THE USA JOURNALS
THE AMERICAN JOURNAL OF ENGINEERING AND TECHNOLOGY (ISSN – 2689-0984)
VOLUME 06 ISSUE02

PUBLISHED DATE: - 29-02-2024
DOI: - https://doi.org/10.37547/tajet/Volume06Issue02-04 PAGE NO.: - 21-25

RESEARCH ARTICLE Open Access

STUDYING THE RELIABILITY OF AN INTERNAL COMBUSTION ENGINE BASED ON AN ANALYSIS OF ENGINE OIL

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Abstract
Specifically, greenhouse gases (CH4, N2O, CO2, CO, SO2), are strong climate forcers, and articulate pollution all have detrimental health effects. Vehicle on-road traffic is a major contributor to air pollutants in urban areas that affect human population health, the environment at local and regional scales, and the global climate.[1] This study forces a numerical study of engine oil by engine conditions by using different type of fuels. Engine oil main parameters and internal combustion engines were investigated under real-world conditions for driving cycles typical for Tashkent urban environments. Three kinds of laboratory equipment and ISO standards were utilized. Our study shows that by using different types of fuel, the life cycle point of motor oil varies. Total base number (TBN), Total acid number (TAN), viscosity and flash points were taken as basic parameters of engine oil. The viscosity value of oil dominated the other characteristics. In general, in our study to improve engine performance, we must consider engine oil, which is one of the key parameters.

Keywords TAN, TBN, Viscosity, Flash point, Greenhouse gases, Engine oil, Internal combustion engine.

INTRODUCTION

Engine oil protects critical parts from wear and reduces friction. Engine oil, however, has a reliability index of data that might impact machinery health in addition to its lubricating function. This is the field of engine oil analysis. Engine oil protects critical parts from wear and reduces friction. Engine oil, however, has a reliability index of data that might impact machinery health in addition to its lubricating function. This is the field of engine oil analysis. This study intends to shed light on the significant implications of using oil data for predictive maintenance plans, from the methods used in oil analysis to the interpretation of crucial factors including wear metals, pollutants, and viscosity. We traverse the terrain where data-driven decision-making meets mechanical expertise through case studies and real-world applications, opening the door to proactive maintenance interventions and operational excellence. Come along as we explore the complex fabric of engine oil analysis and how it may be used to maintain the performance and integrity of machinery. Internal combustion engines (ICE) face challenges in reducing fuel consumption due to fossil fuel depletion and market demands, while also meeting urgent environmental demands.[2] An useful addition to gasoline fuel derived from petroleum is hydrogen gas produced by alkaline electrolysis. It is sulfur-free, nontoxic, low in contaminants, and biodegradable. It also has an environmentally beneficial profile. Gasoline gains octane rating and lubricity when hydrogen gas is added, potentially reducing starting difficulty and waiting time for a spark. While hydrogen is highly combustible, it does not typically spontaneously burn under high pressure. Hydrogen produced from water electrolysis typically has an octane range greater than 130, higher than any other fuel. The novel technology may improve the fuel efficiency and engine-out emissions reduction of SI engines. [3]

Methodology. A variety of methods are used to evaluate the condition of internal combustion engines based on the analysis of engine oil. The sampling procedure is the first one. To assess the state of the internal combustion engine by means of motor oil analysis, a methodical sample procedure has been instituted. Samples of engine oil have been taken from a wide variety of cars, including various types, models, and mileage ranges.[4] Samples were taken at regular maintenance intervals to record changes in oil deterioration levels and engine running conditions. To reduce the potential of contamination, care was made to utilise clean sample equipment and adhere to suggested sampling procedures. Analytical Techniques comes next. A variety of cutting-edge analytical methods have been used to break down the characteristics and make-up of the motor oil samples. FTIR spectroscopy and UV-V spectrophotometry were two types of spectroscopic examination that were used to evaluate additive depletion, identify oxidation by products, and describe chemical features. Metal wear elements and oil pollution levels were revealed by elemental analysis using ICP-MS.[5] Another is Parameters Analysed. It was carefully examined because it is an important parameter that is essential for determining the state of the internal combustion engine. Viscosity measurements were made in order to track variations in fluid consistency and identify any possible deterioration of the oil. Wear metal analysis made it easier to identify metal components that were indicative of engine component wear, such as iron, aluminium, and chromium. Furthermore, measurement of pollutants like salt and silicon helped determine the sources of external contamination.[6] Determining engine oil can also be done by data interpretation. The information obtained from the motor oil study was carefully interpreted in order to derive important conclusions about the condition of the internal combustion engine. To find unusual trends and possible problems with the engine system, trends in pollution levels, wear metal concentrations, and viscosity variations were studied. In order to identify deviations and provide maintenance suggestions, comparisons with industry norms and baseline values were conducted.[7] Determining engine oil can also be done by data interpretation. The information obtained from the motor oil study was carefully interpreted in order to derive important conclusions about the condition of the internal combustion engine.[8] To find unusual trends and possible problems with the engine system, trends in pollution levels, wear metal concentrations, and viscosity variations were studied. In order to identify deviations and provide maintenance suggestions, comparisons with industry norms and baseline values were conducted. In assessing the internal combustion engine's reliability, the Wear Metal Index (WMI) was calculated using the following equation:[9]

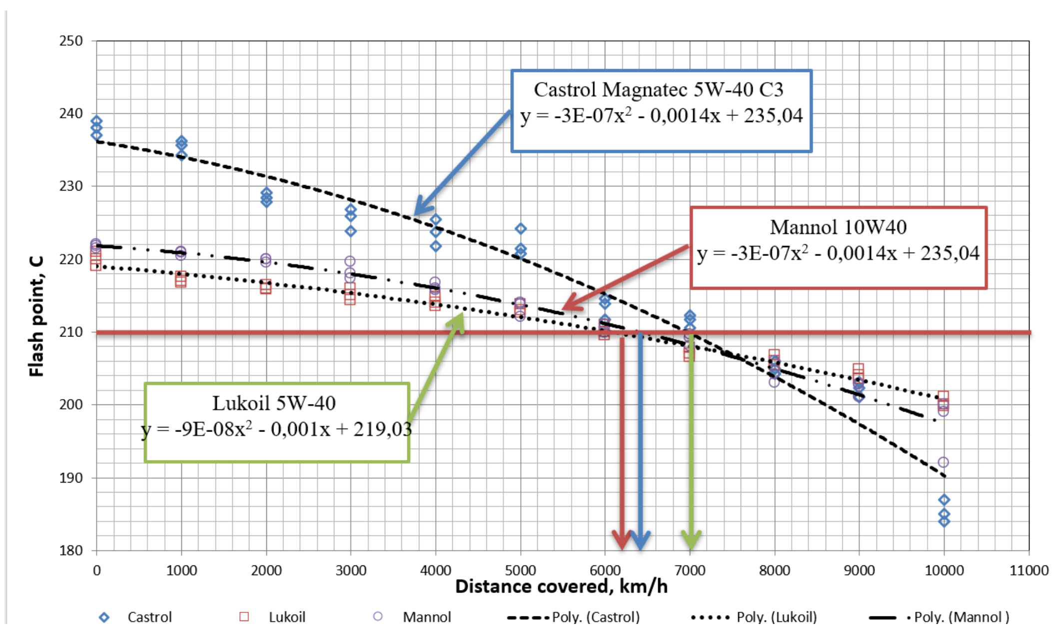
WMI = (Wear Metals)/(Total Oil Volume)

Where: Wear Metals represents the concentration of wear metals in the oil sample (in ppm). Total Oil Volume denotes the total volume of the oil sample analysed (in ml).

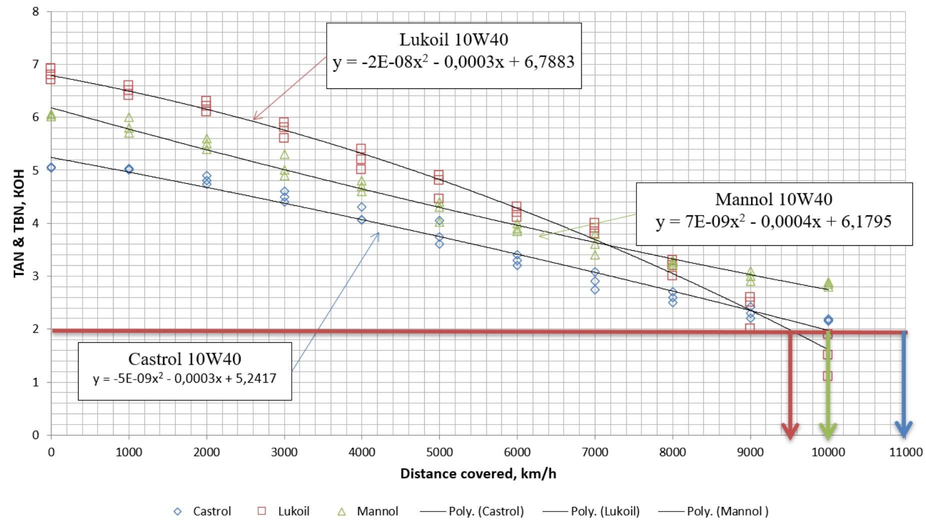
Result. During scientific work, optional result obtained on based of the sampling integral procedure.

To Find type of engine oil		
Testing 3 motor vehicles		
Every 1000km/h gain used engine oil sampling		
Lube oil laboratory tests		
Viscosity	TBN & TAN	Flash point
Compilation of approximatsya equations		
Limit value indicators		
Evaluate L_v	Evaluate $L_{TBN\&TAN}$	Evaluate L_{FP}
$Min\ (L_v,\ L_{TBN\&TAN},\ L_{FP})$		
Engine oil life cycle.		

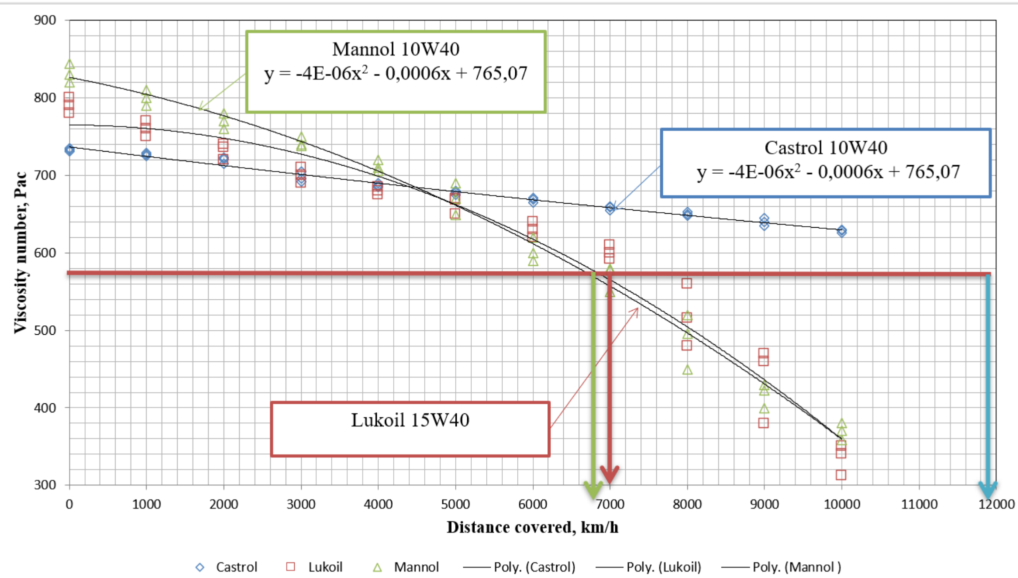
To determine the flash point of used motor oil in an open case, a TVO apparatus designed for testing sample motor oils according to GOST 4333 and ISO 2592 was used (flash point range 79°S-360°S).



I-160-MI laboratory ionomer is an apparatus for direct and indirect potentiometric measurement of H+ activity (pH), activity and concentration of monovalent and dissociable anions and cations (pH), oxide potential and temperature results in aqueous solutions.



The character of the change of viscosity with temperature change was taken to determine the ratio of kinematic viscosity at 40°C and 100°C. From the obtained results, the coefficient of viscosity (VI) is calculated in the following order.



CONCLUSION

The global synergistic difficulties surrounding the use of alternative hydrogen gas as a motor oil additive in cars with petrol engines have not received enough attention. Additionally, it was discovered that these technologies are not being used to their full potential in our environment, that there are reserves in the field to solve problems, and that, according to research, fuel consumption was reduced by 34%, the useful work coefficient was increased by 5%, and the amount of environmentally friendly gases—CO, HC, and HA—was reduced to 14%, 16%, and 1518%, respectively. 2. Using the primary vehicle as an example, the practical features of the impact of motor oil with alternative fuel in local conditions were investigated based on the analysis of the automotive hydrogen-gasoline power system. The numerical analysis showed that during the vehicle's operating mode, the viscosity indicator would be the first to reach the limit output.

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