

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

A Thesis

**Submitted by
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ABSTRACT

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

Degree: Ph. D. (Chemistry)

The objective of this work aimed at synthesizing of petroleum extreme 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 mixtures with castor oil. The synthesized products were evaluated for solubility in mineral oils and for absence of corrosive active sulfur. Reactions were monitored through measuring the viscosity, FTIR spectra, and the sulfur and phosphorus percentage in the products. The synthesized products after blending with mineral base oils were evaluated for extreme pressure properties, oxidation stability, and for rust-preventing characteristics.

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

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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 ahnrad 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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