4. Василенко П.М. Теория движения частицы по шероховатым поверхностям сельскохозяйственных машин /П.М. Василенко. - Киев: УСХА, 1960. - 283 с.
5. Патрин, А.В. Обоснование процесса сегрегации при инерционном сдвиговом течении зернового вороха в горизонтальном цилиндрическом решете: дис. ... канд. техн. наук. 05.20.01. /А.В. Патрин -Новосибирск, 2004.- 168 с.
6. Тищенко Л.Н. Влияние вибрации на технологический процесс барабанного зернового скальператора /Л.Н.Тищенко, А.В.Миняйло, С.А.Богданович //Вибрации в технике и технологиях. Винница, №2(70), 2013. С.200 -204.
7. Насіння сільськогосподарських культур. Методи визначення якості. ДСТУ 4138–2002. – [Чинний від 2004-01-01]. – К.: Держспоживстандарт України, 2003. – 173 с.
8. Сельскохозяйственная техника. Методы определения условий испытаний: ГОСТ 20915-75. – [дата введения 1977-01-01] – М.: Издательство стандартов, 1975. – 118 с.

Leonid Tischenko, Sergey Bogdanovich
Kharkiv national technical University of agriculture named. Vasilenko, Kharkov
Experimental research of the influence of vibration on efficiency the grain heap scalperation

Objective. The objective is to perform analysis and comparative study of the effectiveness of a cylindrical sieve when it only rotational movement and with the addition of vibration.

The results of experimental investigation of the technological process of separation of grain heap on the horizontal drum separator for the separation of large impurities when only the rotational motion of his sieve and when applied to this movement vibration. Imposition of vibration significantly improve specific productivity of separator. The optimum mode of vibration.

Conclusions

1. Adding vibration to rotational motion of a cylindrical sieve drum skalperators can increase its share performance without sacrificing quality of the process skalperuvannya. The optimum value of vibration intensity is (1.2 ... 2) g.

2. Vertical vibrations are more favorable to the quality of the skalperuvannya than the horizontal axis.
separator, cylindrical sieve grain mass, vibration, efficiency

Одержано 31.10.13

UDC 668.52

Z. Tkáč, prof. Ing. PhD., J. Kosiba, Ing. PhD., J. Tulík, Ing.
Slovak University of Agriculture, NITRA, Slovak Republic

The laboratory tests of ecological hydraulic fluid

The paper deals with testing of ecological hydraulic fluid. The ecological hydraulic fluid was applied in the gear-hydraulic circuit of a Zetor Forterra 114 41 tractor. The paper deals with the life extension of the ecological fluid by proposed filtration system in the laboratory at the Department of Transport and Handling, Faculty of Engineering, SUA in Nitra. The tests were supported by the Scientific Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic – VEGA, Grant No. 1/0857/12.
tractor, hydraulic pump, flow effeciency

З. Ткач, Я. Кошиба, Я. Тулик
Словацкий сельскохозяйственный университет, г. Нитра, Словакия
Лабораторные исследования экологической гидравлической жидкости

В статье рассматриваются испытания экологической гидравлической жидкости. Экологическая гидравлическая жидкость была использована в гидравлическом контуре трансмиссии трактора Zetor Forterra 114 41. В статье рассматривается вопрос о продления срока службы экологической жидкости. Для этого в лаборатории Словацкого сельскохозяйственного университета предложена система фильтрации. Испытания проводились при поддержке Научного Агентства по грантам Министерства образования, науки, исследований и спорта Словацкой Республики - VEGA, грант № 1/0857/12.

Положительный эффект фильтрации выражается в уменьшении чистоты кода загрязнения (ISO 4406) для частиц больших, чем 14 мкм.

трактор, гидравлический насос, экологическая жидкость

Introduction. Due to advantages in renewability and environmental acceptability, bio-sourced and biodegradable hydraulic fluids are increasingly used in fluid power applications [1, 22]. In this time, the difference between of conventionally produced fluid and ecological fluid two or three times of the price. Therefore is necessary to look for new solutions how to extend the technical life, which could have the effect on their increase use. Consumption of ecological fluids in EU is 0.12 Mt per year from total world production of 35 Mt per year [20]. Almost 50 % of all the sold fluids in the world finish at present times as forfeits during the operation in nature [10].

In working device the fluid transfers the energy and also carries the information about process in it. Into the fluid during the device operation entrance metal particles through which is possible to evaluate a wear process and predict the next operation of the device. Particle contamination in hydraulic fluid accelerates wear of system components [2,3]. Therefore is very important to pay attention to purity of hydraulic fluid which is used.

The fluid should be replaced if the value exceeds the limits, which are specified by manufacturer. The most common hydraulic fluid contaminants are water and air, along with particles of metal, rubber or dirt [21, 9, 12]. If the fluid is contaminated and has a good physical-chemical properties (total acid number, kinematics viscosity, water content) have to be replaced. This means shortening the operational life. It is an uneconomical solution especially for expensive ecological fluids. Solution can prevent by the right choice of filtration [15,27].

During the operational test was observed effect of new developing synthetic ecological fluid on the basis of flow characteristics of hydraulic pump UD 25. The new hydraulic pump was mount on the tractor Zetor Forterra 114 41.

Flow characteristics of UD 25 hydrostatic pump were measured on the experimental device at the Department of Transport and Handling, Faculty of Engineering, SPU in Nitra. Hydrostatic pump type UD 25 was mounted on the Zetor Forterra 114 41 tractor. After completing of 450 and 900 Eh was unmounted hydrostatic pump from the tractor and was mounted to the experimental device. In this device was effective the measurement of the flow characteristics.

Materials a method. Properties of ecological fluid type HERP (VDMA 24568) were studied under operational conditions in tractor Zetor Forterra 114 41. The operational test was carried on the basis of results obtained from accelerated laboratory tests of ecological fluid. The ecological fluid is a newly developed ecological fluid, which is made with synthetic base fluid based on poly-alpha-olefins. We choose this fluid, because it has high chemical stability and miscibility with mineral fluids, which are currently used in tractors in Slovakia. During the test we used a new ecological fluid MOL Farm UTTO Synt, which is produced by MOL Group, Hungary.

This fluid belongs to the group of universal transmission hydraulic fluid designed for tractors. The specifications of fluid are: kinematics viscosity at 40 °C = 58. 14 $mm^2 . s^{-1}$; kinematics viscosity at 100 °C = 10. 22 $mm^2 . s^{-1}$; viscosity index = 165; pour point = (-42 °C).

During operation of tractor were observed the following physical–chemical properties of ecological fluid:

- kinematics viscosity;
- total acid number;
- water content;
- contamination of fluid particles by cleanliness code (ISO 4406);
- contamination of fluid particles by ICP spectrometry;
- fluid mixtures contamination by infrared spectroscopy.

During sampling, we have to ensure a procedure by which it was necessary to observe all of sample case principles and sampling equipment. Others important factors during obtaining of representative samples are the right choose of delivery points, mixing and heating the fluid at operating temperature.

During operation of tractor, we monitored the fluid effect on wear of tractor hydraulic pump. In case of hydraulic pump of tractor Zetor Forterra is in operation immediately after the engine starting. The quality of ecological fluid influences on wear always whenever the tractor is working. Hydraulic pump is a part of the hydraulic system which is susceptible to wear and its possible for the simple dismounting easily evaluate the technical state on the basis of flow efficiency [13,14].

Flow rate characteristic of hydrostatic pump

After completing of 450 and 900 Eh was unmounted hydrostatic pump type UD 25 from the tractor. It was placed consecutive in an experimental device for measuring the rate characteristics. The characteristics were measured at nominal rotations of 1,500 rpm. In the picture 3 are depicted the flow characteristics of the UD 25 hydrostatic pump.

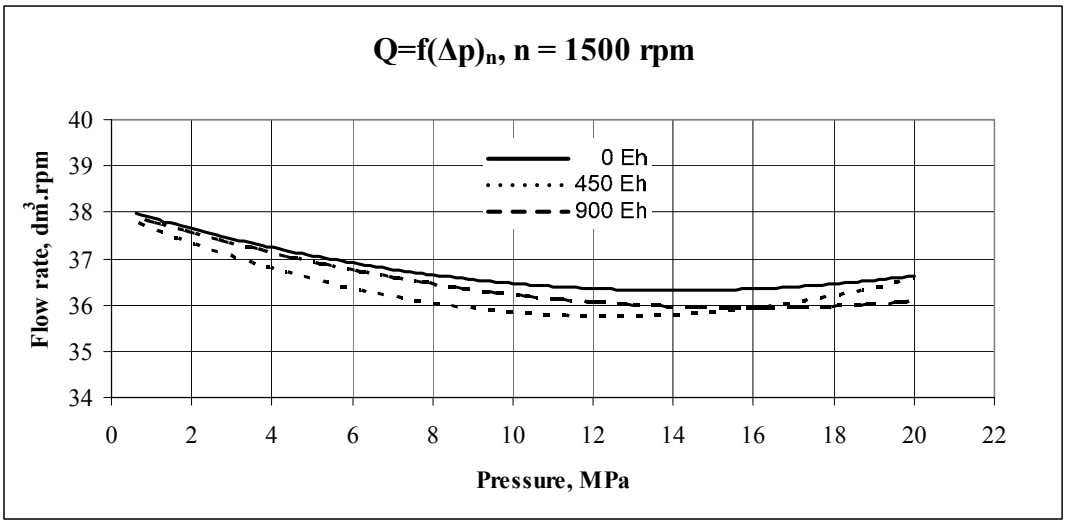


Figure 1 – Flow rate characteristic of hydrostatic pump at n = 1,500 rpm

The calculation of flow efficiency decrease

The standard STN 11 9287 determines the way of the test evaluation. The fluid must by evaluate by flow efficiency decrease of the hydrostatic pump s follows [24,18,19]:

$$\Delta\eta_{pr} = \frac{\eta_{pr0} - \eta_{pr900}}{\eta_{pr0}}.100, \quad (1)$$

where $\Delta\eta_{pr}$ – flow efficiency decrease (%);
η_{pr0} – flow efficiency at 0 engine hours (start of the test);
η_{pr900} – flow efficiency after 900 engine hours (end of the test).
Then, the flow efficiency is expressed by the equation:

$$\eta_{pr} = \frac{Q}{V_G \cdot n}.100, \quad (2)$$

where Q – flow of hydrostatic pump (dm^3.rpm);
V_G – geometrical volume of hydrostatic pump (dm^3);
n – nominal rotation speed of hydrostatic pump (l.rpm).

Rotation speed of 1,500 rpm and pressure of 20 MPa at 0 Eh result in the flow rate of 6.17 dm^3.rpm and of 36.33 dm^3.rpm at 900 Eh. The flow rate decrease is 1.197%. Tkáč et al. (2010) [23], using the hydrostatic pump UD 25 with biodegradable fluid type ERTTO, obtained a decrease of flow rate of 7.3 % after 10^6 cycles of pressure loading (STN 11 9287). Drabant et al. (2010) [7] obtained a decrease of flow rate of 3.6 % at revolution of 1,500 rpm and pressure of 20 MPa after 300 Eh.

Table 1 – The evaluation of hydraulic test by rotation speed n = 1,500 rpm

Count of engine hours	Rotation speed (n = 1,500 rpm)		
	Flow Q (dm^3/rpm)	Flow efficiency η (%)	Decrease of flow efficiency Δη (%)
0	36.71	96.89	0
450	36.64	96.75	0.146
900	36.33	95.73	1.197

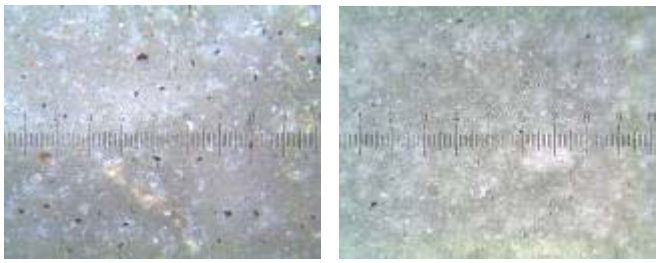
Fluid evaluation of solid particles contamination

Monitoring of fluid evaluation on the basis of solid particles contamination during tractor operation by ICP spectrometry is in table 2. We can see the content of chemical elements which contaminate the ecological fluid. This is mainly Fe, Cu, Sn, Pb, Si, Cr, Al. The origin of the metal content as are Fe, Cu, Sn, Pb, Al is attributes to wear friction pairs. Silicium is an indicator of dust contamination, which it obtains into the system from external environment.

Table 2 – Contamination Values of ecological fluid on the basis of tractor operation by ICP spectrometry

Element	Unit	Count of engine hours (engine hours - EH)			
		0	150	450	900
Si	mg . kg^{-1}	6	8	12	18
Al	mg . kg^{-1}	1	1	2	6
Cr	mg . kg^{-1}	<1	<1	1	2
Cu	mg . kg^{-1}	1	40	59	75
Fe	mg . kg^{-1}	2	37	48	88
Sn	mg . kg^{-1}	<1	<1	<1	2
Pb	mg . kg^{-1}	3	2	7	7

Figure 2 shows the used fluid samples obtained by filter kit FAS 2, which were analyzed by microscope.

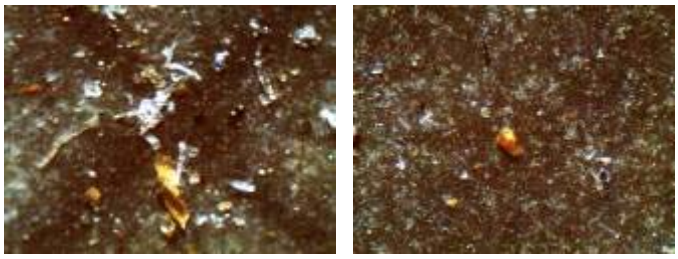


a b

a) magnification 50 x, b) magnification 100x

Figure 2 – Fluid samples of solid contamination at 0 EH

In new fluid were identified particles of contamination (figure 1) that can get to fluid during the process of production and distribution. Some level of particle contamination is always present in hydraulic fluid, even in new fluid [2]. In practice, this case occurs frequently and therefore would by appropriate to be concerned with entry control and consequently filtration of fluid before its first use in device.



a b

a) magnification 50 x, b) magnification 100x

Figure 3 – Samples of solid contamination after 900 EH

In figure 4a we can see the sample after 900 EH where there are visible yellow coloured particles. These particles originate mainly by adhesive wear. In the sample (figure 3b) was identified a brass particle of abrasive wear, what could be indicate approaching failure of the hydraulic and transmission system. Comparing of figure 2 and 3 we can see that the fluid after 900 EH was considerably contaminated with dirties of various origins. This was reflected in dark colouration of the filter paper. There are mainly resins, which originate during degradation process. Ecological hydraulic fluid had good physical-chemical properties, and therefore aging products of fluid into the fluid fill probably got trough outer hydraulic circuit from attachments.

Origin analysis of ecological fluid contamination

Evaluation of ecological fluid by IR spectroscopy is in figure 4. In areas around 1,650 cm^{-1} and 1,600 cm^{-1} are parts of IR spectra at which we can see the change of identity of used fluid. From 450 EH we can see the resizing of peaks in observed areas which can be to attribute to mixing of ecological fluid and other fluid. This mixing and the resulting contamination are caused by connection of attachments from outer hydraulic circuit of tractor. Based on the size of the peak in area 1,600 cm^{-1}, we can assume that the tested ecological fluid was mixed with mineral fluid used in majority of agricultural machinery in Slovakia. The type of contamination is likely that this are resin, which are produced during the degradation processes – fluid aging. It is characteristic of the degradation of mineral fluid which is mixed with the used fluid during test [25,27].

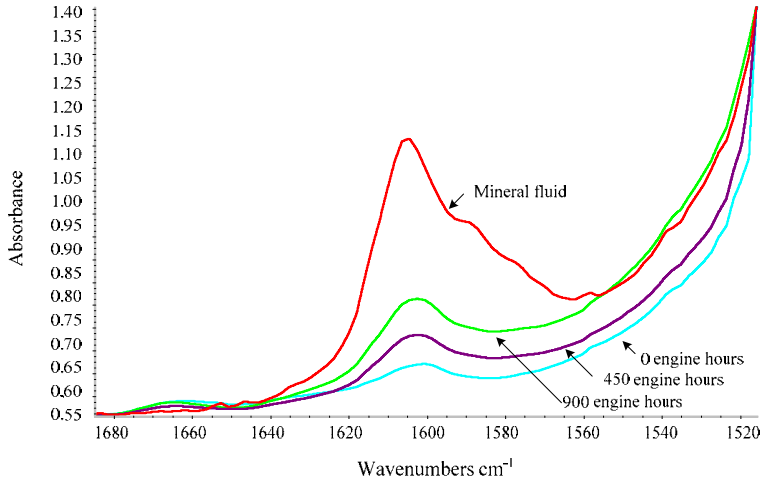


Figure 4 – Evaluation of contamination of ecological fluid by FT-IR spectroscopy

Physical-chemical properties of ecological fluid

The first of the physical-chemical properties of fluid which was evaluated is kinematics viscosity.

Manufacturer considers the fluid as eligible for continued operation if the measured values of kinematics viscosity are within tolerances ± 10 % in view of new fluid. The values of kinematics viscosity measured at 40 °C (table 3) are in required tolerance during test. Whereupon that the fluid is possible in term of kinematics viscosity used without exchange.

During the test we also measured total acid number (table 3). This is important evaluation parameter for fluid, because an increase of acids is characterized by aging, degradation of fluid. The measured values didn't exceed the limit value and the ecological fluid can be used without exchange.

Water content contained in tested fluid was determined with coulometric method. The water can get into the system through a variety leaking e.g. leakage of cooler system, improper seal fluid system, improper storage or longer stop of devices work. Water in the hydraulic system acts as degradation catalyst and can impair some additives, increase the acid number and creating conditions which are suitable for corrosion [15,16]. During the measurements of water content, we don't found water in fluid and a fluid meets for next operation (table 3).

Table 3 – Values of physical-chemical properties of ecological fluid

Parameter	Unit	Count of engine hours			
		0 EH	150 EH	450 EH	900 EH
Kinematics viscosity	$mm^2 . s^{-1}$	58	57	54	54
Total Acid Number	$mg . KOH.g^{-1}$	1.19	3	3.2	3.2
Water content	ppm	0	0	0	0

Removal of dangerous contamination from ecological fluid

To remove of dangerous contamination from fluid, we used the designed filter system (figure 4). It was designed on the basis of components which were used in various devices and are still functional. These components can be founded in almost all agriculture farms in Slovakia. After this manner were given economics vantage and available solution. Price of bought filter cartridge is 5 €. Filtration ability of paper cartridge 10 μm and a maximum

pressure 0.25 kp.cm^2. The basis of proposed filtration device is filter block Kovolis Hedvikov FS 32 – 10 connected to the outer hydraulic circuit of tractor (figure 5). The filter device was connected to a hydraulic outside circuit by pressure hoses. Flow rate, pressure and temperature of fluid were regulated by Owatonna device, which is also connected to a hydraulic outside circuit

Figure 5 – Filter device, Owatonna device and CS 1000 optical device connecting to a hydraulic outside circuit of tractor

The filtration device was designed to remove contaminants from the transmission and hydraulic system of tractor. Operating parameters of fluid and hydraulic system of tractor were improved. An analysis of parameters of tractor hydraulic parts for the purpose of research to improve their properties solved the authors of contributions in scientific journals Hujo (2000), Drabant (2001,2005,2006), Gurina, (2005), [11, 4, 5, 6,8].

In figure 6 can see the progress contamination of ecological fluid during the test and after application designed of filtration device. The picture shows the limit values of pollution for the elements CU and Fe, which exceeded the limit values during the test. The concentration of Si was exceeded and concentration of Pb and Al was adjacent. After tractor running 900 Eh was applied designed filtration device, upon which there was a decrease in the concentrations of elements. Content of Fe decreased after filtration by 30%.

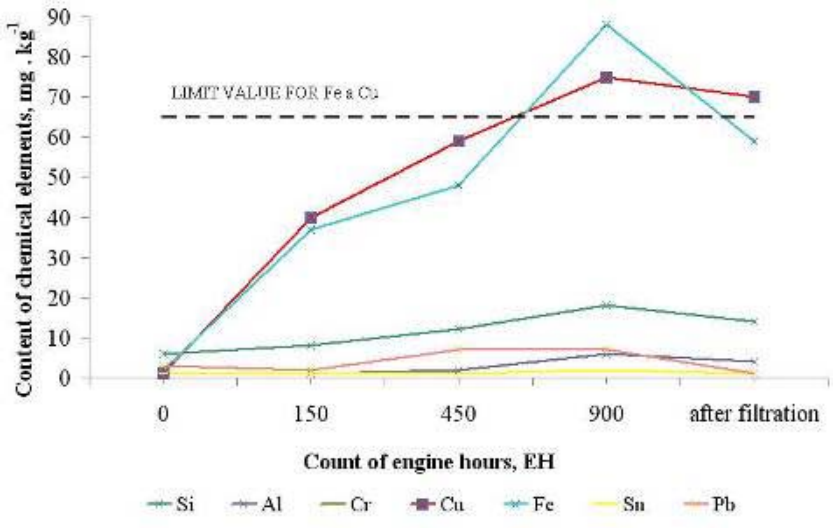


Figure 6 – Evaluation of fluid contamination by IR spectroscopy

Table 4 shows the results of measurements of cleanliness code by CS 1000 device, manufactured by Hydac, Germany. The device was attached to the filtration device during the filtration of ekological fluids. From value is obvious decrease character elements large than 14 μm, which shows by the correct functioning designed of filtration device.

Table 4 – Evalauation of measurements cleanliness code

Measurement	Cleanliness code by ISO 4406		
	< 4 μm	< 6μm	<14μm
1.	24	23	10
2.	24	23	9
3.	24	23	8

Conclusion

The paper deals with testing of ecological gear-hydraulic fluid type MOL Farm UTTO Synt, applied in a Zetor Forterra 114 41 tractor which was preceded by an accelerated laboratory test performed on the Department of Transport and Handling, Faculty of Engineering, Slovak University of Agriculture. During the operational fluid test were sampled and its quality characteristics were rated. At the end of the operating test by revolution n = 1,500 rpm decreased flow rate efficiency of the hydrostatic pump from value η_{pr0} = 96.89 % to value flow rate efficiency η_{pr900} = 95.73 %. Basically of decrease flow rate efficiency was achieved assessment of technical condition of UD 25 hydrostatic pump. Decrease of flow rate efficiency by revolution n = 1,500 rpm after completing 900 Eh was $\Delta\eta$ = 1.197 %. MOL Farm UTTO Synt hasn't negative influence of durability hydrostatic pump type UD 25.

Based on the obtained values from measurements of the cleanliness code and IR spectroscopy, was decided to stop testing of MOL Farm UTTO synt, because the fluid was in inconvenient condition and manufacturer's of fluid dissuaded in the next operating test.

In pursing IR spectra was founded, that during the test of ecological fluid gave out a mixing of the new ecological fluid with the fluid contained in tractor additional device, which increased the level of fluid contamination. On measuring of solid contaminants were detected elements of adhesive and abrasive attritions, which indicating imminent failure of the tractor transmission-hydraulic circuit. They were also detected values of kinematic viscosity, total acid number and water content, those didn't exceed the limit values after the test. We found by measuring, that after completing 900 Eh the fluid showed good physico-chemical properties, but were found above the limit levels of particulate pollution.

Based on this detection were applied designed filtration device for the renewal of life of the fluid. Content of Fe decreased after filtration by 30%. Positive effect of filtration are reflected by a decrease of cleanliness code for particles large than 14 μm about the two classes.

Acknowledgement

Supported by the Ministry of Education of the Slovak Republic, Project VEGA 1/0857/12 "Reduction of unfavorable impacts of agricultural and transport machinery on environment".

References

1. M. Barrett, M. Mcmahon. 2000. Analytical Ferrography - Make It Work For You. Practicing Oil Analysis Magazine. October 2000.
2. Casey. 2011.: Defining And Maintaining Fluid Cleanliness For Maximum Hydraulic Component Life. [on/line]. Available: http://www.plant-maintenance.com/articles/hydraulic_fluid_cleanliness.pdf [Accessed: 03-03-2012].

3. P. Cvíčela, R. Majdan, R. Abrahám, J. Jablonický. Monitoring the operating loading of a hydrostatic pump UD 25. In X. International conference of young scientists 2008 : Conference Proceedings,, Czech Republic. Prague : Czech University of Life Sciences Prague, 2008. s. 42-47 ISBN 978-80-213-1812-0.
4. Š. Drabant, Ľ. Hujo. 2001. Skúšky regulačného hydraulického systému (The tests of regulatory system hydraulic). In: Agrotech Nitra 2001. s. 95-101. Nitra : SUA in Nitra, 2001. ISBN 80-7137-874-7.
5. Š. Drabant, A. Žikla, Ľ. Hujo, D. Varga, P. Kleinedler. 2005. Analýza zaťažovacích charakteristík trojbodového závesu traktora (Analysis of the load characteristic tractor tree-hitch point). In. Hydraulické mechanizmy mobilnej techniky. Dudince. Nitra: SUA in Nitre. 2005, s. 113 – 124. ISBN 80-8069-601-2
6. Š. Drabant, J. Turan, J. Jablonický, R. Abrahám. 2007. Operating measurement of the pressure in hydraulic system of the tractor. In: Savremena poljoprivredna tehnika. -- Vol. 33, No. 1-2 (2007), s. 40-47. ISSN 0350-2953.
7. Š. Drabant, J. Kosiba, J. Jablonický, J. Tulík. The durability test of tractor hydrostatic pump type UD 25 under operating load. In Research in agricultural engineering. Prague : Institute of agricultural economics and information. Vol. 56, no. 3 (2010), s. 116-121.ISSN 1212-9151.
8. M. Gurina, R. Abrahám, Ľ. Hujo: 2005. The life test of tractor hydraulic pump UN 10L.21.In: VII. International Conference of Young Scientists 2005.- S. 45-50. Prague : CZU, 2005. ISBN 80-213-1368-4.
9. J. Jablonický, R. Abrahám, R. Majdan, P. Cvíčela. Skúšky traktora s biologicky odbúrateľným olejom (The test of tractor with biodegradable oil). In Bezpečnosť - kvalita - spoľahlivosť : 3. medzinárodná vedecká konferencia. Košice : Technická univerzita, 2007. ISBN 80-8073-258-2, s. 123-127.
10. K. Jakob, H. Theissen. Bio-based OILS in Hydraulics – Experience from Five Years of Market Introduction in Germany. Institute for Fluid Power Drives and Controls (IFAS) 2006, RWTH Aschen University, Germany.
11. Ľ. Hujo, R. Abrahám. 2000. Metodika skúšania trojbodového závesu traktora (Method of testing tractor tree-hitch point). In: International Conference of Young Scientists 2000. s. 120-125. Nitra : SUA in Nitra, 2000. ISBN 80-7137-762-7.
12. J. Jobbágy, I. Petranský, J. Simoník. 2003.Tlakové režimy v hydraulike traktorov ZTS v súprave s poľnohospodárskym náradím. In. International Conference of Young Scientists. Nitra. Nitra: SUA in Nitre, 2003, s. 94 – 101. ISBN 80-8069-178-9.
13. J. Kosiba, Z. Tkáč, Ľ. Hujo, Ľ. Bureš. 2011. Operating modes of hydraulic circuit of tractor Zetor Forterra 114 41. In Acta technologica agriculturae. Nitra : SUA v Nitre. s. 46-49.ISSN 1335-2555.
14. J. Kosiba, Z. Tkáč, Ľ. Hujo, J. Tulík. Application of synthetic oil in tractor hydraulic circuit. In Machines, technologies, materials. MTM: international virtual journal for science, technics and innovations for the industry. - Sofia : Scientific -Technical Union of Mechanical Engineering. Year 5, iss. 4 (2011), s. 57-59. ISSN 1313-0226.
15. R. Majdan, J. Kosiba, J. Tulík, D. Kročková, V. Šinský The comparison of biodegradable hydraulic fluid with mineral oil on the basis of selected parametres. In: Research in agricultural engineering. Vol. 57, special iss. (2011), s. S43-S49. ISSN 1212-9151.
16. R. Majdan, Z. Tkáč, Š. Drabant, J. Tulik, P. Žigiň, J. Jablonický, R. Abrahám, V. Vozárová. 2009. The damping of pressure shock for the hydrostatic circuit of agricultural tractor. In: Traktori i pogonske mašine. Vol. 14, no. 1, s. 22-26. ISSN 0354-9496.
17. R. Majdan, P. Cvíčela, M. Bohát, K. Ivanišová. The observation of hydrostatic pump deterioration during the durability test according to hydraulic fluids contamination. In X. International conference of young scientists 2008 : Conference Proceedings,, 2008 Prague, Czech Republic. Prague : Czech University of Life Sciences Prague, 2008. s. 147-153 ISBN 978-80-213-1812-0.
18. R. Majdan, R. Abrahám, Ľ. Hujo, M. Mojžiš, I. Janoško, I. Vitázek. The test operation of the tractor hydraulic pump with biodegradable fluid. In MendelTech 2012. MendelTech International. Brno : Mendel University in Brno, 2012. ISBN 978-80-7375-625-3.
19. R. Majdan, B. Stančík, I. Vitázek, R. Abrahám, F. Tóth, I. Štulajter. The influence of biodegradable fluids on deterioration of the hydraulic pumps elements. In Naučni trudove : zemedelska technika i technologii, agrarni nauki i veterinarna medicina, remont i nadeždnosť : zemedelska technika i technologii, agrarnye nauki i veterinarnaja medicina, remont i nadežnosť.. Ruse, Bulharsko : University of Rousse "Angel Kanchev", 2012, tom. 51, seria 1.1, s. 187-191. ISSN 1311-3321.
20. E. Mosolygó, Š. Jánošík. 2008. Lubricants based on renewable resources. In Interfaces'08. Sopron : Slovnaft a.s. Member of the MOL Group, 2008, s. 111-120.
21. MTS Systems. 2012.: [online]. Hydraulic Fluid Care Guide. Available: http://www.kleenoilindia.com/Oil%20maintenance.pdf [Accessed: 01-04-2012]
22. Shick, D. 2008. Compatibility Testing of Biodegradable Hydraulic Fluids [online]. Available:http://www.msoe.edu/academics/research_centers/reu/pdf/2008/ Compatibility% 20Testing%20of%20Biodegradable%20Hydraulic%20Fluids.pdf [Accessed: 03-02-2012]
23. Z. Tkáč, R. Majdan, Š. Drabant, R. Abrahám, V. Vozárová, J. Jablonický. Hodnotenie vlastností hydraulických kvapalín na základe skúšok s použitím hydrogenerátora (Evaluation of the properties of

hydraulic fluids based tests with using hydrostatic pump). Nitra: SUA in Nitra, 2010. 112 s. ISBN 978-80-552-0338-6.
24. Z. Tkáč, R. Majdan, Š. Drabant, J. Jablonický, R. Abrahám, P. Cvíčela.The accelerated laboratory test of biodegradable fluid type "ertto". In: Research in agricultural engineering. Vol. 56, no. 1 (2010), s. 18-25. ISSN 1212-9151.
25. Z. Tkáč, R. Majdan, J. Tulík, J. Kosiba. Study of ecological fluid properties under operational conditions of tractors. In TEAM. Osijek-Baranja : University Josip Juraj Strossmayer, 2012, vol. 4, no. 1, s. 295-298. ISSN 1847-9065.
26. J. Tulík, J. Kosiba, Ľ. Bureš, V. Šinský. Analysis of synthetic oil samples during an operating test. In Acta technologica agriculturae. Nitra : SUA in Nitra, 2013, vol. 16, no. 1, s. 21-24. ISSN 1335-2555.
27. A. Žikla, J. Jablonický. Kopírujúca regulácia trojbodového závesu traktorov (Copying control of tractor three-hitch point. In: Hydraulika a pneumatika. Roč. 8, č. 3-4 (2006), s. 42-46. ISSN 1335-5171.

З. Ткач , Я. Кошіба , Я. Тулик
Словацький сільськогосподарський університет, м. Нітра, Словаччина
Лабораторні дослідження екологічної гідравлічної рідини

У статті розглядаються випробування екологічної гідравлічної рідини. Екологічна гідравлічна рідина була використана в гідравлічному контурі трансмісії трактора Zetor Forterra 114 41. У статті розглядається питання про продовження терміну служби екологічної рідини. Для цього в лабораторії Словацького сільськогосподарського університету запропоновано систему фільтрації. Випробування проводилися за підтримки Наукового Агентства по грантах Міністерства освіти, науки, досліджень і спорту Словацької Республіки - VEGA , грант № 1/0857/12 .

Позитивний ефект фільтрації виражається у зменшенні чистоти коду рівня забруднення для частинок більших, ніж 14 мкм .
трактор, гідравлічний насос, екологічна рідина

Одержано 27.09.13

УДК 6.31

В.І. Рубльов, проф., д-р техн. наук, В.Г. Опалко, ст. викл.
Національний університет біоресурсів і природокористування, м. Київ

До аналізу технічного стану зернових сівалок у передексплуатаційний і експлуатаційний періоди

Для забезпечення і збереження споживчих властивостей сільськогосподарської техніки необхідна інформація про можливі зміни її властивостей на всіх стадіях життєвого циклу, причини і відповідні рішення щодо їх усунення.

Для об’єктивної оцінки технічного стану зернових сівалок вирішувалися наступні задачі: виявлення недоліків у передексплуатаційний і експлуатаційний період, їх опис та аналіз; розробка статистичних методів контролю; розробка рекомендацій щодо усунення виявлених недоліків. Результати досліджень сівалок вітчизняного і іноземного виробництва у передексплуатаційний і експлуатаційний періоди свідчать, що недоліки виготовлення відрізняються як номенклатурою показників так і кількістю їх в агрегатах, вузлах і деталях.

Розроблені довідники оцінки недоліків виготовлення сівалок з їх фотографіями і описом; карти контролю з використанням статистичних методів.
якість сільськогосподарської техніки, технічний стан, зернові сівалки, передексплуатаційний період, експлуатаційний період, недоліки виготовлення