

การผลิตโปรตีนเซลล์เดียวจากมันสำปะหลังโดยยีสต์ผสมระหว่าง
Endomycopsis fibuligera และ *Candida utilis*



นาย เล หว่าง เจีญ

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

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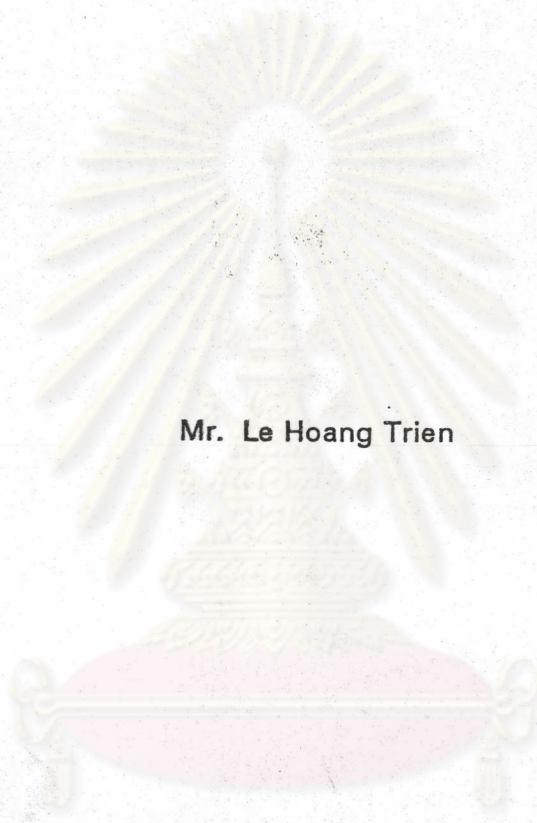
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PRODUCTION OF SINGLE CELL PROTEIN FROM CASSAVA BY MIXED
CULTURE OF *Endomycopsis fibuligera* AND *Candida utilis*



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A study on SCP production from cassava was performed in this research to find a suitable condition using Symba Yeast Process. For larger scale, experiments in a 60-litre tank were carried out to obtain essential data for process design aiming at low production cost and simple process rendering it suitable for developing countries.

The cultivation of E. fibuligera and C. utilis using cassava as carbon source in a mixed culture has shown that E. fibuligera can produce amylase for starch hydrolysis yielding sugar. Glucose produced is utilised for cell synthesis as soon as it is formed. Since C. utilis is fast-growing, the process yields a product substantially of Candida yeast. The starch hydrolysis by such enzyme can be performed at low temperature (30°C) and does not demand a corrosion resistant materials for equipment.

SCP can be obtained from dry cassava with a yield of 0.38 gram of dry biomass (33.8% protein content) per 1 gram of cassava. The process is as follows: dry cassava was ground to powder, dissolved in hot water at 35g/l then added 8.75 g of molasses and other nutrients. The cultivation was performed at room temperature (30°C) and pH 5.5 in a 60-litre tank equipped with two baffles and a shrouded six-flat-blade turbine at Reynolds number of 25,130 and aeration rate of 10.7 l/l broth per hour. A starter of E. fibuligera 5097 was used at 8%^v corresponding to the cell mass of 4.6 g/l. After 18 hour, C. utilis 5001 was added at 2 %^v. Cell mass is finally harvested at the 39th hour of cultivation.

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ลายมือชื่ออาจารย์ที่ปรึกษาร่วม.....



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Endomycopsis fibuligera และ Candida utilis (PRODUCTION OF SINGLE CELL PROTEIN FROM CASSAVA BY MIXED CULTURE OF Endomycopsis fibuligera AND Candida utilis) อ.ที่ปรึกษา ดร.

เพียรพรรค ทศคร, อ.ที่ร่วมปรึกษา ดร สุเมธ ชวเดช, 114 IBSN 974-584-503-5

ในงานวิจัยนี้ได้ศึกษาวิธีการหมัก เพื่อหาอัตราการผลิตโปรตีนเซลล์เดี่ยวจากมัน สำปะหลัง หา สภาวะ ที่เหมาะสมในการหมักแบบ Symba Yeast Process และทดลอง การหมักในถังหมักขนาด 50 ลิตร เพื่อให้ได้ข้อมูลสำหรับการขยายขนาด กระบวนการผลิตโปรตีนเซลล์เดี่ยวจากมันสำปะหลัง และหา วิธีการลดต้นทุนการผลิต เพื่อออกแบบกระบวนการผลิตที่เหมาะสมกับการใช้ในประเทศที่กำลังพัฒนาต่อไป

เมื่อทำการเลี้ยงยีสต์ Endomycopsis fibuligera และ Candida utilis ร่วม กัน โดยใช้แป้งมัน สำปะหลังเป็นองค์ประกอบหลัก E. fibuligera เป็นยีสต์ที่สามารถสร้าง amylase ซึ่งจะย่อยแป้งเป็นน้ำตาลกลูโคส ต่อจากนั้นน้ำตาลกลูโคส จะถูกยีสต์ C. utilis ใช้เป็น อาหารเพื่อการ เจริญเติบโต C. utilis มีอัตรา การแบ่งเซลล์ ที่สูงกว่า E. fibuligera ทำให้ผล ผลิตสุดท้ายประกอบ ด้วยเซลล์ของยีสต์ C. utilis เป็นส่วนใหญ่ การย่อยสลายแป้งแบบนี้ สามารถทำ ได้ที่อุณหภูมิห้องคือประมาณ 30 °C ไม่มีการใช้อุปกรณ์ที่ต้องทนต่อกรด ที่อุณหภูมิสูง ในช่วงเวลาที่ทำการ ย่อยแป้ง

ผลที่ได้จากการวิจัยแสดงว่า การผลิตโปรตีนเซลล์เดี่ยวจากมันสำปะหลังทำได้ดี โดยใช้มัน สำปะหลังตากแห้งมาต้ม และละลายในน้ำ 35 กรัมต่อลิตร เติมน้ำตาล 8.75 กรัมต่อลิตร และสารอาหาร เสริม หมักที่ pH 5.5 และอุณหภูมิ 30 °C ในถังกวนแบบมีครีบ 2 อัน ใช้ shrouded six-flat-blade turbine ที่ Reynolds number 25,130 และอัตราการให้อากาศ 10.7 ลิตรต่อลิตรของ สารหมักต่อชั่วโมง เริ่มโดย การเติมหัวเชื้อที่มี E. fibuligera 5097 ความเข้มข้น 4.5 กรัมต่อลิตร ลงไปในปริมาณ 8% ของสารหมัก หลังจากหมัก 18 ชั่วโมงก็เติมหัวเชื้อที่มี C. utilis 5001 เข้มข้น 4.5 กรัมต่อลิตร ลงไปในปริมาณ 2% ของสารหมัก หมักต่อไปอีก 21 ชั่วโมง จะได้ปริมาณโปรตีนสูงสุดที่ 4.6 กรัมต่อลิตร กล่าวคือได้ยีสต์แห้ง (โปรตีน 33.8%) 0.38 กรัมต่อมันสำปะหลัง 1 กรัม

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