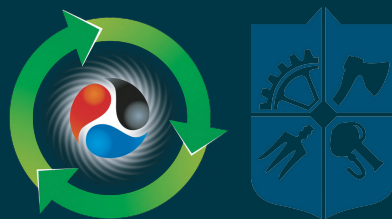


THEORY AND PRACTICE OF RATIONAL USE OF TRADITIONAL AND ALTERNATIVE FUELS AND LUBRICANTS

X International Scientific-Technical Conference
BOOK OF ABSTRACTS

Kyiv, 2025



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DEPARTMENT OF AUTOMATION OF ELECTRICAL
AND MECHATRONIC COMPLEXES

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Sorption Purification Of Hydraulic Oil AW-46

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Introduction

The paper investigated the selective purification of used hydraulic oil AW-46 (manufactured by Chevron Belgium NV, Belgium), provided by LLC Trading House "Favorit Auto Vinnytsia", which was used in the operation of hydraulic presses and lifting mechanisms. Selective sorption purification of used oil AW-46 was carried out using a regenerated mixed sorbent containing activated carbon (AC) and kieselguhr (K), manufactured by E. Begerow GmbH&Co, Germany. The used mixed sorbent (AC + K) after purification of sugar syrups from the production of soft drinks was provided by Manufacturing Company "Panda" (Vinnytsia). The regeneration of the used mixed sorbent (AC + K) was carried out by sequential treatment of the sorbent with water, alkali (KOH, NaOH) and mineral acid (HCl, HNO₃). The sorption capacity of the mixed sorbent (AC + K) was determined by iodine, while the sorption capacity of the regenerated mixed sorbent (AC + K) was 98.5 %. Adsorption purification/regeneration of AW-46 used oil using the regenerated mixed sorbent (AC + K) was carried out under static conditions, mixing the waste oil and the sorbent with a high-speed magnetic stirrer VELP AREC (VELP Scientifica, Italy), followed by filtration of the mixture in a vacuum unit.

Main material

It was established that the optimal regeneration conditions are: ratio (AC + K) : AW-46 = 1 : 10; temperature 50-60 °C; time – 30 min. It should be noted that increasing the amount of sorbent by 2-4 times not only does not improve the purification of hydraulic oil, but also does not allow to isolate the purified fraction by deep vacuum filtration. The obtained physicochemical characteristics of the regenerated AW-46 oil indicate the high efficiency of the used sorbent (AC + K) and the possibility of its use as a liquid base for new multifunctional plastic lubricants. In addition, it should be noted that when using natural sorbents, the issue of recycling

spent solid sorbents remains unresolved, because when using environmentally acceptable purification technology, their price can increase by 40-60 %. The mixed sorbent used after the regeneration of AW-46 oil, in addition to activated carbon and kieselguhr, also contains 5.2-12.6 ml of contaminated liquid fraction of AW-46 oil. To regenerate such a sorbent, a study was conducted on its purification by extraction method for the removal of organic pollutants with industrial xylene at room temperature using a high-speed ($n = 1000$ rpm) magnetic stirrer VELP AREC. After that, the obtained liquid xylene-organic fraction and the regenerated mixed sorbent (AC + K) were separated by filtration in a vacuum unit. However, this method of regeneration of the used mixed sorbent (AC + K) turned out to be multi-stage, material- and energy-consuming. More effective is the low-temperature pyrolysis of the spent mixed sorbent (AC + K) without its preliminary treatment, which was loaded into the pyrolyzer reactor and the mixture was kept in an inert environment at a temperature of 250-300 °C for an hour. The yield of the liquid fraction was 90-92 wt. % of its sorbed amount in the volume of the used mixed sorbent (AC + K). The general scheme of the regeneration of hydraulic oil AW-46 using the integrated technology of processing waste from the food and machine-building industries and its further use within the framework of the circular economy includes the sequential stages shown in Fig. 1.

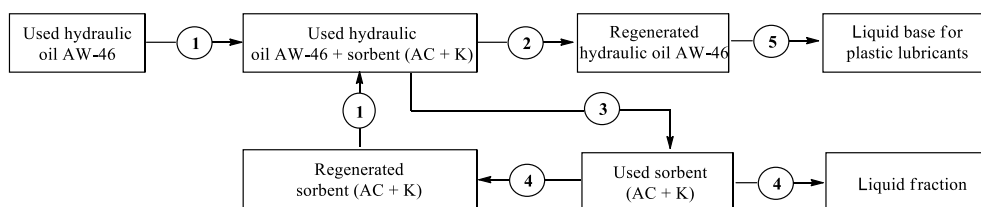


Figure 1. General technological scheme for processing waste from the food and machine-building industries: 1st stage - sorption purification of AW-46 oil with regenerated sorbent (AC + K); 2nd stage - separation of regenerated AW-46 oil; 3rd stage - separation of used sorbent (AC + K); 4th stage - pyrolysis regeneration of used sorbent (AC + K); 5th stage - development and compounding of plastic lubricants

Among the specified stages of use (sorbent (AC + K), regenerated AW-46 oil) and regeneration (waste AW-46 oil, used sorbent (AC + K)), it is necessary to highlight the work of a closed cycle of transformations 1–3–4 due to sorption and pyrolysis processes. At the same time, regenerated AW-46 oil can be effectively used (stage 5) as a liquid medium in the process of manufacturing plastic lubricants, and the regenerated sorbent (AC + K), depending on the destructive oxidation of the original used AW-46 oil, can be used in 3-5 more cyclic transformations.

Conclusions

The feasibility and necessity of regenerating mineral oils, including hydraulic oil AW-46 (Belgium), for their repeated practical use is substantiated. It is shown that regenerated hydraulic oil AW-46 can be used as a liquid base for plastic lubricants. A method of sorption purification/regeneration of used hydraulic oil AW-46 has been developed using a regenerated mixture consisting of activated carbon and kieselguhr (AC + K) as a sorbent. The optimal technological parameters of the process have been established: ratio (AC + K) : AW-46 = 1 : 10; temperature 50-60 °C; time 30-35 minutes. Within the framework of the circular economy, the technology of a closed-loop processing of waste from the food (sorbent (AC + K)) and machine-building (hydraulic oil AW-46) industries has been investigated for the subsequent production of multifunctional plastic lubricants.

Scientific edition

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