# DEVELOPMENT OF TECHNOLOGY FOR THE PRODUCTION OF ISOLATE AND TEXTURATE FOR USE IN THE MEAT INDUSTRY BASED ON LOCAL SOYBEAN VARIETIES

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***Abstract.*** *The article examines the protein content in the product, the frying of the pulp, the conduct of radiation for the inactivation of enzymes, the determination of the optimal pH of the medium, the effect of temperature on the yield of the product of the material under study.*

***Keywords:*** *soy, soy mint, urease, short-term treatment of microwave radiation, extrudate, soy isolate.*

# РАЗРАБОТКА ТЕХНОЛОГИИ ПРОИЗВОДСТВА ИЗОЛЯТА И ТЕКСТУРАТА ДЛЯ ИСПОЛЬЗОВАНИЯ В МЯСНОЙ ПРОМЫШЛЕННОСТИ НА ОСНОВЕ МЕСТНЫХ СОРТОВ СОИ

***Аннотация.*** *В статье рассмотрено содержание белка в продукте, обжаривание мезги, проведение облучения для инактивации ферментов, определение оптимального pH среды, влияние температуры на выход продукта из сырья при исследование.*

***Ключевые слова:*** *соя, соевая мята, уреаза, кратковременная обработка СВЧ-излучением, экструдат, соевый изолят.*

## INTRODUCTION

An exceptional feature of soy, which distinguishes it among field crops, is at the same time a high content of protein and oil. The protein content in soybean seeds ranges from 27 to 68%. Soy is the only crop whose use in small quantities (150-200 g) can satisfy, a person's daily need for all amino acids in the absence of other protein sources in the diet. Soy is the only crop whose use in small quantities (150-200 g) can satisfy a person's daily need for all amino acids in the absence of other protein sources in the diet. Based on the biological structure of the soybean grain, characterized by a large number of pores on its surface and capillaries inside, the dissolution and withdrawal of protein inhibitors and urease depend on the intensity of moisture transfer. [1]

## MATERIALS AND METHODS

In our opinion, short-term treatment with microwave radiation is more suitable for hydrothermal treatment, because according to the results of previous studies, such treatment is very effective for removing moisture from heterogeneous systems. Laboratory studies on the effect of MV radiation on frying pulp, oil and cake yield, were carried out in a microwave oven with a maximum power of 800 watts. The radiation power varied from 100 to 300 watts at a frequency of 2450 MHz. In our opinion, for the inactivation of enzymes in the soy material, a more intense radiation should be selected in a short period up to 5 minutes, because unlike other oilseed materials, after degreasing, the material is used for food purposes. [2]

In the experiments we used with a moistened 3% hydrogen peroxide solution, the material was treated in a microwave oven for 1-5 minutes at a flow rate of 100-500 watts. The initial moisture content of the material was 9.5%, the temperature was 25C. The results of the experiments are given in Table 1.

Table №1

**Influence of the MV heating power on the evaporation of moisture from the oilseed material**

| Processing time, min | Name of the indicator | Power of MO flow, W | | | | |
|---|---|---|---|---|---|---|
| | | 100 | 200 | 300 | 400 | 500 |
| 1 | temperature, ˚C | 65 | 69 | 72 | 75 | 78 |
| | moisture, % | 9,4 | 9,3 | 9,3 | 9,1 | 9,0 |
| 2 | temperature, ˚C | 71 | 75 | 77 | 80 | 84 |
| | moisture, % | 9,3 | 9,1 | 8,7 | 8,5 | 8,3 |
| 3 | temperature, ˚C | 74 | 79 | 86 | 90 | 96 |
| | moisture, % | 8,6 | 7,9 | 7,2 | 6,4 | 5,9 |
| 4 | temperature, ˚C | 77 | 82 | 91 | 95 | 98 |
| | moisture, % | 8,3 | 7,5 | 6,9 | 6,4 | 5,9 |
| 5 | temperature, ˚C | 84 | 89 | 97 | 98 | 99 |
| | moisture, % | 8,1 | 7,3 | 6,7 | 6,1 | 5,7 |

As can be seen from the data given in Table 1, to remove moisture to the optimum for degreasing 7.0-7.5% is achieved with microwave processing of the material for 3 minutes and a flow power of 300 watts. In this limit, the humidity of the material decreased to 7.2% and the temperature did not exceed 86C.

**RESULTS**

As can be seen from the data given in Table 1, with a flow power of 100 and 200 W, with an increase in the duration of processing MV radiation, the moisture of the material decreases to the desired limit within 5 minutes, and the temperature increases rapidly. With an increase in the flow power from 300 to 500 W, in a time interval of 3-5 minutes, the temperature of the material exceeds the possible limit, i.e. above 85C despite the fact that the moisture has not evaporated enough yet. When processing the material with a radiation flux power of 300 W for 3 minutes, moisture evaporation reaches the optimal limit (7.2≈7.0 ±0.5%) and in further experiments, the flux power was taken within these limits. [3]

However, with the evaporation of the main part and a decrease in the water content in the product, the heating intensity of the anhydrous part increases, because the bound moisture in the medium of the material begins to heat up. It is logical to predict that until the intensity of moisture evaporation decreases, i.e. until the bound moisture begins to heat up, the temperature of the protein part of the material does not exceed the boiling point of water -100C, especially since the dielectric constant of the gel part of the material is much lower than the water part. This ensures the safety of the main indicators of the products obtained in the native state. [4]

The material thus obtained was extruded. The enzymatic activity of the material in various stages of processing was determined in the laboratory at Eg-takhlil Service LLC. The results of laboratory tests of the obtained samples are shown in the table 2.

Table №2

**Enzymatic activity of soy in various stages of processing**

| Processing method | Activity after processing | |
|---|---|---|
| | trypsin inhibitor, mg/g | urease, pH |
| Raw soy | 44,8 | 2,20 |
| Soy processed by autoclaving | 4,4 | 0,05 |

| | | |
|---|---|---|
| Roasted soy | 5,2 | 0,15 |
| Soy mint | 45,1 | 2,5 |
| Mint treated with hydrogen peroxide | 6,4 | 1,3 |
| After microwave processing of mint | 4,7 | 0,12 |
| Soy extruded | 4,2 | 0,12 |

The intensity of withdrawal of the trypsin and urease inhibitor is carried out due to convection – internal energy transfer by microcurrents. As can be seen from the data given in Tab. 2 the most effective method of inactivation is the microwave treatment of the material, which led to a decrease in the activity of the trypsin inhibitor to 4.7 mg / g and urease to pH 0.12. [6]

The proposed technology makes it possible to significantly reduce the activity of trypsin inhibitors and urease activity to normalized values. After extrusion of such material, an extrudate with high quality indicators was obtained. When processing soybeans, it is necessary to use only thoroughly cleaned, healthy, mature, yellow seeds, calibrated in size. For oil plants, one of the main biochemical criteria related to the quality of the protein complex of seeds is the change in the acid number of seed oil (kernel). When it increases above 1.5-2.0 mg KOH / g, the total content of crude protein in seeds decreases, the processes of hydrolytic protein breakdown increase, which leads to a decrease in the content of digested and digestible protein. The moisture content of the seeds should be at the level of 10-13%.[7]

Table 3

**Soybean seed quality indicators**

| Indicator | Quantity |
|---|---|
| Acid number of seed oil (kernel), mg KOH | 1,5 - 2 |
| Humidity, % (no more) | 10 - 13 |
| The content of foreign impurities, % (no more) | 1 - 3 |
| Oil content on UHF (dry matter), % | 18 - 20 |
| Protein content per UHF, % (not less) | 36 - 41 |
| Fiber content per UHF, % (no more) | 5 |
| Ash content per UHF, % (no more) | 5 |
| Solubility index NSI (not less) | 90 |
| Mold is not allowed | - |

There are two main ways of processing soybeans: for butter and meal, and for soy dairy products. At the same time, as already mentioned earlier, the bulk of soybeans is processed in order to obtain oil and meal.We propose the following technological scheme for the production of soy isolate – a highly concentrated protein material for use in the formulation of meat products. [8]

As a result, the purified soybean seeds are first moistened with a 3% aqueous solution of hydrogen peroxide by increasing the humidity of the processed material from 8-9 to 9.5-10%. Such treatment is effective, firstly, for moistening the seed coat of seeds, the content of which, as

studies have shown in local soybean seed varieties, reaches up to 2%, and secondly, a decrease in the activity of the urease enzyme, due to the oxidizing effect of hydrogen peroxide [5] and the amount of active inhibitor - due to intensive extraction. In studies of the effect of hydrogen peroxide on the content of urease and proteolytic enzymes, it was found that such treatment without grinding does not have a significant effect.

**DISCUSSION**

It was found that with an increase in the concentration of the oxidant in the working solution, the efficiency of neutralization of the urease enzyme increases, and with a high concentration of hydrogen peroxide is observed in its interaction with other components of soybean grain, which leads to a deterioration of its organoleptic parameters. The seeds treated in this way are settled to soften and separate the seed coat. [10]

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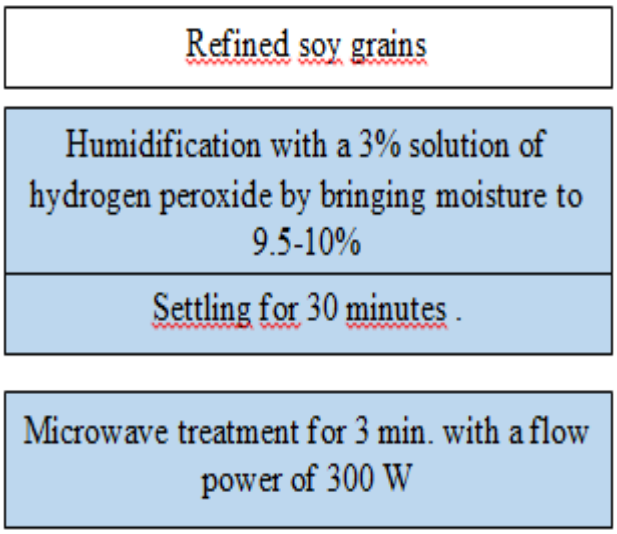
After softening the shell, the moistened seeds are treated with microwave radiation at a frequency of 2450 MHz at a flow power of 300 W for 3 minutes, which leads to a decrease in the moisture content of the material to 7.0-7.5% and a decrease in the activity of urease to 0.12 pH and trypsin inhibitor to 4.7 mg / g, which is effective in comparison with other processing methods **(**Fig.1.).

The processed by microwave radiation and dried material is crushed in hammer crushers to form particles of 3-4 mm in size, which precipitates during the aspiration separation of the shell and is easily separated. The final stages of the process: homogenization, high-temperature treatment and drying in a spray dryer, packaging. The protein content in the powder after drying is more than 90%. The cleaner the protein is obtained, the wider the scope of its possible application. [9]

**CONCLUSIONS**

In conclusion, we can say that, based on the above, a technology for processing soybean seeds has been developed, which differs from analogues using hydrogen peroxide to moisten seeds before processing and microwave processing of moistened material before collapsing.



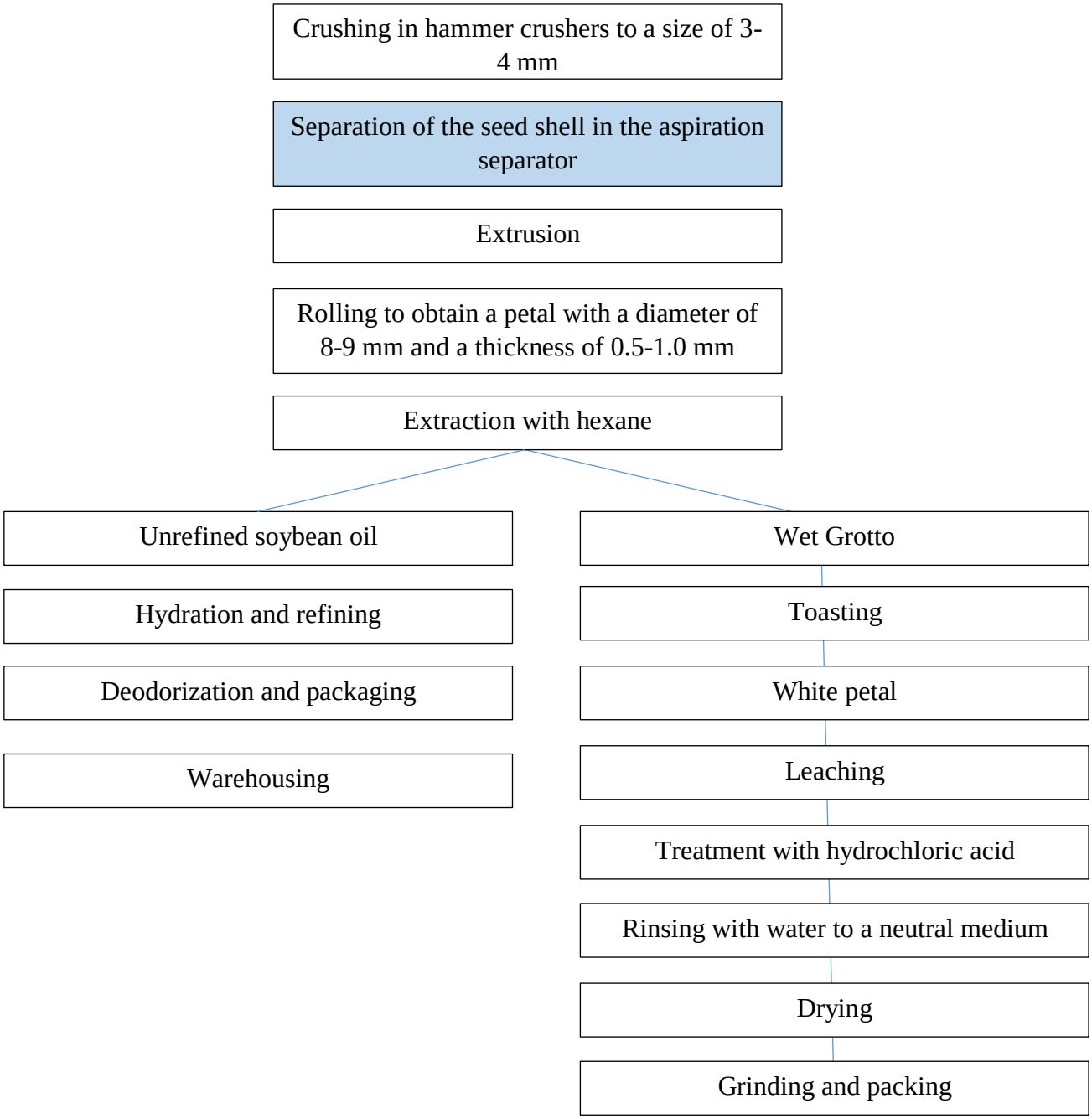



**Fig.1. The proposed technological scheme for obtaining soy isolate**

**REFERENCES**

1. Soy. Collection of articles. Edited by V.B. Enken. - M.: Kolos, 2005 - 70s.
2. Myakushko Yu.P. Soy. Ed. Doctor of Agricultural Sciences, Candidate of Agricultural Sciences V.F. Baranov. M. Kolos, 2014.-332 p.
3. Statistical report for 2021 of the Association “Uzegmoisanoat". www.yogmoy.uz
4. Eliseev A.S. Soy in Russia and in the world: the history of culture and the peculiarities of its cultivation [Text] / A.S. Eliseev // Agrarian Review. – 2010. – № 3 (19). – P. 69.
5. Lviv V.O. The possibility of using soy in the production of combined dairy products [Text] / V.O. Lviv // Maisto chemija ir technologija. Konferencijos pranešimu medžiaga. Kaunas. – 2001. – C. 38.

6. Mendelson G.I. The value of soy protein products in human nutrition [Text] / G.I. Mendelson // Food. prom-st. – 2004. – No. 6. – pp. 90-91.
7. Petibskaya, V.S. Soy: chemical composition and use / edited by V.M. Lukomets. – Maykop: JSC "Polygraph-YUG", 2012. – 432 p.
8. Ruiz N. Urease activity in soybean meal. A new look //Compound feed. -2013. -No. 10. -pp. 59-61.
9. Improvement of soybean processing technology using ultrasound /F.Ya. Rudik [et al.] // Bulletin of the Mordovian University. -2018. -Vol. 28.- No. 2.-pp. 266-286.
10. Soybean processing as a profitable business // Bakertilly [Electronic resource]. – Access mode: http://www.bakertilly . –Access date: 2.05.2017.