

THE INFLUENCE OF YEAST CONCENTRATION IN FERMENTATION OF BEER

Kastriot Pehlivani ¹, Donika Prifti ²,

^{1,2} Faculty of Nature Science, University of Tirana.

kastri71@hotmail.com

donikaprifti@yahoo.it

Abstract

Different factors play their role in the fermentation of beer but very important ones are temperature, CO₂ pressure and yeast concentration.

In this work it has been studied the influence of the yeast concentration in the main parameters of fermentation. It has been studied the beer fermentation in three cases, with three different concentrations of yeast:

1. First case was used the 2.0×10^{-6} cells/ml;

2. Second case was used 2.2×10^{-6} cells/ml;

3. Third case was used 2.4×10^{-6} cells/ml.

All other conditions of production were the same and the same raw material was used, therefore, we used the same quality of barley malt, the same quality of water, the same type and quality of yeast, and the same hops. The work was done in the same equipment and under the same other chemical and thermodynamic conditions.

According to the study we can conclude that the main differences were in the results of the apparent and real degree of attenuation. The small differences were noticed also in the yeast changing mass during fermentation but not so much. While the extract decrease during fermentation was almost the same. It is important to say that organoleptic characteristics at the final product of beer were not noticed.

The study was done under the production conditions of the Peja Brewery, Birra Peja. Analyses were made in the Chemical Laboratory of Birra Peja Brewery, according to the EBC – European Brewery Convention methods.

Keywords: yeast, fermentation, beer, cells, attenuation.

Introduction

In the process of beer production, the fermentation is very important and the most-time consuming step which takes 7-10 days before entering the maturation period. An important objective of fermentation and technology is to reduce the fermentation time while producing an end product of similar quality. However, the influence of the yeast concentration on fermentation and beer quality has never been assessed systematically. The most important process is fermentation of

the sugars in the wort to ethanol and carbon dioxide by the yeast. The reactions occurring during fermentation can be differentiated into those which occur in the main fermentation and those occurring in maturation, but the processes overlap. It is therefore necessary to consider the changes which occur during fermentation and maturation as a continuous process.

In this study, three different concentrations of yeast were applied for fermentation to investigate the influence in fermentation parameters and beer quality.

Material and methods

Three different concentrations of yeast for fermentation were used:

1. the concentration of 2.0×10^{-6} cells/ml, (sample 1),
2. the concentration of 2.2×10^{-6} cells/ml, (sample 2),
3. the concentration of 2.4×10^{-6} cells/ml, (sample 3).

In all cases the mash method with two decoction was processed and the same fermenting conditions.

Fermentation has started with the temperature of 12 C and original extract of wort 13%, has reached the temperature 15C where stayed for round 48 hours and then the temperature dropped to 1C. During this time the apparent extract has been moved from 13% to round 2%.

Practical work has been done in the brewery Birra Peja, in wort production and fermentation department and analyses have been done in the the laboratory of chemical analyses of the brewery. Technical equipment, methods and technological conditions for wort production

Equipment used:

1. Mill for wet milling, MIAG Braunscheing, Type NSA 30100M, 1970- Capacity of 5000 kg/h

- two crash rollers,- time of milling, 1 hour.

2. Vessels for treatment and technological preparation of wort.

3. Cyindroconical vessels (CCVs) for fermentation.

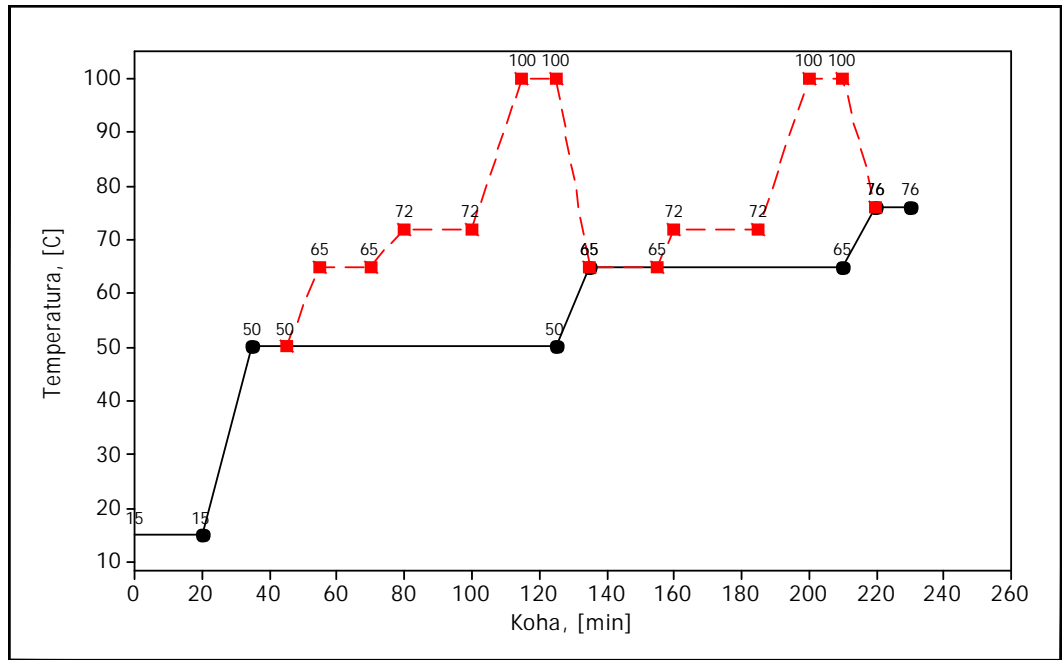


Fig.1. Mash process with two decoctions

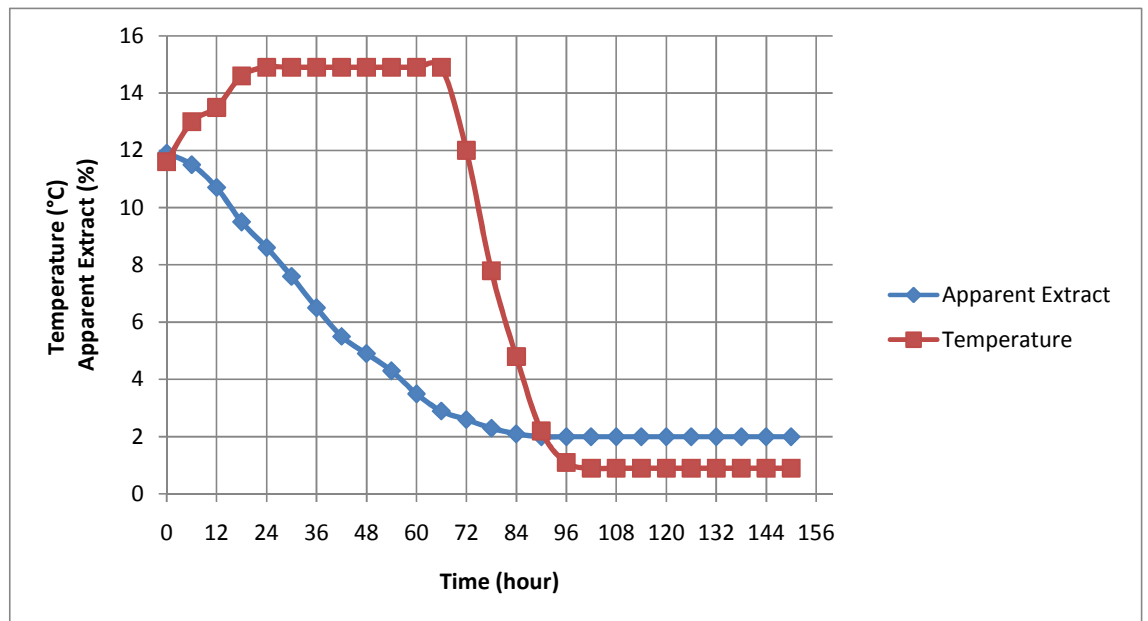


Fig.2. Fermentation of beer with the concentration of 2.4×10^{-6} cells/ml, (Sample 3).

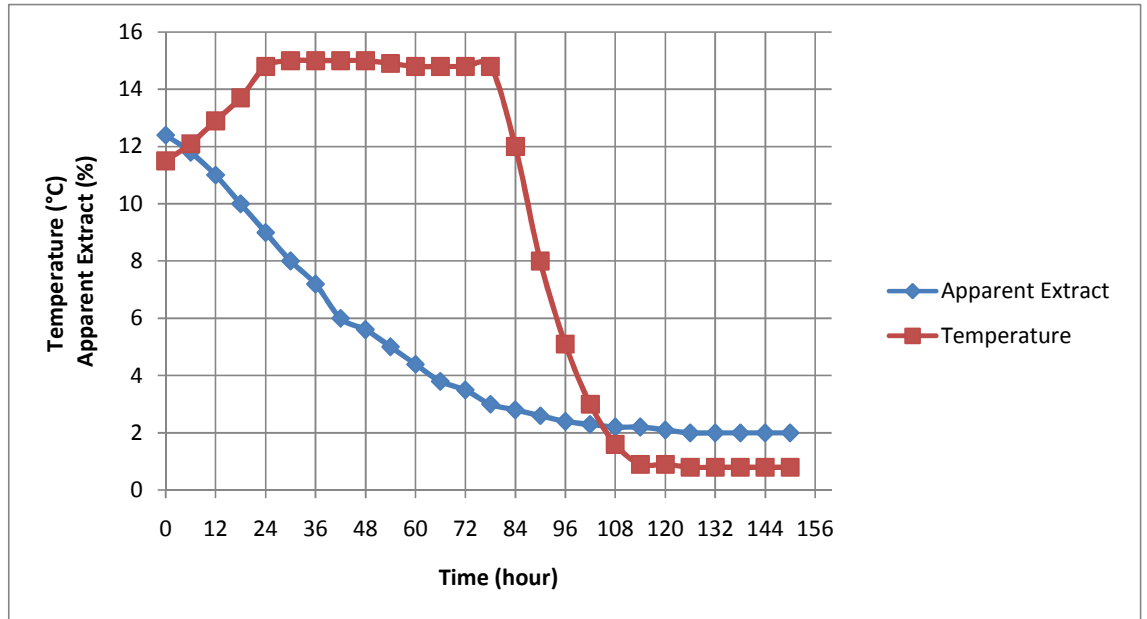


Fig.3. Fermentation of beer with the concentration of 2.2×10^{-6} cells/ml, (Sample 2).

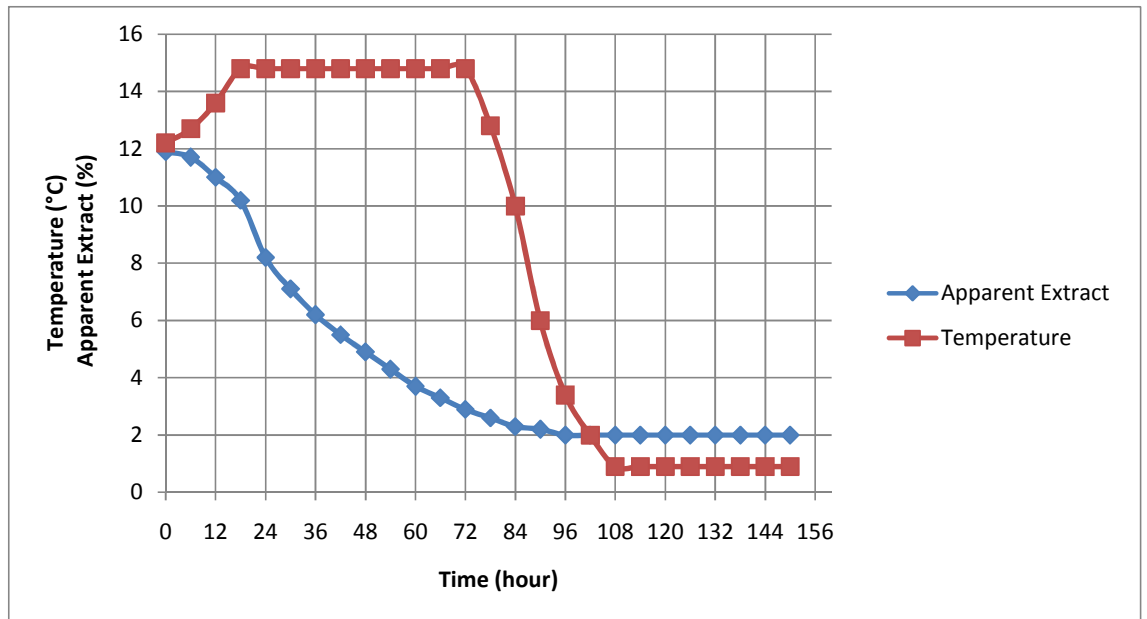


Fig.4. Fermentation of beer with the concentration of 2.0×10^{-6} cells/ml, (Sample 1).

Results

All chemical analyses has been made in the laboratory of Birra Peja according to the EBC methods, European Brewing Convention.

In the table below are given the results of beer chemical analyses for all three cases of fermentation.

Tab.1. Chemical analyses of beer

		Sample 1	Sample 2	Sample 3
1	Original extract of wort, %	10,55	10,27	10,34
2	Real extract, %	3,73	3,58	3,40
3	Apparent extract, %	2,11	1,98	1,75
4	Real degree of attenuation, %	65,86	66,39	68,28
5	Apparent degree of attenuation, %	80,06	80,72	83,07
6	Alcohol, % m/m	3,49	3,42	3,55
7	Alkooli, % v/v	4,45	4,36	4,52
8	Density, g/cm	1.0082	1.0077	1.0068
9	CO ₂ , g/l	5,0	5,2	5,0
10	pH	4,76	4,76	4,83
11	Colour, EBC	8,4	9,1	8,9
12	Bitterness, EBC	21,81	21,23	21,14
13	Acids, ml 0.1N NaOH	2,0	2,1	2,06
14	Foam, sec	> 400	> 400	> 400
15	Polyfenols, mg/l	150,0	154,0	156,0

* Sample 1 = the concentration of 2.0×10^{-6} cells/ml,

** Sample 2 = the concentration of 2.2×10^{-6} cells/ml,

*** Sample 3 = the concentration of 2.4×10^{-6} cells/ml,

Conclusions

According to the results of chemical analyses there are differences in main parameters such as apparent and real degree of attenuation and almost no differences in other chemical parameters. Both, apparent and real degree of attenuation rise with rising the concentration of yeast, but in all three cases the parameters are acceptable. According to the diagram of fermentation we can see that the time for dropping extract to 2% is shortest for the sample 3 which means that higher the concentration of yeast cause shorter time of fermentation. At sample 3 where concentration of yeast is 2.4×10^{-6} cells/ml the time of main

fermentation is shorter for nearly 12 hours which is very important for the economy of process.

Since the other parameters do not differ too much, we can conclude that the fermentation with the higher yeast concentration impact the shorter time of main fermentation and therefore is the most appropriate especially for economic reasons.

It is important to state that there were not noticed any organoleptic differences between three samples.

References

- (1) Wolfgang Kunze. Technology Brewing and Malting, 3rd international edition, VLB Berlin, Germany, 2004.
- (2) MALTING AND BREWING SCIENCE, J. S. Hough, D. E. Briggs, British School of Malting and Brewing, Department of Biochemistry The University, Birmingham, 1971. (proved: prof. Dr. Slobodan Ga eša, Tehnološkog fakulteta, Novi Sad, 1976).