

การเตรียมไมโครแคปซูลของกรดแอสคอร์บิกโดยเทคนิคโคอะเซอเวชัน
และการระเหยตัวทำละลาย



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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาเภสัชศาสตรมหาบัณฑิต

สาขาวิชาเภสัชกรรม ภาควิชาเภสัชกรรม

บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2540

ISBN 974-638-115-6

ลิขสิทธิ์ของบัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย

**MICROENCAPSULATION OF ASCORBIC ACID BY
COACERVATION AND SOLVENT EVAPORATION TECHNIQUES**



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**A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science in Pharmacy**

**Department of Pharmacy
Graduate School**

Chulalongkorn University

Academic Year 1997

ISBN 974-638-115-6

พิมพ์ที่ศูนย์วิจัยเภสัชภัณฑ์มหาวิทยาลัยมหิดลวิทยาเขตกาญจนบุรี

คุณวุฒิ วานิชชนันท์กุล : การเตรียมไมโครแคปซูลของกรดแอสคอร์บิกโดยเทคนิคโคอะเซอร์เวชัน และการระเหยตัวทำละลาย (MICROENCAPSULATION OF ASCORBIC ACID BY COACERVATION AND SOLVENT EVAPORATION TECHNIQUES)

อ.ที่ปรึกษา : ผศ.ดร.พนิดาวัฒน์สุวรรณ อ.ที่ปรึกษาร่วม : รศ.ดร.อุบลทิพย์ นิรมานนิตย์, 178 หน้า. ISBN 974-638-115-6

ไมโครแคปซูลของกรดแอสคอร์บิกเตรียมโดยเทคนิคโคอะเซอร์เวชันโดยการเปลี่ยนแปลงอุณหภูมิ และเทคนิคการระเหยตัวทำละลายโดยใช้เอทิลเซลลูโลสเป็นผนังไมโครแคปซูล การวิจัยนี้มีการศึกษาผลของ อัตราส่วนระหว่างตัวยาต่อผนัง ชนิดและปริมาณของพลาสติกไซเซอร์ (ได้แก่ triacetin, triethyl citrate, และ dibutyl sebacate) ที่มีต่อคุณสมบัติของไมโครแคปซูลที่เตรียมโดยเทคนิคโคอะเซอร์เวชัน และผลของความเข้มข้นของเอทิลเซลลูโลส อัตราส่วนระหว่างตัวยาต่อผนัง ชนิดและปริมาณของสารลดแรงดึงผิว (ได้แก่ Span80 และ Tween80) ที่มีต่อคุณสมบัติของไมโครแคปซูลที่เตรียมโดยเทคนิคการระเหยตัวทำละลาย ผลการวิจัยพบว่าไมโครแคปซูลที่เตรียมโดยเทคนิคโคอะเซอร์เวชันโดยการเปลี่ยนแปลงอุณหภูมิมีรูปร่างไม่แน่นอนและเกาะกลุ่มกัน เทคนิคนี้จะให้ปริมาณไมโครแคปซูลที่เตรียมได้และปริมาณตัวยาในไมโครแคปซูลสูง (95% และ 100-104% ตามลำดับ) การเพิ่มอัตราส่วนระหว่างตัวยาต่อผนังทำให้ได้ไมโครแคปซูลที่มีขนาดเฉลี่ยเล็กลง และมีอัตราการปลดปล่อยตัวยาสูงขึ้น พลาสติกไซเซอร์ที่เหมาะสมสำหรับการเตรียมไมโครแคปซูลที่ใช้เอทิลเซลลูโลสเป็นผนังและให้การปลดปล่อยตัวยาที่ช้าคือ 30% dibutyl sebacate การเตรียมไมโครแคปซูลโดยเทคนิคการระเหยตัวทำละลายให้ปริมาณไมโครแคปซูลที่เตรียมได้และปริมาณตัวยาในไมโครแคปซูลอยู่ระหว่าง 66-88% และ 55-93% ตามลำดับ ความเข้มข้นของเอทิลเซลลูโลสที่ให้การปลดปล่อยตัวยาช้าและให้ปริมาณไมโครแคปซูลที่เตรียมได้สูงคือ 6 เปอร์เซ็นต์ การเพิ่มอัตราส่วนระหว่างตัวยาต่อผนังทำให้ไมโครแคปซูลที่เตรียมได้มีขนาดเฉลี่ยใหญ่ขึ้นและมีอัตราการปลดปล่อยตัวยาสูงขึ้น การเพิ่มปริมาณ Span80 มีผลให้อัตราการปลดปล่อยตัวยาจากไมโครแคปซูลสูงขึ้น ซึ่งเกี่ยวข้องกับการมีผลึกยาบนผิวของไมโครแคปซูล ไมโครแคปซูลที่เตรียมโดยใช้ 1.5% Tween80 มีอัตราการปลดปล่อยตัวยาที่ช้าที่สุดเนื่องมาจากโครงสร้างภายในที่มีความพรุนต่ำ การศึกษาความคงตัวของไมโครแคปซูลที่เตรียมได้แสดงให้เห็นว่ากรดแอสคอร์บิกในไมโครแคปซูลที่เตรียมโดยใช้ 1.5% Tween80 ละลายตัวเร็วที่สุด

ภาควิชา เกษตรกรรม
สาขาวิชา เกษตรกรรม
ปีการศึกษา 2540

ลายมือชื่อนิติกร *ณัฐ วัฒนวิทย์*
ลายมือชื่ออาจารย์ที่ปรึกษา *พนิดา*
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม *อุบลทิพย์*

C875013 : MAJOR PHARMACY

KEY WORD: ASCORBIC ACID / MICROENCAPSULATION / COACERVATION / SOLVENT EVAPORATION / ETHYLCELLULOSE / STABILITY
DUSADEE VANICHTANUNKUL : MICROENCAPSULATION OF ASCORBIC ACID BY COACERVATION AND SOLVENT EVAPORATION TECHNIQUES.
THESIS ADVISOR : ASST. PROF. PANIDA VAYUMHASUWAN, Ph.D.
THESIS CO-ADVISOR : ASSO. PROF. UBONTHIP NIMMANNIT, Ph.D.
178 pp. ISBN 974-638-115-6

Ascorbic acid ethylcellulose-walled microcapsules were prepared by temperature induced coacervation and solvent evaporation techniques. Effects of core to wall ratios, types and amounts of plasticizers (i.e., triacetin, triethyl citrate, and dibutyl sebacate) on the properties of microcapsules prepared by coacervation technique and effects of ethylcellulose concentrations, core to wall ratios, types and amounts of surfactants (i.e., Span80 and Tween80) on the properties of microcapsules prepared by solvent evaporation technique were investigated. The temperature induced coacervation technique gave high yields (95%) and drug entrapments (100-104%) of irregular-shaped, aggregate microcapsules. The higher the core to wall ratio, the smaller the mean size and the greater the drug release rate. Thirty percent dibutyl sebacate was suitable for use as a plasticizer for slow released ethylcellulose-walled microcapsules. When the microcapsules were prepared by the solvent evaporation technique, the yields and drug entrapments ranged from 66-88% and 55-93%, respectively. Six percent ethylcellulose provided slow released and high yield microcapsules. The higher the core to wall ratio, the greater the mean size and the drug release rate. The higher concentration of Span80 increased drug release rate associated with presence of drug crystals on the microcapsule surface. The microcapsules prepared using 1.5% Tween80 showed the slowest release rate due to the less porous internal structure. The stability study indicated that ascorbic acid in the microcapsules with 1.5% Tween80 degraded the fastest.

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ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my thesis advisor, Assistant Professor Dr. Panida Vayumhasuwan and my co-advisor, Associate Professor Dr. Ubonthip Nimmannit for their supervision, guidance and encouragement. Their patience and kindness are also deeply appreciated.

I also wish to express deep appreciation to all members of the thesis committee for their suggestions and comments.

Special thanks are also extended to Chulalongkorn University for granting partial financial support to fulfill this study.

To my friends and all staff members of the Department of Pharmacy for their assistance and great encouragement.

Above all, I would like to express my infinite thanks and deepest gratitude to my family, especially, my parents for giving me the education opportunity, care, help, understanding, and encouragement.

Finally, I would like to express my thanks to all of those whose name have not been mentioned and those who in one way or another have helped to make this thesis a reality.

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LIST OF ABBREVIATIONS

| | | |
|-----------------|---|---|
| °C | = | degree celsius |
| conc. | = | concentration |
| cm | = | centimeter |
| cm ³ | = | cubic centimeter |
| CV | = | coefficient of variation |
| C:W | = | core to wall ratio |
| DBS | = | dibutyl sebacate |
| EC | = | ethylcellulose |
| EDTA | = | ethylenediaminetetraacetic acid |
| e.g. | = | for example (exempli gratia) |
| et al. | = | and others (et alii) |
| etc. | = | and so on (et cetera) |
| g | = | gram |
| h | = | hour |
| HLB | = | hydrophilic-lipophilic balance |
| HPLC | = | high performance liquid chromatography |
| i.e. | = | that is (id est) |
| K | = | release rate constant (% min ^{-1/2}) |
| k | = | degradation rate constant (% days ⁻¹) |
| M | = | molar |
| mg | = | milligram |
| min | = | minute |
| ml | = | milliliter |
| mM | = | millimolar |

| | | |
|------------------|---|--------------------------------------|
| MW | = | molecular weight |
| n | = | number of sample |
| nm | = | nanometer |
| no., # | = | number |
| o/o | = | oil in oil or organic solvent in oil |
| o/w | = | oil in water |
| P | = | probability |
| pp. | = | page |
| r | = | coefficient of correlation |
| r ² | = | coefficient of determination |
| rpm | = | revolutions per minute |
| R.H. | = | relative humidity |
| SD | = | standard deviation |
| SEM | = | scanning electron microscope |
| TA | = | triacetin |
| TEC | = | triethyl citrate |
| µg | = | microgram |
| µm | = | micrometer |
| UV | = | ultraviolet |
| USP | = | United States Pharmacopeia |
| Wt | = | weight |
| λ _{max} | = | wavelength of maximum absorption |
| % | = | percent |
| %w/v | = | percent weight by volume |
| %w/w | = | percent weight by weight |
| > | = | more than |
| < | = | less than |