

**DESIGN OF SPRAY DISTILLATION APPARATUS FOR
ETHANOL PURIFICATION**

By

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

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ABSTRACT

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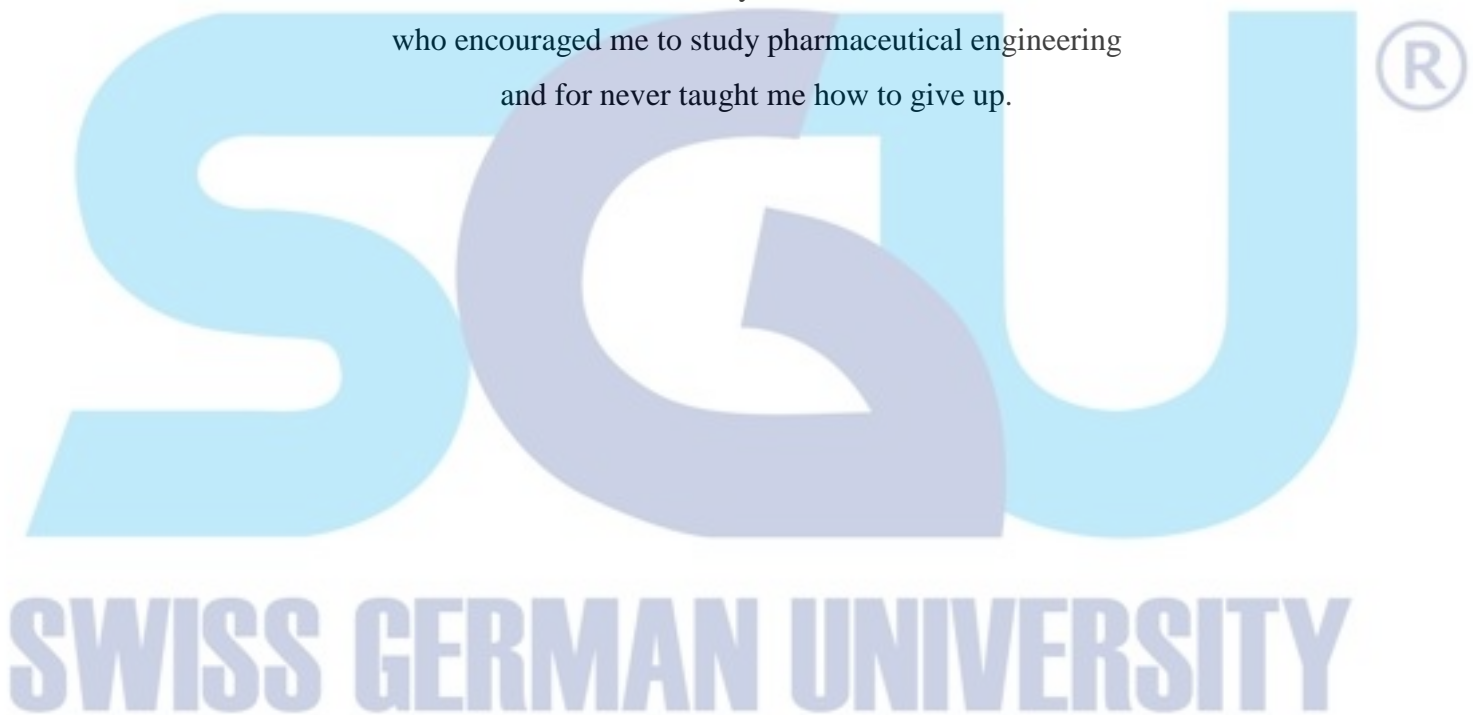
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One of the major problem in bioethanol production is the high amount of energy required for distillation. Alternative methods such as vacuum distillation and pervaporation were developed, however energy required to obtain vacuum condition still pose some problem. Utilizing diffusion and evaporation in droplets may further lower the energy needed for separation since it increases the droplet surface area. This research aims to develop a sprayed feed distillation column for ethanol purification and evaluating its performance in various feed concentrations. Mass, energy, and momentum balance of droplet mixture was used to develop droplet model behavior in the column. Numerical simulation of droplet behavior model was used to determine the height of the column. From this simulation, the ideal droplet falling distance for evaporation was estimated to be 50.84 cm. A prototype was assembled using diameter of 25 cm and height of 70 cm, equipped with spray nozzle. Using 250 ml feed with 12-70% v/v ethanol concentration, the process could produce output concentration of 83-93%. Whereas feed concentration of 96% ethanol could produce ethanol concentration output up to 99% v/v. The process could recover 40-80% of ethanol from the feed.

Keywords: distillation, ethanol-water separation, separation technology, droplet evaporation, mathematical modelling



To my father,
who encouraged me to study pharmaceutical engineering
and for never taught me how to give up.



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TABLE OF CONTENTS

| | |
|---|----|
| STATEMENT BY THE AUTHOR..... | 2 |
| ABSTRACT..... | 3 |
| ACKNOWLEDGEMENTS..... | 6 |
| LIST OF FIGURES | 9 |
| LIST OF TABLES | 9 |
| Chapter 1 - INTRODUCTION | 10 |
| 1.1 Background | 10 |
| 1.2 Research Problems..... | 12 |
| 1.3 Research Objectives..... | 12 |
| 1.4 Significance of Study..... | 12 |
| 1.5 Research Questions..... | 12 |
| 1.6 Hypotheses | 12 |
| Chapter 2 - LITERATURE REVIEW | 13 |
| 2.1 Distillation in Ethanol as Fuel Production..... | 13 |
| 2.2 Ethanol-Water Distillation Theory..... | 15 |
| 2.3 Droplet Evaporation..... | 17 |
| 2.3.1 Evaporation as Mass Transfer Operation..... | 17 |
| 2.3.2 Mathematical Model of Droplet Evaporation | 18 |
| Chapter 3 – RESEARCH METHODS..... | 21 |
| 3.1 Research Framework..... | 21 |
| 3.2 Mathematical Modelling | 22 |
| 3.2.1 Derivation of Droplet Partial Vaporization Mass Balance | 23 |
| 3.2.2 Derivation of Droplet Partial Vaporization Energy Balance | 24 |
| 3.2.3 Development of Droplet Momentum Balance | 24 |
| 3.2.4 Mathematical Model Simulation..... | 25 |
| 3.3 Prototyping and Model Validation..... | 25 |
| 3.3.1 Equipment Design..... | 25 |
| 3.3.2 Prototype Testing | 26 |
| 3.3.3 Analysis..... | 27 |
| Chapter 4 – RESULTS AND DISCUSSION | 28 |
| 4.1 Design of the Separation Column..... | 28 |

| | |
|---|----|
| 4.1.1 Mass Balance Calculation..... | 28 |
| 4.1.2 Energy Balance Calculation..... | 30 |
| 4.1.3 Momentum Balance Calculation..... | 34 |
| 4.1.4 Height of the Column..... | 35 |
| 4.1.5 Design Justifications | 39 |
| 4.2 Performance Evaluation..... | 40 |
| 4.2.1 Process Outlet Purity..... | 41 |
| 4.2.2 Process Yield | 48 |
| Chapter 5 – CONCLUSION | 50 |
| 5.1 Conclusions | 51 |
| 5.2 Recommendations | 51 |
| GLOSSARY | 53 |
| REFERENCES | 54 |
| APPENDICES | 58 |
| Appendix 1. Graphical representation of the mathematical models | 58 |
| Appendix 2. Technical drawing of spray distillation column..... | 60 |
| Appendix 3. 3D model of spray distillation column..... | 61 |
| Appendix 4. Sample of outlet purity calculation | 62 |
| Appendix 5. Graphical representation of the effect of various feed concentration to the separation factor | 63 |
| CURRICULUM VITAE..... | 64 |



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