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Development of technology for a new bacterial concentrate

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Abstract

Rye and rye-wheat bread for centuries occupies a special place in the diet of the peoples of Russia. These baked goods have not only with what incomparable taste and aroma, but also, due to the peculiarities of the chemical composition of rye flour, have a positive impact on human health. Unfortunately, in recent years in our country and abroad, there is a tendency reducing the specific consumption of rye and rye-wheat bread. There is no doubt that only the continuous improvement of the technology of preparation of these products, providing a high quality of finished products in the processing of raw materials unstable, they can return to its former popularity [1].

Rye flour proteins in amino acid composition similar to proteins of wheat flour, but have higher content of essential amino acids - lysine, arginine, and threonine. An essential feature of rye proteins is their ability to rapidly and extensively swell. A significant part of this protein in the swells beyond all bounds, going into a state of viscous colloidal solution. Feature protein rye flour is also that they can not, despite the presence of gliadin and glutenin, to the formation of gluten. Due to the absence of gluten rye dough devoid of elasticity but has high viscosity. In rye dough is relatively a lot of water-soluble substances and free of moisture. Rye easily gelatinized starch and hydrolyzed more attack amylolytic enzymes than starch flour.

The rye flour is always a certain amount of α -amylase in the active state, which, acting on starch, dextrin breaks it up. Dextrins give crumb stickiness zaminaemost and soggy [2].

Acidity rye dough in order to brake action α -amylase at a level necessary to maintain significantly higher than in the wheat dough. Rye dough should have the acidity (10-12) ° N

(degrees Neumann), so it is prepared to leaven, which is a continuous and consumable parts for the new revolving stage.

In the production of rye bread is the main fermentation lactic acid, and alcohol is a byproduct. The causative agent is the yeast of alcohol. In the absence of oxygen by a single energy for the life of the yeast cells is a fermentation of carbohydrates to form as the end products carbon dioxide and alcohol [3]. These processes are carried out through a series of intermediate reactions involving many enzymes. Homofermentative bacteria ferment glucose by glycolytic pathway Embden-Meyengofa and heterofermentative bacteria on the pentose phosphate pathway.

This article presents the results of studies on the development of the technology of the liquid bacterial concentrate for bread production. This bacterial concentrate is made up of a consortium of microorganisms typical for rye sourdough fermentation microflora. Analysis of experimental data shows that the concentrate has a high symbiotic sourdough fermentation activity, a good lift and contains a high titer of mesophilic lactic acid bacteria and yeast, not fermenting lactose.

Keywords: leaven, the leaven of the concentrate symbiotic consortium, a breeding ground biomass.

Introduction

Currently, manufacturing processes, based on the activity of microorganisms, have acquired a special significance. Modern biotechnology is inextricably linked with the use of new approaches to the creation and selection of new microorganisms, which entails an increase in the diversity of biotechnology products [4].

One of the most important tasks is to improve the production of biologics culture techniques (cells, viruses and bacteria) using domestic equipment and taking into account the qualitative characteristics of the product [5].

A necessary stage in the preparation of nutritive and protective medium, serum enzymes in the production of viral vaccines and bacterial preparations are their purification, separation and concentration, sterilization. The choice of methods for their implementation is a complex task and depends on the quality characteristics of the liquid [6].

Exclusive role in the production of a bacterial concentrate plays a nutrient medium. Proper selection of the composition of the culture medium allows the isolation of microorganisms from their habitats, preparation of pure cultures to study their morphology and biochemical characteristics, enables us to obtain the biomass of beneficial microorganisms. The main goal in the selection of the growth medium of any microorganism is to create a balanced blend of essential nutrients in such concentrations that will best growth.

As the needs of micro-organisms are very diverse, you can not create a universal medium for the optimal growth of all microorganisms. There are a variety of composition and technique of cooking medium. They are used all sorts of natural and artificial substrates, ranging from plain tap water and saline solutions to complex extracts from embryos of animals and plants from the waste (manure) to complete proteins of humans and animals.

For reproduction of any bacteria (regardless of purpose), you must provide a suitable biophysical environment. Skillful handling of biophysical and biological factors of particular importance in getting the accumulation of cultures and subsequent isolation of bacteria in the form of a pure culture. Temperature, aeration and the pressure determined by the conditions of cultivation. All of these factors affect the growth rate, biomass yield, metabolism and chemical composition of the bacteria.

The next process is the concentration of biomass. Concentration of the biomass is a process of dehydration – removing water contained in the substance in the free unbound state. Depending on the degree of humidity, density substances, particulate size, technological

requirements in the microbiological industry use different methods of dehydration. These include filtration, centrifugation, coagulation, etc.

The use of membrane methods of purification, separation and concentration allows you to create environmentally friendly, energy-efficient production processes [7].

Due to the fact that the activity and stability of the concentrate of lactic acid bacteria cells is determined by age, a great importance is rapid isolation of cells from the culture medium or cooling it before cell isolation. When used as a culture medium of milk, whey, hydrolyzed milk, the cells are separated from the medium by centrifugation.

Thus, obtaining a bacterial concentrate is dependent on many factors and requires the researcher to specific knowledge and skills [8].

The existing technology of preparation of rye bread from a rye-wheat breads involves the use of traditional thick and liquid starters bred on pure cultures of microorganisms for the three-phase circuit razvodochnogo cycle and supported by the continuous periodic refreshments. This technology is too long, time-consuming for the small bakeries power bakeries working in 1-2 shifts.

In this regard, the current is concentrated leaven creating high biotechnological properties, the use of which will intensify fermentation processes and considerably simplify the technology of preparation of rye bread.

Based on the above, it was determined objective of this work - using a mechanism heterofermentative fermentation kefir fungal leaven, to develop the technology of a bacterial concentrate for bread production.

Objects and methods of study

Experimental studies were carried out at the department "Technology of dairy products. Commodity and examination of goods" in the problem research laboratory of the East Siberian State University of Technology and Management. The object of research served as a fungal kefir starter. The morphology of the flora of the leaven of study by preparing preparations stained with methylene blue and Gram followed microcopying in an immersion lens system 90 with the application of drops of cedar oil. Number of lactose yeast were determined on potato glucose agar by limiting dilution. The amount of yeast fermenting lactose is not determined on the potato sucrose agar by limiting dilution. Total yeast in yeast was determined by limiting dilution, followed by inoculation in a Petri dish with Sabouraud medium. The number of mesophilic and thermophilic account lactobacilli were carried out on the medium "Baktofok".

Results and discussion

The most important factor in determining the course of biochemical processes in the rye leaven and the dough is the species composition of microflora.

The species composition of acid-forming bacteria in the rye leaven divided into two groups: homofermentative and heterofermentative lactobacilli. The main representatives are *L.plantarum*, *L.delbruckii*, *L.casei*. From heterofermentative widely used *L.brevis*, *L.fermenti*, *L.bucheri*, *L.pastorianus*.

According to many researchers, the use of homofermentative lactic acid bacteria alone does not provide good quality bread, heterofermentative bacteria are not only acidifier, but vigorous blowing, plays a significant role in the loosening of rye dough.

As a result of the accumulation of lactic acid, specific for rye dough of acid during prolonged culture almost completely displace no specific flora flour.

Kefir fungal microflora ferment is durable symbiosis consisting of homo- and heterofermentative lactic acid bacteria, yeast, and non-fermentable lactose fermenting, *Acetobacter*, etc.

In the process of the growth of yeast enriched environment near extracellular products of their metabolism, lactic acid bacteria used for its development. In turn, the growth of yeast cells is promoted by high acidity produced by lactic acid bacteria and enriching it, nitrogen compounds, due to the action of proteolytic enzymes of lactobacilli.

Kefir fungi possess the unique ability to self-regulation of the composition of the microflora under the influence of various external factors (nutrient medium, temperature, aeration mode, the pH of the medium). Therefore, by changing the conditions of their cultivation can be carried out selective breeding microflora.

The possibility of obtaining a symbiotic starters for bakery production by adjusting the conditions autoselection kefir fungus to ferment the tea leaves from rye flour. It was found that at a temperature of cultivation (30 ± 1) ° C activates the growth of yeast and heterofermentative lactobacilli flora typical of baking sourdough. It was found that symbiotic yeast has a high biological activity and stability of the composition of the microflora [9].

The studies optimized nutrient medium for bacterial concentrate symbiotic starters, taking into account the balanced growth of mesophilic lactic acid bacteria and yeast, not fermenting lactose. To build symbiotic ferment biomass determined the optimal dose of inoculum 5% of the volume of the medium. It is proved that the introduction to the culture medium 15% potato broth and 0.8% agar accelerates the growth of yeast and provides a high yield of biomass symbiotic leaven [10].

The experimental data allowed us to develop technology to produce liquid bacterial concentrate symbiotic starters. The technological process of the concentrate consists of the following stages: preparation of sourdough, cooking potato broth, cooking the culture medium, increasing biomass symbiotic starters, the separation of the liquid from the suspension culture cells, centrifugation, filling, capping, labeling and storage.

Environment for biomass symbiotic starters is cottage cheese whey with the addition of buffer salts and growth factors. Serum was previously clarified. For this purpose, it is heated to a temperature of 92-95 ° C, perekislyayut 40% sodium hydroxide solution, allowed to stand for 10-15 min and filtered.

The prepared serum make potato broth, sodium citrate, potassium phosphate, magnesium sulfate, sucrose, ascorbic acid, agar and adjusted the pH to within 6.0-6.5.

Component composition of the culture medium shown in Table 1.

Table 1

The composition of the components of the culture medium for biomass symbiotic starters

Name of raw materials and basic materials	Flowrate
Serum curd	850 ml
Potato Broth	150 ml
Sodium citrate trisodium	1,0 g/l
Potassium phosphate monobasic	0,5 g/l
Magnesium sulphate	0,1 g/l
Ascorbic acid	0,1 g/l
Agar Microbiology	0,8 g/l
Saccharose	0,5 g/l

The finished medium is sterilized at a temperature of (121 ± 1)°C for 30-40 minutes, then cooled to a temperature (30 ± 2)°C.

Cooking potato decoction is conducted as follows: peeled and sliced potatoes weighing 200 g is poured 1 liter distilled water and boiled for 1 hour. The broth was filtered, the filtrate was added water to the original volume, adjusted to pH = 3.5; bottled and sterilized at 121 °C for 10 minutes.

The chilled to a temperature (30 ± 1) ° C medium making potato broth in an amount of 15%, followed by the inoculum in an amount of 5% by weight of medium. Medium with inoculum thoroughly mixed and neutralized to a pH value of 6.0-6.5.

Artificial symbiotic ferment biomass is carried out under batch culture with twice medium neutralization and stirring at 12 and 24 hours of culture. The duration of cultivation is 24 ± 2 hours at a temperature of (30 ± 1) ° C (Figure 1).

Fig. (1). – Effect of culture conditions on the growth of biomass and quantitative content of mesophilic lactic acid bacteria and yeast, not fermenting lactose

After completion of culturing fused upper layer was separated whey remaining biomass was cooled to a temperature $(5 \pm 3)^{\circ}\text{C}$ and centrifuged at 3500 rpm the frequency of v/c , time 15 minutes. The cell suspension was separated from the culture fluid concentrate dispensed into sterile vials feeders $2 \pm 0.15\text{ cm}^3$, vials sealed with rubber stoppers and aluminum caps roll.

Quality indicators bacterial concentrate are presented in Table 2.

Table 1

Qualitative characteristics of the concentrate symbiotic starters

Indicator	Characteristics
The consistency and appearance	Homogeneous, allowed separation of serum
Colour	From white to light yellow
The active acidity, pH	5,5-7,0
Number of mesophilic lactobacilli, C.F.U./cm ³ , no less	1×10^{10}
The amount of yeast no fermenting lactose, C.F.U./cm ³ , no less	1×10^{10}
Product Volume (cm ³), which is not allowed:	
- Coliform bacteria (coliforms)	10
- S. aureus	10
- pathogens (including Salmonella)	50
Mildew, C.F.U./cm ³ , no more	10

As seen from Table 2, the bacterial concentrate is characterized by high titer of viable cells of mesophilic lactobacilli and yeasts not fermenting lactose.

Conclusion

The process for producing leaven symbiotic bacteria concentrate has a number of advantages to the known manufacturing methods for producing sourdough of rye bread:

- for biomass used in cooking simple and cheap nutrient medium based on cheese whey;
- as inoculum used symbiotic starters, close to a natural sourdough for rye bread;
- thanks to the balanced composition of the medium intensifies the process of accumulation of biomass;
- microbial biomass is characterized by high titer of viable cells.

The peculiarity of the proposed technical solution is a fundamentally new approach to the preparation of the inoculum and biomass symbiotic starters. Particular attention in the

manufacture of symbiotic concentrate was paid to the optimization of culture medium, and the creation of conditions for the growth of mesophilic lactic acid bacteria and yeast fermenting lactose is not characteristic of the fermentative microflora used in baking production.

Thus, the developed technology for producing bacterial symbiotic ferment concentrate provides the ability to eliminate semi-continuous cultivation in production without requiring additional factors to sustain activity and reducing the costs of raw materials.

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Practical use of opportunities of the center of youth innovative creativity in Karelia

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Abstract

There are presented the information about Youth Innovation Creation Centre by Petrozavodsk State University in Petrozavodsk city. It is shown the purposes, equipment of modern appliances and possibilities. There are expositions of some real results that young people receive on its base.

Key words: innovations, teaching, 3D-printing, program-lathes.

Introduction

The project to create the Center for Youth Innovative Creativity (CYIC) was initiated in 2012 by the executive director of the All-Russian public organization Young Innovative Russia A. Bukhalo and approved by the Supervisory Board of the Agency for Strategic Initiatives.

Since 2012, the project on the creation of CYIC has been introduced (realized) as part of the State Support Program for Small and Medium Enterprises of the Russia Ministry of Economic Development. The priority is the non-commercial use of equipment by children and youth in order to acquire skills in working with high-tech equipment [1].

In various regions of the Russian Federation, more than 140 CYICs have been opened; new similar centers are continuing to open.

The requirements for CYIC are put forward, mainly by the presence of: