

CHOICE OF REFINING METHOD AND COMPLEX PROCESSING OF USED OILS TO OBTAIN VALUABLE PRODUCTS

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ABSTRACT

The review of modern trends in utilization of used motor oil cleaning is given in the article. Cleaning by coagulation method used in restoration of motor oils is proposed. The scheme of complex processing of used motor oils enables to obtain valuable raw materials for processes of production of motor and transmission oils, plastic greases, oil and coal coke, road, construction bitumen and fuel distillates.

KEYWORDS: cleaning, coagulation, complex processing, engine oil, used oil, utilization, gear oils, plastic greases, coke, bitumen, fuel distillates, fractional composition, viscosity index.

INTRODUCTION

Millions of tons of used motor oils are produced annually in Uzbekistan, which undoubtedly poses a significant threat to the environment. Meanwhile, developing the processes of utilization, in particular, processing of used motor oils, instead of accumulated waste it is possible to get perspective energy resources, rational use of which will allow reducing the prime cost of products of petrochemical and coke-chemical industries of our country.

Lubricating oils of various brands find a wide and very diverse application in the operation of modern technology. However, in the process process equipment operation oil is exposed to a number of factors factors (ambient air, temperature, pressure, natural light, etc.) that change its physical and chemical properties. Firstly, the destruction products formed by oxidation sharply reduce the quality of oils. Secondly, mechanical impurities in the form of

dust and sand contribute to the more intense wiping of metal from work surfaces and, consequently, to premature wear and tear of devices. Thirdly, moisture entering the oil from the atmosphere or due to leaks in water coolers leads to watering. Thus, oils, on the one hand, undergo a deep change in their chemical composition, and on the other hand, are contaminated with foreign substances [1].

The issue of involvement in the production of secondary raw materials is also relevant at the current stage of development of state industry to achieve environmental and economic benefits. In this regard, used oils can be considered as a raw material base for valuable oil products at proper processing, i.e. after removal of contaminants and restoration of oil to operational quality, it can be reused.

Possible areas of utilization of used motor oils in the world can be presented in the form of a diagram shown in Fig. 1.

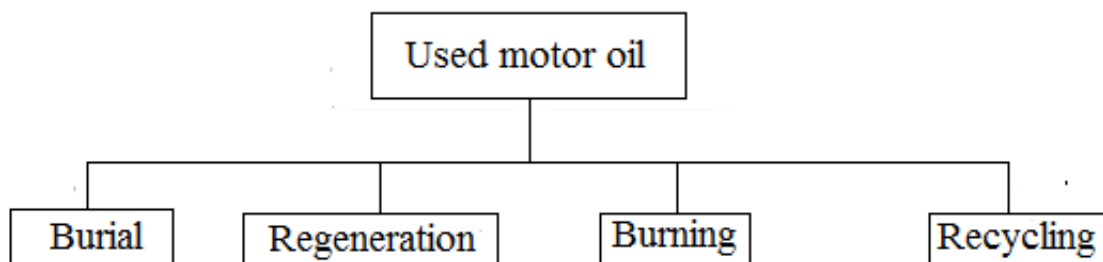


Fig. 1. Worldwide recycling of used motor oils

One of the earliest and most economically impractical directions is to dispose of used oils by draining them into soil or water bodies, which also poses a danger to the environment and disrupts natural ecosystems.

Regeneration of used oils is a field that began more than 30 years ago and is still developing rapidly. At most of the waste oil regeneration plants, mechanical impurities and water are simply removed from them [1], which may not always restore the original properties of the oil. Therefore, deeper regeneration of oils is carried out using vacuum, which in turn leads to an increase in the cost of the regenerated oil. So, for example, in work [2] possibility of use of the spent oils as a complex reagent-collector for flotation of coal slurries is shown.

The concept of application of composite compositions for temporary corrosion protection of agricultural machinery with the use of used motor oils as a solvent base and multifunctional additive has been developed [3]. Soap (hydrated calcium and lithium) and hydrocarbon greases were obtained by the author [4] on the basis of used motor oils.

A combination of factors such as high costs of regeneration, environmental pollution by waste from this process and, most importantly, stricter requirements for the quality of marketable oils has led to the development of technologies related to the use of motor oils as a boiler-oven fuel or its component.

Meanwhile, the methods of used oil processing, which allow to get more economic effect than their combustion in heating systems, began to develop rapidly: co-processing in blends with oil at oil refineries and targeted processing with thermal cracking.

The existing Potram-Diesel mini-unit, which operates on the basis of thermal cracking and distillation processes, allows to obtain from waste motor oil: associated gas (3-4 %), gasoline (4-5 %), diesel fuel (80-85 %), as well as semi-coke (3-5 %) [5].

The mini-plant of the Potram Diesel Shah converts any liquid petroleum feedstock. Raw materials can be oil, fuel oil, waste oil, pyrolysis fluid from tire processing shown in Fig. 2.

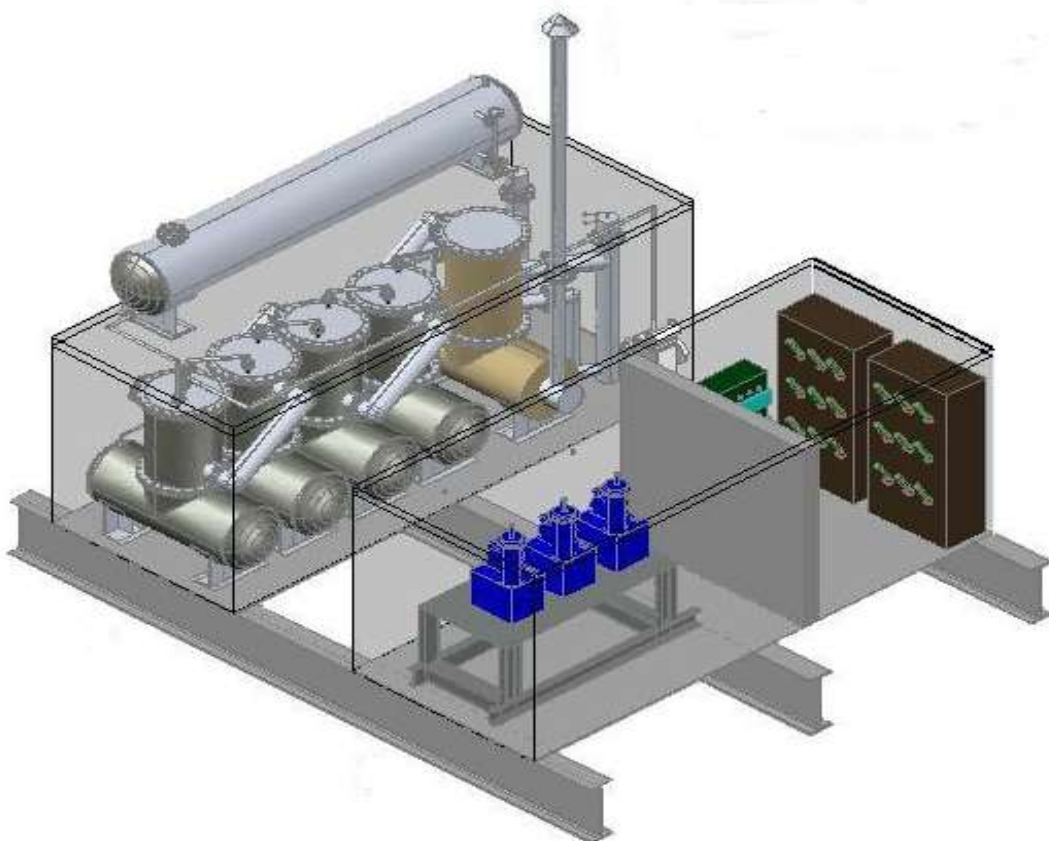


Fig.2. Mini installation for production of diesel fuel from various oil liquids "Potram-Diesel".

Setting the task. Despite such a variety of uses of used motor oils, in our opinion, it is more economically expedient to develop and implement recycling schemes for used motor oils, which allow to obtain basic components for the production of motor

and transmission oils, greases, on the import of which the economy of Uzbekistan depends.

It is also necessary to solve the problem of our coke-chemical industry, which is associated with insufficient reserves of well-sintered coal grades "K"

and "Z" for the production of blast furnace coke. Therefore there is a necessity to expand raw material base of coking at the expense of use of coals with low sintering capacity and application of sintering additives in a coal charge.

THE RESULTS OF THE EXPERIMENT

To increase the effect of purification it is necessary in one way or another to carry out "enlargement" of oxidized compounds - coagulation. Coagulation process of used motor oil is devoted to a number of works, which focus on finding effective coagulants and determining their doses.

One of these works shows [3] that the greatest effect is observed when using as a coagulant aqueous solutions of urea with the addition of ethyl and isopropyl alcohols. The essence of the process is that in the oil preheated to 80-95 ° C brought isopropyl alcohol and aqueous solutions of urea, taken in a ratio of 1:1, in an amount of 1-2 % of the mass of the purified oil. After which the mixture is heated to 110 ° C, ie complete removal of water.

The conducted researches of used engine oil purification by the proposed method showed the following results (Table 1).

Characteristics of used oil before and after cleaning

Table 1

No	Indicators	Used motor oil	Purified motor oil
1	Content of mechanical impurities, %	2,40	0,9
2	Viscosity kinematic, mm ² / s	16,3	14,6
3	Water Content, %	0,06	0тс
4	Flashing point in open crucible, °C	182	185
5	Acid number, mg KON/g	3,2	0,4
6	Alkaline number, mg KON/g	2,1	1,9

The table shows that the coagulating effect of urea has a positive effect on the basic physical and chemical characteristics of used oils. However, due to strong contamination of raw materials, the content of mechanical impurities in the purified oil has not been sufficiently reduced to use it for the manufacture of secondary products (e.g. greases), as their presence does not always lead to a product corresponding in quality to the level of the finished lubricant.

And on work of complex processing of the processed oils with reception of valuable products I want to offer the scheme of complex processing of the spent motor oils which basic directions are presented on fig. 3.

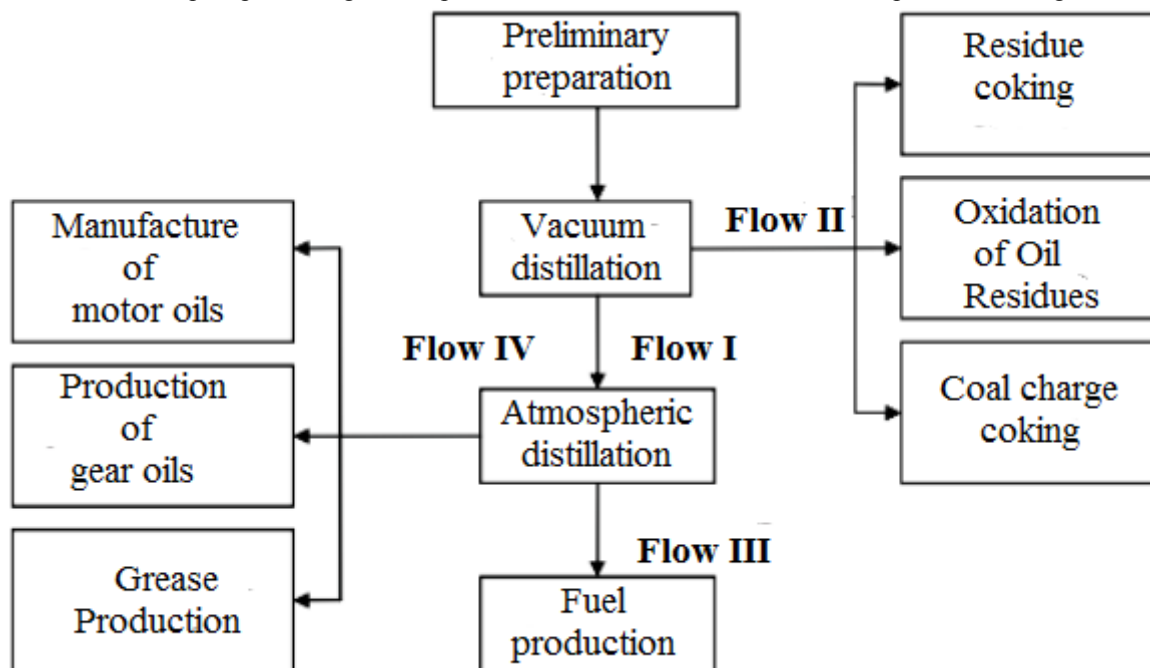


Fig. 3. Scheme of complex processing of used motor oils

Looking at the scheme, we note that used oil coming for processing is subjected to preliminary preparation: settling at a temperature of 60-65 ° C or

centrifugation. In this case, mechanical impurities and water are removed from it, which can accumulate in the oil during the operation of machinery, storage and



transportation. In some cases, before sedimentation or centrifugation, in order to wash out the remaining additives and, as a result, to reduce the ash content of finished products, oils can be previously subjected to washing with water.

The prepared oil is subjected to vacuum distillation, where two streams I and II are obtained from it. Flow I is a fraction boiling at temperatures up to 400 ° C, which contains both fuel that gets into the oil during the operation of machinery and light fractions formed during vacuum distillation as a result of the decomposition of hydrocarbon raw materials.

Flow II is a fraction boiling at a temperature of more than 400 ° C, which contains resinous asphaltene formed during the oxidation of oil hydrocarbons in the operation of machinery.

In the future, this fraction is a valuable raw material for the processes of obtaining petroleum coke, oxidation of oil residues to produce road and construction bitumen, as well as for coking coal charge. Moreover, in the process of obtaining coke from coal charge, this fraction serves as a binder

additive, which allows increasing the percentage of cheaper, weakly sintering coals in the charge while maintaining the specified properties of coke.

Flow I is directed to the atmospheric distillation, where it is divided into two streams: flow III - the boiling fraction up to 360 ° C; flow IV - the boiling fraction at 360-400 ° C. Further flow III can be used for production (compounding) of various fuels.

Flow IV is a basic component to which various additive groups are added in the production of motor and transmission oils. This flow can also be a component to which lithium, calcium or sodium soaps are added in the production of greases.

In the laboratory conditions, using the example of engine oil LOTOS SAE 10W-40 (API SL/CF), which has worked 10 thousand km in the engine of Cobalt LT, the quality indicators (table 2) were determined, allowing to evaluate the suitability of each flow as a raw material for a particular technological process.

Laboratory research results
Table 2

Name of indicators	Flow II	Flow III	Flow IV
Potential output, % (gn.)	37,50	6,20	54,30
Ash content, % (wt.)	1,0	-	-
Mass fraction of sulfur, % (wt.)	1,47	-	-
Coking capacity, % (wt.)	10	-	-
Fraction composition, % (gn):			
- petrol fraction	-	2,49	-
- kerosene fraction	-	1,22	-
- diesel fraction	-	2,49	-
Kinematic viscosity at 100°C, mm ² /s	-	-	4,5
Viscosity index, un.	-	-	90
Flashing point, ° C	-	-	219

According to the results of the carried out researches it is visible (table 2) that flow II is suitable for production of oil coke by all checked indicators [6]. Bitumen obtained from such raw materials will have a number of positive properties: have not high penetration values, plasticity interval and sufficiently high values of extensibility, temperature brittleness and cohesion [7]. As a sintering additive to the coking charge, this flow will also cause lower ash content and mass fraction of sulfur in the finished coke.

Flow III is a by-product and may well be used as a component of engine and heating oil.

Flow IV of the given quality indexes, especially viscosity index, in a mixture with a residual component with higher viscosity and flash

point values may well serve as a base oil in the production of motor and transmission oils. This flow is also suitable as a base oil for thickening with various metal soaps in the production of greases [8].

If it is necessary to obtain higher boiling products by fractional composition, the flow I can be taken away not up to 400 ° C, and, say, to a temperature of 450 ° C or 470 ° C. Losses in the implementation of the proposed scheme of processing used motor oils is 2.0 % (gn.).

CONCLUSION

Of all existing areas of recycling used motor oils in the world, the most promising is their recycling, which allows to reduce the amount of



harmful, toxic waste, on the other hand helps obtain valuable and relatively inexpensive energy resources. For deeper removal of mechanical impurities and excess coagulant it is necessary to carry out a fine purification with the help of ultrafiltration processes that do not require large material and time expenditures. So far, there are quite a few efficient filters available to produce cleaned oil that is close to oil-based.

The research carried out on the example of LOTOS SAE 10W-40 oil (API SL/CF) showed that using the proposed scheme of complex processing of used motor oils it becomes possible to obtain valuable raw materials for the most important processes in the petrochemical and coke industry.

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