ACKNOWLEDGEMENT

The first acknowledgement goes to no one but Jesus Christ, for His strength to push me forward to fulfill this thesis entitled \textit{THE EFFECT OF KOMBU FERMENTATION ON THE ANTIOXIDANT ACTIVITY OF BOTTLE GOurd (Lagenaria siceraria Standl. Mol.) JUICE}, without Him I am nothing. This thesis is written as partial requirement of obtaining the degree of \textit{Sarjana Teknologi Pertanian Strata Satu} in Food Technology Department, Faculty of Industrial Technology of Universitas Pelita Harapan.

There has been so many help, support, guidance, and prayers invested during the making of this internship report. For the honor of these people, the writer would like to present gratitude to these contributors.

1. Prof. Dr. L. Broto S. Kardono, Apt. as the Supervisor for this thesis, who has given his time, guidance, patience, and intelligence given during the making of this thesis.

2. Ms. Julia Ratna Wijaya, MAppSc as Co-Supervisor for her time, continuous guidance, support, ideas, and inspiration throughout the process of finishing this thesis.

3. Mrs. Nuri Arum Anugrahati, MP as the head of Food Technology Department for the opportunity to make this thesis.

4. My father (Yonathan Wiryoahadi) and my mother (Swissa Flora); for the support, push, and effort they have put for the fulfillment of this thesis.
5. Samuel Derian who has unconditionally backing me up throughout the progress of this thesis making.

6. Ms. Ria and Ms. Sugi for their marvelous help during this research

7. Mr. Jeremia Manuel Halim as the head of quality control laboratory, Mr. Adolf Parhusip as the head of biology laboratory, Mrs. Sisi Patricia as the head of food processing laboratory, Mrs. Natania as the head of chemistry laboratory, and Ms. Ratna Handayani, MP as the head of Food Research Laboratory for allowing the writer to use the laboratory with all the equipment during the research.

8. Mr. Hendra, Mr. Rudi, Mr. Aji, and Mr. Donny as the laboratory assistants for the time spent in the extra hours, help, and guidance during the making of this research.

9. Kezia Daniela, Isaura Petrina, Maria Clarissa, Jessica Siswadi, and Felicya as friends under the same supervision for the help, support, and laughter shared throughout research and thesis making.

10. Jessica Ignacia, Jefri Sanjaya Kho, Joshua Andrew Mulia, and Lauralia Bernetta for the help, ideas, and support during the thesis making.

11. All members of C class Food Technology 2008 that has been a big help in the process of finishing this thesis.

12. All of the people and relatives that have a great contribution in the making of this thesis report that cannot be mentioned one by one.

The writer realizes that this report is not perfect, therefore any critics and suggestions are welcome. This thesis is expected to be able to provide useful
information and scientific knowledge to those who read it. Finally, the writer
would also like to give a big thank you to the readers for the attention, suggestion,
and critics to this report.

Karawaci, July 2012

Writer
TABLE OF CONTENTS

ABSTRACT ........................................................................................................................................... i
ACKNOWLEDGEMENT ................................................................................................................... vi
LIST OF FIGURES .......................................................................................................................... xi
LIST OF TABLES ............................................................................................................................. xii
LIST OF APPENDICES .................................................................................................................... xiii

CHAPTER I INTRODUCTION

1.1 Background .................................................................................................................................. 1
1.2 Research Problem ...................................................................................................................... 2
1.3 Objectives .................................................................................................................................. 3
1.3.1 General Objective ................................................................................................................ 3
1.3.2 Specific Objectives .............................................................................................................. 3

CHAPTER II LITERATURE REVIEW

2.1 Bottle Gourd ............................................................................................................................... 4
2.2 Antioxidant ............................................................................................................................... 5
2.2.1 Polyphenols ..................................................................................................................... 6
2.2.2 Flavonoids ....................................................................................................................... 9
2.3 Fermentation ............................................................................................................................. 10
2.3.1 Kombu Fermentation ...................................................................................................... 11
CHAPTER III MATERIALS AND METHODS

3.1 Materials and Equipments..................................................................................13
3.2 Research Steps ....................................................................................................13
  3.2.1 Preliminary Research Steps .........................................................................13
  3.2.2 Main Research Steps ....................................................................................14
  3.2.3 Analysis .......................................................................................................15
3.3 Experimental Design ..........................................................................................17
  3.3.1 Preliminary Research Step Experimental Design .......................................17
  3.3.2 Main Research Step Experimental Design ...............................................17

CHAPTER IV RESULTS AND DISCUSSIONS

4.1 Preliminary Research Stage ..............................................................................19
  4.1.1 Proximate Analysis .....................................................................................19
  4.1.2 Antioxidant Activity ...................................................................................19
4.2 Main Research Stage ..........................................................................................20
  4.2.2 Total Phenolic Content .............................................................................23
  4.2.3 Total Flavonoid Content ............................................................................25
4.3 LC-MS-MS Analysis of Fermented Bottle Gourd Juice with Highest Antioxidant Activity ..............................................................27

CHAPTER V CONCLUSION AND SUGGESTION

5.1 Conclusion .........................................................................................................30
5.2 Suggestion ..........................................................................................................30

BIBLIOGRAPHY ........................................................................................................31

APPENDICES ..........................................................................................................35
LIST OF FIGURES

Figure 2.1 Bottle gourd ................................................................. 4
Figure 2.2 Activity of antioxidant as a radical scavenger ................... 5
Figure 2.3 Chemical structure of polyphenol groups .......................... 8
Figure 2.4 Some of phenolic compounds in plants ............................ 9
Figure 2.5 Kombu tea ................................................................. 11
Figure 2.6 Kombu culture ............................................................. 12
Figure 3.1 Preliminary research steps ............................................ 14
Figure 3.2 Main research steps ..................................................... 15
Figure 4.1 Antioxidant activity of fermented bottle gourd drink (expressed in IC$_{50}$) ................................................................. 22
Figure 4.2 Total phenolic content of fermented bottle gourd juice ....... 24
Figure 4.3 Total flavonoid content of fermented bottle gourd juice ..... 26
Figure 4.4 Isoquercitrin chemical structure .................................... 28
Figure 4.5 Oleanolic acid chemical structure ................................. 29
LIST OF TABLES

Table 3.1 Treatments for main research stage.........................................................17

Table 4.1 Antioxidant activity (expressed in IC₅₀) of bottle gourd clear juice......20
LIST OF APPENDICES

Appendix 1 Calculation of juice concentration from total dissolved solid measurement..................................................36

Appendix 2 IC\textsubscript{50} of Clear Juice..........................................................37

Appendix 3 IC\textsubscript{50} of \textit{kombu} bottle gourd juice...........................................39

Appendix 4 Statistical analysis of DPPH (IC\textsubscript{50}) of fermented bottle gourd juice..45

Appendix 5 Gallic Acid standard curve.................................................................47

Appendix 6 Total phenolic in fermented bottle gourd juice.................................48

Appendix 7 Statistical analysis of total phenolic content.....................................50

Appendix 8 Quercetin standard curve.................................................................52

Appendix 9 Total flavonoid in fermented bottle gourd drink..................................53

Appendix 10 Statistical analysis of total flavonoid content....................................55

Appendix 11 Moisture content of bottle gourd......................................................57

Appendix 12 Ash content of bottle gourd............................................................58

Appendix 13 Total fat content of bottle gourd......................................................59

Appendix 14 Protein content of bottle gourd..........................................................60

Appendix 15 Total carbohydrate content in bottle gourd.....................................61

Appendix 16 Taxonomy analysis of bottle gourd...................................................62

Appendix 17 LC-MS-MS analysis of chosen fermented bottle gourd juice.........63