



شبكة المعلومات الجامعية  
التوثيق الإلكتروني والميكروفيلم

# بسم الله الرحمن الرحيم



**MONA MAGHRABY**



شبكة المعلومات الجامعية  
التوثيق الإلكتروني والميكروفيلم



# شبكة المعلومات الجامعية التوثيق الإلكتروني والميكروفيلم



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التوثيق الإلكتروني والميكروفيلم

# جامعة عين شمس التوثيق الإلكتروني والميكروفيلم

## قسم

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



## يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



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Ain Shams University  
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*Trimetallic catalyst supported on modified alumina  
for upgrading and hydrotreating of petroleum  
fractions*

Thesis Submitted for  
Ph.D. Degree of Science in Physical Chemistry

By

**Asmaa Ismail Hussein Zahran**

**(B.Sc. Microbiology-Chemistry, 2011)**

**(M.Sc. Physical Chemistry, 2016)**

To  
Chemistry Department  
Faculty of Science  
Ain Shams University  
Cairo, Egypt

**2020**



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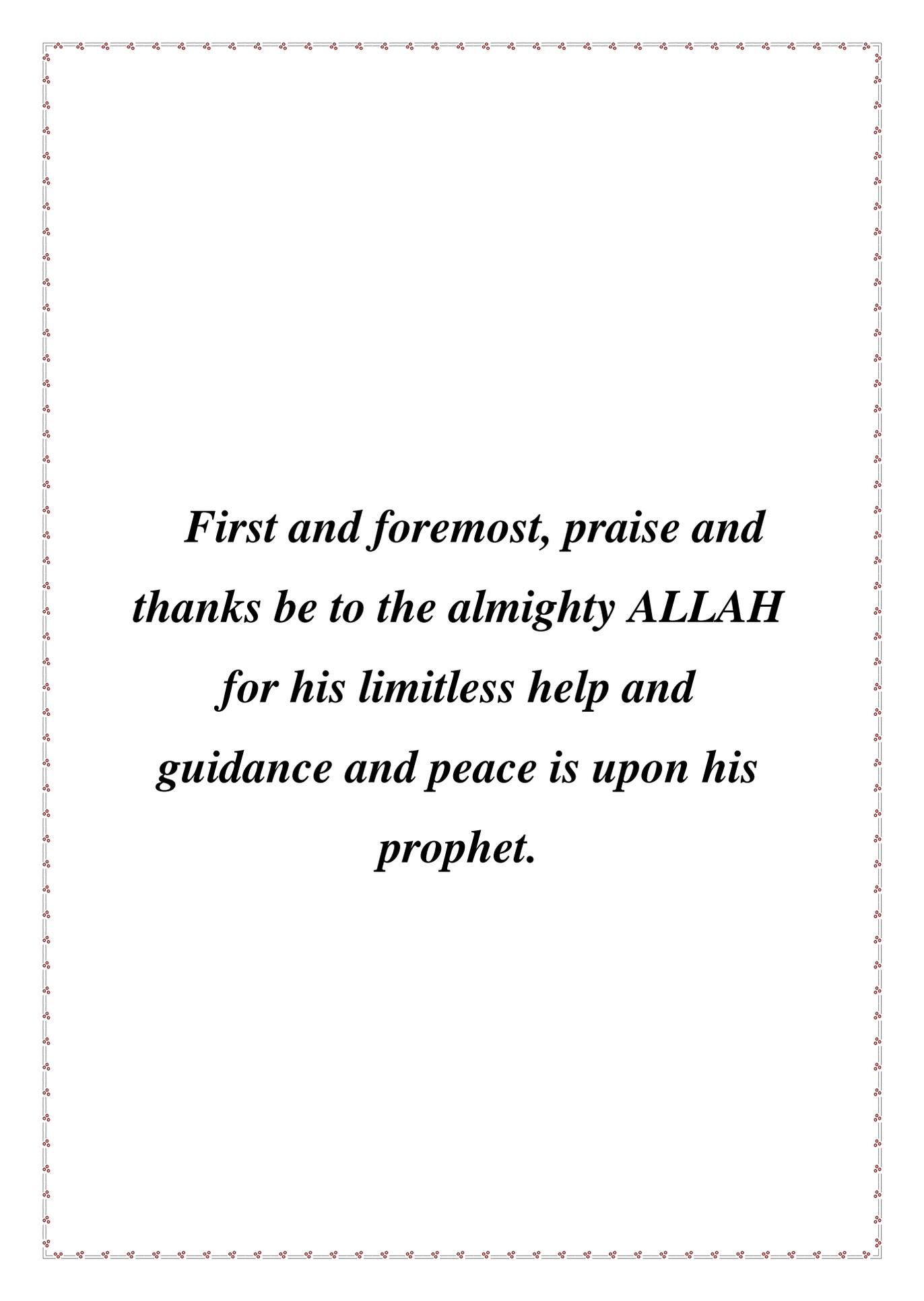
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*First and foremost, praise and  
thanks be to the almighty ALLAH  
for his limitless help and  
guidance and peace is upon his  
prophet.*

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*Asmaa Ismail Zahran*

بسم الله الرحمن الرحيم

**قالوا سبحانك لا علم لنا الا ما علمتنا انك انتم العليم الحكيم**

صدق الله العظيم  
(سوره البقره ايه 32)

***Aim of the work***

The main goal of this research work is to improve the quality of petroleum fractions via removing sulfur, nitrogen and aromatic compounds. Removal of these compounds is designated via three techniques:

- 1- Adsorption via some polymer-based blends
- 2- Catalytic hydrotreatment
- 3- Combined method of both adsorption and hydrotreating process.

In first technique, imidazole and imidazole derivatives blended polystyrene will be used as a novel adsorbents for removing contaminated compounds from petroleum fractions especially nitrogen compound which aimed to avoided ammonia formation during hydrotreating and also enhancement the HDS process.

In second technique synthesis of developed catalysts composed of ternary metal oxides supported on various structures for use in improving quality of petroleum fraction(s)

In third technique combined methods of both adsorption and hydrotreating processes aimed to generate high quality of petroleum fractions (heavy vacuum gas oil and a diesel oil). Thus, overall quality of sulfur and aromatic compounds disposal from the presented feedstock(s), in this study, will be increased.

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## *List of abbreviation and symbols*

Abbrev.	Description
HVGO	Heavy vacuum gas oil
HT	Hydrotreating
WPS	Waste polystyrene
ADS	Adsorptive desulfurization
HDS	Hydrodesulfurization
HDN	Hydrodenitrogenation
HDA	Hydrodearomatization
OECD	Organization for Economic Cooperation and Development
Btu	British thermal units
EIA	Energy Information Administration
LHSV	Liquid hourly space velocity
CTC	Charge transfer complex formation
LUMO	Lowest unoccupied molecular orbital
HOMO	Highest occupied molecular orbital
DMDS	Dimethyldisulfide
H <sub>2</sub> O <sub>2</sub>	Hydrogen peroxide
EPA	Environmental protection agency
TEM	Transmission electron microscopy
SEM	Scanning electron microscopy

## *List of abbreviation and symbols*

BET	Brunauer-Emmett-Teller
XPS	X-ray photoelectron spectroscopy
TPR	Temperature-programmed reduction
XRD	X-ray diffraction
FT-IR	Fourier-transform Infrared
ppm	Part per million
HYD	Hydrogenation pathway
SO <sub>x</sub>	Sulfur Oxides
Non-OECD	Non-Organization for Economic Cooperation and Development
SOPC	Suez Oil Petroleum Company
GPC	Gel permeation chromatography
C <sub>3</sub> H <sub>4</sub> N <sub>2</sub>	Imidazole
C <sub>20</sub> H <sub>37</sub> NaO <sub>7</sub> S	Dioctyl sulfosuccinate sodium surfactant
C <sub>8</sub> H <sub>8</sub>	Styrene monomer
CH <sub>3</sub> C <sub>3</sub> H <sub>3</sub> N <sub>2</sub>	Methylimidazole
C <sub>7</sub> H <sub>12</sub> N <sub>2</sub>	Butylimidazole
BJH	Barrett, Joyner and Halenda method

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