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# SEMI-LIQUID LUBRICATING OIL COMPOSITION MADE BASED ON LOCAL PROCESSES INFRARED SPECTROSCOPY ANALYSIS METHOD RESULTS

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**Abstract**
The results of the infrared spectroscopy analysis method of the semi-liquid lubricating oil composition prepared using local raw materials are comprehensively approached in this article, which was prepared based on the results of the research. In addition, the IR-spectrum analysis and graph of tar, paraffinized oil SD-7, salomas, which are included in the composition of surkov oil, are widely covered.

**Keywords**: functional group, infrared spectroscopy, component, analysis, fraction, tar, resin, exploitation, durability, aromatic ring, dispersed phase.

## Introduction

After the independence of our country, there was a practical, ecological and economic need to re-equip the oil refining industry, obtain high-quality gear oil from local raw materials and secondary products. Effective use of alternative raw materials in the creation of new compositions of reducer lubricating oils leads to saving of the main ones. In our Republic, there are huge amounts of industrial waste and secondary raw materials, which can replace the main raw materials for the production of reducer lubricants.

This method helps to determine the chemical structure of substances and the functional groups of their constituents. This method is superior to other methods due to the fact that a very small amount of substance is used for analysis and the analysis is performed quickly and clearly. In each molecule, the atoms are chemically bonded to each other and are in constant oscillating motion. Since any compound has its own infrared spectrum, this spectrum is also called the passport of this compound.

It is known that reducer lubricants consist of structurally complex components, and the use of modern analytical methods in their research helps to better study the product. The use of the infrared spectroscopy method is of great importance in researching the components of the reducer lubricating oil composition. Research using this method, the chemical group structure





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of extremely complex physicochemical heterogeneous mixtures and the complete identification of individual compounds, in the case of using additional different methods (chromatography and group chemical composition), sufficiently accurate and reasonable conclusions about the structure of the various fractions under investigation can be done.

In particular, IR-infrared spectroscopy is used to monitor quality changes of components of reducer oil due to chemical cycles, processes of saponification reactions during thermal treatment are determined. In this case, comparing the infrared spectra of the fractions before and after the reaction, it will be possible to make a clear opinion about the absorption of chemical changes.

Based on local raw materials, the analysis of the following components of the new composition reducer lubricating oil was performed by infrared spectroscopy: tar component (conditional viscosity at 100 °C) in the amount of -50%; deparaffinized oil (conditional viscosity at 100°C) in the amount of -48.2%; salomas-1.5% amount; SD-7 compounds - in the amount of 0.3%;

This obtained reduction gear oil was analyzed in an infrared spectrometer "IK-20". An optical shielding liquid was used in the cuvette range of 9000-3400 cm-1 A4 using a device working on the principle of two-beam alternating light.

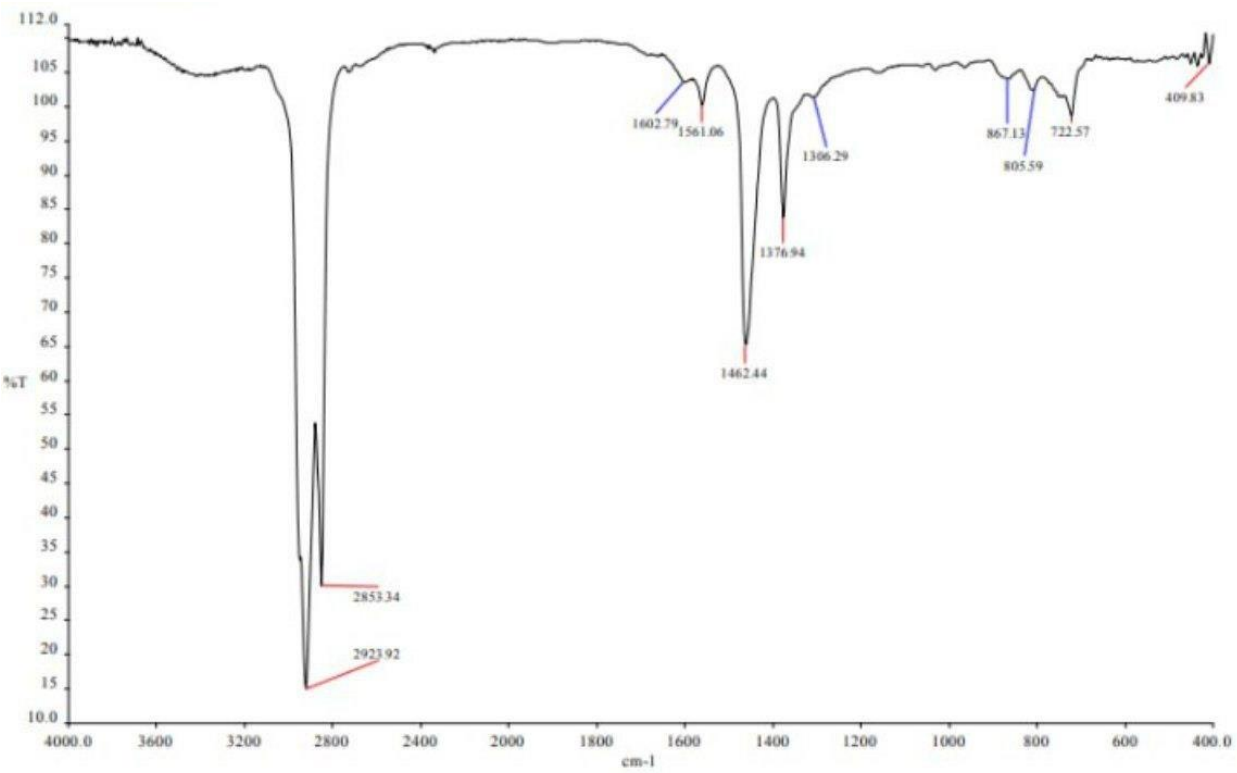


**Figure 1. IR-spectrum analysis of reducer lubricating oil composition.**

During this analysis, the chemical group of the components included in the composition of the reducing gear oil was determined (shown in Fig. 17).

By means of IR-spectrum analysis of reducer oil, strong absorption lines at 2853 cm-1 and 2923 cm-1 can be distinguished and can be explained by symmetric and antisymmetric vibrations according to the SN2 group. Absorption of 1462 cm-1, 1376 cm-1 and 722 cm-1 lines belongs to vibration of SN2-SN2 long paraffin chains, 1467 cm-1 belongs to vibration of





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methylene group, and 1460 cm-1 belongs to methyl group.

Based on the IR-spectrum analysis of the reducing gear oil, it is possible to distinguish not only paraffin, cycloparaffin and aromatic hydrocarbons, but also to identify a group of less important aromatic hydrocarbons. It is possible to distinguish between monocyclic (gasoline homologues) and condensed bicyclic (naphthalene homologues) hydrocarbons.

As the basis of the above-mentioned distinctions, the linear absorption of bicyclic condensed aromatic hydrocarbons at 1040 cm-1 is determined, and it depends on the intense emission of trippet at 700-800 cm-1, which is clearly observed in the IR-spectrum of the composition.

Due to the characteristics of the presence of tars in the composition of the reducing gear oil, it resembles the spectra of condensed bicyclic aromatic hydrocarbons. The main difference between them is that in the spectra of resins, the absorption of vibration lines corresponding to the requirements of S=O and –S – O – S – groups was expressed.

The absorption of the lines at 1467 cm-1 indicates that the lubricating oil contains SO2 group belonging to suffatror. The presence of sulfur in the composition increases its resistance to corrosion during operation.

The absorption of the 1602 cm-1 lines indicates the presence of a small amount of aromatic ring structures, that is, the presence of compounds belonging to the benzene type, by the absorption of the 1600 cm-1 line.

In order to determine the quality of the components of the gear oil composition and to determine the chemical changes in the production process, the IK spectrum of the gear oil was obtained. An IR spectrum analysis of tar was obtained.

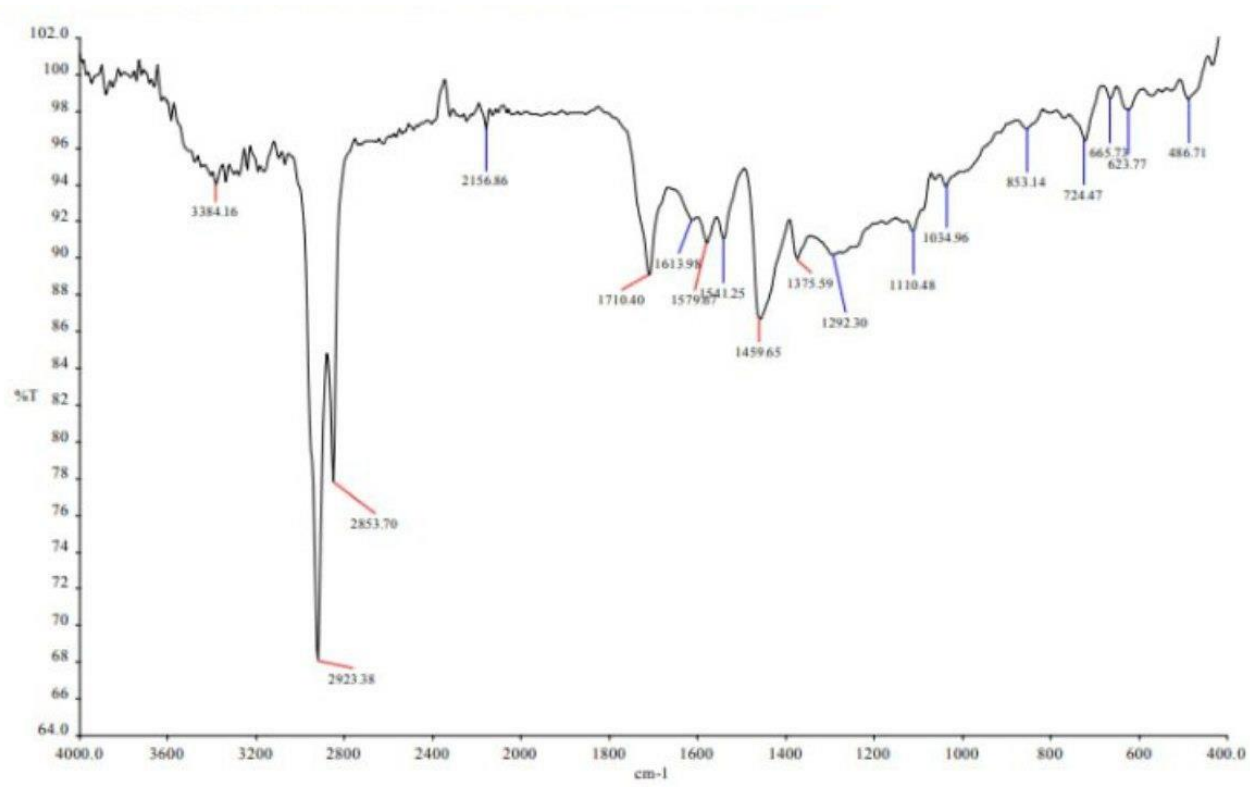


**Figure 2. In the composition of reducer lubricating oil IR spectrum analysis of incoming tar**





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According to the composition of the chemical group presented in the table, tar contains paraffin naphthene, aromatic hydrocarbons, tar and asphaltenes, and additional absorption lines at 1700-1710 cm-1 were formed. Their saponified products and naphthenic acids are characterized by S=O carbonyl group acids.

The absence of these groups in the composition of reductant oil means that there were complex chemical changes in the structure of the composition, which were accompanied by the formation of a dispersed phase.

In the IR-spectrum analysis of deparaffinized residual oil, it can be seen relatively clearly in the absorption of the 1462 cm-1 line that they belong to the bicyclic condensed aromatic compounds in the triplet scattering intensity of 700-800 cm-1, reminiscent of the fractions of condensed bicyclic aromatic hydrocarbons in terms of the quality of the IR spectrum of tars.

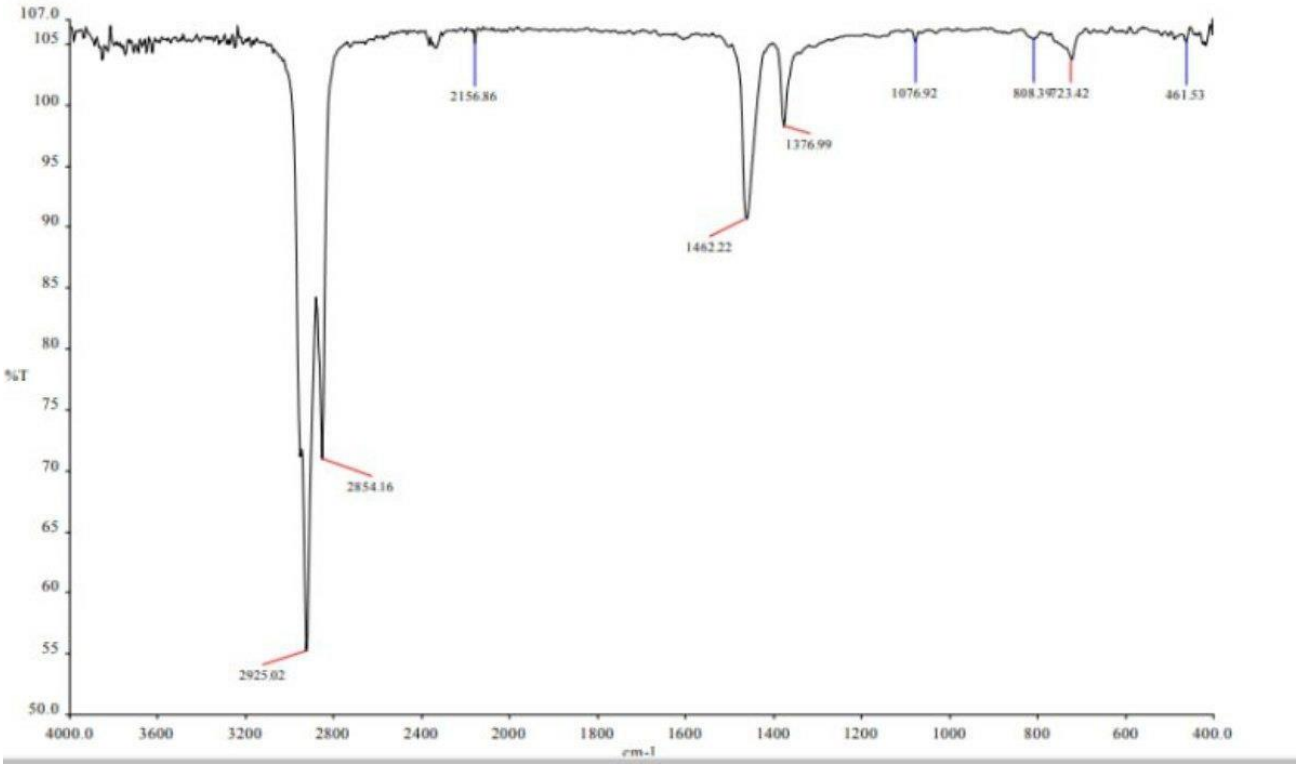


**Figure 3. In the composition of reducer lubricating oil IR-spectral analysis of incoming deparaffinized oil**

Figure 3 shows that the desulfurization of deparaffinized residual oil increases the oxidation and anti-corrosion properties of the lubricating oil according to the reverse absorption coefficients.

The reducing gear oil composition contains the TsD-7 additive as an anti-oxidation additive, and is a 90% solution of zinc dithiophosphate in mineral oil with a spark temperature of not less than 190 °C that meets the requirements of the technical conditions TU-0257-10-11246224-38, (4 shown in Fig.). The IR-spectrum of the TsD-7 installation represents the absorption of lines of various sulfo-phosphorus organic compounds of petroleum mineral oils.





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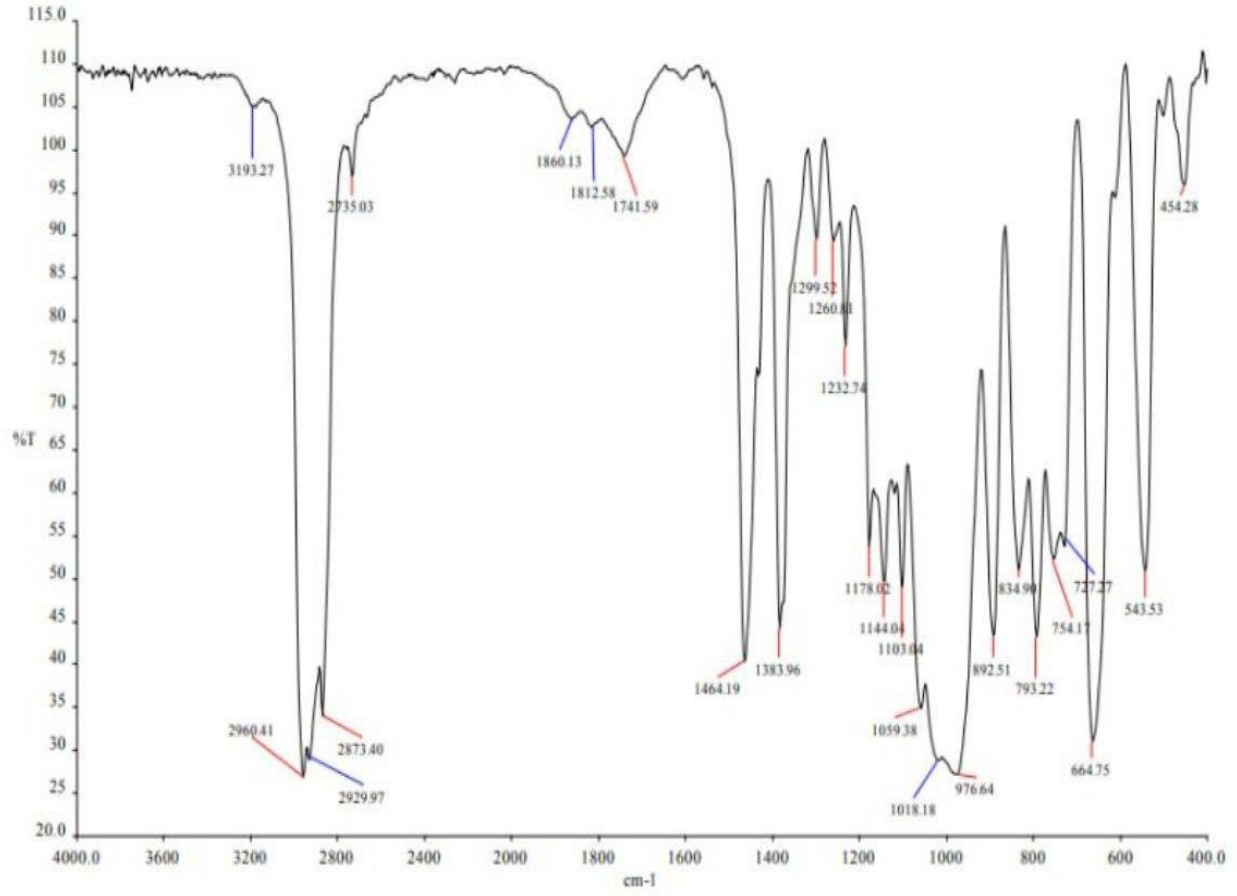


**Figure 4. In the composition of reducer lubricating oil IR-spectrum analysis of incoming TsD-7 launcher**

According to the IR-spectrum analysis of the TsD-7 installation, 1464 cm-1; 1383 cm1; and the vibrations corresponding to 724 cm-1 were found to belong to sulfoxides related to the –CH2–CH3 group. This TsD-7 compound was analyzed separately due to the fact that it was not clearly visible in the main spectrum of the gear oil due to its small amount in the gear oil. In the IR-spectrum of salomas, which is a part of reducer lubricating oil, the absorption of the 1734 cm-1 and 1710 cm-1 lines is clearly shown, which represent the fatty acids of the carbonyl group connected with the glycerols of the ON group.





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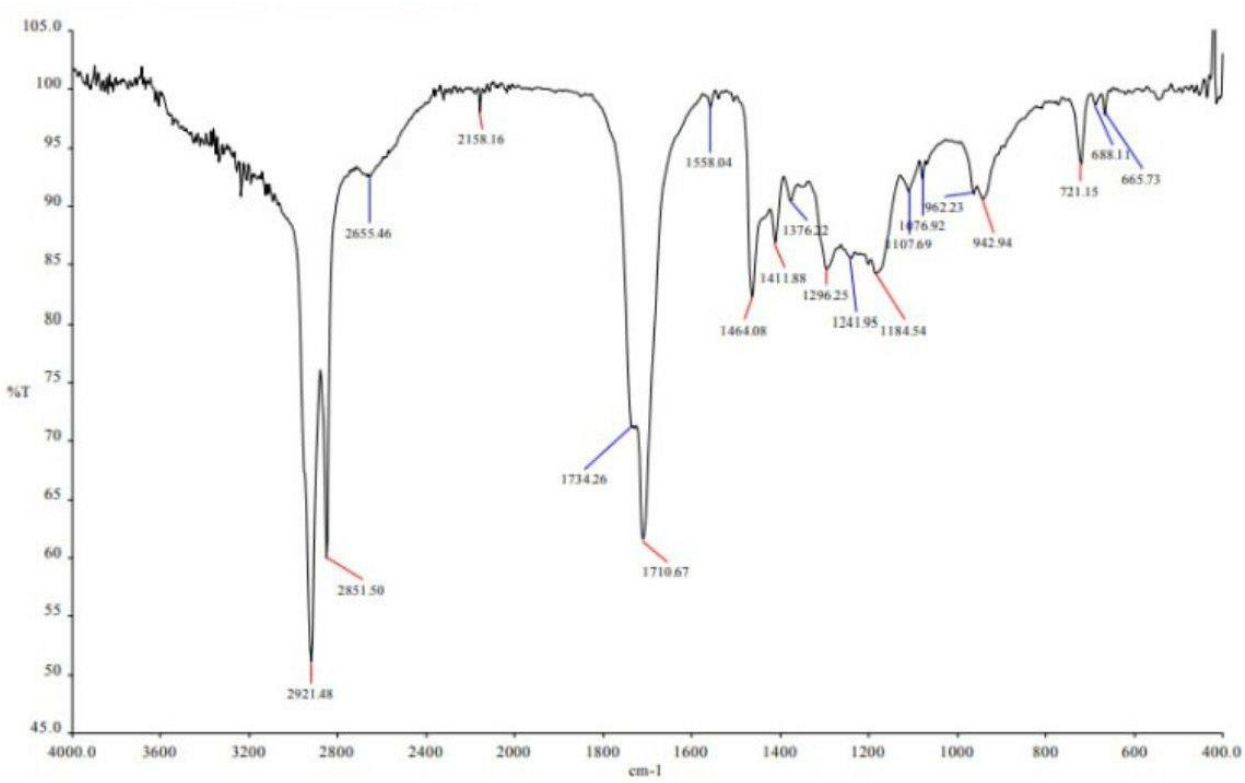


**Figure 5. In the composition of reducer lubricating oil IR spectrum analysis of incoming salomas**

According to the results of IR-spectrum analysis of Salomas, in the process of preparation of reducing gear oil, these groups saponify together with the carbonyl groups of naphthenic acid, forming a dispersed phase in the composition, which leads to an increase in the viscosity and rheological indicators of reducing gear oil (shown in Figure 5).

The main purpose of identifying this component using the IR spectrum is to determine the anti-oxidation property of the gear oil, and it also helps us to study the lubricating properties of the oil.

In conclusion, it can be said that during the conducted scientific research, taking into account that lubricating oil is a complex chemical compound, the IR-spectrum analyzes of tar, deparaffinized oil, salomas, SD-7 components of the components included in the composition were obtained, and the chemical composition of the new reducing lubricating oil was obtained. collected information about the processes. According to the results of the IR-infrared spectroscopy analysis method of the semi-liquid lubricating oil composition, it can be noted that the mechanisms of the formation of a dispersed phase in the reducing lubricating oil composition were implemented during the saponification process together with the carbonyl groups of salomas and naphthenic acid. As a result of the analysis of infrared spectra, observing the absorption from fraction to fraction, parallel changes in the chemical composition and properties of the above (elemental and structural-group composition, functional groups, etc.) are considered, and it was found that it is possible to evaluate the structural changes in the production process of lubricants.





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