EFFECT OF MICROWAVING AND SELF-LIFE EVALUATION STUDY OF HEALTHY FLOUR AT AIR- CONDITION STORAGE.

BY

ARUMUGAM INTHUJA.

DEPARTMENT OF AGRICULTURAL CHEMISTRY

FACULTY OF AGRICULTURE

EASTERN UNIVERSITY

SRI LANKA

2017

ABSTRACT.

Wheat is most widely produced cereal grain in the world after maize and rice for human consumption. Healthy flour which include here are "Whole grain wheat flour" and "Chakki Atta". Whole wheat flour is increasingly popular as research continues reveal the benefits of whole grains and for industry offers more whole grain options for customers. The purpose of this review is to address self-life issues that are unique to whole grain flour. Self-life of whole grain flour is shorter compared to white flour due to the presence of lipid and lipid degrading enzyme. Lipolytic degradation leads to reduction in functionality, palatability and nutritional properties, strategies to stabilize whole grain flour have been focused on controlling lypolytic enzyme activity. Whole grains are a source of multiple nutrients and dietary fibre, recommended for children and adults in several daily servings containing variety of food that meet whole grain-rich criteria. "Chakki Atta" which is mostly used in rural areas. Chakki Atta is ground wheat without any addition or subtraction, and is thus in more neutral form.

The present study was conducted at Prima Ceylon Pvt Ltd, to evaluate the quality changes that could be occurred in the Healthy flour during the storage of 12 weeks and also to study the effect of microwaving in the quality of the flour; Two treatments were designed to each flour for the experiment which was conducted within air-conditioned room. Whole grain wheat flour (Micro waved & Non-Microwaved) & Chakki Atta flour (Micro waved & Non-Microwaved) were packed in polyethylene bags separately as Microwaved & Non-microwaved and evaluated for quality changes 12 weeks under air-conditioned storage temperature. The physicochemical properties analysis (Moisture, Protein Ash, Wet Gluten, Colour, Fat acidity, Crude Fat, Crude Fibre, sieve test and smell test), biological properties analysis (weevils count by sieve test 355µm) and

sensory evaluation were conducted in weekly interval and finally products (Healthy cake & Chapatti) were developed from each flour & sensory characteristics of end products were evaluated by using seven hedonic scale method at the end of each month. Results were analysed by statistical software (SAS) for analysis of variance.

The study showed that there was no any significant differences in the quality parameters of whole grain wheat flour such as moisture, protein, ash, smell, Crude fibre and crude fat whilst wet gluten colour and fat acidity had significant changes over twelve weeks. Microwaving have a distinct effect on moisture, colour and fat acidity whereas other parameters remains equally same. On the other hand, physiochemical properties of chakki atta such as colour, protein, crude fat and fat acidity have changed with the storage period and microwaving treatment prominently influenced on moisture , wet-gluten, colour, protein, ash and fat acidity. There was no any weevils infestation found for both flour. Sensory characteristics of end products also not affected by storage for both flours. It was found from this study that, it is so obvious that these flours can be best used for three months from the date of manufacture.

It can be recommended that the study period should be extended at least to 9 months to study the changes in the flour properties minutely because 3 months is fairly shorter. Furthermore, microbial test can be included to find out the extent of microbial contamination since microbial contamination is a fact of self-life and further analysis can be included other than sensory evaluation to evaluate minutely about texture (Chapatti and Cake) for the product developed from healthy flour. Ultimately it can be suggested that Nitrogen (N_2) gas packaging can be practiced instead of microwaving thermal treatment.

TABLE OF CONTENTS.

ABSTRACT i

ACKNOWLEGEMENT iii

TABBLE OF CONTENTS iv

LIST OF TABLES. x

LIST OF FIGURES. xi

CHAAPTER 01

1.0 Introduction. 1

1.1 Objectives.

1.1.1 General Objective. 10

1.1.2 Specific Objectives. 10

CHAPTER 02

2.0 Review of Literature. **11**

2.1 Wheat. 11

2.1.1 Wheat Kernel. 12

2.1.2 Wheat Grain Anatomy. 12

2.1.3 Components and composition of Wheat Kernel. 12

2.2 Chemical Properties of Wheat Grain. 14

2.2.1 Carbohydrate in Wheat. 16

2.2.2 Wheat Protein. 17

2.2.3 Lipids. 21

2.2.4 Fibre. 23

2.2.5 Vitamins. 26

2.2.5.1 Tocols. 26

2.2.5.2 Carotenoids. 27

2.2.6 Minerals. 28

2.2.6.1 Zinc and Iron (Zn & Fe). 28

2.2.6.2 Selenium (Se). 29

2.2.7 Enzymes. 29

2.3 Milling. 31

2.3.1 Product Control. 33

2.3.2 Cleaning the Wheat. 34

2.3.3 Magnetic Separator. 34

2.3.4 Disc Separator. 34

2.3.5 Scourer. 35

2.3.6 Conditioning the Wheat Tempering. 35

2.3.7 Impact Scourer. 35

2.3.8 Grinding the Wheat. 35

2.3.9 Miller's Skill. 36

2.3.10 Sifters. 36

2.3.11 Purifiers. 37

2.3.12 Bleaching Flour. 38

2.3.13 Enrichment. 38

2.4 Wheat Flour. 39

2.4.1 All-Purpose Flour. 39

2.4.2 Bleached All-Purpose Flour. 39

2.4.3 Unbleached All-Purpose Flour. 40

2.4.4 Bread Flour. 40

2.4.5 Self-rising Flour. 40

2.4.6 Cake Flour. 40

2.4.7 Semolina. 40

2.4.8 Whole Wheat Flour. 41

2.5 Whole Grain Flour. 41

2.5.1 Overview. 41

2.5.2 Benefits. 42

2.5.3 Drawback. 42

2.6 Chakki Atta. 43

2.6.1 Overview. 43

2.6.2 Chapatti. 44

2.7 Storage of Wheat Flour. 46

2.8 Environmental factors affecting wheat flour quality during storage. 47

2.8.1 Water activity. 47

2.8.2 Temperature. 48

2.8.3 Relative Humidity. 49

2.9 Aging of Wheat flour. 49

2.10 Physical and chemical changes during flour storage. 52

2.10.1 Effect of storage and aging on baking properties of wheat flour. 53

2.10.2 Effect of storage and aging on wheat starch. 54

2.10.3 Effect of storage and aging on wheat protein and gluten. 54

2.10.4 Effect of storage and aging on wheat lipids. 55

2.11 Packaging materials used to pack wheat flours. 55

2.12 Dry storage of wheat flour. 56

2.13 Self-life of wheat flour. 57

2.14 Wheat flour quality. 58

2.14.1 Quality components of the wheat flour and proximate analysis. 58

2.14.1.1 Physical parameters. 59

2.14.1.1.1 Moisture. 59

2.14.1.1.2 Colour. 61

2.14.1.1.3 Sieve test. 62

2.14.1.2 Chemical Analysis.

2.14.1.2.1 Protein. 62

2.14.1.2.2 Ash. 63

2.14.1.2.3 Wet Gluten. 63

2.14.1.2.4 Crude Fibre. 64

2.14.1.2.5 Crude Fat. 65

2.14.1.3 Biochemical Analysis.

2.14.1.3.1 Fat acidity. 66

2.14.1.4 Baking properties. 67

2.14.1.4.1 Preparation of Healthy cake. 67

2.14.1.4.2 Preparation of Chapatti. 67

2.14.1.4.3 Sensory Evaluation of Healthy'cake and Chapatti. 67

CHAPTER 03

3.0 Methods and Methodology. 68

3.1 Location of the study. 68

3.2 Experiment time period. 68

3.3 Study design. 69

3.4 Materials. 69

3.5 Physicochemical properties analysis.

3.5.1 Smell Test. 70

3.5.2 Sieve Test. 70

3.5.3 Long Moisture analysis. (Hot Air Oven Method) 70

3.5.4 Moisture NIR. (Near Infrared Ray) 72

3.5.5 Wet Gluten. 72

3.5.6 Colour Test. 73

3.5.7 Protein content. (NIR) 74

3.5.8 Ash content. (NIR) 74

3.5.9 Crude Fat. 75

3.5.10 Crude Fibre. 77

3.6 Biochemical Analysis.

3.6.1 Fat acidity. 79

3.7 Biological Analysis.

3.7.1 Sieve Test. 82

3.8 Product Development.

3.8.1 Healthy cake from Superfine Whole Grain General Purpose Flour. 82

3.8.2 Preparation of Chapatti from Chakki Atta. 83

3.9 Sensory Evaluation. 84

3.10 Statistical Analysis. 84

CHAPTER 04

4.0 Results and Discussion.

4.1 Smell Test. 85

4.2 Sieve Test. 86

4.3 Long Moisture. 88

4.4 Moisture NIR. 90

4.5Wet-Gluten. 92

4.6 Colour. 95

4.7 Protein NIR 97

4.8 Ash NIR. 100

4.9 Crude Fat. 102

4.10 Crude Fibre. 105

4.11 Fat Acidity. 107

4.12 Sieve Test- Weevil count. 109

4.13 Sensory Evaluation. 110

4.12.1 Healthy Cake. 110

4.12.2 Chapatti. 112

CHAPTER 05

5.0 CONCLUTION. 115

CHAPTER 06

References. 116

APPENDIXES.

Statistical Analysis Results.