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RECYCLING OF USED OILS USING PHYSICAL METHODS

The problem of utilization of used industrial lubricants (oils) is one of the most pressing and important issues of our time.

According to the Resolution of the Cabinet of Ministers of Ukraine No. 1221 of December 17, 2012 "Some Issues of Collection, Removal, Decontamination and Utilization of Used Oils (Lubricants)", used oils are hydraulic, motor and other lubricants (oils), brake and other insulating and coolant fluids that are no longer suitable for their original purpose [3].

Waste lubricants pose a serious threat to the environment, are classified as hazardous waste, and their management requires a license for recycling or disposal. At the end of their service life, they must be replaced and disposed of. Used oils are water insoluble, chemically resistant, and contain toxic substances and heavy metals. The problem of their disposal is also an issue of environmental safety, as they take a long time to decompose in natural conditions.

However, many operating companies are severely limited in their ability to recover it. Meanwhile, the used oil is not disposed of or disappeared, but is mostly used in heating and cooling systems, posing a threat to humanity and the environment. It is known that one liter of such oil contaminates nearly 1,000 tons of groundwater, destroys soil fertility, and worsens the condition and quality of ecosystems, including heavy metal pollution [1].

Some companies utilize oil by burning it. The combustion of 1 ton of oil is known to produce about 7000 m3 of flue gases containing hydrogen chloride, polyaromatic hydrocarbons, zinc, aluminum, and heavy metals. Combustion products are extremely dangerous [5].

Oil refining is economically unprofitable, and out of 1.6 liters of used product, refining yields only 1 liter of new lubricant. According to statistics, in Ukraine, only 25% of the total consumption of lubricants is recovered, of which only 15%, or about 3% of the total consumption, is regenerated (recycled). For comparison, in developed countries such as the UK, Japan and the US, the share of recycled lubricants (as a percentage of total production) is about 30%.

Waste oil treatment methods include settling, centrifugal cleaning and filtration. Filtration is the process of passing oil through a mesh or porous filter baffle to remove particles of mechanical impurities and resinous compounds [4]. Centrifugal flushing is the most effective and high-performance method for removing mechanical impurities and water from used oil [4]; in [7], the authors propose using jet pumps for centrifugal flushing of oil. Settling is based on the separation of oil, water and mechanical impurities under the influence of gravity [4].

Consequently, the proposed method can be used to regenerate used oils, but more detailed research is needed. Finding methods for recycling or regenerating oil using environmentally friendly technologies will reduce the environmental impact and return it to the technological cycle.

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IMPACT OF CONSTRUCTION AND OPERATION OF HIGHWAYS ON THE ENVIRONMENT

The construction and operation of roads become one of the main sources ofpotential environmental risks that negatively affect the functioning of ecologicalsystems and, of course, humans [1,2].

As an engineering structure, a road changes natural landscapes, surface and groundwater flow regimes, habitats of flora and fauna and causes changes in the coastlines of water bodies, the microclimate of certain areas. In addition, the road is a source of vibration, noise, electromagnetic and ionizing effects on the environmental components, population and wildlife. The transport sector is the largest source of toxic water, soil and air pollution in many countries [1].

Artificial structures on highways are complex engineering structures.

The design, construction, and maintenance of such structures often raise such environmental issues that require timely and informed solutions. These environmental problems can be associated with the following main factors:

- animals road crossing;
- pollution of permanent and non-permanent watercourses, which negatively affects aquatic biological resources, during the construction and repair of artificialstructures;
- change in the hydrological regime of a watercourse caused by the construction of a bridge [3,4].

Construction and roads repair and artificial structures often leads to river pollution [1]. Sources of water pollution are facilities that discharge harmful substances into water bodies that degrade water quality, limit its use, and negatively affect the condition of the bottom and banks of the water objects.

Studies have shown that the main pollutants in the construction and repair of artificial structures are as follows:

- construction garbage;
- petroleum products in the form of leaks of fuels and lubricants from construction machinery, mechanisms and vehicles;
- paints and varnishes and other chemicals used in construction works;
- corrosion products and paint residues from sandblasting of rebar, steel bridge structures (spans, supporting parts, protecting bridge deck structures, etc);
- wash water from tanks of concrete mixers and dump trucks;
- household wastewater from functioning construction camps, household waste [1,2].

Besides this, stormwater is runoff from the roadway appeared during the operation of artificial structures, especially bridges, has a negative impact on the aquatic biological resources. The most harmful chemical pollutants are oil products. The oil film that is formed on the water surface disrupts all physical and chemical processes in the reservoir: the temperature of the surface water layer rises, gas