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1. FOOD SCIENCE AND TECHNOLOGIES

IMPROVEMENT OF THE TECHNOLOGY OF SUNFLOWER HALVA WITH THE USE GRAPE SEEDS POWDER

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Abstract. *An analytical review of the literature has been conducted and the features of halva technology of different types have been studied. The main problems encountered during halva storage and the existing methods for their prevention are considered. The use of grape seeds powder in the food industry, mainly in fat-containing products has been analyzed. The grape seeds powder was determined to contain a large number of polyphenol compounds that exhibit potent antioxidant and antimicrobial properties.*

According to the results of experiments of acid and peroxide numbers, the addiction of powder in the amount of 5% is notable to lead to slow down the oxidation processes, thereby prolonging the shelf life of the finished product by 1.3 times. The content of dietary fiber prevents the separation of oil, as a result it has a better appearance and the weight of the finished product is nearly unchanged.

The rational dosage of grape seed powder into halva technology, which doesn`t influence the quality has been substantiated. It is 5% to protein mass.

Sunflower halva technology which differs from existing technologies has been developed by using secondary raw materials, lack of synthetic additives, introduction of halva fine grape powders with high content of polyphenolic compounds in the second stage, improved organoleptic properties.

Keywords: *halva technology, sunflower halva, grape seeds powder, antioxidants, storage time, fat oxidation, oil separation.*

INTRODUCTION

Human health is determined by the way of life primarily degree of availability of body with essential nutrients and energy, which come from food.

According to the statistics, confectionery is one of the most prevalent and affordable kind of food in Ukraine. This is due to their wide assortment, good organoleptic characteristics, and affordable. On the other hand, the vast majority of confectionary products contains practically none of biologically active substances, such as vitamins, minerals, food fibres and contain overly high calories. Therefore, the tasks ahead of scientists of the confectionery industry are extending the assortments, developing output, increasing biological and reducing energy values of products.

Halva has a special place in the wide range of confectionery and has been holding a steady position since come to us from Earth, as well as it was differentiated as a separate classification group.

The chief aim of this study is foundation and development the technology of sunflower halva with the addition the grape seeds powder which enrich the finished product with biologically active substances with high antioxidant properties, extend the expiration date, reduce energy value and expand the range.

To achieve this aim, it was necessary to solve the following tasks:

- to study assortments and existing ways to improving halva technology;
- to study the influence of grape seeds powder on the organoleptic and physico-chemical properties of halva sunflower
- to investigate the process of oxidation and hydrolysis of the oil components in the presence of grape seeds powder;
- to consider the process of separation of oil during storage of sunflower halva;
- to improve the technology of sunflower halva, to validate the rational dosing of the choose additive;
- to develop a draft technological documentation for sunflower halva with the addition of grape seeds powder.

1. ANALYTICAL REVIEW OF THE LITERATURE

1.1. Characteristics and features of halva production

Halva is a kind of confectionary product which has a layered fibrous structure. It is obtained by whisking the caramel mass with the foaming agent, followed by the mixing of the whipped mass with the grinded oil seeds. Halva composed of 10…20% protein, 30…35% fat, 40…55% carbohydrates, caloric content 100 g of product is 470…550 kcal [1].

Depending on the type of appearance coating, halva can be glazed and no glazed; by the way treatment method – vacuum or non-vacuum treated; by the way packaging method – packed and weighted. Halvah can be prepared either without additives, as well as with the addition of cocoa powder, milk powder, chocolate, blown cereals (extrusion products), with dried fruits or candied fruits [1, 2]. Depending on the type of raw material used, halva is divided into sunflower, sesame (tahini), peanut, corn, combined. By appointment, halva for general purpose and dietary (for diabetes mellitus patients) are released.

The main ingredients of halva cooking are oil-containing raw materials, sugar, starch syrup and foaming agents. The manufacturing process for halva consists of the following main stages: seeds dehulling; semi-finished products such as tahini and caramel mass) preparation; foaming agent preparation; whipping the caramel mass with the foaming agent; components mixing; packing and packaging [1].

The oilseeds supplied into the manufacture are cleaned of mineral and vegetable impurities. After that, they are crushed and subjected to heat treatment. The technological parameters of these operations depend on the type of raw material.

After dehulling, the sunflower seeds should be calibrated and separation of the whole kernels from husks and unbroken seeds and other fine particles. The kernels are dried to a moisture content by mass of 13…15% and subjected to a heat treatment at a temperature of 130…170° C to a moisture content of not more than 1.0…1.4% (higher moisture can lead to a particulate mass during grinding, as a consequence, deterioration quality of the finished product).

Before calving, sesame seeds are soaked in a salt solution with a concentration of 17…19% NaCl at a temperature of 35 ± 3° C for 30…180 min. During this period, the seeds swell, its mass increases by 30...50%, the shell becomes more elastic and easily separates from the kernels. Drying is carried out to a moisture content of 10…14% by mass, heat treatment to 0,9…1,2% at a temperature of 130…170° C.

Distinctive feature of the peanut kernels is the specific legume taste, which can

be gotten rid by soaking in warm salt solution (35…45° C, concentration 4…6%) with constant mixing for 20 min. The kernels are separated from the brine solution, dried to a moisture content of no more than 10%, fried to a mass fraction of moisture 1…2% at a temperature of 130…170° C.

Corn grits are pre-fried in a deep fryer to a moisture content of 2.5%, fat – 25…26% (due to the absorption of frying fat) [3].

Protein mass is obtained by grinding the roasted seeds of oil or nut kernels to obtain a homogeneous suspension, consisting of a protein fraction and oil content of which is 45...60%. Feature of corn protein mass production is the addition of oil for fat content of 45…49%.

For cooking caramel mass use starch syrup and sugar in the ratio of 188 to 100, which prevents the process of crystallization and gives more plasticity at high temperatures. The finished semi-finished product contains 96…97.5% of dry and 32…34% of reducing substances. It also can be prepared with invert syrup, added instead of part of starch syrup (87 kg of starch syrup is used 100 kg of sugar). The mass is boiled to a moisture content of 3…4% [1, 4].

In the production of dietary halva, fructose or isomalt are used instead of sugar, which decrease the energy value of the finished product and hardly change the organoleptic characteristics set out in the regulatory documents. The use of fructose increases the absorption of the product by the body, and isomalt provides products with low hygroscopicity, don`t increase the level of glucose and insulin in the blood [5, 6].

The foaming agent in the halva production are used as extracts.

The best foaming agent is a soap root, which contains a glucoside saponin. To extraction the root is washed with running water and soaked in warm water (60…80° C) for 10…24 h, then crushed and boiled to a moisture of 90%. The obtained decoction has a dark color, odorless. With the passage of time its foaming capacity deteriorates therefore it should be used immediately after preparation.

The licorice root can be used to replace soap root, which exhibits it's a huge foaming capacity due to the glycerrhizin contained in it (the potassium-calcium salt of glycerixed acid).

The tea seeds are known to use as a foaming argent. It is washed, soaked and boiled extract to a dry matter content of 7% [4].

The production of halva as an easily available foaming agent is albumen at home.

The caramel mass with foaming agent are churned at 105...110° C for 15...20 min until a lush white semi-finished product with a density of 1100...1500 kg/m³ is formed. Whipping the caramel mass at lower temperatures can lead to increase the viscosity and deterioration of the foaming process. The duration of the whipping determines the quality of the product: in the case of long whisking, the caramel semi-finished product is more lush, but the caramel threads are short and easily torn; with insufficient whipping, a coarse fiber of yellow is obtained.

To get a good quality product, it is advisable to follow the optimal ratio 54 of the tahini mass on 45 parts of the caramel mass for sunflower and 60:45 for other types of halva. With such dosages, the texture of halva will be soft, and oil consisting of protein mass is distributed fairly evenly between the caramel layers and is not removed during storage.

When mixing of protein and caramel masses, the temperature of the mass is gradually reduced and the structure of the finished product is formed. At first, the protein mass (40° C) and caramel mass (110° C) are being mixed for 1...1.5 minutes to obtain a heterogeneous structure with large fiber caramel mass (the temperature decreases to 75...80° C); then the caramel threads are being pulled into thinner ones and the protein mass is being evenly distributed between them (the temperature drops to 65…70° C) for 3…4 min; in the next 3…4 min, the final formation of a thin-fiber structure of mass (temperature decreases to 55…60° C) [1, 3].

Halva is known to be a high-caloric product with a large number of biologically active substances. In order to correct its composition, experts from NUFT have been proposed the addition of non-traditional raw materials to the technology of halva sunflower. The use of sunflower and flax seeds, meal of pumpkin seeds made it possible to increase the nutritional value and lower the energy value of the finished product [7].

Halva is stored for 1.5 months and glazed with chocolate or confectionery glaze for 2 months at a temperature of 18 ± 3° C and relative humidity not higher than 70%.

Of all types of halva, sunflower is the most common in our country due to the availability of raw materials for its production. That's why we have chosen sunflower halva for research. The following are problems that may occur during storing this product.

1.2. The main problems of halva storage and their solutions

During the storage of halva processes occur that affect the organoleptic and physicochemical quality indicators and make the finished product unfit for consumption. One of them is oil separate, whose content is up to 35%.

For example, glycerol monostearate, first mentioned in research papers of Damir (1984 and 1990). Its addition to tahini halva has helped to reduce the amount of separated oil from 7.6% to 4.1%, and in sunflower oil – from 11.8% to 6.2% for 90 days of storage [5]. Dietary fiber and emulsifiers [8], hydrogenated palm oil [9] have been effective in halva, as a result of the manifestation of homogenizing properties. These additives are noted not to have significantly affect the organoleptic characteristics of the finished product. At the same time, they increase its viscosity, thereby prevent the separation oil from halva during storage.

The opportunity of solving this problem by adding gelatin, soy protein and $CaCl_2$ was investigated, but as it turns out, these additives interact with sugar and foaming agent during the technological process and lead to change of colloidal state of tahini mass, increase the instability of the emulsion [8].

An important problem is the oxidation of fats during the storage of halva. To solve it, use additives with antioxidant properties or special packaging.

Thus, at the University of Thessaly, pack halva in a modified atmosphere with a CO_2 level of more than 20% was proposed [10]. This makes it possible to reduce the pH of the test samples by dissolving CO_2 in the aqueous fraction, as well as improve the oxidative stability of the halva fat.

It also worth noting that of all types of halve, the most resistant to oxidation is tahini, because of the large number of antioxidants that are formed during the roasting stage of seeds [11, 12].

It would be useful to introduction of antioxidant additives into sunflower halva. But chemical antioxidants, solving the problem of the extension of shelf life of food products, whereas harming our body. Therefore, preference should be given natural addiction. This is due to its availability, low cost by the fact of being a by-product, and rich chemical composition, first of all, the presence of polyphenolic compounds – substances with high antioxidant activity. The properties of this supplement are described below.

1.3. Characteristics and properties of grape seeds powder

Grape seeds powder is a product of the processing of grape pomace that remain after wine production. The essential component is the pomace dietary fiber, including polysaccharides of cell walls and lignin. Their content is 43…75% [13]. Moreover, seeds are a source of calcium, phosphorus, sulfur, magnesium. But the most valuable components of grape pomace are phenolic compounds [14].

Grape powders have been used in food technology due to a rich chemical composition. They were added to dairy [15], flour [16], confectionery [17] products, etc. This has enabled to enrich products with deficient minerals, such as potassium, calcium, magnesium, zinc, copper, manganese and phosphorus, which perform important functions in the body. Moreover, the addition of grape powders allows to extend the shelf life of the food. Antioxidant properties of pomace have been proven by various scientists. For example, the introduction of grape seeds powders in exchange of a portion of cocoa powder in a confectionery glaze has been proved allows to slow down the processes of fat oxidation, which increases the shelf life of the glaze and its glazed products.

Grape seeds components have also been shown to improve the microbiological indices of foods, namely, delay the growth of lactic acid, aerobic mesophilic bacteria, Pseudomonas and psychotrophic populations of microorganisms in food. Grapes extracts have bactericidal action against yeast and mold [18].

Consequently, the use of grape seeds powder will promote the enrichment of halva with dietary fiber, minerals, and prolong its shelf life due to the high content of polyphenolic compounds.

Conclusion of section 1

1. Halva is a popular consumption product that has remained at the center of the main focus of attention for a long time due to its high taste properties.

2. In order to improve the technology of halva, various additives have been used emulsifiers, dietary fibers, hydrogenated palm oil, which help to prevent the processes of oil spillage as well as its oxidation.

3. We have chosen grape seeds powder as an additive, which contains nutrients, minerals, polyphenolic compounds, has antioxidant and antimicrobial properties.

2. OBJECT, SUBJECT, MATERIALS AND METHODS OF RESEARCHES

2.1. Object, subject and material of researches

We have chosen the technology sunflower halva with added grape seeds powder as an object.

Subject of research: Halva quality on the standard recipe and Halva with added grape seeds powder (3.0%, 5.0% and 7.0% of the protein mass) during storage.

The following raw materials have been used to producing samples of halva:

– sunflower seeds – DSTU 7011-2009;
– grape seeds powder – TU U 10.8-34801551-004:2013;
– sugar powder – DSTU 4625:2006;
– soapwort extract – GOST 3448-78;
– starch syrup – DSTU 4498:2005.

Raw and other materials were used to the production of halva have met the requirements of the existing standards and regulations.

The quality indicators and the chemical composition of grape seeds powder was used to studies are shown in Table 2.1 and 2.2.

Table 2.1 – The quality indicators of grape seeds powder

Indicator	Characters
Organoleptic characters	
Appearance	Fine-dispersed and granulated consistency
Color	Brown
Taste	Neutral
Smell	Neutral
Physicochemical characters	
Moisture, %	6.0±0.2
pH	7.0±0.2
Particle size, mkm	20.0…30.0

Table 2.2 – The chemical composition of 100 g of grape seeds powder

Component	Grape seeds powder
Water, g	6.0
Proteins, g	12.4
Fats, g	8.2
Mono-, disaccharides, g	2.3
Dietary fibre, g	
Cellulose	16.4
Hemicellulose	13.2
Pectinaceous substances	0.7
Lignin	30.2
Carotenoids, mg	0.6
Vitamins, mg:	
B_1	0.26
B_2	0.40
B_6	0.20
PP	9.8
Minerals, mg:	
Iron	30.0
Calcium	330.0
Magnesium	360.0
Potassium	1350.0
Phosphorus	260.0
Zinc	5.6
Manganese	1.0
Polyphenols, mg	6111.0

2.2. Methods of researches

Evaluation of organoleptic qualities that are typical for this type of product, namely: appearance, taste, odor, consistency and structure (the structure of faults) were performed according to DSTU 4683:2006.

The physicochemical parameters were determined by the following methods.

Determination of the mass fraction of moisture was carried out by the accelerated method in the oven DEB-3 according to the method DSTU 4910: 2008.

The degree of fat deterioration was determined with acid and peroxide numbers, according to DSTU 4350:2004 and DSTU 4570:2006. Weight of researched sample was poured into 96% ethanol in the ratio of 1 to 2, followed by extraction for 24 hours.

The acid number was established by titrating (in the presence of a phenolphthalein indicator). The solution of weight containig 2…3 g of fat was titrated with 0.1N solution of potassium hydroxide in a neutral mixture (96% ethanol and ethyl ester in a ratio of 1:2). The acid number (AN) was calculated with the formula

$$AN = \frac{a \times T_{KOH} \times 100}{H}, \quad (2.1)$$

where a – the amount of 0.1N KOH, which went to the titration sample, ml,

H – weight, g.

The peroxide number was measured by titrating. A sample weight (dissolved in 7 ml of chloroform and 14 ml of glacial acetic acid) of about 1 g in the presence of 1 ml of saturated aqueous potassium iodide was titrated a 0.01N sodium hyposulphite solution with. The peroxide number (PN) was calculated by the formula

$$PN = \frac{(V - V1) \cdot 100 \cdot 0{,}001269}{M}, \quad (2.2)$$

where V – the amount of 0.01N solution of hyposulphite spent on titration, ml,

V_1 – the amount of 0.01N solution of hyposulphite spent on titrating of control, ml,

M – weight, g.

Amount of reducing substances contained was determined by the ferricyanide method, which is based on the visual titration of oxidized reducing agents with an alkaline solution of ferricyanide in the presence of a methylene blue indicator until the blue color disappears by glucose. Samples were prepared according to [19]. Mass fraction of reducing substances in percentage ratio was determined by the formula

$$Z = \frac{0{,}0016 \times (V - V_1) \times 100 \times K}{m}, \quad (2.3)$$

where Z – mass fraction of reducing substances, %;

V, V_1 – the volume of the standard glucose solution that went to the titration of control and of the test sample, respectively, ml;

K – the correction factor, which is determined by the ratio of the presence of reducing agents and total sugar in the product;

0,0016 – glucose concentration in standard solution;

m – mass of sample, g.

To find out the amount of oil separated while storing halva, each 25 g sample was placed in filter paper and then in foil. All samples were stored for 80 days at 20° C in a desiccator containing absorbent. Samples with a certain frequency were

weighed and the results were calculated by the formula

$$O = \frac{W_1}{W} \times 100, \quad (2.4)$$

where O – amount of separated oil, %;

W_1, W – the weight of the sample at the beginning and after n days of storage, respectively, g.

The energy value of 100 g of sunflower halva and sunflower halva with the addition of grape seeds powder was calculated by the method [20].

Conclusion of section 2

1. The characteristics of the grape seeds powder used in the studies are provided.
2. The methods of conducting experiments for the study of organoleptic parameters, physicochemical properties, determination of acid and peroxide numbers, the amount of separated oil during storage of sunflower halva are defined and described.

3. RESULTS OF THE RESEARCH AND THEIR DISCUSSION

Grape powders were added in an amount of 3.0, 5.0 and 7.0% into the protein mass at the halva mixing stage. The best distribution of grape seeds powder is established to occur at the temperature of 75…80° C during the formation of halva structure with large fibers of caramel mass. Physicochemical characters of halva are shown in Table 3.1.

Table 3.1 – Physicochemical indicators of sunflower halva for different dosage of grape seeds powder

Indicator	Dosage of powder, % to protein mass				According to normative documents
	control	3.0	5.0	7.0	
Moisture, %	3.26	3.19	3.04	3.02	According to approved recipes, but not more than 4
Total sugar, %	39.86	38.24	38.86	34.82	25.0…45.0 limit of deviation from the expected value to decrease no more than 2.0
Redusing sugar, %	19.84	19.06	18.97	17.03	no more than 20.0
Total fat, %	30.65	30.56	30.04	29.89	28.0…34.0

The results of experimental studies provide some evidence for the choose additive to the recipe of sunflower halva doesn`t produce significant changes in the physicochemical properties compared to the control sample. Increasing dosage of grape seeds powder to protein mass can be seen to increase the content of solids in halva slightly, from 96.74% (control) to 96.81%, 96.96%, 96.98% (the test samples containing 3.0, 5.0 and 7.0% of the additive, respectively). At the same time the total mass fraction of sugar and fat of reducing substances slightly reduced by the number of fiber that are made with powder. The grape seeds powder is known to contain a large number of polyphenolic compounds that has exhibited high antioxidant properties. In order to study the effect of choose additive on the state of fat in halva, its acid number was considered. The results obtained are shown in Fig. 3.1.

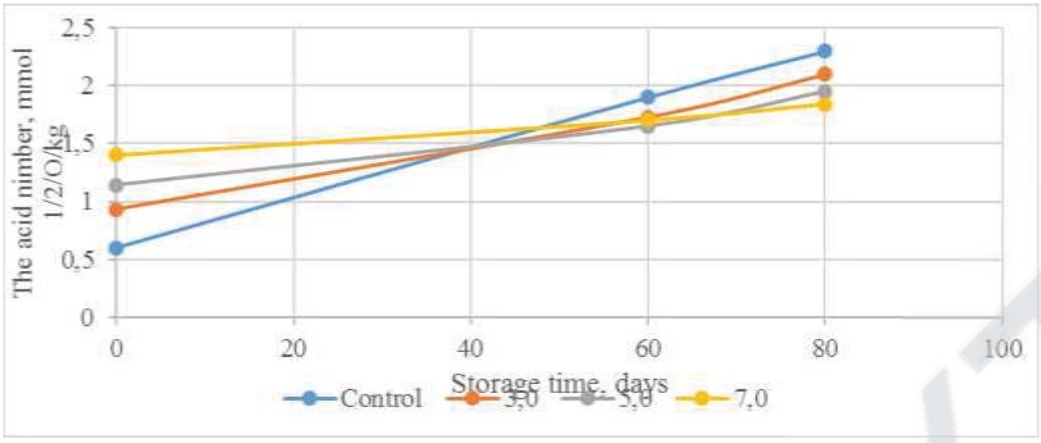

Fig. 3.1 – The dependence of the acid number of fat on the storage time of sunflower halva

From the obtained results it is seen that at the beginning of storage in the test samples, which recipe include grape seeds powder, the acid number is much higher than that of the control one. We can explain this this phenomenon by the presence in the composition of the choose additive of organic acids.

The acid number of the control sample increases rapidly, and in all other samples, the accumulation of acids occurs slowly during storage of halva.

Thus, at the end of the standard storage period (60 days), the acid fat in the control sample is 1.9 mg KOH/g, in the samples with the addition of grape seeds powder in the amount of 3.0, 5.0 and 7.0% – 1.73, 1.65 and 1.7mg KOH/g, respectively. It should point out that the taste sample of sunflower halva which contains 5.0% of grape seeds powder reaches a control value only at 78 days of storage. It prolongs the shelf life by 1.3 times. At 80 days of storage, this figure becomes 2.3 mg KOH/g in the control sample, and in products with the addition of the choose additive in the amount of 3.0, 5.0 and 7.0% – 2.1, 1.95, 1.84 mg KOH/g.

It is concluded that the accumulation of fatty acids has been reducing by the addition of test powder for storage of sunflower halva. However, the acid number hasn`t given a complete description of their degree. The peroxide number is an important indicator, which shows the accumulation of primary oxidation products (peroxides and hydroperoxides) is. The results of his research are shown in Fig. 3.2.

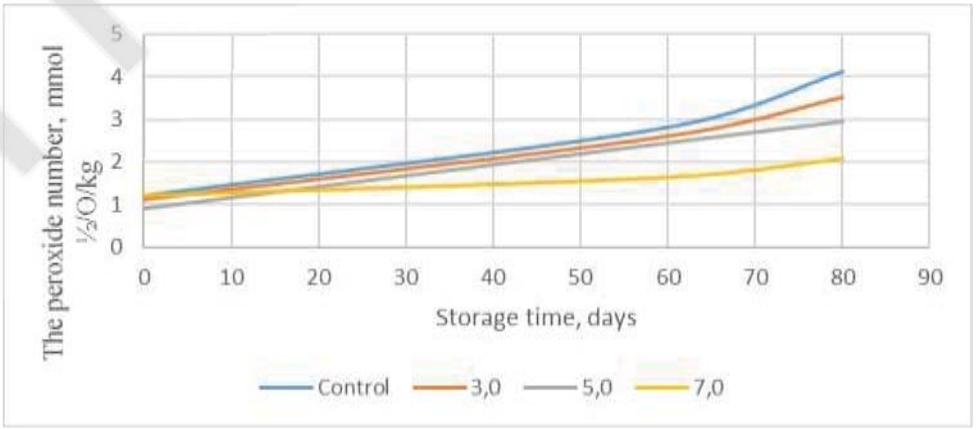

Fig. 3.2 – Dependence of peroxide number on the storage time of sunflower halva

According to the obtained results, in the control sample peroxide number (as well as acid number), acquires significant changes to compare the beginning and the end of storage of the test samples.

The storage time of sunflower halva is known to be 2 months at the necessary conditions. A detailed study revealed that sunflower halva with the addition of 3.0, 5.0 and 7.0% of grape seeds powder to protein mass has had a peroxide value of 80 days of storage of 3.52, 2.94 and 2.06 mmol ½/Okg, respectively, while the control sample for 60 days' storage this value has been 4.1 mmol ½/O kg. The researched additive has been found to retain and improve organoleptic properties, on the other hand, the oxidation processes have been decreased, consequently, the storage time of the rapidly oxidizing product has been increased. The effect of experimental additives on the separation of oil during storage of sunflower halva was investigated. The results obtained are presented in Table 3.2.

Table 3.2 – Influence of test additives on oil separation during storage of sunflower halva

Dosage of grape seeds powder,%	Storage time, days							
	1	10	20	30	40	50	60	80
0 (control)	0.75	2.13	3.78	4.22	5.07	6.02	6.34	7.41
3.0	0.13	0.15	0.15	0.16	0.16	0.18	0.18	0.19
5.0	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
7.0	0	0	0	0.01	0.01	0.01	0.01	0.01

The data obtained indicate that oil is separated in the control sample throughout the shelf life. When adding a test supplement, this rate decreases rapidly and hardly changes during carrying out of the experiment. Thus, for 80 days for 3.0, 5.0 and 7.0% the amount of separated oil is 0.19, 0.03 and 0.01%, while in the control sample – 7.41%. In our opinion, grape seeds powder not only shows its antioxidant properties well, but also firmly holds the oil at its expense. In this way, grape seeds powder not only has good antioxidant properties, but also has a strong oil content. We can explain this by the high content of dietary fiber and the porous structure of the powder, which has been confirmed in [21].

Addition shouldn`t aggravate the organoleptic quality of the finished product. Therefore, it was their basis in determining the rational dosage of grape seeds powder. The results of relevant studies are given in Table 3.3.

According to the data have been obtained, halva with the addition of grape seeds powder in a quantity 3.0 and 5,0% have the similar results, namely sunflower taste and odor, brown shade, retaining a fibrous layered structure, friable texture, as in the control sample. Increasing the dosage of the powder have led to a compaction of the consistency of the product. Therefore, we also think that the rational dosage of the choose additive, which not only improves the organoleptic properties, but also extends the shelf life of sunflower halva, is 5% to protein mass, thereby solving the main problems of the industry.

We calculated the nutritional and energy value of the developed product. The results of the obtained data are shown in Table 3.4.

Table 3.3 – Organoleptic characteristics of sunflower halva with different dosage of powder from grape seeds

Indicator	Dosage of powder, % to protein mass				According to DSTU
	Control	3.0	5.0	7.0	
Odor and taste	Sunflower, no signs of rancidity	Sunflower, no signs of rancidity	Sunflower, no signs of rancidity	Sunflower, no signs of rancidity	Inherent to this type of halva, without signs of rancidity, free of foreign smell and taste
Color	Greyish	Grayish with barely visible light fibers	Grayish with barely visible light fibers	Expressed brown with barely visible light fibers	Inherent to this type of halva
Consistency	Friable, it`s easily cut	Friable, it`s easily cut	Friable, it`s easily cut	Condensed, difficult to cut	Friable, it`s easily cut
Structure in the fault	Fibrous layered	Fibrous layered	Fibrous layered	No fibers	Fibrous layered, fine fibrios

Table 3.4 – Results of calculation of energy and nutritional value of sunflower halva

Sample of sunflower halva	Content in 100 g, g			Energy value, kcal
	Proteins	Fats	Carbohydrates	
Control (no additives)	12.52	30.65	53.77	541.1
With the addition of 5.0% grape seeds powder	12.50	30.04	52.39	530.0

Studies have shown that the choose additives positively influence the chemical composition, while at the same time reduces the energy value of the product, namely the caloric content of 100 g of the control sample is 541.1 kcal, and the halva with grape seeds powder is 530.0 kcal per 100 g.

Referring to our research, we have developed the technology of halva sunflower, which differs from existing halva technologies using natural raw materials, the absence of food additives of synthetic origin, the addiction in the second stage of mixing halva fine powder from grapes with high content polyphenolic compounds, dietary fibers, minerals lead to get a high quality product and an extended shelf life.

The functional and technological scheme of making halva of sunflower with the addition of grape seeds powder is shown in Fig. 3.3

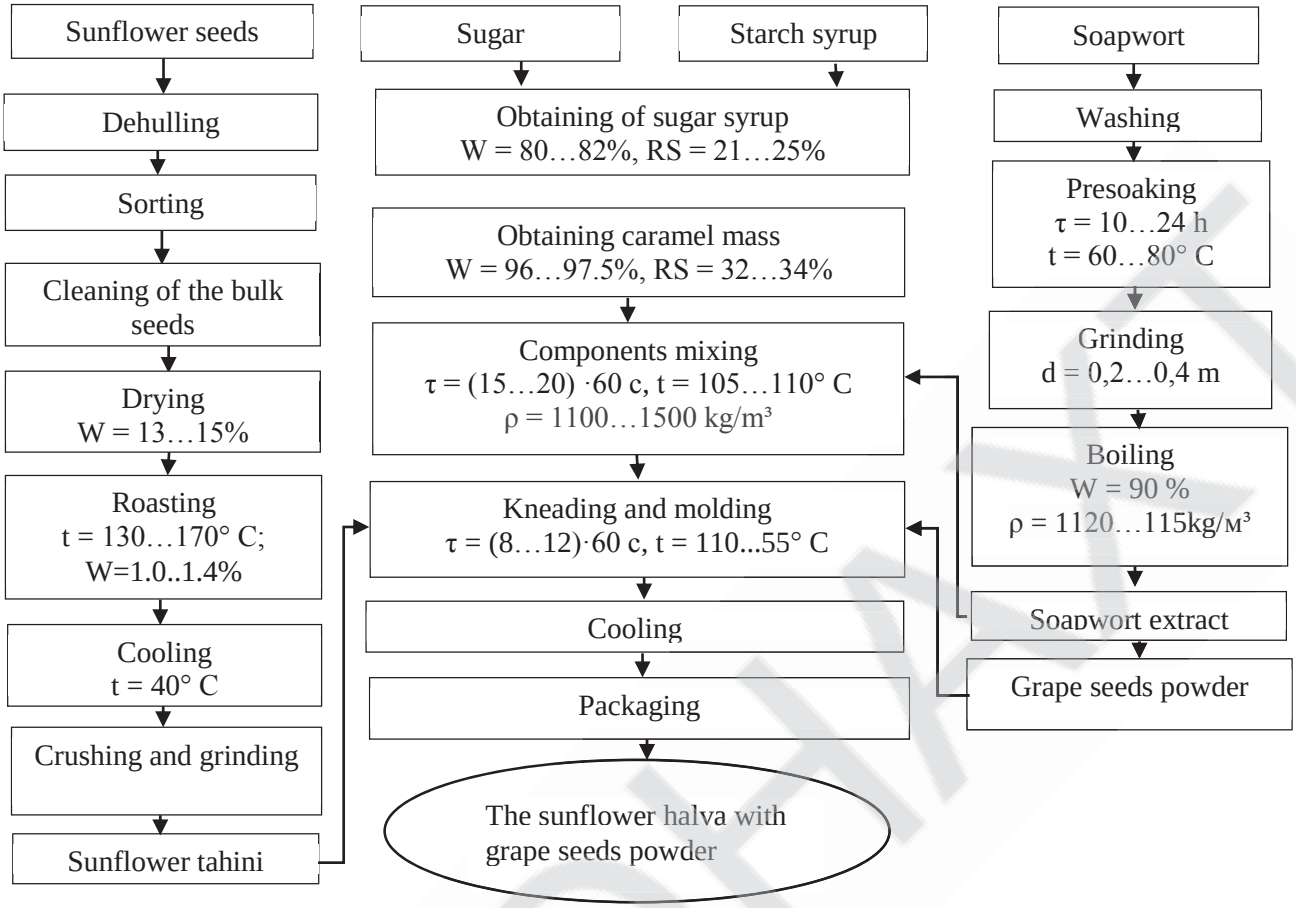

Fig. 3.3 – Functional-technological scheme of manufacturing halva of sunflower with grape seeds powder

Conclusion of section 3

1. Addition of grape seeds powder does not significantly increase the solids content and reduce the mass fraction of total sugars, reducing substances and fat.
2. The addition of grape seed powder leads to slow down the hydrolysis and oxidation of fats
3. Addition of grape seeds powder reduces the separation of oil (80 days) for the samples with the addition of 3.0, 5.0 and 7.0% the amount of separated oil is 0.19, 0.03 and 0.01% while in the control sample – 7.41%.
4. Established rational dosage of the choose additive It is 5% into protein mass this prevents the accumulation of acid number in the finished product
5. The technology of sunflower halva with grape seed powder have been developed by including the introduction of additives with a high content of polyphenolic compounds and dietary fiber in the second stage of kneading

CONCLUSION

1. During of the analytical review of the literature, the features technologies and the main technological stages of the production of different types of halva were studied, as well as the existing problems and methods of their solution.
2. Due to the content of polyphenolic compounds, which have powerful antioxidant and antimicrobial properties, grape seeds powder is used in the production of fat-containing products, which lead to slow down the processes of oxidative and

microbiological spoilage.

3. The results of acid and peroxide numbers, the action of antioxidants contained in grape seeds powder was proved, by analyzing. This made it possible to increase the shelf life of the finished product by 1.3 times and to solve one of the most important problems of spoilage of products.

4. Grape seeds powder is a natural supplement that prevents the separation of fat during storage. As a result, the product has a better appearance and the weight of the finished product remains almost unchanged throughout the life of the product.

5. The optimal percentage of dosage of grape seeds powder – 5% to protein mass has been established that provides a halva with high organoleptic quality.

6. The functional technological scheme of halva of sunflower with grape seeds powder has been developed. The introduction of the experimental additive in the second stage of mixing was determined to provide equal distribution.

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