COMPARATIV STUDY ABOUT ENZYMATIC CARACTERISTICS OF *SACCHAROMYCES* YEASTS

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Rezumat

Drojdiile au o largă întrebuinţare în domenii tradiţionale ca industria de panificaţie, bere, vinificaţie, dar şi pentru producerea pe scara industrială de proteine, vitamine şi enzime. De aceea cercetările de biologie a drojdiilor, sub toate aspectele, au implicaţii importante atât de ordin teoretic, prin explicarea unor concepte fundamentale ale biologiei, cât şi practic, prin numeroase domenii de aplicabilitate industrială.

Scopul lucrării a fost de a testa comparativ activitatea enzimatică a drojdiilor *Saccharomyces cerevisiae* şi *Saccharomyces carlbergensis*.

Résumé

Les levures ont une large utilisation dans des domaines traditionnels tels l'industrie de la panification, de la bière, de la vinification, et aussi pour la production sur échelle industrielle de protéines, de vitamines et d'enzymes. C'est pour cela que les recherches biologiques des levures, sous tous les aspects, ont des implications importantes tant du point de vue théorique par l'explication des concepts essentiels de la biologie, que du point de vue pratique dans de nombreux domaines d'applications industrielles. Le but du travail a été de tester comparativement l'activité enzymatique des levures *Saccharomyces cerevisiae* et *Saccharomyces carlbergensis*.

Abriss

Die Hefen haben eine breite Anwendung in traditionelle Gebiete wie, z.b.: Brot-, Bier- und Weinherstellung sowie auch für die industrielle Herstellung von Proteine, Vitamine und Enzyme. Dadurch die Forschungen in dem Gebiet der Hefenbiologie haben sehr wichtige Folgen: theoretisch – durch die Erklärung den Grundkonzepten der Biologie, sowie auch praktisch – durch die zahlreiche industrielle Gebrauchsdomäne.

Der Zweck der Arbeit ist das komparative Studium der enzymatischen Tätigkeit von *Saccharomyces cerevisiae* und *Saccharomyces carlbergensis*.

Introduction

Yeasts from *Saccharomyces* family and related species presents major industrial importance. *Saccharomyces cerevisiae* has the capacity to assume and ferment a large variety of sugars such as sucrose, glucose, fructose, galactose, maltose and maltotriose. Moreover, *Saccharomyces carlsbergensis* yeast is able to use dextrin and melibiose as substratum.

Like living organism, yeasts realize continuous transformations of substance necessary for development and growth.

As yeasts are heterotrophy microorganisms, they take organic and anorganic substances from nutritive medium that assumed them with help of energy liberated through the metabolic decomposition of absorbed organics substances.

The enzymes of microbian cells are essential in transformation the transformation they produce, and the enzymatic preparation obtained could have different enzymatic activities, with ones predominance.

In this respect one determinate the invertase activity (taking into consideration predominant activity), proteolitical activity and maltase activity for yeast commercial strains.

Materials and methods

As a source of yeast we used six assortments of baker yeast (*Saccharomyces cerevisiae*) and three assortments of beer yeast (*Saccharomyces carlsbergensis*), from internal production and import.

Yeast strain used in our determinations are specified In table 1, and their codification and origin too.

Table 1

Commercials strain of *Saccharomyces cerevisiae* used for study

Strain	Species	Producer firm
S1	*Saccharomyces cerevisiae*	Compressed yeast ROMPAK
S2	*Saccharomyces cerevisiae*	Dry yeast ROMPAK
S3	*Saccharomyces cerevisiae*	Compressed yeast LESAFFRE
S4	*Saccharomyces cerevisiae*	Dry yeast LESAFFRE
S5	*Saccharomyces cerevisiae*	Compressed yeast Dr. OTKER
S6	*Saccharomyces cerevisiae*	Dry yeast Dr. OTKER
S7	*Saccharomyces carlsbergensis*	Production yeast by BERMAS S.A., Suceava
S8	*Saccharomyces carlsbergensis,* Saflager S189	Dry yeast, collection FERMENTIS
S9	*Saccharomyces carlsbergensis, W34/70*	Yeast from WEISTEFAN collection

The pure culture , obtained through isolation were preserved by maintaining under sterile paraffin oil.

In table 2 are specified methods used for our experiments.

Table 2

Enzymatic activity and methods used for them determination

Determination activity	Method name	Conditions of reaction	Unit of measure
0	1	2	3
Invertase activity	3,5 DNS (dinitrosalycilic acid) reaction (Method of Analysis – AOAC). (IRS-SR 13421).	Substratum 20% sucrose, *p*H=4,5 in 0,02M acetate buffer Temperature= 45^{0}C	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^{0}C.

Table 2 (continuation)

0	1	2	3
Maltase activity	After Segal R., 2000	Substratum maltose 1% *p*H = 4,5 fit with acetate buffer Temperature=37^{0}C	One unit of maltase activity represents the number of glucose micromoles produce by 1cm^3 enzymatic extract or 1g d.m. for 1 minute.
Proteolitical activity	Adapted method	Substratum peptone 10% Temperature=35^{0}C	The quantity of amynoacidic nitrogen moulded through the action of proteolitical enzymes included in 100g product, for one hour

Results and discussion

The ***proteolitical activity*** of yeast strains was tested in nutritive medium with variable *p*H, with values between 6,1 and 8,3, using phosphate buffer. Reproductible results were obtained for all tested strains at *p*H=7,3.

The obtained data are shown in table 3 and figure1.

Table 3

Proteolitical activity of *Saccharomyces* strains

Strain of yeast	S1	S2	S3	S4	S5	S6	S7	S8	S9
Proteolitical activity, %	46,66	40,83	45,21	39,37	43,75	37,91	35	42,87	37,33

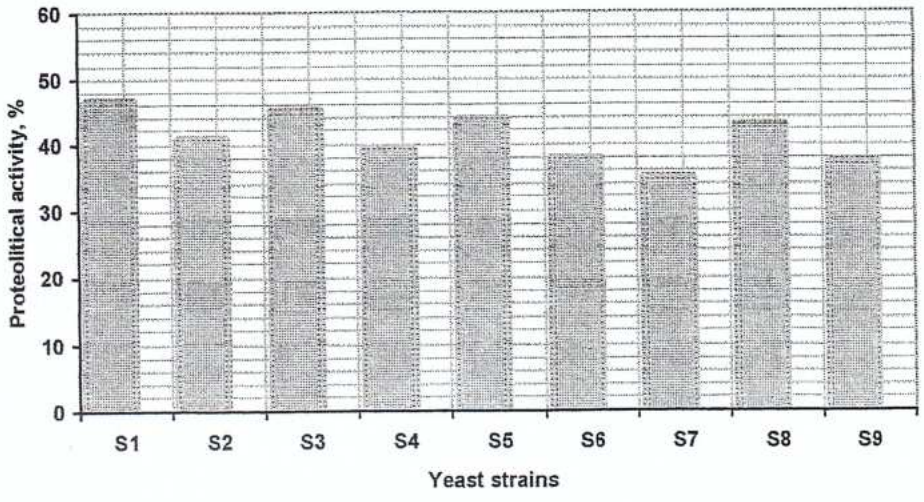

Figure nr. 1. Evaluation of proteolitical activity of commercial strains of *Saccharomyces*

If we analyse the graph from figure 1, we can easily observe that the S1 (*Saccharomyces cerevisiae*) yeast strain has the best proteolitical activity following by the S8 strain (*Saccharomyces carlsbergensis*). We can also see the competition between S1, S3, S5, S7 and S9.

The ***maltase activity*** is an important caracteristic of *Saccharomyces* yeast, being an index of its adaptability at the maltose fermentation from medium.

Maltose can not be fermented only after an induction period useful to biosynthesis the enzyme named α–glucosidase (maltase). The experimental results, which are shown in table 4 and figure 2, certify the fact that the *Saccharomyces cerevisiae* strains S1, S2, S3, S4, S5, and S6 have a higher activity than *Saccharomyces carlsbergensis* S7, S8 and S9, irrespectively of their displaying are compressed or dry forms.

Table 4

Maltase activity of *Saccharomyces* strains

Yeast strains	S1	S2	S3	S4	S5	S6	S7	S8	S9
Maltase activity, AM	3,72	3,43	3,68	3,47	3,70	3,45	1,84	1,65	1,71

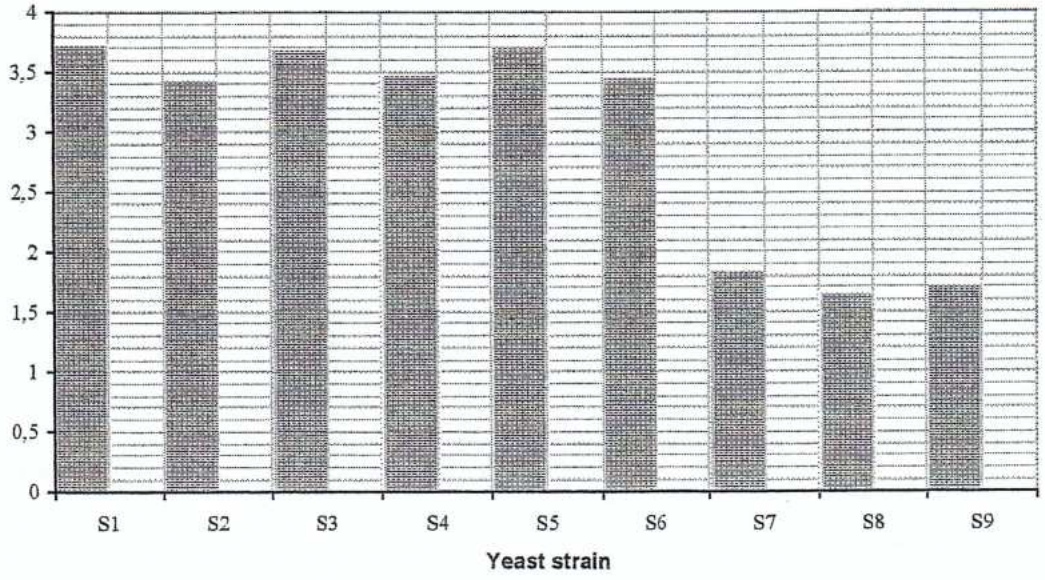

Fig. 2 Evaluation of maltase activity of commercial strains of *Saccharomyces*

Speaking about invertase activity, we can say that the potential to biosynthesize invertase depends on strain and species. We must select the best strain producing of invertase for obtain a competitive improvement of invertase potential. As there is a direct link between the biosynthesis potential and enzyme activity,we determine enzymatic activity of commercial strains in study. The results of experiments are shown in table 5 and figure 3.

Table 5

Invertase activity of *Saccharomyces* strains

Yeast strains	S1	S2	S3	S4	S5	S6	S7	S8	S9
Invertase activity, UE	1356	1283	1180	890	1287	1174	1152	1171	1084

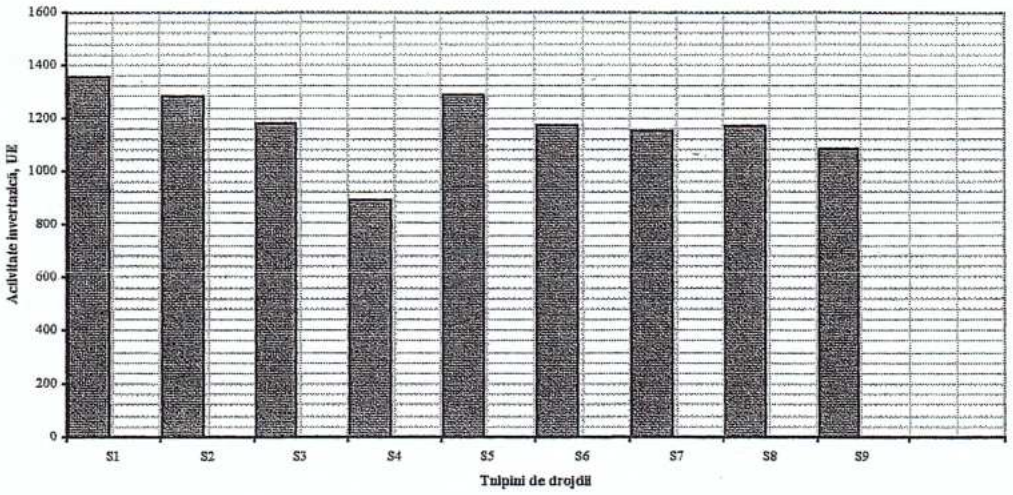

Fig. 3 Evaluation of invertase activity of commercial strains of *Saccharomyces*

It is easy to observe that the supremacy of S1, S5 and S8 strains is maintained. And we can observe an light diminution for S7 versus S8.

Conclusions

After we have determined the enzymatic activity of commercial strains of yeast we can affirm following:

- The *Saccharomyces cerevisiae* strains S3 and S5 have a native invertase activity slightly higher than *Saccharomyces carlsbergensis* S7 and S8
- The *Saccharomyces cerevisiae* strains have the best maltase activity, which explain the best results obtained in dough processing.
- The best invertase activity is observed to the *Saccharomyces cerevisiae* S1 strain, fact that recommends it as an industrial source of enzyme.

Bibliography

1.Anghel, I., 1991, *Biologia şi tehnologia drojdiilor,* Editura Tehnică, Bucureşti.
2.Bahrim, G., 1999, *Microbiologie tehnică*, Editura Evrika, Brăila
3. xxx, Enciclopedia of Food Science, Food Technology and Nutrition, Ed. R. Macroe, Academic Press, London, 1993
4. Segal, R, Muscă, L., Vâţă, C., 2000 *Îndrumar de lucrări practice pentru biochimia produselor alimentare*, Universitatea „Dunărea de Jos", Galaţi.
5. Pop, G., 2004, Cercetări privind îmbunătăţirea potenţialului invertazic al drojdiilor de panificaţie şi bere, Teza de doctorat, Galaţi