****

**A STUDY ON PREPARATION AND PRESERVATION OF FERMENTED BEVERAGES FROM GRAPE, APPLE & BARLEY**

**Submitted by**

**Himel Dutta**

Roll No: 01-15/04

Registration No: 275

Session: January-June, 2015-2016

**A thesis submitted in the partial fulfillment of the requirements for the degree of Master of Science in Food processing and Engineering**

**Department of Food processing and Engineering**

**Faculty of Food Science and Technology**

**Chittagong Veterinary and Animal Sciences University**

**Chittagong-4225, Bangladesh**

**DECEMBER 2016**

**Authorization**

I hereby declare that I am the sole author of the thesis. I also authorize the Chittagong Veterinary and Animal Sciences University (CVASU) to lend this thesis to other institutions or individuals for the purpose of scholarly research. I further authorize the CVASU to reproduce the thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

I, the undersigned, and author of this work, declare that the electronic copy of this thesis provided to the CVASU library, is an accurate copy of the print thesis submitted, within the limits of the technology available.

**Himel Dutta**

**December, 2016**

**A STUDY ON PREPARATION AND PRESERVATION OF FERMENTED BEVERAGES FROM GRAPE, APPLE & BARLEY**

**Submitted by**

**Himel Dutta**

**Roll No: 01-15/04**

**Registration No: 275**

**Session: January-June, 2015-2016**

**This is to certify that we have examined the above Master’s thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made**

**-------------------------------------------------------------**

**Supervisor**

**Md. Kauser-Ul-Alam**

**Assistant Professor**

**Department of Food Processing and Engineering**

**Faculty of Food science and Technology**

**-------------------------------------------------------**

**Shireen Akther**

**Assistant Professor & Head**

**Department of Food Processing and Engineering**

**Faculty of Food science and Technology**

**(Chairman of the Examination Committee)**

**Chittagong Veterinary and Animal Sciences University**

**Khulshi, Chittagong-4225, Bangladesh**

**DECEMBER 2016**

***Dedication***

I dedicate this small piece of work

to my beloved parents

**Acknowledgements**

Firstly, I would like to express my deepest sense to GOD, who enables me to complete the research work and dissertation successfully for the degree of Master of Science (MS) in Food Processing and Engineering. This thesis is the result of hard work whereby I have been accompanied and supported by many peoples. It is a pleasant aspect that I now have the opportunity to express my gratitude to all of them.

I deem it is a proud privilege to acknowledge my gratefulness, heartfelt gratitude and best regards to my honorable research supervisor Md. Kauser-Ul-Alam, Assistant professor, Department of Food Processing and Engineering, Chittagong Veterinary and Animal Sciences University (CVASU) for his continuous inspiration, valuable suggestions and affectionate feelings during the entire period of research work. The door to Md. Kauser-Ul-Alam office was always open whenever I ran into a trouble spot or had a question about my research or writing. He consistently allowed this paper to be my own work, but steered me in the right the direction whenever he thought I needed it. It was my great pleasure and amazing experience to work under his supervision.

I would also like to thank my honorable madam Shireen Akther, Head of the department, Food processing & Engineering; CVASU; who was involved in the validation survey for this research project, for managing to read the whole thesis so thoroughly and for helpful comments on the text. With immense pleasure, I express my indebtedness to her kind cooperation and supports.

I sincerely thank to the directorate of research and extension, CVASU for giving me research grant to accomplish my research work. I also wish to acknowledge the Department of Food Processing and Engineering and Poultry Research and Training centre (PRTC), CVASU for providing me all the lab facilities.

Author

December, 2016

**Table of Contents**

|  |  |  |
| --- | --- | --- |
| **CHAPTER** | **TITLE** | **PAGES** |
|  | Authorization | ii |
|  | Acknowledgements | v |
|  | List of Figures | vii |
|  | List of Tables | viii |
|  | Abstracts | ix |
| Chapter One | Introduction | 1 |
|  | 1.1 Objectives | 3 |
| Chapter Two | Review of Literature | 4 |
| Chapter Three | Materials and Methods | 12 |
|  | 3.1 Materials and methods for Grape fermentation | 12 |
|  | 3.2 Materials and methods for Apple fermentation | 15 |
|  | 3.3 Materials and methods for Barley fermentation | 17 |
| Chapter Four | Results & Discussions | 20 |
|  | 4.1 Results for Grape fermentation | 20 |
|  | 4.2 Discussions for grape fermentation | 21 |
|  | 4.3 Results for Apple fermentation | 22 |
|  | 4.4 Discussions for apple fermentation | 23 |
|  | 4.5 Results for Barley fermentation | 24 |
|  | 4.6 Discussions of Barley fermentation | 25 |
|  | 4.7 Sensory evaluation of fermented products | 25 |
| Chapter Five | Conclusions | 28 |
| Chapter Six | Recommendations and future perspectives | 29 |
|  | List of References | 30 |
|  | Appendix-1 : Picture Gallery | 32 |
|  | Brief Biography | 33 |
|  |  | |
|  | **List of Figures** |  |
|  | Fig.1. Microbiologically sterile nutrient broth of *Saccharomyces cerevisiae* | 10 |
|  | Fig.2. Microbiologically sterile enzyme of *Aspergillus kawachi* | 11 |
|  | Fig.3. Samples taken from the fermentation of grape | 12 |
|  | Fig.4. Samples taken from the fermentation of apple | 15 |
|  | | |
|  | **List of Tables** |  |
|  | Table 1. pH of wine after regular intervals of time period | 20 |
|  | Table 2.Sugar concentration of wine after regular intervals of time period | 20 |
|  | Table 3. Ethanol concentration of wine after regular intervals of time period | 21 |
|  | Table 4. pH of Cider after regular intervals of time period | 22 |
|  | Table 5. Sugar concentration of Cider after regular intervals of time period | 22 |
|  | Table 6. Ethanol concentration of Cider after regular intervals of time period | 23 |
|  | Table 7. pH of beer after regular intervals of time period | 24 |
|  | Table 8. Sugar concentration of beer after regular intervals of time period | 24 |
|  | Table 9. Ethanol concentration of beer after regular intervals of time period | 24 |
|  | Table 10. Sensory evaluation of wine fermentation | 25 |
|  | Table 11. Sensory evaluation of cider fermentation | 26 |
|  | Table 12. Sensory evaluation of beer fermentation | 26 |
|  | Table 13. Summary of sensory evaluation of grape, apple and barley fermentation | 27 |

**Abstract**

The study focuses on fermented beverages production using grape, apple and barley. Fermentation is performed by *Saccharomyces cerevisiae* for grape and apple & fermentation of barley is done by using *Aspergillus kawachi*. During experiment growth of yeast cell, total solid contents and degree of liquor alcohol was considered critically. The various alcoholic compounds was analyzed with selective method of gas chromatography. Results obtained in the present study indicates that volume of all compounds like ethyl acetate (p*<*0.01) at 125 μmol/L, propyl alcohol (p*<0.05* and p*<*0.01, respectively), isobutyl alcohol (p*<*0.01), isoamyl acetate decreased (p<0.05) at 4mg/l, isoamyl alcohol and ethyl formate (p*<*0.01 or 0.001) was increased with the function of time during fermentation. While during ageing process the contents of methyl acetate, ethyl acetate, isoamyl acetate and ethyl lactate was increased but isoamyl alcohol decreased. The levels of propylalcohol and isobutyl alcohol fell after short period of time. However, no significance effects of ageing process on methyl acetate, ethyl acetate, isobutyl alcohol, isoamyl alcohol and ethyl lactate (p>0.05) was observed. Whereas significance effects of ageing on the propyl alcohol and isoamyl acetate (p<0.05) was observed. Alcoholic compounds & ageing process is considered also affects color, flavor, aroma, consistency and overall acceptability. A shelf life study was carried out on all the fermented beverage product for 90days.