CURRENT PROBLEMS

THE NOTION OF COLLECTION AND TREATMENT OF SPENT LUBE OILS

A. P. Kartoshkin

Due to the lack of a centralized collection and treatment system for spent lube oils (SLO) in Russia, small and medium-sized users must independently solve the problem of disposing of them. SLO are primarily incinerated or poured onto the ground, resulting in persistent pollution of soil, water, and air.

With a low degree of biodegradability (10-30%) and accumulation in the environment, they alter the ecological equilibrium. Their toxic components, for example, polychlorinated biphenyls (PCB) enter food products and are stored in human fatty tissues and cause cancer and immune system disorders.

According to data from the Institute of Toxicology, RF Ministry of Health, approximately 50,000 tons of SLO are formed in St. Petersburg each year, the accumulated stocks amount to approximately 1 million tons, and the concentration of PCB in human breast milk is 21.5 mg/liter with a maximum admissible concentration of 1 mg/liter.

Because of the above, regeneration and reuse of SLO for direct or indirect applications are an important resource-saving and environmental protection problem. To solve this problem, it is necessary to organize mandatory separate collection of SLO by grades and basic brands (Fig. 1a) and regenerate them at sites of consumption with multifunctional, small, mobile and stationary (Fig. 1b) modular regeneration complexes (MRC) that use unified, comprehensive, environmentally clean technology.

Small mobile units with output of 50-300 liters/h are used for LO of the same type with a total SLO storage volume of less than 0.75 m³. Dimensions: 1500 × 1000 × 1000 mm. A special feature of these units is an exchangeable unit for execution of the required regeneration technology for the concrete type of SLO based on the results of intake control analysis.

Fundamental units: control unit; exchangeable unit consisting of a full-flow filter, evaporator, water trap (water absorber) and neutralizer (regenerator); ultrasound unit; receiving tank; filters-traps; vacuum unit; switch distribution unit; batcher unit.

Mobile plants with output of 250-1500 liters/h are used by some agricultural, energy, and transport companies located within a maximum radius of 100 km. Dimensions: 6400 × 2300 × 3000 mm.

A special feature is an automated system for selecting the regeneration technology based on oil analysis results on the side of the full-sized MRC and an autonomous portable laboratory or a stationary laboratory on the side with autonomous feed.

Stationary plants with output of 1000-3000 liters/h cover lube oil users with a SLO delivery distance of no more than 50 km. The basic process equipment consists of a stationary MRC, mobile MRC, and treatment module.
The mobile MRC and mobile treatment module can be quickly dismantled and shipped by the LO consumer for processing a large batch of SLO on site and then returned and incorporated in operation of the plant or stored. These plants are equipped with water cycle systems and treatment equipment.

Comprehensive technology for regeneration of SLO and a RFT for planning the MRC were developed at St. Petersburg State Agrouniversity, and working model samples of the small stationary and mobile plants were created. Regeneration technology was developed for spent motor oils.

The projected quality parameters of the regenerated oils were confirmed in the petroleum product test laboratory at Krasnyi Neftyanik tank farm and their workability was tested. The results were approved at Gatchina-passazhirvotrans DGUP and at PTK-Terminal Motor Transport Shop.

To complete the project, it is necessary to plan and prepare an industrial sample of MRC, perform operating tests, and organize production of regeneration plants.

The strategy for implementation of the proposed project includes the following stages:

- creation of a high-output plant for regeneration of industrial oils at large industrial entities;
- direction of recovered resources from regenerated oils of this kind for creation of plants for regeneration of transformer and turbine, hydraulic, and transmission oils;

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**Fig. 1.** Diagram of the concept for collection (a) and treatment (b) of spend lube oils: P, M, S: portable, mobile, and stationary plants.