

การผลิตแก๊สชีวภาพจากขยะกระดาษ โดยแบคทีเรียคูล์ชนิคชอบร้อน

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ศูนย์วิทยทรัพยากร

จุฬาลงกรณ์มหาวิทยาลัย

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

สาขาวิชาวิทยาศาสตร์สภาวะแวดล้อม

บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย

พ.ศ. 2539

ISBN 974-634-214-2

ลิขสิทธิ์ของบัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย

I 17318385

**BIOGAS PRODUCTION FROM PAPER WASTE BY  
THERMOPHILIC BACTERIAL COCULTURE**

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ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

**A Thesis Submitted in Partial Fulfilment of the Requirements**

**for the Degree of Master of Science**

**Inter-department of Environmental Science**

**Graduate School**

**Chulalongkorn University**

**1996**

**ISBN 974-634-214-2**



Thesis Title            Biogas Production from Paper Waste by Thermophilic Bacterial  
                                 Coculture  
By                            Mr. Supawin Watcharamul  
Inter-department        Environmental Science  
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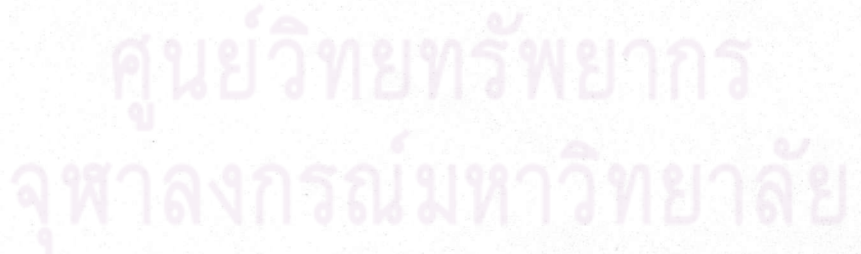
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ศุภวิน วัชรมูล : การผลิตแก๊สชีวภาพจากขยะกระดาษโดยแบคทีเรียกลุ่มชนิดชอบร้อน (BIOGAS PRODUCTION FROM PAPER WASTE BY THERMOPHILIC BACTERIAL COCULTURE)  
อ. ที่ปรึกษา : ผศ.ดร.ปิ่น-ฉวี เวชชานูเคราะห์, 131 หน้า. ISBN 974-634-214-2

แบคทีเรียชอบร้อนที่ย่อยสลายเซลลูโลสจำนวน 2 สายพันธุ์ ซึ่งคัดเลือกมาจาก 123 สายพันธุ์ ได้นำมาใช้ในการทดลอง โดยให้ชื่อสายพันธุ์ว่า C23 และ C73 พบว่าทั้งสองสายพันธุ์เมื่อย่อยเซลลูโลสแล้วจะได้อะซิเตทและแก๊สคาร์บอนไดออกไซด์ แบคทีเรียชอบร้อนที่สร้างแก๊สมีเทนจำนวน 3 สายพันธุ์ ซึ่งคัดเลือกมาจาก 147 สายพันธุ์ ได้นำมาใช้ในการทดลอง โดยให้ชื่อสายพันธุ์ว่า M38 M47 และ M48 พบว่า ทั้งสามสายพันธุ์สามารถใช้แก๊สคาร์บอนไดออกไซด์และอะซิเตทเป็นสารเริ่มต้นในการผลิตแก๊สมีเทน แบคทีเรียชอบร้อนทั้งหมดได้นำมาใช้ทดลองผลิตแก๊สชีวภาพจากเซลลูโลสบริสุทธิ์ ในโมโนคัลเจอร์พบว่า สารที่เกิดจากการย่อยสลายเซลลูโลสบริสุทธิ์ต่อหนึ่งกรัมของเซลลูโลสมีดังต่อไปนี้ อะซิเตท 0.523-0.605 มิลลิโมล และแก๊สคาร์บอนไดออกไซด์ 10.8-13.8 มิลลิโมล ส่วนการย่อยสลายเซลลูโลสโดยโคคัลเจอร์ ได้ทำการหาปริมาณกรดไขมันที่ระเหยได้ 3 ชนิด ได้แก่ อะซิเตท โพรไพโอเนท และบิวทิเรท พบว่า อะซิเตทเป็นกรดไขมันที่ระเหยได้ชนิดเดียวที่พบ ปริมาณของอะซิเตทและแก๊สคาร์บอนไดออกไซด์มีปริมาณลดลง ส่วนแก๊สมีเทนจะเกิดขึ้นจำนวน 4.73-6.54 มิลลิโมล ในการทดลองผลิตแก๊สชีวภาพจากขยะกระดาษ แบคทีเรียชอบร้อนที่ย่อยสลายเซลลูโลส สายพันธุ์ C23 และ C73 ผลิตอะซิเตท 1.04-1.16 มิลลิโมลต่อขยะกระดาษหนึ่งกรัม และแก๊สคาร์บอนไดออกไซด์ 10.95-13.40 มิลลิโมลต่อขยะกระดาษหนึ่งกรัม จากนั้นนำมาโคคัลเจอร์กับแบคทีเรียชอบร้อนที่สร้างแก๊สมีเทน พบว่าปริมาณของอะซิเตทและแก๊สคาร์บอนไดออกไซด์มีปริมาณลดลงทั้งหมด ปริมาณแก๊สมีเทนจะค่อย ๆ เกิดขึ้นจำนวน 4.97-6.73 มิลลิโมลต่อขยะกระดาษหนึ่งกรัม จากโคคัลเจอร์ทั้งหมดหาคู่พบว่า คู่ของแบคทีเรียชอบร้อนที่ย่อยสลายเซลลูโลสสายพันธุ์ C23 และแบคทีเรียชอบร้อนที่สร้างแก๊สมีเทนสายพันธุ์ M48 สามารถผลิตแก๊สมีเทนได้ปริมาณสูงที่สุด แบคทีเรียคู่นี้จึงจะนำไปประยุกต์ใช้ในการบำบัดขยะกระดาษเพื่อผลิตแก๊สชีวภาพต่อไป



ภาควิชา ..... สหสาขา .....  
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ลายมือชื่ออาจารย์ที่ปรึกษาพร้อม ..... - .....



## C526358 : MAJOR ENVIRONMENTAL SCIENCE

KEY WORD: BIOGAS / THERMOPHILIC METHANOGEN / CELLULOLYTIC BACTERIA /  
COCULTURE / PAPER WASTE

SUPAWIN WATCHARAMUL : BIOGAS PRODUCTION FROM PAPER WASTE BY  
THERMOPHILIC BACTERIAL COCULTURE. THESIS ADVISOR : ASSIST. PROF.  
PIN-CHAWEE VEJJANUKROH, Ph.D. 131 pp. ISBN 974-634-214-2

Two of 123 strains of the thermophilic cellulolytic bacteria were selected and named C23 and C73. The fermentation products of cellulose were acetate and carbon dioxide. Three of 147 strains of the thermophilic methanogens were selected and named M38, M47, and M48. They all utilized carbon dioxide and acetate as substrates for methane production. The fermentation of pure cellulose by thermophilic cellulolytic bacteria in the absence and presence of thermophilic methanogens was studied. In the monoculture, millimoles of products per gram of cellulose fermented were : acetate, 0.523-0.605; and carbon dioxide, 10.8-13.8. In the coculture of cellulose fermentation, the amounts of volatile fatty acids (acetate, propionate, and butyrate) were determined. Acetate was the only volatile fatty acid found. Acetate and carbon dioxide contents decreased whereas substantial amounts of methane were produced (4.73-6.54 mmol/g cellulose). In the fermentation of paper waste, the monocultures of the thermophilic cellulolytic bacteria strain C23 and C73 produced 1.04-1.16 mmol acetate/g paper waste and 10.95-13.40 mmol carbon dioxide/g paper waste. In the presence of thermophilic methanogens, acetate and carbon dioxide decreased in all six coculture combinations, and methane was formed at 4.97-6.73 mmol/g paper waste. Among the six combinations for biogas production, the coculture of thermophilic cellulolytic bacteria strain C23 and thermophilic methanogen strain M48 produced the highest amount of methane. The pair would be suitable for further investigations in paper waste treatment for biogas production.

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ภาควิชา INTER - DEPARTMENT

สาขาวิชา ENVIRONMENTAL SCIENCE

ปีการศึกษา 1995

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## ACKNOWLEDGEMENT

I wish to express my utmost appreciation and sincere gratitude to my thesis advisor, Assistant Professor Dr. Pin-Chawee Vejjanukroh, for her valuable suggestion, assistance, guidance, time spent discussing on various aspects, and strong encouragement during the thesis work.

It is a pleasure to acknowledge the Department of General Science, Faculty of Science; the Gas Chromatography Unit and the Scanning Electron Microscopic Unit, the Scientific and Technological Instrument Center, Chulalongkorn University, for offering laboratory facilities in the research.

I also would like to express my appreciation to Assistant Professor Dr. Kumthorn Thirakhupt, Associate Professor Dr. Chaufah Thongthai, Assistant Professor Dr. Sirirat Rengpipat, and Dr. Pienpak Tasakorn, the members of thesis committee, for their valuable advice.

My sincere gratitude is due to Mrs. Judy Brown and Mrs. Peggy McNutt, my former microbiology and chemistry teachers at Montgomery Blair High School, Maryland, USA, for their suggestion and ideas.

Very special thanks are due to Assistant Professor Dr. Somkiat Piyathiratitivorakul, the Department of Marine Science, for offering a camera-equipped microscope and Mr. Chainamm Prempreechakul for lending a crimper for aluminum seal and a gas regulator throughout my anaerobic works.

I must thank the following people and friends for their help and strong encouragement; Assistant Professor Dr. Jariya Suchareekul, Mrs. Suneey Panichtharasit, Mrs. Rujiporn Prateepasen, Mrs. Naiyanan Ariyakanon, Ms. Warintorn Manosittisak, Ms. Mukda Chea, Mr. Chaiwat Ngamjettanawat, Ms. Sasidhorn Buddhawong, Ms. Premruedee Chamchalio, Mr. Roj Khun-anake, staff at the Faculty of Science's library, and staff at the Department of General Science.

Thanks to Ms. Whitney F. Small at Burson-Marsteller (Thailand) Ltd. for giving me a chance to further my education while working.



I am indebted to the Graduate School of Chulalongkorn University for financial assistance to partly undertake the research. Also, a two-year scholarship awarded by the University Development Committee (UDC), Ministry of University Affairs, is fully acknowledged.

As the last opportunity, I would like to express my wholeheartedly thanks, dedication and the deepest appreciation to my beloved father and mother, my younger sister, my grandparents, and Mr. Witthaya Choenubol for their moral and financial supports, continuous assistance, precious suggestion, and strong encouragement.



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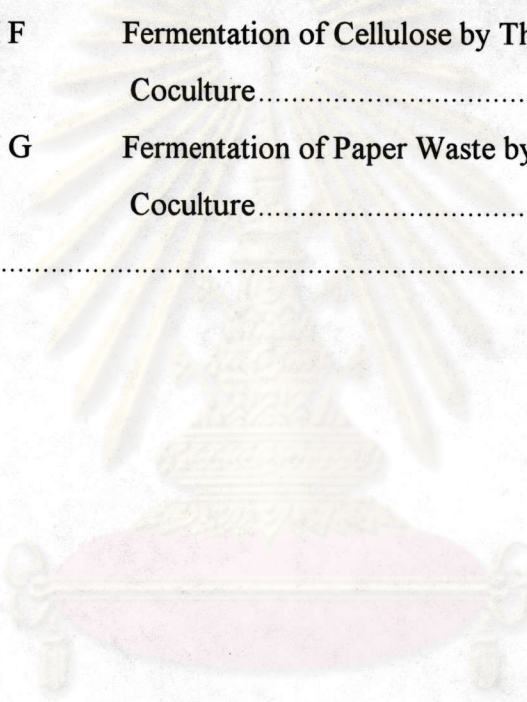
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## ABBREVIATION

°C	=	Degree Celcius
µg	=	Microgram
µl	=	Microliter
µmol	=	Micromole
16s rRNA	=	Sixteen Svedberg Units Ribosomal RNA
BMA	=	Balch's Medium II Agar
BMB	=	Balch's Medium II Broth
CA	=	Cellulose Agar
CB	=	Cellulose Broth
CH <sub>4</sub>	=	Methane
cm	=	Centimeter
CO <sub>2</sub>	=	Carbon Dioxide
Da	=	Dalton
DNA	=	Deoxyribonucleic Acid
g	=	Gram
G + C	=	Guanine + Cytosine
H <sub>2</sub>	=	Hydrogen
K	=	Degree Kelvin
Kg	=	Kilogram
L	=	Liter
lb	=	Pound
m	=	Meter
mµ	=	Millimicron
mA	=	Milliampere
mg	=	Milligram
min	=	Minute
ml	=	Milliliter
mm	=	Millimeter
mmol	=	Millimole



mol	=	Mole
N <sub>2</sub>	=	Nitrogen
NaOH	=	Sodium Hydroxide
O <sub>2</sub>	=	Oxygen
RNA	=	Ribonucleic Acid
Temp	=	Temperature
tRNA	=	Transfer RNA
V	=	Volume
VFA	=	Volatile Fatty Acid
W	=	Weight



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