

Effect of storage time on table margarine characterization in refrigerated temperature

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ABSTRACT

In this research table margarine was made based on soybean and palm and storage for 90 days in refrigerator in 4°C, and its physicochemical properties in different period include 15, 30, 45, 60, 75 and 90 days were investigated. Melting point, peroxide and iodine value, significantly was increased and after 90 days of storage reached to 36.7 °C, but resistance to oxidation was significantly decreased and reached to 15.34 h.

Key words: table margarine, storage time.

INTRODUCTION

To days due to urbanization phenomenon and increased occurrence of cardiovascular diseases production and consumption of vegetable oil, i. e. margarine has been increased. According to Iranian National standard, margarine is a water – in – oil emulsion with oil phase being a mixture of permitted edible oils and water phase containing milk or its products or a mixture of them. Also low content of allowed ingredient such as emulsifier, salt, antioxidant, flavoring agent, and vitamin are added to this product [1].

Commonly a mixture of two or more different oils is used to margarine formulation. Soybean and palm olein are one of widely used oils usually applied to margarine production [2]. Today, manufacture and consumption of margarine is growing worldwide, because it is less saturated than butter and has no cholesterol resulting in reduced incidence of cardiovascular diseases [3]. One of the most important problem for oil preservation, is storage condition especially in long time storage, because the oils highly sensible to oxidation and if storage condition it wasn't suitable, very soon oxidized and will be rancid. Also in margarine formulation high level of water was used and hydrolysis reaction and formation of free fatty acid could be occur, therefore controlling of its properties during storage is important. The objective of this study was, made a kind of table margarine including palm and soybean oil and investigates the change of its physicochemical properties during 90 days storage in 4 °C.

MATERIALS AND METHODS

A kind of table margarine was produced using the formulation presented in Table 1. Potassium sorbat and citric acid were purchased from Aryan shimi Co. Butter essence, Firmenich brand, Swiss, ordered by Nasim-e-Sabah Co., glycerol mono-stearat, china, ordered by Pars Behbood Asia Co., iodine – less salt, Iranian salt purification food & industry co., and non-fat milk powder, Zarrin shad food industries co., were purchased.

Methods

For analysis each 15 days sampling was done. Measurements of peroxide value, acid value, melting point, refraction index, iodine value, and moisture content were performed according to national standard No. 4179, 4178, 87981, 4887, 5108, 4886, 7513, respectively.

Data Analysis

Data collected from the this study samples were analyzed based on 0.05% coefficient of error by a software program. The data analysis was performed using MINITAB statistical software, release 14.2 (MINITAB Inc., state college, PA and USA). At first such software program proved samples normal conditions and then the significant difference among data was precisely studied via Anova –one – way test and p-value was determined.

RESULTS AND DISCUSSION

The results of physicochemical analysis of the produced industrial margarine are presented in table2. There was no significant difference between the produced margarine samples for moisture ($P>0.05$) being on average about 19%. Peroxide value of the samples showed a rising trend. Previous work has shown that, it was 0.32 meq/kg at 1d [10] and then increased to 0.45 meq/kg following 15 d of storage at 4°C. The peak number was observed at 90d with the value of 0.89 meq/kg, it is worthy to note that according to national standard, peroxide value must not exceed 2, so the sample complies with the standard after 90 d of storage at 4°C. Nogala – kalucka (2000)[11] investigated the changes occurring in margarine during 137d at 4C. The results showed that peroxide value increased significantly. Abramoviet *et. al.* (2005) [12] examined the changes occurring in oil under different conditions. The results indicated an increase in peroxide value. Averaged acidity value of the table margarine sample over 95 d of storage was ~ 0.12% and the show any significant variations. According to National standard maximum level of acidity must not exceed 0.3%, thus at the end of 90d of storage at 4C, the produced sample exhibited an acceptable value. This result is consistent with the finding of Memon *et. al.* (2010) [13], who investigated the variations of oil refrigerated for 120d. Their results showed that acidity value increased significantly over time as increased from ~ 13% to 16%.

Maskan *et. al.*, (1993) [14] stored two types of margarine at 4° c and studied the variations of acidity. The results suggested an increase in acidity over time. Their finding is in consistence with our result. The amount of two preservatives, sorbic and benzoic acids did not show any significance difference over time ($P<0.05$). on average the content of this preservative in table margarine is about 500 ppm. National standard specifies the maximum level of any preservative as 1000 ppm, thus both types of margarine showed an acceptable level to the end of 75 d of storage at 4°C. Concerning slip point the produced margarine showed a slight increase over time. slip point of the table margarine at 1d it was 32.5°C (data not shown) [10] and then increased to 35.8°C at 30 d and to ~ 36°C at 90d. According to national standard, maximum acceptable melting point for margarine is 37°C, so the produced margarine complies with the standard. Refract index did not show any significant variation over storage ($P>0.05$), but slightly decreased being on average 1.4594. Iodine number of table margarine increased significantly ($P<0.05$) as increased from 65.74 at 1d to 67.64 at 75d. The stability of the margarine against oxidation decreased over time being a common phenomenon for all types of oils. The stability of the produced table margarine decreased significantly from 25.18h at 1d to 15.34 at 90d. Statistical analyses showed these significant variations ($P<0.05$). Abramoviet *et. al.*, (2005) investigated the variations of oil over storage at 85°C. Their result suggests a decrease in the stability against oxidation over time [12].

Table 1- Formulation of produced table margarine

Ingredient	Table margarine
Salt	6600 g
Potassium sorbet	1950 g
Sodium benzoate	1050 g
Milk powder	25 kg
Mono glyceride	12 kg
Citric acid	900 g
Butter essence	750 g
Water phase	600 kg
Oil phase (75% palm olein – 25% soybeen)	2400 kg
Total	3000 kg

Table 2- Physicochemical properties of the produced table margarine

Table margarine	15 day after production	30day after production	45 day after production	60 day after production	75 day after production	90day after production	Accepted limit
Moisture (%)	19.23±0.23 ^a	19.01±0.5 ^a	18.77±0.61 ^a	18.70±0.41 ^a	19.02±0.14 ^a	18.85±0.09 ^a	Max 16
Peroxide value (meq/kg)	0.45±0.02 ^b	0.57±0.01 ^c	0.68±0.03 ^d	0.72±0.01 ^e	0.81±0.04 ^f	0.89±0.08 ^f	Max 2
Acidity (% oleic acid)	0.13±0.01 ^a	0.14±0.03 ^a	0.11±0.01 ^a	0.13±0.01 ^a	0.14±0.03 ^a	0.14±0.05 ^a s	Max 0.30
Preservatives (sorbic and benzoic acids) (ppm)	490±34.21 ^b	493±21.42 ^b	485±24.17 ^b	504±28.31 ^a	478±12.13 ^b	48.8±16.14 ^b	Max 1000
Slip point	35.5±0.32 ^a	35.8±0.17 ^{ab}	36.4±0.20 ^b	36±0.11 ^b	36.4±1.21 ^b	36.7±1.05 ^b	Max 37
Refraction index (40C)	1.4597±0.00 ^a	1.4594±0.00 ^a	1.4594±0.01 ^a	1.4594±0.02 ^a	1.4595±0.00 ^a	1.4596±0.00 ^a	-
Iodine value	65.5±1.05 ^a	66.42±0.98 ^{ab}	66.42±1.81 ^{ab}	66.3±2.31 ^{ab}	66.14±0.71 ^b	67.64±0.91 ^b	-
Resistance / h (Rancimate at 110C)	18.15±0.87 ^a	16.84±0.64 ^b	16.84±0.28 ^b	16.43±0.57 ^{bc}	15.80±0.67 ^c	15.34±0.67 ^c	-

CONCLUSION

Temperature and duration of storage have significant effect on the variation trend of chemical indicators. Storage for a long time results in undesirable chemical changes and accelerates the rancidity. The results of the tests revealed the effect of storage time on the chemical properties of margarine. Chemical degradation of oil increased over time; however the produced samples show good quality because of storage at low temperature.

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