QUALITY EVALUATION OF FROZEN COCONUT 'SAMBOL' OR 'POL SAMBOL'

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Abstract
Coconut is one of the major plantation crops in Sri Lanka and coconut 'sambol' or 'pol sambol' is one of the most popular food products in Sri Lanka which is made from freshly scraped coconut. Preserved coconut 'sambol' is more convenient and time saving since it is a ready to eat product. The effect of packaging materials (LLDPE and MPF) and levels of vitamin E concentration (0%, 0.01% and 0.05%) on the shelf life and the quality attributes of coconut 'sambol' were studied. It was found that the rate in increase of free fatty acid (FFA) content between samples treated with vitamin E was less compared to those without vitamin E in both the packaging materials. However, FFA values remained within the acceptable level. There was no significant difference (p>0.05) in FFA in samples with higher vitamin E concentration and samples with lower vitamin E concentration. Moisture contents of coconut 'sambol' samples packed in both the packaging materials decreased with time in spite of vitamin E treatment. Peroxide value (PV) was not detected during storage since there was no peroxide formation in the samples. Vitamin E treated samples showed lower total plate counts (TPC) compared to those of non vitamin E treated samples. Since there was no significant difference in FFA, moisture, PV, TPC and sensory attributes between the samples treated with lower vitamin E concentration and higher vitamin E concentration (p>0.05) it indicated that lower vitamin E concentration was sufficient for 3 months of storage of coconut 'sambol' at freezing temperature. Results reveal that coconut 'sambol' could be stored for 3 months at -18±2 ^{o}C in any of the two tested packing materials (LLDPE or MPF) with 0.01 % vitamin E.

Keywords: 'Pol sambol', Freezing, Vitamin E, Storage, Packaging, Free fatty acids.

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1. INTRODUCTION

Coconut 'sambol' or 'Pol sambol' is one of the most popular food products in Sri Lanka which is made from scraped fresh coconut kernel. In addition to scraped coconut kernel, chillies, onion, garlic, curry leaves, salt and lime juice are used as the main ingredients. Coconut kernel is found to contain 44% moisture, 4% protein, 37% fat, 11% carbohydrate, 3.39% crude fiber and 1.03% minerals (Subodinee, 2005, Thampan, 1993). Fresh coconut 'sambol' has a high degree of perishability due to high amounts of moisture and fat in the coconut kernel. In normal household preparation it takes much time for the preparation of coconut 'sambol' which includes chopping, grinding and mixing of other ingredients and also the shelf life of fresh coconut 'sambol' is as short as five to six hours at ambient temperature. Therefore, frozen coconut 'sambol' or 'pol sambol' will be an ideal opportunity to the busy housewives. It is more convenient and time saving since it is a ready to eat product. Freezing is a common practice in the food based industry, because it preserves the quality for an extended time and offers several advantages such as insignificant alterations in the product dimensions and minimum deterioration in products colour, flavour and texture (Arannilewa et al., 2005, Obuz and Dikeman, 2003, Desrosier et al., 1987). However, there are some disadvantages associated with frozen storage (Kropf and Bowers, 1992) including freezer burn, product dehydration, rancidity, drip loss and product bleaching which can have an overall effect on the quality of the frozen foods.
The objectives of this study were to determine the effect of vitamin E at two levels of

concentration on the shelf life of frozen coconut 'sambol' and to determine the effect of packaging material (LLDPE and Metalized Poly Film) on the shelf life of frozen coconut 'sambol'.

2. MATERIALS AND METHODS

Methodology

Onions, garlic, curry leaves were dried in a conventional oven at 50 °C for 20 minutes and mixed with coconut. Salt and lime were added according to the taste. The prepared coconut 'sambol' was blanched at 90 °C for 5 minutes in a steamer and was divided into 3 portions; the first portion was treated with 0.01% vitamin E, the second portion was treated with 0.005% vitamin E and the third was treated with no vitamin E. Samples in each portion was packed in LLDPE and Metalized Poly Film (MPF), respectively and stored in a freezer at -18±2 °C for 3 months.

Treatments

T1-LLDPE + freezing temperature (-18±2 °C), T2-MPF + freezing temperature (-18±2 °C), T3-0.005% vitamin E +LLDPE + freezing temperature (-18±2 °C), T4-0.005% vitamin E +MPF + freezing temperature (-18±2 °C), T5-0.01% vitamin E +LLDPE + freezing temperature (-18±2 °C) and T6-0.01% vitamin E +Metalized Poly Film (MPF) + freezing temperature (-18±2 °C).

The samples were analysed for free fatty acid content (Pearson, 1973, SLS 251: 2010), moisture content (AOAC, 1999), peroxide value (Pearson, 1973, SLS 251: 2010) and total plate count (SLS 516: 1991) at monthly intervals. Sensory evaluations were also carried out at monthly intervals using a simple ranking test on taste, colour, flavour, appearance and overall acceptability.

Statistical Analysis

Statistical analysis was performed by using ANOVA in MINITAB 14 computer software. Sensory data were analysed by Kruskal Wallis one-way ANOVA non-parametric statistical test.

3. RESULTS AND DISCUSSION

The rate in increase of free fatty acid (FFA) content in samples treated with vitamin E was less compared to those without vitamin E in both the packaging materials. Since coconut meat contains about 37% fat it can undergo hydrolytic rancidity on storage which may occur by enzyme action or by heat and moisture resulting in the liberation of free fatty acids (Fennema, 1996).

However, FFA values remained within the acceptable level. There was no significant difference (p>0.05) in FFA in samples with higher vitamin E concentration and samples with lower vitamin E concentration (Table 1).

Table 1: Variation of FFA content of frozen coconut 'sambol' on storage

Time (months)	FFA% Control	FFA% No vitamin E		FFA% 0.005 % vitamin E		FFA% 0.01% vitamin E	
	Fresh sample	LLDPE (T1)	MPF (T2)	LLDPE (T3)	MPF (T4)	LLDPE (T5)	MPF (T6)
0	0.3±0.01^{a}	0.02± 0.003^{b}	0.02± 0.004^{b}	0.02± 0.003^{b}	0.02± 0.002^{b}	0.02± 0.003^{b}	0.02± 0.001^{b}
1	-	0.09± 0.002^{c}	0.08± 0.003^{c}	0.03± 0.002^{b}	0.03± 0.004^{b}	0.03± 0.001^{b}	0.03± 0.002^{b}
2	-	0.15± 0.02^{d}	0.12± 0.03^{d}	0.05± 0.001^{b}	0.03± 0.002^{b}	0.05± 0.002^{b}	0.03± 0.003^{b}
3	-	0.30± 0.01^{e}	0.25± 0.01^{e}	0.07± 0.001^{b}	0.04± 0.003^{b}	0.05± 0.003^{b}	0.04± 0.001^{b}

Same superscript indicates not significant at p>0.05 level

Moisture contents of frozen coconut 'sambol' samples packed in both the packaging materials decreased with time in spite of vitamin E treatment. The loss of moisture content might have been also due to desiccation as well as temperature fluctuation during frozen storage. Temperature abuse in the freezer can cause the migration of water vapour from the product to the surface of the container (Arannilewa *et al.*, 2005).

Peroxide value was not detected during storage since there was no peroxide formation in the samples.

Vitamin E treated samples showed lower total plate counts (TPC) compared to those of non vitamin E treated samples (Table 2). There was no significant difference in FFA, moisture, PV and TPC between the samples treated with lower vitamin E concentration and higher vitamin E concentration ($p>0.05$) indicating that lower vitamin E concentration was sufficient for 3 months of storage of coconut 'sambol' at freezing temperature. It is worth noting that total plate count increased on storage despite the addition of vitamin E. The increasing total plate counts could be attributed to temperature fluctuation resulting from unstable electric power. Temperature fluctuation is known to bring about some physico-chemical changes in frozen foods (Bald, 1990).

Table 2: Total plate count values of coconut 'sambol' stored at -18±2 °C

Time (months)	No vitamin E		0.005 % vitamin E		0.01% vitamin E	
	LLDPE (T1) (CFU/g)	MPF (T2) (CFU/g)	LLDPE (T3) (CFU/g)	MPF (T4) (CFU/g)	LLDPE (T5) (CFU/g)	MPF (T6) (CFU/g)
0	<$1x10^{1a}$	<$1x10^{1a}$	<$1x10^{1a}$	<$1x10^{1a}$	<$1x10^{1a}$	$1x10^{1a}$
1	<$2.5x10^{2b}$	$2.0x10^{2b}$	<$2x10^{1a}$	<$1.8x10^{1a}$	<$1.5x10^{1a}$	$1x10^{1a}$
2	<$1.9x10^{3c}$	<$1x10^{3c}$	<$8.0x10^{2d}$	$6.5x10^{2d}$	<$7.8x10^{2d}$	$7x10^{2d}$
3	<$2.8x10^{3c}$	<$2x10^{3c}$	<$9.9x10^{2d}$	<$7.5x10^{2d}$	<$9x10^{2d}$	$7.2x10^{2d}$

Same superscript indicates not significant at p>0.05 level

Table 3: Effect of storage period on sensory ratings of frozen coconut 'sambol'

Treatment	P values					
	Time (months)	Odour	Taste	Colour	Texture	Overall acceptability
T1	1	0.525	0.255	0.855	0.751	0.651
	2	0.742	0.346	0.746	0.512	0.412
	3	0.885	0.774	0.523	0.923	0.635
T2	1	0.325	0.452	0.781	0.731	0.912
	2	0.645	0.625	0.348	0.421	0.458
	3	0.850	0.789	0.945	0.659	0.624
T3	1	0.256	0.345	0.207	0.352	0.434
	2	0.742	0.475	0.623	0.741	0.725
	3	0.445	0.385	0548	0.987	0.642
T4	1	0.456	0.875	0.756	0.513	0.364
	2	0.685	0.568	0.841	0.257	0.484
	3	0.995	0.498	0.652	0.654	0.478
T5	1	0.289	0.687	0.451	0.424	0.237
	2	0.466	0.548	0.821	0.345	0.481
	3	0.358	0.625	0.348	0.652	0.623
T6	1	0.756	0.256	0.312	0.874	0.257
	2	0.848	0.347	0.422	0.625	0.472
	3	0.738	0.652	0.583	0.765	0.351

According to the statistical analysis (Table 3), there was no significant difference among samples by means of odour, taste, colour, texture and overall acceptability on storage ($p>0.05$).

4. CONCLUSIONS

There was no significant difference in FFA, moisture content, PV, TPC and sensory attributes between the coconut 'sambol' samples treated with lower vitamin E concentration and higher vitamin E concentration ($p>0.05$) indicating that lower vitamin E concentration was sufficient for 3 months of storage of coconut 'sambol' at freezing temperature indicating that coconut 'sambol' could be stored for 3 months at -18±2 ^{o}C in any of the two tested packing materials (LLDPE or MPF) with 0.01 % vitamin E.

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