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Application of enzymatic agents during reprocessing of soy-beans

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Тази статия представя съвременен изглед на стойността на храненето по време на възпрепятстване и лечение на заболявания. То тества също така работата на продукцията на соевия екстракт и възможните начини на подобрението на неговите функционални качества. Ние развихме технология от приложение от enzymatic агент по време на получаване на соева селекция. Ние проучихме също така динамиката при изменение с размер на соеви частици в процеса на enzymatic третиране. В тази статия ние показахме целесъобразността на употребата на футовете на подкваса.

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This article presents a modern outlook to the value of nutrition in prevention and treatment of diseases. It also examines the problem of production of soy extract and possible ways of improvement of its functional qualities. We developed a technology of application of enzymatic agent during receiving of soy extract. We also investigated the dynamics of alteration of size of soy particles in the process of enzymatic treatment. In this article we proved the advisability of use of ferment-based preparations during production of soy extract.

One of the most critical conditions of maintaining of health, workability and active long life of a man is right nutrition. Deterioration of ecological situation in the whole world connected with technical progress, and also lack or excess of separate components of food results in irreversible demographic changes: each year we see increase in the number of ill people, falling of the birth rate and rocketing of death rate.

So not only adequate nutrition but also its prophylactic function became important for the health of people. It mainly determines modern requirements to the structure of rational nutrition.

Mass trend of eating of healthy products leads to broad development of production of functional products which, thanks to containing of bioactive ingredients, make positive affect to the human organism. Such functional ingredients are widely represented in the number of vegetable products among which we must determine soy and products of its reprocessing. [8]

Soy contains unique proteins which are almost as nourishing and valuable as proteins of animal origin, perfect oil, unique bioactive components including irreplaceable in nutrition lecithin, vitamins B, C and E, macro and microelements and a number of other substances. It is that reason which initiated wide industrial use of soy and products of its reprocessing such as soy oil and flour, soy extract, okara, soy protein. [2,5]

Soy extract is an idea substitute of cow milk, especially in nutrition. People who have allergy for cow milk may replace it with soy drinks. Contents of carbohydrates in them are not high and thus these products are safe for the ill people who suffer diabetes.

Soy drinks do not contain milk sugar – lactose and so they can be used by the people with abnormalities of assimilability of this polysaccharide. Drinks on the basis of soy are recommended by modern medicine for prevention and even treatment of many diseases: cardio-vascular and lever, bile-stone illness, atherosclerosis, myocardial infarction, thrombosis, animal protein allergy etc. [2]

One of the most important and useful component of soy extract is soy lecithin. This component contains cholines – phosphatidylcholine, acetylcholine – which are very important for functioning of human body. These substances participate in formation and renovation of neural tissue and brain cells. Cholines are also responsible for such functions as: thinking, planning, memory, education, moving activity, metabolism of fats and regulation of cholesterol in blood. [6,7]

Traditional technologies of production of soy extract are based on water extraction of shelled soy. Main restriction of application of such technologies are undesired taste and odour which appear in the result of hydrolyse of lipid fraction of extract under influence of ferment of lipoxygenase which becomes the most active during grinding of soy beans and simultaneous extraction. And, use of hot water during extraction may cause inactivation of ferments and this reduces their outcome to extract.

One of the alternatives of this process is usage of whole beans of soy. In this case beans undergo soaking, blanching, grinding with water and homogenising. But in this case suspensioning of particles of edible fibres increases instability of soy extract.

Application of enzymatic agents during reprocessing of soy allows to increase and stabilize outcome of nutrition products and to improve the quality of the raw materials to be received [1,3,4].

We developed technological scheme of production of soy extract (Fig.1) in which we used the following enzymatic agents for stabilizing of the system and increasing of outcome of the product: "Cellulase-100", "Macerobacillin Гзх", "Pectinase Г20х", "Cellokandin ".

This technology included the following stages – preparation of soy beans, cleaning, soaking ($t = 50°C$; $\tau = 8$ hours). At the 1st stage of reprocessing during soaking a specific odour bean odour appears which must be eliminated by receiving of ready product. The analysis showed that the major part of aromatic substances of soy consists of alcohols: isobutanol, isopentanol, hexanol, decanol, heptanol and volatile fat acids: acetic, formic, isobutyric, isovaleric acids [4].

By soaking of soy in 0,5% solution of natrium hydrocarbonate we may see activation of lipoxygenase complex of soy enzymes. After soaking beans are washed and moved to blanching at the temperature 90 – 100°C, during 45 – 50 min and proportion of water and beans as 2:1. During blanching we see inactivation of enzymes including lipoxygenase complex and partial removal of very volatile products of dissolution. After blanching beans are rinsed with the water ($t = 20°C$; during 10 – 20 min.), and are peel.

Then we perform grinding of soy beans. Grinding is performed in several stages: 1st – grinding to paste state, during 2 minutes with $n=13000c^{-1}$, 2nd – grinding with water, $n=13000c^{-1}$ during 3 minutes after which in water solution proteins, lipids, carbohydrates, vitamins are extracted. One part of soy to 6 parts of water at $t = 80°C$.

Then we enter enzymatic agents in the amount of 1% of the total weight to water soy mixture for stabilizing of the system and increasing of outcome of the product. After enzymatic hydrolyses we filter soy mixture through the tissue with the size of cells 20-μm. At the result of performing of all technological operations soy extract of improved quality is created.

Selection of enzymatic agents for performance of enzymatic hydrolysis is explained by composition of cellular walls of soy which contain 3% of pectin, 50% of hemicelluloses, and 20% of cellulose. Since cellular walls of soy are multiply structure which consists of protein bodies, cellular walls and seed-lobe, it is reasonable to use enzymatic agents with wide action range.

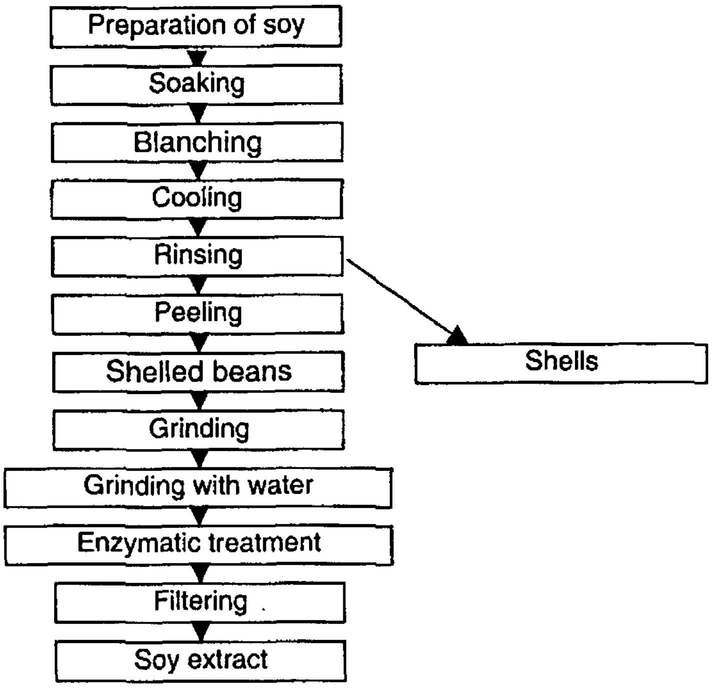

Figure 1 – Technological scheme of receiving of soy extract

For examination of influence of enzymatic agents of hydrolytic action on the rate of hydrolysis of soy mixture we investigated optimum conditions of their – Table 1.

Table 1 – Characteristics of enzymatic agents

Names of enzymes	Optimum conditions of action	
	pH	t°C
Cellulase-100	4.5	30-50
Macerobacilin Г3х	6.5-7.5	35
Pectinase Г20	5.5	30-40
Cellokandin	4.5-6	40

After examination of characteristics of enzymatic agents and knowing their optimum conditions of action we performed comparative assessment of influence of enzymatic hydrolysis on cellulase complex of soy cells (Fig. 2).

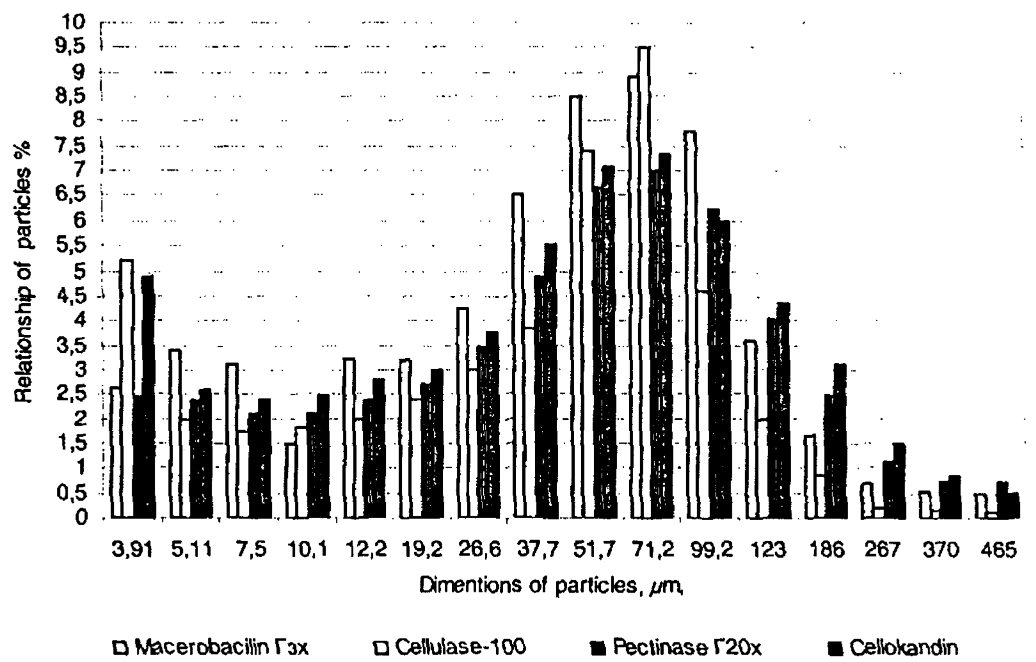

Figure 2 – Influence of enzymatic agents on degradation of particles of soy mixture

Represented data characterises influence of separate enzymatic agents on alteration of size of particles and their ration in soy mixture. Process of enzymatic treatment was performed during three hours. We examined four similar mixtures in which we created optimum conditions for a separate enzymatic agent, and the concentration of used enzymes in the mixture is 1% of the total volume.

We found that during the process of treatment we reach optimum relation of size of particles and this allows to increase and stabilize outcome of soy extract and to improve its quality.

We also determined the best enzymatic agents which were actively influencing on the rate of alteration of size of particles – "Cellulase-100", "Cellokandin". The largest amount of particles in the mixture during action of "Cellokandin" was made of the particles with the size 71,2 µm, which were about 7,33% of the mixture volume, the smallest size of the particles was 3,91µm making 4,88 % of the mixture, and the largest particles had the size 465,1µm made 0,48% of the solution. During the action "Cellulase-100" the largest size of the particles was 465,1µm making 0,13 % of the mixture, the smallest was 3,91µm, making 5,2% of the total volume of the mixture.

Soy extract after treatment with complex preparations has stable system, decreased composition of nutrition fibres and its assimilability rises because of bioavailability of biopolymers of soy.

The developed technology allowed us to receive soy extract which acid activity (pH) was, by the ration of dry substances 12%. Chemical composition of the received soy extract was as follows: protein 2.8%, fat – 2.2%, carbohydrates – 4.4% and mineral salts – 0.8%.

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