Characteristics of textured soy protein products as raw materials in the meat industry

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Abstract. Soy protein belongs to the group of whole proteins and is recognised as a high quality plant protein. In the meat industry, soy-based protein products are used as functional additives (emulsifiers, stabilizers) or as good nutritional fillers, i.e. replacement for part of the meat in a recipe. They can be added in dry or in hydrated states (textured soy products). As a result of regular product control conducted for the company Sojaprotein, data on protein content and water hydration capacity obtained between 2016 and 2018 for textured soy protein SOPROTEX –N, and textured soy concentrate TRADCON T, both minced products, are presented in this paper.

1. Introduction

Soy is a unique plant, in that during 3 to 5 months of growth, it can create the largest amount of protein with the most favourable amino acid composition that is suitable for use in human and animal nutrition. Soy proteins belong to the group of complete or whole proteins. A complete protein or whole protein is a food source of protein that contains an adequate proportion of each of the nine essential amino acids necessary in the human diet [1]. Protein quality, as determined by the protein digestibility-corrected amino acid score (PDCAAS) method, is a measure of a protein’s ability to provide adequate levels of essential amino acids for human needs. PDCAAS is calculated using an amino acid profile and the true digestibility of a food protein. Soy protein is recognized as a high quality plant protein, but published protein assessment values can vary based on the soy protein ingredient as well as the reproducibility and accuracy of the testing methods [2]. Among the foodstuffs of plant origin, soy products rich in proteins are becoming more significant, as they are used in the production of various meat dishes, baked goods, confectionery products, vegetarian dishes, beverages based on soy proteins and other important products.

2. Soy products applied in the meat industry

The main advantages, and therefore the most important reasons to use soy products in the food industry, especially in meat industry, are as follows:

1. Increasing the overall nutritive and biological value and usability of the final product
2. Improvement of the organoleptic properties of the final product
3. Decreasing cost of production of final products

In the meat industry, the protein-made soy products are used as functional additives (emulsifiers, stabilizers) or as good nutritional fillers (replacement for part of the meat in the recipes), with the
purpose of producing positive effects in terms of improving nutritional and sensory properties and assuring standardization of production for meat products in large-scale production series. These positive effects are achieved through the functional properties of soy protein (such as water binding, swelling, gelling, fat emulsification, etc.), the amino acid composition which is very similar to meat proteins, and the abundance of other nutrients (vitamins and minerals).

Under the applicable Serbian legislation on quality of protein products and mixtures of protein products for food industries, protein products from oil seeds (soy) are divided into the following groups:

1. Full-fat products (flour and grits), with minimum protein content of 38% in dry matter (dm) and fat content minimum 18% dm;
2. Semi-fat products (flour and grits), with minimum protein content of 45% in dm (44% dm for grits) and maximum fat content of 9% in dm;
3. Defatted soy products (flour and grits), with minimum protein content of 47% in dm and maximum fat content of 2% in dm;
4. Concentrated soy protein, with minimum protein content of 65% in dm and maximum fat content of 2% in dm;
5. Isolated soy protein, with minimum protein content of 86% in dm and maximum fat content of 1% in dm.
6. Structural soy proteins

Because of their high oil content (and the unsaturated fatty acids they contain), full-fat and semi-fat soy products are avoided in the meat industry.

Soy products intended for meat industry can be used alone or in combination with other protein products in various meat products, such as different types of sausages (cooked finely chopped, cooked roughly chopped, cooked with meat pieces, cooked, fresh, frying sausages, etc.), shaped minced meats, smoked products, ready meals and canned meats. The use of soy protein products in the meat industry is usually very simple. The soy products can be added in dry or in hydrated states (textured soy products), and thereafter are treated like meat ingredients, so they do not interfere with the technological processes of meat product manufacture.

3. Soy protein products from Sojaprotein

Sojaprotein is the most important and largest soy processor in Central and Eastern Europe, with a processing capacity of over 250,000 tons of soy annually. The company was established in 1977 while in 1983 regular production started, and has continuously been operating since. In 2012, a new section for production of soy concentrate went into operation. Special attention is paid to the quality of raw material and to ensuring that the soy is not genetically modified (non-GMO).

Sojaprotein products used in the meat industry include:

- Defatted soy flour;
- Soy protein concentrates;
- Textured soy protein (from soy flour and soy protein concentrates).

SOPROTEX N minced is a textured product mainly used as a filler (to replace meat in a recipe). SOPROTEX N minced expresses its optimal properties when it is hydrated, by adding 2-3 parts of water to one part of flaked product. The usual dosage is 2-4% SOPROTEX N minced, calculated according to the weight of the final product. It can be used in different types of sausages, minced products and shaped meat products.

TRADCON T minced is a textured soy protein concentrate. The production process for traditional soy protein concentrates involves deactivating anti-nutritional factors, thus increasing the usability of the proteins. The removal of part of the soluble carbohydrates results in TRADCON T having a more neutral taste and lighter colour than soy flour-based textured products. TRADCON T minced is also mainly used as a filler. It expresses its optimal properties when it is hydrated, by adding 3-4 parts of water to one part of TRADCON T minced. The usual dosage is 2-4 % of the calculated weight of the
final product. This soy product can be used in different types of sausages, minced products and shaped meat products.

4. Analysis of textured soy protein SOPROTEX-N minced and textured soy concentrate TRADCON T minced

SP Laboratories performs regular quality control of the physical and chemical properties, as well as microbiological parameters of Sojaprotein’s products. This paper presents results of analysis for protein content (% in dm) and water hydration capacity (WHC) for the period between 2016 and 2018, for textured soy protein SOPROTEX-N minced and textured soy concentrate TRADCON T minced. Protein content was determined by the total combustion method [3]. WHC is defined as the maximum amount of water that 1 g of material will imbibe and retain under low speed centrifugation [4].

The percentage of soy products examined during 2016, 2017, and 2018 in various categories of protein content in dm (Tables 1 and 2) and WHC (Tables 3 and 4) are shown. In each category, the percentage of all results that fit the given range is shown.

Table 1. Percentage (%) of SOPROTEX-N minced soy samples analysed in 2016-2018, categorised according to percent of protein in dry matter (dm)

| Protein content | <50 % protein in dm | 50-52 % protein in dm | 52-54 % protein in dm | 54-55 % protein in dm | > 55 % protein in dm |
|-----------------|---------------------|-----------------------|-----------------------|-----------------------|---------------------|
| 2016            | 0.45                | 1.35                  | 43.24                 | 43.24                 | 11.71               |
| 2017            | 0                   | 0.87                  | 45.02                 | 28.14                 | 25.97               |
| 2018            | 0                   | 1.22                  | 13.88                 | 45.71                 | 39.18               |

Table 2. Percentage (%) of TRADCON T minced soy samples analysed in 2016-2018, categorised according to percent of protein in dry matter (dm)

| Protein content | <68 % protein in dm | 68-70 % protein in dm | >70 % protein in dm |
|-----------------|---------------------|-----------------------|---------------------|
| 2016            | 0                   | 80.00                 | 20.00               |
| 2017            | 0                   | 42.86                 | 57.14               |
| 2018            | 0                   | 62.50                 | 37.5                |

Table 3. Percentage (%) of SOPROTEX-N minced soy samples analysed in 2016-2018, categorised according to water holding capacity

| WHC | <2.5 cm³/g | 2.5-3.0 cm³/g | 3.0-3.5 cm³/g | 3.5-4.0 cm³/g | >4.0 cm³/g |
|-----|------------|--------------|--------------|--------------|------------|
| 2016| 0.71       | 16.96        | 63.25        | 18.2         | 0.88       |
| 2017| 0          | 7.53         | 63.22        | 26.59        | 2.66       |
| 2018| 0.13       | 3.79         | 72.36        | 22.36        | 1.36       |
Table 4. Percentage (%) of TRADCON T minced soy samples analysed in 2016-2018, categorised according to water holding capacity

| WHC | <4.0 cm³/g | 4.0-4.5 cm³/g | >4.5 cm³/g |
|-----|------------|---------------|------------|
| 2016| 0          | 80.00         | 20.00      |
| 2017| 0          | 42.86         | 57.14      |
| 2018| 0          | 62.50         | 37.5       |

5. Conclusion

The results presented in this paper demonstrate the quality of SOPROTEX-N minced and TRADCON T minced is of a high standard and is temporally stable as far as protein content and WHC are concerned. In 2016, 99.55% of SOPROTEX-N minced samples examined complied with protein content quality standard of a minimum of 50% protein in dm, while in 2017 and 2018, 100% of the SOPROTEX-N samples examined achieved this quality minimum. The WHC was higher than 3cm³/g in between 82.33% and 96.08% of samples examined. The protein content in TRADCON T minced was always higher than the minimum 68% in dm, while the WHC was always higher than 4cm³/g.

Because of their high protein content, high water hydration capacity, favourable amino acid composition, and other properties, soy protein products have found widespread application in the meat industry. Soy products, when used in meat products, show positive effects in terms of improving the sensory properties, while ensuring stable production as well as efficiency for large-scale production series. Although products made from meat with added soy protein products mostly cost less than products without soy, consumers get a measurably (organoleptic, nutritional, etc.) better product, and are not damaged in any respect. Disclosure of soy protein on the product package is, however, mandatory, in order not to mislead consumers in terms of the contents and quality of the products they purchase, and in order that manufacturers do not attain ungrounded financial profits.

References

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