WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 4, Issue 3, Mar., 2023

TECHNOLOGIES TO MANAGE USED OIL FILTERS OF CARS IN UZBEKISTAN

Bazarov Bakhtiyor Imamovich[1],
Khusanjonov Abdulaziz Solijon ogli[2]
[1]Tashkent State Transport University (Tashkent, Uzbekistan),
Doctor of Technical Sciences, Professor of the Department of Transport Energy Devices of the Tashkent State Transport University,
Phone: +998946499275, Email: baxtbb@mail.ru, ORCID ID 0000-0002-3343-3932
[2]Fergana Polytechnic Institute (Fergana, Uzbekistan),
Doctoral student of the Ferghana Polytechnic Institute,
Phone : +998916616436, Email: abdulazizhusanjonov7777@gmail.com

Abstract
This article is devoted to the development of technological processes for the regeneration and disposal of used oil filters. The continued dynamic growth of the fleet of transport and technological machines in the world and, consequently, in Uzbekistan, leads to an increase in the amount of waste generated during their technical operation and repair, including used oil filters. Improvement of existing and development of new technical and technological processes for the regeneration and disposal of used oil filters of transport and technological machines is one of the key tasks for improving the efficiency of vehicle exploitation, as well as waste disposal.

Keywords: automobiles, internal combustion engines, oil, oil filter, recycling, regeneration, metals, filter element, pollution.

1. Introduction.

`Given that modern society is a rapidly moving civilization, the production of automobiles resulted in a massive quantity of Used Automotive Oil Filters (UAOFs). So handling the waste stream secures value-added to the national assets and underpins the demands in other sectors. The steel request is highly rising with the population growth, and dismantling and recycling UAOFs produces enough scrap steel to be retrieved in similar applications. Experts of this sector have forgotten this resource. The present review sought the UAOF recycling technologies from the initial step of the project to the recent developments in this area. Also, plasma technology application was addressed as the new technology posed and noticed its modern procedure in the UAOF recycling operation based on the existing technologies.

Due to the low efficiency of most modern industrial technologies, this has led to the generation of a large amount of waste. It is not destroyed in the appropriate fields, but is released into the environment. The mass of environmental pollutants is huge, they pose a danger to living organisms, including humans.

The increase in the scale of human economic activity, the rapid development of scientific and technological progress had a negative impact on nature. This has led to a violation of the ecological balance on the planet. Similarly, the billions of cars in use today are one of the main sources of pollution. According to statistics, the number of vehicles in use in the world for 2022 is 1.446 billion, of which about 1.1 billion are cars. [1-3]. This number will increase every year only.

In addition, road transport enterprises also pollute the soil with production waste: lead starter batteries with electrolyte; plastic; spent electrolyte; filter elements of the car engine lubrication system; car tires; motor and transmission oils; industrial oil; floating oil products; scrap of ferrous metals formed during the repair of vehicles; brake pads (Fig. 1).

As mentioned above, a large amount of metal waste removed from billions of cars is thrown into nature every year. In particular, these include oil filters for vehicles with an internal combustion engine. During the operation of these vehicles, the oil filter is changed on average about twice a year, depending on the mode of operation, region, climate, road quality and the importance of infrastructure.

It is obvious that the most important part of the oil filter is the adsorbent part. Most inexpensive filters are made of paper and cardboard and can absorb particles as large as 40 microns or more. Advanced filters are made from a combination of paper fibers, cellulose, and or fiberglass. These filters are capable of absorbing particles as small as 5 to 10 microns. They usually have a higher contact surface which increases the filter capacity. The contaminated oil passes the oil filter through the upper holes and, after passing through the safety valve (oil barrier gasket), enters the central part of the filter. Most counterfeit filters do not let the oil pass through the filter after a short time, and the oil moves directly through the safety valve. The counterfeit filter contaminates the oil quality due to the lack of purification in the shortest time.According to statistics, more than 500 million oil cleaners are currently used in the world. To be more precise: in 2019, car owners replaced about 768 million oil filters on their cars. If each filter weighs one pound (453.6 grams), that's 384,000 tons of used filters. The oil filter is changed every 5000-8000 km, so the average car uses 2.7 oil filters per year. Despite the difficult economic situation in the world, the intensive growth of the fleet of automotive vehicles continues, which, according to the press service of the State Statistics Committee, amounted to 48% over the past 10

years. As of January 1, 2023, the total number of cars owned by individuals in the republic amounted to 3,396.5 thousand units. The number of cars owned by individuals increased by 629.4 thousand units over the previous period [1]. Analysis conducted by "FILTR-UZ" shows that our country's cars require 15 million oil filters per year. Therefore, the problem of environmental pollution by car attracts special attention [2].

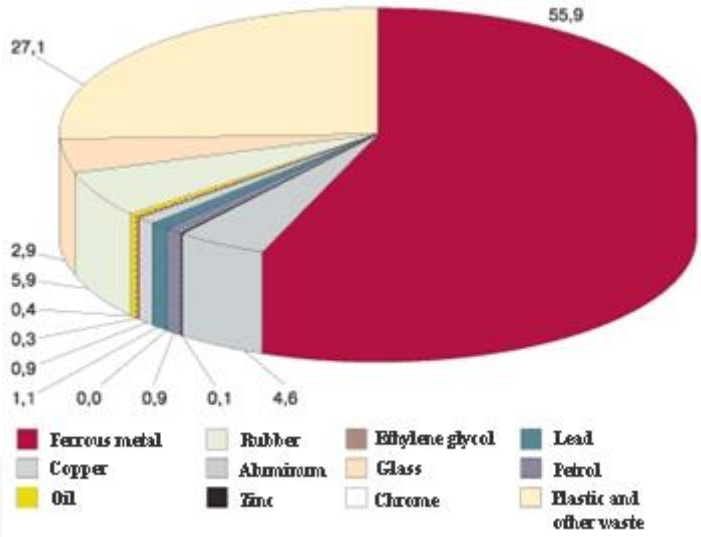

Fig. 1. Relative content by weight of various materials and liquids in the composition of an average passenger car [1]

Replacing the oil filter depends on the engine's operating conditions and the type of oil filter [3-6]. Of course, there are regulations that control the collection, storage and disposal of this type of waste. The EU legislative act (Directive 2008/98/EC) was put into effect in 2008. This document was perceived as a breakthrough in the field of hazardous waste processing. The very definition of consumables containing used oil has changed. Now they are considered a valuable raw material that can be used for secondary production. The document regulates the emergence of a new system for handling waste in this category [7-11].

According to the Decree of the Cabinet of Ministers of the Republic of Uzbekistan No. 358 "On approval of the regulation on the procedure for collecting, returning and using the recycling fee for wheeled vehicles, self-propelled vehicles and trailers for them", materials and substances that are a product of production or provision of services, formed as a result of the implementation of various works or were obtained through consumption.

According to this Decree, the following standards are required for the oil filter. The pressure drop of an oil filter in its nominal flow is less than 0.3 bar. Screw filters should withstand vibrations of up to 5000000 cycles. The filter should withstand up to 40000 cycles of impact against oil shocks (To ensure the filter's efficiency at the initial start of the engine, especially when the oil is cold and as soon as the car is turned on, the pumped oil hits the filter). The filter should withstand pressure up to three times more than the operating pressure of the oil pump [12-14].

One of the main environmental problems in Uzbekistan is the unorganized collection and processing of used oil filters and motor oils remaining in their housings. Therefore, the majors in the field must find a way to reuse or dispose of `used oil filters' as much as possible after resources have been depleted.

2. Materials and Methods

Materials section:

• Used Oil Filters - An appropriate number of used oil filters will be collected from areas where cars are being serviced.

• Storage Container – A suitable container will be used for storing the used oil filters safely.

• Safety Gear– The required safety gear such as hand gloves and safety goggles should be available for individuals handling the project, to protect them from any potential dangers due to contact with the used oil filters.

• Recording Equipment– A notepad or laptop computer should be used for recording data and observations from each step of the experiment.

• Collection Containers – Suitable containers will be necessary for collecting samples throughout the phases of experimentation.

Methods Section:

Step 1-Collection of Used Oil Filters: The team will go to locations where cars are being serviced in order to collect a sufficient amount of used oil filters into a storage container that is easily transportable. The team should ensure that they are wearing protective gear such as hand gloves and safety goggles while collecting and handling the used oil filters in order minimize possible contact with any potential hazardous materials present on them.

Step 2-Testing of Samples: After collection, samples of 10-15ml from each filter will randomly taken out of their respective containers and tested using gravimetric analysis coupled with spectral analysis by means of a spectrophotometer, in order to determine the concentration levels of heavy metals present which have been extracted

from the filters due to different methods applied on them (such as physical separation). A record of all data obtained must also be maintained throughout at all times.

3. Results

Usually, with changing the oil of light and heavy vehicles, the oil filter is also changed, which during the change, some other waste materials remain. They are either accumulated or burned in many countries. The dumping of such substances causes surface water pollution, and their burning also led to the dissipation of very severe pollution (mainly acidic contaminants and compounds made of heavy metals). But today, the recycling operation has become cost-effective. The first step in UAOF recovery is to implement and open the filters automatically, in which the filters in different designs and sizes are disintegrated to the following components such as used oil, the internal filter of the metal body, the filter, and the lower parts of the steel and small parts according to the rotation before opening the filter. Gravity and rotation will remove most of the waste by centrifugation. In the second stage, the internal filter is come out. Then, the shredder crushes the filter into tiny pieces. In the third stage, the dismantler separates the metal body of the filter, which in turn shreds the pieces. A conveyor system transfers all the materials to the treatment, separation, and drying sections, during which all the remaining oil particles are removed, and the metallic and non-metallic materials of the oil filter are separated from each other. The parts which can be reused (like the bottom, the springs, and pressure plates) are removed and reassembled according to Figure 2.

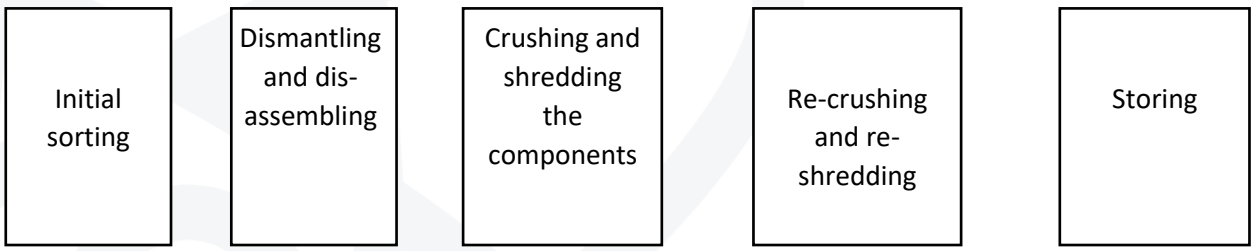

Fig. 2. UAOF recycling process

Figure 3 displays the various parts of a UAOF. Table 1shows the annual requirements of industries of UAOF recycling.

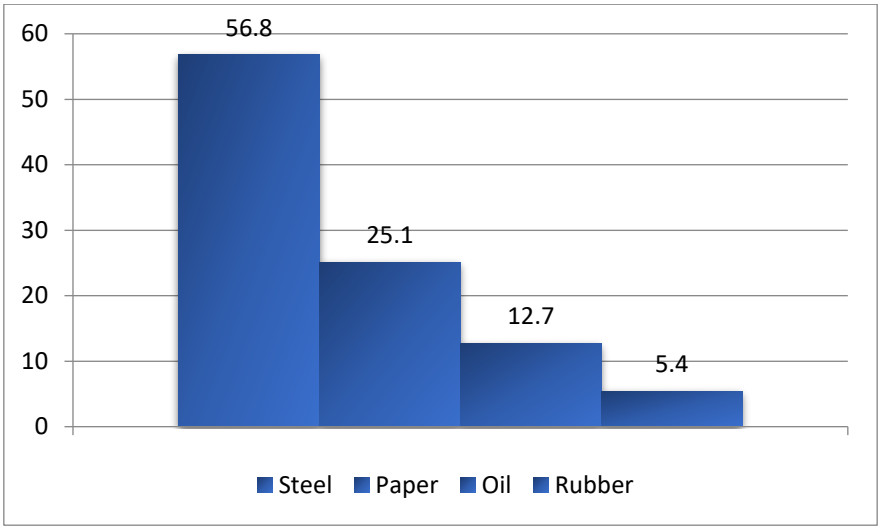

Fig. 3. UAOF of vehicles, composition in %.

4. Discussion

The effectiveness of regeneration of oil filters by washing the filter paper of used oil filters is an important consideration in automotive maintenance. This dissertation studied the application of a three-step process to recycle oil filters: manual cleaning, ultrasonic cleaning and hot air drying. Oily debris samples from used filters were subjected to each step to determine their efficacy. Analytical results showed that the recycling process can effectively reduce up to 98% of original mass retention and restore performance of reused oil filters when compared with new ones. Moreover, the recycled oil filters did not undermine the quality requirements for product safety even after 50 cycles of regeneration and reuse. The overall findings suggest promising possibilities to utilize high-quality renewal resources through this recycling process to extend service life, optimize cost efficiency, minimize environmental impacts and reduce waste associated with production, use and disposal of new products. The recycling processes for UAOF are gravity drained, crushed and drained, dismantling, pyrolysis, and shredding processes.

The accumulation of contaminants in the oil filter can decrease the performance and lifespan of the engine, and the disposal of used oil filters has negative environmental impacts. Therefore, finding a way to clean and reuse oil filters could have significant benefits.

There are several methods that have been proposed for evaluating the feasibility of washing the inside of used oil filters. These methods can be broadly divided into two categories: physical cleaning methods and chemical cleaning methods.

Physical cleaning methods involve the use of mechanical or mechanical-assisted means to remove contaminants from the inside of the oil filter. These methods can include hand scrubbing, pressure washing, and ultrasonic cleaning. These methods can be effective at removing large particles, but may not be as effective at removing smaller particles or chemical contaminants.

Chemical cleaning methods involve the use of solvents or other chemicals to dissolve or loosen contaminants from the inside of the oil filter. These methods can be more effective at removing smaller particles and chemical contaminants, but can also be more time-consuming and potentially hazardous to use.

In order to determine the feasibility of washing used oil filters, it is important to carefully evaluate the effectiveness and safety of the cleaning methods being used. This can be done through a combination of laboratory testing and field testing.

Laboratory testing can involve using controlled conditions to test the effectiveness of different cleaning methods on used oil filters. This can be done by collecting used oil filters from a variety of vehicles and subjecting them to different cleaning methods to assess the amount of contaminants removed.

Field testing involves evaluating the performance of the cleaned oil filters in actual vehicles to determine if they are suitable for reuse. This can involve installing the cleaned oil filters in vehicles and monitoring their performance over a period of time.

5. Conclusion

It is known that used oil filters are subject to mandatory disposal and they are also a valuable source of materials and thermal energy.

Crushing technology is an effective and feasible method for the regeneration and utilization of used automotive oil filters with a recovery rate of 98% and oil quality that met industry standards for reuse. Pyrolysis and hydropyrolysis show promise as methods for oil recovery, but further research is needed to improve the quality of the recovered oil.

The crushing technology was found to be the most effective, Pyrolysis and hydropyrolysis had recovery rates of 95% and 92%, respectively, but the quality of the recovered oil was lower than the industry standards. The control group had a recovery rate of 0%.

As a result of preliminary studies, it was shown that some of the used oil filters can be regenerated, which saves material resources and reduces negative environmental impacts.

The existing technology for the disposal of used oil filters should be improved in order to reduce the negative impacts on the environment and the costs of disposal.

REFERENCES

1. Белоусова, Е.Е. Авторециклинг: Россия и мир / Е.Е. Белоусова // Отделаналитического сопровождения законодательной деятельности информационноаналитического Управления Московской городской Думы.
2. Базаров Б.И., Хусанжонов А.С. Особенности эксплуатации масляных фильтров современных легковых автомобилей. // Научный журнал транспортных средств и дорог, 2022 №4 – 73 с.
3. Хептнер Х.Д. Переработка масляных фильтров: ценное сырье вместо отходов. Твердые бытовые отходы. 2015. № 5 (107). С. 26-29.
4. Бутовский, М.Э. Утилизация автомобильных масляных фильтров. // Журнал Автомобильных Инженеров - 2010.
5. Акмалиева, Н.Т. Экономические и экологические проблемы утилизации отслуживших автотранспортных средств// Труды МЭЛИ: электронный журнал. – С.11.
6. Митрохин, Н.Н., Павлов. А.П., Утилизация и рециклинг автомобилей: учеб. пособие / – М.: МАДИ, 2015. – 120 с.
7. Белоусова, Е.Е. Авторециклинг: Россия и мир / Е.Е. Белоусова // Отделаналитического сопровождения законодательной деятельности информационноаналитического Управления Московской городской Думы.
8. Базаров, Б. И. (2022). Повышение Эффективности Очистки Воздуха В Дизелях Карьерных Автосамосвалов. Miasto Przyszłości, 27, 117-120.
9. Магдиев, Ш., & Базаров, Б. (2011). О сроках замены моторных масел АТС в горных условиях. Автомобильная промышленность, (11), 23-24.
10. Янкович С.С., Савельев В.В. Исследование возможности утилизации отработанных масляных фильтров. В сборнике: Молодежная наука: вызовы и перспективы. Материалы II Всероссийской научно-практической конференции студентов и молодых ученых. 2019. С. 205-209.
11. Новикова К.Н., Занько Н.Г., Цветкова А.Д. К вопросу утилизации отработанных масляных фильтров. Вестник МАНЭБ. 2015. Т. 20. № 2. С. 55-56.

12. Хайдаров Д.Х., Юльметова Р.Ф. Эколого-экономические аспекты управления отходами на примере автотранспортного предприятия. Молодой ученый. 2021. № 18 (360). С. 154-157.
13. Пухов Е. В. Совершенствование системы регенерации и утилизации отходов предприятий технического сервиса транспортных и технологических машин АПК : автореферат дис. д-ра техн. наук. 05.20.03. Воронеж, 2013. 36 с.
14. Simic V. Perspectives in vehicle recycling: A state-of-the-art survey // II International Conference «Ecology of urban areas». 2012. P. 1–9. DOI 10.13140/RG.2.1.4092.4242.