STUDY OF NOODLES MANUFACTURING WITH ADDITION OF CO$_2$-MEAL FROM THE SPICE BLEND

Abstract.: Natural flavoring ingredients were produced from a mixture of coriander seeds, allspice berries, summer savory, black peppercorns, namely fat-soluble extracts and meal, by the method of supercritical CO$_2$-extraction. The CO$_2$-meal from the spice blend was used to prepare the noodles in order to add flavors and stimulate the appetite, being added in a ratio lower than 6%. As the added amount of CO$_2$-meal from the spice mixture increases, so the total content of dietary fiber increases and the energy value of the noodles decreases.

Keywords: noodles, spices, supercritical CO$_2$ extraction, fat-soluble extract, CO$_2$-meal, flavor.

Introduction

Noodles are a type of food made of unleavened dough, stretched, extruded or rolled flat and cut into different shapes: long and thin strips - the most popular, in the form of waves, spirals and others. They are usually cooked in hot water, adding
only oil and salt. They are often served with a sauce or in soup (zeama). The noodles can be stored in the refrigerator for a short time or they can be dried and stored for a longer period. [1, 2]

In order to meet the growing and varied requirements specific to a modern diet, it is necessary to diversify the noodle assortment, which can be achieved by adding different ingredients (tomato paste; carrot juice; spinach, etc.) and flavors (spices, etc.), which gives the finished product original and unique tastes.

The spices have a well-expressed taste and flavor. They have the effect of improving the quality of food, due to the increased content of volatile oils, organic acids, vitamins, minerals. The spices add a pleasant taste and very varied flavors to the dishes, and a feeling of freshness that stimulates the appetite [3, 4]. Due to these qualities, they increase the taste of food, appetite and have a beneficial effect on the food assimilation. Most spice plants have fungicidal properties and act lethally on the harmful microflora. [3]

The industrial use of dry spices may encounter some impediments, and an alternative is the use of fat-soluble extracts obtained by supercritical CO₂-extraction process. Among the strengths of lipophilic extracts are: efficient use of the compounds contained in them, sterility, comparative simplicity of the technology of incorporation into the finished product, long shelf life. [5, 6]

After the extraction process, from the spicy raw material remains the CO₂-meal that can be capitalized, thus contributing to sustainable management of natural resources.

**CO₂-meal obtained from spice blend**

As a source to obtain fat-soluble extracts were used vegetable raw materials (figure 1), purchased from the company "Rodals" LLC, Chisinau, Republic of Moldova.

At the laboratory-pilot plant for supercritical CO₂ extraction, HA 120-50-01 model (Food Technology laboratory, IP ISPHTA), samples of lipophilic ingredients were obtained from a mixture of coriander seeds, allspice berries, summer savory and black peppercorns, according to the elaborated recipes [7].
Fig. 1. Samples of vegetable raw materials

(a) Coriander seeds, crushed  (b) Allspice berries  (c) Summer savory, chopped  (d) Black peppercorns

Fig. 2. Samples of meal from spice blends

Spice mixture
(vegetable raw material)
coriander, allspice, summer savory and black pepper

Spice meal
coriander, allspice and black pepper

Through the supercritical CO$_2$-extraction process the lipophilic fraction, containing biologically active compounds and flavoring substances, is separated. Consequently, the hydrophilic fraction: amino acids, proteins, dietary fiber and mineral remain in the spice meal.

Thus, after the extraction of the fat-soluble fraction, in the extractor remains the meal of spicy vegetable raw materials (figure 2), which is low in fat and it can be used in the manufacture of food.

One possibility to capitalize on the meal of spice blend is to use it as an ingredient in the manufacture of high-quality wheat flour noodles.
Noodles with CO$_2$-meal from spice blend

Developing new recipes for making patent wheat flour noodles with the addition of meal from the spice blends, the basic recipe (control) was varied by introducing different quantities of meal, as a vegetable ingredient - low in fat, source of bioactive compounds and remaining flavoring substances.

The whole assortment of noodles was based on patent flour (ratio: 58 - 67 %) and chicken egg mixture (ratio: 26 - 33 %), and as an ingredient of vegetable origin, rich in bioactive compounds and flavorings it was used the meal from spice mixture.

The CO$_2$-meal ratio of the spice blend (coriander, allspice, summer savory and black pepper) in the developed noodle recipes was less than 6%.

Fig. 3. Preparation of noodles with the addition of CO$_2$-meal from the spice blend

It was prepared 4 laboratory samples of high-quality wheat flour noodles, by adding different ratios of CO$_2$-meal from spice mixture, thus a new assortment of noodles was created (figure 4).

Fig. 4. Samples of noodles with CO$_2$-meal from the spice blend
Noodles with the addition of CO$_2$-meal from a mixture of spices: coriander, allspice, summer savory and black pepper, are in the form of long or short strips, straight or curved.

The organoleptic characteristic of the noodles is specified in Table 1.

**Table 1**

<table>
<thead>
<tr>
<th>No</th>
<th>Characteristic</th>
<th>High quality wheat flour noodles</th>
<th>Noodles with CO$_2$-meal from spice blend</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Appearance: Shape</td>
<td>Short, straight or curved strips.</td>
<td>Smooth, possibly with roughness, no traces of flour.</td>
</tr>
<tr>
<td></td>
<td>Surface</td>
<td>Smooth, possibly with roughness, no traces of flour.</td>
<td>Glassy appearance</td>
</tr>
<tr>
<td>2</td>
<td>Colour</td>
<td>White - yellow</td>
<td>White-yellow, with brown spice inclusions.</td>
</tr>
<tr>
<td>3</td>
<td>Taste and smell</td>
<td>Characteristic of wheat flour noodles, without foreign taste and smell.</td>
<td>Characteristic of noodles, with a natural aroma of spices. Taste remaining spicy. No foreign taste and smell.</td>
</tr>
<tr>
<td>4</td>
<td>Noodles after boiling</td>
<td>Elastic products, do not lose their shape, do not stick, do not form conglomerates, do not fall apart. The water in which the noodles were boiled is slightly opalescent, without sediment.</td>
<td></td>
</tr>
</tbody>
</table>

The noodle samples with the addition of more than 5% of CO$_2$-meal from the spice mixture have a more pronounced aroma and taste of spices, highlighting summer savory and coriander, but also the presence of coarser particles of meal is noticeable. In noodle samples with the addition of less than 2% of CO$_2$-meal from the spice blend, the meal content is less noticeable.

Both for the raw materials used (Table 2) and for the finished products - noodles (Table 3), the nutritional and energy values were established.

**Table 2**

<table>
<thead>
<tr>
<th>No</th>
<th>Raw material</th>
<th>Nutritional value, g/100 g of product</th>
<th>Energy values, kcal</th>
<th>Dietary fiber g/100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Proteins</td>
<td>Lipids</td>
<td>Carbohydrates</td>
</tr>
<tr>
<td>1</td>
<td>Patent flour</td>
<td>10,6</td>
<td>1,1</td>
<td>68,9</td>
</tr>
<tr>
<td>2</td>
<td>CO$_2$-meal from spice blend</td>
<td>9,2</td>
<td>1,4</td>
<td>16,4</td>
</tr>
<tr>
<td>3</td>
<td>Eggs</td>
<td>12,7</td>
<td>11,5</td>
<td>0,7</td>
</tr>
</tbody>
</table>
The nutritive and energetic value was established for the control sample (Sample 1) and the other samples, at which the meal content is increasing (Sample 2 to Sample 4).

Table 3

<table>
<thead>
<tr>
<th>No</th>
<th>Noodles</th>
<th>Nutritional value, g/100 g of product</th>
<th>Energy values, kcal</th>
<th>Dietary fiber g/100 g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Proteins</td>
<td>Lipids</td>
<td>Carbohydrates</td>
</tr>
<tr>
<td>1</td>
<td>Sample 1</td>
<td>11.2</td>
<td>4.5</td>
<td>46.4</td>
</tr>
<tr>
<td>2</td>
<td>Sample 2</td>
<td>10.6</td>
<td>4.5</td>
<td>41.0</td>
</tr>
<tr>
<td>3</td>
<td>Sample 3</td>
<td>10.7</td>
<td>3.9</td>
<td>45.8</td>
</tr>
<tr>
<td>4</td>
<td>Sample 4</td>
<td>10.4</td>
<td>3.8</td>
<td>43.8</td>
</tr>
</tbody>
</table>

The introduction of CO₂-meal from the spice mixture in the preparation of noodles contributes to the increase of the total dietary fiber content, almost 2 times (Sample 4).

In the manufacture of noodles, the addition of CO₂-meal from the spice mixture helps to reduce the content of macronutrients (lipids, carbohydrates), respectively to decrease the energy value and increase the content of dietary fiber, necessary for a healthy diet, because dietary fiber helps regulate digestion and intestinal transit, regulates blood glucose levels, prevents the occurrence of type 2 diabetes.

**Conclusions:**

CO₂-meal samples were obtained from a spice blend, namely: coriander, allspice, summer savory and black pepper, after supercritical extraction of the fat-soluble fraction.

It has been developed recipes and the technological scheme and it was prepared noodle samples with the addition of less than 6% CO₂-meal from the spice mixture.

The CO₂-meal from spice blend contributes to the increase of the total content of dietary fiber and to the decrease of the energy value in the noodles.

It is recommended for the manufacture of noodles with the addition of less than 5 % of CO₂-meal from the spice mixture.

Diversifying the range of noodles and selling them on the domestic and foreign
markets would increase the income of agri-food entrepreneurs, including by replacing imported products with those manufactured in the country.

References:


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