SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF GRADUATE STUDIES

Modeling of Engine Lubricating Oil Degradation While In Use

نموذج تدهور زيت التزييت لماكينه اثناء فترة استخدامه

Thesis Submitted to the College of Graduate Studies in Partial Fulfillment of the Requirements for the Degree of Master of Science in Mechanical Engineering

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بسم الله الرحمن الرحيم

قال تعالي:

[يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ.

(صدق الله العظيم)

(المجادلة: الآية 11).

DEDICATION

I would like to dedicate this work to my family who have supported and encouraged me in all my academic and professional endeavors.

Abstract

The objective of this research is to obtain a model for estimating the degradation of the engine

lubricating oil, instead of the engine manufacturer .[recommendation [interval method

The model was achieved by experimental data obtained from the analysis of the used lubricating oil during its useful life as applied on three trucks. The model was built by using the relationships between the changing of the oil parameters and the engine operating conditions specifically the engine coolant temperature .The oil analysis was initially conducted under regular interval .during truck running at the end of each trip

The model output results gave more understanding on how to use and extend the life time of .lubricant oils

The model findings indicated that the oil can be used in these trucks for 15,000km approximately as opposed to the previous 8,000km (as of owner regulation) .(and 10,000km (as of manufacturer recommendation

{التجريد}

الغرض من هذا البحث عمل نموذج لتقدير التـدهور فـي زيت تزييّت الماكينة بدلاً من تقنية تحليل الزيت ويوضح متى يتــم استبدال الزيت المستخدم للشاحنات.
تم تحقيق هذا النموذج بواسطة تجارب معملية لتحليل زيــت التزيّيت المستخدم ، حيث وجدت علاقة بين التدهور في مقــاييس الزيت وحالة عمل الماكينة. ولقد أجريـت عمليـات تحليـل الزيـت أثناء عمل الشاحنة وفي نهاية كل رحلة .
مـن هـذا البحـث نسـتنتج كيفيـة الإسـتفادة مـن عمـر زيـت الـتزييّت المتبقـي بالطريقـة المثلـى .وتبعـاً لهـذه النتـائج يمكـن استخدام الزيت المسـتعمل فـي هـذه الشـاحنات حـتى 15.000 كلم بالتقريب بدلاً عن 8.000 كلم (على حسب تعليمات المالــك) 10.000 كلم (تعليمات المصّنع للشاحنات) .

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My time at Sudan University for Science and
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Abbreviation

amu	atomic mass unit
ACEA	European Automobile Manufacturers' Association
API	American Petroleum Institute
SAE	Society of Automotive Engineers
ARAIBA	Elnefeidi Truck Company
CPU	Computer programmer unit
Trucks Company code numbers	1060 ,1131 ,1053
A	For truck 1053
B	For truck 1131
C	For truck 1060
ANOVA	Analysis of Variance
S.O.V	Source of variation
TBN	Total base number (mg (KOH/g of lubricant
TAN	Total acid number ((mg/g

KOH	Potassium Hydroxide

Nomenclature

Symbol	Definition	Units
T	Temperature	(°(C°, F
Hr	Hour	
X1, X2….	Set numbers	
$\bar{X}$	Arithmetic sample mean	
n	Number of occurrence or parameters	
f	Frequency	
Yi	Predictor	
(ß0	The intercept term (constant	
ß1	Slope	
Ui	Random variable	

$\hat{Y}i$		Estimated value
	Intercept	$\hat{ß}_o$
$\hat{ß}1$		Estimated slope
σ^2_u		Is error variation
t		Is the student’s t test
F		Use for test same like t