

ปัจจัยที่มีผลต่อประสิทธิภาพการทำสารละลายแท่งและสารละลายคอลลอยด์ให้เข้มข้น  
ด้วยวิธีแซ่เยือกแข็งแบบก้าวหน้า



นาง ประภาศรี เทพรักษา

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จุฬาลงกรณ์มหาวิทยาลัย

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต

สาขาวิชาเทคโนโลยีทางอาหาร ภาควิชาเทคโนโลยีทางอาหาร

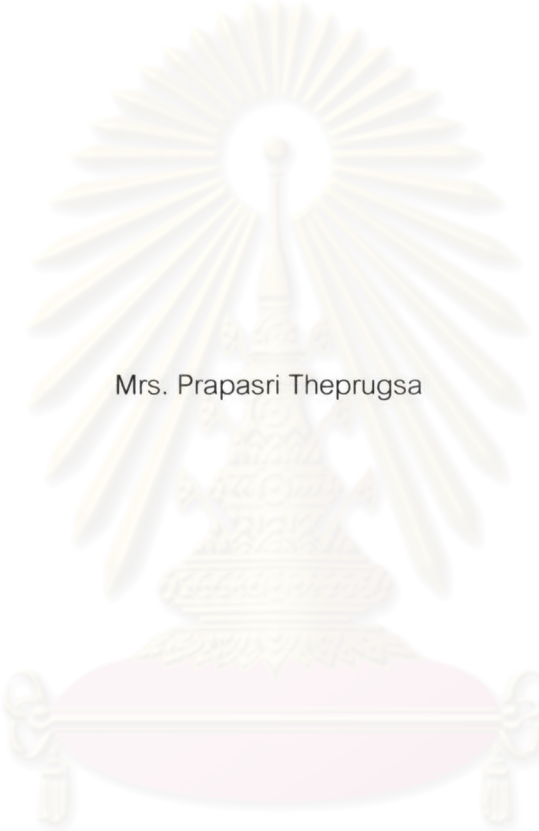
คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2545

ISBN 974-17-3366-6

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

FACTORS AFFECTING THE EFFICIENCY OF THE PROGRESSIVE FREEZE-CONCENTRATION OF  
TRUE AND COLLOIDAL SOLUTION



Mrs. Prapasri Theprugsa

ศูนย์วิทยทรัพยากร

จุฬาลงกรณ์มหาวิทยาลัย  
A Dissertation Submitted in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Philosophy in Food Technology

Department of Food Technology

Faculty of Science

Chulalongkorn University

Academic year 2002

ISBN 974-17-3366-6

Thesis Title FACTORS AFFECTING THE EFFICIENCY OF  
THE PROGRESSIVE FREEZE-CONCENTRATION  
OF TRUE AND COLLOIDAL SOLUTION  
By PRAPASRI THEPRUGSA  
Field of study Food Technology  
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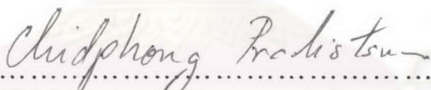
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Accepted by the Faculty of Science, Chulalongkorn University in Partial  
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นาง ประภาศรี เทพรักษา : ปัจจัยที่มีผลต่อประสิทธิภาพการทำสารละลายแท้และสารละลายคอลลอยด์ให้เข้มข้นด้วยวิธีแช่เยือกแข็งแบบก้าวหน้า. (FACTORS AFFECTING THE EFFICIENCY OF THE PROGRESSIVE FREEZE-CONCENTRATION OF TRUE AND COLLOIDAL SOLUTION) อ. ที่ปรึกษา : ดร. ชิดพงศ์ ประดิษฐ์สุวรรณ, อ.ที่ปรึกษาร่วม : Assoc. Prof. Dr. Osato Miyawaki , 117หน้า. ISBN 974-17-3366-6.

งานวิจัยนี้ศึกษาวิธีการหาค่าสัมประสิทธิ์การแยกสูงสุด (Limiting Partition Coefficient;  $K_0$ ) และปัจจัยที่เกี่ยวข้องในการทำสารละลายให้เข้มข้นด้วยวิธีการแช่เยือกแข็งแบบก้าวหน้า ค่า  $K_0$  สามารถหาได้จากค่าสัมประสิทธิ์การแยก (Effective Partition Coefficient,  $K$ ) ซึ่งได้จากการทดลองโดยตรง โดยอาศัยหลักการของแบบจำลองของปรากฏการณ์ concentration polarization ที่เกิดขึ้นที่ผิวหน้าระหว่างภูมิภาคน้ำแข็งและของเหลว

ตัวแปรที่ทำการศึกษาได้แก่ อัตราการกวนที่ผิวหน้าน้ำแข็ง ในช่วง 200-1000 รอบต่อนาที อัตราการเคลื่อนตัวของผิวหน้าน้ำแข็ง ในช่วง 0.1-2.7 ซม/ชม ชนิดของสารละลาย ซึ่งประกอบด้วย สารละลายมีขั้ว ได้แก่ LiCl, NaCl, KCl และ CsCl สารละลายไม่มีขั้ว ได้แก่ ไรโบส กลูโคส ฟรุคโตส ซูโครส และแลคโตส และสารละลายคอลลอยด์ ได้แก่ เดกซ์แทรน ที่มีน้ำหนักโมเลกุล 9,000-2,000,000 และ ความเข้มข้นเริ่มต้นของสารละลาย ( $C_0$ ) เท่ากับ 0.5-20% (w/w) ผลการศึกษาสำหรับสารละลายมีขั้วพบว่า ค่า  $K_0$  เป็นสัดส่วนโดยตรงกับความเข้มข้นเริ่มต้น และ ขึ้นกับชนิดของสารละลาย โดยที่  $K_0/C_0$  มีความสัมพันธ์เป็นเส้นตรงกับค่า Hydration Number ของอิออนบวกในสารละลายซึ่งมีลำดับจากมากไปน้อยดังนี้  $Li^+$ ,  $Na^+$ ,  $K^+$  และ  $Cs^+$  สารละลายไม่มีขั้วให้ผลแบบเดียวกับสารละลายมีขั้ว แต่ค่า  $K_0$  ของสารกลุ่มนี้จะไม่ขึ้นกับชนิดของตัวถูกละลาย สำหรับสารละลายคอลลอยด์นั้น ไม่พบว่าค่า  $K_0$  ขึ้นกับขนาดโมเลกุล และความเข้มข้นเริ่มต้นของสารละลาย

ภาควิชาเทคโนโลยีทางอาหาร  
สาขาวิชาเทคโนโลยีทางอาหาร  
ปีการศึกษา 2545

ลายมือชื่อนิสิต.....  
ลายมือชื่ออาจารย์ที่ปรึกษา.....  
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม.....

## 4173825723 : MAJOR FOOD TECHNOLOGY

KEY WORD: progressive freeze-concentration / effective partition coefficient / limiting partition coefficient / ice crystal growth rate /

PRAPASRI THEPRUGSA : FACTORS AFFECTING THE EFFICIENCY OF THE PROGRESSIVE FREEZE-CONCENTRATION OF TRUE AND COLLOIDAL SOLUTION.

THESIS ADVISOR : CHIDPHONG PRADISTSUWANA, Ph.D., THESIS COADVISOR : Assoc. Prof. OSATO MIYAWAKI, Ph.D., 117 pp. ISBN 974-17-3366-6.

In this research, the limiting partition coefficients ( $K_o$ ) were determined. Factors affecting the progressive freeze concentration process were also investigated.  $K_o$  could be obtained from the effective partition coefficient ( $K$ ), which was, in turn, obtained experimentally using the concentration polarization model.

The factors studied in this research included the stirring speed at the ice-liquid interface, in the range of 200-1000 rpm; the advance rate of the ice front, in the range of 0.1-2.7 cm/h; and the type of solution, which included ionic solutions comprising LiCl, NaCl, KCl, and CsCl, non-ionic solutions comprising ribose, glucose, fructose, sucrose, and lactose; and colloidal solutions comprising dextran with the molecular weight ranging from 9,000-2,000,000 and the initial concentration ranging from 0.5-20% (w/w). It was found that, for the ionic solutions the  $K_o$  value depends directly on initial concentration ( $C_o$ ) and type of solution. It was also found that the  $K_o/C_o$  ratio was linearly proportional to the hydration number of the cation of the solute, which could be ordered as follows:  $Li^+$ ,  $Na^+$ ,  $K^+$ ,  $Cs^+$ . For the non-ionic solutions, the results were similar to those of the ionic solutions, except that the  $K_o$  value was not affected by the type of the solute. The  $K_o$  value of the colloidal solution (i.e. dextran) was found that to be not affected by the size of molecule and the initial concentration of the solution.

Department	FoodTechnology	Student's signature.....
Field of study	FoodTechnology	Advisor's signature.....
Academic year	2002	Co-advisor's signature.....

## ACKNOWLEDGMENTS

I would like to express my highest respect and appreciation to my major advisor, Dr. Chidphong Pradistsuwana, for being insightful, intelligent, humorous, and for his time, advice, and tireless assistance. I am also highly grateful to my co-advisor, Assoc. Prof. Dr. Osato Miyawaki, of the Department of Applied Biological Chemistry, the University of Tokyo, for sharing his time, graciously providing me the equipment used in this research, and giving me constructive suggestions throughout the research. I also wish to thank my examining committee, Asst. Prof. Dr. Romanee Sangeundeeikul, Assoc. Prof. Dr. Kalaya Laohasongkram, Assoc. Prof. Dr. Saiwarun Chaiwanichsiri, and Assoc. Prof. Dr. Tipaporn Yoovidhya, for their invaluable suggestions.

I wish to thank all of my friends at Chulalongkorn University and to my colleagues at Thammasat University for their help and personal support. Special thanks should go to Dr. Ubonrat Siripattrawan and Dr. Prodpran Siritheerasas for useful discussion and for their assistance during the preparation of the manuscript.

I would like to express my gratitude to Thammasat University for giving me an opportunity to further my doctoral studies at the Department of Food Technology, Chulalongkorn University. The financial assistances from the Royal Thai Government and Chulalongkorn University Graduate School are acknowledged. The partial research fund from the Thailand-Japan Technology Transfer Project (TJTTP) is also thanked.

Last but not least, I wish to express my overwhelmingly gratitude to my caring parents, Major General Kanee and Mrs. Amorn Vangchana, and my sisters, Ms. Prapapan and Maneerom Vangchana, for their unconditional and moral support. I would also like to express to my deepest appreciation and gratitude to my wonderful husband, Mr. Sinnop Theprugsas, and all my lovely children, Noon, Naa, and Nont, for their endless love, inspiration, personal support, and patient throughout this difficult time.

# TABLE OF CONTENTS

	Page
ABSTRACT (Thai).....	iv
ABSRTACT (English).....	v
ACKNOWLEDGEMENTS.....	vi
TABLE OF CONTENTS.....	vii
LIST OF TABLES .....	xiii
LIST OF FIGURES.....	xiv
CHAPTER	
I INTRODUCTION.....	1
1.1 Objectives.....	3
II LITERATURE REVIEW.....	4
2.1 Concentration of Food Liquids.....	4
2.2 Freeze Concentration.....	5
2.2.1 Principles of Freeze Concentration.....	7
2.3 Freeze Concentration of Liquid Foods.....	10
2.3.1 Suspension Crystallization Method.....	10
2.3.2 Progressive Freeze-Concentration.....	15
2.4 Principles of Progressive Freeze-Concentration.....	17
2.4.1 Slow- freezing at the Only One Side.....	17
2.4.2 Exclusion of Solute Molecules from the Advancing of Ice Front.....	18
2.5 The Efficiency of the Progressive Freeze-Concentration.....	23

# TABLE OF CONTENTS

viii

	Page
2.6	Water-Solute interaction.....30
2.6.1	Interaction of water with ionic solutes.....32
2.6.2	Interaction of water with non-ionic solutes.....36
2.6.3	Interaction of water with colloidal particles.....38
III	METHODOLOGY.....39
3.1	Materials.....39
3.1.1	Ionic Solutions.....39
3.1.2	Non-ionic Solutions.....39
3.1.3	Colloidal Solutions.....39
3.1.4	Coolant.....39
3.2	Equipment.....40
3.2.1	Cylindrical Sample Vessel.....40
3.2.2	Cooling Bath.....41
3.2.3	Driving and Stirring Units .....42
3.3	Sample Preparation.....43
3.3.1	Ionic Solutions.....43
3.3.2	Non-ionic solutions.....43
3.3.3	Colloidal solutions.....43
3.3.4	Coolant.....43
3.4	Method.....44



# TABLE OF CONTENTS

ix

	Page
3.4.1 An Investigation of Factors Affecting the Efficiency of the Progressive Freeze-concentration in the Ionic Solutions .....	48
3.4.1.1.Parameters.....	48
3.4.1.2.Analytical Procedure.....	48
3.4.1.3.Evaluation of the effects of the parameters as above on the K value.....	49
3.4.1.4 Determination of the limiting partition coefficient of solute based on the concentration polarization model.....	49
3.4.2 An Investigation of Factors Affecting the Efficiency of the Progressive Freeze-concentration on the Non-ionic Solutions .....	49
3.4.2.1 Parameters.....	49
3.4.2.2 Analytical Procedure.....	49
3.4.2.3 Evaluation of the effects of the parameters as above on the K value.....	50
3.4.2.4 Determination of the limiting partition coefficient of solute based on the concentration polarization model .....	50
3.4.3 An Investigation of Factors Affecting the Efficiency of the Progressive Freeze-concentration on the Colloidal Solutions.....	50

# TABLE OF CONTENTS

x

	Page
3.4.3.1 Parameters.....	50
3.4.3.2 Analytical Procedure.....	50
3.4.3.3 Evaluation of the effects of the parameters as above on the K value.....	51
3.4.3.4 Determination of the limiting partition coefficient of solute based on the concentration polarization model .....	51
IV RESULTS AND DISCUSSION.....	52
4.1 An Investigation of Factors Affecting the Efficiency of the Progressive Freeze-concentration in the Ionic Solutions.....	52
4.1.1 Effects of the Stirring Speed at the Ice Front ( $N_r$ ) and the Advance Rate of the Ice Front ( $u$ ).....	52
4.1.2 Effects of the Operating Conditions and the Initial Concentration ( $C_0$ ) of the Ionic Solution on the Effective Partition Coefficient ( $K$ ).....	57
4.1.3 Determination of the Limiting Partition Coefficient ( $K_0$ ) of an Ionic Solute Based on the Concentration Polarization Model.....	65

# TABLE OF CONTENTS

xi

	Page
4.2 An Investigation of Factors Affecting the Efficiency of the Progressive Freeze-concentration in the Non-Ionic Solutions.....	71
4.2.1 Effects of the Stirring Speed at the Ice Front ( $N_r$ ) and the Advance Rate of the Ice Front ( $u$ ).....	71
4.2.2 Effects of the Initial Concentration ( $C_0$ ) of the Ionic Solutions and the Operating Conditions on the Effective Partition Coefficient ( $K$ ).....	74
4.2.3 Determination of the Limiting Partition Coefficient ( $K_0$ ) of a Non-ionic Solute Based on the Concentration Polarization Model.....	81
4.3 An Investigation of Factors Affecting the Efficiency of the Progressive Freeze-concentration on the Colloidal Solutions.....	84
4.3.1 Effects of the Initial Concentration ( $C_0$ ) of the Colloidal Solutions and the Operating Conditions on the Effective Partition Coefficient ( $K$ ).....	84
4.3.2 Effects of the Colloidal Molecular Weight (M.W.) and the Operating Conditions on the Effective Partition Coefficient ( $K$ ) of the Colloidal Solutions.....	86
4.4 Determination of an $\alpha$ Constant of Ionic, Non-ionic, and Colloidal Solutions.....	91
V CONCLUSIONS.....	93

# TABLE OF CONTENTS

xii

	Page
REFERENCES.....	94
APPENDICES.....	98
APPENDIX A.....	99
APPENDIX B.....	102
APPENDIX C.....	114
VITA.....	117



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## LIST OF TABLES

TABLE	Page
2.1 The diffusion coefficients of various ions in water and the hydration numbers at 25°C.....	35
4.1 The a-values of ionic, non-ionic, and colloidal solutions.....	92



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## LIST OF FIGURES

FIGURE	Page
2.1 Phase diagram for a binary system.....	8
2.2 Freezing point curves for milk and sugar solutions.....	9
2.3 The ice crystal formed in suspension crystallization method.....	16
2.4 The ice crystal formed in progressive freeze-concentration method.....	16
2.5 Vertical migration of particles in front of a freezing plane.....	20
2.6 Concentration polarization at the ice front in progressive freeze- concentration.....	27
2.7 The polar water molecule.....	30
2.8 Hydrogen bonding among water molecules.....	31
2.9 Polar water molecules interact with the ionic substances.....	33
2.10 The hydrated cation and anion.....	33
2.11 The non-ionic molecule contains a polar O-H.....	37
2.12 The polar water molecule interacts with the polar O-H bond.....	37
2.13 A representation of two colloidal particles.....	38
3.1 The cylindrical sample vessel.....	40
3.2 The cooling bath.....	41
3.3 Diving and Stirring unit.....	42
3.4 Ice lining at the bottom of cylindrical vessel.....	45
3.5 The operation of equipment.....	45
3.6 The beginning of progressive freeze-concentration experiment.....	46
3.7 Ice crystal growth at the bottom of vessel from (a) to (b).....	47

# LIST OF FIGURES

xv

FIGURE	Page
4.1	Effect of the stirring speed ( $N_r$ ) on the effective partition coefficients (K) of the 2.5 % (w/w) LiCl, NaCl, KCl, and CsCl solutions.....53
4.2	Effect of the advance rate of the ice front (u) on the effective partition coefficients (K) of the 2.5%(w/w) LiCl, NaCl, KCl, and CsCl solutions at a stirring speed of 600 rpm.....56
4.3	Effects of the operating conditions on the effective partition coefficient of ionic solution at 2.5 %(w/w). .....58
4.4	Effects of the advance rate of the ice front (u) and the stirring speed ( $N_r$ ) on the effective partition coefficient (K) of the 2.5% (w/w) CsCl, KCl, NaCl, and LiCl solutions.....59
4.5	Effects of the initial concentration( $C_0$ ) of LiCl solution and the operating conditions on the effective partition coefficient (K).....61
4.6	Effects of the initial concentration( $C_0$ ) of NaCl solution and the operating conditions on the effective partition coefficient (K). .....62
4.7	Effects of the initial concentration( $C_0$ ) of KCl solution and the operating conditions on the effective partition coefficient (K).....63
4.8	Effects of the initial concentration( $C_0$ ) of CsCl solution and the operating conditions on the effective partition coefficient (K).....64
4.9	Effects of type of salt and its initial concentration( $C_0$ ) on the limiting partition coefficient ( $K_0$ ).....67
4.10	The relationship between the hydration number and the $K_0/C_0$ .....68
4.11	A phase equilibrium plot of the LiCl, NaCl, KCl, and CsCl solutions.....70

## LIST OF FIGURES

xvi

FIGURE	Page
4.12 Effect of stirring speed ( $N_r$ ) on the effective partition coefficients ( $K$ ) of the 10.0% (w/w) D-(-)-ribose, D-(+)-glucose, D-(-)-fructose, lactose, and sucrose solutions.....	72
4.13 Effects of the advance rate of ice front ( $u$ ) on the effective partition coefficients ( $K$ ) of 10.0% (w/w) D-(-)-ribose, D-(+)-glucose, D-(-)-fructose, lactose, and sucrose solutions. at a stirring speed 600 rpm....	73
4.14 Effects of the advance rate of ice front ( $u$ ) and the stirring speed ( $N_r$ ) on effective partition coefficient ( $K$ ) of non-ionic solutions at concentration of 2.5% (w/w).....	76
4.15 Effects of the advance rate of ice front ( $u$ ) and stirring speed ( $N_r$ ) on effective partition coefficient ( $K$ ) of non-ionic solutions at concentration of 5.0% (w/w).....	77
4.16 Effects of the advance rate of ice front ( $u$ ) and stirring speed ( $N_r$ ) on effective partition coefficient ( $K$ ) of non-ionic solutions at concentration of 10.0% (w/w).....	78
4.17 Effects of the advance rate of ice front ( $u$ ) and stirring speed ( $N_r$ ) on effective partition coefficient ( $K$ ) of non-ionic solutions at concentration of 20.0% (w/w).....	79
4.18 Effects of initial concentration ( $C_0$ ) of the non-ionic solutions and the operating conditions on the effective partition coefficient ( $K$ ).....	80
4.19 Effects of the initial concentration ( $C_0$ ) on the limiting partition coefficient ( $K_0$ ) .....	82
4.20 A phase equilibrium plot of the non-ionic solutions .....	83



## LIST OF FIGURES

xvii

FIGURE	Page
4.21 Effects of the initial concentration ( $C_0$ ) of the colloidal solutions and the operating conditions on the effective partition coefficient (K) .....	85
4.22 Effects of the molecular weight of the colloidal solution and the operating conditions on the effective partition coefficient(K) of the colloidal solution at the initial concentration 0.25% (w/w).....	87
4.23 Progressive freeze-concentration of blue dextran solution: before and after the process.....	89
4.24 Phase equilibrium plot of the colloidal solutions. ....	90



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## LIST OF FIGURES

xvi

FIGURE	Page
4.1 Effect of the stirring speed ( $N_r$ ) on the effective partition coefficients (K) of the 2.5 % (w/w) LiCl, NaCl, KCl, and CsCl solutions.....	53
4.2 Effect of the advance rate of the ice front (u) on the effective partition coefficients (K) of the 2.5%(w/w) LiCl, NaCl, KCl, and CsCl solutions at a stirring speed of 600 rpm.....	56
4.3 Effects of the operating conditions on the effective partition coefficient of ionic solution at 2.5 %(w/w). ....	58
4.4 Effects of the advance rate of the ice front (u) and the stirring speed ( $N_r$ ) on the effective partition coefficient (K) of the 2.5% (w/w) CsCl, KCl, NaCl, and LiCl solutions.....	59
4.5 Effects of the initial concentration( $C_0$ ) of LiCl solution and the operating conditions on the effective partition coefficient (K).....	61
4.6 Effects of the initial concentration( $C_0$ ) of NaCl solution and the operating conditions on the effective partition coefficient (K). ....	62
4.7 Effects of the initial concentration( $C_0$ ) of KCl solution and the operating conditions on the effective partition coefficient (K).....	63
4.8 Effects of the initial concentration( $C_0$ ) of CsCl solution and the operating conditions on the effective partition coefficient (K).....	64
4.9 Effects of type of salt and its initial concentration( $C_0$ ) on the limiting partition coefficient ( $K_0$ ).....	67
4.10 The relationship between the hydration number and the $K_0/C_0$ .....	68
4.11 A phase equilibrium plot of the LiCl, NaCl, KCl, and CsCl solutions.....	70

# LIST OF FIGURES

xvii

FIGURE	Page
4.12 Effect of stirring speed ( $N_r$ ) on the effective partition coefficients ( $K$ ) of the 10.0% (w/w) D-(-)-ribose, D-(+)-glucose, D-(-)-fructose, lactose, and sucrose solutions.....	72
4.13 Effects of the advance rate of ice front ( $u$ ) on the effective partition coefficients ( $K$ ) of 10.0% (w/w) D-(-)-ribose, D-(+)-glucose, D-(-)-fructose, lactose, and sucrose solutions. at a stirring speed 600 rpm....	73
4.14 Effects of the advance rate of ice front ( $u$ ) and the stirring speed ( $N_r$ ) on effective partition coefficient ( $K$ ) of non-ionic solutions at concentration of 2.5% (w/w).....	76
4.15 Effects of the advance rate of ice front ( $u$ ) and stirring speed ( $N_r$ ) on effective partition coefficient ( $K$ ) of non-ionic solutions at concentration of 5.0% (w/w).....	77
4.16 Effects of the advance rate of ice front ( $u$ ) and stirring speed ( $N_r$ ) on effective partition coefficient ( $K$ ) of non-ionic solutions at concentration of 10.0% (w/w).....	78
4.17 Effects of the advance rate of ice front ( $u$ ) and stirring speed ( $N_r$ ) on effective partition coefficient ( $K$ ) of non-ionic solutions at concentration of 20.0% (w/w).....	79
4.18 Effects of initial concentration ( $C_0$ ) of the non-ionic solutions and the operating conditions on the effective partition coefficient ( $K$ ).....	80
4.19 Effects of the initial concentration ( $C_0$ ) on the limiting partition coefficient ( $K_0$ ) .....	82
4.20 A phase equilibrium plot of the non-ionic solutions .....	83

## LIST OF FIGURES

xviii

FIGURE	Page
4.21 Effects of the initial concentration ( $C_0$ ) of the colloidal solutions and the operating conditions on the effective partition coefficient (K) .....	85
4.22 Effects of the molecular weight of the colloidal solution and the operating conditions on the effective partition coefficient(K) of the colloidal solution at the initial concentration 0.25% (w/w).....	87
4.23 Progressive freeze-concentration of blue dextran solution: before and after the process.....	89
4.24 Phase equilibrium plot of the colloidal solutions. ....	90



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