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SMALL PACKAGES DIABETIC MARMALADE QUALITY

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Abstract
The number of people suffering from insulin-dependent (Diabetes Melitus type I) and insulin-independent (Diabetes Melitus type II) is huge, and the number of potential diseased is in permanent rise. For this reason, products with reduced amount of sugar have become very popular. It is assumed that small single packages will become more and more popular, regarding to special requirements of diabetics. The possibility of using multilayer foils for small single packages of diabetic marmalades was investigated.

Key words:
diabetic marmalade, small single packages, surface colour, microbiological status, sensory evaluation, aseptic packaging.

1. INTRODUCTION

Marmalade is a gelly product manufactured by cooking fresh or semi-processed edible parts of whole fruit (without peel, skin, seeds etc.) which has been transformed to a purée by straining through a sieve or a similar process, with added sugar or sugar syrup, pectin and acid. Dietetic (low calorie) food products are intended for special diets. The energy value of low-calorie products, compared with the traditional products is reduced by 30% at least.

The number of people suffering from diabetes in Serbia and Montenegro is permanently increasing. Diabetic products found on our market are imported from foreign countries and pretty expensive for most of the people. Therefore, the aim of the project was to produce diabetic jelly products, which would be cheaper and of the same quality than the imported ones.

Fructose, sorbitol, manitol, aspartame, cyclamate and saccharin are permitied for use as sugar replacers [1].

Low-esterified (amidated and non-amidated) pectins are used as gelling agents in diabetic jelly production. They form gels with little or no sugar. The addition of Ca^{++} ions (from some salt, e.g. calcium-citrate) is necessary for successful gelation of non-amidated pectins. Amidated pectins need considerably less Ca^{++} ions than the non-amidated. Therefore, Ca originating from added fruit is sufficient for their gelation.

To provide optimal gelation, it is important to adjust pH to recommended value.

Yeasts, moulds and lactic acid bacteria are the main coases of microbiological spoilage of fruit preserves, due to relatively high soluble solids (for their growth) and low pH of these products. For that reason, these products have to be preserved by pasteurization or adding preservatives (sorbic acid and its salts, as well as benzoic acid and its salts).

The colour is one of the main characteristics of food quality. Among a number of instrumental methods in use, the most known are tristimulus photocolourimeters, which give the characteristics of colour in different systems (CIE normal, CIELab, ANLab, Hunter) [2].

Diabetic marmalades are usually filled into glass jars (up to 370g). Due to specific needs of consumers, it is desirable to have small single packages (20-30g). Small glass jars are suitable for these purposes, but expensive. Multilayer foil packages are much cheaper and simplier and more practical for use [3]. Features of these materials (gas, water, aroma impermeability, easy sealing capability) provide maintanance of their content during packaging and storage. Among a variety of multilayer foils, PET/PE foil with metalic layer between and Al-laminate foil were chosen for packaging of diabetic marmalades in this paper.

The aim of this work was to investigate quality differences (surface colour, microbial profile, sensory evaluation) between diabetic marmalade samples packaged in glass jars and multilayer foil (PET/Al/PE and PET/met/PE) sachets, after 5 months storage.

2. EXPERIMENTAL

Materials:

- raspberry mash, purchased from the factory "Nectar", Backa Palanka, Serbia and Montenegro
- low-methoxyl, amidated pectin "Grinsted-Pectin", type LA 410, Danisco Cultor, Denmark
- fructose, Danisco Cultor, Denmark
- tap water
- citric acid, food grade
- sodium benzoate, food grade
- PET/met/PE, 12/50 μm (PET/PE foil with metallic layer between), Beograf-Bukulja, Belgrade, Serbia and Montenegro
- PET/Al/PE, 12/9/80 μm (Al-laminate foil), Beograf-Bukulja, Belgrade, Serbia and Montenegro
- glass jars, 370g

Laboratory production of raspberry marmalade

Marmalade was prepared according to the recipe:

material	g/kg
pectin LA 410	10
fructose	300
fruit	400
water	425
citric acid	up to pH 3.1-3.2

The pectin/fructose mixture (1:5) was added to warm raspberry mash (40°C).The system was heated up to 90°C, for 30 sec. The rest of fructose was added and the cooking was continued until soluble solids reached 30%, followed by dosing of citric acid (50% solution) up to pH 3.1-3.2. The hot marmalade was devided into three parts and immediatelly filled into three different packages. One part of marmalade was filled into glass jars, closed with twist-off cups, pasteurized at 85°C for 25 minutes and stored. The second part was filled into previously formed sachets

(about 30g), sealed, pasteurized at 85°C for 25 minutes and stored. Sodium benzoate in amount of 0,1% was added into the third part of marmalade. Marmalade was filled into previously sterilized sachets (about 30g), sealed in aseptic conditions and stored without pasteurization. All samples were stored at ambient temperature, exposed to daylight.

Surface colour of jellies was measured using the Minolta CR 400 hromameter.

Microbiological analyses of jellies were performed according to usual methods [4].

Sensory evaluation was carried out by a point system (samples were scored with 20 points maximum) [5].

3. RESULTS AND DISCUSSION

Results of surface colour measurement are presented in Table 1.

Table 1. Parameters of surface colour of raspberry marmalades during storage

Sample		L	a	b	ΔE	c	h°
0 months							
		23.45	14.02	5.96	75.17	15.23	23.05
1 month							
1	glass jar	23.68	10.84	4.09	74.33	11.59	20.66
2	PET/Al/PE (P*)	25.40	12.82	5.11	72.99	13.80	21.72
3	PET/Al/PE (NP**)	22.74	12.32	4.68	75.51	13.18	20.79
4	PET/met/PE (P)	22.94	10.30	4.09	74.99	11.08	21.65
5	PET/met/PE (NP)	22.32	10.99	4.20	75.70	11.76	20.92
3 months							
1	glass jar	23.87	9.26	4.26	73.95	10.20	24.69
2	PET/Al/PE (P)	23.34	10.18	4.39	74.60	11.09	23.34
3	PET/Al/PE (NP)	23.40	10.26	4.17	74.54	11.07	22.10
4	PET/met/PE (P)	23.16	7.51	3.77	74.44	8.40	26.67
5	PET/met/PE (NP)	23.10	8.90	3.82	74.66	9.68	23.21
5 months							
1	glass jar	24.89	8.19	5.29	72.85	9.75	32.85
2	PET/Al/PE (P)	23.06	7.74	3.95	74.56	8.69	27.06
3	PET/Al/PE (NP)	25.18	8.12	4.05	72.50	9.07	26.52
4	PET/met/PE (P)	23.38	6.25	4.06	74.11	7.45	33.03
5	PET/met/PE (NP)	24.26	7.04	4.02	73.30	8.10	29.71

* P – pasteurized

** NP – non-pasteurized

From the table it can be seen that the lightness (L) of samples hadn't changed. Redness (a) decreased in all samples during storage of 5 months, from 14.02 to 6.25-8.19. Chroma, the measure of colour saturation or purity, decreased, in the same period, from 15.23 to 7.45-9.75, which indicates that colour of all samples became less vivid. No significant difference between surface colour of samples packaged in glass jars and multilayer foil packages after 5 months storage was observed. Microbiologial status of jellies in different packagings, after 5 months storage, is presented in Table 2.

Table 2. Microbiological status of jellies in different packagings after 5 months storage

Sample	Total count of microorganisms in 1g			E. coli in 1g	Salmonella spp. in 50g	Proteus spp. in 1g	Staph. in 1g	Clostr. in 1g
	Yeasts	Moulds	Bacteria					
1	0	0	0	–	–	–	–	–
2	0	0	0	–	–	–	–	–
3	0	0	0	–	–	–	–	–
4	0	0	0	–	–	–	–	–
5	0	0	0	–	–	–	–	–

No presence of yeasts, bacteria, moulds nor pathogenic bacteria (*E. coli*, *Salmonella* spp., *Proteus* spp., *Staphylococcus*, *Clostridium*) in raspberry diabetic marmalade was established. The microbiological characteristics satisfied the requirements of the Regulations for this group of products (1). It can be concluded that the chosen packages protected the content from outer influences.

Immediatelly after laboratory production, the diabetic marmalade was sensory evaluated by 18.85 points. After 5 months storage, the sensory evaluation was repeated, and the results are presented in Table 3. A slight syneresis was stated in all samples, but there were no significant differences in sensory features between samples.

Table 3. Results of sensory evaluation of diabetic marmalades after 5 months storage

Sample		Total points
1	glass jar	18.37
2	PET/Al/PE (P)	18.71
3	PET/Al/PE (NP)	18.75
4	PET/met/PE (P)	18.62
5	PET/met/PE (NP)	18.68

As the quality characteristics of diabetic marmalades in small packages (surface colour, microbial profile, sensory features) hasn't changed during storage, the possibility of using multilayer foils as packaging materials for diabetic jellies is justified.

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