UDC 662.767.3

THE INFLUENCE OF ROTATIONAL SPEED ON THE MIXER SHAFT ALKALINITY BIODIESEL IN ITS PURIFICATION

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The methods and results of investigations of rotational speed on the mixer shaft alkalinity biodiesel in its purification. The optimal frequency mixer shaft at neutralizing biodiesel at 40℃

Biodiesel, alkalinity, mixer, speed, neutralization, methyl ester, Soap stock.

Problem. In the production of biodiesel (methyl ester) by conventional technology to accelerate the reaction methanolysis must apply the acid or alkaline catalyst. The heterogeneous catalyst in the production of biofuels byzelnoho rarely used primarily serves homogeneous catalyst. In the case of an acid catalyst reaction time ranging from one to 45 hours, alkaline – from a few tens of minutes to 8 hours (depending on temperature and pressure). Because of faster the reaction methanolysis mainly used alkaline catalyst (potassium hydroxide or sodium), whose solution in methanol is added to fats for biodiesel. However, the catalyst does not react methanolysis, but it accelerates. Therefore, biodiesel manufactured it remains completely, causing corrosion of the engine. Corrosion products, falling into the gap between the cylinder and the piston, causing them to abrasive wear. If it gets into the fuel system, they may slaughter fuel filters, or completely block the fuel spray equipment due to the inability of fuel through the injector [1, 2].

One way to remove the catalyst of biodiesel in the traditional technology of its production is its acid neutralization followed by removal of the formed Soap stock. In [3] The optimal volume of 1% aqueous solution of citric acid to neutralize the alkalinity of biodiesel to below 5 mg / kg according to DIN 51 606 [4] that at pH

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Biodiesel 9.45 are 4,5-6 ml per 100 ml of methyl ether at pH = 8.32 – 4-5 ml per 100 ml of methyl ether. This mixing of reagents was carried on a magnetic mixer at speed magnetic stirring device 214 rev / min. However, the impact of biodiesel neutralization efficiency at other speeds mixer was not determined.

The purpose of our research is to establish the influence of

rotational speed of the mixer to the alkalinity of biodiesel during cleaning.

Results. Methyl ester produced for the study of oil from false flax (83%) of the acid number of 7.75 mg KOH / g, which was added potassium methoxide (17%). Components mixed up magnetic mixer (Fig. 1, a) at 40°C for 15 min., After which the reaction products flowed in separating funnel (Fig. 1b), where they were separated for two hours on crude methyl ester and glycerol. As a result, received 82% methyl ester and 18% crude glycerin. Crude glycerol was poured, and with methyl ether by distillation at 65°C (Fig. 2) at constant aeration air removed excess methanol (0.9% by volume of methyl ester).

a)

b)

Fig. 1. Production of biodiesel: A - mixing reagents magnetic mixer; b - the separation of the reaction products on crude methyl ester and glycerol.

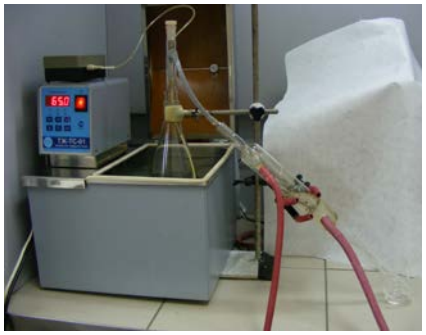


Fig. 2. Remove residual methanol from biodiesel.

Determining the influence of parameters on the mixer alkalinity biodiesel in its purification was conducted in a laboratory setting, which consists of a liquid thermostat LS-TS-01/16 and verhnopryvodnoyi EUROSTAR digital mixers. The sample purified from methanol biodiesel volume of 300 ml was poured into the beaker capacity 0.5 lThat zakriplyaly on a tripod, and pomishaly in water, pour in liquid thermostat (Fig. 3).

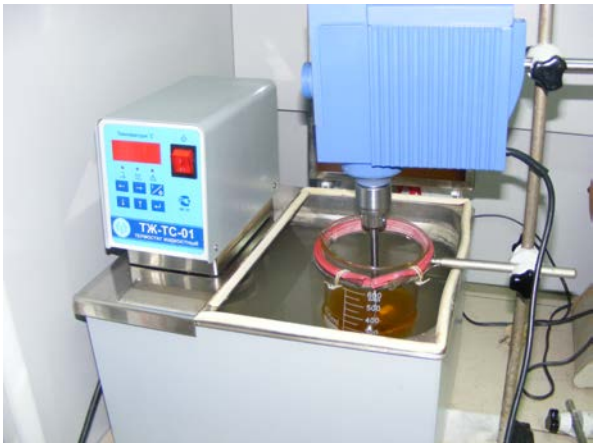


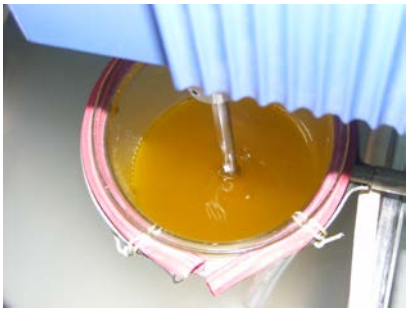
Fig. 3. The laboratory setting to determine the influence of parameters on the mixer alkalinity biodiesel.

At the same tripod zakriplyaly verhnopryvodnu mixer with a paddle chotyrylopatevoyu inclined blades. By means of the required frequency exposed shaft mixers.

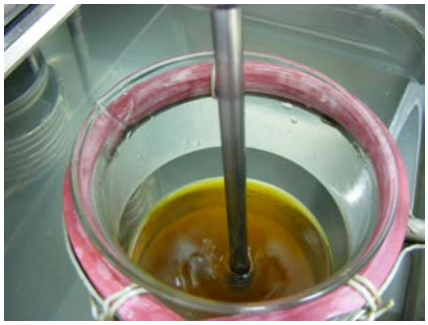
The influence of parameters of the mixer on alkalinity biodiesel conducted at temperatures neutralize 20°C and 40°C and speeds shaft mixers 200; 350; 500 and 650 rev / min (Fig. 4). Mixing time was 5 minutes. As seen from Fig. 4, the frequency mixer shaft 200 rev / min does not cause disturbances methyl ester, and its movement in the glass close to laminar. With increasing frequency shaft mixers in biodiesel appears crater, the depth of which increases with increasing frequency shaft mixers, and at 650 rev / min almost reaches the bottom of the funnel stirrer blades.

After neutralizing the methyl ester poured into a funnel dividing (Figure 5 a) or polyethylene bottles (Fig. 5, B) and allowed to stand for 2-3 days (with increasing ambient temperature while upholding decreased).

While upholding the bottom of the bottle or funnel settles Soap stock - potassium soap formed by neutralization of potassium hydroxide with citric acid (Fig. 6) and the methyl ester of cloudy becomes transparent. Lighted biodiesel drained and determine its alkalinity by the method described in [5]. The results of experimental studies on the influence of parameters mixers alkalinity biodiesel in its neutralizing shown in Fig. 7.



200 rev / min



350 rev / min

500 rev / min.

650 rev / min

Fig. 4. Neutralization methyl ether with stirring with the rotation speed of the shaft mixers.

a)

b)

Fig. 5. Defending neytralizova tion methyl ester: a - a separating funnel; b - transfusion in plastic bottles.

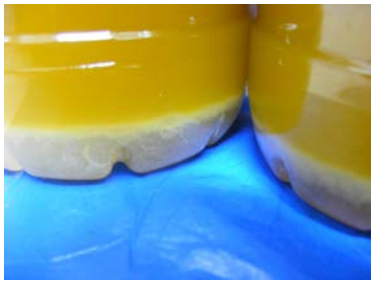


Fig. 6. Settling potassium salts on the bottom of plastic bottles.

The initial alkalinity of biodiesel in the experiments was 37.9 mg / kg. As seen from Fig. 7, reducing its alkalinity is observed when the temperature at which the process of neutralization. At a temperature of 20 neutralization°C can not achieve alkalinity methyl ester below 5 mg / kg (according to DIN 51 606) at all values of rotational speed of the mixer shaft.

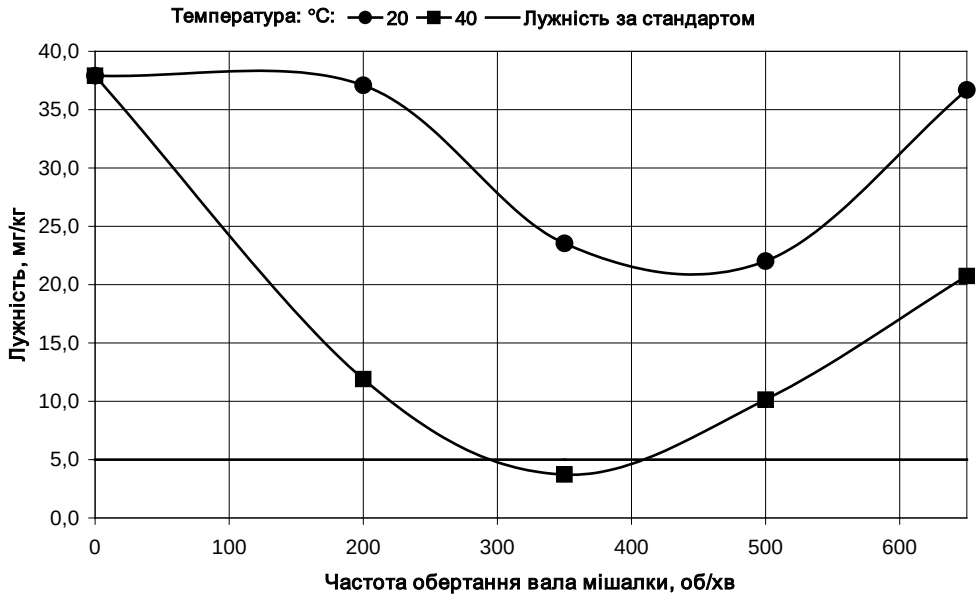


Fig. 7. Dependence of alkalinity methyl ester of the speed mixer at its neutralization.

At a temperature of 40 neutralization°With the optimum speed shaft mixers, where biodiesel alkalinity below 5 mg / kg (ie 3.7 mg / kg) is 350 rev / min. As at lower rotational speed mixers, and in its growth, alkalinity neutralized biodiesel increases and exceeds the value specified in the standard. Poor neutralization methyl ester at low speeds shaft mixers explained by poor mixing of the reactants at high speeds shaft mixers - the formation of the crater, which also complicates mixing.

Conclusion. At a temperature of 40 neutralization°With the optimum speed shaft mixers, where alkalinity biodiesel is lower than 5 mg / kg (ie 3.7 mg / kg) is 350 rev / min. As at lower rotational speed mixers, and in its growth, alkalinity neutralized biodiesel increases and exceeds the value specified in the standard. Poor neutralization of biodiesel at low speeds shaft mixers explained by poor mixing of the reactants at high speeds shaft mixers - the formation of the crater, which also complicates mixing.

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Pryvedenы method and Results of the study of influence of the shaft rotation frequency mixer for alkalinity diesel byotoplyva ego when cleaning. Installed optymalnaya frequency shaft mixer with diesel neytralyzatsyy byotoplyva at 40 °S.

Diesel byotoplyvo, alkalinity, mixer, frequency of rotation, neytralyzatsyya, metylovыy ether, Soap stock.

The methods and results of studies of the effect of frequency of rotation of the agitator shaft alkalinity of biodiesel in its cleaning. It was found the optimal frequency of the agitator shaft, while neutralizing the biodiesel fuel at 40 °C.

Biodiesel, alkalinity, stirrer speed ,, neutralization, methyl ester, soapstock.

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TERMS OF SOLUTIONS OF WEAKLY PERTURBEDLINEAR BOUNDARY PROBLEMS (IF)$\mathrm{k} = -2$

R.F. Ovchar

It is proposed and proved a theorem to obtain sufficient conditions for the existence of solutions of weakly perturbedlinear inhomogeneous boundary value problem in the case where the condition $P_{B_0} = 0,\ P_{B_0^*} P_{Q_d^*} = 0$ *is not fulfilled.*

Heterogeneity, boundary value problems, solutions.

Problem.The relevance of this topic is due, above all, the importance of the practical application of the theory of boundary value problems in the theory of nonlinear oscillations, the theory of stability of motion, control theory, a number of geophysical problems. On the other hand, the article received significant new findings complement research on the theory of nonlinear oscillations for slabozburenyh boundary problems.