

## SUBSTANTIATION OF HOT SMOKING PARAMETERS BASED ON SENSORY RESEARCHES IN HOT FISH MARINADES TECHNOLOGY IN THE JELLY POURING

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### Abstract

Modern technologies of food products provide creation of healthy, tasty and safe products, characterized by high organoleptic properties, balance by main food factors and structural-mechanical parameters of a product.

The main technological process in the technology of fish marinades and a jelly pouring is the hot smoking. Technological parameters of the hot smoking have been scientifically grounded on the base of the statistical processing of data of sensory studies. Organoleptic assessment of semi-products after the thermal processing was carried out by 5-point system corresponding to the elaborated scale. The quantitative assessment of organoleptic parameters of the quality of experimental samples was determined by the totality of all assessment points, taking into account chosen weight coefficients depending on the importance degree of a given parameter at forming consumer qualities of a product. The generalizing quality parameter was calculated as a sum of assessments of organoleptic parameters – taste, consistence and appearance. Individual assessments of separated quality parameters of products (in points) were put in degustation lists and statistically processed by the averaging method.

The smoking process realization, according to scientifically grounded parameters allows to produce the new type of tasty, healthy and presentable culinary products of a perspective object of Ukrainian aquaculture – silver carp of a prolonged storage term.

**Keywords:** hot smoking, fresh-water fish, culinary products, organoleptic, storage term.

DOI: 10.21303/2504-5695.2017.00420

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### 1. Introduction

Despite the fact that Ukraine has the most area of internal water bodies in Europe, near 1,3 mln ha, the unsatisfactory situation with their use has been formed in the country. Such sit-

uation led to the fact that potential possibilities of fresh-water fish production and processing are practically not used [1]. This tendency is typical for all countries that develop aquaculture [2–6].

The typical, most mass object of the Ukrainian aquaculture is a silver carp, which catch is 44 % from the general catch of fresh-water fish [1]. That is why, there is presented the technology of producing hot marinades in a jelly pouring of this fresh-water fish. At elaborating this technology we tried to reach balance of the biochemical composition, according to nutritiology requirements, and also high organoleptic and structural-mechanical parameters of a product.

The aim of the work is the scientific substantiation and elaboration of parameters of the hot smoking of a salt semi-product of fresh-water fish, based on complex organoleptic studies. Obtained experimental data will form the base of scientifically substantiated parameters of the technology of hot marinades of smoked carp silver fillet.

Earlier studies have demonstrated the principal possibility of using natural biopolymers of the vegetable origin in the fish product technology for producing a pouring of the jelly consistence [7–10].

Fish marinades may be divided in two groups: cool, or produced of a mature salt semi-product, and hot, produced of fish, subjected to the preliminary thermal processing (PTP) (blanching, frying, baking) [11]. Complex organoleptic studies have proved the expedience of using the hot smoking as PTP in the technology of hot fish marinades.

For attaining the set aim it was necessary to solve the following tasks:

- to choose preliminary technological parameters of the hot smoking, based on the analysis of literary data for substantiating the rational regime;
- to realize the complex organoleptic assessment of the smoked semi-product;
- to substantiate and to choose rational parameters of the hot smoking of the semi-product of a silver carp, based on sensory studies.

## 2. Materials and Methods

There has been realized a tasting of samples of the prepared semi-product for producing culinary products – hot marinades of a smoked silver carp.

Taking into account tendencies to the development of the Ukrainian aquaculture and raw material sources, we have chosen a silver carp as an object of the research [1–2, 4]. Silver carps are big herbivorous fishes. The industrial processing is mainly realized for fishes with the mass up to 500–600 g, characterized by the muscular tissue output near 39 % [13].

The technological process of hot marinades producing included the following operations: washing, elimination of scales, cutting for filler, gustatory salting, draining, hot smoking, preparation of jelly on the base of the spicy-acetic broth using combinations of low-etherified pectin substances and alginic acid as a structure-creator, cold storage.

At preparing samples for testing, a silver carp was cut in fillet with the further cutting in pieces with the size 10×5×2 cm or 8×4×1,5 cm for providing the fast salting. At the hot smoking the salting was realized by the brine way at the temperature 10 °C during 40–50 min in a brine with the density 1,18–1,20 g/cm<sup>3</sup> to the mass share of culinary salt in the muscular tissues not higher than 1,5 %.

It is known from literary sources, that the one of variants of the preliminary thermal processing of fish for producing hot marinades is the hot smoking [11]. The hot smoking is the process of fish baking in the flow of combustion gases, on which result a fish is boiled, reaches the culinary readiness, gains the smoking taste and smell. The combination of this semi-product with the smell of spices of a jelly marinade pouring allowed to receive the product with the unique taste-smell and rheological properties.

The literature doesn't include data about parameters for the hot smoking of silver carp pieces. That is why parameters of the hot smoking of a big carp, which morphological signs coincide with a silver carp, were taken as a base.

The salt semi-product was directed to the hot smoking in the laboratory setting “Boris-fen” (Fig. 1). The process of hot smoking was realized corresponding to parameters, presented in Table 1. Ready samples were directed on the sensory analysis.

**Table 1**  
Selection of rational smoking regimes

No. of sample	Drying		Boiling		Smoking	
	Temperature, °C	Time, min	Temperature, °C	Time, min	Temperature, °C	Time, min
1	60–70	20	100–110	20	90–100	30
2	60–70	25	100–110	25	90–100	35
3	60–70	30	100–110	30	90–100	40
4	60–70	35	100–110	35	90–100	45



**Fig. 1.** Compact smoking-drying setting “Borisfen”

The quantitative assessment of organoleptic parameters of the quality of experimental samples was realized by the expert method by the totality of all points of assessments taking into account chosen weight coefficients [12]. A weight coefficient was given to each parameter: depending on the importance degree of this parameter in the formation of positive consumer qualities of the product. Organoleptic parameters were determined in the following order: appearance, color, smell, consistence and taste. A taster compared the own impression of organoleptic parameters by the verbal description of the product, given in the elaborated point scale, and gave the quantitative analysis in points. The organoleptic assessment was realized at the product temperature 18 ... 20 °C and relative humidity 70–80 %, according to requirements, set to the laboratory, where the sensory analysis was realized [14]. The whole content of a consumer container was subjected to the organoleptic assessment.

The appearance, smell, consistence and taste of products were controlled by structural schemes of the organoleptic assessment [12].

Optimal parameters of the salt semi-product hot smoking were chosen on the base of the statistical processing results.

The hot smoking was realized in the laboratory compact smoking-drying setting “Borisfen” (Kyiv city, Ukraine).

The technology of products processing is determined by the choice of the temperature in the smoking chamber. The temperature in the smoking chamber is regulated from 30 to 200 °C.

## 2. 1. Experimental procedures

The hot smoking consists of three stages: drying, boiling (baking) and smoking itself. Based on the data [11] we have chosen technological parameters for the hot smoking to substantiate the rational regime (**Table 1**) for 4 groups of samples.

For substantiating smoking parameters, there was taken the general criterion of the quality assessment, presented in **Table 2**.

**Table 2**

Statistical processing of testing results by the organoleptic assessment of studied samples

No.	Parameters	Point marks of tasters (Xi)												K	$\sum Xi$	X	X <sup>2</sup>	S	X-K	Q
1	Appearance of pieces	5	3	3	4	4	4	3	4	4	5	5	0,1	44	4,00	16,00	0,74	0,40	4,26	
	Appearance of pouring	4	4	4	5	5	4	4	4	5	5	5	0,1	49	4,45	19,84	0,50	0,45		
	Color of appearance surface	4	4	5	5	3	4	3	3	5	3	5	0,1	44	4,00	16,00	0,85	0,40		
	Smell	4	5	4	4	5	4	3	4	4	5	5	0,3	47	4,27	18,26	0,62	1,28		
	Consistence	4	5	4	4	5	4	3	3	5	5	5	0,1	47	4,27	18,26	0,75	0,43		
	Taste	4	5	5	5	5	4	3	3	5	4	5	0,3	48	4,36	19,04	0,77	1,31		
2	Appearance of pieces	4	3	4	5	5	5	5	5	5	4	4	0,1	49	4,45	19,84	0,66	0,45	4,52	
	Appearance of pouring	5	5	5	5	4	5	4	5	5	5	5	0,1	53	4,82	23,21	0,39	0,48		
	Color of appearance surface	4	5	5	5	5	5	5	5	5	5	5	0,1	54	4,91	24,10	0,29	0,49		
	Smell	4	5	5	5	5	4	4	5	3	5	5	0,3	50	4,55	20,66	0,66	1,36		
	Consistence	4	5	5	5	4	5	4	4	5	4	5	0,1	50	4,55	20,66	0,50	0,45		
	Taste	4	5	4	4	4	3	3	5	5	5	5	0,3	47	4,27	18,26	0,75	1,28		
3	Appearance of pieces	5	5	5	5	5	5	5	5	5	5	5	0,1	55	5,00	25,00	0,00	0,50	4,75	
	Appearance of pouring	5	5	5	5	5	5	5	5	5	5	5	0,1	55	5,00	25,00	0,00	0,50		
	Color of appearance surface	5	5	5	4	4	4	4	4	5	5	5	0,1	50	4,55	20,66	0,50	0,45		
	Smell	5	5	5	5	5	5	3	4	5	5	5	0,3	52	4,73	22,35	0,62	1,42		
	Consistence	5	5	5	5	5	5	3	3	5	5	5	0,1	51	4,64	21,50	0,77	0,46		
	Taste	5	5	5	5	5	5	4	3	5	5	5	0,3	52	4,73	22,35	0,62	1,42		
4	Appearance of pieces	5	5	5	5	5	5	5	5	5	5	5	0,1	55	5,00	25,00	0,00	0,50	4,76	
	Appearance of pouring	4	4	5	5	5	5	4	5	5	5	5	0,1	52	4,73	22,35	0,45	0,47		
	Color of appearance surface	5	5	5	5	5	5	5	5	5	5	5	0,1	55	5,00	25,00	0,00	0,50		
	Smell	5	5	5	5	5	5	5	5	5	5	5	0,3	55	5,00	25,00	0,00	1,50		
	Consistence	4	5	4	4	5	4	4	5	5	5	5	0,1	50	4,55	20,66	0,50	0,45		
	Taste	4	5	5	5	5	4	4	3	5	4	5	0,3	49	4,45	19,84	0,66	1,34		

5-point scale was used for the organoleptic assessment of the smoked semi-product. At compiling there was taken into account that the zone of positive marks must be no less than 80 %. The approbation was realized by assessing four codified samples with numbers 1, 2, 3, 4 according to the aforesaid method [12]. According to the data of the statistical processing of tasting results, the studied samples with numbers 3 and 4 demonstrated the better complex organoleptic mark that was 4,75 and 4,76 respectively. The organoleptic assessment included such individual parameters as the appearance of pieces, appearance of the pouring, color of the piece surface, smell, consistence, taste. The parameters allow to make a conclusion about the attainment of the main tasks of the hot smoking – the full culinary readiness, new organoleptic properties of a product. The samples with numbers 1 and 2 were not completely smoked at the processing by the offered regimes, because the consistence characterized the insufficient culinary readiness, and the color of the piece surface was not enough brightly expressed. The samples with numbers 3 and 4 had most expressed properties of smoked fish. Such results allow to make a conclusion about the expedience of using the chosen parameters for the hot smoking of silver carp pieces.

The prepared semi-product, received by the rationally scientifically grounded parameters, was put in the consumer container and poured by the preliminarily prepared jelly pouring. The pouring preparation consisted of the following stages: dosing of components, boiling of the spicy broth, mixing with the structure-creator composition, boiling during 5 min. The spicy broth was prepared using cloves, cinnamon, laurel leaf, sweet-scented and black pepper, salt, sugar, acetic acid.

### 3. Results

Thus, the use of a silver carp for producing the non-traditional assortment of fish products – marinades of a silver carp using the hot smoking in a jelly pouring as a PTP, allows to widen the assortment of culinary products of fresh-water fish essentially and to decrease the tension in the sphere of bioresources consumption by the Ukrainian population.

The complex assessment of organoleptic characteristics has demonstrated that it is most expedient to organize hot marinades production on the base of a preliminarily smoked silver carp. The parameters of main technological processes of hot marinades production have been elaborated on the base of experimental procedures.

### 4. Conclusions

The analysis of existent smoking regimes has allowed to make the table of the preliminary technological parameters of the hot smoking of the prepared alt semi-product of a silver carp with four determined variants of this process realization.

Samples of silver carp pieces, coded by correspondent numbers for sensory studies, were prepared, according to each alternative.

The hot smoking rational parameters have been substantiated on the base of the complex organoleptic assessment of prepared fish semi-products with the highest point mark. It was offered to realize the drying at the temperature 60...70 °C, during 25 min; boiling must be realized during 25 min at the temperature 100...110 °C. The stage of the hot smoking itself must be realized at the temperature 90...100 °C during 45 min.

These studies allow to widen the assortment of culinary products of the prospective object of the Ukrainian aquaculture – silver carp. The one of shortcomings of this work is the use of acetic acid for preparing the marinade pouring. It limits the consumers' circle of this product. The further development must be perspective for such scientific direction as the change of the classic steam smoking for the use of natural smoking preparations.

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