RESEARCHES CONCERNING INFLUENCE OF MALT ENZYMES ON WORT AND BEER QUALITY

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Abstract: *There are generally tendencies from economic reasons with other cereals, even ungerminated cereals. But this leads to many difficulties through some technological phases in malting and brewing process concerning a constant and continous quality of malt, wort and beer .In this study we have tried to suggest a optimal evaluation of barley, as raw material in beer industry, besides his technological parameters, depending on assortment, climate and sole conditions, chemical composition, water sensibility and establishing optimal diagram of temperature and time for malting, also for brewing.*

Keywords: *barley, wort, amylases, proteases*

Introduction

In the food industry, particularly beer industry, there is practically no single technological process, without endogenetyc enzyme participation. These enzymes derive directly from biological raw materials or from microorganisms that are used for materials transformation. Active proteins, biochemical catalysts, the enzymes represent the life manifestation. In the field of industrial production the enzymatic activity control is a considerable advantage. The beer producers for their special amylasic and proteolityc activities have always used the malt enzymes. From technological and economic reasons, malt was partially replaced by auxiliary materials in many beer factories. The quality of raw materials is varying from one crop to another, from one sort to other, from one bench to another, or even inside the bench. In the same time, there are other parameters that influence the process: special qualities of beer, specific features of the brewing process, the used equipment. The enzymatic products and immobilized enzymes used in different food industry technological programs are considered as transforming additives. In 1982, FAO/OMS -- Food Additives Experts Committee have established "General procedures for enzymatic preparations used in performing food products, that regulate the obtaining of enzymatic preparations, used for food industry, from animal, vegetable or microbial raw materials, as entire cells, fragments of cells or even extracts without cells. In this work we suggest studying and identifying of certain correlations between malt enzymatic capacity and some wort quality parameters. The germination rest phenomenon was intimately studied by Pollock & co (England) and also by, Urion & Chapon (France). The main factors for germination are: certain humidity level, adequate temperature for process developing and furnishing the optimum quantity of oxygen, for germ breathing. The most important of all three is water supplying, for absorption process that may launch germination process. The germination main purpose is forming and developing inside the kernel of

amylolytic enzymes: α-amylase; β-amylase; limit dextrinase; invertase and maltase, all of them supplying the main substrates for yeast fermentation. It supposes that the first attack on starch granules is made by α- amylase, limit dextrinase, β-amylase and α-glycosidase together solubilises dextrines released by granules α-amylolisis. It is true that a malt extract, with the same value of α-amylolitic activity as purified enzyme, hydrolysis starch granules more rapidly, one of hypothesis saying that one of the three mentioned enzymes could attack these granules. Glucose is obtained in every form of treatment and the main quantity is produced by a-amylase comparing with the two forms of α-glycosidase. Besides all this glucose isn't it the only product released by a-amylase, in many times reductible carbohydrate overpasses this component. The absolute level of synergism is varying with time of hydrolysis and substrate utilization: glucose or reductible carbohydrates. Synergism is referring to α-glucosidase action on dextrines developed by α-amylase attack on intact starch granules. It supposes that its action consists of releasing of α-amylase from its dextrines combinations, this permitting the following attack on starch granules. The significance of α-glucosydase in degradation of starch molecule is minor comparing with that of α-amylase. Estimation of α-glucosydase and α-amylase activity and hydrolysis activity for α-1,4 links indicates α-amylase the most important enzyme in breaking process of starch granules " in vivo", α-glucosydase can attack intact starch granules but with smaller rate than α-amylase.In table no.1 is presented the carbohydrate composition for finite malt.

Table 1 Composition for finite malt

Carbohydrate or fraction	Medium content% dry malt
Starch	56.5
Reductible carbohydrate (invert)	3.0
Unreductible carbohydrate (saccharose)	5.0
Pentosans (phurphuraldechide)	10.0
Cellulose (corrected)	5.5
Total	**80.0**

Materials and methods

To study the influence of amylolitic enzymes on some quality indicators of malt we have done the following analyses: extract content, at dry substance, saccharification time, filtration time, malt humidity, technological parameters at 20^0, 45^0,65^0 and 80^0C, Hartong parameter, Kolbach parameter, amylolytic capacity. All of these being determined on Kongress worts, produced by EBC method.

Results and discussions

Concerning some aspects detaching from values analysis for mainly malt indicators, in table no.2, we can group them like:

- majority malt samples obtained in pilot station from barley sorts of three Experimental Stations presents a real connection between solubilisation by malting process - that is characterized by " farinosity"- and effect developed by proteolityc enzymes- through Kolbach indicator-that reveals the importance of rigorous respecting of temperatures diagrams in every phase of malting process for creating optimal activity conditions for enzymes activity;
- another significant observation is the correlation of "farinosity", the general kernel solubilisation ,with amylolitic

enzymes action, suggested by indicator "amylolitic capacity", so that underlines the major role of simultaneous and connected activity of both proteases, preparing the action field for others enzymes, amylases, responsible for supplying the main substrate for following technological phases: brewing, respective main fermentation;
although "amylolytic capacity " is referring at a and b amylases, priority on b, a strong correlation is observed among all groups of enzymes on entire malt definition, that is revealed by depending equations between "amylolitic capacity" and technological indices at 45^0, 65^0 and 80^0C, in other words, we cannot speak about optimal amylolitic capacity malt without a well correlated action among all the enzymes that involves malting process, beginning with hemicellulases attacking wall cells until proteases and phosphates that prepares optimal conditions for acting all categories of enzymes in the starch breaking process .

Table 2 Malt quality parameters

Assortment	Farinosity [%]	Saccharification time [min.]	Filtration time [min.]	Hartong	Kolbach [%]	Amylolitic capacity [WK]
VICTORIA	92	12	37	4,23	36,78	317
ANDRA	86	10	41	4,15	37,08	322
ADI	85	11	38	3,70	35,73	310
DANA	88	11	40	4,65	35,95	311
LAURA	90	14	38	3,48	37	316
F 529-84	88	11	42	4,03	36,25	318
F1112-88	88	12	38	4,53	36,93	308
F 1147-92	89	15	40	4,65	36,78	324

In the field of proteolityc enzymes we insist on some of wort parameters as is seen in tables no 3: total nitrogen, coagulable nitrogen, Lundin fractions, albumin content and globulin content. There are significant correlations among "amylolytic capacity", saccharification time, filtration time, farinosity, Hartong and his implications in brewing and fermentation. Wort from weak enzymatic malt (with low content of mono- and di-saccharides) needs a content of these saccharides much more than normal for a regular fermentation. Monosaccharides content affects main fermentation quality, while disaccharides content affects the fermentation following rest intermediate period. When we mix low monosaccharides content malts with low disaccharides content malts we can see an improved fermentation among every media sample, as a fermentescibile saccharides composition remedy. For establishing and intervention as a result of proteolityc action effects, at malting and mashing, on malt and wort quality we have been proceed at barley, malt and wort analysis through following indicators: total nitrogen, coagulable nitrogen, albumins, glutellins, hordeins, globulins and Lundin fractions all complete a whole image opposite the established goal. It's known the major influence of raw material in malt quality definition, means barley, followed by germination equipment and technological diagram. Another parameter that furnishes us information on intensity of proteolityc malting process with many implications concerning malt brewing behavior and the assurance of yeast fermentations conditions is fraction" hordeine". This is a proteic fraction from initial endosperm and it is shown some influences about beer quality, mainly

from hydrophobic parts, which are revealed in finite beer.

Table 3 Wort proteic characterization

Assortment	Coagulable nitrogen [g/100 ml]	Lundin fraction, [g/100 ml]			Albumine [g/100 ml]	Globuline [g/100 ml]
		A	B	C		
VICTORIA	0,0016	0,014	0,012	0,040	0,008	0,003
ANDRA	0,0018	0,013	0,013	0,037	0,006	0,006
ADI	0,0014	0,010	0,012	0,038	0,007	0,004
DANA	0,0018	0,018	0,012	0,042	0,008	0,004
LAURA	0,0016	0,015	0,014	0,039	0,010	0,005
F 529-84	0,0017	0,018	0,013	0,042	0,011	0,006
F1112-88	0,0015	0,014	0,011	0,035	0,009	0,005
F 1147-92	0,0017	0,019	0,013	0,046	0,010	0,006

Table 4 Malt proteic characterization

Assortment	Total nitrogen [% d.m.]	Proteic nitrogen [% d.m.]	Albumin [%d.m.]	Globulin [% d.m.]	Hordeine [%d.m.]	Gluteline [% d.m.]
VICTORIA	2.03	0.16	1.12	0.39	4.1	7.36
ANDRA	2.19	0.17	1.01	0.36	4.4	8.64
ADI	1.87	0.16	1.19	0.35	4.6	7.55
DANA	2.11	0.16	1.28	0.32	4.1	7.80
LAURA	2.00	0.15	1.16	0.40	4.3	7.12
F 529-84	2.23	0.18	0.78	0.40	4.4	8.15
F1112-88	2.13	0.21	1.19	0.44	4.5	6.82
F 1147-92	2.08	0.16	0.66	0.37	3.6	7.90

Conclusions

These experiments have tried to find the best modalities for intervention on malting or brewing process to turning to account the physical-chemical and biochemical potential of barley, as raw material, especially for the reasons in the last years: decreasing the barley production and quality parameters worsen. Foreign sorts of barley differs a lot on malting properties, so that they cannot follow the same germination diagrams, even drying processing in malting, being genetic and physiologic unmatchable with local barley.

We have trade to reveal the aspects correlated with quality evaluation of barley, as raw material in beer industry, starting from morphological and genetic aspects establishing water sensibility depending on assortment, crop landing, optimal temperature for initiating malting process. We cannot find the ideal brewing formula analyzing the complex phenomena of entire processing, because optimal conditions for one enzyme activity affect the other enzymes: temperatures and pH conditions, intersecting many times along fabrication.

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