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PRODUCTION OF NON-ALCOHOLIC BEER

Mybeshir Pajaziti
University for Business and Technology - UBT, mybeshir.pajaziti@ubt-uni.net

Kastriot Pehlivani
University for Business and Technology - UBT

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Mybeshir Pajaziti[1], Kastriot Pehlivani[1]

[1] UBT – Higher Education Institution, Lagjja Kalabria, 10000 p.n., Pristina, Kosovo

Abstract. This study is conducted on the basis of market demand and J.S.C. “Birra Peja”, Peja, Kosovo, beer factory management demand for a quality non-alcoholic beer. The study shows the entire technological production process of producing alcohol-free beer of 0% alcohol and 6.0 - 6.2% basic extract. The work done in the production was monitored by the laboratory of the factory "Birra Peja". The work was also monitored in the laboratory of the brewery “Union” in Ljubljana, Slovenia, the National Institute of Health in Pristina, and the Peja Agricultural Institute. Chemical and microbiological analyzes were carried out based on methods according to the European Convention on Breweries (ECB) and Mitteleuropäische Brautechnische Analysenkommission e. V. (Central European Commission for Brewing Analysis) or MEBAK. From laboratory analyzes and sensory evaluations of beer quality, we have come to the conclusion that non-alcoholic or zero-alcohol beer is of good quality, and, considering the high quality, it should be produced in “Birra Peja".

Keywords: Basic extract, Non-alcoholic beer, ECB, MEBAK

Introduction

There are several efficient and safe ways to produce non-alcoholic beer. Based on Kunze’s methodology on beer production, we decided that the beer must be natural and with no added ingredients of modified origin (1961, 2004). We produced beer that has all the characteristics of the beer with alcohol but without alcohol or a level of zero-alcohol. The study was concerned with alcoholic fermentation which does not produce alcohol. We have worked with four different yeast yield rates 2.0 × 107, viable cells (wort ml), which yeast at the beginning of fermentation did not contain alcohol or had 0% alcohol (Schuster et al., 1976).

The used raw material for the production of this beer was the same as when producing beer with alcohol. As raw material for the production of non-alcoholic beer was used Croatian barley malt, quality analysis results of which will be presented below.

The yeast that is used is the second generation in our fermentation process. The results obtained showed that the yield rate turned a higher maximum number of yeast culture cells, higher amount of fermentable sugar obtained and ethanol production rate, lower diacetyl and pentandione in green beer, as well as higher amounts of high alcohols and esters. The results of the process of obtaining the wort show that this method itself was even more efficient as a controlled method for obtaining wort with limited amounts of fermentable sugars resulting in the composition of the production product; ethanol, and concentrations of diacetyl, high alcohols and ethers in green beer.

The used method of obtaining higher concentration of wort and high gravity beer, which beer after the fermentation process was interfered with dehydrated water containing maximum 0.002% oxygen. The beer dilution process was done after the fermentation was completed to a certain extent and during the filtration of the finished product until the initial extract of 6.2%. Chemical

and microbiological analyzes were carried out based on methods according to the European Convention on Breweries (ECB) and Mitteleuropäische Brautechnische Analysenkommission e. V. (Central European Commission for Brewing Analysis) or MEBAK (Anger et al., 2005).
The beer obtained after fermentation and maturation contains a raw material odor (milled mater with water. We had the option to remove this fragrance through chemical aromatic compounds that would have given the flavor of our choice (vermicelli or beer flavor). However, we chose a different method that was based on purifying the aroma through gases, which do not alter the taste and quality of the beer but only affect the elimination of the unpleasant odor.
The purpose of this paper was to study the production of non-alcoholic beer in the technological process.

Material and Methods

The 6.2oP wort is prepared from boiling 100% malt with a one decoction procedure. Water from the "Drini i Bardhë" spring with strength of 9.5°dGH. For this study, was used Aurora (bitter) and Golding (aromatic) humulus lupulus with Slovenian origin with the ratio of 70:30%. During the process, we have added 6.3 gr α-acide/hl to the wort. The yeast used for the production of these beers is Saccharomyces carlsbergensis with the previously stated concentration of yeast cells per ml. We have cooled the wort by withdrawing oxygen. We used a tool for stabilizing polyphenols. The main fermentation was carried out and completed at 4oC, in which case the total amount of the extract was not consumed. This method was based on Narziss's recommendations (1976).
Yeast, temperature, amount of carbon dioxide, amount of ethanol, and gravity were continuously monitored during the fermentation process.

Results and Discussion

The natural production of beer was conducted in order to complete this study successfully. So primary in this study are the advantages and not the dependencies on the raw material or the technological process of brewing.
By doing the cost-benefit analysis of the final product, savings were noticed from the initial stages of production of this beer. The cost of filtering beer has fallen in proportion to the index beforehand. We should mention about 15% energy savings in wort preparation, about 15% energy savings during the main and supplementary fermentation, capacity utilization compared to beer produced by wort at 6.2°P for about 50%. Also due to changes in production recipes based on the methodology by Pajaziti (2014), we have been able to reduce the substances used for stabilization (protein and polyphenols) by 50%. As we see in the tables and histograms, we have changes in the amount of secondary fermentation products such as the increase of the amount of esters and the decrease of the amount of high alcohols, in which case there is a change of the taste of the beer produced with these modifications. Therefore, the beer produced by this method due to the halved amount of polyphenols has taste stability over-time because the oxidation of polyphenols does not happen. Also, below are presented the results of two tasting groups, one from "Birra Peja" and the other from "Union" brewery, who conducted tasting separately. In this case, the beer produced by this method compared to the beer produced without alcohol in the region has been scored higher.

Table 1. Results of beer tasting at "Union" brewery, Ljubljana.

Beer tasting at “Union” brewery, Ljubljana						
Taster	Sample					
	S	T	G	A	K	M
Taster #1	3.30	3.20	3.30	3.20	3.20	3.20
Taster #2	3.20	3.30	3.20	3.20	3.20	3.20
Taster #3	3.20	3.30	3.20	3.20	3.20	3.20
Taster #4	3.20	3.30	3.20	3.20	3.20	3.20
Taster #5	3.10	3.20	3.30	3.20	3.20	3.30
Taster #6	3.10	3.30	3.20	3.20	3.20	3.20
Average scoring	3.18	3.27	3.23	3.20	3.20	3.21
Evaluation	Very good	Excel-lent	Excel-lent	Very good	Very good	Very good

Table 2. Results of beer tasting at “Birrfa Peja” brewery, Peja.

Beer tasting at “Birra Peja” brewery, Peja					
Organoleptic characteristics	Sample				Maximum points
	A	B	C	D	
Taste	1.00	1.00	1.00	2.50	3
Smell	1.20	1.00	1.00	1.50	2
Colour	4.20	4.00	4.00	4.50	5
Clarity	3.40	3.00	2.00	4.00	4
Foam	4.00	3.00	3.00	5.50	6
Full points	13.80	12.00	11.00	18.00	20
Evaluation	Very good	Very good	Excel-lent	Excel-lent	

Table 3. Beer analysis results.

Date of work	26.03.2019	23.05.2019	min/max
Basic extract %	6.04	6.06	6.0-6.2
Real extract %	5.74	5.75	
Apparent extract %	5.67	5.68	
Real rate of fermentation %	5.03	5.24	
Appar. rate of ferment. %	6.09	6.34	
Alcohol %v/v	0.19	0.20	0.0-0.30
Density 20/20	1.0223	1.0224	
CO_2 g/l	5.2	5.3	4.7-5.7
pH	5.10	5.17	5.0-5.3
Color EBC	6.80	7.0	6.5-8.0
Bitter EBC	19.6	19.0	18-20

O_2 total mg/l	0.15	0.14	0-0.5
Polyphenols mg/l	68.19	72.14	

Table 4. Results of analysis of secondary fermentation products.

Peja Beer	26.03.2019	23.05.2019
Diacetyl (mg/l) 0.1	0.0060	0.0084
Pentanedione (mg/l) 0.6	0.00	0.00
DMS (mg/l) 0.03-0.12	0.015	0.019
Acetaldehyde (mg/l) 2-20	0	0
Etyl Acetate (mg/l) 5-30	0.50	0.57
Iso-Amyl Acetat (mg/l) 1-5	0.00	0.00
Propanol (mg/l) 5-30	0.00	0.00
Iso-Butanol (mg/l) 5-20	1.20	1.24
Iso-Amyl Alcohol (mg/) 50-60	2.4	2.5

Conclusion

This study was conducted in the period between October 2017 – May 2019 and by comparing the results it was concluded that non-alcoholic beer produced at “Birra Peja” meets the most the quality requirements as compared to beers produced at other factories that have been studied for comparison. The main drawback of the beer produced by this method is that it is not 0.00% v/v alcohol. It is worth mentioning that this non-alcoholic beer produced in "Birra Peja" has a colloidal and microbiological viability of 12 months.
In consultation with the factory's management, we have come to the conclusion that the continuous production of these beers should begin as soon as possible. The beer is of high quality, it is drinkable and has satisfactory colloidal stability.

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