The Austrian Journal of Technical and Natural Sciences, No 7–8
ISSN 2310-5607

PREMIER Publishing
ppublishing.org

DOI:10.29013/AJT-25-7.8-126-130

OPERATING CHARACTERISTICS OF OILS USED IN THE TEXTILE INDUSTRY AND METHODS OF THEIR REGENERATION

Davletov Zafar [1], ***Kobilov Nodirbek*** [2], ***Nasullaev Khikmatullo*** [2], ***Gulomov Shuxratqodir*** [2], ***Igamkulova Nargisa*** [1]

[1] Tashkent Institute of Chemical Technology, Tashkent, Uzbekistan

[2] Uzbekistan scientific research of chemical-pharmaceutical institute, Tashkent, Uzbekistan

Cite: *Davletov Z., Kobilov N., Nasullaev Kh., Gulomov Sh., Igamkulova N. (2025). Operating Characteristics of Oils Used in the Textile Industry and Methods of Their Regeneration. Austrian Journal of Technical and Natural Sciences 2025, No 7–8.* https://doi.org/10.29013/AJT-25-7.8-126-130

Abstract

The article presents the main operational characteristics of oils used in the textile industry and methods of their recovery. methods of oil recovery used in the textile industry, technological processes and their comparative descriptions are given.

Keywords: *oil, technology, properties, description, operation, method*

Introduction

The frictional properties of working parts in the textile industry lead to their wear, overheating and shortening of their service life. Therefore, it is necessary to constantly lubricate the rubbing surfaces. This task is performed by the lubrication system. A certain amount of mechanical energy is spent on overcoming friction. As a result of lubrication, the power required to overcome friction decreases, the wear of the rubbing surfaces slows down, and the heat released during the friction process is removed. At the same time, the oil washes away crushed particles and various contaminants from the rubbing surfaces, protects the surfaces from rust, and in some cases prevents the formation of deposits on neighboring moving surfaces (Zagidullin et al., 2016).

During the operation of machines, the quality of the oil deteriorates due to metal particles, oxidation and contamination. Also, a decrease in the amount of additives that provide good lubricating properties of the oil leads to a decrease in its quality. Mechanical impurities are metal particles and additives that are formed when two friction surfaces slide.

Mineral impurities (sand, dust) enter the engine through the air and reduce the lubricating properties of the oil. The amount of mechanical impurities in the oil composition should not exceed 0.2% (Rylyakin E. G. and Voloshin A. I., 2015).

Quantitative changes in the oil include the loss of light fractions due to evaporation, combustion and dispersion. Qualitative changes are associated with chemical changes in the substances in the oil, oxidation products and polymerization, combustion products of fuel and oil, dust, water and other contaminants.

Under operating conditions, textile oil must maintain sufficient fluidity and high colloidal stability at low temperatures. High fluidity at low temperatures ensures good flow of the oil into the friction nodes, sealing gaps, forming a film separating the friction surfaces and, as a result, reducing friction and wear (Abishek, 2024).

The need to operate in low-temperature regions and store equipment for long periods of time requires attention to the low-temperature properties of motor oils and their behavior in conditions of high humidity condensation. Condensation of water in the oil leads to its loss of stability and deterioration of its quality. The high colloidal stability of the oil, especially in the presence of water, ensures its performance, minimizes rust and corrosion (including corrosion-mechanical wear), as well as oxidation and the formation of various deposits (Majidov and Sharipov, 2000).

Materials and methods

In the textile industry, oils and lubricants are used for the following purposes: lubrication of bearings, shafts, chains and guides; protection of fibers from static electricity and improvement of their fluid movement; protection of metal parts from rust.

Mineral, synthetic or emulsion oils are often used, with the addition of SFM, anti-rust and antistatic additives. During operation, such oils are contaminated with fibers, dust, water, paints, oxidation products and form emulsions, which reduces their performance. In order to extend the service life and reduce costs, oils are regenerated – their properties are restored and the possibility of further use is created.

Used lubricating oil (ULO) is considered hazardous as it is able to cause pollution and affect the environment. The presence of degraded additives, contaminants, and by-products of degradation render ULO more toxic and harmful to health and environment than virgin base oils. Recovery of ULO generally comprises cleaning, drying, and adsorption in order to eliminate water, sludge, and impurities. As the ULO is one of the hazardous wastes generated in various industries, such as industrial and automotive, it should not be used or disposed of in ways that are harmful for the environment. Recovery of ULO carries out many advantages which includes lower environmental impact, higher energy saving and lower risks. The main objective of this paper was to thoroughly review various recovery process principles and treatment methods for ULO. Importance of ULO recycling and various techniques along with their limitations were also discussed. The significance of this study lies in reviewing the roles of adsorbent and adsorption reclamation processes of ULO and few promising adsorbents were earmarked for further study (Anisuzzaman S. M. et al., 2021).

The contamination characteristics of textile oils are such that, compared to motor oils, they contain fewer metal particles; more organic fibers and dust; paints and pre-treatment chemicals; water and emulsions; SFM and tarry deposits.

Results and discussion

In this regard, we have developed methods for cleaning oils used in the textile industry.

The main methods of regeneration of textile oils:

1. Mechanical cleaning. Filtration through fabric, paper or fine-mesh filters – removal of fibers, dust and large mechanical impurities. Centrifugation – separation of water and fine dispersed particles. Sedimentation – used as a preliminary stage.

2. Physico-chemical cleaning. Coagulation and flotation – removal of emulsified water droplets and surfactants (PAVs). Sorption cleaning – activated clays, silica gel or zeolites are used to remove coloring substances, resins and oxidation products. Demulsification – heating and adding special reagents to destroy stable emulsions.

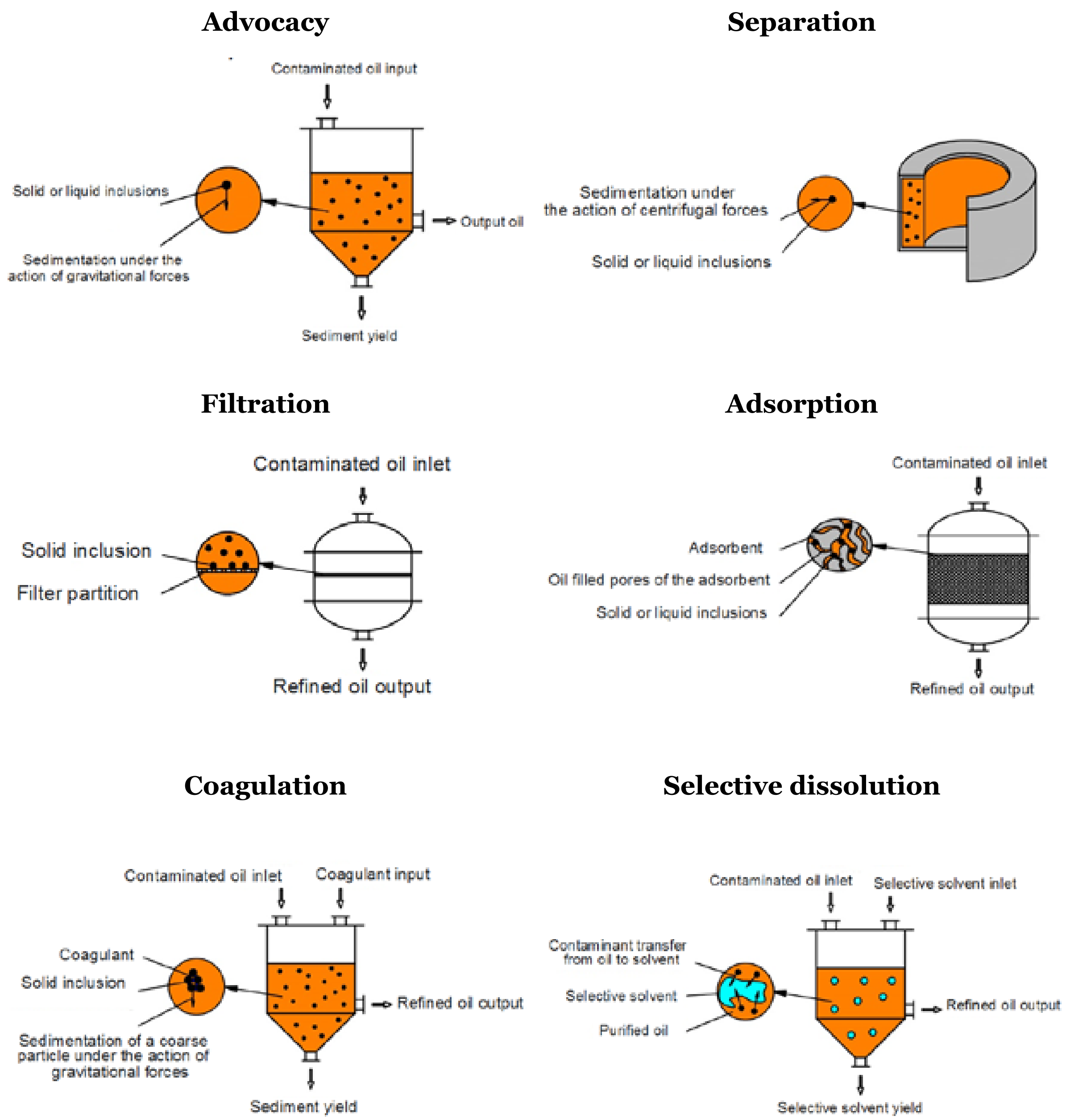
3. Heat treatment. Vacuum drying – removal of moisture and volatile substances under reduced pressure. Inert gas (nitrogen) blowing and heating – prevents oxidation during heating.

4. Chemical re-purification. Treatment with alkaline solutions – neutralization of acid products formed as a result of oxidation.

Adsorption on activated carbon – improvement of the color and odor of the oil. Additives – addition of additives to restore antistatic and anti-corrosion properties.

The figure and table below show regeneration methods for reusing motor oils in the textile industry.

Figure 1. *Used oil purification methods*



Thus, the regeneration of oils used in the textile industry is an important element of efficient and environmentally friendly production. The analysis shows that the best results can be achieved when using a complex cleaning scheme that includes mechanical, physicochemical, thermal and chemical methods, followed by the addition of additives. This approach allows: to remove up to 90–95% of contaminants of various nature, restore the main operational properties of the oil, reduce the cost of purchasing new lubricants by 30–60%, and reduce the negative impact on the environment by reducing the volume of hazardous waste.

Table 1. *Comparative descriptions of used oil regeneration methods in the textile industry*

Methods	Contamination	Cleaning efficiency	Costs	Advantages	Disadvantages	Applications
Landing	Large particles, sediment	40–50%	Low	Simplicity, no complex equipment	Requires a long time, ineffective for fine particles	Initial cleaning
Filtration	Fibers, dust, mechanical particles	50–70%	Low-medium	Simplicity, possibility of automation	Filter replacement required	Initial and intermediate cleaning
Centrifuge	Fine particles, water	70–85%	Medium–high	High speed, good water separation	Requires expensive equipment	Primary cleaning in enterprises using large volumes of oil
Coagulation and flotation	Emulsions, SFM, water	75–90%	Medium	Effective breaking of stable emulsions	Reagents and pH control required	Basic and additional purification
Sorption purification	Dyes, resins, oxidation products	80–95%	Medium	Improves color, odor, stability	Requires regeneration or disposal of the sorbent	Final purification
Vacuum drying	Water, volatile matter	85–95%	Medium–high	Removes moisture without strong heating	Consumes a lot of energy	After mechanical or chemical cleaning
Chemical neutralization	Acidic oxidation products	90–95%	Medium	Restores average pH and stability	Produces alkaline wastewater	Final cleaning before adding additives
Additive addition	Lack of functional properties	-	Medium	Fully restores operational properties	Does not remove impurities	Final stage

Conclusion

Regeneration of oils used in the textile industry is not only economically acceptable, but also an important environmental safety measure. Modern technologies allow recovery of 70–90% of the original oil resource, which reduces the need for processing of petroleum products, reduces the amount of hazardous waste, and plays an important role in protecting the environment.

References

Abhishek Kumar, Avinish Kumar. Performance Characterization of Lubricants. CRC Press, Boca Raton FL USA-2024.

Zagidullin S.Kh., Dolganov V. L., Lykov A. N., Kiselyov A. M. Development of a new method of thermal mineralization problem. Chemical technology and biotechnology. Vestnik PNIPU. – No. 4. 2016. – P. 129–137.

Rylyakin E. G., Voloshin A. I. Ochistka i vosstanovlenie masel. "Molodoy uchyonyy" Ejemesyachnyy nauchnyy journal. g. Kazan. – No. 1 (81). January, 2015. – P. 92–94.
Anisuzzaman S. M., Muhammad Hazaruddin, N. N. M. Nasir. Used lubricating oil recovery process and treatment methods: A review. 2021. IOP Conference Series Materials Science and Engineering 1195(1):012031
Majidov A. H., Sharipov K. A. Osnovy ochistki masel. – Tashkent, Science. 2000. – 140 p.

submitted 08.06.2025;
accepted for publication 22.06.2025;
published 29.09.2025

Contact: nodirbekdoc2020@gmail.com