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INFLUENCE OF *PLEUROTUS OSTREATUS* PREPARATIONS ON YOGURT CULTURES

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Abstract: *The object of our study was polysaccharide preparations, obtained from submerged cultivated Pleurotus ostreatus biomass. It was obtained 3 preparations: preparation P1, which was collected after removing from biomass lipids with 80% ethanol repeated; preparation P2, collected after ethanol extraction and extraction in a boiling water bath and then concentrated by evaporation and precipitated with five volumes of 96% ethanol solution; and preparation P3, taken as the solid residue remaining after the ethanol and aqueous extractions. Preparations were added to milk in different concentration before the introduction of yogurt cultures: Lactobacillus bulgaricus and Streptococcus thermophilus. The titrated acidity was analyzed by acid-base titration with sodium hydroxide. Some physical-chemical parameters of obtained dairy products were also evaluated.*

Keywords: *polysaccharides, Pleurotus ostreatus, fuctional food, Lactobacillus bulgaricus, Streptococcus thermophilus, yogurt.*

INTRODUCTION

In recent years, attention of scientists has been attracted to the medical effects of basidiomycetes. The high efficiency of the treatment of bacterial and viral infections, diabetes, hypocholesterolemia and cardiovascular diseases with basidiomycetes preparations is known (Giavasis, I., 2014).

Pleurotus ostreatus is well-known and commercially important edible basidiomycetes. Polysaccharides, obtained from P. ostreatus, are suitable candidates for research and development of new functional foods and nutraceuticals. P. ostreatus preparations can provide to the products additional therapeutic properties, such as anti-cancer, anti-inflammatory and hypoglycemic properties (Patel, Y., 2012).

β-glucans are the substances, which are thought to be responsible for many of this activities. There is an assumption, that β-glucans have a huge and not fully revealed potential for the treatment of diabetes and related complications (Giavasis, I., 2014).

One of the following beneficial and widely used foods in the world are dairy products. Yoghurt is the popular base for functional products (Ahmad, A., 2012). Useful additives

can be simple added into yoghurt, but they can also impact on process of milk fermentation by lactic acid bacteria: *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus*. Many manufacturers enrich yogurts with various vitamins, minerals and natural flavor additives (Vital, A. C. P., 2015).

EXPOSITION

It would be interesting to combine the useful properties of yogurt and β-glucans of basidiomycetes. The first step towards the creation of such a functional product based on yogurt is to check the effect of polysaccharide additives on individual yoghurt cultures. This article examines the effect of different concentrations of various preparations of polysaccharide from *P. ostreatus* on development and level of milk fermentation by monocultures that make up yogurt: *L. bulgaricus* and *S. thermophilus*. Some physical-chemical parameters of obtained dairy products were also evaluated.

The aim of present research was the study of some polysaccharides from *P. ostreatus* influence on milk fermentation by yogurt cultures *L. bulgaricus* and *S. thermophilus.*

The object of our study was polysaccharide preparations, obtained from submerged cultivated *P. ostreatus* biomass. It was obtained 3 preparations: preparation P1, which was collected after removing from biomass lipids and low-molecular compounds by 80% ethanol repeated; preparation P2, collected after ethanol extraction and extraction in a boiling water bath and then concentrated by evaporation and precipitated with five volumes of 96% ethanol solution; and preparation P3, taken as the solid residue remaining after the ethanol and aqueous extractions.

Preparations were added to milk in different concentration before the introduction of lactic acid cultures. Contents of total glucans and α-glucans were measured by the assay kit (Megazyme, USA). Contents of beta glucans were calculated. Table 1 shows information about preparations.

Table 1. Preparations from *P. ostreatus*

Preparations	Description	Concentrations
Preparation 1 (P1)	biomass *P. ostreatus* treated with 80% ethanol (33.5% beta-glucans)	0.1%; 0.5%; 1.0%; 1.5%;
Preparation 2 (P2)	water-soluble polysaccharides (23.8% beta-glucans)	0.1%; 0.25%; 0.5%;
Preparation 3 (P3)	water-insoluble polysaccharides	0.1%; 0.5%; 1.0%; 1.5%.

The titrated acidity was analyzed by standart method of acid-base titration with sodium hydroxide (GOST 3624-92, 1992). It was measured for every culture during all the time of fermentation.

At the result of fermentation of milk by the culture *L. bulgaricus* the dynamic of titratable acidity was obtained. At the Figure 1 the relation of titratable acidity from added preparations after 6 hours of fermentation is presented.

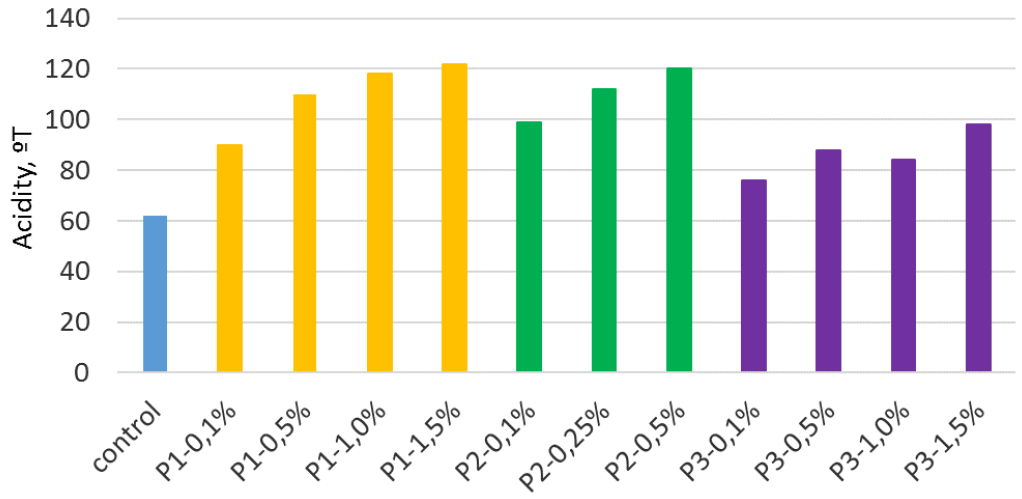

Fig. 1. Titratable acidity after 6 hours of fermentation of milk by *L. bulgaricus* with the addition of preparations P1, P2, P3

It is shown, that the addition of all the preparations to milk before its fermentation by *L. bulgaricus* causes a significant increase in glycolytic activity. The best results were demonstrated by preparations P1 and P2.

For all preparations the dynamic of titratable acidity of fermented milk by the culture *S. thermophilus* was studied. The data for 6 hour of fermentation are presented on Figure 2.

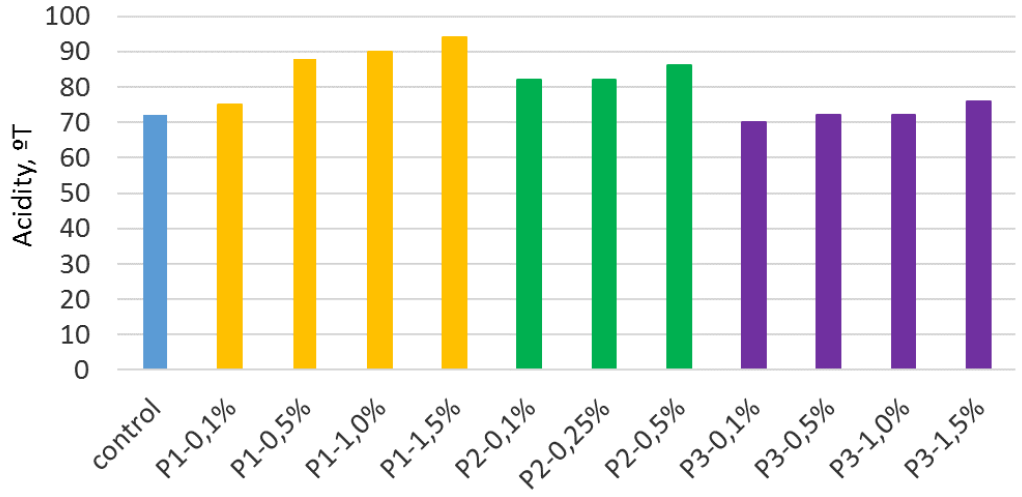

Fig. 2. Titratable acidity after 6 hours of fermentation of milk by *S. thermophilus* with the addition of preparations P1, P2, P3

In the case of *S. thermophilus*, similar results to those of *L. bulgaricus* were obtained. The best results were demonstrated by preparation P1.

One of the important physical-chemical parameters, which determine the texture of a dairy product, is water holding capacity (WHC). The WHC was defined as the ratio of the weight of the fermented clot to the weight of the total fermented milk product after 24 hours storage from the time of preparation (Sodini, I., 2002).

For all preparations water-holding capacity was measured in milk clot, produced by fermentation of milk by the culture *L. bulgaricus* after 24 hours from the beginning of fermentation. The results of measurement are presented in Figure 3.

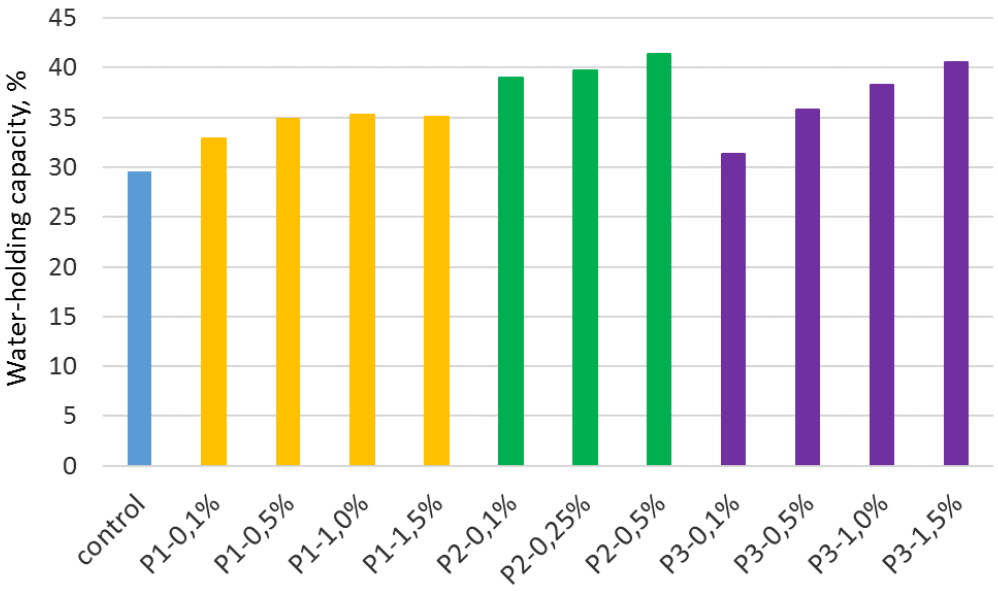

Fig. 3. Water-holding capacity after 24 hours of fermentation of milk by *L. bulgaricus* with the addition of preparations P1, P2, P3

The best results were detected for preparations P2 and P3. Despite of fact, that preparation P1 is a combination of preparations P2 and P3, it does not show the same effect.

The water-holding capacity was measured as well for milk clot, produced of fermented milk by the culture *S. thermophilus* after 24 hours from fermentation. The results are demonstrated on Figure 4.

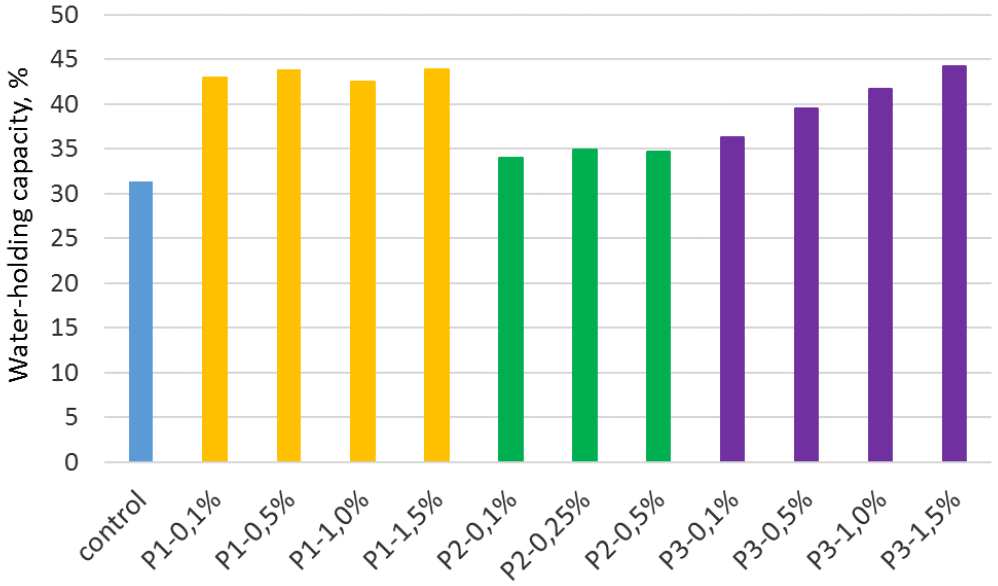

Fig. 4. Water-hloding capacity after 24 hours of fermentation of milk by *S. thermophilus* with the addition of preparations P1, P2, P3

As it can be seen from Figure 4, the largest difference from control samples is shown for preparations P1 and P3.

After study of preparation influence on milk products, fermented by individual cultures, influence of the same preparations on yogurt was studied. To produce the yogurt enriched by preparations of polysaccharides following preparations showed the best results were chosen: preparation P1 and P3 in concentration 0,5%, preparation P2 in concentration 0,1% (Fig. 5).

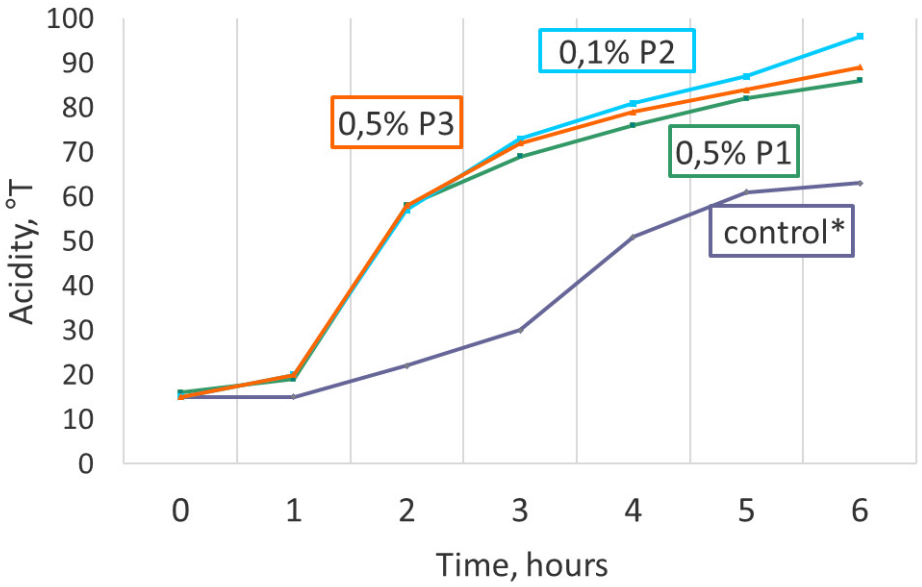

Fig. 5. Dynamic of titratable acidity of fermentation of milk to yogurt with the addition of preparations P1, P2, P3

It is shown, that all preparation sample show the same influence on titratable acidity, which is larger, that titratable acidity of control sample. The best result was obtained for preparation P2.

CONCLUSION

1. The addition of *P. ostreatus* preparations to milk increased the glycolytic activity of individual yoghurt cultures of *S. thermophilus* and *L. bulgaricus* and increased the WHC of the clots. The best results of increasing of titratable acidity level were obtainted for preparations P1 and P2. Highest water-holding capacity was achived by adding preparations P2 and P3 in milk, fermented by *L. bulgaricus*, and by adding preparations P1 and P3 in milk, fermented by *S. thermophilus*.

2. It was detected, that polysaccharide preparations accelerate and significant increase the titratable acidity of yogurt. Therefore, the addition of polysaccharide preparations before the lactic fermentation stage reduces the fermentation time and improves the physico-chemical properties of yoghurt.

3. The addition of polysaccharides positively affects the process of lactic acid fermentation, carried out by the studied cultures of microorganisms. The results obtained suggest the possibility of using fungal polysaccharides containing β-glucans to create functional foods based on fermented milk products.

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