

Comparative physico - chemical and microbiological analysis of obtained beer in laboratory system and the same product obtained in industrial system

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Abstract Beer is an alcoholic non-distilled beverage fermented with yeast to a mash made from malt, water and boiled with hops. It is considered a food drink. We performed comparative analysis of the characteristics obtained in laboratory beer comparative with a standard industrial system.

We performed physico-chemical and microbiological analyzes and the result reflects the lack sterile environment.

It is noted that in the process of maturation of beer, the fermentation process seems to continue, expressed by decreasing of the pH and increasing of the alcohol content.

Key words

extract, polyphenols, yeast, bacteria

All constituent substances give beer its characteristics and largely determines the types and varieties of beer produced, differing in their components concentration. [1,2]

The Er beer extract (real extract) varies between 3.5-5% depending on: primitive wort concentration and obtained beer. The fermentation of beer assortment. The special beers have a Er 3.5% lower (hypoglucidic beers) by forced hydrolysis of polysaccharides and is made by using enzyme preparations that lowers the levels of carbohydrates. Er from special beers with more than 5% are nutritious beers and shall consist of: 80- 85% carbohydrate C; 6-9% protein; 3-5% glycerol as a by-product of the alcoholic fermentation; 3-4% mineral substances; 2-3% bitter substances, polyphenolic substances and coloring; 0.7-1% organic acids and small amounts of mainly water-soluble vitamins.

C-hydrates are 60-75% dextrin type α - and β from starch hydrolysis - gluconate from hydrolysis of β -glucans. A 20-30% of acetates hydrates is the monosaccharides, disaccharides and trisaccharides. Approximately 6-8% are pentosan (derived from hemicellulose). [1,2]

Concentrate bitter substances are found in the 15-50 mg / l and differ from one brand to another. These are iso - α - bitter acids and that substances from β - bitter acids.

Polyphenolic substances derived one third of hops and malt other two thirds. In beer is found in a concentration of 150 mg / l beer. Polyphenols are substances of phenolic acids to tonaide and relevance to physicochemical and sensory qualities of beer. [3,4]

The main volatile encountered that give beer its specific smell and taste are: alcohol; substances resulting from alcoholic fermentation; Maillard reaction compounds and essential oils from hops. Concentration of ethyl alcohol derived from fermentation varies greatly depending on the concentration of fermentable wort primitive extract and also the degree of fermentation carried out. This results in a concentration usually of 3-6% vol.. But there may be small concentrations of 3% or greater than 6% by volume of alcohol. [2,3]

Materials and Methods

The quality of the finished product we can define as a whole whose stability depends on many factors, factors that contribute to obtaining the product and are represented by indices grouped into two broad categories. These categories are: physico-chemical indices and sensory cues. Each index influences the quality of the beer and can be determined by laboratory analysis.

In the first stage of beer was carried out under laboratory conditions and analyzes were carried out a week or two weeks of product is obtained. Measurements were performed in the laboratory unit Burger- Brewery SC European Food SA, one of the largest brewers in Romania.

The product obtained is a beer that has used the following materials: malt, untreated drinking water, pearl hops and yeast for beer generation IV. Obtained beer is part of unfiltered and unpasteurised, being an

assortment for brewery that has a standard issue them as a corporate professional standard.

Results and Discussions

The results are shown in Tables 1-3 and in Figure 1.

Table 1

Physico-chemical analysis laboratory beer in two stages of maturation

Results from the first week of maturation (18.06.2014)	Results from the second week of maturation (02.07.2014)
pH = 4,62	pH = 4,42
Alcohol = 5,04	Alcohol = 5,85
Colour = 9,25	Colour = 9,5
Polyphenols = 92,16	Polyphenols= 168,92
Bitter substances= 13	Bitter substances= 20
Primitive extract = 13,62	Primitive extract= 13,64
Real extract= 4,87	Real extract= 4,85
Apparent extract= 2,79	Apparent extract= 2,76

Table 2

Comparative analysis with a similar product – Meister beer

Results from the first week of maturation (18.06.2014)	Results from the second week of maturation (02.07.2014)	Meister beer analysis from two weeks of maturation
pH = 4,62	pH = 4,42	pH= 4,38
Alcohol = 5,04	Alcohol= 5,85	Alcohol= 5,19
Colour = 9,25	Colour = 9,5	Colour = 6,5
Polyphenols = 92,16	Polyphenols = 168,92	Polyphenols = 213,2
Bitter substances= 13	Bitter substances = 20	Bitter substances = 30
Primitive extract= 13,62	Primitive extract = 13,64	Primitive extract = 11,74
Real extract= 4,87	Primitive extract = 4,85	Primitive extract = 3,65
Apparent extract= 2,79	Apparent extract = 2,76	Apparent extract = 1,96

Analysis of the results after two weeks of realizing the product we can draw the following conclusions: boiling step was performed correctly, resulting the conclusion of the value of the primitive extract, alcohol real and apparent extract; secondary fermentation step is not yet fully completed.

Both primitive extract (13.64 ° P) as well as the alcohol content (5.85% vol) at 2 weeks of maturation is higher than Meister beer. There is, however, a lower content of polyphenols (168.92) in the beer produced in the laboratory compared to the industrial processed beer (213.2).

We also performed the microbiological analysis that can be found in the table below, and the

results of the analysis reflects the lack of a sterile environment thus the product achieved the presence a thin layer of coliform bacillus. The presence of yeast is normal in this type of product and the number and viability of yeast decreases with increasing duration of the ripening period. In this type of beers under current legislation, namely: ORD. 975/1998 - Rules for food sanitary reviewed by ORD. / 176 of 18.02.2009 and ORD. 27 / 15.11.2011 provided the following conditions for admissibility of microbiologically: lactobacillus, coliforms - 1/100 cc presence of E. coli - absent; yeasts and molds 3000 / cm³.

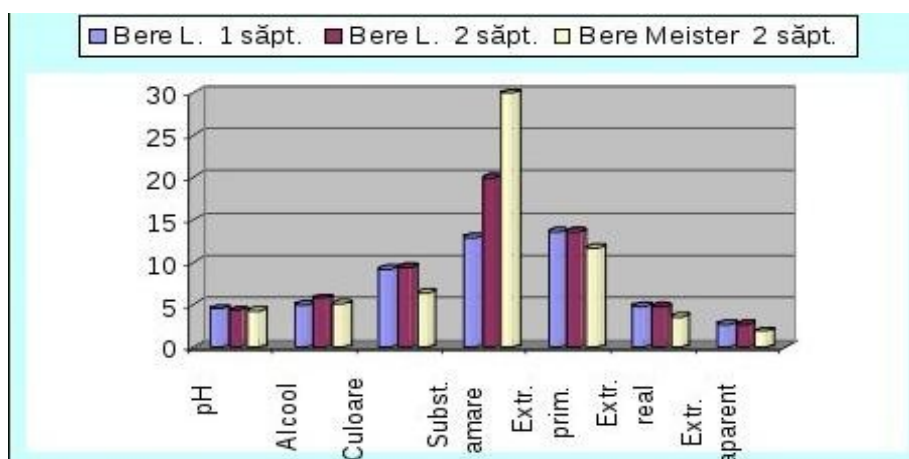


Fig. 1. Graphic diagram of the results by physico-chemical analysis

Table 3

Microbiological analysis of two stages of maturation

Results from one week of maturation (18.06.2014)	Results from two weeks of maturation (02.07.2014)
Yeast cell count= 16 millions	Yeast cell count = 3 millions
Viability = 95%	Viability = 78%
Coliform bacteria= thin layer	Coliform bacteria= thin layer
WA=thin layer of destroyed yeasts, few wild yeasts	WA= thin layer of destroyed yeasts, few wild yeasts
NBB-A = thin layer of short and long	NBB-A = thin layer of short and long bacillus
E. coli= absent	E. coli= absent

Table 4

Comparative microbiological analysis with Meister beer

Results from one week of maturation 18.06.2014.	Results from two weeks of maturation 02.07.2014.	Results for Meister beer at two weeks of maturation
Yeast cell count = 16 millions	Yeast cell count = 3 millions	Yeast cell count =1,5 millions
Viability = 95%	Viability = 78%	Viability= 50%
Coliform bacteria= thin layer	Coliform bacteria= thin layer	Coliform bacteria= absent
WA= thin layer of destroyed yeasts, few wild yeasts	WA= thin layer of destroyed yeasts, few wild yeasts	WA= absent
NBB-A = thin layer of short and long	NBB-A = thin layer of short and long	NBB-A = absent
E. coli= absent	E. coli= absent	E. coli= absent

The result reflects the lack of environmental analyzes sterile product realization by the presence of

coliform bacteria film and the presence of bacilli film. The presence of yeast is normal in this type of product

and the number and viability of yeast decreases with increasing duration of the maturation period.

Conclusions

Considerations on the difference between physical and chemical parameters obtained in laboratory beer to beer Meister reference is the following: the primitive extract of the beer obtained in laboratory is higher by about 2% compared to reference beer, because being connected as an approximate calculation of the formulation, and reduced opportunities to simulate the industrial technology. Regarding the formulation which should have been correlated exactly the amount of malt extract derived from water used to knead and exhausted marc to get a slightly larger volume of wort at a concentration of about 12.2% of the primitive mash. (before fermentation).

Also technological phases were carried out with difficulty under laboratory conditions, not having adequate equipment nor the ability to make determinations of physical and chemical parameters during the process to operate corrections during wort production.

There is a lack of hops in the laboratory beer compared to the reference product.

Lack of hops with high content of alpha acids (as CO₂ hop extract) and use only hop flavor is one of the main causes of low content of bitter substances in the finished beer. Also, the addition of hops should have done according to the alpha acid content thereof, the degree of isomerization correlated with the desired bitter substances in the finished beer.

In matured beer, fermentation process seems to continue, if we analyze by lowering the pH and increasing the alcohol content.

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