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RESEARCH ARTICLE

OBTAINING AND CHARACTERIZATION OF BEERS WITH CHERRIES

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Abstract

Brewers try to offer to the consumer a larger variety of quality beers made after new or old recipes. For the obtaining of various types of beers brewers use diverse adjuvant or modify the fermentation parameters of beer. One of the aromatisation methods consists in adding fruits or fruit aroma in the wort prepared for fermentation. Sometimes, sugars may be added to wort, for the saturation of the beverage after refermentation. In this paper we compare two methods for the obtaining of beer with cherries aroma analyzing the main aroma substances found in this beer (diacetyl, 2, 3 pentanedione, acetaldehyde, etylacetate, propanol, isobutanol, isoamyl alcohol, isoamyl acetate). The aroma substances were determinated by head space gas-chromatography. The fermentation methods used were with added sugar and without sugar. We found that etylacetate; isoamyl acetate and isoamyl alcohol contents were higher in the sample with added sugar. Pentanedione, diacetyl, acetaldehyde, propanol and isobutanol contents were higher in the sample without sugar. For flavour improvement of beers fruits may be added before fermentation.

Key words: Special beers, cherry, aroma compounds, flavour

Introduction

Special beers represent only a small part of the beers sales in the world and are in the most cases brewed in small and medium sized breweries. However, the success of some special beers made brewers to seek to develop their own special brands. Scientific knowledge and understanding of these products is essential to assure the production of high quality special beers.

Certain special beers are highly typical in character because their production is the consequence of the judicious determination of the major parameters which influence beer physico-chemical and organoleptic characteristics.

For the characterisation of special beers all sensory aspects must be taken into consideration. (Derdelinckx, *et al.,*2000).

The target of our work is to improve the bouquet of the beer by natural treatments applied during

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fermentation and we hope that the introduction of new flavouring molecules will improve the satisfaction level of the actual consumers and convince non-beer lovers to become consumers.

A fruit beer is a beer brewed with a fruit adjunct or flavouring during the fermentation process, providing obvious yet harmonious qualities. Fruits have been used as a beer adjunct or flavouring for centuries, especially with Belgian lambic styles. Modern breweries may add only flavoured extracts to the finished product, rather than actually fermenting the fruit.

If we compare the added value generated by diverse brewing processes we observe that most food and beverages technologies generate more benefits than beer production. For the increasing of the added value of a beer we create a special beer with fruits (cherries) using a regular wort.

In this way, we developed a new product and we must agree that some findings are applied successfully. We tried to improve the bouquet of the beer by natural treatments applied during beer fermentation.

We hope that the introduction of new flavoring agents will improve the satisfaction level of the actual consumer and convince non-beer lovers to become consumers.

For the obtaining of new special beer with fruits we added cherries and sometimes sugar in the wort and realized a fermentation process at 20˚C. The beer obtained has a specific color given by the fruits and a specific taste.

In this paper we present the results of a research about the obtaining of beer with cherries using two methods: in one of the sample we added a small amount of sugar and in the other we didn't. We compared the aroma compounds profile for the beers obtained.

Materials and methods

The fermentation process was conducted in 2 liter flasks. For the experiment industrial wort was used having next properties: original extract 13.26˚P, pH – 4.1, color – 17.5 EBC units.

The wort was pasteurized at 85˚C for 5 minutes.

The fruits used for fermentation were Romanian cherries. In one sample we added sugar.

The wort was pitched with industrial slurry brewing yeast. The pitching rate was $15x10^6$ cells/ml and the yeast was introduced at the beginning of the assay.

The laboratory apparatus used were:

- Karl Zeiss Jena Microscope – for cell counting,
- Analytical balance Owalabor type 750.05 – for weighing the samples,
- Shimadzu gas-chromatograph with capillary column Chromopack 7773, length 50 m, detectors FID and ECD, mobile phase N_2/H_2 – for the determination of aroma compounds,
- Anton Paar DSA 5000 – for alcohol content and extract determination,
- Spectrophotometer for free amino nitrogen content, color and bitterness determination,
- pH-meter for pH measurements.

The methods used were:

- Direct counting of microorganisms with Thomas camera,
- Vitality staining of yeast with methylene blue according to EBC method,
- Head space by gas-chromatography for aroma compounds using EBC method,
- Ethanol determination using standardized method SR 13355-3/1999,
- Free amino nitrogen content using ninhydrin method,
- Color, bitterness and polyphenols were determined according to EBC methods.

Results and discussion

The fermentation process was conducted in two flasks with capacity of 2.0 liters; each flask was filled with 1.5 l of boiled wort with the properties above-mentioned and cherries. The cherries were added at the beginning of the fermentation process

in the amount of 250 mg/l. In one flask we added sugar and in the other we didn't, trying to determine if between the two samples major differences are concerning beer's aroma.

The wort was pitched with $15x10^6$ cells of Saccharomyces carlsbergensis per milliliter. The fermentation process was conducted at a constant temperature of 20˚C. The fermentation lasted for 4 days. In the end the samples were analyzed for aroma compounds content, color, pH, apparent extract, alcohol content. There weren't major differences between the samples depending of the original gravity of the sample.

The two samples were: ZC – the sample with sugar and FZC – the sample without sugar. Because of the different primitive extract of the samples, all the results were reported to an original extract of 12˚P.

The differences between the samples are not major. As it can be observed from figure 1, the difference in the apparent extract for the samples is 0.3, and the sample with sugar has a lower apparent extract than the sample without sugar.

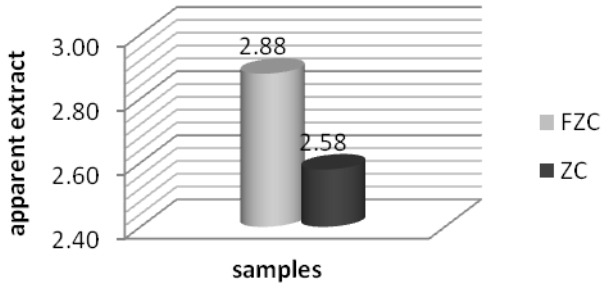

Figure 1. *The apparent extract for the samples*

The alcohol content of the samples is correlated with the apparent extract, as it is shown in figure 2. The sample with sugar has higher alcohol content because it has the highest content in extract, given by the added sugar.

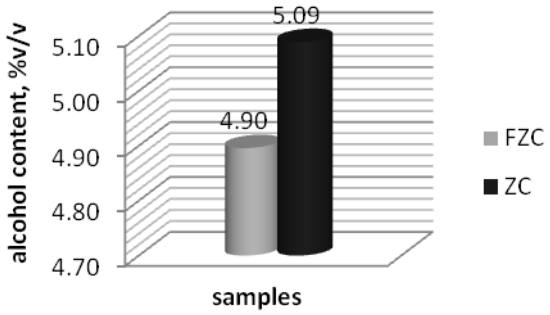

Figure 2. *The alcohol content of the samples*

In the aroma compound profile, the differences between samples are not major, as it can be seen below. In figure 3 the acetaldehyde content is presented. The approximate flavour threshold for

acetaldehyde is 5-15 ppm and this compound is responsible for the green apples aroma in beer. The acetaldehyde content of the samples is 5.16 ppm for FZC sample, respectively 5.11 ppm for ZC sample, in the range of the typical concentration for this compound in beer (2-15 ppm).

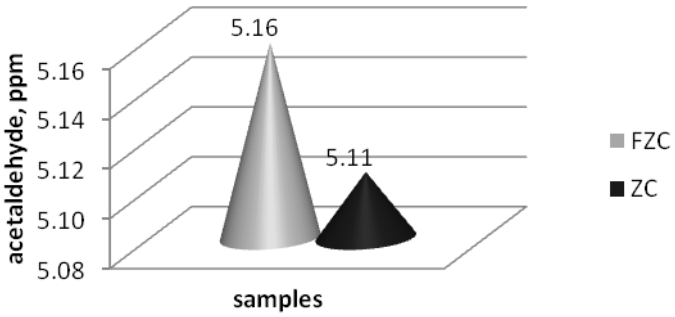

Figure 3. *The acetaldehyde content of the samples*

The diacetyl which imparts a buttery aroma and flavour is one of the vicinal diketones. Its presence is recognized down to 50 ppb, but is identified at 150 ppb. In our samples the diacetyl content is lower in the ZC sample and higher in the sample without sugar (figure 4) and is below the identifying threshold.

The 2, 3-pentandione content is low, but together with diacetyl is over the sensorial threshold for vicinal diketones (figure 5).

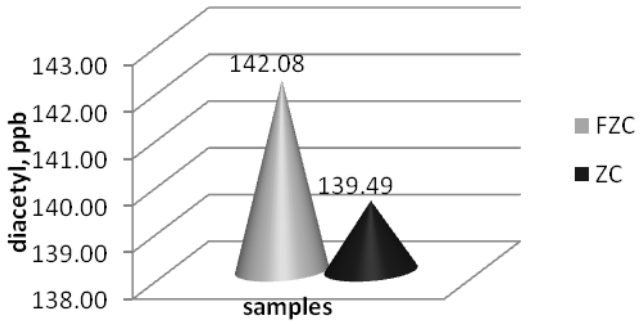

Figure 4. *The diacetyl content of the samples*

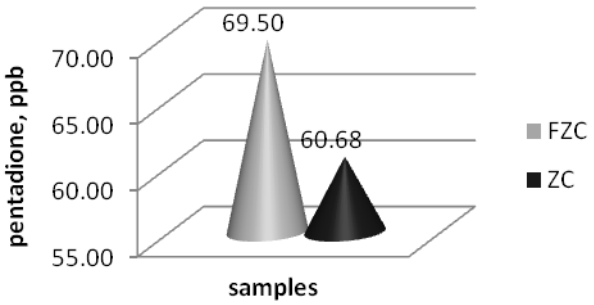

Figure 5. *The 2, 3 pentadione content of the samples*

The higher alcohols affect the aroma, taste and smell of the beer and their content in beer is varying between 60-150 ppm. We determined the n-propanol content, isobutanol content and izoamylic alcohol content. The higher alcohol content is different for the two samples as it can be seen from the figures below.

The propanol content is lower than the sensorial threshold (100 ppm) and it isn't dangerous for the final beer's aroma and flavour (figure 6). The difference in the propanol content for the samples is low.

The isobutanol content is over the sensorial threshold (12-15 ppm) and imparts in beer an unpleasant bitter taste (figure 7). The difference between samples is very low

The izoamylic alcohol content is very high, over the sensorial threshold (60-65 ppm) – figure 8.

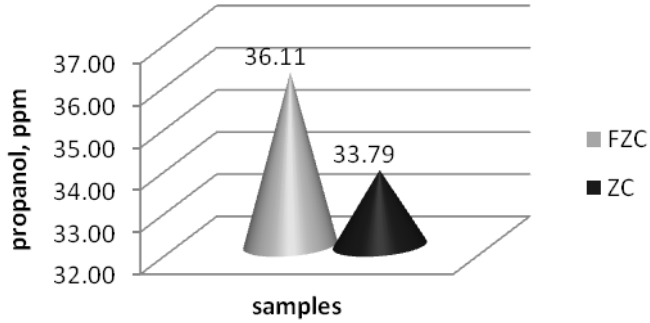

Figure 6. *The propanol content of the samples*

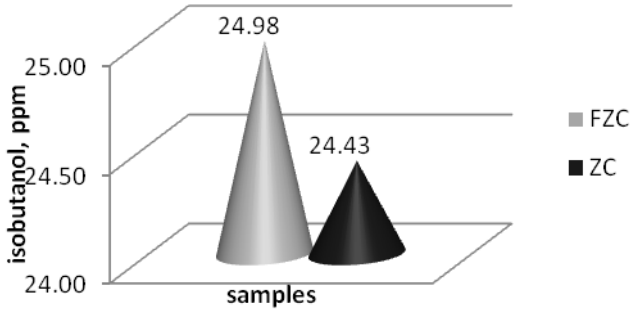

Figure 7. *The isobutanol content of the samples*

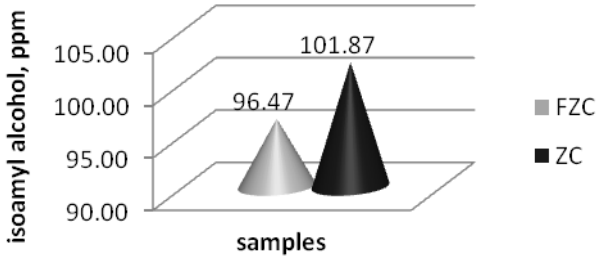

Figure 8. *The isoamyl alcohol content of the samples*

The higher alcohols content does not present major differences between the samples, but is higher than the flavour threshold for this compounds due probably to the high fermentation temperature used.

The ester content may achieve 80 ppm in final beer. Esters are compounds responsible for the fruity aroma of beer. The ester content of our samples is higher in the sample with added sugar for both esters determined.

The etylacetate content (figure 9) of FZC sample is 30.05 ppm and for the sample with sugar is 48.34 ppm, below the sensorial threshold for etylacetate (50 ppm).

The isoamyl acetate content (figure 10) is also higher for the sample with added sugar than in the sample without sugar and is correlated with the isoamyl alcohol content. The isoamyl acetate content is over the sensorial threshold for this compound – 5 ppm.

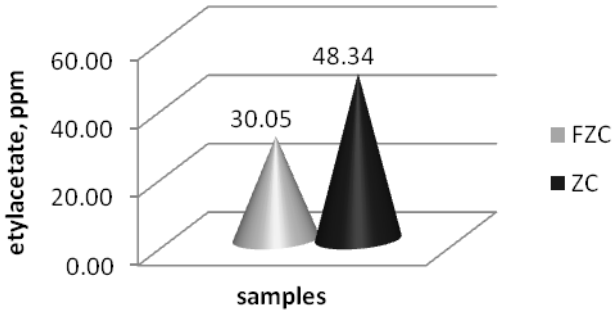

Figure 9. *The etylacetate content of the samples*

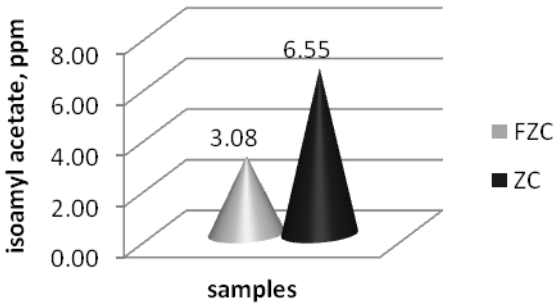

Figure 10. *The isoamyl acetate content of the samples*

Using fruits for beer fermentation brings in beer a specific pleasant flavour given by the specific esters found in these fruits and formed during fermentation. The beer with cherries has also a reddish color given by the fruits.

Adding sugar in the wort before fermentation leads to a higher content in esters and isoamyl alcohol and a lower content in isobutanol, propanol, 2,3 pentadione, diacetyl and acetaldehyde.

In literature we didn't find aroma profiles for special beers, so we couldn't compare our samples with similar beers on the market but more studies can be made for the characterization of these types of beers.

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