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PROLONGING THE BIOTECHNOLOGICAL QUALITIES OF BAKER'S YEAST BY ADDING EXOGENOUS TREHALOSE

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ABSTRACT

Saccharomyces cerevisiae cells separated from the cultivation media suffers different kinds of stress (thermo stress, osmostress, nutrient starvation) leading to biotechnological qualities gradually diminished and in the end to autolysis.

Trehalose (α-D-glucopyranosyl α-D-glucopyranoside) is a disaccharide very often associated, lately, with increasing survival of yeast cells exposed to several physical and chemical stresses.

Considering the above-mentioned facts, this paperwork show the possibilities to extend the keeping period of baker's yeast biotechnological qualities by adding exogenous trehalose.

KEY WORDS:
saccharomyces cerevisiae, biotechnological qualities, trehalose

1. INTRODUCTION

Trehalose has been shown to be one of the most effective saccharides in the stabilization of biological membranes against osmotic shock. It is a compatible solute wich can replace cellular water, enable enzyme activity to continue. Now is widely recognized as a general stress metabolite in yeast, acting as osmoprotectant, antidesicant, cryoprotectant, thermoprotectant and chemical detoxicant. So, we found interesting to study if the effect of endogenous trehalose is amplified by exogenous added trehalose.

2. MATERIALS AND METHOD

A commercial Saccharomyces cerevisiae strain (S.C. RomPak, Paşcani) was used. The baker's yeast cream contained 700 g baker's yeast cells (27% dry matter)/ litre, in stationary phase of evolution.

Exogenous added trehalose was obtained from British Sugar Co. United Kingdom. 0,1%, 1%, 5%, 10% trehalose (referring to yeast's dry matter) was added to yeast cream samples, which were separated in two sets.

These were filtrated after 30 minutes, respectively 24 hours (Sartorius filter), in order to obtain compressed baker's yeast (35-36% dry matter) with exogenous trehalose content. A digital MA 30 Sartorius moisture analyser connected to a printer was used to determine the dry matter percentage. The obtained compressed baker's yeast samples were wrapped, labelled, refrigerated and stored at 4°C. Simultaneously and similarly a blind sample, without exogenous trehalose was made.

Weekly we have determinate the samples fermentative activity and dry matter percentage. The samples fermentative activity was evaluated by analysing the CO_2 volume from dough fermentation on established conditions, using the SJA fermentograph type JM451. This is a self-recording analyser for baker's yeast, which records continuously the evolution of CO_2 volume in dough. This is an IUPAC approved analyser of high precision, which offers a true continuous picture of CO_2 evolution in an all results diagram. [1]

This method stipulates the preparation of a standard consistency (550 units) dough using the Brabender farinograph. We have mixed together, for 5 minutes, 5 g compressed baker's yeast (suspended in 40 ml NaCl 2.5%) with 280 g flour (maintained at 35°C) and another 100 ml NaCl 2.5%. The mixed dough temperature was 30-30.5°C the mixer's bowl is maintained at 30°C. The obtained dough was introduced in an oiled tray and then in the SJA fermentograph. The recording system allows observations upon the evolution of CO_2 volume during the first and then the second hour of fermentation. After the first hour, the elimination of CO_2 retained in the dough is needed. Sample's fermentative activity, in cm^3 CO_2, was red directly on the fermentograph chart. Fermentograph charts interpretations allow the yeast fermentative activity evaluation and also the time interval for maximum fermentation.

3. RESULTS AND DISCUSSION

The OX axis values represent time intervals for determinations, and those on the OY axis represents samples fermentative activity for 100% yeast dry matter. Because we cannot compare fermentative activity for samples with different % d.m., we expressed fermentative activity for 100% dry matter. Fermentative activity evolution for compressed yeast refrigerated samples

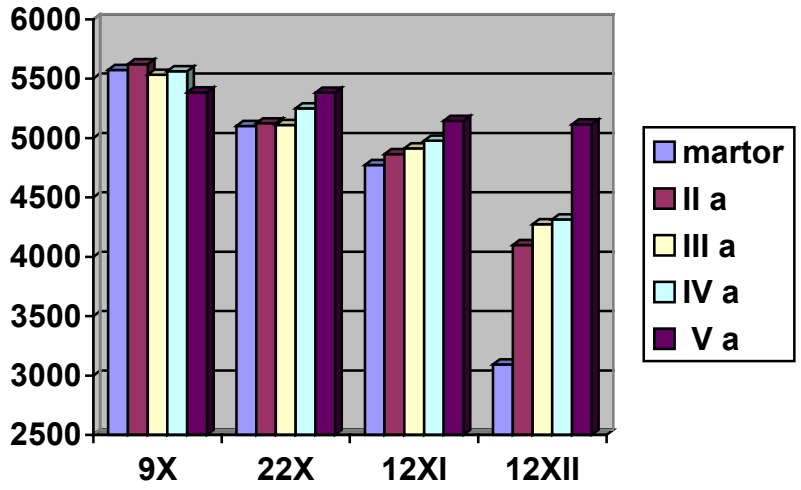
Samples were labelled as follows:

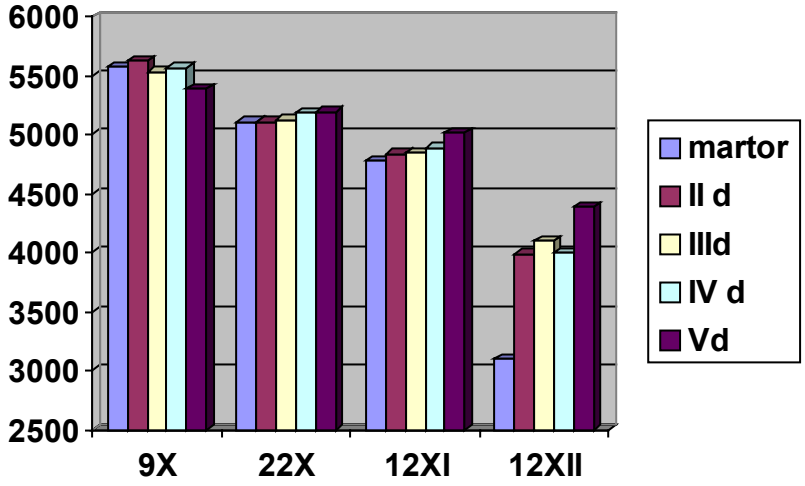
IIa = yeast cream with 0,1% trehalose/ yeast dry matter, filtered after 30 minutes.

IIIa= yeast cream with 1% trehalose/ yeast dry matter, filtered after 30 minutes.

IVa= yeast cream with 5% trehalose/ yeast dry matter, filtered after 30 minutes.

Va= yeast cream with 10% trehalose/yeast dry matter, filtered after 30 minutes.





IId = yeast cream with 0,1% trehalose / yeast dry matter, filtered after 24h.

IIId = yeast cream with 1% trehalose / yeast dry matter, filtered after 24h.

IVd = yeast cream with 5% trehalose / yeast dry matter, filtered after 24h.

Vd = yeast cream with 10% trehalose / yeast dry matter, filtered after 24h.

The obtained results showed that all samples with exogenous trehalose have a higher fermentative activity than the blind sample. Also, samples that were filtrated soon after trehalose addition are slightly more active in dough then samples, which were filtrated after 24 hours (in refrigerated conditions). That may be due to trehalose partial penetration in yeast cells, fact demonstrated in another paper work (which evaluate the trehalose left in the yeast cake).

Best results corresponding to 10% trehalose addition maybe linked with concentration were exogenous trehalose is most effective.

4. CONCLUSIONS

In earlier research [3,5,8,11], it was observed that there was a direct relationship between the Saccharomyces cerevisiae survival to various stresses and the trehalose content. The mechanism is not yet understood but it seems that the disaccharide helps membrane proteins to avoid being denature.[4]

Our present research suggests that the presence of trehalose on both sides of cell membrane is offering an advantage comparing with baker's yeast without exogenous trehalose. Also trehalose is a new, safe food additive, manufactured using the Hayashibara patented enzyme conversion and crystallization process resulting in a white crystalline powder (trehalose dihydrate) with very high organic and mineral purity. A commitment to quality assures the food industry of a high degree of consistency and quality.

Because of its ability to protect proteins and other substances from the effects of cold shock, osmotic shock and desiccation [9, 10], trehalose may help maintain the texture, flavour and colour of frozen foods (e.g. frozen dough).

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