UDC 620.95

ENERGY PERFORMANCE ESTERIFICATION PROCESS RAPESEED OIL

MY Pavlenko, applicant
GA Holub, PhD

The experimental results depending specific energy consumption for production of biodiesel frommajor operational and technological parameters of equipment.

Esterification capacity, specific energy intensity, rapeseed oil, diesel biofuel.

Problem. For the production of biodiesel from rapeseed oil there are a number of technologies. The most efficient currently the methanol technology using methanol and alkali catalysts in the specified proportions. Availability in the price of components and equipment for the production of biodiesel makes it economically viable. Compared with ethanol technology, methanol requires a large amount of electricity to generate high pressure in the reactor to undergo esterification of rapeseed oil.

Further improvement of production technology of biodiesel from rapeseed oil is impossible without impact assessmentbasic operational equipment and process parameters on energy intensity esterification process.

Analysis of recent research. Production of biodiesel from rapeseed oil involved: Dubrovin VA [1] Yevych P. [2] V. Polishchuk [8] Are in the works studied production technology; Oil IP [5] Rope MI [4] Golub, GA and Chub VV [3] Who developed and investigated the use of this fuel in terms of agriculture. Melnychuk MD, Dragnev SV Datsenko MS and AE Konechenkov [6] Analyzed the main trends for biodiesel production and drew attention to reducing the cost of production by reducing the cost of purchased grain. To calculate the parameters of the equipment for the production of biodiesel Dragnev SV, based on experimental research was a formula that allows you to calculate the power density during the mixing process of esterification of rapeseed oil, depending on the speed of the mixer blade [7].

However, data on the energy performance of biodiesel production process for methanol technology depending on major operational and technological parameters of equipmentavailable, which in turn inhibits an energy efficiency by improving equipment and facilities.

The purpose of research. Identify dependence energy performance process estyryfikatsiyi rapeseed oil from operational and technological parameters.

Results. Investigation of esterification of rapeseed oil was conducted in laboratory conditions using water termobani to heat and maintain the temperature of the mixture and three-blade stirrer. To establish the relationship influence of time(τ_M) rotational speed three-blade mixers (n) And operating temperature process (T) On the specific energy intensity esterification process (E) Conducted an experiment plan Box-Banking. Spacing values and varying levels of factors studied are shown in Table. 1.

During the experiment were determined (Table. 2), the heating time (τ_H)Time defending mixture (τ_B), Electricity consumed for heating the mixture, stirring it and maintaining temperature esterification process (W)biodiesel yield $V_{ДБП}$.

1. The range of values and levels of varying factors studied

Name factor and its designation	Levels factors			Varying intervals
	-1	0	+1	
The temperature of the mixture, ° C	5	25	45	20
Rotation speed mixers, rev. / Min.	80	115	150	35
Mixing time, min	10	30	50	20

Based on the determined:
biodiesel output ratio:

$$k_{ДБП} = \frac{V_{ДБП}}{V_O} 100 \qquad (1)$$

where $k_{ДБП}$ - Output ratio biodiesel%; $V_{ДБП}$ - The amount of biodiesel, Jr; V_O - The amount of oil (in all experiments was at 400 ml).

- performance esterification:

$$Q = \frac{V_O k_{ДБП}}{\tau_H + \tau_M + \tau_B} \qquad (2)$$

where Q - Performance esterification process, m3 / h. τ_H - Mixing time, h .; τ_M - Heating time, h .; τ_B - Time defending, h.

- specific power consumption for the process:

$$E = \frac{W}{Q} 100 \quad (3)$$

where E - Specific electricity consumption, kWh. / M3; W - Electricity consumed for mixing oil, heating oil and maintain the desired temperature oil kWh.

According to experimental results obtained mathematical model - the regression equation in the form of a second order polynomial, which is:

$$E = - 3.7120 - 0.0368T + 0.0842n - 0.0119\tau + 0.0112T^2 - 0.0004n^2 + 0.0006\tau^2 - 0.0003Tn + .0030T\tau + 0,0010n\tau . \quad (4)$$

2. Measured and calculated values.

τ_H ,min.	τ_B Min.	W, kWh.	$V_{ДБП}$ Ml	V_{CM} Ml	$k_{ДБП}$, %	Q, m3 / h	E, kWh / m3
16	34	.0105	365	460	91.3	0.000273	28.83
0	189	0,0015	370	455	92.5	0.000101	4.05
16	43	.0097	355	455	88.8	0.000239	27.53
0	83	0.0022	370	455	92.5	0.000196	6.08
16	26	.0128	365	455	91.3	0.000238	35.22
0	168	0.0006	370	460	92.5	0.000124	1.80
16	60	.0086	375	470	93.8	0.000261	23.15
0	60	.0033	370	455	92.5	0.000201	9.01
8	58	.0066	370	455	92.5	0.000191	17.85
8	140	.0031	375	465	93.8	0.000142	8.28
8	120	.0033	375	460	93.8	0.000163	8.95
8	76	.0053	372	460	93.0	0.000166	14,40
8	44	.0047	370	460	92.5	0.000270	12.70
16	44	.0046	370	460	92.5	0.000270	12.56
0	44	.0046	370	460	92.5	0.000270	12.43

Regression analysis shows that with increasing temperature esterification process specific power consumption increases due to the increase in electricity consumption for heating and maintaining temperature esterification process (Fig. 1). With increasing rotational speed mixers specific power consumption increases slightly (Fig. 2), due to an increase in electricity consumption by stirring the mixture.

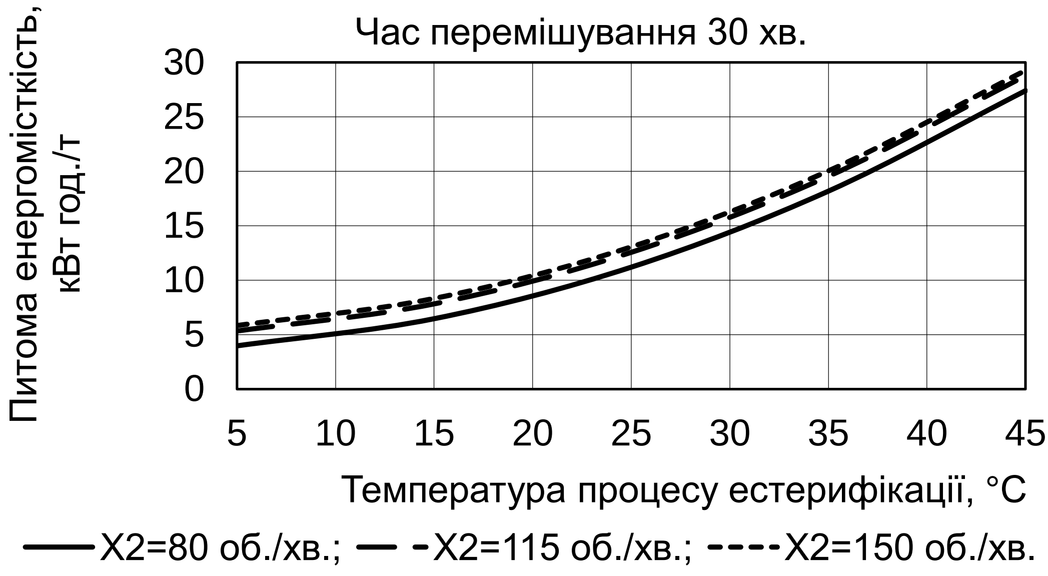

Fig. 1. Dependence of specific energy consumption process, the temperature of the mixture.

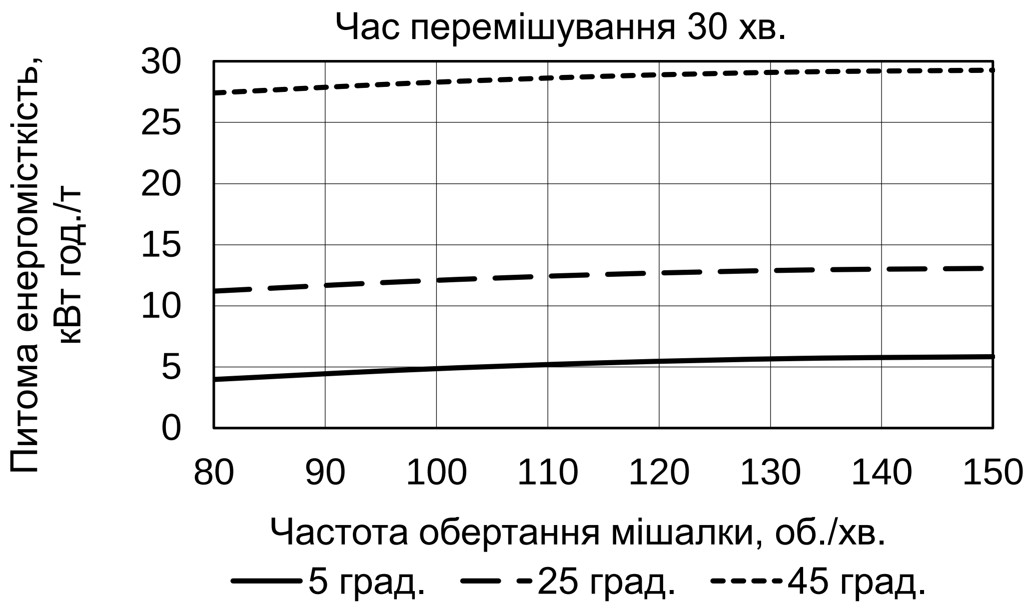

Fig. 2. Dependence of specific energy consumption of the process of the speed stirrer and temperature esterification process.

Analysis of the mutual influence of rotational speed stirrer and temperature of the mixture (Fig. 3) showed that with increasing rotational speed stirrer and temperature esterification process specific power consumption increases due to the increase in electricity consumption for heating, maintaining esterification process temperature and stirring the mixture. Minimum relative power consumption of 4 kWh. / Vol. esterification process at 5 ° C and a rotation frequency mixers 80 rev / min.

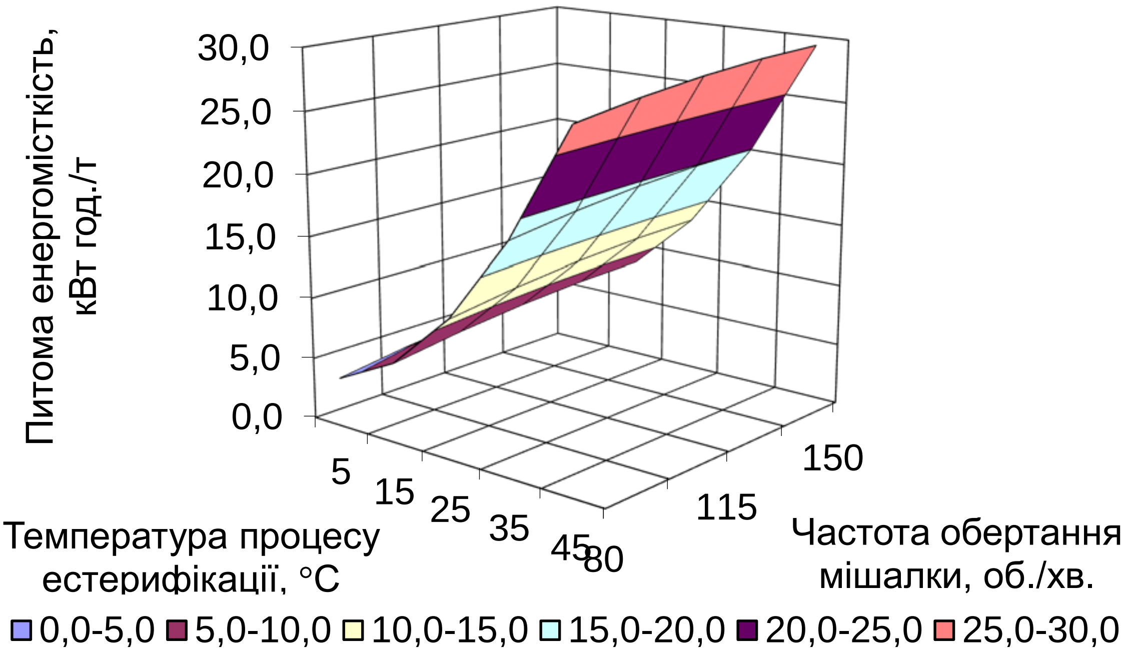

Fig. 3. Dependence of specific energy consumption of the process of esterification process temperature and rotational speed mixer.

It was also established (Fig. 4) that the specific power consumption increases with increasing mixing time, due to the increase in electricity consumption for heating and maintaining temperature esterification process. With increasing temperature, the mixture relative energy intensity of the process increases with the temperature esterification process (Fig. 5), due to an increase in electricity consumption for heating and maintaining temperature esterification process.

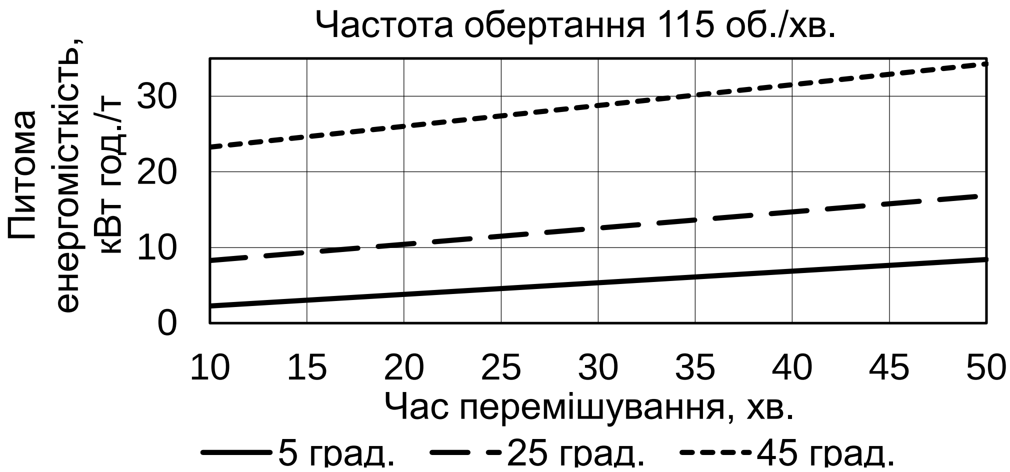

Fig. 4. Dependence of specific energy consumption process occasionally stirring the mixture.

Analysis of the influence of time and temperature mixing process of esterification (Fig. 6) showed that with increasing mixing time and mixing process temperature increases specific power consumption process, due to the increased energy consumption for heating and maintaining the esterification process, depending on the increase in mixing time. Minimum relative energy intensity of the process is 2.3 kWh. / Vol. mixing time at 10 minutes. esterification process and temperature 5 ° C.

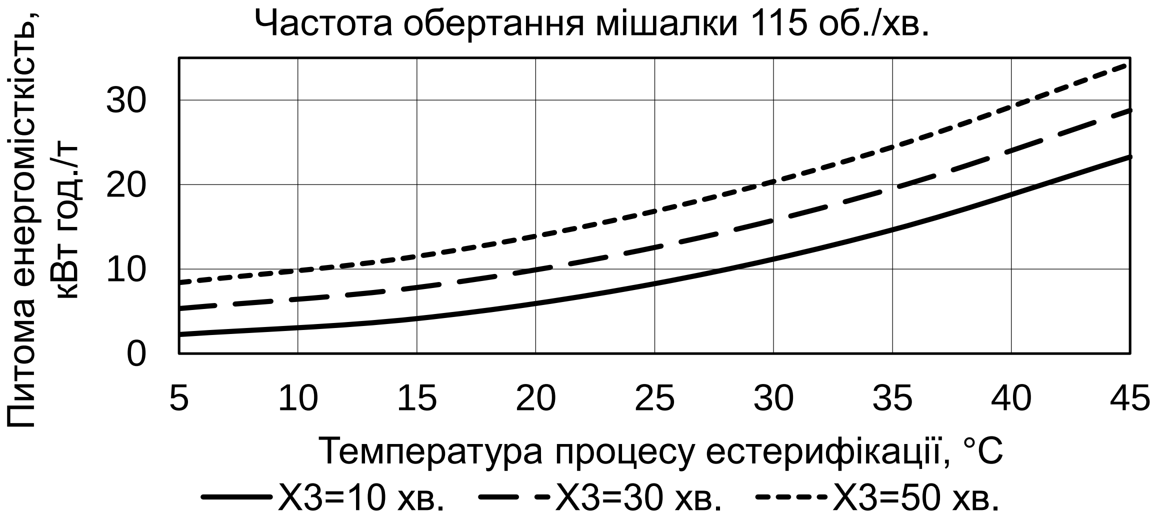

Fig. 5. Dependence of specific energy consumption process temperature esterification process.

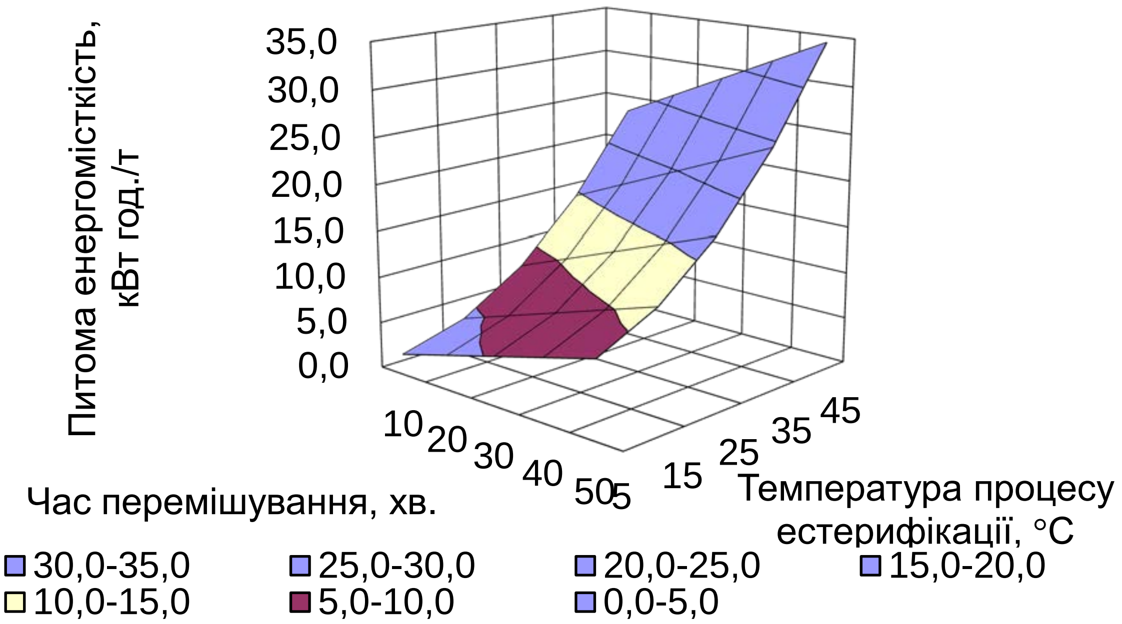

Fig. 6. Dependence of specific energy consumption of the process of esterification process temperature and mixing time.

Specific process energy intensity also increased with increasing rotational speed mixers, due to the increase in electricity consumption by stirring the mixture (Fig. 7). When mixing time 10 min. and the frequency of rotation of the agitator specific power consumption was almost unchanged, due to increasing mutual electricity consumed in the process of mixing and performance esterification. Was found that with increasing rotational speed mixers specific power consumption increases (Fig. 8) depending on the rise time stirring the mixture due to the increase electricity consumption for heating and stirring the mixture.

Analysis of the influence of rotational speed mixers and mixing time showed that (Fig. 9) with increasing rotational speed mixers mixing time depending on the specific energy intensity remains virtually unchanged, due to a simultaneous increase in energy consumption and process performance throughout the period. The minimum specific power consumption is 7.6 kWh. / Vol. at speed of 80 rev. / min. and mixing time 10 min.

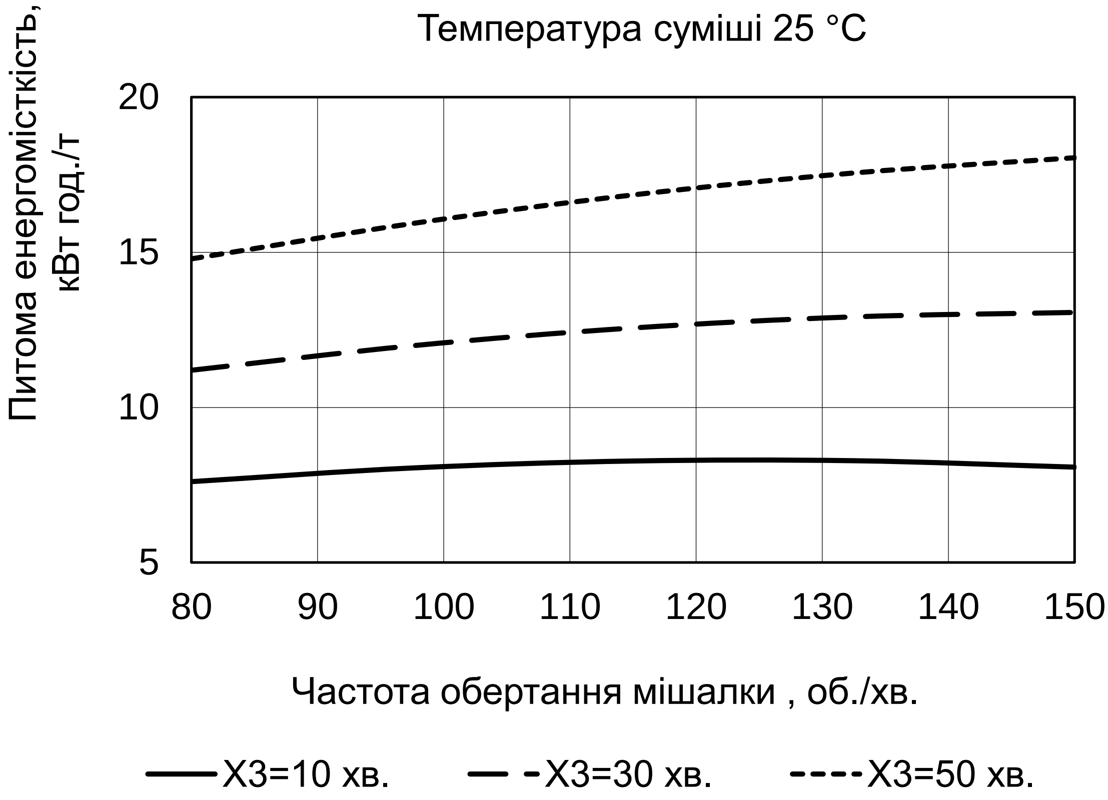

Fig. 7. Dependence of specific energy consumption of the process of the speed mixers.

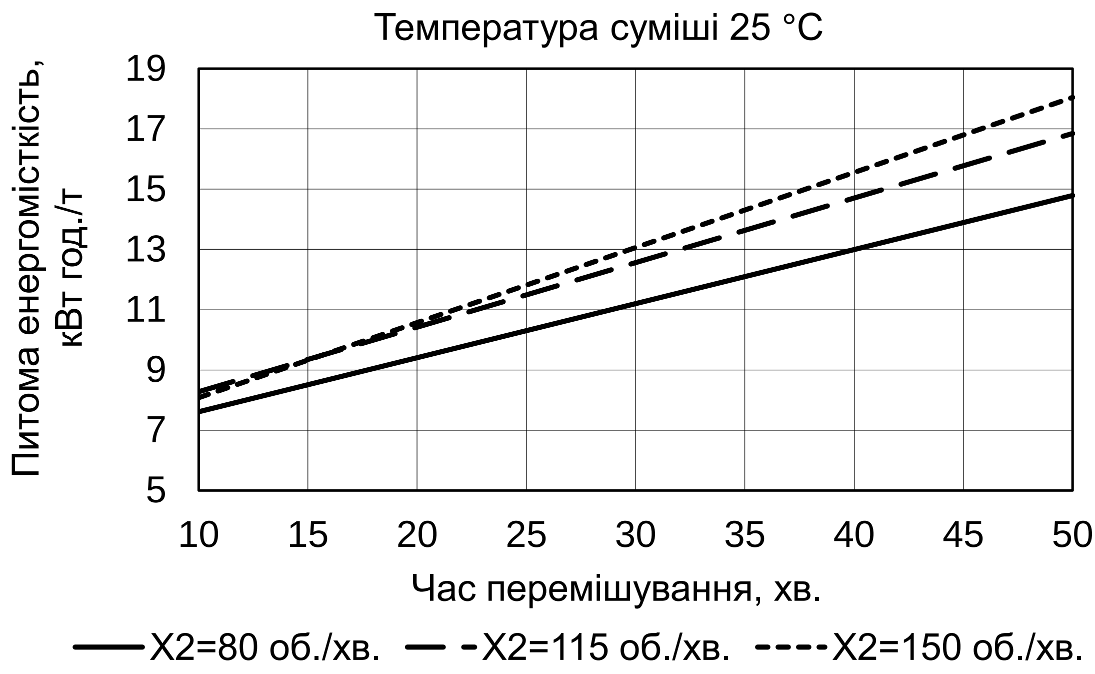

Fig. 8. Dependence of specific energy consumption of the process of mixing time.

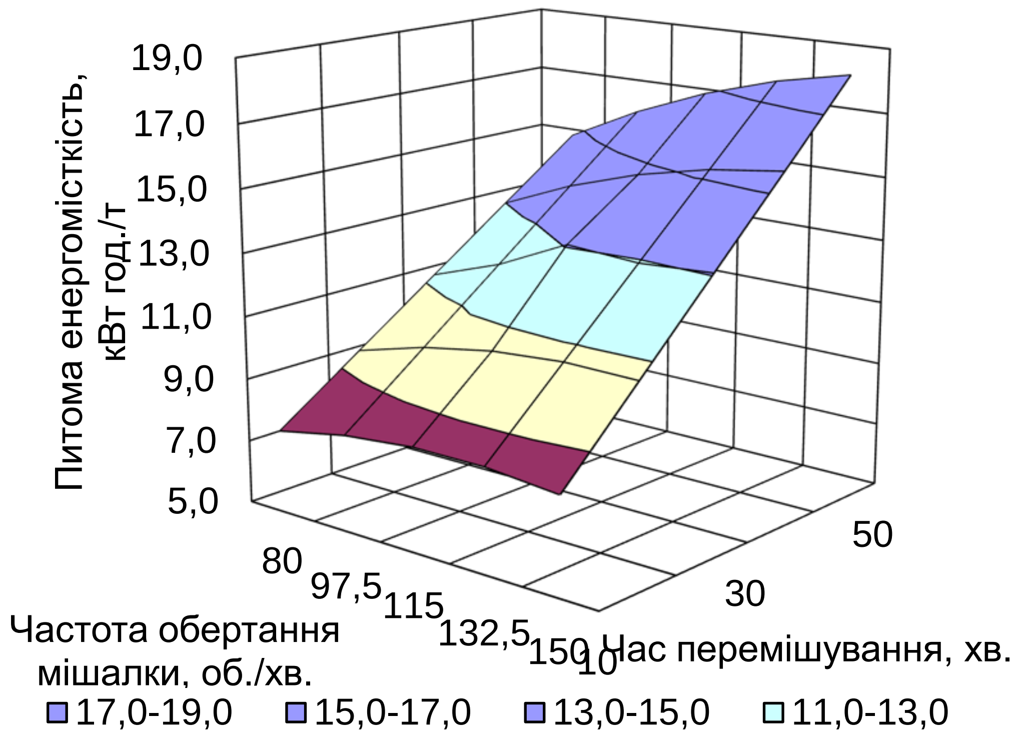

Fig. 9. Dependence of specific energy consumption of the process of the speed mixers and mixing time.

Conclusion. Research has established that the minimum specific energy intensity esterification process rapeseed oil is from 2.3 to 7.6

kWh. / t mixer at speed of 80 rev. / min., stirring time of 10 min. esterification process and temperature 5 ° C. Given the fact that obtaining high-quality biodiesel possible with the same parameters, but mixing time about 50 min., it is necessary to improve the manufacturing process of biodiesel production towards the use of equipment with stirring at the start of the reaction for esterification and at the end to remove excess methanol.

References

1. *Biological* resources and technologies biofuels: Monograph / YB Blum, G. Geletukha, IP Hryhoryuk, KV Dmitruk, VA Dubrovin, AI Yemets, GM Zabara, GM Kaletnik, MD Melnychuk, V. Myronenko, DB Rakhmetov, AA Sybirnyy, SP Tsygankov - K. "Agrar Media Group", 2010. - P. 289-298.
2. *Biofuels* (Technology, machinery and equipment). [Dubrovin VA, Korchemnyy MO, Oil IP, Sheptitsky O. Pastore S., A. Hzhybek, Yevych P. Amon T., V. Kryvoruchko] - K .: TSTI : Power and Electrification, 2004. - P. 76-87.
3. *Golub, GA* Features plants for biodiesel production / GA Golub, V. Chub, MI // Ropes Industrial hydraulics and pneumatics (Ukrainian scientific journal). - 2011. - № 2 (32). - P. 91-95.
4. *Golub, GA* Pcookie domain coiled pipe eteryfikatora for biodiesel / GA Pigeon, MI // Ropes Scientific Bulletin of National University of Life and Environmental Sciences of Ukraine / Editors: DO Melnychuk (editor) and others - K., 2009. - Vol. 134, p. 2. - P. 124-131.
5. *Oil IP* Production and use of biofuels based on vegetable oils / I.P.Maslo, V.P.Zaborskyy, M.I.Virovka // Proceedings of the International Scientific Conference "Problems and prospects of agricultural mechanics." - Dnepropetrovsk. 2004. - P. 49-51.
6. *Melnychuk MD* The development of bioenergy as new areas of agricultural production in Ukraine / MD Melnychuk, VA Dubrovin, SV Dragnev, MS Datsenko, AE Konechenkov // Scientific Bulletin of the National Agrarian University. - Kyiv, 2007. - Vol. 117. - P. 190-212.
7. Justification adaptive process parameters and reactor to produce methyl esters of vegetable oils: Author. Thesis. ... Candidate. engineering sciences: 05.05.11 - machinery and mechanization of agricultural production / SV Dragnev; National University of Life and Environmental Sciences of Ukraine. - K., 2009. - 20 p.
8. *V. Polishchuk* Biodiesel Production Technology (review) / VM Polishchuk, S. Tarasenko, ID Gumenyuk, MN Hawk, AV Polishchuk // Scientific Bulletin of National University of Life and Environmental Sciences. - Kyiv, 2010. - P. 354-359.

Results of research Pryvedenы эksperymentalnыh dependence on energy costs udelnыh Production of diesel byotoplyva from major rezhymnыh and parameters of technological equipment.

Etherification, power, udelnaya эnerhovmesty Bridge, rapsovoe oil, diesel byotoplyvo.

The experimental research results specific energy consumption dependence for the biodiesel production and main operational and process parameters equipment are given.

Etherification, power, specific energy intensity, rapeseed oil, biodiesel.

UDC 669.18.621: 539.21

PROSPECTS FOR IMPROVEMENT RESOURCE The responsible PARTS AGRICULTURAL MACHINES

EG Aftandilyants, PhD
OV Zazymko, KG Lopatko, Ph.D.

Powered promising areas increase service life of critical parts of agricultural machines.

Resource nanoparticle dispersion strengthening, carbides, nitrides, vanadium, driving wheel, roller, link tracks, tractor.

Problem. The structure of the materials used in the engineering of farming country, irrational and a hindrance to the successful resolution of the problem of raising the technical level of machines produced. For example, the proportion of high-strength steels used in total Cast and rolled steel is 6% compared to 18-20% in rural economic engineering developed countries. In the design of the machine is mainly used traditional construction materials, assortment and quality of which do not meet modern requirements. This is one reason that about 40% of agricultural machinery, manufactured, and 30% of tractors are compared with foreign counterparts high metal content, low resource idovhovichnist separate units that are particularly exposed to abrasion wear.

For example, to set cultivator working bodies of foreign firms «Lemken» in terms of a superior domestic counterparts 10 times. Compared to classic agricultural machinery use of such technology can reduce fuel consumption of lubricants by 30% and shorten the field work.

The technical provision of agriculture in Ukraine remains quite low. Recently, at the same time narrowing the volume of agricultural production declined and agricultural machinery fleet. Much of the technology that is available on farms worked by two or more legal limit.

To restore the previous level of agriculture should significantly increase the number and quality of agricultural machinery. Do this by