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RESEARCH OF THE INFLUENCE OF THE QUALITY OF THE WORKING FLUID ON THE EFFICIENCY OF THE HYDRAULIC SYSTEM

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Abstract
Recently, the main problem in the operation of hydraulic fluids of hydraulic mining machines is contamination with various small rock, dust impurities. As a result, parts of such machines quickly wear out. The article deals with the purification of contaminated liquids by clarifying the content of contaminated mixtures. In particular, some physical properties were studied (solubility, density, viscosity in organic solvents). The viscosity of the samples examined after distillation decreased compared to the initial samples.

Keywords. Hydraulic system, working fluids, viscosity, density, pollution components, working fluid purity class.

Introduction

The main function of the working fluid in a hydraulic system will be situations caused by the transport of pressure energy, the retention of parts from the carriage, the nature of the lubrication between parts, the increase in temperature caused by friction, and changes in the form of seals in the grooves between parts.

Hydraulic system failures many sources have researched the results of adverse effects on useful performance factor, efficient performance, and the overall system itself as a result of a study of the buoyancy of working fluids to purity quality and viscosity. [1]

Impurities can be in a solid, liquid and gaseous state.

The fact that the amount of liquid water contained in the contamination is suspended in the liquid, if small drops get into it, the lubricating layer of the hydraulic system parts is disrupted and corrosion of the parts occurs.

Solid particles cause the pair to be eaten as a result of friction between the details and, as a result of being harmed under pressure, cause the details to end and break in the slit.

As the air mixed into the working fluid suddenly heats up, forming a diesel-effect, that is, the air bubble rises and explodes at a temperature of 300-350 C^0, micro-alloys that are released in the wear of the working fluid and the burning of additives cause negative effects. It is the solid particles that are most exposed in the hydraulic system, causing a malfunction in the amount of 50-80%. Reduces the resources of seaplanes up to 3-50 times. [2]

Pollution from solid particles in the working fluid has become micro-alloys under the physical and chemical action of additives contained in the working fluid under the influence of water

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and air intercalated from the external environment or not. The working fluid is classified as follows for partial contamination to begin from production:

- productive pollution - pollution from the structure or external condition;
- operational pollution - the occurrence of external or structural contamination in storage and transportation;
- exploitation pollution - pollution caused by the use of a hydraulic excavator in a hydraulic system;
- technological pollution - in a technological ravine (pressure, temperature, etc.) comical reaction with air results in;
- atmospheric pollution - pollution by dust in the air (silicon, calcium, aluminum, iron);
- contact contamination is a condition under the influence of pollution in all processes, as well as with details [3].

The influence of the working fluid with a mechanical air mixture, a change in the nature of the seals, is observed when the atmospheric pressure of the hydraulic system is added to the amount of air at the moment of the formation of the process of repeated surge into the working fluids at low points. As a result, a mechanical air mixture is formed in the system, and the pressure pump with an impact of 200 kgf/cm2, the efficiency factor is reduced by 10% [4]. [4].

Oboyansyev O.Yu's candidate of technical sciences found in a study of fluid pollution in the working hydraulic system that contamination in the composition of the working fluid in the amount of 0.005% of the mass of particles corresponds to the 9 purity class. But in most analyses it has been observed that this amount increases up to 10 times. According to research data, the content of the working fluid in the storage state is 0.011% by weight, 0.016% when pouring, 0.030% in winter, 0.05-0.08% in summer as a whole, even 0.2%. In hydraulic excavators, contamination increases 2-4 times during transportation of the working fluid and 5-8 times during pouring. 30-40% of metal, 4-29% of paints and varnishes, and 18-50% of rubber products were found in the composition of contaminated working fluids [5]. [5].

And the composition of the working fluid polluted by the atmosphere in the hydraulic system is 70% quartz sand, 3-5% iron oxide, 15-17% aluminum, 2-4% calcium components, and according to the Mohs hardness scale, these minerals and metals cause significant abrasive destruction during friction of parts, and we can see the indicators of this process in a graphical representation in the figure 2.9. For example, at a concentration of 0.0005% by weight of metal powder added to the hydraulic working fluid, the efficiency of gear pumps decreased by 17% when operating for 138 hours, while the efficiency of the plate pump decreased by 50%.

The reason for the serious impact of contaminated working fluids on the parts lies in the small size of the intermediate slots. For example, for gear pumps and hydraulic motors, slots of various parts will be up to 20-80 microns, slots of axial piston pumps and hydraulic motors up to 20-40 microns, slots of hydraulic distributor up to 12-24 microns, slots of pressure valves up to 10-20 microns.

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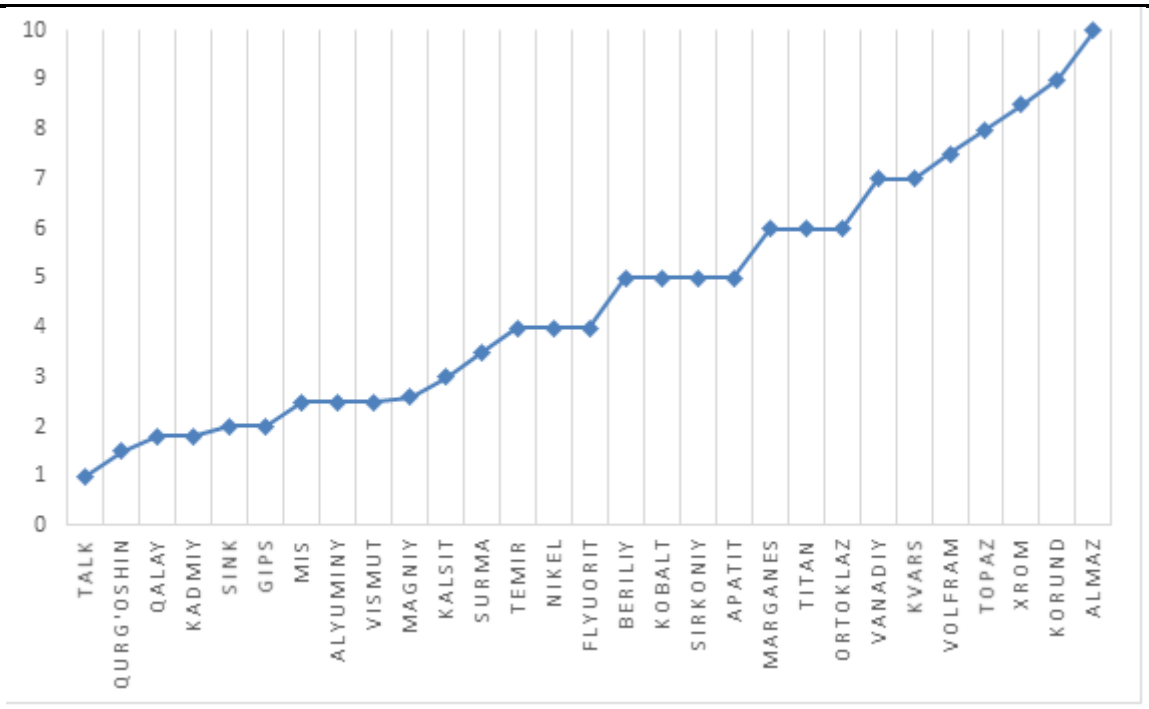

Figure 1. Hardness of metals and minerals on the Mohs scale

The hydraulic fluids of the hydraulic system of hydraulic excavators, we can also observe the effect of contamination on the components. Sedimentary filters and slags that do not have high hardness will lead to depletion. Abrasive particles - mix with the liquid to form an abrasive medium. Metal scraps, on the other hand, lead to oxidation and an abrasive environment. In the case of paint particles, the filter, throttle and valve cause the distributors to break down.

At high temperatures and clogging, contamination of the working fluid in the environment occurs and, again, as a result of exceeding its temperature, leads to a violation of the filtering properties of the filter elements. As a result of a sharp increase in the temperature of the working fluid, interruptions associated with the cooling of the hydraulic system amount to 15-20% [6-15].

In the research of Kelsch Heins Rutger, it was shown to maintain the purification of contaminated working fluid::

- the resource of hydraulic units is increasing;
- the productivity of the hydraulic excavator increases as a result of an increase in the useful work factor of the hydraulic units;
- the coefficient of performance of the excavator increases;
- fuel waste is reduced by 7-10 %;
- waste of working fluid by 15-25% is reduced;
- costs for maintenance and repair are reduced.

Boris Vyacheslavovich Slesarov has established in his research that the reliability of the hydraulic system of a hydraulically driven excavator depends on the above parameters, taking into account the influence of the control class, availability of repair equipment and cleanliness, and we will be able to see these results in Table 1. [7-23]

Table 1. The dependence of the working fluid on the reliability of the hydraulic excavator in relation to the cleaning class

Parameters	State in the CIS countries	State in a foreign state	Research results	
			Result achieved	Recommended result
K_t	0,8-0,89	0,92-0,98	0,89-0,94	0,98
$K_{t.i}$	0,54-0,68	0,85-0,87	0,85	0,92
Resource: pump, hydraulic motor, cylinder, spool, thousand m/s	5-6	20-35	25-30	30-40
Labor cost to service.	30-65	15-25	25-30	20
Working fluid cleanliness class.	15-16	11-13	13-15	10-12
$K_{xiz.ko'r}$	0,7	0,98	0,88	0,99
$K_{ta'm.tay}$	0,8	0,96	0,9	0,95

The reliable operation of hydraulic equipment, which is often found in various industrial enterprises, depends on such an indicator as the purity class of 90% hydraulic oil.

Working fluid uses special standards to assess the purity class. It is used by the Russian Standard GOST-17216-2001, US SAE as 4059F and NAS 1638 and European standard ISO 4406. [7-23]

So, as a result of our research and analysis, depending on the division of working fluid pollution into a standard classifier and the increase in the purity class, it was found that it negatively affects all components of the hydraulic system and the reliable operation of the hydraulic excavator, and we will be able to characterize the purity of working fluids in Table 2,

Table 2. Standards of the working fluid purity class

GOST 17216	NAS 1638	ISO 4406	SAE AS 4059
7 class	3 class	14/12/9	4 class
8 class	4 class	15/13/10	5 class
9 class	5 class	16/14/11	6 class
10 class	6 class	17/15/12	7 class
11 class	7 class	18/16/13	8 class
12 class	8 class	19/17/14	9 class
13 class	9 class	20/18/15	10 class
14 class	10 class	21/19/16	11 class
15 class	11 class	22/20/17	12 class
16 class	12 class	23/21/18	13 class

References

1. Nikitin G.A., Chirkov S.V. The influence of liquid contamination on the reliability of hydraulic systems of aircraft. M., Transport, 1969-183 p.
2. Operating instructions for the RS-5500 diesel hydraulic excavator, Komatsu Mining Germany, 2001.
3. Kovalenko V.P., Ilyinsky A.A. Fundamentals of liquid purification technology from mechanical impurities. Moscow, Chemistry, 1982. — 270 p.
4. Kragelsky I.V., Alisin B.B. and others. Friction, wear and lubrication. Book 2. M., Mechanical Engineering, 1979. — 358 p.
5. Belenkov Yu.A., Neiman V.G., Selivanov M.P., et al.Reliability of volumetric hydraulic drives and their elements. M., Mechanical Engineering, 1977 — 167 S.
6. M.M. Tennenbaum Wear resistance of structural materials and machine parts during abrasive wear. M., Mechanical Engineering, 1966 - 331 p.
7. Udler E.I. Filtration of hydrocarbon fuels. Tomsk, Tomsk University Publishing House, 1981. 152 p.
8. Abduazizov N.A., Toshov J.B. Analysis of the influence of the temperature of the operating liquid on the performance of hydraulic excavators // “GORNY VESTNIK UZBEKISTAN", 2019, No.3 (78) pp. 89-91
9. Azamatovich N. et al. INVESTIGATION OF THE INFLUENCE OF THE AMOUNT OF CONTAMINATION OF THE WORKING FLUID ON THE RELIABILITY OF MINING MACHINES //RESEARCH AND EDUCATION. – 2022. – Vol. 1. – No. 8. – PP. 95-103.
10. Abduazizov N.A. Development of methods to improve the efficiency of quarry hydrofected excavators based on optimization of their hydraulic systems Uzbekistan // Dissertation of the Doctor of Technical Sciences. – Almalyk, 2020. – 200 p.
11. Slesarev B. V. Substantiation of parameters and development of means to improve the efficiency of operation of quarry hydraulic excavators : abstract. ... Candidate of Technical Sciences. — M. : Institute of Mining, 2005. — 24 p.
12. Krivenko A. E., Zang Kuok Khan. Investigation of the influence of the temperature regime of the hydraulic fluid on the efficiency of a quarry hydraulic excavator // Mining Journal. 2020. No. 12. pp. 78-81.
13. Zang Kuok Khan, Krivenko A. E., Pudov E. Yu., Kuzin E. G. Development of a model for evaluating the efficiency of the working fluid cooling system of a hydraulic quarry excavator // Mining Journal. 2021. No. 12. pp. 64-69.
14. Rakhutin M.G., Giang Quoc Khanh, Krivenko A.E., Tran Van Hiep. Evaluation of the influence of the hydraulic fluid temperature on power loss of the mining hydraulic excavator. Journal of Mining Institute.2023. Vol. 261, p. 374-383.
15. Abduazizov N.A., Dzhuraev R.U., Zhuraev A.Sh. Study of the effect of temperature and viscosity of the hydraulic fluid of hydraulic systems on the reliability of mining equipment. Gornyi vestnik Uzbekistana. 2018. N 3 (74), p. 58-60 (in Russian). DOI: 10.13140/RG.2.2.11942.96329.

16. Juraev A. Study of the Effect of Hydraulic Systems Operation on the General Performance of a Hydraulic Excavator. The American Journal of Engineering and Technology. 2021. Vol. 3. Iss. 10, p. 36-42. DOI: 10.37547/tajet/Volume03Issue10-07
17. Raykhanova G. Y., Djuraev R. U., Turdiyev S. A. DEVELOPMENT AND EXPERIMENTAL RESULTS OF A NEW CONSTRUCTION OF THE ELEMENT OF PROTECTION OF THE BASE OF THE JAVE PART OF QUARRY EXCAVATORS //The American Journal of Engineering and Technology. – 2022. – vol. 4. – No. 04. – pp. 58-67.
18. Turdiyev S. A., Djuraev R. U. Experimental results on the effectiveness of an improved excavator bucket tooth design //The American Journal of Engineering and Technology. – 2022. – vol. 4. – no. 03. – pp. 1-13.
19. ABDUAZIZOV N. A., JURAYEV A. S. H., TURDIYEV S. A. GIDRAVLIK EKSKAVATORNING GIDRAVLIK TIZIMDAGI QISMLARNING NOSOZLIKLAR KATEGORIYASI PAYDO BO ‘LISH EHTIMOLIGA TA’SIR ETUVCHI OMILLARNI TAHLILI //KONCHILIK MASHINALARI VA TECHNOLOGIYALARI. – 2023. – p. 3.
20. Raykhanova G. Y., Djuraev R. U., Turdiyev S. A. DEVELOPMENT OF A NEW DESIGN OF CUTTING ELEMENTS FOR QUARRY EXCAVATOR BUCKETS AND RESULTS OF ITS EXPERIMENTAL RESEARCH //The American Journal of Engineering and Technology. – 2022. – vol. 4. – No. 04. – pp. 68-78.
21. Turdiyev S. A. GIDRAVLIK YURITMANING TASHQI TARMOQ TAVSIFINI HISOBLASHNI ASOSLASH //Innovative Development in Educational Activities. – 2023. – Vol. 2. – No. 5. – pp. 327-333.
22. Raykhanova G. Y., Dzhuraev R. U., Turdiyev S. A. STUDY OF THE LOADS ON BUCKETS AND CUTTING ELEMENTS OF QUARRY EXCAVATORS DURING DIGGING AND CUTTING //Academic research in educational sciences. – 2022. – Vol. 3. – No. 4. – pp. 1123-1132.
23. Turdiyev S. A., Akhmedov S. T. FUNDAMENTALS OF EXTERNAL NETWORK CHARACTERISTICS OF HYDRAULIC SYSTEM //Educational Research in Universal Sciences. – 2023. – Vol. 2. – No. 1 SPECIAL. – pp. 87-93.

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