

STUDY OF QUALITY OF SNACK GHERKIN TINNED FOOD

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Abstract

This work considers a problem of raising a marinade quality for producing snack gherkin tinned food. There is offered a new way for raising a marinade food value. The aim of the work is to raise a tinned food quality at the expense of recipe peculiarities of ingredients. There is offered to produce snack tinned food with adding mustard. The tinned food contains gherkin, sugar refined sunflower oil, kitchen vinegar 9 %, salt, dry mustard, grinded red pepper and chopped garlic. An optimal recipe for diminishing mass consumption of the raw materials is developed in the study. The tinned food recipe was modeled by the simplex method that allowed to get an optimal variant with a maximal complex quality parameter. According to the recipe, a bank of 1-82-500 needs: gherkin – 375 g, sugar – 37.5 g, refined sunflower oil – 37.5 g., kitchen vinegar 9 % – 37.75 g, salt – 3.75 g, garlic – 3.75 g, mustard (powder) – 3.75 g, grinded red pepper – 1 g.

It is established, that the new snack tinned food is characterized by high organoleptic properties.

The technological scheme at producing the snack tinned food “Pickled gherkins with mustard” includes the following processes: preparation of the raw materials (cleaning, sorting), soaking in cold water for 5–8 hours; inspection; pouring with marinade; mixing and infusion; packing; closing; sterilization, formation of ready products. Gherkins are processed by the standard technology for pickled vegetables. Physical-chemical parameters in the raw materials and ready products were studied during the work: the content of soluble dry substances – by the refractometric method; the total content of organic acids – by titration; pH-medium – by the potentiometric method; the content of nitrates – by the ionometric method. Mustard was added for raising a food value and quality of the snack tinned food. It is healthy, because it improves the appetite, disintegrates fats and facilitates digestion of protein meals, at that activating metabolism. Main healthy properties of mustard are antimicrobial, antifungal, antioxidant and anti-inflammatory effects. Added spices and garlic give a pleasant taste and add the composition of mineral substances.

The developed recipe is designed for production technological lines and recommended for implementation at processing enterprises. The conducted work testifies to the expedience of producing new types of snack tinned food, which food value is increased and organoleptic parameters are improved at the expense of ingredients.

Keywords: technological scheme, recipe, vegetable tinned food, marinade, quality, chemical composition, food value, vitamins.

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1. Introduction

Priority directions of the processing industry at the modern stage include the rational use of vegetable raw materials, maximal preservation of biologically active substances, widening of the assortment of products of a raised food and biological value.

A necessary amount of the preservative – acetic acid – is added to vegetables at their preparation for pickling. As a result, microbes cannot develop, and a product becomes tinned. Suppression of different microorganisms is manifested even at small concentrations of acetic acid (0.2–0.3 % of acid of the total mass of pickled products). At small concentration 0.4–0.6 % of acetic acid subacid marinades, not stable at storage, form [1–5]. As a result of the small concentration of vinegar, microorganisms in such marinades are partially suppressed, their essential part can develop and cause spoilage of the product. So, it is necessary to pasteurize subacid marinades. Concentrated acetic acid (essence), obtained at dry wood distillation by the chemical way, is most often used at enterprises. Acetic acid with concentration 80 %

(sometimes 70 %) is for sale. The use of acetic essence negatively influences the condition of the human gastrointestinal tract. The better quality of marinades is attended at using natural vinegar (wine or apple vinegar). Natural vinegar has the consistence of acetic acid from 4 % to 9 %. It has a soft taste and nutritive value, pleasant smell. It contains biologically active substances, including organic acids, some amounts of sugars, phenol substances, aldehydes, ethers and microelements [6–8].

The aim of the study is a way of raising a food value of gherkin tinned food.

2. Problem review

Today different technologies for giving gherkins a crispy texture are used at tinned food enterprises. One of undesirable methods is to add calcium chloride, and cheap synthetic aromatizers and sweeteners, used for eliminating an unpleasant taste and smell. An advantage of such products, made by the “hard” technology, is rather doubtful [9].

One of methods of raising a quality of ready products and eliminating the aforesaid defects is to improve the marinade technology at the expense of using high-quality vegetable raw materials, determining an optimal recipe with using natural fruit vinegar [10–12]. The analysis of modern studies on the quality improvement of vegetable tinned food testifies to the necessity to optimize a recipe of marinades at preparing snack tinned food for raising a food value of ready products [13–15].

Based on studied consumers’ preferences, works [17, 18] demonstrate a method of making new products with given production properties, oriented at the target audience. This method allows to see quality characteristics of a product in their quantitative expression and to compare several products. There appears a possibility to correct undesirable tints and smacks of functional supplements, introduced at the stage of the recipe development, and also to develop a recipe of a maximally competitive product, based on concrete consumption preferences.

Thus, problems of designing new food products are solved at the expense of multi-ingredient character of a product, under condition of evaluating the complex quality parameter (CQP). The results of the quality evaluation of tinned food are presented on **Fig. 1**.

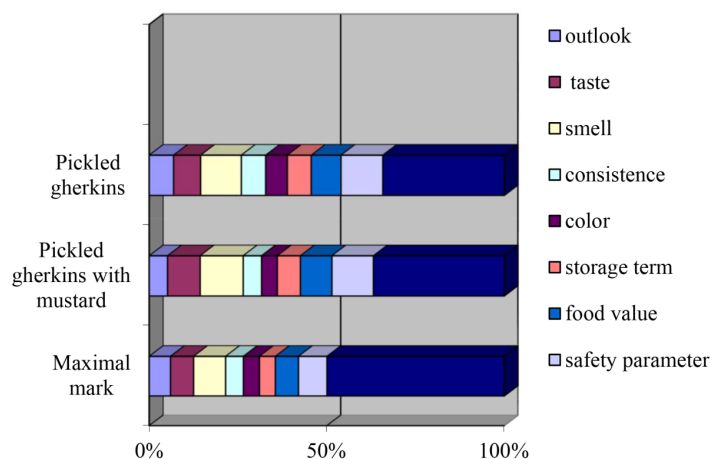


Fig. 1. Quality parameters of the pickled gherkin tinned food

For evaluating a quality of pickled gherkins, the tinned food was estimated by the organoleptic parameters: taste, smell, consistence, color. There were also estimated the physical-chemical parameters: mass share of dry substances, titrated acids, chloride content. The maximal amount of points for each parameter was calculated by the ranking method, based on expert marks. Based on literary data, an unalienable part is studies for determining a quality of the tinned food “Pickled gherkins with mustard”, produced by the changed recipe.

3. Materials and methods

The research object is the snack tinned food “Pickled gherkins with mustard”.

The research subject is marinade, technological scheme and production processes of vegetable tinned food.

The research methods are theoretical and experimental. Theoretical studies are scientific methods of determining normative quality and safety parameters of food products for improving a quality of pickled products.

The experimental studies were conducted at the department of Food technologies of Kher-son national technical university. The commission included 5 testers (professors of the department of Food technologies). The studies were conducted, using the methods of determining organoleptic parameters; existent standard physical, chemical, physical-chemical, biochemical, microbiological methods of analyzing functional-technological and structural-mechanical quality and safety pa-rameters of the ready pickled tinned food.

The chemical composition of gherkins includes vitamins of the groups: A, PP, C, B5, B1, B2, K. At that the vegetables are rich of the microelements and minerals: carotene, Ca (23 mg), Na (8 mg) and K (141 mg), P (42 mg), Fe (0.6 mg), folic acid. The composition of cucumbers includes: water 95 %, proteins (0.8 g), organic acids (0.1 g), carbohydrates (2.5 g), mono- and disaccharides (2.4 g).

4. Experiments

4. 1. The development of the marinade recipe for the tinned food “Pickled gherkins with mustard”

The system approach to creation of innovative products with given consumption properties provides realization of a series of main principles. At solving problems for minimum, a value of the target function must change reversely: from the maximal to the minimal possible one. The maximal value of the function will be initial, and the minimally possible – at the final solution. As far as fic-tious variants of the recipe are included in the initial plan, reverse CQP values that essentially exceed ones for real variants of the recipe must be accepted for them. For obtaining a mathematic model of the problem, several recipe variants are needed [19]. 5 variants of the recipe of the tinned food “Pick-led gherkins with mustard”, including the following components: vinegar (9 %), sugar, sunflower oil, salt, garlic, mustard (powder), grinded red pepper with different ratios of ingredients, were designed for the experiment. The optimal recipe of the snack tinned food (taking into account the complex quality parameter (CQP 98.67 %) was selected among the experimental recipe variants.

The component ratio of the optimal recipe of the new type of tinned food “Pickled gherkins with mustard” is presented in **Table 1**.

Table 1

The component ratio of the recipe of the tinned food “Pickled gherkins with mustard”

Raw material	Component ratio, mass %
Gherkins	75
Kitchen vinegar 9 %	7.55
Sugar	7.5
Refined sunflower oil	7.5
Salt	0.75
Garlic	0.75
Mustard (powder)	0.75
Red grinded pepper	0.20

The tinned food “Pickled gherkins with mustard”, including gherkins, salt, kitchen vinegar 9 %, differs from the prototype “Pickled gherkins” by the presence of mustard (powder), sugar, refined sunflower, grinded red pepper and garlic.

According to the optimal recipe results, standards of the raw materials for package in a bank of I-82-500: gherkin – 375 g, sugar – 37.5 g, refined sunflower oil – 37.5 g, kitchen vinegar 9 % – 37.75 g, salt – 3.75 g, garlic – 3.75 g, mustard (powder) – 3.75 g, grinded red pepper – 1 g.

4. 2. The Method of titration acidity determination. SSU 4957:2008

The essence of the visual method: potentiometric titration of the testing solution by sodium hydroxide of the molar concentration $(\text{NaOH})=0.1 \text{ mol/dm}^3$ with the phenolphthalein indicator. Distilled water, used for the study, must not contain carbonic acid, so it must be freshly boiled and cooled or neutralized by the solution of sodium hydroxide of the molar concentration $(\text{NaOH})=0.1 \text{ mol/dm}^3$ to the weakly-pink color by phenolphthalein.

A batch of the product with the mass from 5 g to 50 g, depending on permitted acidity, is transferred through a funnel of 50 cm^3 with hot distilled water in a conic flask of 250 cm^3 . Then the flask is poured with distilled water at temperature $(80 \pm 5)^\circ\text{C}$ up to the half of its volume, accurately mixed, kept during 30 min, periodically shaking, or connected to a dephlegmator, the content is heated on the water bath during 30 min. After cooling the content of the flask is put to a measuring flask of 250 cm^3 and the volume is added with distilled water to the mark. Then it is corked, the solution is accurately mixed and filtered through a filter or wadding. If the product is liquid, the batch of mass 50 g is quantitatively transferred by distilled water of the room temperature in the measuring flask of 250 cm^3 and the volume is added with distilled water to the mark, mixed and filtered.

An aliquot portion. $25 \text{ cm}^3 - 100 \text{ cm}^3$ of filtrate is taken by a pipette to the conic flask of 250 cm^3 . Such amount of taken filtrate allows titration at no less 6 cm^3 of the sodium hydroxide solution. The flask with filtrate is added with three drops of the phenolphthalein solution and titration by the sodium hydroxide solution is realized at continuous mixing to the pink coloration that doesn't disappear during 30 min. The mass share of titrated acidity in percents in recalculation for the dominant acid is calculated by the formula:

$$x = \frac{V \times c \times M \times V_0}{0.1 \times m \times V_1},$$

where V – volume of the titrated acid of nitrate silver, used for titration, cm^3 ; c – molar concentration of the titrated acid of nitrate silver, mol/dm^3 ; M – molar mass of sodium chloride $M(\text{NaCl})=58.45 \text{ g/mol}$; m – batch mass, g; V_1 – volume that the water extract of the product batch is added to, cm^3 ; V_2 – volume of filtrate, taken for the determination, cm^3 .

At the organoleptic evaluation (5-point scale) there were assessed an outlook, consistence, filling quality, taste and smell of the ready products. The data of the organoleptic evaluation are presented on Fig. 2.

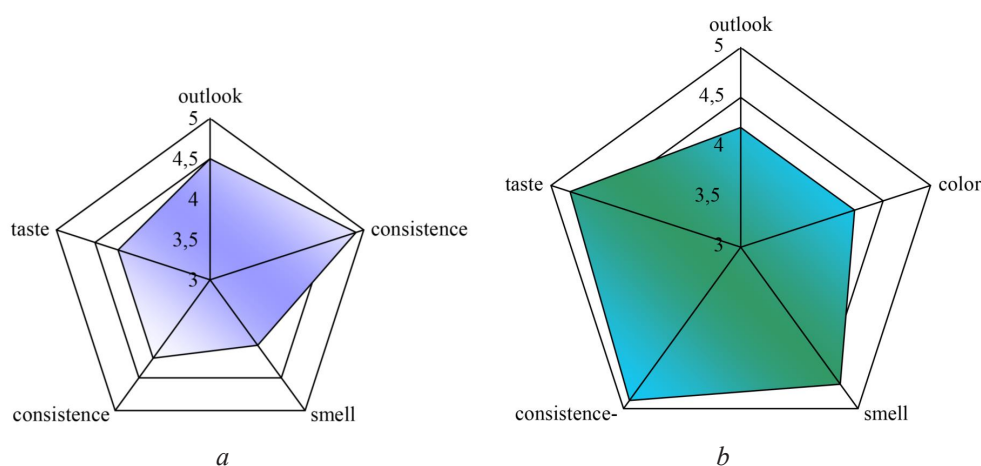


Fig. 2. Comparative evaluation of organoleptic parameters of the snack tinned food:
a – pickled gherkins; b – pickled gherkins with mustard

Based on the results of the conducted testing, a conclusion may be made that pickled gherkins with mustard, developed by the improved technology, differ by the high organoleptic properties.

The snack tinned food “Pickled gherkins with mustard” have the olive color; the smell is pleasant, typical for pickled vegetables. The taste is a bit bitter, a bit sweet, typical for pickled vegetables, brightly expressed taste of cucumbers, mustard is perceived in marinade, and garlic with red pepper give a spicy smack and pleasant fragrance. For improving the filling quality, it is recommended to use mustard in grains instead of dry powder.

4. 3. The technological production scheme of the snack tinned food “Pickled gherkins with mustard”

For producing the snack tinned food “Pickled gherkins with mustard”, there are used gherkins of the technical or biological ripeness stage, with the green fruit color. Gherkins are considered a dietetic foodstuff because of the low caloric content (10–15 kcal for 100 g of the product). At that the substances, included in it, improve digestion and help the gastrointestinal tract to digest other products, perfectly help to cope with removal of harmful toxins. For improving the food value and quality of snack tinned food, mustard was added. Its use is in a fact that it improves the appetite, disintegrates fats and facilitates digestion of protein meals, at that activating metabolism. Main healthy properties of mustard are antimicrobial, antifungal, antioxidant and anti-inflammatory effects [3, 20].

Taking into account the aforesaid, these components were purposefully introduced in the recipes of the offered vegetable tinned food.

The authors developed a procedural production scheme of new types of snack tinned food, corresponding to the international quality control system (HACPP). The technological production scheme of the snack tinned food is presented on **Fig. 3**.

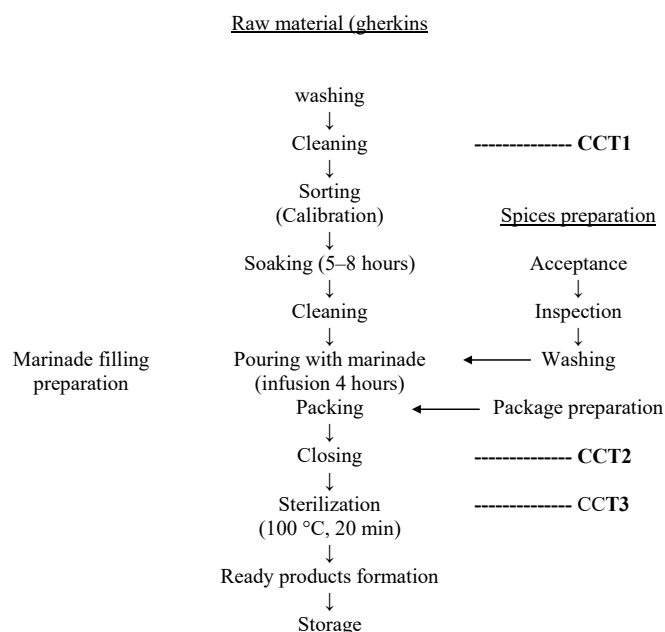


Fig. 3. Technological production scheme of the snack tinned food “Pickled gherkins with mustard”

The technological production scheme of the snack tinned food “Pickled gherkins with mustard” includes the following processes: preparation of the raw materials (cleaning, inspection), soaking in cold water for 5–8 hours; inspection; pouring with marinade; mixing and infusion; packing; closing; sterilization, formation of ready products. Gherkins are processed by the standard technology for pickled tinned food [16].

6. Results discussion

Mathematical modeling at creating new types of fruit-vegetable products is necessary for determining an optimal recipe and also for choosing ready products with high organoleptic indices.

The methodological base of the conducted studies for forming and evaluating the products, based on the vegetable raw materials is a system approach. It allows to consider different factors, forming a quality of the ready products as a system of independent processes that transform the initial raw materials in the ready product with the determined consumption properties.

Based on the conducted studies, the authors substantiated the production technology of vegetable tinned food by the new recipe. The recipe model was made by using the simplex method that allows to get an optimal variant with the maximal complex quality parameter.

At studying the physical-chemical parameters of pickled vegetables, the special attention was paid to their functional properties. The tinned food “Pickled gherkins with mustard” differs by the high organoleptic indices at the expanse of the favorable combination of sugars and acids and also well-expressed marinade smell and taste.

The comparative characteristic of the organoleptic parameters is presented in **Table 2**.

Table 2
Organoleptic quality parameters

Parameter name	Pickled gherkins (SSU 7989:2015) Sample 1	Pickled gherkins with mustard Sample 2
Outlook	Fruits correspond to standards	Fruits correspond to standards
Taste and smell	Taste is a bit sour, vinegar smell is felt, without side admixtures	Natural without side smacks and admixtures
Consistence	Fruits are a bit hard, not enough crispy	Cucumbers are hard, crispy, flesh is dense
Marinade quality	Typical color with a weak yellow tint	Color is green-olive

The studied pickled cucumbers have perfect taste characteristics and don't deviate from requirements of the correspondent standard (SSU 7989:2015 Pickled cucumbers. Technical conditions) by the physical-chemical parameters.

7. Conclusions

The addition of mustard powder in marinade raised the food value of the snack gherkin tinned food. Its quality by taste and smell had better parameters, comparing with the traditional recipe, the consistence of gherkins remained dense and crispy. The complex quality parameter allowed to evaluate the organoleptic properties of the ready tinned food.

The use of the simplex method at developing the marinade recipe allowed to choose the optimal ratio of ingredients.

The technological processing scheme of the raw materials (gherkins) doesn't include the process of blanching by water that allows to decrease production costs.

The studies have the practical importance for implementing at processing tinned food enterprises.

Development prospects of the study are:

1. The change of mustard powder for grains in the marinade recipe for eliminating turbidity.
2. The improvement of the instrument-technological scheme for determining control critical points, corresponding to international standards.

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