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RESULTS OF A STUDY OF THE INFLUENCE OF OIL CONTAMINATION ON WEAR OF THE WORKING SURFACE OF DIESEL CYLINDER LINES

S.A.UTAEV

Karshi State University

A.K.TURAEV

National Research University Tashkent Institute of Irrigation and Agricultural
E-mail.: utaev.s@list.ru, phone.: (+99890) 517 05-36

Abstract:

Objective: to study the influence of changes in the operational properties of oils and to monitor worn cylinder liners of D-243 diesel engines and transport tractors in order to determine the influence of the lubricating properties of motor oils on the wear of the working surface of cylinder liners.

Methods: during the research, the laws of the theory of lubrication, wear friction, as well as methods based on existing regulatory documents were used.

Results. When the engine is running, the oil, together with the contaminants in it, enters the annular grooves of the piston. This mixture, being in the piston grooves in the form of a thin film, at high temperatures, as a result of subsequent oxidative processes, forms viscous asphalt-resin deposits, which reduce the gaps in the grooves and, acting like slot filters, begin to retain contaminants. When operating diesel engines, cylinder liners are exposed to high temperature and pressure, as a result of which microroughness appears on the working surface under the influence of tribomechanical and tribotechnical influences. To determine the amount of wear on the working surface of engine cylinder liners, linear and weight methods, as well as the micrometer method, are widely used.

Conclusion. Experience has shown that contaminants in motor oil consist of particles with a metal base and particles of organic compounds - varnish, similar in structure to graphite. When using diesel fuel with optimal concentrations, less varnish was formed, because wear is reduced to a lesser extent. During engine operation, as a result of natural wear of the liner, the uneven operation of the cylinders increases, performance characteristics decrease, and technical and operational indicators deteriorate. When operating diesel engines, cylinder liners are exposed to high temperature and pressure, as a result of which microroughness appears on the working surface under the influence of tribomechanical and tribotechnical influences. Micrometering of the liner must be carried out in different planes and sections, at least 10, which requires a long time.

Keywords: liner, diesel, pollution, concentration, oil, micrometer, motor.

Introduction. As a result of the release of film decomposition products into the engine crankcase, the oil in the circulation circuit becomes contaminated, varnish is deposited on engine parts, the drainage holes of the oil scraper rings are clogged, the drainage holes in the piston are blocked, and filter contamination increases.

Methods. When the engine is running, the oil, together with the contaminants in it, enters the annular grooves of the piston. This mixture, being in the piston grooves in the form of a thin film, at high temperatures, as a result of subsequent oxidative processes, forms viscous asphalt-resin deposits, which reduce the gaps in the grooves and, acting like slot filters, begin to retain contaminants [1-7].

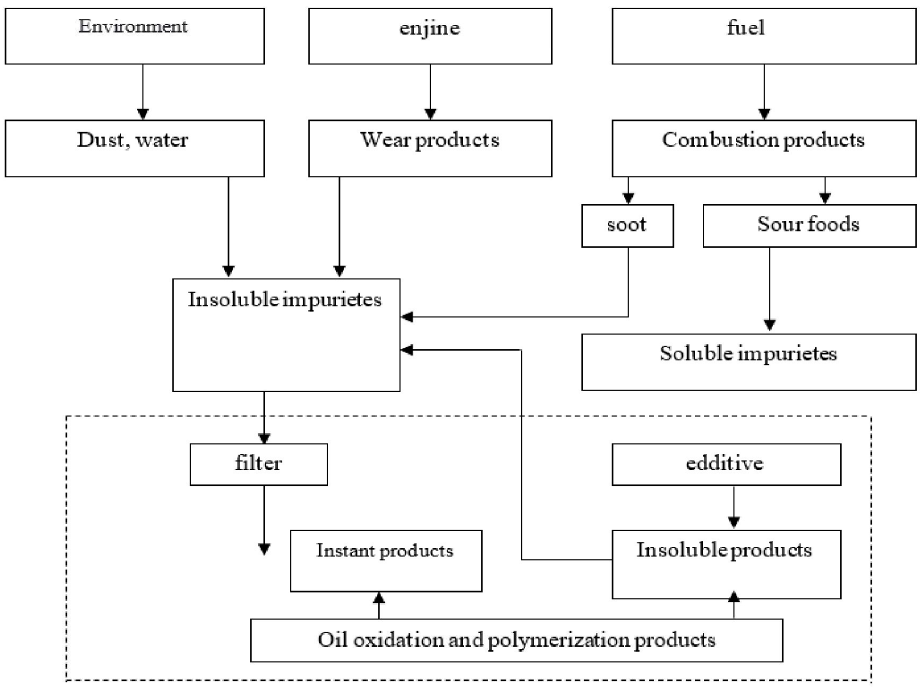

Fig.1. Oil contamination pattern

The general concept of oil contamination refers to the accumulation of undesirable impurities in the oil that reduce the performance properties of the oil. Contaminants entering oil can be divided into soluble and insoluble impurities [11]. Insoluble impurities cause abrasive wear and carbon deposits in the engine, and soluble acidic impurities cause corrosion [11].

Cylinder liners are the most heavily loaded engine parts. They experience stress from gas forces, lateral pressure of the piston and thermal loads.

In forced engines, the thermal load on the oil films in the cylinder group increases significantly. With increasing loads on the crank mechanism, the film thickness decreases, the relative breakthrough of gases at increased speeds increases by almost 60% [1,3,5,7,8]. As a result, mechanical and thermal destruction of the film occurs, accompanied by deep chemical transformations. Under these severe conditions, the oil film must provide the necessary anti-wear and extreme pressure properties, and not release decomposition products on the surfaces of the piston group parts [1-8].

Thus, a large amount of carbon deposits can accumulate in the radial clearance between the ring and the piston groove. If this gap is filled significantly, the rings will “sit” on the carbon deposits and protrude above the piston surface. In this case, the pressure of the ring on the cylinder increases sharply, which can lead to scuffing of the ring and cylinder.

Thus, rubbing and scuffing of cylinders in engines usually occurs when the ring protrudes by 0.3 and 0.5 mm, respectively.

In addition, if this gap is completely filled with carbon deposits and its hardness increases, when the engine switches to a forced mode, when, due to contagious thermal expansion, the piston diameter increases by a greater amount than the cylinder diameter, the pressure of the ring on the cylinder will sharply increase and scuffing may occur. surfaces or jamming of the piston in the cylinder.

When analyzing the conditions under which the oil film is located on the surface of the cylinder-piston group, it is necessary to keep in mind the strong dependence of its oxidation on temperature.

The formation of carbon deposits on the piston surfaces makes it difficult to remove heat and contributes to overheating of the piston. Deposits formed in the grooves of the piston rings cause their jamming, loss of tightness of the above-piston space and, consequently, increased breakthrough of gases, which accelerates the processes of tarring and contamination of the oil film. This is accompanied by an increase in oil consumption, a drop in power, overheating of parts, increased wear and scuffing, especially in the piston group [1-8].

The density and composition of carbon deposits largely determine its abrasive properties. The density of soot is significantly influenced by the degree of oxidation of fuel and oil hydrocarbons, as well as the presence of sulfur compounds in the fuel.

According to Breze and Wilson, an increase in sulfur in diesel fuel from 0.08 to 1.5% increases its content in carbon deposits from 1 to 9%, and their relative density increases in this case from 0.08 to 0.5 g/cm^3 Therefore, the operation of engines on sulfur-containing fuels can contribute to abrasive wear of parts [11-20].

During engine operation, as a result of natural wear of the liner, the uneven operation of the cylinders increases, performance characteristics decrease, and technical and operational indicators deteriorate. When operating diesel engines and gas diesel engines, cylinder liners are exposed to high temperature and pressure, as a result of which microroughness appears on the working surface under the influence of tribomechanical and tribological influences.

To determine the amount of wear on the working surface of engine cylinder liners, linear and weight methods, as well as the micrometer method, are widely used. Micrometering of the liner must be carried out in different planes and sections, at least 10, which requires a long time. In addition, due to the difference in the temperature of the cylinder liner during measurements, as well as possible differences in the temperatures of the tool and the part being measured, and the pressure of the measuring tip on the surface during repeated measurements during micrometering, measurement errors may occur.

Micrometering of cylinder liners of diesel engines and gas-diesel engines of tractor engines is considered promising for assessing large amounts of surface wear.

Analysis of the measurement results of the internal diameters of diesel cylinder liners confirms that the maximum maximum deviations of dimensions vary from 0.02 to 0.62 mm, the range of scatter of ovality values is within 0.02÷0.20 mm, and taper - 0. 02÷ 0.55 mm [1].

Micrometering of the liner must be carried out in different planes and sections, at least 10, which requires a long time.

In addition, due to the difference in the temperature of the cylinder liner during measurements, as well as possible differences in the temperatures of the tool and the part being measured, and the pressure of the measuring tip on the surface during repeated measurements during micrometering, measurement errors may occur. Micrometering of cylinder liners of diesel and gas-diesel engines is considered promising for assessing large amounts of surface wear [1-5].

Results. When the engine is running, the oil, together with the contaminants in it, enters the annular grooves of the piston.

This mixture, being in the piston grooves in the form of a thin film, at high temperatures, as a result of subsequent oxidative processes, forms viscous asphalt-resin deposits, which reduce the gaps in the grooves and, acting like slot filters, begin to retain contaminants [11].

Table 1

Physico-chemical indicators of used diesel engine oils

Indicators	Try- 1	Try -1	Try -1	Try -1	Try -1	Try -1
Kinematic viscosity, at 100 ^{0}C,sS*t*	9,6	8,5	8,8	8,7	8,3	8,8
Density at 20^{0}C, кг/см^3 no more	0,792	0,795	0,798	0,853	0,796	0,794
Pour point, - ^{0}C, not higher	- 16	- 15	- 15	- 15	- 15	- 15
Flash point, *^{0}C*	201	198	196	194	194	193
Water content, *%*	footprints	0,16	0,19	0,20	0,22	0,22
Content of mechanical impuriets, *%*	0,041	0,042	0,044	0,046	0,044	0,047
Base number, мг KOH/g	1,96	1,98	1,94	1,96	1,94	1,89
Ash content, no more %	0,83	1,84	0,85	0,84	0,83	0,83

Wear details of the cylinder-piston group depend on acceleration and load modes. Thus, the average wear rate at idle speed is 6.2...9.9 times less than at maximum load. At the maximum speed mode and load, the concentration of iron (Fe) in the composition of engine oil running on standard fuel increased from $1.1 \cdot 10^{-4}$ to $7.8 \cdot 10^{-4}$ g/hour, which is 8-12% more, than when working on conventional fuel.

When operating diesel engines, cylinder liners are exposed to high temperature and pressure, as a result of which microroughness appears on the working surface under the influence of tribomechanical and tribotechnical influences.

To determine the amount of wear on the working surface of engine cylinder liners, linear and weight methods, as well as the micrometer method, are widely used.

Wear of the cylinder liner occurs in its working surface. As a result of wear, the diameter of the working surface increases and the shape of the surface is disrupted.

The wear process of the working surface of the cylinder liner is affected by organic contaminants and abrasive particles in the oil. Liner wear also depends on engine operating hours.

Discussion. The inner surface of the sleeve loses its taper along its length and its ovality along its circumference.

The amount of wear is greater than the upper part of the liner due to greater contact with the upper compression rings. When the fuel in the upper part of the cartridge burns, the temperature and pressure of the gases increases.

Combustible gases penetrating under the piston rings contribute to an increase in ring pressure on the working surface of the liner. Under the influence of high temperatures, the oil film flares up and lubrication of the upper part of the liner deteriorates. In addition, the fuel mixture partially washes away the oil layer.

When fuel burns, gases containing carbon oxides and sulfur compounds are formed. These products are influenced by water vapor, which contribute to the formation of sulfate and carbonic acid, which lead to corrosive wear of the working surface of the cylinder liner.

Conclusions. Experience has shown that contaminants in motor oil consist of particles with a metal base and particles of organic compounds - varnish, similar in structure to graphite.

When using diesel fuel with optimal concentrations, less varnish was formed, because wear is reduced to a lesser extent.

During engine operation, as a result of natural wear of the liner, the uneven operation of the cylinders increases, performance characteristics decrease, and technical and operational indicators deteriorate. When operating diesel engines, cylinder liners are exposed to high temperature and pressure, as a result of which microroughness appears on the working surface under the influence of tribomechanical and tribotechnical influences.

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UDC 665.5

SEPARATION OF THE POLYMER MASS FROM THE WASTE OF THE ALKALINE CLEANING PROCESS OF PYROGAS BY THE EXTRACTION METHOD

TILLOEV LOCHIN

Associate professor of Bukhara Engineering Technological Institute
E-mail.: tilloyevl@mail.ru, phone.: (+99891) 412 87-91

DUSTOV KHAMRO

Professor of Bukhara Engineering Technological Institute
E-mail.: dkhamro@mail.ru, phone.: (+99891) 647 62-42

Abstract:

Objective. Pyrogas treatment waste segregation and consists in choosing a selective extractant to extract the polymer mass from the hydrocarbon content.

Methods. Segregation of waste, determining the solubility of hydrocarbon content in various solvents and methods such as choosing the most optimal selective extractant for extraction were used.

Results. The waste is separated into two layers when it is cooled. 1 - the upper layer (light layer) is determined to be "hydrocarbon content" and 2 - the lower layer (heavy layer) is "alkaline water". Paraffin hydrocarbons have been proven to be the best extractants for separating polymer mass from hydrocarbon content. The molecular mass and density of paraffin hydrocarbons have been found to have an inversely proportional effect on the separation rate of extract and raffinate during the extraction of hydrocarbon content.

Conclusion. It was found that the most effective method of separating hydrocarbon content and alkaline water from the waste is the leaching method, and the time of leaching is 240 minutes. Paraffin hydrocarbons were selected as an extractant for the extraction of polymer mass from hydrocarbon content.

Keywords: polymer mass, hydrocarbon content, yellow oil, solvent, extraction, organic extractant, alkaline water, selective extractant, raffinate, extract.

Introduction. Among hydrocarbons, ethylene and propylene monomers are important organic chemical raw materials, the demand for which is increasing every year. The traditional method of producing ethylene and propylene is pyrolysis of hydrocarbon raw materials (ethane, propane, propane-butane fraction, gas condensate and naphtha). In order to obtain target products for the polymerization process or to process certain unreacted materials, the pyrogas coming out of the reactor must go through a series of processes: recovery, separation, purification and fractionation. In order to purify the pyrogas from sour gases, it is subjected to the absorption process. An aqueous solution of sodium hydroxide of different concentrations is used to clean pyrogas to the required level

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