EFFECT OF BASE OILS CHEMICAL COMPOSITION ON INDUSTRIAL OILS FUNCTION AND PERFORMANCE PROPERTIES

THESIS

Submitted to the
Faculty of Science
Ain Shams University

For
Ph. D. Degree in Science
(Chemistry)

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(B. Sc. — M. Sc.)

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Cairo - Egypt

1984

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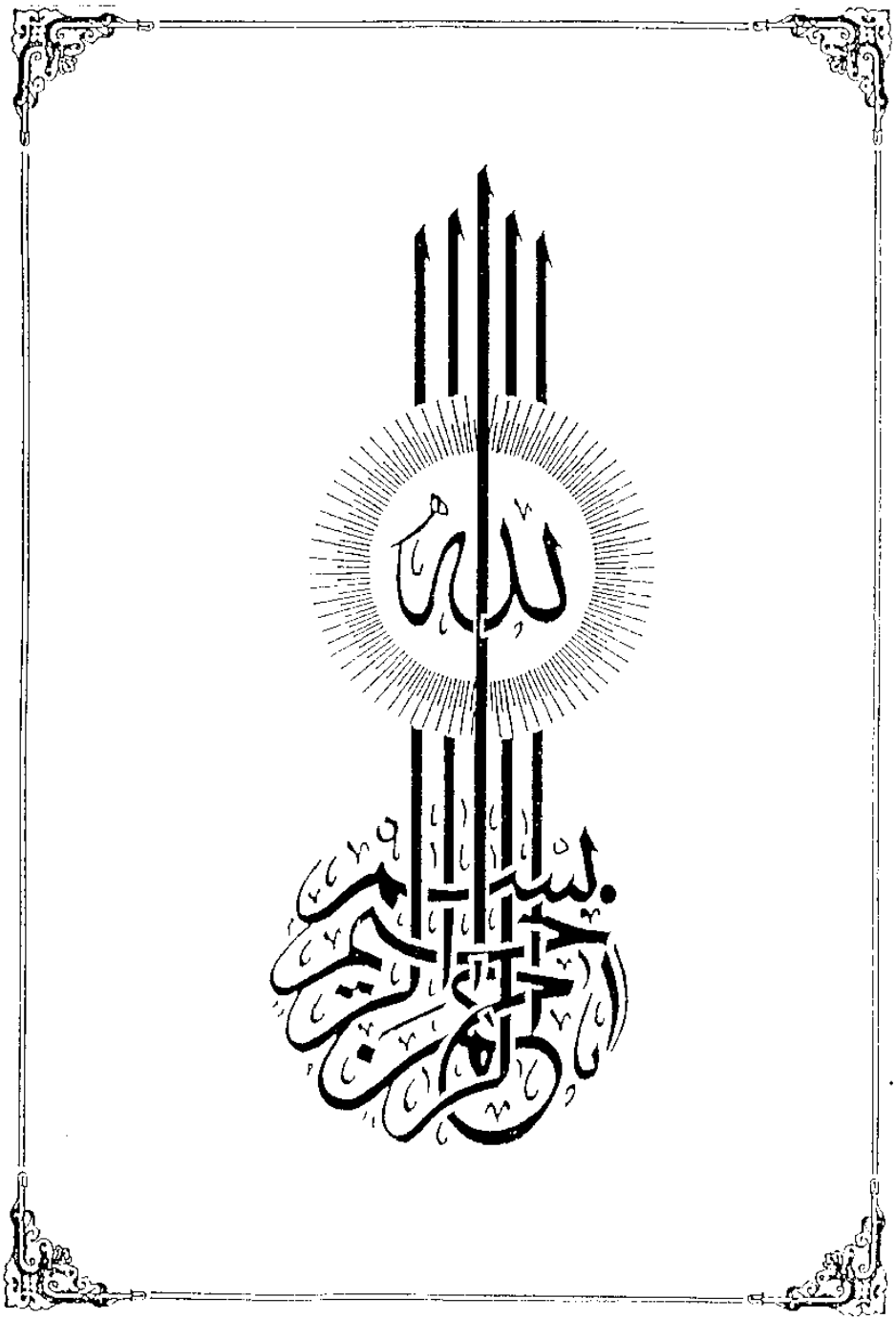

ACKNOWLEDGEMENT

Sincere thanks and appreciation are expressed to Prof. Dr. Ahmed M. Kaddah, Proffessor of organic chemistry, Ain Shams University, for his kind interest and guidance during the course of the work.

The author wishes to express his sincerst application to Dr. Hamdy H. Abou El Naga, Manager of Laboratories and Analytical Researches Sector, Research Centre, Misr Petroleum Co., for suggesting, the present line of work, for helpful guidance, constructive suggestions, discussion and cristicism.

The author also wishes to Dr. Wedad Abd El Azim, Head of Chemical Reseaeches Sector, Research Centre, Misr Petroleum Co., for her kind help, support, encouragement, and helpful Co-operation.

Thanks to Dr. Eng . M.E.Selim, General Manager Research Centre, Misr Petroleum Co., for granting the author a permission to do work.

Special thanks are due to the technical staff of Research Centre, Misr Petroleum Co., for their sincere helpful cooperation.

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SUMMARY

SUMMARY

With the enormous development in the types of engines and machines, it was necessary to produce types of base oil with high quality as motor lubricating blends. Also in view of numerous types of industrial lubricating oils, due to the wide variety in operation conditions and usage purposes, such oils require chemical and physical properties which differ to some extent from motor oils.

Therefore this work aims at studying all factors that would affect the efficiency of local base oils which is using in formulation of industrial oils. The find goal is to produce high quality blends which are matching imported ones.

Our studies have been done through the following steps:

1. Twelve base oil samples have been selected; they are differ from each other in the following:
   a. Crude oil sources,(paraffinic or naphthenic).
   b. Production technique hydrofinishing or solvent extraction.
2. Those base oils have been analysed by utilizing the most up-to-date analytical methods and instruments,

the accurate composition of all tested base oils has been obtained i.e. the type and the percentage of all chemical components such as hydrocarbon compounds; paraffins, naphthenes, aromatics (mono-di-poly cyclic) and nonhydrocarbon compounds (sulfur, nitrogen, oxygen components) have been determined. From these results it was found some differences between those oils in either percentage or types of structural groups.

3. Thirty five blends have been formulated by using previous local base oils comparing with imported base oil, these blends are covering three main types of industrial lubricating oils, turbine,hydraulic and gear oils.

4. These blends have been tested according to the specifications of each type, using standard methods. It was found that a strong relationship between chemical composition of base oils and the performance of finished industrial lubricating oils blends as, follows:-

A. COMPATIBILITY, SOLVENCY AND ADDITIVE RESPONCE;

Aromatic hydrocarbons (specially monocyclic) and nonhydrocarbon components (specially oxygen compounds)

help to improve the compatibility, solvency and additive responce.

B. OXIDATION STABILITY:

1. Saturate hydrocarbons (paraffins and naphthenes) are highly stable to oxidation.
2. Monocyclic aromatics, in general is stable towards oxidation, and the optimum percent is 19% for turbine and hydraulic oils, 35% for light gear oils (ISO 100,180).
3. Dicyclic aromatics, in general act as oxidation promoters.
4. Polycyclic aromatics; is unstable towards oxidation and it is pro-oxidant.
5. Sulfur compounds; has two effects.
   - Autoaccelerating in cases when sulfur as nonsulfide.
   - Auto retarding when containing sulfur as sulfide.
6. Nitrogen compounds; basic nitrogen compounds are pro-oxidants and other nitrogen compounds are neutral effect.
7. Oxygen compounds are autoaccelerating function.

C. SURFACE CHEMICAL PROPERTIES:

1. Most hydrocarbon compounds are not effective on surface chemical properties for industrial oils.

2. Some aromatic types have slight effect on surface chemical properties such as improving the foam character and delay the separation time of water from oil.

3. Nonhydrocarbon components are very effective on surface chemical properties due to their polarity which reduce the surface and interfacial tensions i.e. these components are act to improve some properties as foam tendency, rust prevention and detergent dispersant, but in the same time act to deteriorated other properties as demulsibility and air release specially for turbine and hydraulic oils therefore the optimum percent of nonhydrocarbon components have been determined for these oils as follows:-

Component / Oil types	Sulfur % wt.	Nitrogen p.p.m.	Oxygen % wt.
Turbine	0.2	200	1.15
Hydraulic	0.3	250	1.80

4. Oxygenated compounds are more effective than the sulfur and nitrogen compounds.

5. The surface chemical properties decreased with increase the viscosity or temperature.

D. MECHANICAL PERFORMANCE PROPERTIES:

1. Saturates; in general no significant effect on the wear prevention.

2. Aromatics are extremely effective on lowering the friction and wear properties, except dicyclic aromatics have an opposite effect.

3. Nonhydrocarbons have the highest effect on reducing the friction and wear properties between metal surfaces, this may be due to the polarity of these components which directly reacted with metal surface forming a surface layer with low shear strength to form iron sulfide, iron chloride ...etc. and also prevent welding and severe surface break-down.

E. HYDROFINISHING TECHNIQUE:

Improved the oxidation stability but it is less effective concerning the surface chemical properties.

It was possible to achieve the optimum percentage for different chemical components of various industrial lubricating oils which have been tested as shown in the following table.

Base oil formulation / Chemical components	Turbine oils	Hydraulic oils	Gear Oils		
			ISO 100	ISO 180	ISO 320
Saturates % wt.	80min.	65min.	60min.	55min.	45min.
Monocyclic aromatic %wt	20min	35min.	35min.	35min.	45min.
Dicyclic aromatic %wt	Nil.	Nil.	5max.	8 max.	8max.
Sulfur content %wt	0.25max	0.3max.	0.45max.	0.5max.	0.6max
Nitrogen content ppm	200 max	250max.	350max.	380max.	500max
Oxygen content %wt	1.5	1.8	2.0	2.1max.	2.2max

INTRODUCTION