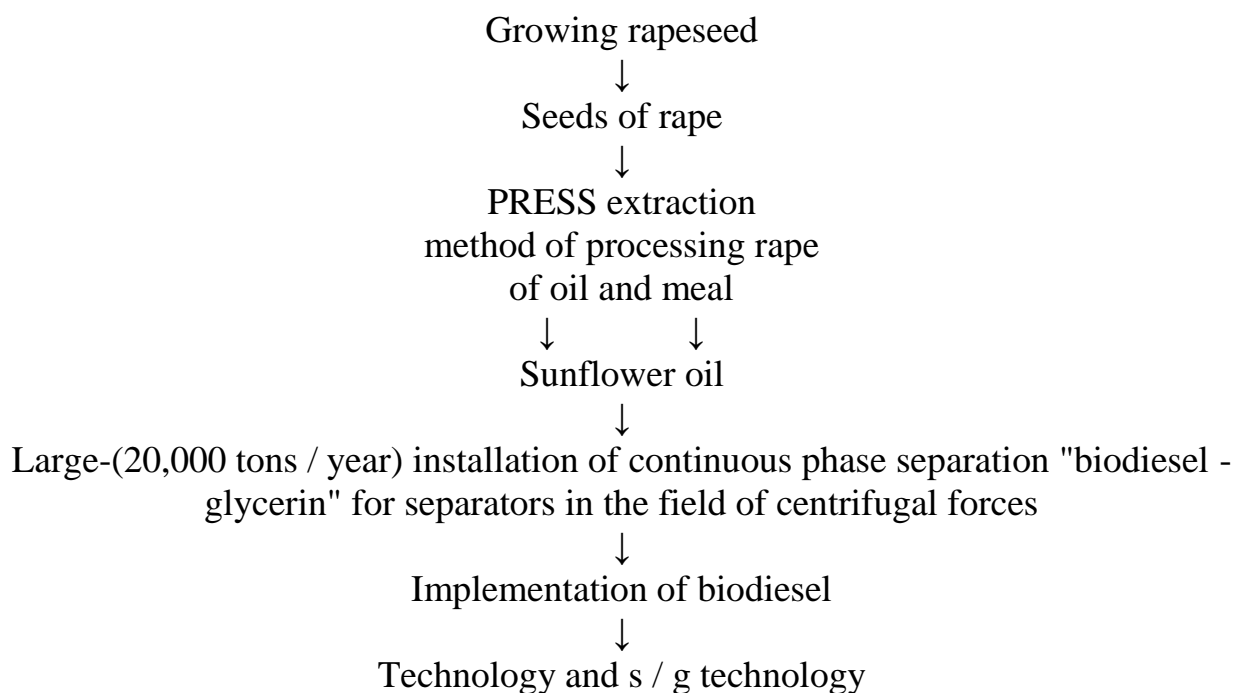


Fig. 4. Structure of material flow in complex commercial biodiesel (cluster association of legal entities).

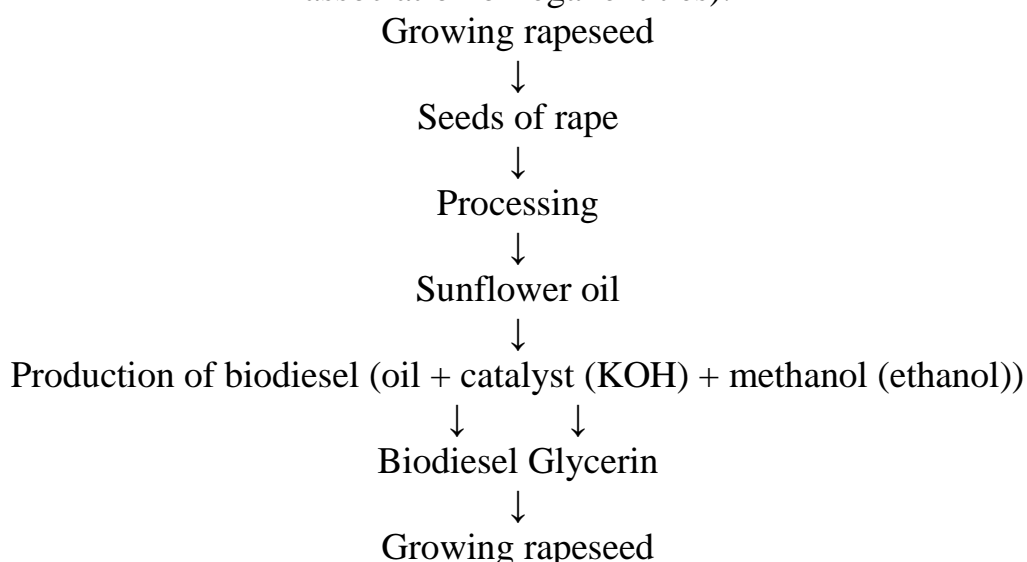


Fig. 5. Structure of material flows in a closed loop production and consumption of biodiesel in a single legal entity (entity).

In the production of biodiesel greatest effect can be obtained by simultaneously combining esterification process of recycling SG products. This experience abroad already exists in the above privacy, Polish company "PRO-KOP" mass-produced industrial complex "AHREKO," which sold an optimal solution with the perfect interaction of two technologies - production of animal feed and production of biodiesel. Flowsheet biodiesel and related substances (glycerin, fertilizers, zhmyhy) is shown in figure 6. Combined production complex "AHREKO" (Figure 6).

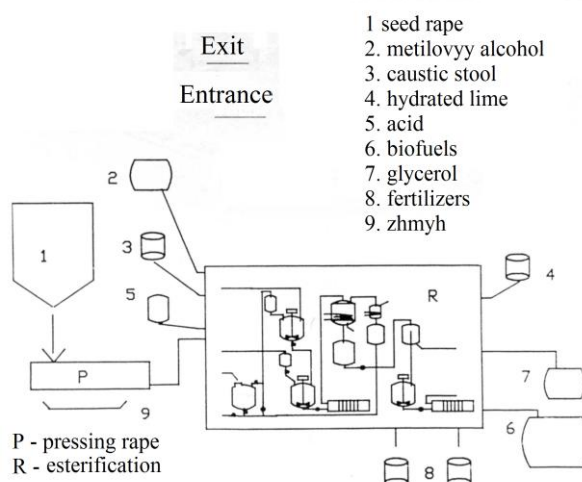


Fig. 6. Scheme biodiesel company "PRO-KOP".

Combined production complex "AHREKO" (Figure 6). Optimal solution is a classic food technology, interconnected with environmentally friendly biodiesel. The process takes place in a closed technological cycle with the primary purpose use within the farm or Agricultural Complex with the possibility of selling the remnants of industrial products (briquettes, electricity, biodiesel, oil, flour, feed additives). The generated biodiesel and lubricant specifications cover all the needs within the agricultural complex or as farmland for fuel and lubricants for machinery, and for the maintenance Energy Center - the provides electricity to produce complex "AHREKO" and the internal network. The main raw material is corn with volhisttyu to 15%, grade of 6%, which feed purposes and soft stuff, so zhmyhovyy meal, bran, feed meal, meat and fish -kistkove, flour, protein and vitamin prysady that meet the standards and trade conditions feed materials. In the production of feed used completely waste arising from the pressing of rapeseed oil, that is, when the production of biodiesel.

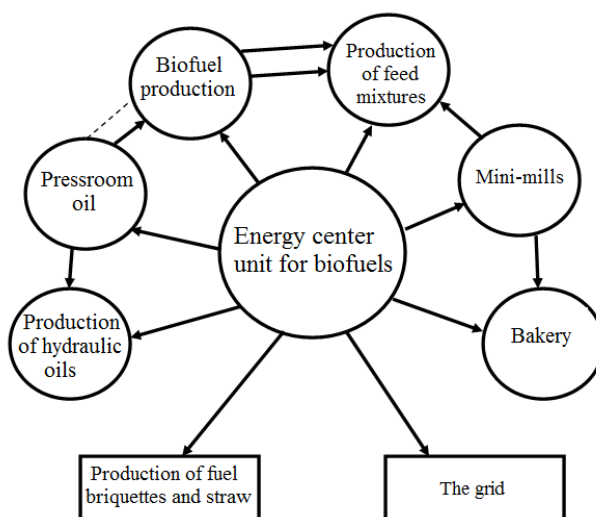


Fig. 7. Combined production complex "AHREKO."

The combined plant can produce feed mixtures with the addition of 5% to 8% fat and molasses. Capacity 2 tons per hour is the rate that will be in feed manufacture 70% of cereals, what - half wheat or corn. Management carried out from a central operator console.

Table 1. **Tehnichni performance combined production complex "AHREKO."**

Technical indicators	
The performance of the main line	2 tons / hour
Productivity receiving and issuing feed	10 tons / hour
A useful volume dispensing bins	56 m ³
Power consumption	30 kW
Mixing hopper	6.5 m ³
Expeditionary bunker	6 pcs. 18 m ³ = 108 m ³
The source of compressed air	0.6 MPa, 50 m ³ / h

Conclusions. Prospects for the international competitiveness of Ukrainian producers of biofuels in international markets based on: -valued annually renewable raw material base of biomass, which currently is not used by more than 10%; -valued global growth, and particularly the European demand for biofuels, as a result of state environmental programs of the European Union, USA and Japan for programs decrease harmful influence the functioning of modern industrial and public technology infrastructures on the environment (Kyoto Protocol on "greenhouse effect"). The cost of bioethanol and biodiesel with current technologies more expensive than gasoline and diesel, but the requirements of environmental and emission reduction "greenhouse" gases create demand for them on the world market at 10% of the volume of motor oil (200 million tons / year). Implementation of projects to build plants to produce biodiesel will solve the great economic problem. Biodiesel is not harmful to the environment. In addition, he exposed almost completely biodegradable, in soil or water microorganisms are processed within 28 days 99% biodiesel. Biodiesel burns with a minimum release of toxic wastes (sulfur, lead), reduced the allocation of carbon dioxide, exhaust smells like oil. The high flash point (120-130 degrees Celsius) makes the new fuel oil it much safer analogues. To process one ton of oil using mahnitoyimpulsnoy high-cavitation treatment requires about 15 kWh of electricity, which is 5-7 times less than in the classical technologies. The development of its resource base in areas adjacent to the plant leads to the development of agriculture sector, this increase cultural land use, proper crop rotation, the use of modern techniques and technologies in agricultural production, significant use of the primary wealth - land. The projected complex will not only produce biodiesel, the positive side of what has been said above, but the meal is extremely useful component for animal feed, which in turn provides a good impetus for the development of livestock in surrounding areas.

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ТЕХНОЛОГИЯ ПОЛУЧЕНИЯ БИОДИЗЕЛЬНОГО ТОПЛИВА ИЗ РАСТИТЕЛЬНЫХ МАСЕЛ

Уминский С.М.

Ключевые слова: возобновляемые источники энергии, дизельный двигатель, моторное топливо, биотопливо, биоэтанол, биодизель, нефтепродукты.

Резюме

Реализация проектов по строительству заводов производства биодизеля позволит решить важную народнохозяйственную проблему - увеличение нормативно определенной части производства и использования биотоплива и смесового топлива моторного. Биодизель не вредит окружающей среде. Развитие собственной сырьевой базы в прилегающих к заводу районах приведет к развитию сельского хозяйства в комплексе- это повышение культуры землепользования, правильный севооборот, использование современной техники и технологий сельскохозяйственного производства.

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Key words: renewable energy, diesel engine, motor fuel, biofuel, bioethanol, biodiesel, oil.

Summary

Implementation of the construction works of biodiesel production projects will help solve important economic problems - increasing the statutory definition of the production and use of biofuels and composite propellant motor. Biodiesel is not harmful to the environment. The development of own raw material base in the areas adjacent to the plant will come to the development of agriculture in this increase komplekse- land of culture, proper crop rotation, the use of modern technology and farming techniques.