سامية محمد مصطفى

شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

سامية محمد مصطفى

شبكة المعلومات الجامعية

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

سامية محمد مصطفى

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

سامية محمد مصطفى

شبكة المعلومات الجامعية

بعض الوثائق الأصلية تالفة

سامية محمد مصطفى

بالرسالة صفحات لم ترد بالأصل

A
THESIS
ENTITLED

STUDY OF SOME ORGANIC SULPHUR COMPOUNDS IN LUBRICATING OIL RELATED TO ITS OXIDATION STABILITY

Presented By

Ahmed Abd El Wahab Ahmed Salem

(Egyptian Petroleum Research Institute)

(B.Sc., Chemistry)

Submitted for partial fulfilment of the
requirement for the degree of

Master of Science

Faculty of Science
Cairo University

2000

APPROVAL SHEET FOR SUBMISSION

Title of the M.Sc. Thesis:

"STUDY OF SOME ORGANIC SULPHUR COMPOUNDS IN LUBRICATING OIL RELATED TO ITS OXIDATION STABILITY"

This thesis has been approved for submission by the supervisors:

1- Prof. Dr. HAMED A. DABOUN
(signature)

2- Prof. Dr. A.A. EL BASSOUSSI
(signature)

Prof. Dr. MOHAMED HELMY EL-NAGDI

Chairman of Chemistry Department
Faculty of science, Cairo University

ABSTRACT

Name: AHMED ABD EL WAHAB AHMED SALEM

Title of Thesis:

STUDY OF SOME ORGANIC SULPHUR COMPOUNDS IN LUBRICATING OIL RELATED TO ITS OXIDATION STABILITY

Degree: M.Sc. Faculty of Science Cairo University, 2000

This work has been carried out to study the oxidation stability of the hydrofinished base stock oil and non-hydrofinished base stock oil at different intervals of time. The process of oxidation was carried out in the presence of oxygen gas over iron-copper catalyst at 120 °C according to ASTM D-943. Organic Sulphur compounds like Dibenzothiophene and Dimethylsulphoxide were added by deferent concentrations (50, 100 and 200 ppm sulphur) to study their effect on the oxidation stability of the hydrofinished base stock oil.

Key Words:

Lubricating oil, base stock, oxidation stability, sulphur compounds, viscosity, total acid no., Infrared, Column chromatography, Gel Permeation chromatography, Gas chromatography.

Supervisors:

1- Prof. Dr. HAMED A. DABOUN

2- Prof. Dr A.A. EL BASSOUSSI

Prof. Dr. MOHAMED HELMY EL-NAGDI

Chairman of Chemistry Department
Faculty of science, Cairo University

ACKNOWLEDGMENTS

The author wishes to express his thanks and sincere appreciation to Prof. Dr. HAMED A. DABOUN professor of organic chemistry, faculty of science, Cairo University for his support and valuable guidance throughout this work.

The author, also wishes to express his thanks to Prof. ALI A. EL BASSOSSI, Professor of Applied Organic Chemistry, Analysis and Evaluation Department, Egyptian Petroleum Research Institute (EPRI), not only for suggesting the subject of the thesis, but also for his continuous advice and valuable criticism during the course of this work.

Finally, The author would like to thank all people and colleagues in EPRI for their help, advice and moral support throughout the course of this work.

Ahmed Abd El-wahab Ahmed Salem

M.Sc. Courses studied by the candidate

Beside the work carried out in this thesis, the candidate Ahmed Abd El Wahab Ahmed Salem has pursued postgraduate courses as a partial fulfilment of the requirement for the degree of Master of Science in the following topics:

1. Designing of organic compounds.
2. Heterocyclic reactions.
3. Physical organic.
4. Photochemistry and chemical technology of textile dying
5. Polymers.
6. Carbohydrate.
7. Applied spectroscopy.
8. Elective course.
9. Biochemistry.
10. Quantum chemistry.
11. Molecular structure Determination.
12. Advanced analytical chemistry.
13. Functional group analysis.
14. Mathematics.
15. Advanced NMR.
16. Peri-cyclic chemistry.
17. German Language.

He has also passed successfully a written examination in the above mentioned topics during the academic year 1994-1995.

Prof. Dr. MOHAMED HELMY EL-NAGDI

Chairman of Chemistry Department

Faculty of science, Cairo University

CONTENTS

Aim of the Work. i

Summary of the Work. ii

GENERAL PART

INTRODUCTION 1

1. Composition of Crude Petroleum 1

1.1 Hydrocarbons 1

1.2 Non-hydrocarbons 4

2. Lubricant 7

2.1 Lubrication Principles 7

2.2 Types of Lubricants 8

3. Composition of Lubricating Oils 11

4. Properties of Lubricants 14

4.1 Physical Tests 14

4.2 Application Tests 20

4.3 Compositional Tests 24

5. Oxidative Degradation and Stabilisation of Mineral Oil Based Lubricants 32

6. Oxidation Stability 38

ORIGINAL PART

EXPERIMENTAL 41

1. Scheme of Study 41

2. Procedures 47

2.1 Thermal Oxidation Stability Test 47

2.2 Analysis of the Oxidation Products 48

RESULTS AND DISCUSSION 51

1. Oxidation Test 52

2. Infrared Spectroscopic Analysis 53
3. Viscosity 74
4. Total Acid Number 78
5. Chromatographic Analysis 82

CONCLUSION 85
REFERENCES 87
ARABIC SUMMARY 93

Aim of the Work

The main object of the present work is to study the effect of some organic sulphur compounds on oxidation stability of the base stock oil at elevated temperature and intervals time in presence of oxygen gas over iron-copper catalyst. The oxidation stability of the oil will be studied in the presence of deferent concentrations of some organic sulphur compounds.

Summary of the Work

The objective of our study in this thesis is to study oxidation stability of the base stock oil. For this reason, two base stock oil samples were delivered from Alexandria Petroleum Refining Company. One of these samples was delivered as it is refined directly from the refiner, i.e. without subject to hydrofinishing process, while the other sample was subjected to hydrofinishing process.

The two samples were oxidised separately by reacting them with pure oxygen at fixed flow rate and fixed temperature at different intervals of time. Oxidation process was first studied on the original oil samples and then by adding different organic sulphur compounds on the hydrofinished oil base stock.

The oxidised samples were analysed physically by Total Acid Number (TAN) and viscosity. The oxidised samples were also subjected to infrared study and gel permeation chromatography (GPC). The two fresh oil samples, their oxidative products at 72 hrs and the samples that has sulphur compounds and oxidised at 72 hrs were separated into saturates, aromatics and resins using column chromatography. The separated samples were studied using infrared spectroscopy and GPC. The separated saturates was analysed by gas chromatography.

GENERAL PART

COMPOSITION AND PROPERTIES OF LUBRICATING OILS