

Evaluation of chemical and organoleptic properties affecting shelf life of rice crackers

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Abstract - In this study, variation of Moisture content, pH and Free Fatty Acid (FFA) of rice crackers with time were determined. Moisture, pH and FFA values were measured using Moisture analyser, pH meter and titration of fat extracted using Werner Schmidt method respectively. A sensory test was done using a five point hedonic scale and was statistically analysed using Friedman test of SPSS 16. These tests were conducted in three months intervals up to twelve months. Results revealed that Moisture content, pH and FFA values increased gradually with time. Also there was a significant difference of sensory properties with time.

Index terms –Free Fatty Acid, Moisture content, Rice crackers, Sensory evaluation, Shelf life.

I. INTRODUCTION

Rice, as a cereal grain is the most consumed cereal grain in Asia and it is the staple food of Sri Lanka. So rice has become a major food component in day to day cooking. Nevertheless, as Sri Lanka has been nearly self-sufficient in rice, diversification of rice into other arenas of food processing is a national duty, of which the farmer will also be able to draw a handsome income for his energy, time and utilities. Hence, one of productive options is converting of rice flour into biscuit, particularly in making of crackers. Because, rice crackers have several benefits over the ordinary biscuits produced from wheat flour as rice flour is enriched with more micro-nutritional components such as thiamine, niacin and riboflavin. Moreover, rice crackers contain least amount of fat and calorie value, which is beneficial for the health conscious consumers.

Initially a common base cracker is produced and it can be flavoured using several varieties of flavours to produce different types of rice crackers. This research is carried out for two categories of Rice crackers as Sweet and Savoury.

Shelf life is a critical factor in food industry. It is the time during which the food product will remain safe, be certain to retain desired sensory, chemical, physical and microbiological characteristics and comply with any label declaration of nutritional data, when stored under the recommended

conditions [5]. Several factors influence the shelf life of the product. Therefore it is important to analyze those factors and take required action to improve the keeping quality of food products. Major factors which influence shelf life of rice crackers are chemical and organoleptic properties.

The main objective of this study was to determine the major objectives which affect the shelf life of rice crackers and evaluate the variation of those properties with time.

II. MATERIALS AND METHODS

2.1 Determination of Moisture content

The moisture content of rice crackers was measured using the moisture analyzer. A sample was ground using mortar and pestle and 1g of it was added onto the tray of the moisture analyser to get the direct reading.

2.2 Determination of pH

Initially, rice crackers were ground using mortar and pestle. Then 5g was weighed and distilled water was added up to 50g. pH value of the solution was measured using the pH meter.

2.3 Determination of FFA value

FFA content was calculated using Werner Schmidt method. First, the total fat was extracted using the following method. Initially rice crackers were ground and 10g of the sample was weighed. Next 10ml of 95% ethyl alcohol and 50ml of 6N HCl solution were added to the beaker (6N HCl solution was prepared by mixing 75ml of conc. HCl with 33ml of distilled water) and was placed in a water bath at 70 - 80°C for 30 – 40 minutes stirring frequently. Then it was cooled to room temperature and 50ml of 95% ethyl alcohol was added and the solution and was transferred to Majonnier flasks. Next 125ml of diethyl ether and 125ml of petroleum ether were added to the flask and was shook vigorously for 1 minute after each addition. The clear solution was collected to a previously weighed, clean and dry beaker. The remaining sample was washed twice more as done before and was collected to the beaker. It was then kept in a water bath at 80°C until a constant weight was obtained. Final weight was recorded.

Then FFA value was determined using following method. Initially 25ml of diethyl ether and 25ml of 95% ethyl alcohol were mixed with 1ml of 1% phenolphthalein solution. The mixture was carefully neutralized with 0.1M NaOH until a light pink colour appeared. Extracted fat was dissolved in the mixed neutral solvent and was titrated with aqueous 0.1M NaOH shaking constantly until a pink colour that persists for 15 seconds was obtained. Finally FFA value was calculated using following equation.

$$\text{Acid value} = \frac{\text{Titration (ml)} \times 5.61}{\text{Weight of sample used}}$$

$$\text{Acid value} = 2 \times \text{FFA}$$

All these tests were conducted for rice crackers from initial stage up to twelve months from production in three month intervals.

2.4 Sensory evaluation

Sensory test was conducted by the sensory panel using the sensory evaluation forms. 30 untrained panelists were taken for the test. All the results obtained for products within one year of production were statistically analysed using Friedman test in SPSS 16.

According to the Friedman test, the hypothesis was written as follows;

$$H_0 = \mu_1 = \mu_2 = \mu_3 = \mu_4$$

$$H_1 = \mu_i \neq \mu_j \text{ at least for one } i \neq j$$

$$\text{If } p < \alpha \rightarrow \text{Reject } H_0$$

III. RESULTS AND DISCUSSION

3.1 Moisture content

The moisture content increases gradually with time due to absorption of moisture through packing material. Variation of moisture content is shown in tables 1 and 2.

	Time (Months)			
Moisture content (%)	3	6	9	12
	4.46	4.21	5.91	6.04

	Time (Months)			
Moisture content (%)	3	6	9	12
	4.41	4.58	5.17	7.57

3.2 pH

pH value also increases throughout but decreases slightly in the final quarter. It can be due to formation of acids. Variation of pH value is shown in tables 3 and 4.

	Time (Months)			
pH	3	6	9	12
	5.91	6.08	6.38	5.88

	Time (Months)			
pH	3	6	9	12
	6.43	6.47	7.00	5.77

	Time (Months)			
FFA (%)	3	6	9	12
	2.12	2.23	2.57	2.87

Table 6

FFA (%) of Sweet rice crackers within 12 months of production

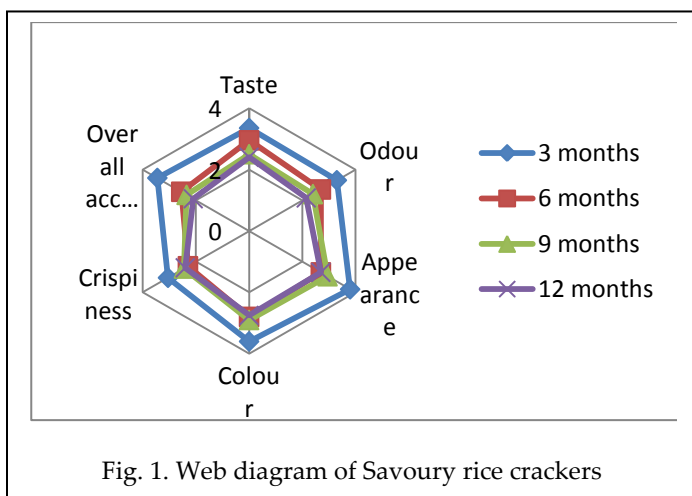
Time (Months)				
FFA (%)	3	6	9	12
	2.12	5.64	9.35	9.92

3.3 FFA value

Free Fatty Acid value increases throughout the period due to hydrolytic rancidity occurred with moisture absorption. Variation of FFA value is shown in tables 5 and 6.

3.4 Sensory evaluation

Taste, Odour, Colour, Appearance, Crispiness and Overall acceptability were the sensory parameters evaluated. Web diagrams drawn using results obtained from sensory evaluation are shown in fig. 1 and 2.



Results obtained from Friedman test are shown in table 7 and 8.

Table 7

Results for Friedman test in Savoury rice crackers

Sensory parameter	p value
Taste	0.002
Odour	0.005
Appearance	0.003
Colour	0.063
Crispiness	0.000
Overall acceptability	0.000

Table 8

Results for Friedman test in Sweet rice crackers

Sensory parameter	p value
Taste	0.002
Odour	0.000
Appearance	0.000
Colour	0.001
Crispiness	0.007
Overall acceptability	0.000

According to table 7, there is a significant difference in the taste ($p=0.002 < \alpha$), odour ($p=0.005 < \alpha$), appearance ($p=0.003 < \alpha$), crispiness ($p=0.000 < \alpha$) and overall acceptability ($p=0.000 < \alpha$) with time in savoury rice crackers at 0.05 level of significance. But there is no significant difference in colour ($p=0.063 > \alpha$) with time

According to table 8, there is a significant difference in the taste ($p=0.002 < \alpha$), odour ($p=0.000 < \alpha$), appearance ($p=0.000 < \alpha$), colour ($p=0.001 > \alpha$), crispiness ($p=0.007 < \alpha$) and overall acceptability ($p=0.000 < \alpha$) with time in sweet rice crackers at 0.05 level of significance.

Therefore, based on results of sensory evaluation obtained by statistical evaluation using Friedman test, there was a significant difference of sensory parameters with time.

IV. CONCLUSION

The moisture content, pH and FFA value of rice crackers are chemical factors affecting shelf life of rice crackers. Sensory factors also affect the shelf life. Moisture and FFA values increases with time while pH value increases and reduces in the final quarter.

According to statistical analysis of sensory testing, the sensory parameters deteriorate with time.

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