

ACKNOWLEDGMENTS

Praise the Lord Jesus Christ for His blessing and guidance in the completion of this thesis report entitled “THE UTILIZATION OF BLACK NIGHTSHADE (*Solanum nigrum* L.) JUICE IN FERMENTED BEVERAGE”. This thesis is written as partial fulfillment of the academic requirements to obtain the degree of *Sarjana Teknologi Pertanian Strata Satu* in Department of Food Technology, Universitas Pelita Harapan, Tangerang.

The author realized this report would not be successfully completed without the help and support from many parties. Therefore, the author would like to express gratitude to:

1. Ms. C.C. Nurwitri, DAA as the main supervisor who has given guidance, support, time and advices to the author throughout thesis preparation until it is completed.
2. Ms. Yuniwaty Halim, MSc as the co-supervisor and the Head of Quality Control Laboratory who has given guidance, support, time and advices to the author throughout thesis preparation until it is completed.
3. Ms. Julia Ratna Wijaya, MAppSc as the Head of Food Technology Department for the opportunity in conducting this research.
4. Ms. Ratna Handayani, MP, Ms. Natania, M.Eng, Ms. Sisi Patricia L.A. Gultom, M.Eng, and Dr. Ir. Melanie Cornelia, MT as the Heads of Research, Food Processing, Microbiology and Chemistry Laboratories, respectively.

5. Mr. Yosafat, Ms. Merri, Mr. Darius, Mr. Adzie, and Mr. Hendra who had helped the author during the work in laboratories.
6. Beloved family for the support and motivation for the the author during thesis completion.
7. All of the lecturers and staff of Food Technology Department of UPH for the assistance and help given to the author during thesis completion.
8. Diana Effendi, Rosselin Leona, and Alfindra Ersanko who worked under the same main supervisor for the support and help during the thesis completion.
9. Christine, Chyntia Dwi Anggraini, Tiara Cahyadi, Virly, Riorita Tandyputri, Caroline Pangestu, Elisabeth Herman, Yolanda, Frisca Christabella, Cindy Irawati, Tiffany Harianto, Jimmy Jaya Nugraha, Yohanes Cahya, and Hong Fu Sheng for their help and support during thesis completion.
10. All member of Food Technology 2012 and all seniors (especially Vincent Halim, Robert Gunawan, and Naufal Diosep Chandra) and juniors from Food Technology Department for their help, guidance and support during thesis research.
11. All friends and relatives who are not yet mentioned but have supported and helped the author during thesis completion.

The author realizes that this report is still far from perfect. Therefore, any criticism and suggestions for this report are welcomed. Lastly, the author hoped that this report would be useful and informative for readers.

Tangerang, February 4th, 2016

Author

TABLE OF CONTENTS

	page
COVER	
STATEMENT OF THESIS AUTHENTICITY	
APPROVAL BY THESIS SUPERVISORS	
APPROVAL BY THESIS EXAMINATION COMMITTEE	
ABSTRACT	v
ACKNOWLEDGMENTS	vi
TABLE OF CONTENTS	viii
LIST OF FIGURES	xii
LIST OF TABLES	xv
LIST OF APPENDICES	xvi
CHAPTER I INTRODUCTION	
1.1 Background.....	1
1.2 Research problem	2
1.3 Objectives	2
1.3.1 General objective	3
1.3.2 Specific objective	3
CHAPTER II LITERATURE REVIEW	
2.1 Black nightshade (<i>Solanum nigrum</i> L.)	4
2.2 Fermentation	6
2.2.1 Lactic acid fermentation	8
2.2.2 Alcoholic fermentation	8
2.3 Nutrients requirement for microorganisms.....	10
2.3.1 Carbon and nitrogen	10
2.3.2 Minerals	10
2.3.3 Vitamins and other growth factors	10

2.3.4 Water	11
-------------------	----

CHAPTER III RESEARCH METHODOLOGY

3.1 Materials and equipment.....	12
3.2 Research methodology.....	13
3.2.1 Research stage I.....	13
3.2.2 Research stage II.....	14
3.3 Experimental design	16
3.3.1 Research stage I.....	16
3.3.2 Research stage II.....	18
3.4 Method of analysis.....	20
3.4.1 Organoleptic analyses.....	20
3.4.1.1 Ranking test (Watts, <i>et al.</i> , 1989 and Rothe, 1988)	20
3.4.1.2 Scoring test (Watts, <i>et al.</i> , 1989 and Rothe, 1988)	20
3.4.1.3 Hedonic test (Watts, <i>et al.</i> , 1989 and Rothe, 1988)	21
3.4.2 Physical Analysis.....	21
3.4.2.1 Color analysis (Zhang, <i>et al.</i> , 2015 with modification) ..	21
3.4.3 Chemical Analyses	21
3.4.3.1 Antioxidant activity - DPPH Radical Scavenging Assay (Amin and Lee, 2005 with modification).....	21
3.4.3.2 Alcohol content (AOAC, 2005).....	22
3.4.3.3 pH analysis (AOAC, 2005).....	23
3.4.3.4 Total titratable acidity (AOAC, 2005)	23
3.4.3.5 Volatile acid (Badan Standardisasi Nasional, 1996 with modification)	24
3.4.3.6 Total dissolved solid (AOAC, 2005)	24
3.4.3.7 Total reducing sugar (Badan Standardisasi Nasional, 1992).....	25
3.4.4 Microbial Analyses.....	27
3.4.4.1 Total yeast count using hemocytometer (Harisha, 2006 with modification)	27
3.4.4.2 Total yeast count and total plate count (AOAC, 2005)...	28

3.4.4.3 <i>Escherichia coli</i> (Badan Standardisasi Nasional, 2006) .	28
3.4.4.4 <i>Staphylococcus aureus</i> (Badan Standardisasi Nasional, 2011).....	30
3.4.5 Proximate analysis.....	30
3.4.5.1 Moisture content (AOAC, 2005).....	30
3.4.5.2 Ash content (AOAC, 2005).....	31
3.4.5.3 Fat content.....	31
3.4.5.3.1 Soxhlet extraction method (AOAC, 2005).....	31
3.4.5.3.2 Weibull method (Badan Standardisasi Nasional, 1992)	31
3.4.5.4 Protein content using Kjeldahl method (AOAC, 2005)..	32
3.4.5.5 Carbohydrate content (AOAC, 2005)	33

CHAPTER IV RESULTS AND DISCUSSION

4.1 Black Nightshade Juice Preparation	34
4.1.1 Ranking Test.....	34
4.2 Black Nightshade Fermented Beverage.....	35
4.2.1 Physical analysis.....	37
4.2.1.1 Color.....	37
4.2.2 Chemical analysis	38
4.2.2.1 Antioxidant activity (IC ₅₀)	38
4.2.2.2 Alcohol content	40
4.2.2.3 pH.....	41
4.2.2.4 Total Titratable Acidity.....	42
4.2.2.5 Volatile acid	45
4.2.2.6 Total Dissolved Solid.....	46
4.2.2.7 Total Reducing Sugar.....	48
4.2.3 Microbial analysis	49
4.2.4 Organoleptic analysis	51
4.2.4.1 Color.....	51
4.2.4.2 Alcoholic Aroma.....	53
4.2.4.3 Alcoholic Taste	57

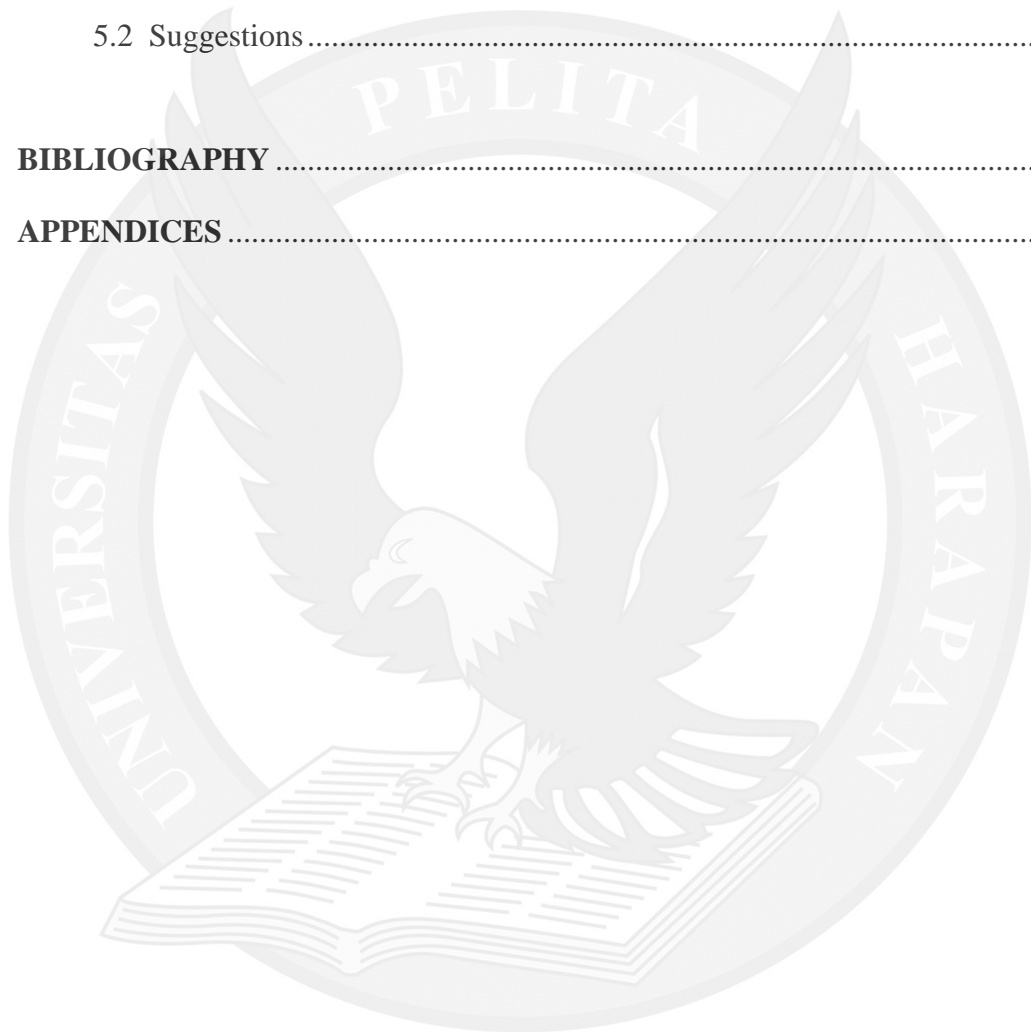
4.2.4.4 Bitter Aftertaste	61
4.2.4.5 Overall Acceptance	65
4.3 Selected Black Nightshade Fermented Beverage	66
4.4 Proximate Analysis	67

CHAPTER V CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions	68
5.2 Suggestions	69

BIBLIOGRAPHY	70
---------------------------	----

APPENDICES	73
-------------------------	----



LIST OF FIGURES

	page
Figure 2.1 Black nightshade (<i>Solanum nigrum</i> L.) fruits.....	5
Figure 3.1 A flowchart of the black nightshade juice making	14
Figure 3.2 A flowchart of the black nightshade fermented beverage making	16
Figure 4.1 Lightness of black nightshade fermented beverage with different fermentation period and sugar concentration	37
Figure 4.2 IC ₅₀ value of black nightshade fermented beverage with different fermentation period and sugar concentration	39
Figure 4.3 Alcohol content of black nightshade fermented beverage with different fermentation period and sugar concentration	40
Figure 4.4 pH of black nightshade fermented beverage with different fermentation period and sugar concentration	42
Figure 4.5 Total titratable acidity of black nightshade fermented beverage with different fermentation period	43
Figure 4.6 Total titratable acidity of black nightshade fermented beverage with different sugar concentration.....	44
Figure 4.7 Volatile acid content of black nightshade fermented beverage with different fermentation period and sugar concentration	45
Figure 4.8 Total dissolved solid of black nightshade fermented beverage with different fermentation period and sugar concentration	47
Figure 4.9 Total reducing sugar of black nightshade fermented beverage with different fermentation period	48
Figure 4.10 Total reducing sugar of black nightshade fermented beverage with different sugar concentration	49

Figure 4.11	Mean color scoring value of black nightshade fermented beverage with different fermentation period and sugar concentration.....	51
Figure 4.12	Mean color acceptance value of black nightshade fermented beverage with different fermentation period	52
Figure 4.13	Mean color acceptance value of black nightshade fermented beverage with different sugar concentration.....	53
Figure 4.14	Mean alcoholic aroma scoring value of black nightshade fermented beverage with different fermentation period	54
Figure 4.15	Mean alcoholic aroma scoring value of black nightshade fermented beverage with different sugar concentration.....	54
Figure 4.16	Mean alcoholic aroma acceptance value of black nightshade fermented beverage with different fermentation period	56
Figure 4.17	Mean alcoholic aroma acceptance value of black nightshade fermented beverage with different sugar concentration	56
Figure 4.18	Mean alcoholic taste scoring value of black nightshade fermented beverage with different fermentation period	58
Figure 4.19	Mean alcoholic taste scoring value of black nightshade fermented beverage with different sugar concentration.....	58
Figure 4.20	Mean alcoholic taste acceptance value of black nightshade fermented beverage with different fermentation period	59
Figure 4.21	Mean alcoholic taste acceptance value of black nightshade fermented beverage with different sugar concentration	60
Figure 4.22	Mean bitter aftertaste scoring value of black nightshade fermented beverage with different fermentation period	61
Figure 4.23	Mean bitter aftertaste scoring value of black nightshade fermented beverage with different sugar concentration.....	62
Figure 4.24	Mean bitter aftertaste acceptance value of black nightshade fermented beverage with different fermentation period	63

Figure 4.25 Mean bitter aftertaste acceptance value of black nightshade fermented beverage with different sugar concentration 64

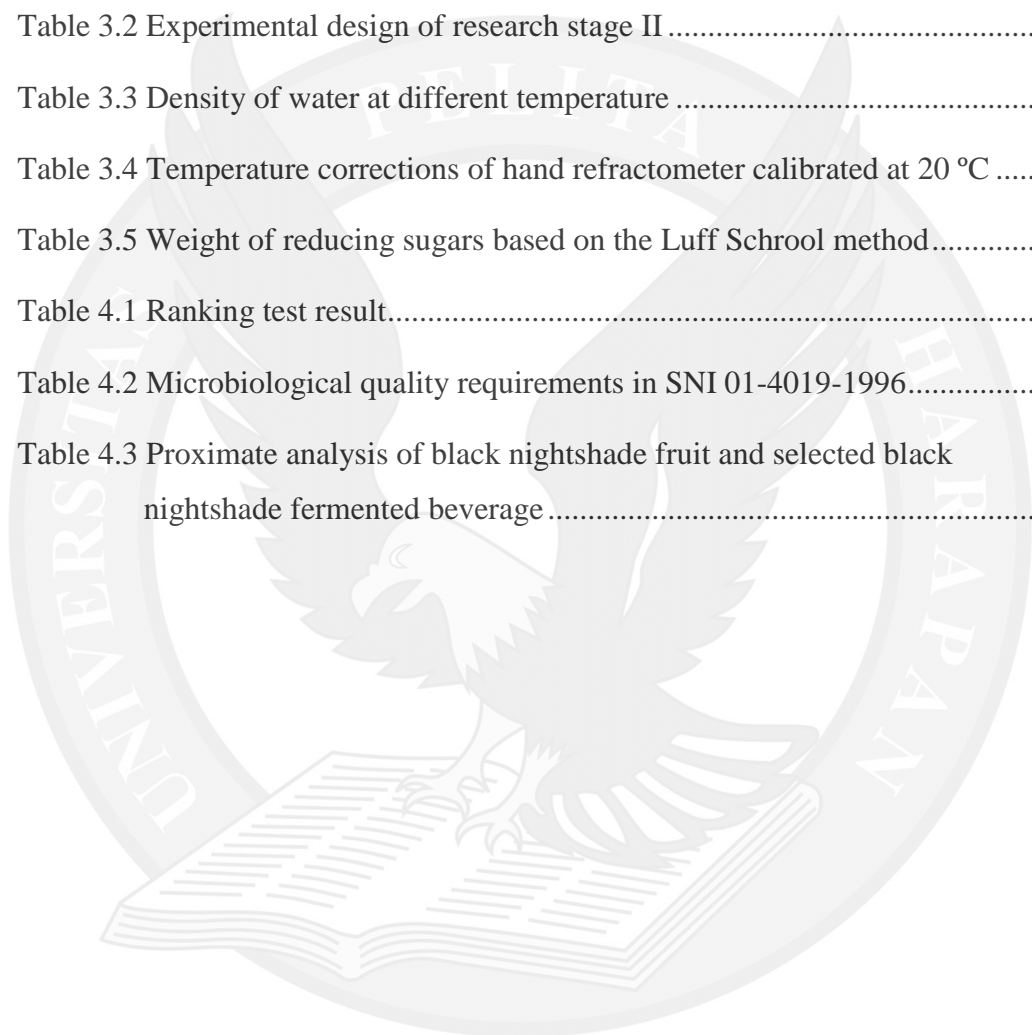
Figure 4.26 Mean overall acceptance value of black nightshade fermented beverage with different fermentation period 65

Figure 4.27 Mean overall acceptance value of black nightshade fermented beverage with different sugar concentration..... 65



LIST OF TABLES

	page
Table 2.1 The nutrition value of <i>Solanum nigrum</i> in 100 gram.....	6
Table 3.1 Experimental design of research stage I	17
Table 3.2 Experimental design of research stage II	18
Table 3.3 Density of water at different temperature	23
Table 3.4 Temperature corrections of hand refractometer calibrated at 20 °C	25
Table 3.5 Weight of reducing sugars based on the Luff Schrool method.....	27
Table 4.1 Ranking test result.....	35
Table 4.2 Microbiological quality requirements in SNI 01-4019-1996.....	50
Table 4.3 Proximate analysis of black nightshade fruit and selected black nightshade fermented beverage	67



LIST OF APPENDICES

	page
Appendix A. Black Nightshade Identification Test	A-1
Appendix B. Organoleptic Analysis of Black Nightshade Juice	B-1
Appendix C. Yeast Count in “Fermipan” Instants Yeast.....	C-1
Appendix D. Physical Analysis of Black Nightshade Fermented Beverage	D-1
Appendix E. Chemical Analyses of Black Nightshade Fermented Beverage	E-1
Appendix F. Microbial Analyses of Black Nightshade Fermented Beverage	F-1
Appendix G. Organoleptic Analyses of Black Nightshade Fermented Beverage	G-1
Appendix H. Proximate Analyses	H-1

