

Sudan University of Science and Technology  
Faculty of Graduate College

Determination of Stoichiometries and Stability  
Constants of Complexes of some Carboxylic  
Acids with Titanium, Chromium and  
Zirconium

تعيين النسبة المولية و ثوابت الاستقرار لمعقدات بعض  
الاحمض الكربوكسيلية مع التيتانيوم ، الكروم و الزركونيوم

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## Abstract

This investigation represents a comparative study of five methods for determination of stoichiometries and overall stability constants estimation techniques, including; two algebraic methods; point-wise calculation method and Henderson-Hasselbalch's equation, and other three graphical methods adopted were half integral method, linear plot method and least squares method, in purpose to select the most sensitive and accurate method, also The work aiming to determine the parameters affecting the precision of the methods under investigation, and steric effect of carbon chain length.

For this purpose, the central metal ions chosen were titanium and chromium from first transition elements series of group four and six respectively of d-block, they have four valence bond electrons  $3d^24s^2$  in addition to zirconium second transition series, group four of d-block.

The carboxylic acids, acetic acid, oxalic acid, oxalacetic acid, propanoic acid and citric acid have been selected as ligands.

Metal-ligand stability constant and stoichiometries of above systems were determined by Calvin and Bjerrum pH-metric titration technique as adopted by Irving and Rossotti. The obtained results are in a good agreement with each other, with some restriction on least squares method for accumulation of error in  $K_n-1$ .

## الخلاصة

هذا العمل يمثل دراسة مقارنة لخص طرق لتحديد النسبة المولية و ثابت الاستقرار، منها طريقتين جبريتين هما: طريقة الحساب التعلبية و معادلة هندرسون- هيسلبش. أما الثلاثة طرق الأخرى فهي: طريقة نصف التكامل و طريقة الرسم الخطي وطريقة المربعات الصغرى. ذلك بهدف تحديد الطريقة المثلى لتحديد النسبة المولية و ثابت الاستقرار، كما تهدف الدراسة أيضاً لتحديد العوامل التي تؤثر على ثوابت الاستقرار كالعوامل الخارجية مثل درجة الحرارة، الرقم الهيدروجيني، القوة الأيونية وتأثير العوامل الأخرى كطول سلسلة ذرات الكربون في اللواقط.

:لهذه الدراسة تم اختبار ثلاثة عناصر انتقالية هي

النتانيم و الكروميوم من الدورة الأولى في سلسلة العناصر الانتقالية من المجموعة الرابعة و السلسة على الترتيب، بالإضافة إلي الزركونيوم كعصر من الدورة الثانية، المجموعة الرابعة.

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# List of Contents

Chapter One	1
Introduction	1
1.1-Transition metals.	1
1.1.1-Physical properties of transition metal.	2
1.1.2- Chemical properties of transition metal.	2
1.2- Complex formation.	4
1.3-The central metal ion.	5
1.4- Ligands.	6
1.4.1-Types of ligands.	6
1.4.1.1-monodentate ligands.	6
1.4.1.2- Bidentate ligands.	6
1.4.1.3-Tridentate ligand.	8
1.4.1.4- Hexadentate.	8
1.4.2-Linkage isomers.	8
1.5-Oxidation state and coordination number.	9
1.5.1-Oxidation state.	9
1.5.2- Coordination number.	9
1.6- Classification of structure in terms of coordination number.	10
1.6.1- Coordination number (2).	10
1.6.2- Coordination number (4).	10
1.6.3- Coordination number (6).	10
1-7- Magnetic properties of transition elements.	11
1.8- Complex ion stability.	12
1.8.1- Stability constant.	12
1.9- Electronic structure of transition metal complex.	14
1.9.1- Genealogy of several theories.	14
1.9.2- Concept of effective atomic number.	15
1.9.3- Valence bond theory (VBT) "Atomic orbitals".	15
1.9.4- Crystal field theory (CFT).	16
1.9.5- Molecular orbital theory: (MOT).	18
1.11-Titanium.	19
1.11.1-Physical properties of titanium.	19
1.11.2-Chemical properties of titanium.	19
1.11.3-Titanium compounds.	20
1.11.4-Chemistry of titanium(IV) ( $d^0$ ).	20
1.11.5-Chemistry of titanium (III) $d^1$ .	21
1.11.6 -Chemistry of titanium (II) $d^2$ .	21
1.12-Zirconium : (Zr).	22

1.11.1-Physical properties of zirconium.	23
1.12.2-Chemical properties.	23
1.12.3-Compounds of zirconium.	23
1.13-Chromium	23
1.13.1-Historical background of chromium.	24
1.13.2-Physical properties of chromium.	24
1.13.3-Chemical properties of chromium.	25
1.13.4-Electronic configuration of chromium.	26
1.14-Chemistry of chromium.	26
1.14.1-Chromium (II) ( $d^4$ ).	26
1.14.1.1-Chromium (III), ( $d^3$ ).	26
1.14.1.2-Chromium(IV) ( $d^2$ ).	27
1.14.1.3-Chromium (V) ( $d^1$ ).	27
1.14.1.4-Chromium (VI) ( $d^0$ ).	27
1.15-Ligands.	28
1.15.1- Acetic acid:	28
1.15.2-Oxalic acid.	28
1.15.3-Oxaloacetic acid.	29
1.15.4- Propanoic acid.	30
1.15.5-Citric acid.	30
1.16- Literature review.	30
1.17-Charaterization techniques.	32
1.17.1-Potentiometric titration.	32
1.17.2- potentiometric determination of stability constants.	33
1.17.3-Importance of stability constant.	34
1.17.4- Determination of stability constant of binary complex.	34
1.18-generally applicable computational methods.	36
1.18.1- Point-wise calculation method.	36
1.18.2-Half integral method of calculation.	37
1.18.3- Method of least squares.	37
1.18.3.1-Limitation of linear least-squares.	39
2.2.4-linear plot method.	40

Chapter Two  
Materials and Methods

2.3-Preparation of stock solution.	41
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Chapter Three	
Results and discussions	44
Titration procedure	44

Chromium carboxylates complexes	46
3-Results and discussion.	46
<b>3.1-Chromium-acetic acid system.</b>	46
3.1.1-Practical proton-ligand stability constant.	49
3.1.1.1-Point-wise calculation method.	49
3.1.1.2-Half integral method (acetic acid).	50
3.1.2-Metal-ligand stability constant (chromium acetate).	50
3.1.2.1-Pointwise calculation method.	50
3.1.2.2-Half integral method.	51
3.1.2.3- Linear plot method.	52
3.1.2.4-Method of least squares.	53
<b>3.2-Chromium-oxalic acid system.</b>	57
3.2.1-Proton-ligand stability constant.	59
3.2.1.1-point-wise calculation method.	59
3.2.2 -Metal-ligand stability constants.	60
3.2.2.1-point-wise calculation method.	60
3.2.2.2-Half integral method.	61
3.2.2.3-Linear plot method.	62
3.2.2.4-Method of least squares.	63
<b>3.3/Chromium-oxalacetic acid system.</b>	66
3.3.1-Dissociation constant of oxalacetic acid.	68
3.3.1.1- point-wise calculation method.	68
3.3.2-Metal-ligand stability constants.	69
3.3.2.1-poin-twise calculation method:	69
3.3.2.2-Half integral method.	70
3.3.2.3-Linear plot method.	70
3.3.2.4-Least squares method.	71
<b>3.4/Chromium-propanoic acid system.</b>	75
3.4.1-Dissociation constants of propanoic acid.	77
3.4.1.1-Point-wise calculation method.	77
3.4.1.2-Half integral method.	78
3.4.2-Metal ligand stability constants.	78
3.4.2.1-Point-wise calculation method.	78
3.4.2.2-Half integral method.	79
3.4.2.3-Linear plot method.	79
3.4.2.4-Least squares method.	80
<b>3.5/ Chromium-citric acid system</b>	83

3.5.1-Practical proton ligand stability constant.	85
3.5.1.1-Point-wise calculation method.	85
3.5.2-Metal-ligand stability constant.	86
3.5.2.1-Pointwise calculation method.	86
3.5.2.2- Half integral method.	87
3.5.2.3-Linear plot method:	87
3.5.2.4 Henderson's or Hasselbalch's equation.	88

#### **Chapter four**

#### **Titanium carboxylates complexes**

<b>4.1/Titanium-acetic acid system.</b>	90
4.1.1-Metal ligand stability constant:	92
4.1.1.1-Point-wise calculation method.	92
4.1.1.2- Half integral method:	92
4.1.1.3 -Linear plot method.	93
4.1.1.4-Least squares method.	94
<b>4.2-Titanium-oxalic acid system.</b>	96
4.2.1-Metal-ligand stability constants.	98
4.2.1.1-pointwise calculation method.	98
4.2.1.2-Half integral method.	98
4.2.1.3-Linear plot method.	99
4.2.1.4-Linear least squares method.	100
<b>4.3/ Titanium-oxalacetic acid system.</b>	101
4.3.1-Metal-ligand stability constant.	103
4.3.1.1-Pointwise calculation method.	103
4.3.1.2-Half integral method.	104
4.3.1.3-Linear plot method.	104
4.3.1.4-Henderson or Hasselbalch's equation.	105
<b>4.4/Titanium-propanoic acid system:</b>	106
4.4.1-Metal-ligand stability constants.	108
4.4.1.1-pointwise calculation method.	108
4.4.1.2-Half integral method.	108
4.4.1.3-Linear plot method.	109
4.4.1.4-Least squares method.	110



4.5/ <b>Titanium-citric acid system</b>	113
4.5.1-Metal-ligand stability constants.	115
4.5.1.1-pointwise calculation method:	115
4.5.1.2-Half integral method.	116
4.5.1.3- Linear plot method.	117
4.5.1.4- Hinderson-Hasselbalch's equation.	118

## **Chapter five**

### **Zirconium carboxylate complexes**

<b>5.1/ Zirconium-acetic acid system</b>	119
5.1.1-Practical proton ligand stability constant.	121
5.1.1.1-Point-wise calculation method.	121
5.1.1.2-Half integral method.	122
5.1.2-Metal-ligand stability constant.	122
5.1.2.1-Point-wise calculation method.	122
5.1.2.2-Half integral method.	122
5.1.2.3-Linear plot method,	123
5.1.2.4-Least squares method.	124
<b>5.2/ Zirconium-oxalic acid system.</b>	127
5.2.1-Metal-ligand stability constant.	129
5.2.1.1-Pointwise calculation method.	129
5.2.1.2-Method of interpolation at half $n^-$ values:(half intedral method).	129
5.2.1.3-Linear plot method.	130
5.2.1.4- Hinderson or Hasselbalch's equation.	131
<b>5.3/Zirconium and oxalacetic acid system.</b>	132
5.3.1-Metal-ligand stability constant.	134
5.3.1.1-Pointwise calculation method	134
5.3.1.2-Half integral method.	135
5.3.1.3-Linear plot method.	135
5.3.1.4-Henderson's or Hasselbalch's equation.	136
<b>5.4/Zirconium-propanoic acid system:</b>	138
5.4.1-Metal-ligand stability constant.	140
5.4.1.1-Point-wise calculation method	140
5.4.1.2-Half integral method.	140

5.4.1.3-Linear plot method.	140
5.4.1.4-Henderson's Hasselbalch's equation.	141
<b>5.5/ Zirconium-citric acid system.</b>	142
5.5.1-Metal-ligand stability constant.	144
5.5.1.1-Point-wise calculation method.	144
5.5.1.2-Half integral method.	144
5.5.1.3-Linear plot method.	145
5.5.1.4-Henderson and Hesselbalch's equation.	146
<b>Chapter Six</b>	147
<b>Conclusion and Recommendation</b>	147
References.	150