Research Regarding the Organoleptic and Physical-Chemical Tests for Carp, Saurel and Mackerel

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Abstract. The research was made on 30 samples of carp and refrigerated mackerel for 3 days at 0 – 4 °C and on 30 samples of frozen saurel, sardine and mackerel which was stored at -18 °C for 2, 4 and 6 months. It was noticed that the alteration organoleptic changes in the case of the refrigerated fish appear at values of the pH of over 3.2 g% total nitrogen, over 350 mg% amine nitrogen, over 40% ammoniac nitrogen, over 3 mg% of nitrogen from trimethylamine. Due to the organoleptic, physical-chemical and microbiological changes in the fish meat stored in refrigerated or frozen state, the period in frozen state will be maximum three months in the case of carp, sardine and mackerel and five-six months for saurel.

Keyword: fish meat, organoleptic test, microbiological test, physical-chemical test.

INTRODUCTION

Fish represents the solution of the future which altogether with the other sea living beings will become a more important source than at present. In some developed countries, with a high population density, fish constitutes the main source of food of animal origin.

Life particularities of fish determine a very intense enzymatic activity whose rhythm is increased after death. The muscular rigidity appears very early, but its duration is short.

The proteolytic modifications/changes during the fish freezing involve a slight decrease of the protein solubility, which is a consequence of the denaturation processed. The denaturation degree is dependent on the period from harvest to freezing. If the fish is frozen before the muscular rigidity, the proteins are less modified in comparison with the fish which is frozen in the rigidity and after-rigidity phase.

The degradation speed of the proteins is directly influenced by the chemical reaction of the meat (pH). The low values of the pH activate the action of the cathepsins.

The bacteria of Clostridium, Bacillus, Pseudomonas type and others that have proteolytic enzymatic systems hydrolyse very fast the proteins with formation of peptides and amino acids.

MATERIALS AND METHODS

The research was made on 30 samples of carp and refrigerated mackerel for 3 days at 0 – 4 °C and on 30 samples of frozen saurel, sardine and mackerel which was stored at -18 °C for 2, 4 and 6 months.

The organoleptic test of the refrigerated fish referred to the estimation of the temperature within the fish, the colour of the muscles at the surface and in section, the consistency of the dorsal musculature, the way muscles adhere to the bones, the aspect of the organs and of the liquid within the abdominal cavity. It was also assessed the aspect of the
mouth, eyes, operculums, gills, scales, anus and the presence of the mucus on the surface of the skin.

The physical-chemical content had in view the determination of the pH, total nitrogen, amino nitrogen, ammonia nitrogen, the nitrogen from trimethylamine, the total content of the free amino acids. The value of the proteic division index was also established being represented by the ratios.

The microbiological test referred to the determination of the total number of germs, number of coliform bacteria, the number of sulphite-reductive clostridia and of the number of mycets and yeasts.

RESULTS AND DISCUSSIONS

**Organoleptic test**
The organoleptic test of the refrigerated and frozen fish samples highlights normal organoleptic analysis in the case of the fish species under study. During the fish storage in refrigeration conditions, after 72 hours, there are recorded organoleptic changes regarding the aspect of the mouth, gills, skin and scales, dorsal musculature and of the organs in the abdominal cavity.

In the case of the altered fish, it is noticed that the mouth is open, the eyes are drawn at the level of eyehole or even sunken in the eyehole, the cornea is watery, the operculums are remote from the body of the fish, the gills are brown, with abundant mucus on the surface, badly smelling, the skin is mat with mucus on the surface, the scales have a mat aspect and they can be detached easily, the anus is prolabate and is pink-red-cyanotic, the dorsal musculature is of reduced consistency, it is easily detached from the bones, it is grey-pink, the internal organs present a prolyasis process, with liquids in the abdominal cavity, and bad-smelling.

The organoleptic altering changes are more obvious in the case of carp, mackerel and sardine and less obvious for saurel and herring.

In the case of the frozen and then de-frozen fish, some alternative changes can be recorded after defrosting and keeping it for 3 days at 0 - 4 C for saurel and in the case of carp, mackerel and sardine after 48 hours at 0 - 4 C.

**Physical-Chemical Test**
The physical-chemical test highlights variations regarding the value of the indices according to the species, state of freshness of the fish, moment of freezing or refrigeration, period of maintenance in a refrigerated or frozen state, respectively after defrosting. The most important modifications are undergone by the proteic substances and by the fat from the meat composition, and in a less degree the other components.

The modifications of the proteic substances and of the fat are influenced in a great extent by a series of factors such as: the state of the fish when freezing (in muscular rigidity or not), temperature of refrigeration and freezing, period of storage in refrigerated or frozen state and the time from defrosting. The proteolytic activity at the level of the fish meat is different from one species to another according to the structure of the muscular fibre.

For saurel, which is a fish with a more fibrous muscular structure, the proteolytic activity is slower in comparison with the meat of other species, such as: mackerel, carp herring, etc.

The intensity of the proteolysis process development in the fish meat is estimated according to some indicators such as: total nitrogen, amino nitrogen, trimethylamine nitrogen,
content in free amino acids and the specter of amino acids and according to the value of the proteic division indices. These changes are also influenced by the value of the pH and by the microflora existent in meat at the surface or in depth.

The results of the physical exam/test of the fish during its storage in refrigerated and frozen condition are presented in table 1 and Tab. 2.

The chemical reaction (pH) of the fish meat during its storage in refrigerated state varies/ ranges between 5.80 and 6.10, and during its storage in refrigerated state ranges between 5.80 and 6.00 with variations from one species to another. The lowest values are found for saurel and the highest for carp.

The low values of the pH when defrosting characterize the fresh meat and imply a freezing of the fish immediately after its harvest, alive or of muscular rigidity. After defrosting, due to the intensification of the proteolytic activity at the level of meat, the pH increases very rapidly. During the storage of the frozen fish, the pH increases from 5.8 to 6.46 for saurel, from 6.04 to 6.60 for sardine, from 5.44 to 6.16 for mackerel and from 5.80 to 6.58 for carp.

During the storage of the refrigerated fish and frozen fish, it presents variations of the physical-chemical indices and of the freshness microbiological indices according to the species. The most important modifications refers to the pH, total nitrogen, amino nitrogen, ammonia nitrogen, nitrogen from trimethylamine, content of free amino acids and the value of the proteic division indices.

The increase of the values for most of the physical-chemical indices under study, during the storage of the fish in refrigerated state (table 1) or frozen state (table 2), proves the existence of a proteolytic activity at the level of the fish meat. In both situations, the modifications prove to be cheaper for the sardine, mackerel and carp samples in comparison with the saurel samples.

During the storage of the refrigerated fish, an increase of the pH from 5.90 to 6.40 for carp, from 5.89 to 6.30 for saurel, from 6.04 to 6.5 for sardine and from 5.44 to 6.40 for mackerel are recorded. Over these values, the presence of some organoleptic alteration changes for all the fish categories is recorded.

The amino nitrogen increases, too during the storage of the refrigerated meat from 265 to 570 mg% for carp, from 250-480 mg% for saurel, from 200-560 mg% for sardine and from 255 to 510 mg% for mackerel.

For these values, the fish presents obvious alternative changes. The free ammoniac from the fish meat records during its storage in refrigerated state quantitative increases up to 50.2 mg% for carp, 48 mg% for saurel, 50 mg% for sardine and 49 mg% for mackerel. For these values, the fish presents changed organoleptic characteristics (of alteration), the total content of amino acids records during the storage of the refrigerated fish significant increases especially in the case of carp meat (850 – 2700 mg%), of sardine meat (1200 – 5200 mg%) and of mackerel meat (1300 – 7600 mg%). For these values, the organoleptic characteristics of the fish are significantly modified.

Important increases are also recorded in the case of the proteic division indices and of the nitrogen from the trimethylamine. Higher values in the case of these indices are recorded for the samples of carp, sardine and mackerel.

The total nitrogen and content in protein record for all the examined samples a quantitative decrease as a consequence of the degradation of the proteic substances under the retainment of the microorganisms present in the fish meat. The total number of germs and mycets/g product record significant quantitative increases for all the examined samples during the storage of the refrigerated fish.
During the storage of the frozen fish, the same types of modifications as in the case of the refrigerated fish are noticed at the end of the storage period (6 months), the values of these recorded indices at the end of the storage period in frozen state are of:

- 5.74 – 6.10 in the case of pH
- 2.88 – 3.40 in the case of total nitrogen
- 410 – 553 mg% for the amino nitrogen
- 32.91 – 42 mg% in the case of the ammonia nitrogen
- 4.60 – 7.00 mg% for the nitrogen from trimethylamine
- total content of free amino acids of 968 – 1215 mg%

The indices of proteic division increase, too during the storage of the frozen fish, for all the samples under study, in the content of proteic substances, record a decrease as a consequence of their storage.

The significant physical-chemical and microbiological modifications are distinguished after the defrosting of the fish and its maintenance at 0 – 4 °C for 2, respectively 4 days. The changes of proteolytic type in this case are more intensive than the previous situations.

After 2 days of storage at 0 – 4 °C, the fish presents alternative changes especially at the surface; they are also noticed in depth after its storage at 0 – 4 °C for four days:

- the chemical reaction of the fish (pH) presents values of 6.46 – 6.60
- total nitrogen decreases at 2.5 – 2.6 g%
- amino nitrogen increases at 531 – 680 mg%
- ammonia nitrogen increases up to 43.6 – 60% mg%
- nitrogen from trimethylamine increase up to 7.6 – 9.6 mg%

Important increases are noticed in the case of the total content of amino acids, of the total number of germs and mycets for all the fish samples under study.

Tab. 1

Dynamics of the physical-chemical changes during the storage of the refrigerated fish

<table>
<thead>
<tr>
<th>Specification</th>
<th>Carp</th>
<th>Saurel</th>
<th>Sardine</th>
<th>Mackerel</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH-ul</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.90</td>
<td>6.20</td>
<td>6.40</td>
<td></td>
</tr>
<tr>
<td>total N g%</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.40</td>
<td>3.20</td>
<td>3.00</td>
<td></td>
</tr>
<tr>
<td>N-NH₂ mg%</td>
<td>265</td>
<td>380</td>
<td>570</td>
<td></td>
</tr>
<tr>
<td>N-NH₃ mg%</td>
<td>26,4</td>
<td>40,5</td>
<td>50,2</td>
<td></td>
</tr>
<tr>
<td>N trimethylamine mg%</td>
<td>1,9</td>
<td>4.0</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td>NTG/g product</td>
<td>610</td>
<td>1400</td>
<td>4200</td>
<td></td>
</tr>
<tr>
<td>Free aminoacids mg%</td>
<td>850</td>
<td>2100</td>
<td>2700</td>
<td></td>
</tr>
<tr>
<td>No. of mycets/g product</td>
<td>520</td>
<td>800</td>
<td>850</td>
<td></td>
</tr>
</tbody>
</table>

A – after one day of storage at 0 – 4°C
B – after two days of storage at 0 – 4°C
C – after three days of storage at 0 – 4°C

Tab. 2

Dynamics of physical-chemical changes during the storage of the frozen fish

<table>
<thead>
<tr>
<th>Specification</th>
<th>Carp</th>
<th>Saurel</th>
<th>Sardine</th>
<th>Mackerel</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH-ul</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>5.9</td>
<td>6.1</td>
<td>6.2</td>
<td>6.5</td>
</tr>
<tr>
<td>total N g%</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>.68</td>
<td>3.4</td>
<td>3.0</td>
<td>2.5</td>
</tr>
<tr>
<td>N-NH₂ mg%</td>
<td>270</td>
<td>410</td>
<td>500</td>
<td>600</td>
</tr>
<tr>
<td>N-NH₃ mg%</td>
<td>26.1</td>
<td>35.2</td>
<td>40.4</td>
<td>50</td>
</tr>
<tr>
<td>N trimethylamine mg%</td>
<td>1.9</td>
<td>7.0</td>
<td>8.5</td>
<td>9.6</td>
</tr>
<tr>
<td>Free aminoacids mg%</td>
<td>840</td>
<td>1200</td>
<td>1600</td>
<td>1800</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>No. of mycets/g product</td>
<td>450</td>
<td>660</td>
<td>700</td>
<td>800</td>
</tr>
</tbody>
</table>

A – after two months of storage in frozen state  
B – after four months of storage in frozen state  
C – after two days from defrosting  
D – after four days from defrosting

**CONCLUSIONS**

The researches determined the following conclusions:

- during the storage of the fish in refrigerated and frozen state, the most important changes are undergone by the proteic and fat substances;  
- the proteic substances undergo degradation processes that are reflected physically-chemically through the decrease of the total nitrogen and the increase of the non-proteic nitrogen presented by the amino, ammonia nitrogen and the one from the trimethylamine and of the total content of free amino acids;  
- the fat substances undergo processes of oxidation, hydrolysis that are manifested organoleptically through the yellowing of the subcutaneous and intramuscular fat and the appearance of a rancid smell and taste;  
- the most intense organoleptic, physical-chemical and microbiological changes are summarized at the sardine, carp and mackerel samples, fact that imposes as the storage period in frozen state not to exceed three months for these species;  
- the physical-chemical changes for the defrosted fish are influenced by the storage period in frozen state, by the moment of freezing and by the species;  
- the alteration organoleptic changes in the case of the refrigerated fish appear at values over 6.2 pH; under 3.2 g% total nitrogen; over 350 mg% amino nitrogen; over 40 mg% ammonia nitrogen; over 3 mg% nitrogen from trimethylamine;  
- there is a positive correlation between the alteration organoleptic changes and the physical-chemical and microbiological ones from the fish meat during its storage in refrigerated and frozen state, that limit the storage period in refrigerated state to 2-3 days, and in frozen state to maximum 3 months, in the case of carp, sardine and mackerel and to 5-6 months for saurel.

**REFERENCES**