SYNTHESIS OF PETROLEUM EXTREME PRESSURE (EP) ADDITIVES USING SOME INORGANIC MATERIALS

A Thesis

Submitted by
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ABSTRACT

Student Name: **Hisham Mohamed Salah Youssef**

Title of the thesis**: Synthesis of petroleum extreme pressure (EP) additives using some inorganic materials**

Degree: Ph. D. (Chemistry)

The objective of this work aim ed at synthesize of petroleum extrem e pressure additives which used in industrial gear oils and in engine lubrication through sulfurization and phosphorization of nine different neat vegetable oils, and to their m ixtures with castor oil. The synthesized products was evaluated f or solubility in m ineral oils and f or absence of corrosive active sulfur. Reactions were m onitored th rough m easuring the viscosity, FTIR spectra, and the sulfur and phosphorus percentage in the products. The synthesized products after blending with m ineral base oils were evaluated for extreme pressure properties, oxidation stability, and f or rust- preventing characteristics.

Keywords: extreme pressure additive, sulfurization, phosphorization, vegetable oils, mineral oils.

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Hisham Mohamed Salah Youssef

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List of Abbreviations

ACEA : Association des Constructeurs Européens d' Automobile (Association of the European car Manufacturers).

AGMA : American Gear Manufacturers Association (USA)

API : American Petroleum Institute.

ASTM : American Society for Testing and Materials.

ATIEL : Association Technique de L'Industrie Européenne des Lubrifiants. (Technical Association of the European Lubricant Industry).

AW : Anti-Wear.

DBS : Di-n-butyl sulfide.

DMTD : Dialkyl-2,5-dimercapto-1,3,4- thiadiazole.

EHL : Elastohydrodynamic Lubrication.

EP : Extreme Pressure.

FTIR : Fourier Transform Infrared

FZG : **F**orschungsstelle Fur **Z**ahnrader Und **G**etriebebau (D), Performance Test Method for Determination of Load Capacity of Lubricants According To FZG Method.

HSAB : Hard and soft acids and bases.

IP : Institute of Petroleum (UK).

I.S.L. : Inetial Seizure Load.

ISO : International Standard Organization.

ISO VG : ISO Viscosity Grade.

Kin. Vis. : Kinematic viscosity.

MHL : Mean Hertz Load.

MO : Mineral Oil.

MoDTC : Molybdenum dithiocarbamate.

MoDTP : Molybdenum dithiophosphate.
NMP : N-methyl-2-pyrrolidone.
OEMs : Original Equipment Manufacturers.
PEP : Passive Extreme Pressure.
PMMA : Poly methyl methacrelate.
PTFF : Polytetrafluorethylene.
R.I. : Refractive Index.
RO : Rust and Oxidation Inhibited.
SAE : Society of Automotive Engineers.
Sp. gr. : Specific gravity.
TAN : Total Acid Number in mg KOH/g sample.
TCP : Tricresyl phosphate.
TPPT : Triphenyl phosphorothionate.
ZDDP : Zinc dialkyldithiophosphate
ZDTP : Zinc dithiophosphate.
VI : Viscosity Index.
HVI : High Viscosity Index.
VHVI : Very High Viscosity Index.

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