THE INFLUENCE OF EXTERNAL FACTORS ON THE ALCOHOLIC FERMENTATION OF WINE YEASTS

Tita Ovidiu, Oprean Letitia, Tita Mihaela, Gaspar Eniko, Mandrean Nicoleta, Pacala Mariana, Iancu Ramona, Lengyel Ecaterina,
Lucian Blaga University
Faculty of Agricultural Sciences, Food Industry and Environmental Protection, Ioan Ratiu street no.7-9
Sibiu , Romania
e-mail: ecaterina.lengyel@ulbsibiu.ro

ABSTRACT

Alcoholic fermentation is directly influenced by physical, chemical and biological factors. Fermentation medium composition, temperature, concentration of sugar are some of the factors that influence these processes biotehnological. In this research follows the evolution of the fermentation under the influence of wine yeast *Saccharomyces ellipsoideus* SC45 in conditions of temperature and environment variables. Enriched culture media is a favorable factor for development of alcoholic fermentation, fermentation monitoring those executing the anaerobic fermentation is completely automated.

KAYWORD

Yeast - alcoholic fermentation – glucose – malt – temperature

INTRODUCTION

Yeasts assimilate glucose, sucrose, maltose and produce their alcoholic fermentation and 1 / 3 of raffinose. To form a high alcohol, the yeast metabolize anaerobically 1,7 g sugar. Yeast is a high alcoholic power, and formed by fermentation under natural conditions from 8.2 to 16.8% v / v alcohol. It can also form from 0.2 to 1.37 g / l acetic acid as a byproduct of fermentation (Tita, 2001).

Yeasts directed involved in spontaneous fermentation of grape must having a clear role on wine quality. Yeasts are included in the genus *Saccharomyces* and established that they are the main agent of alcoholic fermentation of grape. Selection of strains with high biotechnological properties based on the following attributes: alcoholigenic power, osmo-tollerance and biomass fermentation capacity.

The current study aims at monitoring of alcoholic fermentation lees three yeasts strains SC45, witness, SC451and SC452 in conditions of different temperature and inoculated and fermented in different culture media so that they can draw a conclusion on the optimum capacity of fermentation and selecting the strains with the best properties biotechnological (Dragan – Bularda, 2006) .

MATERIALS AND METHODS

The selected wine yeasts SC45, witness ,SC451si SC452:

- Culture medium/ mash of malt with the following composition: malt extract 15 g / l, peptone 1 g / 1 maltose 12.5 g / l dextrin 2.5 g / l dipotassium phosphate 1 g / l ammonium chloride 1 g / l, pH 4.8 (Scharlau Chemie SA, Spain).

Synthetic medium with following composition: pH 3.8

- potassium phosphate (KH2PO4) 5 g / l
- ammonium sulphate (NH4) 2SO4 2 g / l
- magnesium sulphate (MgSO4) x7H2O 0.4 g / l

- extract yeast 1 g / l
- glucose 50 g / l

Sartorius fermenter equipped with temperature sensors, carbon dioxide, oxygen, and optical biomass. Sensor of biomass is an optical and reading is made by comparing readings with a standard curve specific of wine yeast.

Methods used consisted in monitoring of the fermentation conditions and translational above data in a database related software fermenter. Fermenter has a capacity of 5 liters and can be driven fermentation in system bach or feed bach (Oprean, 2010).

RESULTS AND DISCUSSION

After fermentation monitoring finds the influence of external factors on the process and in particular to temperature and composition of medium. As a environment as shown in chart 1 the dynamics of fermentation is accelerated in situations where we provide to process a higher temperature and culture medium contain nutrients elements compatible.

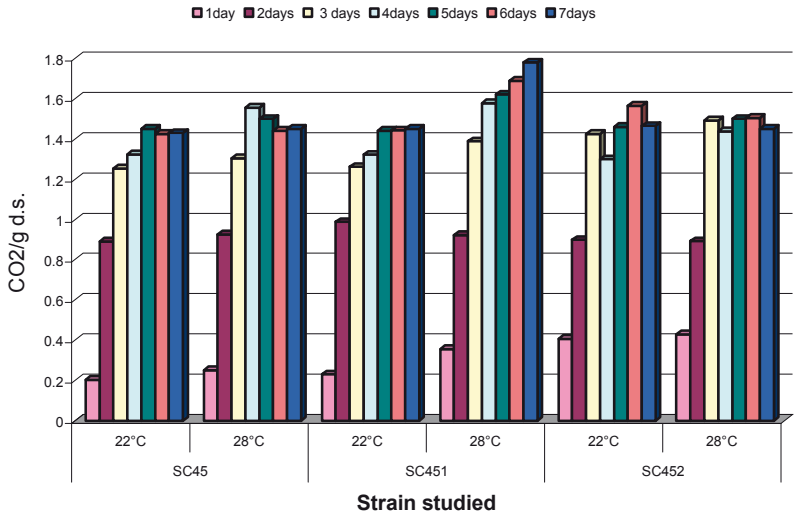

Fig.1. Influence of temperature (22 ° C and 28 ° C) on the activity of yeast fermentation samples seeded in malt worth

In case of added sugars, fermentation is prolonged, but also the values recorded are a mast more. Release of carbon dioxide is higher and constant a longer time and the accumulation of biomass grow. Comparative with the blank is found that is most active strain is SC451, the strain subject to study at 28 ° C, fermented in synthetic medium, the peak being reached on the seventh day.

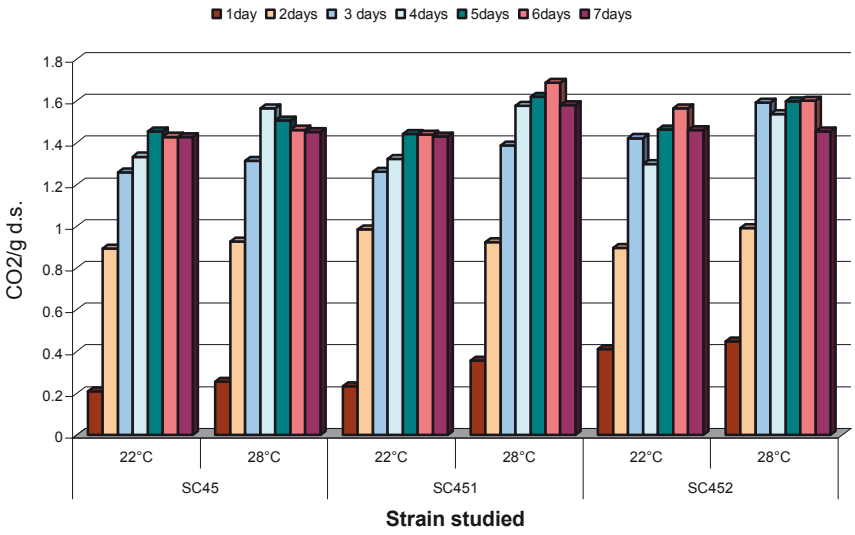

Fig.2. Influence of temperature (22°C and 28°C) on the activity of yeast fermentation samples seeded in synthetic medium

A data analysis of the dynamics process of the yeast fermentation SC451 and SC452 could focus on was the degree to which the two strains follow the same evolutionary function. By the temperature of 28°C : Connection between the two strains (marked with X for SC451 and Y for SC452), relative to their effect on CO_2 atmosphere, can be expressed statistically through covariance and correlation coefficient. If note Dxi the quantity of CO2 between period i from the strain X and Dyi the quantity of CO2 between period i from the strain Y, where i = (24, 48, 72, 92, 116, 140, 164), and M (Dx), M (Dy) the average quantity of CO2 released by the seven measurements, we have:

M(Dx)=1,012 ; M(Dy)= 0.764 şi

$$\text{cov}(X,Y) = \frac{1}{4}\sum_{i=24}^{164}(Dx_i - M(Dx))(Dy_i - M(Dy)) = 0{,}115$$

Having a negative covariation (VOC (X, Y) = 0.115> 0), we conclude that the two quantities of CO_2 trends tend to change in same sense. Link is determined by the intensity of correlation coefficient. First calculate the standard deviation of CO_2 in the two strains:

$$\sigma(X) = \sqrt{\frac{1}{4}\sum_{i=24}^{164}(Dx_i - M(Dx))^2} = 0.512 \qquad \text{şi} \qquad \sigma(Y) = \sqrt{\frac{1}{4}\sum_{i=24}^{164}(Dy_i - M(Dy))^2} = 0.548$$

Correlation coefficient will be:

$$\rho_{XY} = \frac{\text{cov}(X,Y)}{\sigma(X)\cdot\sigma(Y)} = 0{,}398$$ (ratio, generally defined as the interval -1, 1), what indicating a weak link media may say that the fermentation of yeast SC451 and SC452 have the same trend in the proportion of 38 5% or that tend to move independently at a rate of 61.5%.

CONCLUSIONS

The monitoring an cycle of the yeast fermentation of wine SC45, SC451, SC452 found the following:

- wine yeast strains activity is increased after 24 hours in glucose-enriched medium conditions

- wine yeast has a slower average to ferment glucose peak after about 72 hours, at which time phase lag;

- the temperature is directly proportional with the addition of glucose observing a speed of fermentation is significantly improved compared with the strains monitored at 22°C and pH see that influence fermentation of carbohydrates is important for the process to the batch system.

AKNOWLEDGEMENTS

This research paper was supported under the project "Increasing the role of the Phd studies and the competitivity of the Phd students, in an united Europe", POSDRU/6/1.5/S/26, ID 7706, coordinator Phd Prof..eng.Ovidiu Tita.

BIBLIOGRAPHY

Banu, C.**,** 2009. Manualul Inginerului de Industrie Alimentară, vol.I, Ed. Tehnică, Bucureşti.

Banu, C.**,** 2009. Manualul inginerului de industrie alimentară, vol. II, Ed. Tehnică Bucureşti.

Banu, C., Butu, N., Săhleanu, V., Răsmeriță, D., Stoicescu, A., Hopulete, T., 2000. Biotehnologii în industria alimentară, Ed. Tehnică Bucureşti.

Buțu, A., Tudora, C., 2005. Optimisation studies for polysaccharides extraction from the parietal component of wine yeast, vol. III, Rom. Biol. Sci.

***Colecția de Standarde din industria alimentară, 2005. SR EN ISO 22000, EN 29000.De

Hertogh, B., Talla, E., Tekaia, F., Beyne, E., Sherman, D.**,** 2003. Novel transporters from Hemiascomycete yeasts, Mol. Microbiol. Boitechnol.

Drăgan-Bularda, M., Samuel, A., 2006. Microbiologie generală, Ed. Univ.Oradea.

Oprean, L., Tița, O., 2001. Microbiologia vinului, Ed. Univ.Lucian Blaga, Sibiu.

Oprean, L., Gaspar, E., 2010. Metode microbiologice de control şi expertiză a alimentelor**,** Ed. Univ.Lucian Blaga, Sibiu.

Oprean, L., Gaspar, E., Lengyel, E., 2010. Lucrări practice : Metode microbiologice de control şi expertiză a alimentelor **,** Ed. Univ.Lucian Blaga, Sibiu

Saldanha, A.J., Brauer, M.J., Botstein, D., 2004. Nutritional homeostasis in batch and steady –state culture of yeast, Department of Genetics, Stanford University Medical School, Stanford, CA 94305, USA.

Tița, O.,2001. Manual de analiză a calității şi control tehnologic în industria vinului,Ed. ULBSibiu