ACADEMICIA

ISSN: 2249-7137 Vol. 11, Issue 8, August 2021 Impact Factor: SJIF 2021 = 7.492

ACADEMICIA
An International Multidisciplinary Research Journal
(Double Blind Refereed & Peer Reviewed Journal)

DOI: 10.5958/2249-7137.2021.01821.8

DEVELOPMENT AND USE OF A POROUS FILTER FOR CLEANING HYDRAULIC OIL IN A HYDRAULIC SYSTEM

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ABSTRACT

In the process of servicing, fine cleaning of the additional working fluid through the filter reduced the contamination of the working fluid by 3-5 times and ensured reliable operation by 2-3 times. The advantages of hydraulic devices over other devices are noted in foreign literature. In a hydraulic system, the source of the working fluid is energy and its purity is very important. In the course of our research, the material that made it possible to effectively filter the working fluid was a filter with a porous medium. It is widely mentioned in the works of G.G. Tumashev and G.V. Golubev. The obtained mixture was immersed in water of 96 0 C . The process of chipping with mixed water begins to occur. The mixture is immersed in water until the chipping process is complete.

KEYWORDS: *Contamination, Porous, Hydraulic, Immersed*

INTRODUCTION

Currently, many large enterprises of the republic use devices for hydraulic systems. The advantages of hydraulic devices over other devices are noted in foreign literature. In a hydraulic system, the source of the working fluid is energy and its purity is very important. Much research has been done on the cleaning of working fluids in hydraulic systems, and scientists Filkinstein, Brotsky and others have made significant contributions to the cleaning of working fluids. Based on the analysis of these studies, it is important to develop the most effective methods for filtering the working fluid.

Many sources have considered additional control measures for cleaning methods and purity standards, obtained analytical results, and instead improved the purity class of working fluids. In the work of B.N. Slesarov, we see that the results of using the oil unit during storage, transportation and filling of working fluid and a separate filtering device PFU-10m in the tank of the hydraulic system as a separate system showed that the reliability is increased by 25-30%. The TO has improved, and the rational work of the working fluid, depending on the working life of the contaminated working fluids, has reached 10-12 purity classes.

In the work of O.Yu. Oboyantsev in the hydraulic system for cleaning the working fluid, the following results were obtained. In the hydraulic system, the method of operational control of the specific purity of the working fluid was controlled using the FS-112 analyzer, which automatically detects mechanical particles. In the process of servicing, fine cleaning of the additional working fluid through the filter reduced the contamination of the working fluid by 3-5 times and ensured reliable operation by 2-3 times. So, we can conclude that filtration of the working fluid is one of the main tasks.

The economic effect of achieving the above results to ensure the cleanliness of the working fluid of hydraulic excavators used in our country can be achieved due to the localization of filters. In the course of our research, the material that made it possible to effectively filter the working fluid was a filter with a porous medium. It is widely mentioned in the works of G.G. Tumashev and G.V. Golubev.

H asa goal and objective - porous filters used as a separate working fluid filtration system made of local materials. One of the main tasks of our article is the analysis and results of the microscopic structure of a porous filter, obtained when cleaning a working fluid in a hydraulic system from a porous filter.

Any porous barrier can contain up to 3 media per filter. (Figure 1)

Perforated pores, which are small tubes in the form of cracks in the wall, vary in diameter. The result is the ability to trap particulate matter.

1. Writing pores are pores that do not affect closed particles from all sides.

2. Closed pores , i.e. one side is open and the other is labeled. As a result, debris accumulates in these pores.

Figure 1 Microscopic view of a porous filter.

The working fluid is cleaned only in the porous pores of the porous filter. This can be seen in the pore classification of the overall factor barrier filter.

$$m_n = \frac{Vn}{V}$$

m_n - total coefficient of porosity of barriers from

Vn - Total porosity -n Oristà filter.

V - is the filter size.

In this case, if we extend V further, we get V = Vn + Vm .

Vm is the volume of the filter material.

In addition to m $_n$, there are also calculations of the coefficients of external and internal porosity, and only the filtration method with the coefficient of external porosity can be considered. This is due to the fact that the filtration process does not occur with the coefficient of internal porosity. In this case, the filtration coefficient of the external porous barrier is as follows.

$$m_1 = \frac{Vt.g'.+Vb.t.g'.}{V}$$

In porous filters, the pore structure is irregular, which makes it impossible to build a mathematical model of the working fluid. Therefore, it is taken into account when determining the average speed of the working fluid from the porous filter.

$$v_{g'} = \frac{\frac{W}{T}}{\frac{V_{t.g'.}+V_{b.t.g'.}}{V_n+V_m} * S}$$

This is also called Danon Forkshamer 's conjecture .

Based on the above theoretical data, it can be concluded that a large number of permeable pores improves the flow rate and filtration of the working fluid. The sources give the Borus-Beksold method for determining the pore size of porous filters, i.e. (bubble method). In this process, the pore size is determined under pressure. In this case, the porous filter begins to flow out of the pores under the influence of air pressure, saturating the required amount of liquid.

The outlet of the original bubbles is the maximum pressure under pressure. The appearance of bubbles over the entire surface of the filter is the average pressure.

These results are determined using the following formula.

dn = 4a / p

dn - pore diameter , m

a - coefficient of surface tension, N/m

p - air pressure , Pa.

Porosity is the ratio of the volume of porosity to the total volume of the body. In a broad sense, the concept of porosity includes information about the morphology of a porous body. Structural features (hole size, size distribution, specific surface area) are often referred to as "porous body structure". Porous bodies are widespread in nature (minerals, plant organisms) and in technology (adsorbents, catalysts, foams, building materials, filters, fillers, pigments, etc.).

The purpose of the experiment is to develop optimal parameters for cleaning a hydraulic working fluid through a porous filter. In this experiment, we will look at the following tasks:

- Development of a new localized porous filter.

- Microscopic analysis of the pore size of the porous filter.

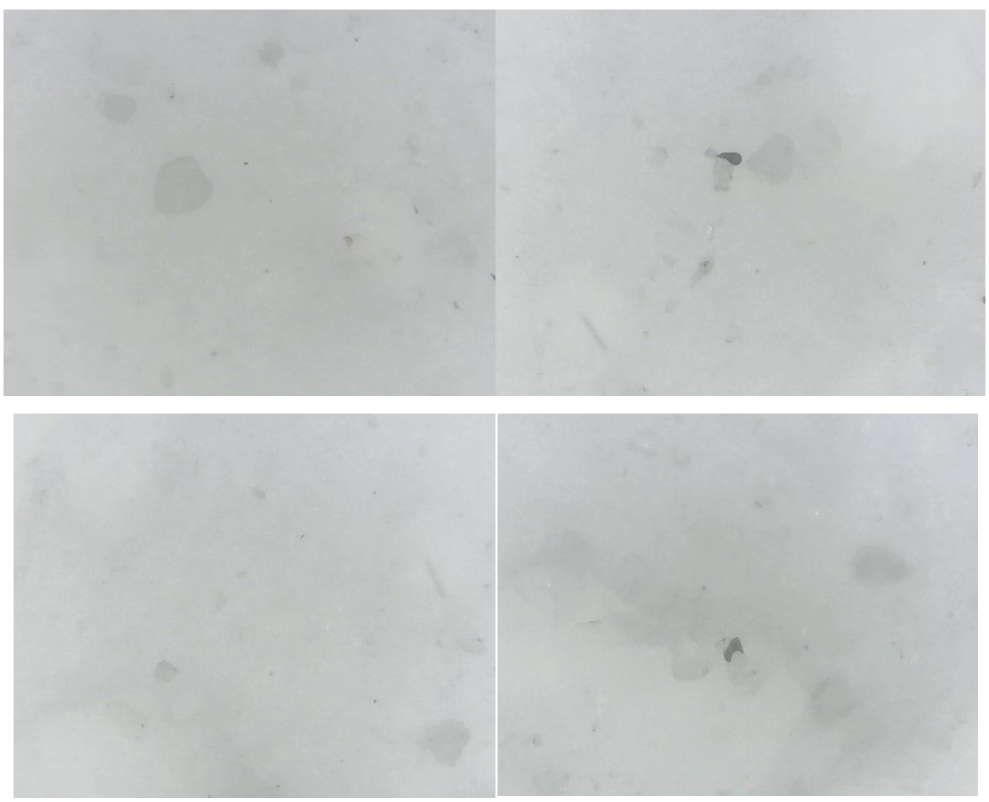
- Research of methods of filtration of hydraulic working fluid.

- Analysis of the filtered parameters of the working fluid from the porous filter.

In our experiment, the following instruments and equipment were used: a device for measuring electricity, a water heater, a mixing vessel, a spatula for mixing the mixture, microscopes, a micrometer calibration line for measuring particle diameter, an LED copy panel, Mettler Toledo analytical balance Model ms204TS

Our experiment begins with the preparation of a porous filter material. It was found that the electricity meter is connected to a 2000 W water heater and consumes 0.350 liters of boiling water. In a vessel, 5 g of NH_5CO_3 and 8 g of R_2SiO mixture are mixed with a spatula for preparation, placed in a mold and dried for 20 minutes. The obtained mixture was immersed in water of 96 ^0C . The process of chipping with mixed water begins to occur. The mixture is immersed in water until the chipping process is complete. The result is a porous medium at the top (Figure 1).

The resulting porous material is photographed under a microscope using a digital microscope model: Digital Microscope Model: x 4 with a resolution of 640x480 (Fig. 2).



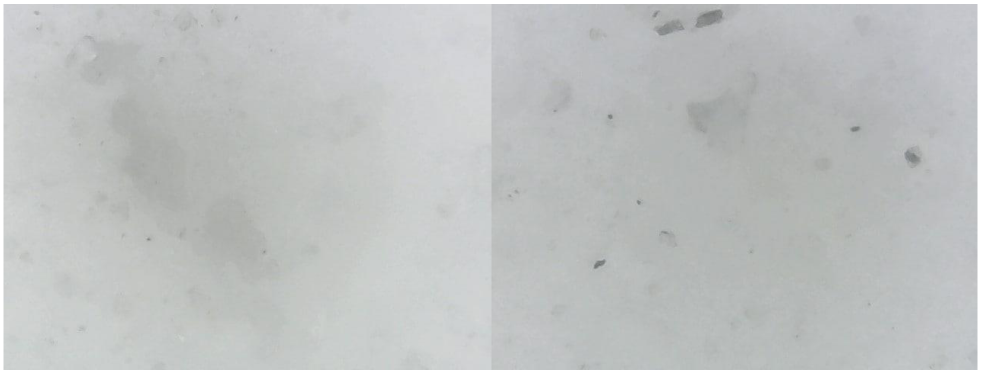


Figure 2. Digital microscope model made of porous material: Digital Microscope model: x 4 samples.

Coordinate line micrometer calibration line (Figure 3) is photographed under a microscope (Digital Microscope Model: Digital Microscope model : x 4) with the extension 640x480, and the size of each sample was measured using an LED copier panel with the coordinate of the calibration line. (Figure 4)

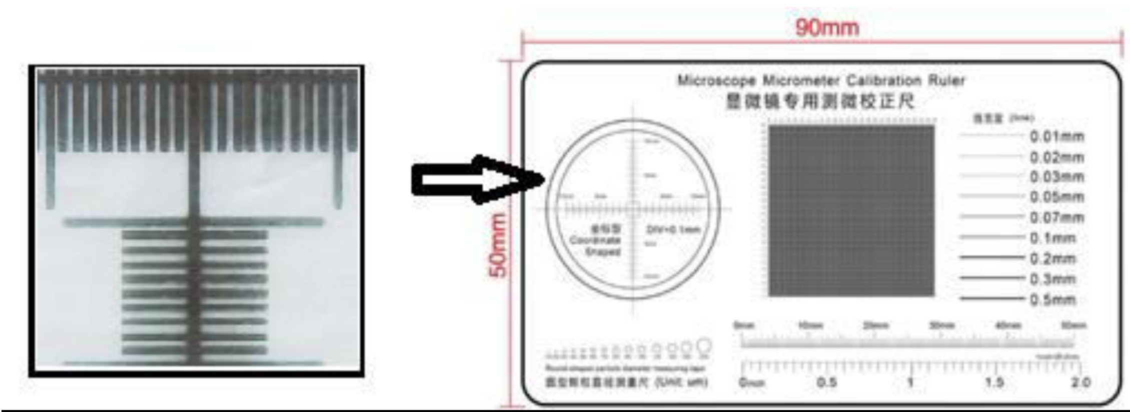
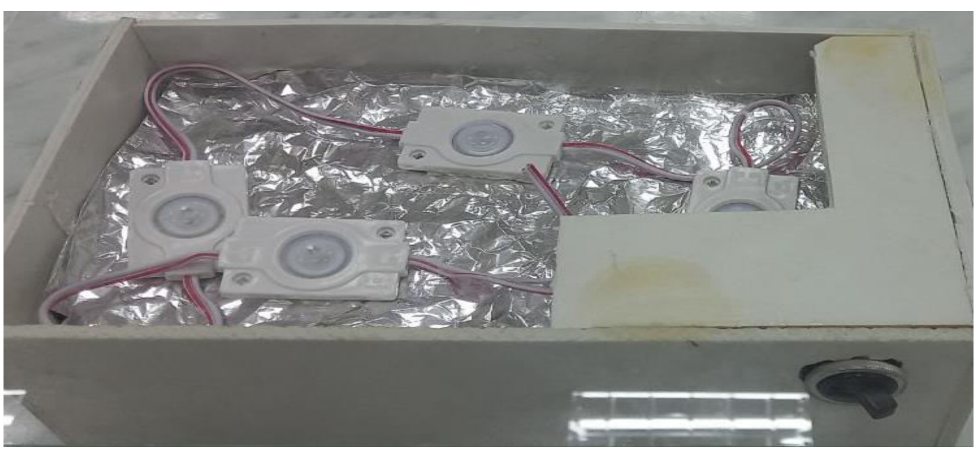
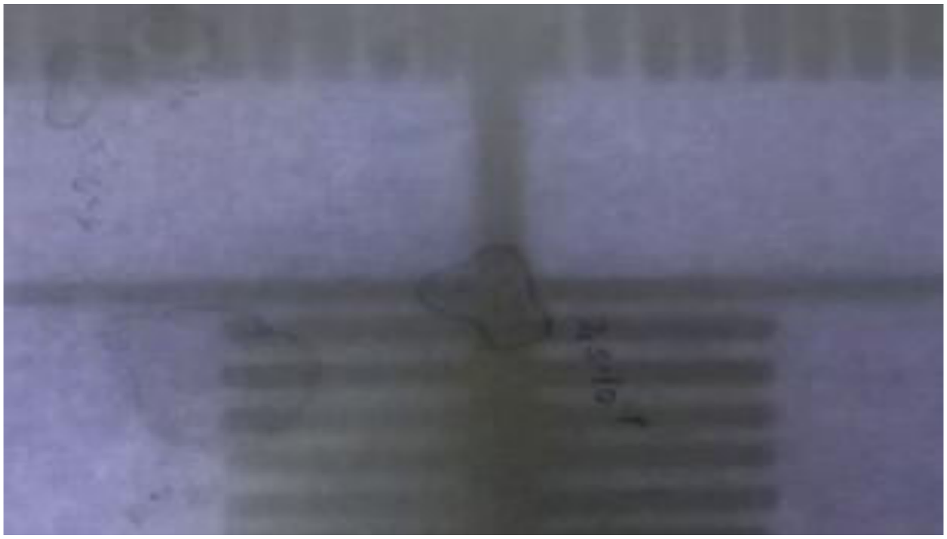


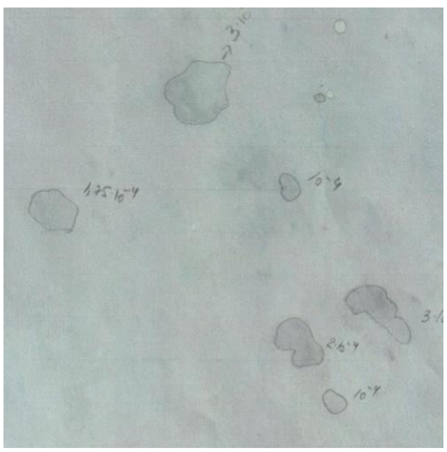
Figure 3. Micrometer calibration line and coordinate line



a)

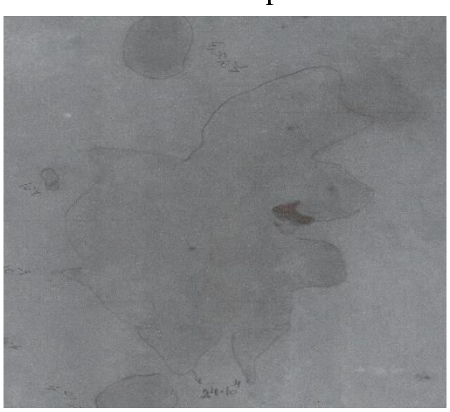


b)

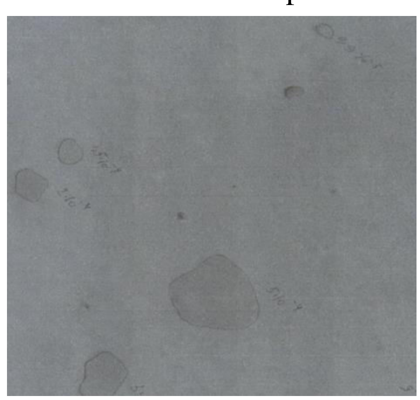


1-sample

2-sample



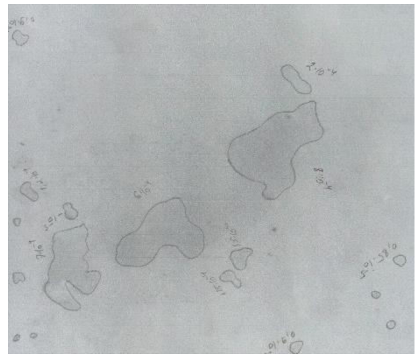
3-sample



4-sample

ISSN: 2249-7137 Vol. 11, Issue 8, August 2021 Impact Factor: SJIF 2021 = 7.492

5-sample



6-sample

d) *Figure 4. Method for determining the pore size of a porous filter: a-LED copy panel, b-pore detection process, d-pore size samples*.

At the next stage of our experiment, we will consider the cleaning of the working fluid of the hydraulic excavator RH-40E, branded Tellus46 and Tellus 68, which worked 3970 and 3088 operating hours , from a porous filter.

Cleaning was carried out in 2 ways.

1. With a layer.
2. Nolayer.

Method1.

The porous filter is cut into pieces and placed on the dish (fig. 5). The working fluid is filtered at atmospheric pressure for 2 hours.

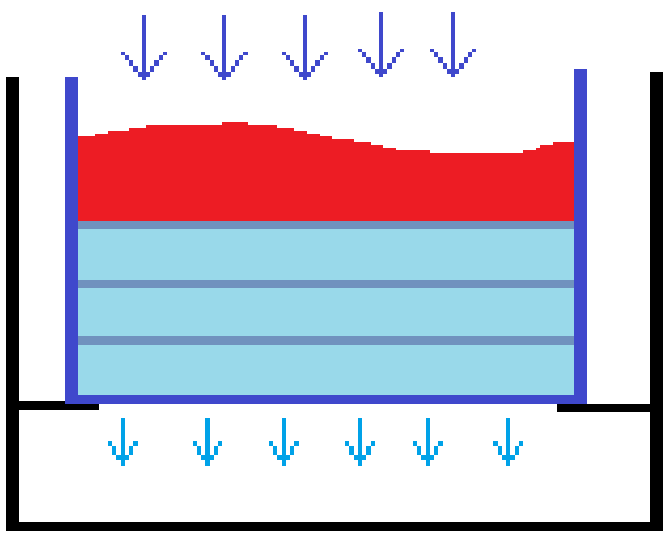


Figure 5.Layer-by-layer cleaning of the working fluid of hydraulic equipment with a porous filter.

Method 2 .

The porous filter is made in the form of a vessel, and the working fluid is filtered (Figure 6).

The working fluid is filtered at atmospheric pressure for 4 hours.

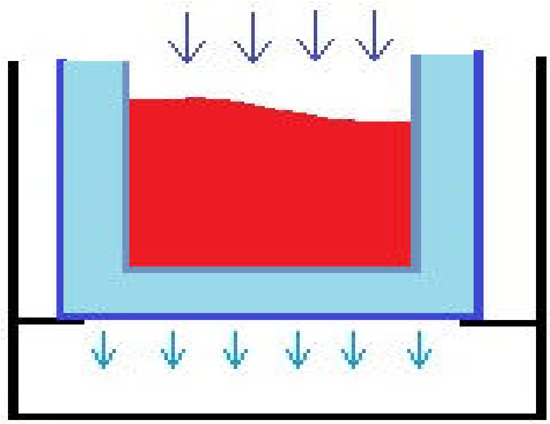
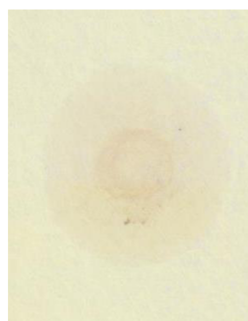


Figure 6.Layer cleaning of hydraulic fluids in a porous filter.

In both methods, samples of filtered working fluids are taken. (Figure 7)

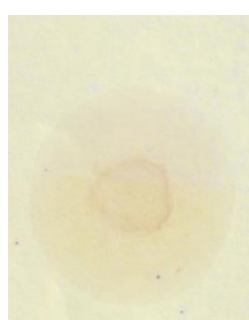
Tellus 46 working fluid in its original state

Tellus 463790 moto / hour Hydraulic excavator RH-40E Working fluid



Tellus 463790 moto / hour Hydraulic excavator RH-40E is a working fluid filtered according to method 1

Tellus 463790 moto / hour Hydraulic excavator RH-40E - the working fluid is filtered according to method 2



Tellus 68
working fluid in its original state

Tellus 68
3088 moto / hour Hydraulic excavator RH-40E Working fluid

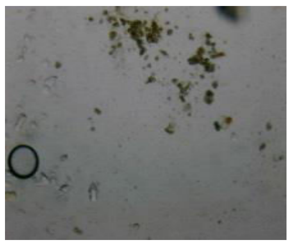
Tellus 68
3088 moto / hour Hydraulic excavator RH-40E is a working fluid filtered according to method 1

Tellus 68
3088 moto / hour Hydraulic excavator RH-40E - the working fluid is filtered according to method 2

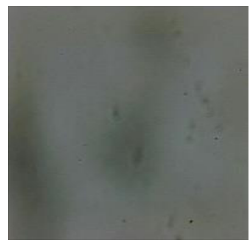
Figure 7. Foamed samples of hydraulic working fluid in a porous medium

The samples are examined under a microscope (model) at 1000x magnification to check for filtered differences. (Figure 8)

Tellus 46
the structure of the working fluid in the initial state.



Tellus 46
3790 moto / hour Hydraulic excavator RH-40E Working fluid composition .



Tellus 46
3790 moto / hour Hydraulic excavator RH-40E Composition of working fluid, filtered according to method 1 .

Tellus 46
3790 moto / hour Hydraulic excavator RH-40E Composition of working fluid filtered by method 2 .

Tellus 68
the structure of the working fluid in the initial state.

.

Tellus 68
3088 moto / hour Hydraulic excavator RH-40E Working fluid composition

Tellus 68
3088 moto / hour Hydraulic excavator RH-40E Composition of working fluid, filtered according to method 1 .

Tellus 68
3088 moto / hour Hydraulic excavator RH-40E Composition of working fluid filtered by method 2

Figure 8.Microscopic image of the filtered states of the hydraulic working fluid.

Experimental results

As a result of the above experiments, we can obtain the following information.

a) Thus, when we measure our porous material on an analytical balance (metlertoledo m: ms204ts), it weighs 10.5 g (Fig. 1), has a surface area of 0.0037 m^2 and a volume of 0.024 m^3. It takes 20 minutes and consumes 250 watts of electricity. As a result, we see the following links.

Figure 1 . Mass of a porous filter on an analytical balance

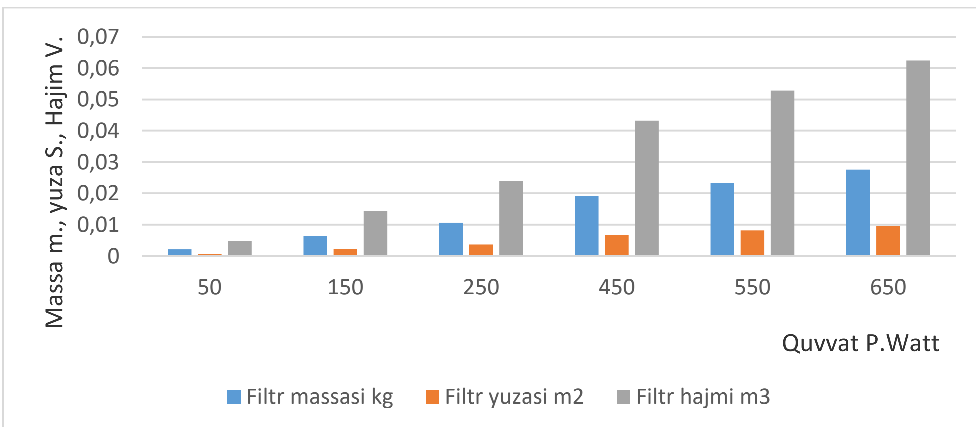


Figure 2 .The ratio of the dimensions of the porous filter to the power consumption.

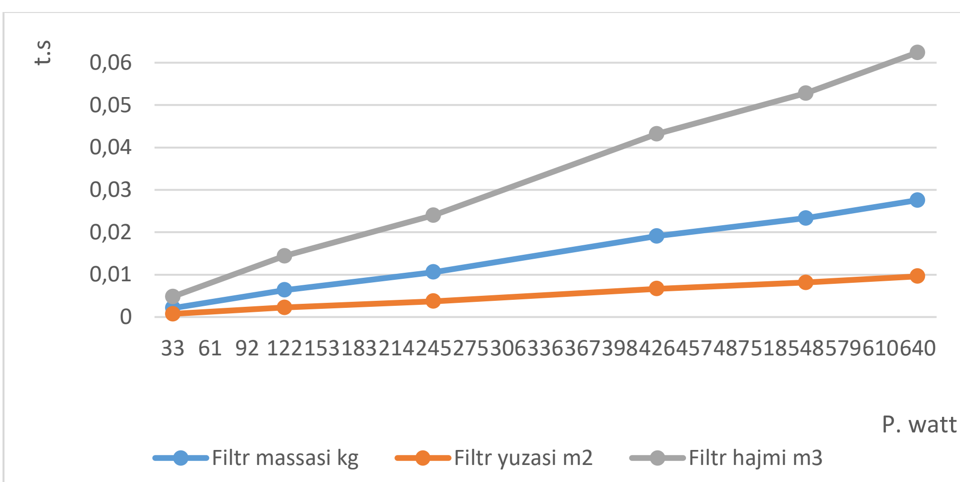


Figure 3.Changing the parameters of the porous filter depending on the time and power.

b) The following pore sizes are plotted using a micrometer calibration line under a microscope (Figure 4).

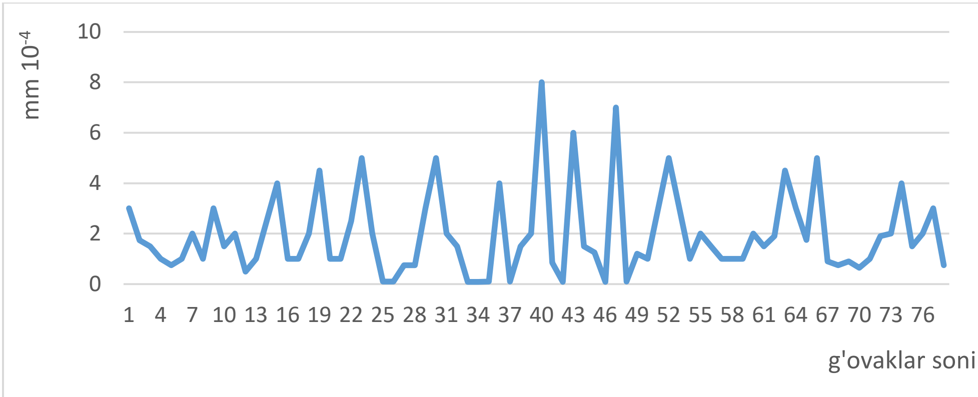


Figure.4. Pore sizes in the sample.

c) The above methods of cleaning the working fluid gave the following results (Fig. 5).

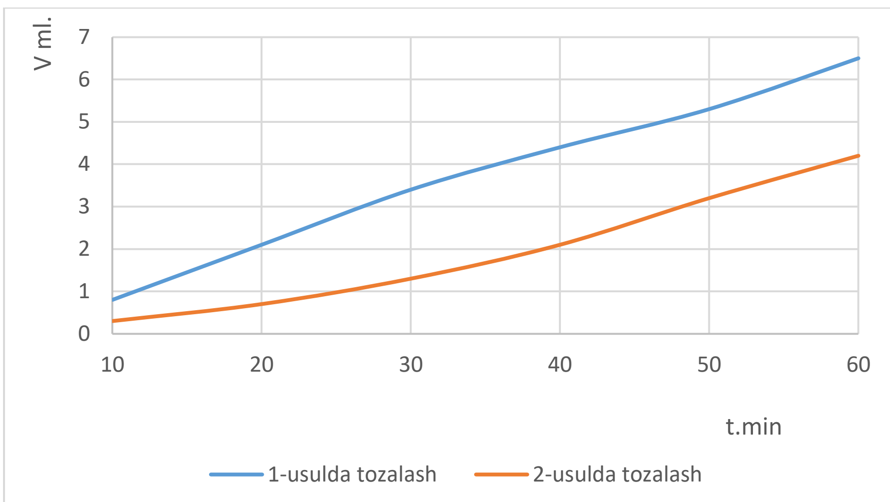
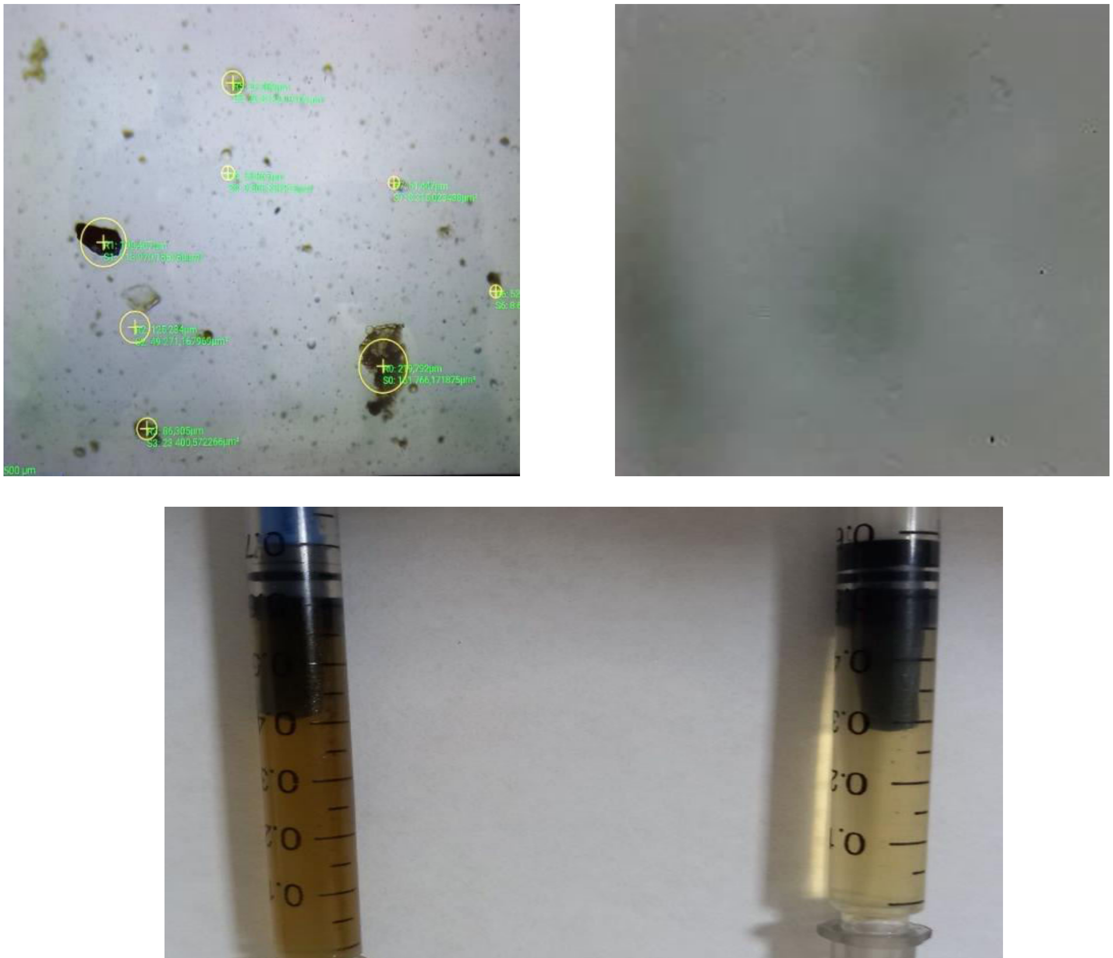


Figure 5.Methods for cleaning working fluids.

d) The results of microscopic analysis showed that it is possible to capture contaminated particles with a size of 0.2–0.3 µm (Fig. 6).



a) b)

Figure 6. View of the working fluid under a microscope.

a) Contaminated condition of the working fluid.

b) - the state of the working fluid after filtration

CONCLUSION

Based on the results of the above experiments, we can say that the porous filter has a significant effect on the purity of the working fluids of mining hydraulic machines in our fields in the Kyzylkum desert zone and in areas with a dusty environment. In turn, hydraulic mining machines provide operational reliability and prevent the failure of parts of the hydraulic system.

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