THE INFLUENCE OF MICROINGREDIENTS UPON THE INVERTASE ACTIVITY OF YEASTS

Gabriela Pop
University “Ștefan cel Mare” Suceava, Str. Universității nr.13
e-mail: gabipop@usv.ro

Abstract

The biology of yeasts cell is in a tight connection with the existence conditions. The most important environment factors its report on chemical composition of medium, especially the concentration of different nutrients (Nam Sum Wang, 2000). For yeasts the most important microingredients are vitamins. Tacking this in consideration we can tell that vitamins could be decisive for yeasts growth and for a real increasing of enzymes activity, too. The scope of experiments was to establish the influence of different quantity of vitamins upon the invertase activity of yeasts.

Keywords: culture medium, strains, yeast, wort, molasses, efficiency

Introduction

The diversity of culture mediums is due to both the adaptation capacity of numerous microorganisms met in natural habitats and the fact that through the modification of culture medium it can obtain higher efficiency on microbian metabolism products with economic value (Bahrim, 1999).

Taking account of growth necessity for yeasts a study about yeasts behavior on different culture mediums has been done.

Experimental

As source of yeast we used baker yeast (Saccharomyces cerevisiae) from ROMPAK S.A. with 32.5% dry matter, and 46.54% protein content (N × 6.25), noted by S1, and beer yeast (Saccharomyces carlsbergensis) from S.C. BERMAS S.A., with 15% dry matter, and 35.93% protein content (N × 6.25), noted S7.
As essential medium for the yeast’s growing we used industrial medium adapted to the laboratory conditions: 40cm$^3$ wort, 0.08g (NH$_4$)$_2$HPO$_4$, 0.08g KH$_2$PO$_4$, 0.02g Mg(NO$_3$)$_2$ and 0.02g KNO$_3$.

Starting to this medium a series of culture medium were conceived through concentration variations of the three vitamins chosen (pyridoxine B 6, thiamine B1 and riboflavine B2). The quantity tested was 0.2 cm$^3$ of each of them.

The growth of the yeast was studied in the same conditions of time, temperature, $p$H and stirring.

The general work scheme was: the baker yeast sizing at $10^6$ cells / cm$^3$ was suspended in 40cm$^3$ nutritive medium, in aseptic conditions. The tests were maintain on mechanical agitator (230 rot/min), at 30°C, $p$H= 4.5 for 24 hours. Then the tests were centrifuged 25 minutes at 4000 rot/min for obtaining the biomasses. The obtained biomasses were studied following the determination of humidity, dry substance and invertase activity.

One unit of invertase activity represents the number of inverted sugar micromoles released by hydrolytic action of one cm$^3$ crude enzyme preparation (or 1 g d.m.), during one minute in the following conditions: 20% sucrose as substrate, 0.02 M acetate buffer $p$H = 4.6 at 45°C. Inverted sugar produced by hydrolysis at the moment of analysis was determinate by 3.5 DNS (dinitrosalycilic acid) reaction (Method of Analysis – AOAC).

**Results and Discussions**

In our determinations we had in view the growth speed of yeasts test strains, the invertase activity and the efficiency in enzyme for the mediums of cultures improved with vitamins. In order to evaluate the mediums composition impact upon the cells form and cells dimensions we studied the microbiological characteristics, too.

The results obtaining trough the comparative determination of invertase activity are shown in the figure 1, figure 2 and figure 3.

Analyzing the former graphics we can observe different rates of increasing of invertase activity.
When pyridoxine was added in medium we could obtain an increase of invertase activity around 1.33 times for *Saccharomyces cerevisiae* S1, and 1.29 times for *Saccharomyces carlbergensis* S7.

In thiamine case, the invertase activity increasing was even bigger that when we added pyridoxine, namely 1.64 for *Saccharomyces cerevisiae* S1, and 1.07 time for *Saccharomyces carlbergensis* S7.

![Graph 1](image1.png)

**Fig. 1.** The invertase activity evolution from *Saccharomyces* yeast which were cultivate submergently on medium with pyridoxine (Pop, 2004)

![Graph 2](image2.png)

**Fig. 2.** The invertase activity evolution from *Saccharomyces* yeast which were cultivate submergently on medium with thiamine (Pop, 2004)
Fig. 3. The invertase activity evolution from *Saccharomyces* yeast which were cultivate submergently on medium with riboflavin (Pop, 2004)

An interesting situation had been observed in riboflavin case, when, for the first time the when *Saccharomyces carlbergensis* invertase activity surpassed *Saccharomyces cerevisiae* on.

The different influence of vitamins upon the invertase potential of yeasts could be explain through different degree of them absorbtion.

For more deeply research about vitamins influence it was studied the invertase efficiency of microbian biomasses obtained in the tests conditions. The results obtaining trough the comparative determination of invertase activity are shown in the figure 4 and figure 5.

Fig. 4. The variations of invertase potential of *Saccharomyces cerevisiae* strain which was cultivate on mediums improved with vitamins (Pop, 2004)
Fig. 5. The variations of invertase potential of Saccharomyces carlbergensis strain which was cultivate on mediums improved with vitamins (Pop, 2004)

If we have a correct analyze from both graphics we can say that we could obtain good results for both strains of yeast for growth and invertase biosynthesis too.

After the microscopic evaluation I discovered the fact that adding vitamins in medium we can also obtain an increase of thickness of wall cells (figure 6).

Fig. 5. The variations of invertase potential of Saccharomyces carlbergensis strain which was cultivate on mediums improved with vitamins (Pop, 2004)

Fig. 6. The evolution of yeast cell walls on medium with vitamins (Pop, 2004)
Conclusions

Analysing the obtained results from the study of growth factors action on invertase potential we can drop that the vitamins had an important contribution on invertase potential increasing, specially thiamine. Also, it could be claimed that adding vitamins in medium it could be obtain a measurable modification of both yeast cells dimensions and yeast wall cells structure.

References