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The changes of table margarine characterization during storage time

Mahboubeh Zaeroomali*, Yahya Maghsoudlou and Peyman Aryaey

Department of Food Science and Technology, Science and Research Ayatollah Amoli Branch, Islamic Azad University, Amol, Iran

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ABSTRACT

In this research table margarine was produced with soybean and palm oil and storage for 90 days and temperature was fixed on 15 ^{o}C, and each 15 days sampling was down and its physicochemical properties were investigated. With increasing the time of storage up to90 days, resistance to oxidation was significantly decreased and reached to9.25h, melting point ,acidity and iodine value, was increased and after 90 days of storage was acceptable by international standard. But, peroxide number increased sharply and after 75 day of storage reached to 2.23 meq/kg that is more than acceptable limit standard.

Key words: Table margarine, peroxide number, storage time

INTRODUCTION

Fat derived products are industrially obtained from edible oils and fats through inter esterification, fragmentation, hydrogenation, and reformulation. One of the most important food stuff included in this category is margarine. in 1869 ,H. Mege Mauries first explained the margarine, in a patent made for the realization of a confectionary fat starting from the calf fat. This new product was destined to replace the butter who was in limited quantities and expensive. The name "margarine" was choosing on the presumption that in the calf fat a margarinic acid predominates. Eventual this term was not confirmed, but the name of margarine remained until today [1]. The margarine is emulsion of "water in oil" (W/O), who reaches its stability through the addition of emulsifier. In margarine formulation, kind of fats and oils are considered to be the most important ingredient, as oils and fats are key factor in relation to the quality of the finished product. The type of oils used has high influence on the crystallization characteristics during margarine production. Soybean oil and palm oil has a favorable composition of fatty acids and it has beneficial effect on human health, therefore it is suitable oil for manufacturing margarine [2]. All the food stuff such as oils prepared and stored in many different condition, each of which can result in a verify expiration date, and if it is not stored properly , all food lasts for a shorter period of time. Food safety techniques and practicing proper hygiene will help prevent food spoilage. . Spoiled margarine will begin to appear paler, grow mold and will be either too hard (the stick) or too soft (the tub) and difficult to spread. In addition, spoiled margarine can smell cheesy, stale or decomposed [1]. There is certain health risks associated with consumption spoiled margarine. suitable oil storage condition is the key to extending the expiration date of product .Some advantages of proper food storage condition include cutting food costs, eating healthier, and helping the environment by decreasing waste. Margarine is a cholesterol free product and has less saturated fatty acid than butter and for this reason manufactured and consumption of this product is growing worldwide, therefore attention to preserve and storage condition is interested. The objective of this study was, made a kind of table margarine including palm and soybean oil and investigates the change of physicochemical properties during 90 days of storage.

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.

Process of margarine production:

water soluble ingredient include milk powder , potassium sorbate, sodium benzoate and salt with the values measured in the formulation are solved in some water, temperature then reached 75º c for 15 S and decreased to about 35-40ºC by Pasteur system due to pasteurize the water phase. In another container oil phase of the prepared formulation is heated to reaching 5º above melting point of the used emulsifier. Then the oil soluble ingredient, emulsifier is solved in the heated oil phase. Oil and water phases are transferred to another container to mixed resulting in formation of margarine emulsion. Then sensitive substance such as vitamins and citric acid essence are added. Then they pass through voteitor by high – pressure pump and then stored at 15ºC for 90 days.

Methods

For analysis each 15 days sampling was done. Measurements of peroxide value, acid value salt content, 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 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 storing table margarine sample at 15c for 90d are presented in Table 2. The amount of water in oils affects negatively the performance and shelf-life of oil. Water may accelerate the lipolysis and oxidation of oils resulting in early degradation of oil as well as inhibitors of oxidation. There were no significant differences between the moisture content of produced sample and control ($p>0.05$) over the storage period and the average moisture of the samples was 30.19%. The peroxide value is an index of quality and stability of oils. The peroxide value of margarine increased over storage as it increased to 32.0, 52.0, 60.0, 65.0, 3.1, 3.2 and 32.2 meq/kg after 15, 30, 45, 60, 75 and 90d of storage, respectively. It should be noted that a significant difference was observed between the samples for peroxide value over time ($p\leq0.05$). According to Iranian national standard the peroxide value of table margarine must not exceed 2 meq/kg. As shown in Table 2, the peroxide value was 3.2 meq/kg after 75 d of storage at 15c being out of the standard range. Maskan *et. al*., (1993)[10] stored two types of margarine at 14ºC and examined the variations of peroxide value. The results indicated that peroxide value increased significantly over storage period. Crapiste *et.al*., (1999)[11] investigated the variations of oil peroxide value over storage. They stated that peroxide value increased significantly as the storage period proceeds. Acid value of the produced sample did not show any significant difference over time, being on average about 13.0%. Moisture content remained constant over storage so the acidity did not much change since moisture is the main cause of hydrolysis and generation of free fatty acids. Slip point of margarine changed over time as it increased from 2.35°C to 3.36°C after 90 d of storage. It should be noticed that this difference was not significant as indicated by the statistical results ($p<0.05$). Regarding acidity, all samples showed acidity value within the range of national standard. Iodine number of margarine did not vary over time being on the average ~ 56. Refract index of margarine did not much change over storage being 4596.1. Over storage time oxidation reactions occur in oil. As these interactions increase secondary compounds including aldehydes ketones alcohols etc. are produced. They gradually generating complex compounds with high molecular weight increasing the slip point. The same trend was observed in this study over time, as the slip point increased from 5.35°C after 15d of storage at 15 c to 3.36 °C on 90d. Iranian national standard has determined the highest melting point of margarine as 37°C. Given this value all produced samples were in accordance with the standard. As the time and the oxidation reactions precede the products of oxidation such as hydroperoxide, aldehyde ketone etc. accumulate thereby accelerating the reactions thus resulting in reduced stability against oxidation. The stability of margarine against oxidation was reduced significantly over time. For instance the stability of margarine decreased to 25.9h after 90d of storage ($p<0.05$). Since margarine contains relatively high amount of water the microorganisms likely grow in the product so two preservatives, sorbic and benzoic acids with the value of ~507 ppm were used in the formulation. This amount did not change significantly 90d storage ($p<0.05$) being always within the specified standard range.

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 (%)	19.69±0.61 [a]	19.45±0.54 [a]	19.54±0.38 [a]	19.14±1.03 [a]	19.23±0.89 [a]	19.25±0.81 [a]	Max 16
Peroxide value (meq/kg)	0.52±0.01 [b]	0.60±0.02 [bc]	0.65±0.03 [c]	1.3±0.04 [d]	2.03±0.57 [e]	2.23±0.05 [e]	Max 2
Acidity (% oleic acid)	0.12±0.05 [a]	0.11±0.01 [a]	0.12±0.01 [a]	0.13±0.03 [a]	0.14±0.04 [a]	0.14±0.02 [a]	Max 0.30
Preservatives (sorbic and benzoic acids) (ppm)	512±21.42 [a]	514±17.25 [a]	507±8.06 [a]	510±9.57 [a]	502±6.91 [a]	506±12.90 [a]	Max 1000
Slip point	35.5±0.94 [a]	35.7±0.52 [a]	36±8.37 [a]	36.12±3.27 [a]	36±2.27 [a]	36.3±1.20 [a]	Max 37
Refraction index (40ºC)	1.4596±0.00 [a]	1.4596±0.02 [a]	1.4596±0.00 [a]	1.4596±0.01 [a]	1.4596±0.01 [a]	1.4596±0.01 [a]	-
Iodine value	66.2±1.51 [a]	66.41±2.31 [a]	66.54±3.41 [a]	66.2±0.87 [a]	66.03±0.96 [a]	66.24±0.53 [a]	-
Resistance / h (Rancimate at 110ºC)	18.04±1.20 [a]	16.25±0.59 [b]	14.84±2.02 [c]	12.43±0.78 [d]	10.28±0.52 [e]	9.25±0.61 [e]	-

CONCLUSION

In addition to proper materials and methods for production the mode and conditions of storage are among the most important factors affecting the quality of food products because high temperature may accelerate many chemical reactions. As indicated in this study storage of margarine at 15c may retain the quality of product within the standard range only for 75d, whereas previous studies showed that refrigeration of margarine might keep its quality more than 90d [12].

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