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MODERN METHODS OF BIOFUEL PRODUCTION

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Abstract:
Vegetable oils (calorific value 33-34 MJ/kg) have been used as motor fuel for a long time; considerable experience has been gained in the use of sunflower, peanut, soybean, corn, rapeseed and other oils. The most widely used is rapeseed oil, as rapeseed is the highest yielding of the oilseed crops.

Keywords: vegetable oil, rapeseed, biofuel, alcohol, peanuts, bacteria, genetic modification, cellulose, triglyceride.

Introduction

Biodiesel is a multicomponent liquid fuel consisting of methyl or ethyl esters of highly unsaturated and fatty acids obtained as a result of a chemical reaction, mainly as a result of esterification of vegetable oils (rapeseed, soybean, palm, sunflower, linseed, etc.), as well as trans esterified fats (animal and feed) are included. Recently, new technologies for the production of biodiesel have been developed, for example, the treatment of plant materials with genetically modified microorganisms (together with LSG at the University of California, USA, they created a genetically modified strain of Coli bacteria, which has the ability to convert cellulose and hemicellulose into biodiesel), restaurant and use of "waste" vegetable oils collected in cafes, production from raw materials of microbial origin, etc [1-7]. For example, due to the limited resources of vegetable oils obtained from agricultural crops, extensive research is being conducted today on the world scale on the prospective use of various - both natural and newly cultivated special types of algae raw material for biodiesel production [8-17]. In European countries, biodiesel is considered as the main renewable liquid biofuel. Its production volume is growing rapidly. Since 2002, the volume of biodiesel production in the world (1.2 million tons) has reached 18 million tons by 2010

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(in 2009 - 14 million tons). According to forecasts, with this trend, by 2022, the volume of biodiesel production in the world will be 100 million tons per year [18-26]. Germany is the leader in the production and use of biodiesel in Europe - about 3 million tons in 2012 (mainly from rapeseed), the technical capacity of all plants is 5 million tons per year. The second place is occupied by France: about 2 million per year. In general, according to the analytical data of the European Union for 2013, 256 biodiesel production plants are operating in Europe [27-38]. When the shortage of rapeseed crops in Europe led to a decrease in the production of biodiesel and, accordingly, to an increase in its import, the competition between European and foreign producers of this type of fuel became relevant. In Germany, rapeseed oil is mainly used for the production of biodiesel. Rapeseed is a simple crop that can be grown on abandoned land. Increases the biological activity and structure of the soil, cleans it of nitrogen. In Germany, biodiesel is cheaper than conventional diesel, but there is a tax on biodiesel. Rapeseed cultivation is subsidized by the federal budget. Today, let's take a general look at the basic technology of biodiesel production by the method of esterification of vegetable oils [39-44].

Experimental Part

Any vegetable oil is a mixture of triglycerides (esters) with trihydric alcohol ($C_3H_8O_3$) combined with a glycerol molecule. It is glycerin that gives viscosity and density to vegetable oil. To obtain biodiesel, it is necessary to remove glycerin and replace it with alcohol. This process (a chemical reaction of the formation of esters by the interaction of acids and alcohols) is called esterification. The feedstock (oil) is supplied simultaneously with methanol (in a ratio of 1:4 to 1:20 with oil) and a catalyst solution (sodium or potassium hydroxide or sodium methoxide in a ratio of 0.3 to 0.3) sent to the esterification unit equal to 1.5% of the volume of all processed raw materials for carrying out the esterification process [45-50]. At the end of the process, the mixture obtained in the esterification unit as a result of precipitation is divided into two layers: the upper one is a mixture of methyl ethers and methanol, and the lower one is glycerol (with a small amount of methanol). The upper layer is sent to the methanol treatment unit, from which the methanol is returned to the esterification unit, and the remaining raw product - methyl ether (biodiesel) - enters the washing unit and the drying chamber sequentially. The esterification process takes 20 minutes. It is carried out at an operating temperature of 65 °C for several hours.

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Crude glycerine, a by-product obtained from the lower layer by distilling methanol to an esterification unit, is widely used in the pharmaceutical and paint industries. By the way, glycerine can also be processed into bioethanol with a yield of up to 95%. Catalyst-free and supercritical esterification technologies are also used. In the first option, instead of catalysts, special solvents are introduced into the esterification reactor.

Conclusion

Biodiesel also has good lubrication properties. It is known that diesel fuel loses lubricity when sulphur compounds are removed from it. But biodiesel, despite its low sulphur content, has good lubricating properties, which is due to its chemical composition and oxygen content. Thanks to this feature, the life of the engine increases: during the operation of the engine, its moving parts and the fuel pump are lubricated at the same time.

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