

การใช้แป้งโซเดียมคาร์บอกซีเมทิล เป็นสารช่วยเอ็กซ์ทรูชันในการผลิตเพลเลต โดย  
กระบวนการเอ็กซ์ทรูชันและสเฟียโรไนเซชัน

นางสาว สุพิตรา นิยมธรรมกิจ



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USE OF SODIUM CARBOXYMETHYL STARCH AS EXTRUSION  
AID IN THE PRODUCTION OF PELLET BY EXTRUSION AND  
SPHERONIZATION PROCESS

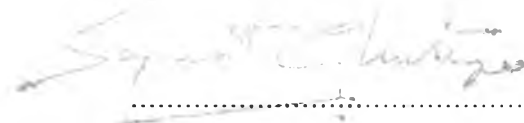
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By                         Miss Supattra Niyomthamakit  
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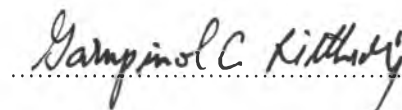
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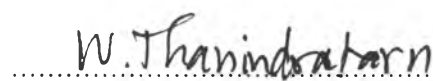



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พิมพ์ต้นฉบับบทคัดย่อวิทยานิพนธ์ภายในกรอบสี่เหลี่ยมนี้เพียงอย่างเดียว

สุพัตรา นิยมธรรมกิจ : การใช้แป้งโซเดียมคาร์บอกซีเมทิล เป็นสารช่วยเอ็กซ์ทรูชันในการผลิตเพลเลต โดยกระบวนการเอ็กซ์ทรูชันและสเฟียโรไนเซชัน (USE OF SODIUM CARBOXYMETHYL STARCH AS EXTRUSION AID IN THE PRODUCTION OF PELLET BY EXTRUSION AND SPHERONIZATION PROCESS.) อ.ที่ปรึกษา : รศ.ดร. พจน์ กุลวานิช, อ.ที่ปรึกษาร่วม : ผศ. วิเชียร ธานินทร์ธรราร, 291 หน้า, ISBN 974-638-858-4

การวิจัยนี้ได้ทำการดัดแปรแป้งข้าวเหนียวที่ได้จากธรรมชาติด้วยปฏิกิริยาแทนที่ทางเคมี เพื่อให้ได้แป้งโซเดียมคาร์บอกซีเมทิลที่มีระดับการแทนที่ในช่วงที่เหมาะสมแตกต่างกัน 3 ระดับ เพื่อนำมาประเมินคุณสมบัติในการใช้เป็นสารช่วยในการผลิตเพลเลตด้วยเทคนิคเอ็กซ์ทรูชัน/สเฟียโรไนเซชัน ได้ศึกษาคุณสมบัติทางกายภาพของเพลเลตที่เตรียมขึ้นโดยใช้สารตั้งต้นหลักแตกต่างกัน 3 ชนิดคือ ซูโครส แลคโตส และไดแคลเซียมฟอสเฟต ไดไฮเดรต ร่วมกับแป้งโซเดียมคาร์บอกซีเมทิล เปรียบเทียบกับเพลเลตที่ไม่มีแป้งดัดแปรนี้เป็นส่วนประกอบ จากผลการทดลองพบว่า ในสูตรตำรับเพลเลตที่ใช้ซูโครสมีลักษณะเป็นแท่งไม่เป็นอนุภาคทรงกลม ในสูตรตำรับเพลเลตของแลคโตสและไดแคลเซียมฟอสเฟตที่ใช้แป้งดัดแปรเป็นส่วนประกอบมีคุณสมบัติของเพลเลตดีขึ้นกว่าสูตรตำรับเพลเลตที่ไม่ใช้แป้งดัดแปร และพบว่าการใช้แป้งดัดแปรในสูตรตำรับทำให้การใช้ไมโครคริสตัลไลน์ เซลลูโลส ซึ่งมักใช้เป็นสารช่วยในการทำเพลเลตมีปริมาณที่ใช้ต่ำลง เพลเลตซึ่งเตรียมโดยใช้แป้งดัดแปรร่วมด้วยนี้จะมีขนาดอนุภาคเฉลี่ยใหญ่ขึ้น ความแข็งและความกลมมากขึ้น มีการเกาะกลุ่มกันระหว่างอนุภาคลดลงและมีพื้นผิวที่เรียบกว่าเพลเลตที่ไม่มีแป้งดัดแปร

ระดับการแทนที่ของแป้งดัดแปรที่แตกต่างกันไม่มีอิทธิพลที่มีนัยสำคัญต่อคุณสมบัติทางกายภาพโดยทั่วไปของเพลเลต แต่มีผลที่สำคัญต่อความแข็งและลักษณะพื้นผิว พบว่าเพลเลตของแลคโตสซึ่งประกอบด้วยแป้งดัดแปรที่มีระดับการแทนที่ 0.26 จะมีความแข็งสูงสุด ขณะที่เพลเลตของไดแคลเซียมฟอสเฟตจะมีความแข็งมากที่สุดเมื่อใช้แป้งดัดแปรที่มีระดับการแทนที่ 0.16 และ 0.32 นอกจากนี้การใช้แป้งดัดแปรที่มีระดับการแทนที่ 0.16 ในสูตรตำรับของไดแคลเซียมฟอสเฟต จะทำให้เกิดเพลเลตที่มีลักษณะพื้นผิวเรียบกว่าการใช้แป้งดัดแปรซึ่งมีระดับการแทนที่อื่น ๆ พบว่าปริมาณน้ำมีอิทธิพลที่สำคัญในกระบวนการเอ็กซ์ทรูชันและสเฟียโรไนเซชัน ปริมาณน้ำที่เพิ่มขึ้นจะทำให้เกิดเพลเลตที่มีขนาดใหญ่ขึ้น ความแข็งและความกลมเพิ่มขึ้น แต่ให้ลักษณะพื้นผิวที่ขรุขระมากขึ้น เมื่อปริมาณแป้งดัดแปรที่ใช้ในสูตรตำรับเพิ่มขึ้นจาก 0.3% ถึง 0.8% โดยน้ำหนัก จะทำให้คุณสมบัติบางประการของเพลเลตดีขึ้นกล่าวคือความแข็งและความเรียบของพื้นผิวมากขึ้น ผลจากการศึกษาความพรุนของเพลเลตแสดงให้เห็นว่าการใช้แป้งดัดแปรในสูตรตำรับแลคโตสไม่มีผลต่อความพรุน แต่ทำให้ความพรุนของเพลเลตไดแคลเซียมฟอสเฟตเพิ่มขึ้นเมื่อเปรียบเทียบกับสูตรตำรับที่ไม่ได้ใช้แป้งดัดแปร และพบว่าความพรุนของเพลเลตแลคโตสสูงกว่าของเพลเลตไดแคลเซียมฟอสเฟต

ภาควิชา ..... ภาควิชาอุตสาหกรรม .....  
สาขาวิชา ..... ภาควิชาอุตสาหกรรม .....  
ปีการศึกษา ..... 2541 .....

ลายมือชื่อนิสิต ..... กัญญา นงนภมกร .....  
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ลายมือชื่ออาจารย์ที่ปรึกษาร่วม ..... [ลายมือ] ✓ .....

## C875248 : MAJOR . MANUFACTURING PHARMACY

KEY WORD: SODIUM CARBOXYMETHYL STARCH / DEGREE OF SUBSTITUTION / PELLET / EXTRUSION AID / EXTRUSION-SPHERONIZATION

SUPATTRA NIYOMTHAMAKIT : USE OF SODIUM CARBOXYMETHYL STARCH AS EXTRUSION AID IN THE PRODUCTION OF PELLET BY EXTRUSION AND SPHERONIZATION PROCESS. THESIS ADVISOR : ASSOCIATE PROFESSOR POJ KULVANICH , Ph.D. THESIS CO-ADVISOR : ASSISTANT PROFESSOR WICHEIN THANINDRATARN 291 pp. ISBN 974-638-858-4

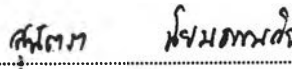
Native glutinous rice starch was chemically modified by etherification reaction to obtain sodium carboxymethyl starch with three different degrees of substitution and evaluated for their properties as the aid in pellet formulations produced by extrusion/spheronization technique. The physical properties of pellets prepared using three different pellet bases (sucrose , hydrous lactose and dicalcium phosphate dihydrate) in combination with this modified starch were characterized in comparison with blank pellets without adding modified starch. It was found that only rod shaped particles were generated in sucrose formulations prepared with modified starch. The improvable physical properties of lactose and dicalcium phosphate pellets employing modified starch could be obtained and the amount of microcrystalline cellulose which commonly used as the extrusion aid in pellet formulation could be decreased. Lactose and dicalcium phosphate pellets prepared with modified starches were larger in size , harder , more spherical , with less agglomeration and smoother surface than blank pellets.

The degrees of substitution of modified starch had a negligibly effect on the physical properties of pellets except hardness and surface characteristic. Among various degrees of substitution , the highest hardness of lactose pellets was yielded by using 0.26 degree of substitution whereas the hardest dicalcium phosphate pellets was obtained when using 0.16 and 0.32 degree of substitution. Moreover , modified starch at 0.16 degree of substitution produced dicalcium phosphate pellets with smoother surface than the others. The amount of added water played a critical role in extrusion/spheronization process. Increasing the amount of water imparted the greater size , hardness , sphericity and surface roughness. Using the higher amount of modified starch (increased from 0.3% to 0.8% w/w) could improve some pellet properties ,i.e. more hardness and surface smoothness. For porosity of pellets , the result showed that modified starch did not affect the porosity of lactose pellets while the porosity of dicalcium phosphate pellets using modified starch was higher than that of blank pellets. It was found that the porosity of lactose pellets was higher than that of dicalcium phosphate pellets.

ภาควิชา..... เกษษุตสาหกรรม

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ปีการศึกษา..... 2541

ลายมือชื่อนิสิต..... 

ลายมือชื่ออาจารย์ที่ปรึกษา..... 

ลายมือชื่ออาจารย์ที่ปรึกษาร่วม..... 

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## Abbreviations

°C	degree Celsius
BU	Brabender unit
DS	degree of substitution
GI	gastro-intestinal
gm	gram
M	milliequivalent of base required for neutralization of 1 gm of MGS
m <sup>2</sup> /gm	squaremeter per gram
MGS	modified glutinous rice starch
min	minute
ml	milliliter
µm	micrometer
mm	millimeter
N	Normality
rpm	rounds per minute
TS.	Test solution
VS.	Volumetric solution
w/w	weight by weight
6S <sub>(1)</sub>	65 % sucrose pellet formulations
7S <sub>(1)</sub>	70 % sucrose pellet formulations
8S <sub>(1)</sub>	80 % sucrose pellet formulations
9S <sub>(1)</sub>	90 % sucrose pellet formulations
6L <sub>(1)</sub>	65 % lactose pellet formulations
8L <sub>(1)</sub>	80 % lactose pellet formulations
6D <sub>(1)</sub>	65 % dicalcium phosphate pellet formulations
8D <sub>(1)</sub>	80 % dicalcium phosphate pellet formulations
( ) <sub>3(1)</sub>	pellet formulations using MGS produced by method A (DS = 0.32)
( ) <sub>2(1)</sub>	pellet formulations using MGS produced by method B (DS = 0.26)
( ) <sub>1(1)</sub>	pellet formulations using MGS produced by method C (DS = 0.16)