

The Optimization of Beer Production Technology by Assessment of Malts Produced by Various European Territories, Aiming to Improve the Properties of Beer



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Abstract

Given the overall demand for savings and quality improvement of beer, this study aimed optimizing of the production technology based on the evaluation of malts produced in Europe being reflected in the improvement of properties of beer in the factory "Birra Peja". The comprehensive study was carried out for the entire beer production chain, in close cooperation with the factory's production and laboratory staff. The study was focused on malts produced in three European countries, Ukraine, Croatia and Serbia, as well as beer produced by these malts. These malts were analyzed in all stages of production, including chemical and microbiological analysis, as well as sensorial evaluation. Beer tasting for this study was done by two taster panels; panel of "Birra Peja" and the panel of Agricultural University of Tirana. We consulted with the working and laboratory staff at the "Union" brewery. Chemical and microbiological tests have been conducted based on European Beer Convention and MEBAK methods. Based on the conducted analysis and assessments of the beer quality, it was concluded that the beer produced with malts from Croatian origin, corresponds to a better quality of beer, which already is under production.

Introduction

The production of the beers was based on the a consistent formula at all stages of production, the same quantity and quality of water, the same amount of malt, the same generation *Saccharomyces carlsbergensis* type of yeast.

Starting from the first stage of beer production, one may observe various differences between the product and final product, such as saccharification time and rate, the apparent degree of fermentation, and the amount of polyphenols. An important factor is the amount of wort obtained at the end of the process or the degree of utilization of raw materials (malt) that is different from one type to another. Another very important factor is the presence of secondary products, such as high alcohols, which move from beer to beer.

In all cases of beer production technological parameters were the same, starting from the first stage in the domestication of the malt with water (quantity of malt, water quantity and water temperature).

Material and Method

For this study, malts originating from Ukraine, Croatia, and Serbia are used. The first raw material used for the production of the beer: malts with the quantity of 4,500 kg, originally from Ukraine, Croatia and Serbia, water from the source of strong white Drin of 9°DGH. In this case hops used on type originating from Slovenia Aurora (bitter) and Golding (aromatic) in report 70:30%. In all three cases there was 6.1gr α -acids/hl. Yeast which is used for production of these beers was *Saccharomyces carlsbergensis* with a concentration of about 20 million yeast cells per ml, or about 0.7 litres of a dense yeast hectoliter of wort. The processes and parameters in the phases of obtaining the wort were the same in all three cases.

The manufacturing process of the sweet solution was made with two decoctions. Cooling temperatures during the transfer to primary fermentation were the same (8 °C at the beginning of the process). The temperature and pressure during the primary fermentation and complement was the same (8 °C - 15 °C and 0.5 bar) for the three cases.

For the decomposition of β -glycan and the assistance of fermentation and decomposition of diacetyl enzymes used (α + β -glycan as amylase + protease, fungal- α -amylase, α -acetolactat decarboxylase).

At maturity, the beers stayed for 23 days at temperatures 0- (-1) °C and 0.5 bar pressure.

The beer was filtered with the same parameters and the same vehicle expense for filtering, (0.117030 kg / hl). The temperature was the same (25 min at 68 °C) for pasteurization as well. At every stage of the production process of technological process is followed by microbiological tests which have been all time to level. Official methods for deriving the abovementioned results and analyzes are the following: the European Brewery Convention (EBC) and The Central European and Technical Analysis Commission “Methodensammlung der Mitteleuropäischen Brautechnischen Analysenkommission” (MEBAK).

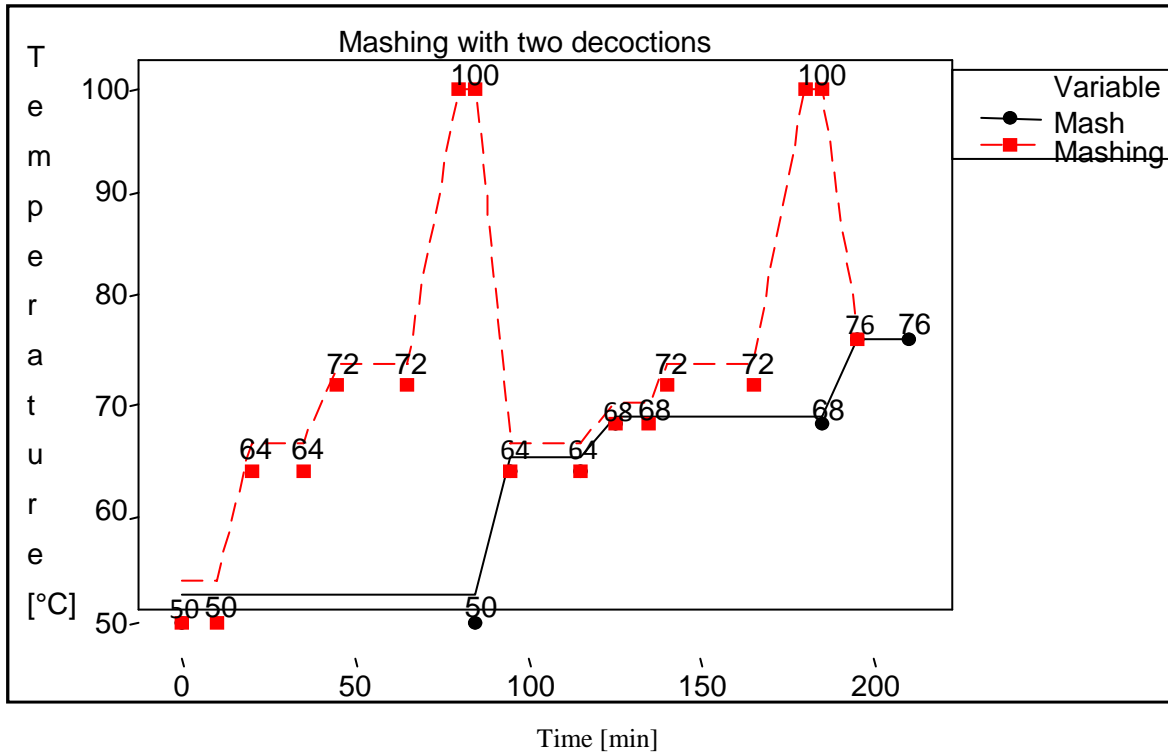


Figure 1. Ratio of mashing

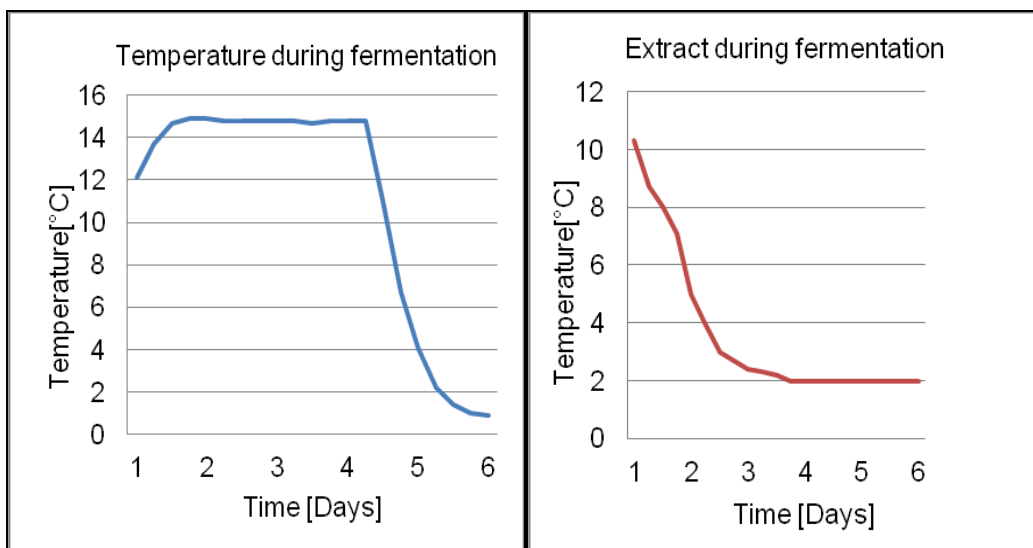


Figure 2. The temperature and extract levels during the fermentation process.

Results and Discussion

Starting from the first stage of beer production, it may observe various differences between the product and final product, such as saccharification time and rate, the apparent degree of fermentation, and the amount of polyphenols. An important factor is the amount of wort obtained at the end of the process or the degree of utilization of raw materials (malt) that is different from one type to another. Another very important factor is the presence of secondary products, such as high alcohol, which move from beer to beer. The three cases have different degrees of fermentation as follows (1. 84.71 %; 2. 85.61 % and 3. 81.44 %).

Beer made from malt from Ukraine - Croatia - Serbia			
The quantity of wort	Extract of wort	Amount used of malt	Degree of utilization
Hl, (hl)	E, (%)	G, (kg)	η, (%)
323.43	10.87	4500	78.30213527
319.43	10.82	4500	76.9518811
318.28	10.63	4500	75.37696873
Report of the degree of utilization of raw material : 78.3% : 76.95% : 75.37%			

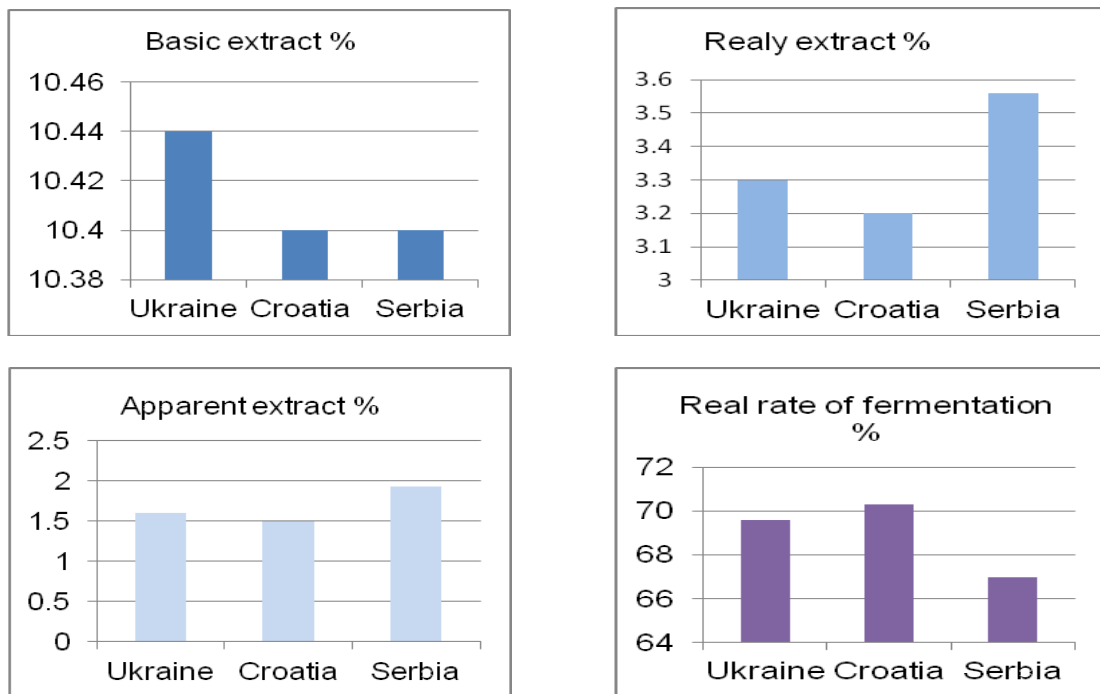
Figure 3. Degree of utilization of raw materials

Origin of malt	Ukraine	Croatia	Serbia	Reference
Ingredients	1.49	1.25	1.04	MEBAK I 4.1.3.1 max.0.5%
Hectolitre weight	56.24	56.44	54.55	MEBAK I 4.1.3.3 48-62 kg.
Moisture	4.30	4.30	4.30	MEBAK I 4.1.4.1 max.4.50%
Extract dry weight	80.30	79.50	77.10	MEBAK I 4.1.4.2.2 min.81.00%
Saccharification	9	9	8	MEBAK I 4.1.4.2.4 max.15'
pH	5.91	5.89	5.96	MEBAK I 4.1.4.2.7 5.7-5.9
Color	4.0	5.0	3.8	MEBAK I 4.1.4.2.8.2 EBC 4.0-5.0
Extract difference	1.1	0.8	0.6	MEBAK I 4.1.2.10 max.1.7%
Time of filtration	27	38	45	MEBAK I 4.1.4.11 max.40'
Hartong	40.64	39.95	36.72	MEBAK I 4.1.4.11 37-42

Figure 4. Malt analysis used for study

Date of work	25.06.10	10.07.10	13.07.10	Min/max.
Basic extract %	10.44	10.40	10.40	10 - 11
Real extract %	3.30	3.20	3.56	
Apparent extract %	1.60	1.49	1.93	
Real rate of fermentation %	69.59	70.30	66.98	
Apparent rate of fermentation %	84.71	85.61	81.44	78.00 - 84.00
Alcohol % v/v	4.65	4.67	4.45	3.70 - 4.70
Density 20/20	1.0062	1.0058	1.0075	
CO ₂ g/l	5.00	5.10	5.20	4.70 - 5.70
pH	4.53	4.60	4.57	4.20 - 4.60
Color EBC	7.00	8.00	8.20	7.50 - 10.00
Bitter EBC	22	22	21	20 - 26
Polyphenols mg/l	145	145	152	145 - 172

Figure 5. Chemical analysis of beer produced during the study



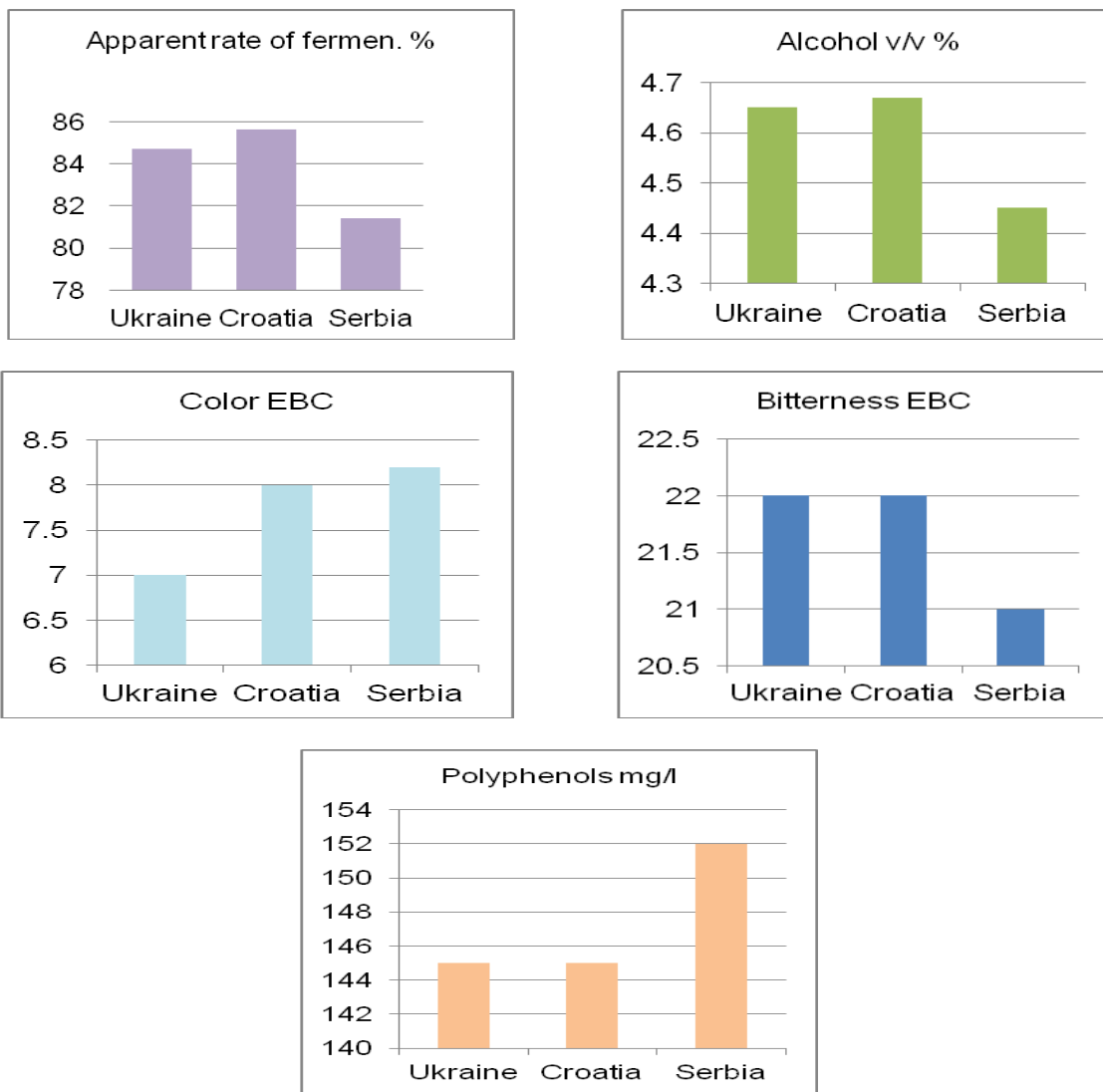


Figure 6. Histogram of chemical analysis of beers

Diacetyl (mg/l)	Pentadion (mg/l)	Acetaldehyd (mg/l)	2-methyl sulphide (mg/l)	Ethyl acetate (mg/l)	2-methyl propanol (mg/l)	2-methyl butanol (mg/l)	Isoamyl acetat (mg/l)	Isoamyl alcohol (mg/l)
0.1	0.6	2-20	0.03-0.12	5-30	5-30	5-20	1-5	30-50
0.023	0.12	13	0.063	12	12	17	1,03	40
0.025	0.10	14	0.056	12	12	18	0,97	40
0.038	0.16	16	0.064	11	14	19	0,96	53

Figure 7. Secondary products

Conclusions

Based on work done in the period March 2010 - December 2010, has come to the conclusion that beer produced from malts originating from Croatia fulfills best conditions. On the basis of chemical and microbiological analysis beers, malts produced by Croatian origin were more qualitative compare to others. Beer stability is high; it is drinkable and shows the colloidal stability of high level.

These beers were evaluated by two tasting panels: panel test of the Agricultural University of Tirana as well as the panel test of JSC "Birra Peja". It is tested to Beer: taste, aroma, color, clarity, and foam. During these tasting beers that both groups have scored as follows: to taste (2.00; 2:45; 2.20), for flavor (1.57, 1:22, 1:35), for color (3.80, 4:45, 4:11) to light (3:42 ; 4:00; 4.00), and foam (3.10, 4.28, 4.44) Both panels evaluated with higher grade the beer produced from selected malts from Croatia.

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