Colours of beers

E. Szabó[1], P. Sipos[2]

University of Debrecen
Faculty of Agricultural
and Food Sciences
and Environmental Management

szabo.edina@agr.unideb.hu

Abstract. Beer is a well-known fermented beverage, which is a complex mixture of more than 800 compounds. Thanks to the raw materials, beer is an excellent source of different valuable components such as polyphenols, which influence the colours of beers. In our research the colour values and total polyphenol contents of our self-brewed beers were determined and the results were compared with the colours of commercial beers. Based on our result it can be stated that there is moderately correlation between the polyphenol content and colour value.

Keywords:

beer, colour,
total polyphenol content,
correlation

INTRODUCTION

Beer is a well-known alcoholic beverage, which is consumed from the beginning of civilization (Piendl, 2005; Eßlinger, 2009). It had an important role in the ancient cultures, it was used even for medication (Eßlinger, 2009). Nowadays, we pay more attention to the quality of our foods and drinks and to their effect on our bodies, because of the more and more popular health-conscious nutrition (O'Brien G. & Davies, 2007). Therefore we pay more attention to the beer, because it contains more valuable components such as polyphenols, which influence the colours of beers (Cortacero & Ramírez et al., 2003; Jaskura-Goiris et al., 2010).

The colours of beers

The colour determines the type of beers. There are light beers, brown beers and provisional colour beers. The colour depends on the grain used as raw material, and also on the processes in what the grain undergo during the brewing. Colour components are produced partly in the Maillard reaction, partly by the oxidative processes of polyphenols derived from barley husk (Shellhammer, 2009; Narziss, 1981).

Roasted malts or caramel malts are added to brew coloured beer. On the higher temperature roasted malt causes tone up in the beer, because of its higher polyphenol and anticarcinogenic compounds content (Narziss, 1981).

In the past, to determine the beer colour it was compared with colour standards. Joseph Lovibond used the solutions of potassium chromate as reference standard. It became possible to compare measurements from different Lovibond Tintometers. These standardized comparator were accepted by the European Brewing Convention in 1951 (Hughes & Baxter, 2001). So when the colours of beers are determined, it refers to colour values in degrees Lovibond (Strien & Drost, 1979).

Table 1: Raw materials of beer samples

		Water	***Malt***	***Caramell malt***	***Colouring malt***
1	Light beer 1	water	**Pilsner 3 EBC[1]**	**Cara-hell 20 EBC[1]**	-
2	Light beer 3	water	**Pilsner 3 EBC[1]**	**Carabelge 30 EBC[2]**	-
3	Light beer from stream water	stream	**Pilsner 3 EBC[1]**	**Carabelge 30 EBC[2]**	-
4	Light beer from mineral water	mineral	**Pilsner 3 EBC[1]**	**Carabelge 30 EBC[2]**	-
5	Ligth beer from distilled water 2	distilled water	**Vienna 7 EBC[1]**	**Abbey 40 EBC[2]**	-
6	Brown beer 1	water	**Pilsner 3 EBC[1]**	**Cara-hell 20 EBC[1]**	**Carafa Type1 800 EBC[2]**
7	Brown beer 2	water	**Pilsner 3 EBC[1]**	**Carabelge 30 EBC[2]**	**Carafa Type1 800 EBC[2]**

		Bitter hops pelletts	***Aroma hops pellets***	***Beer yeast***
1	Light beer 1	Aurora[2]	Spalt Select[3]	Safbrew T-58[4]
2	Light beer 3	Aurora[2]	Spalt Select[3]	Brewferm Lager[5]
3	Light beer from stream water	Spalt Select[3]	Saphir[2]	Brewferm Lager[5]
4	Light beer from mineral water	Spalt Select[3]	Saphir[2]	Brewferm Lager[5]
5	Ligth beer from distilled water 2	Spalt Select[3]	Saaz[2]	Brewferm Lager[5]
6	Brown beer 1	Aurora[2]	Spalt Select[3]	SafLager[4]
7	Brown beer 2	Aurora[2]	Spalt Select[3]	Brewferm Lager[5]

Distributor: [1]Weyermann-Deutschland, [2]No dates, [3]Hallertauer-Deutschland, [4]Fermentis, [5]Brouwland

MATERIAL AND METHOD

Our aims were to determine the colour values and the total polyphenol contents of self-brewed beers and to compare it with the colour values of the commercial beers.

Our self-brewed beers were produced by Zip's Micro Brewery Equipment in the

laboratory of the Institute of Food Science at the University of Debrecen, using the recipe of the equipment.

Tap water was used for 1-2. samples, and for the brown beers, for the light beer from stream water was taken from Kecső stream in Slovakia, and for the light beer from mineral water was used the water of the deep-fount of mineral water company, Debrecen. Distilled water was used for the brewing of 5th beer.

Slovak Pilsner malt was used for all the beers with one exception. We brewed the light beer from distilled water from Vienna malt. Colouring malt was added to get the expected dark colour of the brown beers. The components of the beers are shown in Table 1.

Different hops were used. Our beers were fermented by lager yeast with one exception. Light beer 1 was fermented by ale yeast. Samples were taken from one brewing process.

Different commercial beers were also analysed, which were bought in Hungary. This beers were: Becks (light beer, from Borsodi Brewery); Heineken (light beer), Soproni Fekete Démon (brown beer), Soproni Szűz (light beer) (from Heineken Brewery); Carlsberg (light beer), Holsten (light beer) (from Carlsberg Brewery); Kanizsai (light beer), Pilsner Urquell (light beer) (from Dreher Brewery).

We determined the colour values of beers by the method of European Brewery Convention Analytica in a ten times dilution. EBC colour values and absorbancies were determined (Analytica-EBC, 1999). Total polyphenols were quantified by Folin-Ciocalteu colorimetric method (760 nm), results were given in gallic-acid equivalent value (Kalušević et al., 2011). Chemical analysis were performed in triplicate.

Data were subjected to correlation and variance analysis (sd=0,05).

RESULTS AND DISSCUSIONS

Colour values of beers are presented in Figure 1. As it shows, the highest value belonged to the light beer with mineral water, while the light beer 3 has produced the lowest value. However virtually the brown beers were the darkest, but they had fewer colour values than the light beer from mineral water.

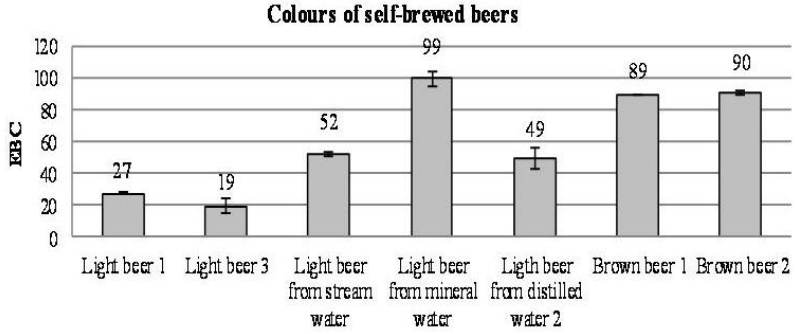

Figure 1
Colour of beer samples

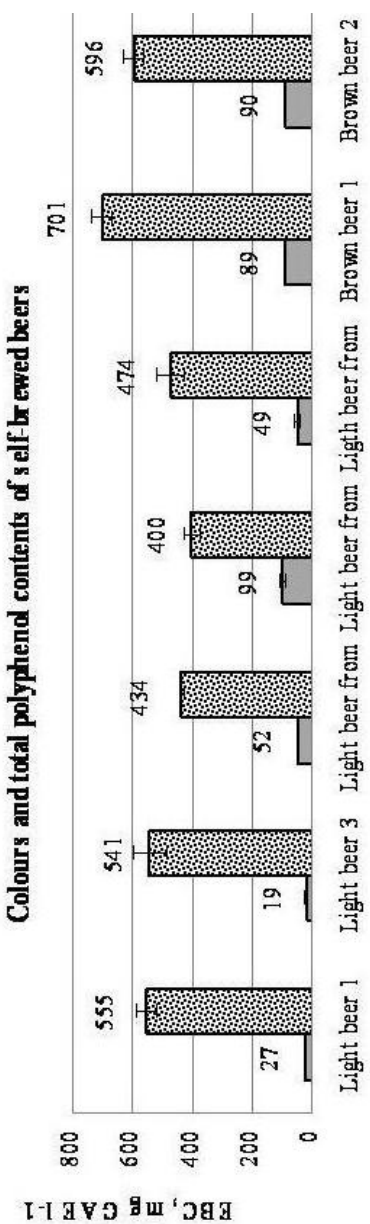

Figure 2

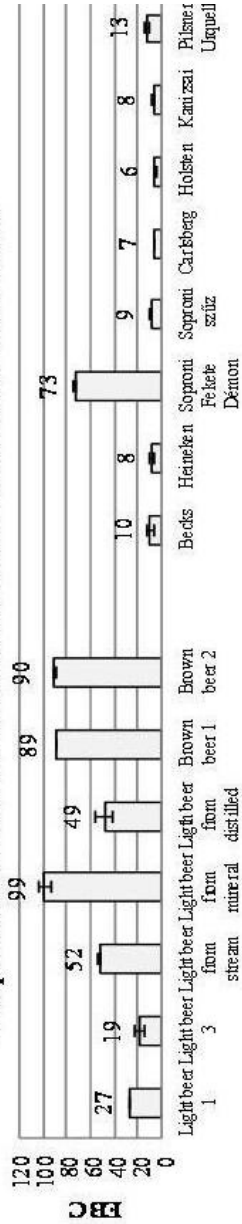

Figure 3

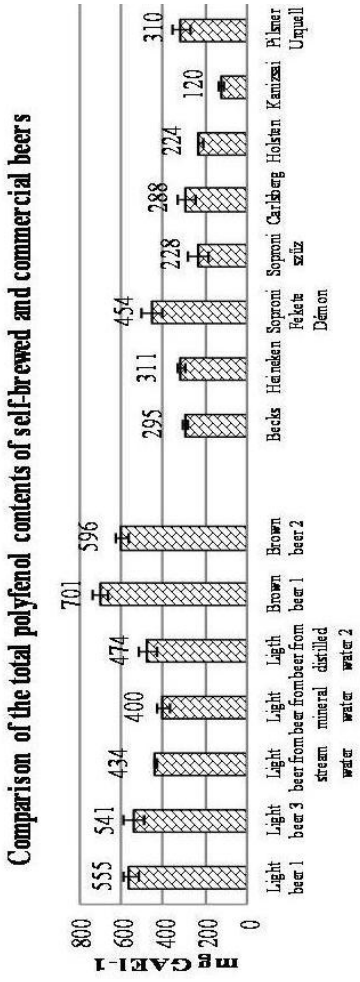

Figure 4

RESULTS AND DISSCUSIONS

Colour values of beers are presented in Figure 1. As it shows, the highest value belonged to the light beer with mineral water, while the light beer 3 has produced the lowest value. However virtually the brown beers were the darkest, but they had fewer colour values than the light beer from mineral water.

When we compared (Figure 2) the colours and total polyphenol contents of self-brewed beers, we could establish that the light beer from mineral water had the highest colour value but the lowest polyphenol content. Brown beer 1 had the highest polyphenol content, and light beer 3 had the lowest colour value.

We compared the colour of the self-brewed beers with the colour values of some commercial beers (*Figure 3*), and we could establish, that our self-brewed beers had higher colour values than the commercial beers, but Soproni Fekete Démon had as high color value as the brewed beers.

Antioxidant contents of the produced and commercial beers were represented in *Figure 4.* Brown beer 1 contained the highest amount of polyphenols, while the light beer from mineral water was the poorest in antioxidants. The commercial beers contained fewer polyphenols than the brewed beers with one exception. There were more polyphenol components in the Soproni Fekete Démon than the light beer from mineral, and stream water.

Evaluating the results it can be established that there is moderately strong correlation between the total polyphenol contents and the colours of the beers. The correlation coefficient was 0,69. The correlation between the inconstants was significant. In case of light beer brewed with mineral water the highest colour value was found together with the lowest polyphenol content. In brown beers we measured higher polyphenol content than in light beers, but the colour values were lower than in the light beer from mineral water. In the light beer brewed with tap water low colour value and higher polyphenol content was found. The

commercial beers usually had lower colour values and lower polyphenol contents.

CONCLUSIONS

Our study showed that the light beer from mineral water had higher colour value than the brown beers but the polyphenol contents were in higher level in the brown beers. We could establish that the commercial beers had the lowest colour values. There was an exception, because the Soproni Fekete Démon had high colour value. To compare the polyphenol contents of brewed beers with the polyphenol contents of commercial beers we could establish that the self-brewed beers contained more polyphenols.

Summarizing the results, there are significant differences between the self-brewed beers and the commercial beers. Comparing the measured parameters it was found that there was moderately strong correlation between the colours and the total polyphenol contents of the beers.

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