Studii şi Cercetări Ştiinţifice 2011, **12** (4), pp. 381 – 386
Chimie şi Inginerie Chimică, Biotehnologii, Industrie Alimentară

Scientific Study & Research
Chemistry & Chemical Engineering, Biotechnology, Food Industry *ISSN 1582-540X*

ORIGINAL RESEARCH PAPER

THE INFLUENCE OF THIAMINE IN THE FERMENTATION OF THE WINE YEASTS♦

Ovidiu Tita, Letitia Oprean, Mihaela Tita, Eniko Gaspar, Nicoleta Mandrean, Mariana Pacala, Ecaterina Lengyel*

"Lucian Blaga" University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environmental Protection, 7-9 I. Raţiu str., 550012 Sibiu, Romania

*Corresponding author: ecaterina.lengyel@ulbsibiu.ro

Received: June 30, 2010
Accepted: September 20, 2011

Abstract: Due to the enzymatic equipment, the yeast cell produces alcoholic fermentation by the meaning of a zimazic complex which catalyzes in different stages the redox processes of the carbohydrates, which are able to ferment, ultimately leading to ethanol. The fermentation rate is an exponential function being influenced by the cells concentration in the development environment and the starter cultures of micro-organisms. Most of the yeast strains do ferment some substrates rich in hexosanes and oligoglucides: sucrose, maltose, raffinose, lactose and celobiose.
The biomass quantity may be increased in various ways. An important aspect in the increasing of the multiplication rate of the yeast cells is the determination of the optimum growing conditions. Some kinetic dependencies, mono and multi-factorial, have been observed; they describe the impact of the concentration of the base components in the nutrient environment, temperature, pH, mixing intensity on the multiplication rate of the yeasts.

Keywords: *alcoholic fermentation, Saccharomyces elipsoideus, thiamine, yeast*

♦ Paper presented at the 6th edition of *Colloque Franco-Roumain de Chimie Appliquée*, **COFrRoCA 2010**, 7-10 July 2010, Orléans, France

© 2011 ALMA MATER Publishing House, "VASILE ALECSANDRI" University of Bacău. All rights reserved.

INTRODUCTION

Due to the enzymatic equipment, the yeast cell produces alcoholic fermentation by the meaning of a zimazic complex which catalyzes in different stages the oxidation-reduction processes of the carbohydrates, which are able to ferment, ultimately leading to ethylic alcohol. The most important enzymes are glycerate-dehydrogenases and alcohol-dehydrogenase, having as co-enzyme the nicotine-amide-dinucleotide which has a role to transfer the hydrogen in the catablolism reactions.
The wine yeasts *Saccharomyces cerevisiae,* strains *ellipsoideus* have important usage in the food industry and therefore we intend to obtain pure cultures and the selection of these strains, which, after laboratory investigations and treatments, have superior bio-technological properties. In this study we intended to observe the evolution and development of the selected yeasts in a malt wort environment which was improved with thiamine; we also observed the fermentation rate and the value of the resulted biomass [1-7].

MATERIALS AND METHODS

The selected yeasts belong to the pure cultures of the Bio-technological Development Centre of the Agricultural Science, Food Industry and Environmental Protection Faculty, "Lucian Blaga" University of Sibiu. They were named: *Saccharomyces elipsoideus* SCE 1, SCE 2 and SCE 3.
The biological samples were activated in 250 mL malt wort during 24 hours, at 24 °C. The three samples were introduced successively into the malt wort which was placed in the Sartorius fermenter, equipped with sensors for temperature, CO_2, dissolved O_2, vaporized O_2, biomass; this fermenter was programmed to monitor the fermentation activity during 10 days, at 20 °C, the obtained data being recorded using a computer [1,5]. We obtained three fermentation models, which were compared to the results obtained after using the improved fermentation environment (by using thiamine additions of 0.05, 0.07 and 0.09 mg/L respectively), in identical temperature and time conditions.

RESULTS AND DISCUSSION

According to the obtained results we noticed modifications in the development curve of the yeasts cultures: lag-phase reduction of approximately 2 times and an essential decreasing of the stationary phase of approximately 4 times. One of the key integral parameters of the yeasts culture is the duration of the development cycle of the cells between the successive divisions. So, we noticed that, after the action of thiamine, there is a synchronization effect: it is observed the same dividing time of a large amount of cells, which continues during several successive cycles. This effect plays a significant role in the perception of the interaction mechanisms of the vitamins with microorganisms (Figure 1).

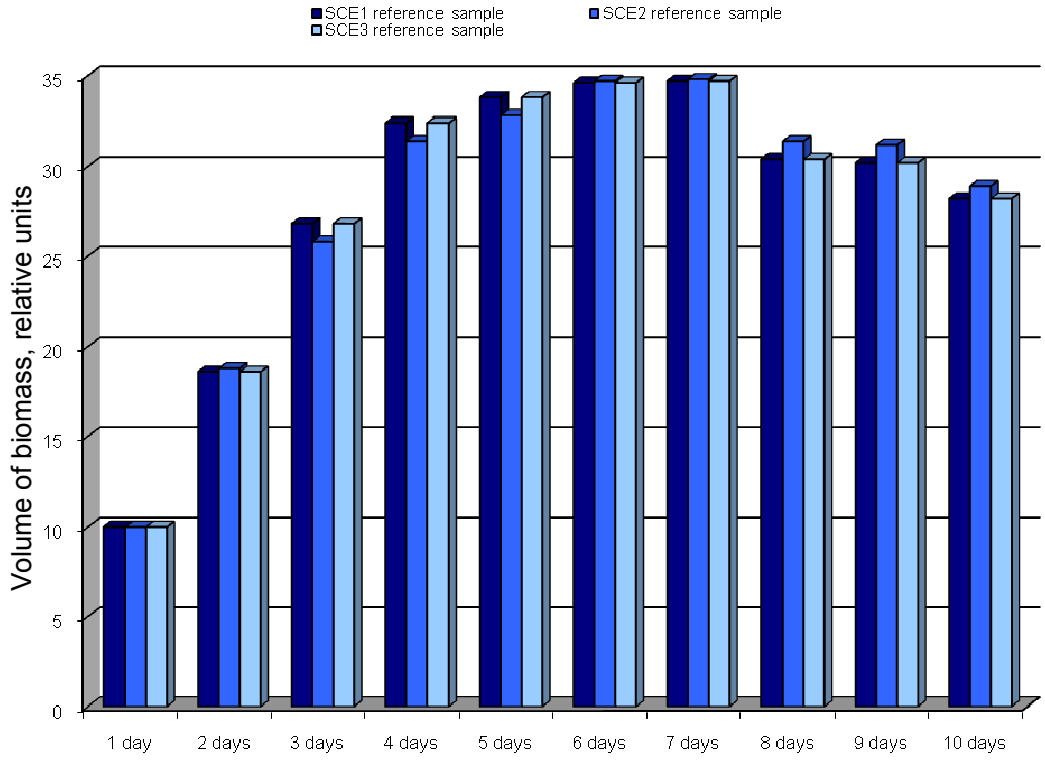

Figure 1. *Evolution of biomass for SCE 1, SCE 2, SCE 3 yeast; reference sample, no thiamine addition*

The fermentation processes are conditioned by the composition of the culture, but also by the quality of the used yeasts.

The graphical representations show the variation of the three yeasts strains regarding the monitored parameters during the 10 days of fermentation. It can be observed a more intense activity to the SCE 2 strain to an addition of 0.07 mg/L thiamine (Figure 3). The SCE 3 strain multiplies itself slower than SCE 1 when 0.05 mg/L thiamine is added (Figure 2). When thiamine is added to the fermentation environment, it can be observed a significant accumulation of biomass, after approximately 2 days, and the maximum value is obtained in the days 5 - 8, so that we may conclude that this plays an important role in the multiplication of the yeasts.

The thiamine plays an important role in the improvement of the biotechnological qualities of the wine yeasts, and the rapid accumulation of biomass, this providing to the technological process a greater stability and the possibility to interfere in the process of obtaining of a wine with superior quality (Figure 4).

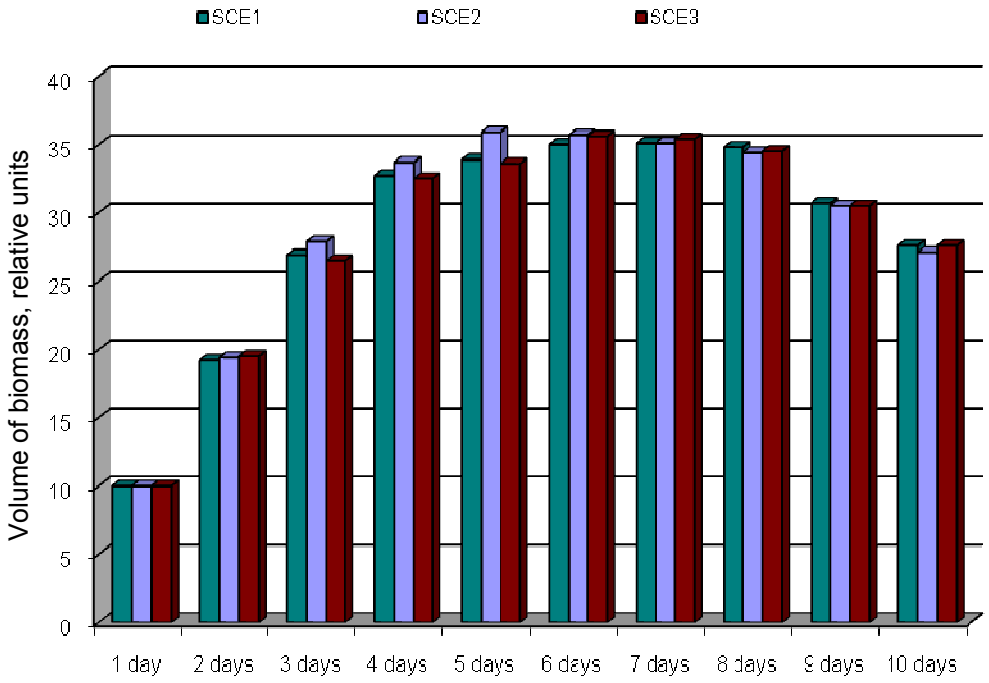

Figure 2. *Evolution of biomass accumulation for SCE 1, SCE 2, SCE 3 yeast with 0.05 mg/L thiamine addition*

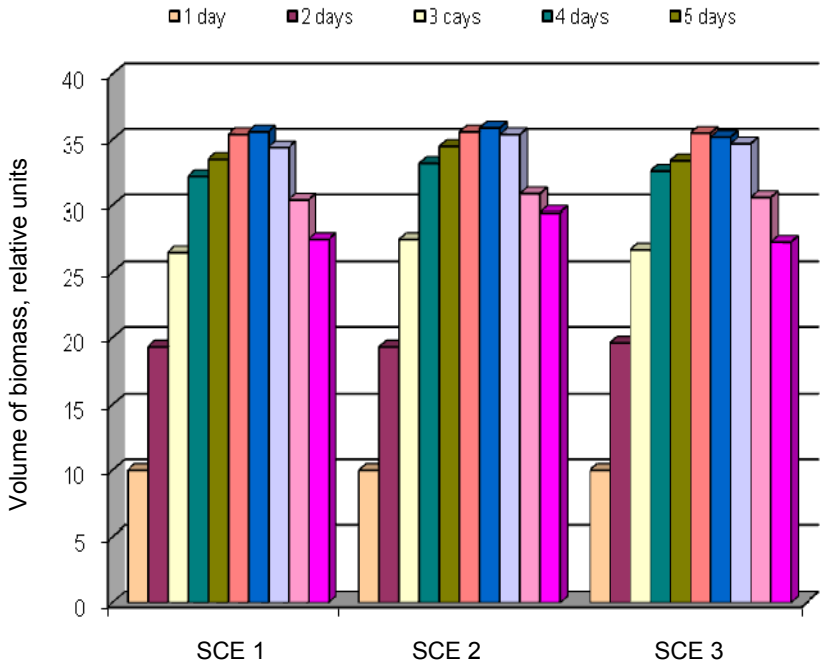

Figure 3. *The evolution of biomass accumulation for SCE 1, SCE 2, SCE 3 yeast with 0.07 mg/L thiamine addition*

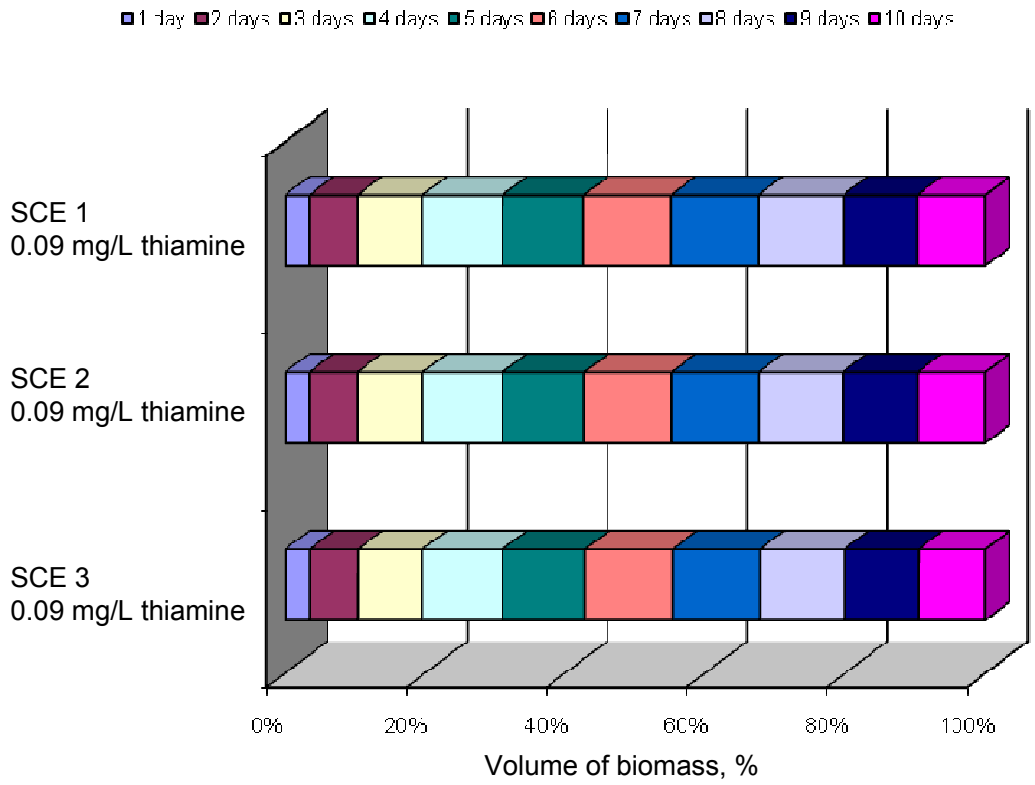

Figure 4. *The evolution of biomass accumulation for SCE1, SCE2, SCE3 yeast with 0.09 mg/L thiamine addition*

CONCLUSIONS

It can be concluded that the thiamine addition may confer significant improvements regarding the fermentation process and it constitutes a stability factor for the wine yeasts *Saccharomyces elipsoideus*. We conclude that the added thiamine to the development environment in controlled quantities is a stimulation factor for the fermentation process, having a positive influence in the biomass accumulation. These results may constitute a starting point in obtaining bio-technological products with multiple practical applications.

REFERENCES

1. Banu, C., Butu, N., Săhleanu, V., Răsmeriță, D., Stoicescu, A., Hopulete, T.: *Biotechnologies in Food Industry* (*Biotehnologii în industria alimentară* – in Romanian), Ed. Tehnică, Bucureşti, **2008**;
2. Berry, D.R., Russell, I., Stewart, G.G. (eds.): *Yeast Biotechnology,* Allen and Unwin Publishers, London, **1987**;
3. Drăgan-Bularda, M.: *General Microbiology. Practical Works* (*Microbiologie generală. Lucrări practice* – in Romanian), Babeş-Bolyai University, Cluj-Napoca, **2000**;

4. Dumitru, F.I., Vamanu, A., Popa, O.: *Yeasts. Classic and Modern Biotechnologies* (*Drojdii. Biotehnologii clasice şi moderne* – in Romanian), Ed. Ars Docendi, Bucureşti, **2002**;
5. Oprean, L., Gaspar, E.: *Microbiological Methods for Foods Expertise and Control* (*Metode microbiologice de control şi expertiză a alimentelor* – in Romanian), Lucian Blaga University Press, Sibiu, **2010**;
6. Oprean, L., Gaspar, E., Lengye,l E.: *Practical Works: Microbiological Methods for Foods Expertise and Control* (*Lucrări practice: Metode microbiologice de control şi expertiză a alimentelor* – in Romanian), Lucian Blaga University Press, Sibiu, **2010**;
7. Tița, O.: *Handbook for Quality and Technological Control in Wine Industry* (*Manual de analiză a calităţii şi control tehnologic în industria vinului* – in Romanian), Lucian Blaga University Press, Sibiu, **2001**.