

การศึกษาเกี่ยวกับการผลิตน้ำส้มสายชูจากน้ำสับปะรดโดยวิธีการหมักแบบเร็ว



นางสาว สุภมาศ ภมรบุตร

005075

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษิตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

แผนกวิชาเคมีเทคนิค

บัณฑิตวิทยาลัย จุฬาลงกรณมหาวิทยาลัย

พ.ศ. ๒๕๒๐

STUDY OF VINEGAR PRODUCTION FROM PINEAPPLE JUICE
BY RAPID FERMENTATION

Miss Supamart Bhamorabut

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science
Department of Chemical Technology
Graduate School
Chulalongkorn University

1977

Accepted by the Graduate School, Chulalongkorn University
in partial fulfillment of the requirements for the degree of
Master of Science.

Visid Prachuabmoh.

.....
(Professor Dr. Visid Prachuabmoh)

Dean

K. San Euanont
Thesis CommitteeChairman

(Assistant Professor Dr. Kiartchai Santiyanont)

Pong Vananuvat
.....Member

(Assistant Professor Dr. Pong Vananuvat)

Napha Lotong
.....Member

(Assistant Professor Napha Lotong)

Sumalee Pichyangkura
.....Member

(Assistant Professor Dr. Sumalee Pichyangkura)

Thesis Advisor: Assistant Professor Dr. Somsak Damronglerd and
Achan Kunlaya Thiemmanynate.

Copyright 1976

by

The Graduate School
Chulalongkorn University

Thesis Title : Study of Vinegar Production from Pineapple Juice
by Rapid Fermentation.

By : Miss Supamart Bhamorabut.

Department : Chemical Technology.

48 ชั่วโมง ในทางตรงข้าม ถ้าเพิ่มอัตราความเร็วของอากาศให้มากขึ้น จะเป็นผลให้
จำนวนกรดที่เกิดขึ้นลดต่ำลง เพราะอัลกออฮอ์และกรดน้ำส้มที่เกิดขึ้นสูญเสียไปจากการ
ระเหย การควบคุมอัตราการไหลของน้ำสาก็มีผลต่อช่วงระยะเวลาที่ต้องการในการ
หมัก คือถ้าใช้อัตราการไหลของน้ำสาเร็วขึ้นก็จะกินเวลาในการหมักนานขึ้น

Thesis Title Study of Vinegar Production from Pineapple
Juice by Rapid Fermentation

Name Miss Supamart Bhamorabut

Department Chemical Technology

Academic Year 1976

ABSTRACT

Two steps of fermentation were performed. Firstly, the pineapple juice was fortified with sucrose to give 18-20 degree Brix of 18-20^o and adjusted pH to 4.5 by adding NaOH or H₃PO₄. Dipotassium hydrogen phosphate 0.5% was supplemented as an internal source of phosphate in the alcoholic fermentation. The fermentation was carried out in 25 litres bottle under anaerobic condition and high alcohol producing strains of Saccharomyces ellipsoideus was used as the inoculum. The fermentation was completed within 4 days with alcohol content of about 11%. The fermented liquor was kept for 2-3 weeks after fermentation in order to settle down the yeast cells and pineapple pulp.

Secondly, the fermentation of acetic acid by rapid or generator method consisted of a glass column, which its diameter of 4 "and length of 48", packed loosely with sterile bamboo shoot shavings. These shavings were inoculated by passing with the Acetobacter aceti culture grown in acetobacter broth several times. Then the clear fermented pineapple juice was trickled

from the stock bottle through the column. More than 4% of acetic acid was achieved after 60 hours. The addition of phosphate and acidification in the fermented pineapple juice by using 0.5% K_2HPO_4 and about 1% acetic acid were done in order to optimize the acetobacter culture medium for the increase of both acid yield and the efficiency of the fermentation. On the other hand, high flow rate of air pump caused the poor yield of acid on the reason of the evaporation of alcohol and acid produced. High fermented juice flow rate prolonged the fermenting time.

In our country, the process of fermented vinegar making is naturally operated with the slow process which take too long fermenting time for 1-3 months. This rapid method will be more useful because it take a shorter period of the fermentation but the manufacturing process is much more delicate.

ACKNOWLEDGEMENT

The author is grateful to Dr. Somsak Damronglerd, for his constant encouragement, useful suggestion and keen interest throughout her work. She also wish to thank Dr. Pong Vananuvat, Achan Kunlaya Thiemmanynate, and Achan Vanna Tulyatun for their advice.

Special thank to Assistant Professor Napha Lotong (Head of the Microbiology section, Department of Biology, Kasetsart University) and Miss Sermsir Kongsak (Department of Science, Ministry of Industry) for providing her with the cultures used in this work.

Financial support by the Faculty of Science, Chulalongkorn University.

CONTENTS

	Page
Abstract (Thai).....	iv
Abstract (English).....	vi
Acknowledgement.....	viii
List of Tables.....	xi
List of Figures.....	xii
Chapter	
I INTRODUCTION.....	1
II LITERATURE REVIEW..	4
2.1 Pineapple Juice.....	4
2.2 Vinegar.....	5
2.3 General Requirements for Alcoholic Fermentation	8
2.4 General Requirements for Acetic Acid Fermentation..	12
2.5 Methods of Manufacture	17
III EXPERIMENTS	21
3.1 Preparation of Pineapple Juice	21
3.2 Method of Analysis	21
3.3 Alcoholic Fermentation	25
3.4 Acetic Acid Fermentation..	29



	Page
IV RESULTS...	35
4.1 Qualities of Pineapple Juice	35
4.2 The Growth of <u>S.ellipsoideus</u>	35
4.3 Effect of Some Nutrients	36
4.4 Effect of Nutrient Concentration	37
4.5 Effect of Sugar Concentration	37
4.6 Change of pH, °Brix, and % Alcohol...	38
4.7 The Growth of <u>Acetobacter aceti</u> ..	38
4.8 Effect of Recycling on Acetic Acid Fermentation	39
4.9 Effect of Phosphate on Acetic acid Fermentation	40
4.10 Effect of Acidification..	40
4.11 Effect of Air Flow Rates	41
4.12 Effect of Fermented Juice Flow Rates	41
V DISCUSSION	56
VI CONCLUSION AND RECOMMENDATION	63
Bibliography	66
Appendix	72
Vita	75

LIST OF TABLES

Table	Page
1. A Typical Proximate Analysis of Pineapple Juice ...	5
2. Effect of Nutrients $(\text{NH}_4)_2\text{HPO}_4$ and K_2HPO_4 on the Utilization of Pineapple Juice for Alcoholic Fermentation ...	42

LIST OF FIGURES

Figures	Page
1. Flow Diagram of Pineapple Juice Extraction... ..	22
2. Flow Diagram of Vinegar Manufacture..	23
3. Schematic Diagram of the Laboratory-Type Generator Column... ..	31
4. The Growth of Yeast, <u>S.ellipsoideus</u> , in Term of Optical Density..	43
5. The Growth of Yeast, <u>S.ellipsoideus</u> , in Term of Number of Cells..	44
6. Effect of Concentration of Nutrient, K_2HPO_4 , on the Alcoholic Fermentation by <u>S.ellipsoideus</u> ...	45
7. Effect of Sugar Levels on the Utilization of Pineapple Juice for Alcoholic Fermentation... ..	46
8. Change of pH value during Alcoholic Fermentation of Pineapple Juice by <u>S.ellipsoideus</u>	47
9. Change of Degree Brix during Alcoholic Fermentation of Pineapple Juice by <u>S.ellipsoideus</u>	48

	Page
10. Change of Percent Alcohol during Alcoholic Fermentation of Pineapple Juice by <u>S.ellipsoideus</u>	49
11. The Growth of <u>Acetobacter aceti</u> in Term of Optical Density... ..	50
12. Effect of Recycling on the Rate and Efficiency of Acetic Acid Fermentation.. ...	51
13. Effect of Adding 0.5% K_2HPO_4 to the Fermented Pineapple Juice on the Rate and Efficiency of Acetic Acid Fermentation.. ...	52
14. Effect of Adding 0.5% K_2HPO_4 and Acetic Acid to the Fermented Pineapple Juice on the Rate and Efficiency of Acetic Acid Fermentation	53
15. Effect of Air Flow Rates on the Rate and Efficiency of Acetic Acid Fermentation... ..	54
16. Effect of Fermented Juice Flow Rates on the Rate and efficiency of Acetic Acid Fermentation	55