



**Ain Shams University**  
**Faculty of Science**  
**Chemistry Department**

**EFFECT OF NATURAL PRODUCT EXTRACTS IN  
CALCIUM OXALATE MONOHYDRATE  
CRYSTALLIZATION**

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**(Inorganic Chemistry)**

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Chemistry Department**

## **Approval Sheet for Submission**

### **A Thesis Title**

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## ABSTRACT

Kidney stone formation is a major health problem all over the world. Calcium oxalate monohydrate (COM) kidney stones are the most common type of kidney stone (renal calculi); about 70% to 80% of kidney stones are formed from COM crystals. The mechanism underlying calcium oxalate stone formation is complex and not completely understood. Therefore, better understanding of calcium oxalate monohydrate crystallization is in urgent need to find out much efficient drug for inhibition kidney stone formation.

This study was carried out using herbal extracts as crystallization inhibitors of kidney stone. Crystallization kinetics of calcium oxalate monohydrate (COM) was studied with and without an aqueous *Ammi Visnaga* (Khella) and *Nigella Sativa*(Habbet El-Barakah) extracts individually.

To our knowledge, it is the first time to study the effect of an aqueous *Nigella Sativa* extract on COM crystallization as well as it is the first time to compare *Nigella Sativa* extract effect with the effect of an aqueous *Khella* extract on the COM crystallization. The induction period was determined under different supersaturation ratios at 37 °C using the conductivity method. The induction time decreased exponentially with increasing super saturation ratio whereas the induction time was increased with addition of an aqueous Egyptian khella and

Nigella Sativa extracts individually compared to without additives. By using theory of classical homogenous nucleation, the calculated surface energy was increased from 7.97 mJ/m<sup>2</sup> without additive to 9.15 mJ/m<sup>2</sup> and 10.31 mJ/m<sup>2</sup> with Khella and Nigella Sativa extracts, respectively. However, the nucleation rate at a supersaturation ratio of 3.26 corresponding to 3.27 and 5.44 with Khella and Nigella Sativa extracts, respectively was decreased from  $3.9 \times 10^{29}$  nuclei/cm<sup>3</sup>.s (without additive) to  $2.4 \times 10^{29}$  nuclei/cm<sup>3</sup>.s and  $1.3 \times 10^{29}$  nuclei/cm<sup>3</sup>.s with Khella and Nigella Sativa extracts, respectively. The results indicate that increasing surface energy leads to decreasing nucleation rate. The number of molecules required for the formation of stable nucleus was calculated with and without addition of extracts at different supersaturation ratios. COM crystals were investigated by X Ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and Energy Dispersive X Ray Spectroscopy (EDX). SEM photomicrographs show formation of small crystals, less aggregated with extracts inhibitor compared with the baseline. This study can help us to find out much efficient medicine from herbs extract for removal/inhibition kidney stone formation.

**Keywords:** Calcium oxalate monohydrate; Crystallization; Crystal morphology; Induction time; Crystal growth inhibitor.

## **ABBREVIATIONS**

COM	Calcium oxalate monohydrate
CaOx	Calcium oxalate
CaP	Calcium Phosphate
RS	Relative supersaturation
S	Supersaturation
W/O	Without
K.E.	Khella Extract
N.S.	Nigella Sativa
UTI	Urinary tract infection
GAG	Glycols amino glycan
GAGS	Glycols amino glycans
M	Molarity
mM	Milli molar
mL	Milliliter
XRD	X-ray powder diffraction
SEM	Scanning electron microscopy
EDX	Energy-dispersive X-ray spectroscopy

# CONTENTS

## CHAPTER I

### I. INTRODUCTION& LITERATURE SURVAY ----- 1

#### I.1. Kidney Stones----- 3

##### I.1.1. Composition and Types of Kidney Stones -----4

###### I.1.1.1. Calcium Stones ----- 6

###### A. Calcium Oxalate Stone----- 6

###### B. Calcium Phosphate Stone----- 7

###### I.1.1.2. Uric Acid Stones ----- 8

###### I.1.1.3. Struvite Stones----- 9

###### I.1.1.4. Cystine Stones----- 9

#### I.2. Risk Factors for the Formation of Kidney Stone ----10

7

##### I.2.1. Urinary Calcium ----- 11

##### I.2.2. Urinary Oxalate----- 12

##### I.2.3. Urinary Magnesium----- 13

##### I.2.4. Urinary Citrate----- 13

##### I.2.5. Urinary Uric Acid ----- 14

##### I.2.6. Urinary Phosphate ----- 14

<b>I.2.7. Urinary Pyrophosphate -----</b>	<b>15</b>
<b>I.2.8. Urinary pH-----</b>	<b>15</b>
<b>I.2.9. Urinary Volume-----</b>	<b>16</b>

### **I.3. Physicochemical Mechanisms of Calcium Oxalate**

#### **Monohydrate Formation----- 18**

##### **I.3.1. Nucleation and Crystallization ----- 18**

###### **I.3.1.1. Supersaturation -----18**

###### **I.3.1.2. Nucleation -----21**

###### **A. Homogeneous Nucleation -----26**

###### **B. Heterogeneous Nucleation-----29**

###### **I.3.1.3. Crystal Growth-----31**

###### **I.3.1.4. Aggregation -----34**

###### **I.3.1.5. Induction Time -----35**

##### **I.3.2. Inhibitors of Calcium Oxalate Monohydrate Crystal Growth37**

###### **I.3.2.1. Urinary Inhibitors -----37**

7

###### **I.3.2.2. Citrate Inhibitor----- 39**

###### **I.3.2.3. Magnesium salt Inhibitor ----- 39**

###### **I.3.2.4. Medicinal Plants Inhibitor-----41**

###### **A. *Ammi Visnaga* (Khella) Plant----- 42**



<b>B. <i>Nigella Sativa</i> (Black Cumin) Seeds</b>	45
---	----

## **CHAPTER II**

<b>II. EXPERIMENTAL</b>	49
-------------------------	----

<b>II.1. MATERIALS</b>	49
------------------------	----

<b>II.2. APPARATUS</b>	51
------------------------	----

<b>II.3. PROCEDURE</b>	52
------------------------	----

### **II.3.1. Experimental Technique**

<b>II.3.1.1. Extract Preparation</b>	52
--------------------------------------	----

<b>II.3.1.2. Calcium Oxalate Monohydrate Preparation</b>	54
--	----

<b>II.3.1.3. Conductivity Measurements</b>	58
--	----

<b>II.3.1.4. Crystallization Kinetics</b>	59
---	----

<b>i. Calculation of Induction Time</b>	59
---	----

<b>ii. Calculation of Supersaturation</b>	60
---	----

<b>iii. Calculation of Surface Energy</b>	60
---	----

<b>iv. Calculation of Nucleation Rate</b>	61
---	----

<b>v. Calculation of Free Energy Change (<math>\Delta G_{cr}</math>)</b>	62
--	----

<b>vi. Calculation of Critical Nucleus Radius (r) and Number of</b>	
---	--

<b>Molecules in the Critical Nucleus (i)</b>	63
--	----

<b>II.3.2. Characterization</b>	64
---------------------------------	----

<b>II.3.2.1. Chemical Analysis</b>	64
------------------------------------	----

a. EDX. Elemental Analysis -----	64
b. C, H Elemental Analysis-----	64
II.3.2.2. Physical Analysis -----	64
A. Morphology Investigation -----	64
B. Particle Size Distribution -----	64
II.3.2.3. Mineralogical Analysis -----	65
II.3.3. The Flow Sheet of the Whole Experimental Procedure ---	66

## CHAPTER III

III. RESULTS AND DISCUSSION-----	67
III.1. CRYSTALLIZATION OF CALCIUM OXALATE MONOHYDRATE-----	67
III.1.1 Crystallization of Calcium Oxalate Monohydrate without Additives (Base Line)-----	67
III.1.1.1. Calculation of Induction Time -----	68
III.1.1.2. Relation between Induction Time and Supersaturation Ratio-----	70
III.1.1.3. Results of Surface Energy -----	70
III.1.1.4. Results of Nucleation Rate -----	72

<b>III.1.1.5. Results of Free Energy Change (<math>\Delta G_{cr}</math>)-----</b>	<b>73</b>
<b>III.1.1.6. Results of Critical Nucleus Radius (r) and Number of Molecules in the Critical Nucleus (i) -----</b>	<b>75</b>
<b>III.1.1.7. Characterization of Formed Crystals-----</b>	<b>77</b>
<b>A. X-Ray Diffraction Analysis -----</b>	<b>77</b>
<b>B. Particle Size Distribution -----</b>	<b>79</b>
<b>C. Scanning Electron Microscopy -----</b>	<b>79</b>
<b>D. Chemical Analysis-----</b>	<b>81</b>

## **III.1.2. CRYSTALLIZATION OF CALCIUM OXALATE WITH ADDITIVES----- 82**

### **III.1.2.1. Effect of An Aqueous Extract of *Ammi Visnaga* (Khella) On COM -----83**

#### **III.1.2.1.1. Effect of Ammi Visnaga Extract Concentration on Induction Time of COM. ----- 83**

#### **III.1.2.1.2. Calculation of Induction Time ----- 84**

#### **III.1.2.1.3. Surface Energy ----- 86**

#### **III.1.2.1.4. Nucleation Rate----- 87**

#### **III.1.2.1.5. Free Energy Change ( $\Delta G_{cr}$ )----- 89**

#### **III.1.2.1.6. Critical Nucleus Radius (r) and Number of Molecules in the Critical Nucleus (i) ----- 91**

<b>III.1.2.1.7. Characterization of Formed Crystals -----</b>	<b>93</b>
<b>A. X-Ray Diffraction Analysis -----</b>	<b>93</b>
<b>B. Particle Size Distribution -----</b>	<b>95</b>
<b>C. SEM Photomicrographs of COM Crystals with and without Khella Extract-----</b>	<b>96</b>
<b>D. Chemical Analysis-----</b>	<b>98</b>
 <b>III.1.2.2. Effect of an Aqueous Extract of Nigella Sativa (Habbet El- Barakah) -----</b>	 <b>100</b>
<b>III.1.2.2.1. Effect of Nigella Sativa Extract Concentration on Induction Time of COM -----</b>	 <b>100</b>
<b>III.1.2.2.2. Calculation of Induction Time -----</b>	<b>101</b>
<b>III.1.2.2.3. Surface Energy -----</b>	<b>104</b>
<b>III.1.2.2.4. Nucleation Rate-----</b>	<b>105</b>
<b>III.1.2.2.5. Free Energy Change (<math>\Delta G_{cr}</math>)-----</b>	<b>107</b>
<b>III.1.2.2.6. Critical Nucleus Radius (r) and Number of Molecules in the Critical Nucleus (i) -----</b>	 <b>108</b>
<b>III.1.2.2.7. Characterization of Formed Crystals -----</b>	<b>111</b>
<b>A. X-Ray Diffraction Analysis -----</b>	<b>111</b>
<b>B. Particle Size Distribution -----</b>	<b>113</b>
<b>C. SEM Photomicrographs of COM Crystals with and without Habbet El-Barakah Extract -----</b>	 <b>114</b>
<b>D. Chemical Analysis-----</b>	<b>116</b>

## **III.2. COMPARISON FOR *AMMI VISNAGA* [KHELLA] AND *NIGELLA SATIVA* [HABBET EL-BARAKAH] EXTRACTS ON COM CRYSTALS**

-----118

### **III.2.1. Effect of Additives Concentration on the COM Crystals**

**Induction Time -----118**

### **III.2.2. Effect of Supersaturation Ratios on Induction Time of COM**

**with and w/o Khella and Nigella Sativa Extracts-----119**

**III.2.3. Results of Surface Energy -----120**

**III.2.4. Results of Nucleation Rate-----122**

**III.2.5. Results of Free Energy Change ( $\Delta G_{cr}$ ) -----123**

### **III.2.6. Results of Critical Nucleus Radius (r) and Number of Molecules**

**in the Critical Nucleus (i)-----125**

**III.2.7. Characterization of Formed Crystals -----129**

**A. X-Ray Diffraction Analysis -----129**

**B. Particle Size Distribution -----131**

**C. Scanning Electron Microscopy -----132**

**D. Chemical Analysis-----134**

## **CHAPTER IV**

**IV. SAMARRY & CONCLUSION -----135**

**REFERENCES -----144**

**ARABIC SUMMARY -----164**

# LIST OF TABLES

Serial No.		Page No.
1	<b>Table I.1.</b> Different Types of Kidney Stones, Their Formulas and Percent Occurrences.	5
2	<b>Table I.2.</b> Classification and Characterization of Different Types of Kidney Stones and its Urinary Risk Factor	17
3	<b>Table I.3.</b> Surface Tension Factor for Heterogeneous Nucleation	31
4	<b>Table II.1.</b> Chemical Analysis for Aqueous Extract of Ammi Visnaga (Khella)	53
5	<b>Table II.2.</b> Chemical Composition of the Nigella Sativa Seeds	53
6	<b>Table II.3.</b> Experimental Procedures of Different COM Supersaturation Ratios with Ammi Visnaga Extract	55
7	<b>Table II.4.</b> New Calculated Supersaturation Ratios of COM System with an Aqueous Extract of Ammi Visnaga	56
8	<b>Table II.5.</b> Experimental Procedure of Different COM Supersaturation Ratios with and without Nigella Sativa Extract	57
9	<b>Table III.1.</b> Effect of S on the Induction Time w/o Additives	69
10	<b>Table III.2.</b> Nucleation Rate, Free Energy Change for Formation of Critical Nucleus Size of COM Crystals at Different Supersaturation Ratios (S)	74
11	<b>Table III.3.</b> Radius of Critical Nucleus and Number of Molecules in the Critical Nucleus at Different Supersaturation Ratios (S)	77
12	<b>Table III.4.</b> XRD Data of Calcium Oxalate Monohydrate w/o Additives	78
13	<b>Table III.5.</b> Particle Size Distribution and Mean Diameter of COM Crystals w/o Additives at 4.51 S	79
14	<b>Table III.6.</b> Theoretical and Experimental Chemical Analyses of COM w/o Additives	82
15	<b>Table III.7.</b> Induction Time at Different Supersaturation Ratios with and without Khella Extract	86
16	<b>Table III.8.</b> Effect of KE on Nucleation Rate, Free Energy Change for Formation of Critical Nucleus Size of COM Crystals at Different Supersaturation Ratios (S)	90
17	<b>Table III.9.</b> Effect of Khella Extract on Radius of Critical Nucleus and Number of Molecules in the Critical Nucleus at Different Supersaturation Ratios	93