STUDY OF COMPATIBILITY OF COMMERCIALMAYONNAISES TO FOOD SAFETY CRITERIA IN UZBEKISTAN

ShakhnozakhonGaipova
PhD student, Tashkent Chemical-Technological Institute,
100011, Uzbekistan, Tashkent, A.Navoiy str., 32
AhrorAbdurakhimov
doctor technical sciences, docent, Tashkent Chemical-Technological Institute
100011, Uzbekistan, Tashkent, A.Navoiy str., 32
AkbaraliRuzibayev
candidate technical sciences, docent, Tashkent Chemical-Technological Institute
100011, Uzbekistan, Tashkent, A.Navoiy str., 32
ZulfiyakhonKhakimova
PhD student, Tashkent Chemical-Technological Institute
100011, Uzbekistan, Tashkent, A.Navoiy str., 32
Mansur Akbarov
PhD student, Tashkent Chemical-Technological Institute,
100011, Uzbekistan, Tashkent, A.Navoiy str., 32

Abstract

In the research work, the compatibility of commercial mayonnaise in Uzbekistan with food safety requirements was studied. For this, seven different brands of mayonnaise with a fat content of 67% were selected and their oil phase and sensory properties were analyzed. The fat content of only one of the mayonnaises corresponded to the fat content written on the label. Two more and four less. In terms of chemical composition, all mayonnaises differed from each other. This indicates that various food additives have been added to their recipe. Since food additives and fatty acid content affect the shelf life of mayonnaise, the optimal shelf life of all mayonnaises was studied and determined. It was found that all analyzed mayonnaises meet the requirements of food safety in terms of sensory, physico-chemical and microbiological parameters.

Key words: Mayonez, sensory property, food safety, fat content, food additives, coli group bacteria(CGB), yeast, mold, microbiological properties, fatty acid, storage

DOI Number: 10.14704/nq.2022.20.11.NQ66150 **NeuroQuantology 2022; 20(11): 1575-1583**

1 Introduction

Mayonnaise is a oil-in-water emulsion stabilized by emulsifiers found in egg yolks and egg whites. It has a low pH and high lipid content and its main ingredients are vegetable oil, water, egg yolk and acetic acid[1]. One of the most common foods based on mayonnaise-emulsion, an attempt has been made to increase its nutritional value and reduce its calorie content. In all cases, texture and rheological properties are important factors that can affect sensory perception, physical stability, and consumer satisfaction [2].

The increase in the number of consumers following a healthy diet is forcing the food industry to produce healthy food products containing functional ingredients. Adding oils containing polyunsaturated fatty acids (PUFA) to commonly consumed staple foods such as mayonnaise, omega-3 (ω-3) and omega-6 (ω-6) may be an alternative to improve dietary intake. The presence of these fatty

acids is associated with dietary aspects and the intake of unsaturated fatty acids recommended to reduce the risk of cardiovascular disease. Recent studies have shown that the ω-6:ω-3 ratio can affect the selectivity of the cytotoxic activity of lipids against normal or tumor cells[3,4]. In addition, the imbalance of ω-6 and ω-3 in the diet has been reported to be closely related to metabolic disorders and chronic diseases [5].

On a global scale, large-scale research is being carried out to reduce the fat content of mayonnaise, increase its quality, enrich it with biologically active substances and increase its assortment [6,7]. In particular, the main attention is paid to replacing some of the vegetable oils in mayonnaise with oil replacers, finding natural stabilizers, thickeners and plasticizers that increase its quality and stability, and determining the optimal technological conditions for mayonnaise production technology [8, 9].

Reducedfat mayonnaises have been on the world market for a long time. The recipe of such mayonnaise contains maltodextrins[10], modified starch[11], Xanthan gum[12] and other gelling agents, which have the function of replacing part of the fat, thus, in relation to one gram of mayonnaise reduces calorie intake. In some studies, such a problem was partially solved by including inulin in the recipe [13].

Today, various additives are used to improve the sensory and physicochemical properties of mayonnaise [14]. However, the effect of these additives on the food safety of mayonnaise has not been fully studied. For this reason, it is considered urgent to study the compliance of mayonnaise in the market stalls of our Republic with food safety requirements.

2 Materials and metods

2.1 Materials

In order to analyze the mayonnaise products in the market stalls of our Republic and study their compliance with safety requirements, the mayonnaise products available in the market stalls were used as raw materials in this research.

"Monarch", "Ryaba", "Sloboda", "Olivez", "Maheev", "Maselko", "MechtaKhozyayki" brand mayonnaises were selected for analysis. In order not to violate the rights of the product manufacturers and to ensure anonymity, mayonnaises were conditionally numbered as mayonnaise-1, mayonnaise-2, mayonnaise-3, mayonnaise-4, mayonnaise-5, mayonnaise-5, mayonnaise-7. The results obtained in the experiments were expressed and analyzed with these figures.

2.2 Methods of analysis of mayonnaise products

2.2.1. Sensory properties

Sensory properties are determined in the following sequence: consistency, appearance, color, smell, taste.

Before determining the properties, mayonnaise is brought to a temperature of 20 ± 2 °C.

Determination of consistency

Usually, consistency is made no later than 12 hours after production of mayonnaise. Consumer packaging (glass bottles, boxes, glasses) is opened and the layer of mayonnaise is moved to the side with a spatula. The trace from the spatula should not flow within 25 ± 5 seconds.

The consistency of mayonnaise packed in tubes, bags or bottles is determined 30 minutes after transferring a 150 g portion of the product into a glass.

Determination of appearance and color.

A sample of mayonnaise weighing 30 g is placed in a glass container. The glass is placed on a sheet of white paper and examined in daylight, determining its appearance, color, and noting the absence or presence of foreign inclusions.

Determination of smell and taste.

Mayonnaise in glass jars, polymer cups, samples from flasks is pre-mixed with a spatula. The smell of mayonnaise is determined organoleptically. When determining the taste, the amount of the product should be enough to distribute 3-10 g in the oral cavity. Mayonnaise is held in the mouth for 5-30 seconds without swallowing, then removed.

2.2.2. Chemical analysis

Moisture, crude protein, total lipids, ash and acid value (AV) were determined in the mayonnaise according to the method described in AOAC (2000). Three replicates were used in each test. The carbohydrate content was calculated by differences. Titratable acidity (T.A) was determined by titrations of 10 g mayonnaise to pH 8.1 with 0.1 N NaOH and results were converted to percentage of acetic acid according to the method of AOAC (2000). The pH values of mayonnaise samples were measured using a pH meter (model Mettler Toledo FiveGo™ pH F2), using 10 % dispersion of mayonnaise in distilled water. Mineral contents, i.e. calcium (Ca), phosphorus (P), iron (Fe), potassium (K), sodium (Na) and zinc (Zn) were determined according to the method of AOAC (2000) using an atomic absorption spectrophotometer Aurora TRACE AI 1200.

2.2.3. Separation of lipids from mayonnaise

Lipids were extracted from all samples of mayonnaise according to the procedure described in the literature [28]. Mix the mayonnaise carefully before sampling. Thirty grams of mayonnaise is poured into 50 ml polypropylene centrifuge tubes. Samples were frozen at −20°C for 24 h and thawed at 4°C for 2 h to break the emulsion. Two milliliters of water are added and the mixtures are centrifuged at 5000 rpm for 20 minutes. The lipid phase separated from the emulsion residue was stored in sealed glass bottles at -40°C until analysis.

Fatty acid composition of oils was determined by Shimadzu GC2030 gas chromatograph (capillary column SH-2560; 0.25 mm ID; 0.2 mm df; 105 m).

2.2.4. Microbiological analysis

Coli group bacteria(CGB), yeast, mold counts,Staphylococcus aureus (S. aureus) andSalmonella spp. were determined according to(APHA, 1992).

3 Results

Since mayonnaise is an oily sauce product, its quality directly depends on the quantity and quality of the oil in it. Provansal mayonnaise with a fat content of 67% was selected for analysis. First, the fat content of mayonnaise was anlyzed. The oil phase of mayonnaise was separated by the separation method in a centrifuge (Table 1).

Table 1

Amounts of fat content of commercialmayonnaises

№	Sample number	The amount of fat on the label	The amount of fat determined in practice	Fat difference
1	mayonnaise-1	67	64,0±0,6	less
2	mayonnaise-2	67	66,3±0,6	less
3	mayonnaise-3	67	64,5±0,6	less

4	mayonnaise-4	67	64,9±0,6	less
5	mayonnaise-5	67	67,0±0,6	equal
6	mayonnaise-6	67	71,4±0,6	excess
7	mayonnaise-7	67	67,0±0,6	equal

From the data in Table 1, it can be seen that out of the seven analyzed samples of mayonnaise, the amount of fat in four samples was less than indicated on the label, in one sample it was more, and in two samples it was the same. All mayonnaises meet the safety requirements in terms of fat content.

In the following experiments, the fatty acid composition of oils extracted from mayonnaise was analyzed. For this purpose, a specified amount was taken from all extracted oil samples, splittedwith sulfuric acid and fatty acids were extracted. Then the methyl esters of fatty acids were obtained and the content of acids absent in gas-liquid chromatography was determined. The obtained results are presented in Table 2.

From the data in Table 2, it can be seen that the content of fatty acids of the oils extracted from all mayonnaise samples is almost the same, only the content of myristic acid is relatively high in samples 1-4. Especially in mayonnaise sample 4, it can be seen that the amount of myristic and other fatty acids is different from other samples. From this, it can be concluded that there is another type of oil in this sample

.Table 2

Fatty acid composition of oils extracted from commercial mayonnaise

№	Sample number	$C_{14:0}$,$C_{14:1}$	$C_{16:0}$,$C_{16:0}$	$C_{18:0}$	$C_{18:1}$	$C_{18:2}$	$C_{18:3}$	Other fatty acids
1	mayonnaise-1	1,4	6,87	3,64	21,41	63,56	0,42	2,7
2	mayonnaise-2	1,25	6,66	3,88	23,95	63,04	0,26	0,96
3	mayonnaise-3	1,79	7,31	3,63	22,73	62,45	0,4	1,69
4	mayonnaise-4	5,32	7,32	3,52	20,2	58,42	1,04	4,18
5	mayonnaise-5	0,2	7,2	3,5	29,9	57,8	0,1	1,3
6	mayonnaise-6	0,1	6,9	3,6	20,0	68,2	0,1	1,1
7	mayonnaise-7	0,1	7,2	3,5	30,2	57,9	0,1	1

Mayonnaise is a finely dispersed creamy "oil-in-water" type emulsion made from refined, deodorized vegetable oils with the addition of emulsifiers, stabilizers, thickeners, flavorings, and spices [15]. Traditional mayonnaise recipe is refined and deodorized vegetable oil (72%), egg yolk (9.2%), mustard (2.4%), sugar (2%), food acid (14.4 %) [16]. But this type of mayonnaise contains a lot of cholesterol and has a low biological value. It has low delamination stability and high energy value. It contains food acid, which makes it impossible to be used by a wide range of consumers [17]. Analysis of the production and prospective needs of mayonnaise products revealed the need to improve quality and diversify by using food additives that provide the necessary nutritional value of the product [18]. Food additives in the mayonnaise recipe not only improve the nutritional and biological quality of

mayonnaise, but also stabilize the emulsion and help to avoid traditional texture builders with undesirable side effects [19]. In some cases, an emulsifier is added to create a stable emulsion of high-calorie mayonnaise. In the case of low-fat recipes, stabilizers are used to provide stability and prevent separation. They improve the viscosity of the dispersed medium, prevent the synthesis of oil droplets, are hydrophilic in nature [20]. Reducing calories is very important when developing health products. At present, fats provide 30-35% of human food energy, so fat reduction is one of the requirements for the production of dietary and healthy emulsion products. Healthy mayonnaise should have a ratio of ω-6 to ω-3 polyunsaturated fatty acids (5-10):1 [21]. Food acids added to mayonnaise serve as both flavor and preservative. Caloric emulsions reduce the pH from 6.9 to 4.0-4.7, which prevents the appearance of unwanted microorganisms [22]. Speaking about the functionality of the product, it should be noted that the acetic acid or citric acid used in the mayonnaise recipe has a significant irritating effect on the mucous membrane of the gastrointestinal tract. In recent years, people's attitudes towards diet and its importance have changed dramatically. Consumers are increasingly interested in the health effects of various foods and their ingredients.

Physico-chemical properties of mayonnaise samples were analyzed in the following experiments in order to determine the presence of additives in the composition of mayonnaise and the effect of these additives on the quality indicators of mayonnaise. The obtained results are presented in Table 3.3.

It can be seen from the data in Table 3 that the physico-chemical properties of the mayonnaise samples are different. Ph value is in the range of 3.7-4.6, Acidity is in the range of 0.15-0.29%, calculated as acetic acid, Moisture content is in the range of 20.5-30.8%, Mass percentage of protein is in the range of 0.27 -2.3%, the mass fraction of Carbohydrate was in the range of 0.6-6.58%. Significantdifferences in the mass fractions of protein and carbohydrates were observed among mayonnaise samples. This is explained by the fact that mayonnaise recipes and components are different.

Table 3

Physico-chemical properties of mayonnaise samples

№	Sample number	Ph	Acidity, calculated as acetic acid, %	Mass fraction moisture, %	Mass fraction of protein, %	Carbohydrate mass percentage, %	Peroxide number, mmol active oxygen/kg
1	mayonnaise-1	3,9	0,2	28,0	0,74	6,05	5,15
2	mayonnaise-2	3,7	0,22	28,1	0,45	4,01	4,28
3	mayonnaise-3	4,3	0,15	27,2	0,63	6,58	8,13
4	mayonnaise-4	3,7	0,21	28,2	0,56	5,13	5,95
5	mayonnaise-5	3,7	0,25	29,4	0,31	2,2	3,6
6	mayonnaise-6	4,6	0,18	20,5	2,3	4,0	2,9
7	mayonnaise-7	3,8	0,29	30,8	0,27	0,6	4,2

It is known that the peroxide value of the oil phase of mayonnaise seriously affects its shelf life and food safety. Taking this into account, the peroxide values of the oils extracted from mayonnaise were analyzed in the next experiments (Table 3). All mayonnaise samples comply with the safety requirements for the number of peroxides (the specified norm is 10 mmol of active oxygen/kg). In particular, the hightestnumber of peroxides in mayonnaise-3 was 8.13 mmol of active oxygen/kg, and in mayonnaise-6 the lowest was 2.9 mmol of active oxygen/kg. However, it is possible to estimate oxidation stability and shelf life of mayonnaise samples based on the determined peroxide values.

Food additives in mayonnaise can seriously affect not only its physical and chemical properties, but also its microbiological properties. Because the milk, egg and other components of mayonnaise can be a favorable food environment for microorganisms. Therefore, mayonnaises are microbiologically analyzed.Microbiological properties of mayonnaise samples were analyzed in the following experiments (Table 4).

Table 4

Microbiological properties of mayonnaise samples

Microbiological properties		Mayonnaise samples						
		mayonnaise-1	mayonnaise-2	mayonnaise-3	mayonnaise-4	mayonnaise-5	mayonnaise-6	mayonnaise-7
CGB (coliforms)	determined	Not detected at 0.1 g						
	allowed	0.1 g is not allowed						
Pathogenic mikroorganisms, including Salmonella	determined	Not detected at 25 g						
	allowed	25 g is not allowed						
Mold	determined	Less than 1.0*10						
	allowed	Not more than 50.0						
Yeast	determined	Less than 1.0*10						
	allowed	Not more than 500						

From the data in Table 4, it can be seen that all 7 mayonnaise samples analyzed meet the safety standards in terms of microbiological indicators.

From the data in Table 3, it can be seen that the components of all mayonnaises differ from each other. Although the basis of the oil phase of all mayonnaises is sunflower oil, the composition and types of additives are different. This, in turn, directly affects the organoleptic and physicochemical properties of mayonnaise. We can see this from the data presented in Tables 1-4.

The components of mayonnaise affect not only its sensory and physico-chemical properties, but also its storage period and shelf life. In the following experiments, storage conditions and period of mayonnaise were analyzed (Table 5).

Table 5

Storage conditions and duration of mayonnaise samples

№	Sample number	Storage conditions	Storage periods, days
1	mayonnaise-1	from 0 °C to + 6 °C	100
		from+6 °C to +18 °C	45
2	mayonnaise-2	from0 °Cto +10 °C	90
		from+10 °Cto +18 °C	45
3	mayonnaise-3	from0 °Cto +10 °C	90
		from+10 °Cto +18 °C	45
4	mayonnaise-4	from0 °C to + 6 °C	90
		from+6 °C to +18 °C	45
5	mayonnaise-5	from+2°Cto +6°C	180
		from+6 °Cto + 18 °C	45
6	mayonnaise-6	from+2°Cto +6°C	100
		from+6 °Cto + 18 °C	45
7	mayonnaise-7	from+2°Cto +6°C	180
		from+6 °Cto + 18 °C	45

All mayonnaises were stored in a cold place at temperatures from 0 °C to +6 °C and in room conditions at temperatures from +6 °C to +18 °C, and their peroxide value, anisidine value and sensory properties were analyzed. The values of the obtained results were compared with the values allowed in the standard. Mayonnaises have a shelf life of 90 to 180 days when stored in cold conditions. It was 45 days when stored in room conditions.

Conclution

When analyzing the fat phase of seven commercial mayonnaises in our country, 4 samples had less than the specified amount of fat, 1 - excess and 2 - the same amount.Physico-chemical properties of mayonnaise samples: Ph value, acidity, moisture content, mass fraction of protein, mass fraction of carbohydrate were determined, significantdifferences were observed in the mass fraction of protein and carbohydrates. The physico-chemical, microbiological and sensory properties of all samples were determined and it was proved that mayonnaise samples meet the standard requirements for all parameters. Based on the physico-chemical, microbiological and sensory properties of the samples, it was determined that the additives in mayonnaise meet the safety requirements. In general, it was found that all mayonnaises selected for analysis comply with safety standards.

References

1.McClements D. (2005), Food Emulsions: Principles, Practices, and Techniques, 2nd edition, CRC Press, Boca Raton, pp. 609.

2.Nechayev A.P. et all.Mayonnaieses. -St. Petersburg: GIORD, 2000. - 80p.

3. Jacobsen, C. (2010). Enrichment of foods with omega-3 fatty acids: A multidisciplinary challenge. Ann NY Acad Sci (1190), 141-150.

4. Jacobsen, C., Let, M.B., Nielsen, N.S., Meyer, A.S. (2008) Antioxidant strategies for preventing oxidative flavour

deterioration of foods enriched with n-3 polyunsaturated lipids: A comparative evaluation. Trends Food Sci. Technol. Vol 19/2 pp 76-93

5. Artemis P. Simopoulos. (2010) The omega-6/omega-3 fatty acid ratio: health implications.OCL. 17 (5) 267-275

6.Amin, H., Elbeltagy, A. E., Mustafa, M., & Khalil, A. H. (2014).Development of low-fat mayonnaise containing different types and levels of hydrocolloid gum Sensory optimization of low-fat mayonnaise (different oils and gums).Journal of Agroalimentary Processes and Technologies, 20, 54–63.

7.Chang, C., Li, J., Li, X., Wang, C., Zhou, B., Su, Y., & Yang, Y. (2017).Effect of protein microparticle and pectin on properties of light mayonnaise.LWT – Food Science and Technology, 82(Suppl C), 8–14.

8.C. Sun, S. Gunasekaran, M.P. Richards Effect of xanthan gum on physicochemical properties of whey protein isolate stabilized oil-in-water emulsions. Food Hydrocolloid, 21 (2007), pp. 555-564.

9.Campos, J. M., Stamford, T., Rufino, R. D., Luna, J. M., Stamford, T., &Sarubbo, L. A. (2015). Formulation of mayonnaise with the addition of a bioemulsifier isolated from Candida utilis. Toxicology reports,2, 1164–1170. https://doi.org/10.1016/j.toxrep.2015.08.009

10.PenkwanChompreeda; VichaiHaruthaithanasan; SombatKhotavivattana. Development of reduced calories mayonnaise using maltodextrin from tapioca flour. AGRISAU. 2005. P. 210-211

11.SaehunMun, Young-Lim Kim, Choon-Gil Kang, Kwan-Hwa Park, Jae-Yong Shim, Yong-Ro Kim, Development of reduced-fat mayonnaise using 4αGTase-modified rice starch and xanthan gum, International Journal of Biological Macromolecules, Volume 44, Issue 5, 2009, Pages 400-407.

12. Muhammad Hussein Alu'datt, TahaRababah, Sana Gammoh, Khalil Ereifej, Majdi Al-Mahasneh, Stan Kubow, DeiaTawalbeh, 16 - Emulsified protein filaments: types, preparation, nutritional, functional, and biological properties of mayonnaise, Editor(s): Alexandru Mihai Grumezescu, In Nanotechnology in the Agri-Food Industry, Emulsions, Academic Press, 2016, Pages 557-572,

13.Alimi, M., Mizani, M., Naderi, G., &Shokoohi, S. (2013).Effect of inulin formulation on the microstructure and viscoelastic properties of low-fat mayonnaise containing modified starch.Journal of Applied Polymer Science,130(2), 801–809. 10.1002/app.39159

14. Stern, P., Valentova, H. and Pokorny, J. (2001). Rheological properties and sensory texture of mayonnaise. Eur. J. Lipid Sci. Technol., 103, p. 23-28

15. ShaxnozaGaipova, ShaxnozaxonSalidjanova, AkbaraliRuzibayev. Development of the recipe of dietary mayonnaise of functional purpose // Universum: texnicheskiyenauki. 2019. №9 (66).

16. Berestova A., Zinyukhin G., Mezhueva L.V. (2014), Osobennosti tekhnologiipishchevykh maslozhirovykh emul'siy funktsional'nogo naznacheniya, VestnikOGU, 1, pp. 150-156.

17. McClements D. (2005), Food Emulsions: Principles, Practices, and Techniques, 2ndedition, CRC Press, Boca Raton, pp. 609.

18. Laca A., Sáenz M., Paredes B., Díaz M. (2010), Rheological properties,

stability andsensory evaluation of low-cholesterol mayonnaises prepared using egg yolk granulesas emulsifying agent, J. Food Eng., 97, pp. 243–252.

19. Depree J., Savage G. (2001), Phisical and flavor stability of mayonnaise, Trend inFood Science & Technology, 12, pp. 157–163.

20. Tkachenko N., Makovsjka T., (2015), Tekhnologhijanyzjkokalorijnoghomajonezu, zbaghachenoghokompleksomsynbiotykivperiodychnymsposobom, Kharchovanaukaitekhnologhija., 9 (4), pp. 74-81.

21. Eliseeva N. (2008), Nizkozhirnyemayonezyisousy s pishchevymivoloknamiikompleksombiolohicheskiaktivnyhsoedinenii. J Maslozhirovaya promyshlennost;4, pp. 40-44.

22.Liua H., Xua X., GuoSh.D. (2007), Rheological, texture and sensory properties oflow-fat mayonnaise with different fat mimetics, Food Science and Technology, 40(6), pp. 946–954.

eISSN 1303-5150