INNOVATIVE TECHNOLOGY FOR CLEANING USED MOTOR OILS

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Abstract. *In this scientific article, based on the study of the problems of utilization, as well as the regeneration of waste lubricating oils, a method for restoring their quality is considered. In addition, the results of experimental data obtained during the study are presented.*

Keywords: *Lubricating oils, oil quality, regeneration.*

INTRODUCTION

The main part of waste lubricating oils (WLO) is subject to disposal by burning. Direct burning of WLO in non-specialized furnaces without preliminary cleaning leads to the emission of persistent toxic organic and inorganic pollutants into the atmosphere, which subsequently have a negative impact on the geoecological situation.

MATERIALS AND METHODS

There are many methods of recycling WLO, which allow to reduce the costs of servicing construction and road equipment by reducing the costs of purchasing fresh lubricants. The most important place is given to regeneration methods, which ensure the restoration of the original properties of oils for the purpose of their repeated use. This approach is the most rational in terms of environmental impact [1, p. 3].

Currently, two methods of lubricating oil purification are mainly used - chemical and physical. The main disadvantages of existing chemical methods are that the use of such substances as sodium orthophosphate, sodium metasilicate, sodium carbonate, sulfuric acid leave a strong or acidic reaction in the oil, which entails the need for their additional processing, and significant difficulties arise during waste disposal. When regenerating used oil, its performance properties are not fully restored, only

aphaltenes, carbenes and carboids, acidic compounds, ash inclusions and wear of friction surfaces are removed, and resins, acid salts, polycyclic aromatic hydrocarbons, sulfur-containing compounds are almost not removed. When cleaning heavily contaminated oils, complete sedimentation does not occur. The resulting oil has a dark color and does not meet GOST standards for some indicators. The purpose of our development was to develop a regeneration method that allows improving the quality of the restored lubricating oil. The method is carried out as follows: contaminated oil is heated to a temperature of 80-100 0C, then an aqueous solution consisting of 30-50 wt.% urea, 4-6 wt.% monoethanolamine and 2-4 wt.% aluminum chloride, taken in an amount of 0.5-1.0 vol.% of the volume of used oil, is added to it. At a given temperature, it is maintained for one hour with periodic stirring, and the contaminants are separated by centrifugal means [2].

RESULTS AND DISCUSSION

An aqueous solution of urea, monoethanolamine and aluminum chloride destabilizes oil as a colloidal system. The processes of coagulation and sedimentation of dispersed phase particles begin actively. At the same time, urea and monoethanolamine sharply reduce the thickness of the adsorption-solvation shell of highly dispersed particles, leading to their complete exposure and adhesion to each other due to electrostatic attraction. Monoethanolamine also promotes the formation of sedimentation-unstable associates of resinous substances due to the formation of hydrogen bonds, in addition, it is a demulsifier of aqueous emulsion in oil. Aluminum chloride forms insoluble coordination compounds with resinous substances, polycyclic aromatic hydrocarbons and sulfur-containing compounds due to donor-acceptor interaction.

It is with these parameters that the best effect of regeneration of waste oil from aging products and contaminants is achieved. Addition of less than 0.5 vol.% of an aqueous solution of urea, monoethanolamine and aluminum chloride (composition 1) to waste oil reduces the quality of regeneration, and when more than 1.0 vol.%

(composition 5) is introduced, it does not lead to an increase in regeneration indicators (Table 1).

Table 1

Regeneration indicators of M-10G2k waste oil using various compositions of an aqueous solution of urea, monoethanolamine and aluminum chloride

composition	Composition of aqueous solution			The amount of aqueous solution in vol.% of the volume of waste oil	Regeneration rates		
	Carbamide	Monoethanolamine	Aluminum chloride		Mechanical impurities wt.%	Resins, wt.%	Pollution, cm^{-1}
1	25	3	1	0,25	0,35	0,42	84
2	30	4	2	0,50	fr	0,30	75
3	40	5	3	0,75	fr	0,29	75
4	50	6	4	1,00	fr	0,29	74
5	60	7	5	1,25	fr	0,29	75

In order to condense the steamed oil gas, we also need a condensing device. Our company uses circulating water to cool, and the cooling water is not in contact with oil gas. The cooling water is cleaned and recycled without causing waste of water resources.

Most of the impurities in the used motor oil are separated and precipitated by the action of the catalyst A. In the catalytic A process, a chemical reaction occurs between the catalyst A and the colloidal, asphaltic impurities in the waste engine oil to precipitate the waste residue.

Under the action of the first catalyst A, a partial precipitation will occur. The fourth catalyst B deodorization step can neutralize the precipitate and remove the heavy color of the diesel fuel to make the oil clear and bright.

CONCLUSION

To conduct the experiment, we used MS-8 waste oil. In the first case, we restored the quality using a known method [2], where a 30-50% aqueous solution of urea is used as a coagulant, taken in an amount of 0.5-1.0% based on dry urea from the mass of waste oil, added to preheated oil to 80-100 0C with subsequent separation of the regenerated oil. In the second case, we used the method we developed. As a result of the experimental studies, the following data were obtained (Table -2). Based on the results of the analyses, it was established that the proposed method for regenerating waste lubricating oils is capable of solving the tasks set to increase the degree of restoration of individual quality indicators.

REFERENCES

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