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THE IMPACT OF SYNTHETIC GTL FUEL ON CRANKCASE OIL SERVICE LIFE

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Annotatsiya. Ushbu maqolada sintetik GTL (Gas-to-Liquid) va an'anaviy neft dizel yonilg'ilarining dvigatel karter moyi degratsiyasiga ta'siri qiyosiy tahlil qilinadi. Izlanishlar shuni ko'rsatadiki, yonilg'ining kimyoviy tarkibi, xususan setan soni va oltingugurt miqdori moyning yaroqlilik muddatiga ta'sir qiluvchi asosiy faktorlar hisoblanadi.

Kalit so'zlar: sintetik GTL, karter moyi, qurum, karter moyi resursi, abraziv yeyilish, setan soni, oltingugurt miqdori

Аннотация. В данной статье проводится сравнительный анализ влияния синтетического топлива GTL (Gas-to-Liquid) и традиционного нефтяного дизельного топлива на деградацию моторного масла в картере двигателя. Результаты исследований показывают, что химический состав топлива, в частности цетановое число и содержание серы, являются основными факторами, влияющими на срок службы масла

Ключевые слова: синтетическое топливо GTL, картерное масло, сажа, ресурс картерного масла, абразивный износ, цетановое число, содержание серы

Abstract. This article presents a comparative analysis of the effects of synthetic GTL (Gas-to-Liquid) fuel and conventional petroleum diesel fuels on the degradation of engine crankcase oil. The study shows that the chemical composition of the fuel, particularly the cetane number and sulfur content, are the main factors influencing the service life of the oil

Keywords: synthetic GTL (Gas-to-Liquid), crankcase oil, soot, crankcase oil service life, abrasive wear, cetane number, sulfur content

1. INTRODUCTION.

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In modern internal combustion engines, the oil change interval depends not only on the quality of the oil but also on the combustion characteristics of the fuel used. Aromatic compounds and sulfur present in conventional diesel fuel are the main sources of contamination in crankcase oil during combustion. Synthetic fuels produced using GTL technology address this issue due to their high cetane number and low aromatic content.

The Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated November 23, 2017, establishes general technical regulations for diesel and marine fuels, as well as aviation and automotive fuels, jet engines, and fuel oil [1]. These regulations ensure automotive and aviation safety, control the delivery of high-quality fuels to consumers, and minimize the harmful environmental impact of fuels in accordance with ecological standards.

On December 25, 2021, the “Uzbekistan GTL” plant was inaugurated. The plant occupies a total area of 135 hectares and produces four types of fuel: aviation kerosene, compressed gas, diesel, and naphtha. “Uzbekistan GTL” is one of the five largest GTL plants in the world, with the other four located in Qatar, Nigeria, South Africa, and Malaysia [11]. The plant produces environmentally friendly fuels.

2. LITERATURE REVIEW

2.1. The influence of fuel-related factors on oil degradation

Soot and abrasive wear. Soot is composed of carbon particles formed during fuel combustion. A portion of these carbon particles enters the crankcase oil, leading to a reduction in the thickness of the lubricating layer and an increase in friction and abrasive wear between metal surfaces [2].

The negative effects of soot in diesel engine oil can be summarized as follows:

Component wear: Soot primarily causes abrasive wear. An increase in soot concentration negatively affects the delivery of oil to lubricating surfaces, accelerating the rate of wear.

Tribological layer issues: Soot particles can absorb protective zinc dithiophosphate (ZDDP) additives or mechanically strip protective layers from the surfaces of moving components.

Changes in oil properties: Accumulation of soot during operation increases oil viscosity, which reduces lubrication efficiency and leads to higher fuel consumption.

Protective measures: Increasing the amount of detergent additives can help reduce soot buildup; however, when soot reaches very high levels, maintaining the proper balance of ZDDP is essential to effectively reduce wear [3].

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GTL fuel, with its near absence of aromatic hydrocarbons, reduces soot formation. When the oil contains less soot, its viscosity remains stable, and the risk of damage to the lubricating layer is minimized.

2.2. Effectiveness of ZDDP additives. ZDDP (zinc dialkyl dithiophosphate) additives reduce wear on engine components by capturing soot particles in the oil [4, 5]. When GTL fuel is used, the lower soot content allows ZDDP additives to retain their functionality for a longer period. This ensures that the protective properties of the crankcase oil are maintained, enabling extended service life.

2.3. Chemical kinetics and acidity. The high cetane number of GTL fuel ensures more complete combustion [6]. In contrast, conventional diesel fuel has a lower cetane number, and its sulfur content creates an acidic environment that accelerates the reduction of the oil's total base number (TBN) [7]. The absence of sulfur in GTL fuel slows down oil oxidation and helps preserve its anti-corrosion capacity.

3. RESEARCH METHODOLOGY

The study will investigate the effects of synthetic GTL and conventional diesel fuels on crankcase oil using experimental and analytical methods.

Object of the study: Diesel engines (for buses and freight transport), GTL and conventional diesel fuels, engine oil meeting SAE standards.

Experimental conditions: The engines will be operated under specific load regimes and varying environmental conditions. Separate tests will be conducted for each type of fuel. Oil samples will be collected at predetermined intervals.

ANALYSIS METHODS:

- **Tribological analysis** to determine wear intensity and friction coefficient.
- **Physicochemical analysis** to measure viscosity, acidity (TAN), and total base number (TBN).
- **Soot content** will be determined using infrared spectroscopy.

Data processing: Statistical analysis (comparison, regression) and graphical methods (using Excel).

4. ANALYSIS AND RESULTS

Justifying the crankcase oil change interval. By summarizing the results of studies conducted by researchers, it is possible to develop methods for extending engine service life and reducing maintenance costs by monitoring the condition of the oil [8]. For heavy-duty diesel engines, it is recommended to use machine learning and statistical methods to predict oil change intervals. In this approach, analyzing parameters such as TBN, TAN, wear elements, and viscosity can help reduce costs by up to 30–40% [9].

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Table 1.

The effect of using GTL fuel on the service life of crankcase oil

№	Condition	Reason
1	Slowing of oil thickening	Due to lower soot content
2	Extension of filtration system service life	Filters fill more slowly because of fewer solid particles
3	Thermo-oxidative stability	Clean combustion products do not degrade the chemical composition of the oil

The most important fuel-related factor affecting the oil change interval is clean combustion and minimal soot formation. GTL fuel, with its high cetane number and near-zero sulfur content, allows the operational properties of engine oil to be preserved up to 20–30% longer. This serves as a key factor in reducing maintenance costs and increasing engine service life [Table 1].

Laboratory analysis of oil condition makes it possible to predict unexpected failures in advance by identifying wear in engine components and the level of contamination in the oil [10].

CONCLUSION.

In conclusion, the conducted research is considered highly relevant, as analyzing the changes in oil composition during operation makes it possible to detect potential engine faults in advance and perform proper diagnostics. This, in turn, significantly reduces maintenance costs.

Furthermore, based on the results of tribological and chemical analyses, synthetic GTL fuel—due to the near absence of aromatic hydrocarbons and sulfur compounds—ensures more complete combustion and reduces soot formation. As a result, the concentration of abrasive particles in the oil decreases significantly, leading to reduced wear of frictional components. The lower soot content also helps preserve protective additives such as ZDDP in the oil for a longer period, thereby maintaining the integrity of the tribological layer.

The use of synthetic GTL fuel is effective not only from an environmental perspective, but also from tribological and economic standpoints. It contributes to extending the service life of engine crankcase oil and improving overall operational efficiency.

REFERENCES

1. The Cabinet of Ministers of the Republic of Uzbekistan General Technical Regulation on “Requirements for Automotive and Aviation Gasoline, Diesel and Marine Fuels, Jet Engine Fuels, and Fuel Oil”. Decision No. 931 dated November 21, 2017

ISSN 3030-3907

2. Ratoi, M., et al. *Influence of carbonaceous particles on lubricant film breakdown.* Wear, 476. 2021
3. Green, D., Lewis, R. Effect of soot contamination on engine oil wear behavior. Tribology International, 150. 2020
4. Kassem, M., et al. *Diesel soot–lubricant interactions and wear mechanisms.* Lubricants, 10(4). 2022
5. Spikes, H. *The history and mechanisms of ZDDP.* Tribology Letters, 68. 2020
6. Westbrook, C. K. *Chemical kinetic modeling of GTL diesel fuels.* Progress in Energy and Combustion Science, 82. 2021
7. Fox, M., Stachowiak, G. *Oxidation stability and acid formation in engine oils.* Tribology Series 2020
8. ExxonMobil Research & Engineering. *Used Oil Analysis Guidelines for Diesel Engines.* — Technical Bulletin. — 2023. — 67 p
9. Hu E., Wang H., Li Y. "Predictive modeling of oil drain intervals in heavy-duty diesel engines" // *Applied Energy*. — 2021. — Vol. 285. — 116–128
10. Whitby, R. D. "*Used oil analysis and condition monitoring*". Wear Check International 2021
11. The official website of Uzbekistan GTL: https://www.uzgtl.uz

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