

# LIST OF CONTENTS

Chapter	Page
<b>I INTRODUCTION.....</b>	<b>1</b>
Statement of problem .....	1
Objectives of the study .....	3
Expected Benefits.....	3
Scope of the Study.....	3
<b>II LITERATURE REVIEW.....</b>	<b>4</b>
Rice Flour .....	4
Properties of Rice flour .....	6
Effect of milling type on product .....	7
Effect of amylose content on product .....	10
Effect of particle size on product .....	11
Crackers.....	12
Substituted wheat products .....	14
Hydrocolloids .....	16
Spoilage of biscuits and cracker.....	18
<b>III REREARCH AND METHODOLOGY .....</b>	<b>21</b>
List of Materials and Equipments .....	21
Cracker preparation .....	24
Experimental Design.....	25
<b>IV RESULTS AND DISCUSSION.....</b>	<b>34</b>
Effect of rice cultivar and amylose content on rice cracker qualities.....	34
Effect of flour milling types on rice cracker qualities.....	40
Effect of particle size on rice cracker qualities .....	42
Effect of different hydrocolloids on qualities of rice crackers.....	45

## LIST OF CONTENTS (CONT.)

Chapter	Page
Sensory evaluation of rice crackers.....	60
Shelf-life Study of rice cracker during 6 month storage .....	74
<b>V CONCLUSION AND RECOMMENDATION .....</b>	<b>85</b>
Conclusion.....	85
Recommendation.....	86
<b>REFERENCES .....</b>	<b>87</b>
<b>APPENDIX .....</b>	<b>92</b>
<b>BIOGRAPHY .....</b>	<b>109</b>

## LIST OF TABLES

Tables	Page
1 Proximate composition of rough rice and its milling fractions at 14 percent moisture .....	5
2 Vitamin and mineral content of rough rice and its milling fractions at 14 percent moisture .....	5
3 Chemical properties of rice flour .....	6
4 Key characteristics of cracker and cookie dough.....	13
5 Gel consistency, amylose and protein contents of various cultivar of rice.....	34
6 Physical and chemical properties of rice crackers made of flour from.	35
7 Physical and chemical properties of rice crackers made of flour from.	41
8 Color value of rice crackers made of flour from various milling types	42
9 Properties of rice crackers from various particle sizes.....	44
10 Effect of particle size on color of rice crackers shown by values of L*, a*, b*, hue angle and chroma .....	44
11 Effect of hydrocolloids on color of mixed-flour blend rice crackers shown by values of L*, a*, b*, hue angle and chroma .....	52
12 Effect of hydrocolloids on sensory characteristic of cracker samples ..	59
13 The binomial test for percent observation frequency on the color of samples.....	65
14 The binomial test for percent observation frequency on the surface appearance of samples .....	66
15 The binomial test for percent observation frequency on the butter odor of samples .....	67
16 The binomial test for percent observation frequency on the odor of samples .....	68
17 The binomial test for percent observation frequency on the sweetness of samples.....	69

## LIST OF TABLES (CONT.)

Tables	Page
18 The binomial test for percent observation frequency on the saltiness of samples .....	69
19 The binomial test for percent observation frequency on the taste of samples .....	71
20 The binomial test for percent observation frequency on the crispness of samples .....	72
21 The binomial test for percent observation frequency on the crumbiness of samples.....	73
22 The moisture content of cracker during storage times.....	75
23 The water activity value ( $a_w$ ) of cracker during storage times.....	76
24 The Hardness of cracker during storage at times .....	77
25 The 2-Thiobarbituric acid value (TBA.) of cracker during storage times .....	78
26 The Brightness ( $L^*$ ) of cracker during storage at times.....	79
27 The Redness ( $a^*$ ) of cracker during storage at times .....	80
28 The Yellowness ( $b^*$ ) of cracker during storage at times.....	80
29 The Chroma value of cracker during storage at times .....	81
30 The Hue angle value of cracker during storage at times.....	82
31 Total plate count during storage for 6 month.....	84
32 Yeast and mold during storage for 6 month.....	84
33 Physical and chemical properties of rice crackers from different hydrocolloids.....	96
34 Contingency Analysis .....	103
35 Minimum number of correct responses for difference and preference tests using forced-choice methods.....	104

## LIST OF FIGURES

Figures	Page
1 Flour particles and starch granules of wet milling flour and dry milling.....	7
2 Processing of rice flours from different milling types .....	10
3 Processing of cracker .....	25
4 Effect of rice cultivars on rheological properties of rice cracker.....	39
5 Rheological properties (amplitude sweep test) of rice cracker dough.....	39
6 Effect of hydrocolloids on moisture content of mixed-flour blend rice crackers .....	47
7 Effect of hydrocolloids on water activity of mixed-flour blend rice crackers.....	47
8 Effect of hydrocolloids on hardness of mixed-flour blend rice crackers.....	48
9 Effect of hydrocolloids on puffiness of mixed-flour blend rice crackers .....	50
10 Effect of different hydrocolloids on rheological properties of rice cracker based on the frequency sweep test.....	53
11 Rheological properties, based on the amplitude sweep test, of rice cracker dough with different hydrocolloid addition .....	54
12 Effects of hydrocolloids on the surface appearance of mixed-flour blend rice crackers comparing (a) controls: 100% commercial rice flour (CRF), 100% wheat flour (WF) and formulated flour blend (FF) to samples with additions of (b) xanthan, (c) CMC, and (d) HPMC at various levels.....	55

## LIST OF FIGURES (CONT.)

Figures	Page
13 (a-k) Effect of hydrocolloids on the dough microstructure of mixed-flour blend rice crackers. (xanthan 1.5, 3.0, 4.5%(a, b, c) CMC1.5, 3.0, 4.5%(d, e, f) HPMC1.5, 3.0, 4.5% (g, h, i) (×300) Wheat flour 100%(j) (×300) Commercial rice flour 100% (k) (×300).....	57
14 (a-g) Demography of consumer including Education (a), Revenue (b), Career (c), Rice product consumption (d), Number of household resident (e), Beverage choices (f) and interest in product purchase (g) .....	61
15 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the color of samples .....	65
16 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the surface appearance of samples .....	66
17 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the butter odor of samples.....	66
18 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the overall odor of samples .....	67
19 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the sweetness of samples .....	68
20 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the saltiness of samples.....	70
21 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the taste of samples .....	70
22 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the crispness of samples.....	72

## LIST OF FIGURES (CONT.)

Figures	Page
23 Trend of consumer acceptance illustrated as observation frequency (a) and percent of responses (b) on the crumbiness of samples .....	72
24 The surface (a, c, e) and layer (b, d, f) of formulated flour (a, b) compared with rice cracker (negative control) (c, d) and wheat cracker (positive control) (e, f) .....	93
25 Effect of hydrocolloids on the dough microstructure of mixed-flour blend rice crackers (xanthan 1.5, 3.0, 4.5%(a, b, c) CMC1.5, 3.0, 4.5%(d, e, f) HPMC1.5, 3.0, 4.5% (g, h, i) (×100) Wheat flour 100%(j) (×100) Rice flour 100% (k) (×100).....	94
26 Effect of hydrocolloids on the dough microstructure of mixed-flour blend rice crackers. (xanthan 1.5, 3.0, 4.5%(a, b, c) CMC1.5, 3.0, 4.5%(d, e, f) HPMC1.5, 3.0, 4.5% (g, h, i) (×700) Wheat flour 100%(j) (×700) Rice flour 100% (k) (×700).....	95
27 Dough preparation of cracker .....	97
28 Molding of dough cracker.....	98
29 Rheological properties (amplitude sweep test) of rice cracker dough from different flour .....	99
30 Rheological properties (frequency sweep test) of rice cracker dough from different flour .....	100
31 Rheological properties (frequency sweep test) of rice cracker dough from different hydrocolloids added.....	101
32 Rheological properties (frequency sweep test) of rice cracker dough from different cultivars .....	102