COST EFFECTIVE METHOD TO ANALYZE LUBRICATION OIL

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DECLARATION

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The above candidate has carried out research for the Masters Dissertation under my supervision.

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Abstract

The lubricating oil analysis is the most common method to identify the condition of any machinery. There are various ways to analyze lubricating oil, and those methods are based on an individual examination of lubricant properties such as Viscosity, Total Base Number (TBN), Total Acidic Number (TAN), Water Content, Impurities (element analysis), etc. However, to carry out these analyses, sophisticated pieces of equipment are required. They are costly and need specific environmental conditions. Furthermore, as the tests are done in a laboratory, away from the machine, carefully collected lubricating oil samples must be transported to them. The whole process, from collecting samples to obtained results, takes a considerable amount of time. Therefore, this process will hamper the maintenance program's efficiency since the machine has to be kept in idle until receiving the results. Hence, it is of utmost importance to have a cost-effective and faster results-giving method to analyze lubricating oil at the place where the machines are installed. Then the operator himself can check the condition of lubricating oil to ensure the safe and smooth operation of the machine.

A comprehensive literature survey was carried out to understand the current trends in lubricating oil analysis. Most of the tests described in the literature are based upon Physical, Chemical, Electro-magnetic and Optical methods. The proposed design is based on an optical technique that deals with the Refractive Index (RI) since it is an indicator of the physical as well as the chemical property characteristic of a substance. The critical angle of a material is directly related to RI. Therefore, monitoring the critical angle changes leads to an understanding of the quality of the lube-oil. During the design stage, special attention was paid to the cost of the fabrication and user-friendliness of the device.

The performance of a proposed lube-oil analyzer was assessed using Shell Gardenia 40 (lubricating oil used in high-speed marine engines of Fast Attack Craft) lubricant. The lubricant used for different operating hours were analyzed. This analysis unveiled that, though Original Equipment Manufacturer (OEM) emphasize changing the lubricating oil after 500 hours, lube-oil quality has not deteriorated below the specified levels at this stage. This shows that the lifetime of lube-oil can be further extended, and frequent quality testing of lube-oil can save large sums of money without putting the machine life into any danger.

The results obtained from the proposed device was compared with the tests carried out according to the American Society for Testing and Materials (ASTM) standards. Moreover, forced diluted lube-oil samples were analyzed using the proposed device. Both tests confirm the effectiveness of the proposed device.

Keywords: Lubricating oil analysis, Refractive Index, Cost-effective lubricating oil analyzer

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LIST OF ABBREVIATIONS

AES	Atomic Emission Spectroscopy
ASTM	American Society for Testing and Materials
CBPM	Condition Based Preventive Maintenance
FAC	Fast Attack Craft
ODI	Oil Draining Interval
OEM	Original Equipment Manufacturer
port	Left hand side of the ships bow when facing the bow
PPM	Plan Preventive Maintenance
ppm	Parts per million
RI	Refractive Index
stbd	Right hand side of the ships bow when facing the bow
TAN	Total Acid Number
TBN	Total Base Number
VI	Viscosity Index

LIST OF APPENDICES