

#### AIN SHAMS UNIVERSITY University College for Women (Arts, Science and Education)

# Catalytic Conversion of Some Hydrocarbons Pollutants

A Thesis
Submitted for the Ph.D Degree in Science
(Physical Chemistry)
by

### Nouran Gaber Mahmoud Mostafa Mossa

Supervised by

### Prof. Dr. Essam Mohammed Ezzo

Professor of Physical Chemistry Chemistry Department University College for Women (Arts, Science and Education) Ain Shams University

#### Ass.Prof.Dr.Suzan Ahmad Hassan

Dr. Magda Abdel basset Elkherbawi

Ass. Physical Chemistry Lecturere Of Physical Chemistry
Prorf. of Chemistry Department Chemistry Department

University College for Women
Women
(Arts, Science and Education)
Ain Shams University
University College for
(Arts, Science and
(Arts, Science and
Ain Shams University
Ain Shams University

Ain Shams University 2012

# وسو الله الرجمين الرجيع

ell lla rally:

(اقترأ واسم ربّك الّذي طَق (١) طَقَ الإنسانَ عن عَلَق (٦) اقترأ وربّك الإنسانَ عن عَلَق (٦) اقترأ وربّك الأكرم (٣) الّذي علّم والقلم (٤) علّم الإنسانَ عا لم يعلم (٥)}

حدق الله العظيم

سورة العلق (٩٦)



#### AIN SHAMS UNIVERSITY University College for Women (Arts, Science, and Education)

### APPROVAL SHEET

Catalytic Conversion of Some Hydrocarbons Pollutants

A Thesis

Submitted for the Ph.D Degree in Science (Physical Chemistry)

**b**y

Nouran Gaber Mahmoud Mostafa Mossa

Board of Advisors Approved

Prof. Dr. Essam Mohammed Ezzo

Ass. prof. Dr. Suzan Ahmad Hassan

Dr. Magda Abdelbasset Elkherbawi

Head of Cemistry

Deparrtement

Prof. Dr. Essam Abdel-

*Azeiz* 



#### AIN SHAMS UNIVERSITY University College for Women (Arts, Science, and Education)

# **QUALIFICATION**

**Student Name:** Nouran Gaber Mahmoud Mostafa

Mosa

**Scientific Degree:** M.Sc. (Chemistry)

**Department**: Chemistry

Name of Collage: University Collage for Women

(Arts, Science and Education)

**University:** Ain Shams

M.Sc. Graduation Date: Oct 2009



Great thanks to ALLAH for all gifts he gave me.

Words are no real assistance to express my deepest gratitude and thanks to Prof. Dr. Essam Mohamed Ezzo, Professor of Physical Chemistry, Chemistry Department University Collage for Women (Arts, Science and Education) Ain Shams University I would like to thank him for his guidance, patience and mentorship. In addition to his technical knowledge, his support has made it easier to go through the ups and downs of research and I cannot thank him enough for the patience he has shown towards me in order to complete my thesis. I am extremely fortunate to have had the opportunity to interact with him and will cherish those interactions forever. Also, I am indebted to express my sincere thank to Ass. Prof. Dr. Suzan Ahmad Hassan and Dr. Magda Abdel -Basset El - Kherbawi Chemistry Department, University Collage for Women (Arts, Science and Education ) Ain Shams University for their encouragement, continuous help and careful guidance, throughout accomplishment of this work.

I am eternally grateful to my friend Dr. Hanan Mohammad Ezzat (Leibinz Institute for Catalysis-University Rostock Germany) for her help and support and I wish her the very best; I believe she has a bright research career before her.

Finally, my deep thanks to all staff members at my department for their encouragement and moral support.



جامعة عين شمس كلية البنات للأداب والعلوم والتربية قسر الكيم الكيماء

## التحول الحفزى لبعض الهيدروكربونات الملوثه للبيئه

رسالة مقدمة إلى قسم الكيمياء كلية البنات ـ جامعة عين شمس

من **نوران جابر محمود مصطفی موسی** 

> ماجيستير العلوم ( ٢٠٠٩ ) للحصول على

درجة دكتوراة الفلسفة في العلوم (كمياء فيزيائية)

لجنة الإشراف الأستاذ الدكتور/ عصام محمد عزو أ.م.د / سوزان أحمد حسن د/ ماجدة عبد الباسط الخرباوى

 $(Y \cdot Y)$ 



جامعة عين شمس كلية البنات للأداب والعلوم والتربية قسط الكيم الكيم

## رسالة حكتوراة

غنوان الرسالة : التحول المغزى لبعض الميدروكربونات الملوثة للبيئة

لبنة الإشراف

الأستاذ الدكتور/ عصاء محمد عزو

أ.و.د / سوزان أحمد حسن د / عاجدة عبد الباسط الخرباوي البدرباوي (۲۰۱۲)



جـــامعة عــــين شمـس كلية البنات للأداب والعلوم والتربية قســــم الكيمـــياء

اسم الطالبة : نوران جابر محمود مصطفى موسى

الدرجة العلمية : ماجيستير في العلوم

القسم التابع له : الكيمياء

اسم الكلية : البنات للأداب والعلوم والتربية

الجامعة : عين شمس

سنة التخرج : مايو ٢٠٠٤

سنة المنح :اكتوبر ٢٠٠٩



# شكــــر وتقديـــر

تتقدم الطالبة بخالص الشكر والتقدير للجنة الاشراف على الرسالة المكونة من

- ١ ا. د / عصام محمد عزو استاذ الكيمياء الفيزيائية بقسم الكيمياء بكلية البنات للاداب والعلوم والتربية جامعة عين شمس
  - ٢ د/ سوزان أحمد حسن استاذ مساعدالكيمياء الفيزيائية بقسم الكيمياء بكلية
     البنات للاداب والعلوم والتربية جامعة عين شمس
- ٣ د/ ماجدة عبد الباسط الخرباوى مدرس الكيمياء الفيزيائية بقسم الكيمياء بكلية
   البنات للاداب والعلوم والتربية جامعة عين شمس

على مساعدتهم ومتابعتهم وتشجيعهم اثناء فترة البحث العملى وخلال الاعداد النهائي للرسالة .



I dedicate this thesis to my wonderful family. Particularly to my understanding and patient husband, Mohammad, who has put up with these many years of research, and to our precious son Hassan, who is the joy of our lives. I must also thank my loving mother, father and sisters who have helped so much with baby-sitting and have given me their fullest support.

Finally, I dedicate this work to all my friends and colleagues for their kindness and support



## List of Tables

Table No.	Title	Page
1	The catalysts used and their pretreatment conditions	39
2	Adsorption – desorption data for nitrogen at -196°C for VSOWI at 500,750,900°C	41-43
3	Adsorption – desorption data for nitrogen at -196°C for CVSOWIII at 500,750,900°C	44-46
4	Adsorption – desorption data for nitrogen at -196°C for VSOUWV at 500°C	47
5	Adsorption – desorption data for nitrogen at -196°C for CVSOUWVII at 500°C	48
6	Adsorption – desorption data for nitrogen at -196°C for FVSOUWIX at 500°C	49
7	Adsorption – desorption data for nitrogen at -196°C for MVSOUWXI at 500°C	50
8	The X – ray diffraction pattern for VSOWI calcined at 500,750,900°C	53-54
9	The X – ray diffraction pattern for CVSOWIII calcined at 500,750,900°C	54-55
10	Textural properties of the prepared catalysts	66
11	The TGA data of the investigated solid samples	75
12	DSC data of the investigated solid samples	77
13	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOWI catalyst pretreated at 500°C in flow system under normal pressure at 300°C	85

Table No.	Title	Page
14	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOWI catalyst pretreated at 500°C in flow system under normal pressure at 320°C	86
15	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOWI catalyst pretreated at 500°C in flow system under normal pressure at 340°C	87
16	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOWI catalyst pretreated at 500°C in flow system under normal pressure at 360°C	88
17	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOWI catalyst pretreated at 500°C in flow system under normal pressure at 380°C	89
18	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOWI catalyst pretreated at 500°C in flow system under normal pressure at 400°C	90
19	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOAII catalyst pretreated at 500°C in flow system under normal pressure at 300°C	91
20	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOAII catalyst pretreated at 500°C in flow system under normal pressure at 320°C	92
21	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOAII catalyst pretreated at 500°C in flow system under normal pressure at 340°C	93
22	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOAII catalyst pretreated at 500°C in flow system under normal pressure at 360°C	94

Table No.	Title	Page
23	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOAII catalyst pretreated at 500°C in flow system under normal pressure at 380°C	95
24	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOAII catalyst pretreated at 500°C in flow system under normal pressure at 400°C	96
25	Effect of working time of exposed catalyst to benzylol vapor without air flowing on CVSOWIII catalyst pretreated at 500°C in flow system under normal pressure at 300°C	97
26	Effect of working time of exposed catalyst to benzylol vapor without air flowing on CVSOWIII catalyst pretreated at 500°C in flow system under normal pressure at 320°C	98
27	Effect of working time of exposed catalyst to benzylol vapor without air flowing on CVSOWIII catalyst pretreated at 500°C in flow system under normal pressure at 340°C	99
28	Effect of working time of exposed catalyst to benzylol vapor without air flowing on CVSOWIII catalyst pretreated at 500°C in flow system under normal pressure at 360°C	100
29	Effect of working time of exposed catalyst to benzylol vapor without air flowing on CVSOWIII catalyst pretreated at 500°C in flow system under normal pressure at 380°C	101
30	Effect of working time of exposed catalyst to benzylol vapor without air flowing on CVSOWIII catalyst pretreated at 500°C in flow system under normal pressure at 400°C	102
31	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on CVSOAIV catalyst pretreated at 500°C in flow system under normal pressure at 300°C	103

Table No.	Title	Page
32	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on CVSOAIV catalyst pretreated at 500°C in flow system under normal pressure at 320°C	104
33	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on CVSOAIV catalyst pretreated at 500°C in flow system under normal pressure at 340°C	105
34	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on CVSOAIV catalyst pretreated at 500°C in flow system under normal pressure at 360°C	106
35	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on CVSOAIV catalyst pretreated at 500°C in flow system under normal pressure at 380°C	107
36	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on CVSOAIV catalyst pretreated at 500°C in flow system under normal pressure at 400°C	108
37	Textural properties of the prepared catalysts	122
38	TGA and DSC data of the investigated solid samples	129
39	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOUWV catalyst pretreated at 500°C in flow system under normal pressure at 300°C	139

Table No.	Title	Page
40	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOUWV catalyst pretreated at 500°C in flow system under normal pressure at 320°C	140
41	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOUWV catalyst pretreated at 500°C in flow system under normal pressure at 340°C	141
42	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOUWV catalyst pretreated at 500°C in flow system under normal pressure at 360°C	142
43	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOUWV catalyst pretreated at 500°C in flow system under normal pressure at 380°C	143
44	Effect of working time of exposed catalyst to benzylol vapor without air flowing on VSOUWV catalyst pretreated at 500°C in flow system under normal pressure at 400°C	144
45	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOUAVI catalyst pretreated at 500°C in flow system under normal pressure at 300°C	145
46	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOUAVI catalyst pretreated at 500°C in flow system under normal pressure at 320°C	146
47	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOUAVI catalyst pretreated at 500°C in flow system under normal pressure at 340°C	147
48	Effect of working time of exposed catalyst to benzylol vapor at a constant stream of dry air on VSOUAVI catalyst pretreated at 500°C in flow system under normal pressure at 360°C	148