

## UNTRADITIONAL BEER DRINKS

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### Abstract

A research has been done on the possibility to increase the range of beer drinks by substituting hops with additives of other plants in the wort boiling process. Obtained data present evidence of the possibility of substituting hops by oak bark, yarrow, wormwood and oak acorn.

**Keywords:** untraditional beer, oak bark, acorn, yarrow, wormwood.

### Introduction

Important raw material in beer brewing is hop. Basic hop constituents are bitter substances ( $\alpha$ - and  $\beta$ -acids), and volatile oils. Hop  $\alpha$ - and  $\beta$ -acids are generally recognized as traditional partial formers of the specific aroma and taste of beer. They also oppress proliferation of grampositive and gramnegative bacteria in the fermentation process but, at the same time, do not have any influence on yeast cells (Buckwold, 2004).

Also other plants, including herbs of many grass teas, contain bitter substances. Therefore their admixture to hop or individual use would enable to obtain new sorts of beer drinks, which would increase the existing assortment. The bitter taste of wormwood is created by the volatile oils present in them ( $\sim 2\%$ ), as well as bitter substance glycosides absinthine and unabsinthine with the sensation threshold  $1.3 \cdot 10^{-1} \text{ mmol L}^{-1}$  (Ternes, 2006).

The explanation of the concept "beer" is differs in different countries. Summarizing the concepts found in the literature (Bundesgesetzblatt, 1993; Regeln, 1993; Deckblatt, 1996), the following definition has been made: "Beer is a fermented and aromatized drink that has been obtained from the products containing carbohydrates". Such formulation would be universal because it would admit the possibility of use of various additives.

Russian scientists assert that recently there has arisen an interest in the beer in which production various fruit, roots and berries have been used the product has been named Fitobeer (Фитопиво). That beer has not yet been introduced in to the production its technology elaboration and development is still in progress. This task is not simple because in many cases the

experimentally obtained fitobeer had unpleasant taste and aroma (Оюун, 2005).

In China, fruit are added to the wort that has been boiled together with hop and afterwards cooled, then the wort is aerated with oxygen and fermented. During the main fermentation, specific aroma and color appear depending on the added fruit. Chinese call this drink not beer but an alcoholic drink made on the basis of malt (Mori, 2003).

Historically, beer mixed with various grass teas, has been used in medicine. In Germany, in 14th century, there was the house book 'Colerus' with 18 recipes of medical beer. In the 17th century in Hanover area it was possible to purchase grass beer (*Giffhornsche Kräuterbier*) that was used for medical treatment of definite diseases. Also different spices - mostly cardamon, coriander, gingseng, anise, and pepper roots - were added to beer (Papazion, 1994).

Use of coriander (*Coriandrum sativum L.*) in beer industry was studied by Russian scientists in 2005. Beer was fermented in the laboratory conditions for 7 days at 6-8 °C, after that to the newly brewed beer there were added coriander volatile oils that had been obtained by variously extracting coriander seeds (by CO<sub>2</sub>, by water steam, by 70% spirit). Best organoleptical indices were for the beer using volatile oils that had been obtained by 70% spirit (Ливинска, 2005).

Since 2000 Chinese scientists have been making an extensive research on beer using various additives - chrysanthemums, green tea, American gingseng (*Panax ginseng*), aloe juice, rice, etc. (Song et al., 2001; Zhang et al., 2001).

In some countries also other additives are used: plant leaves, flowers, stems, seeds, nuts, twigs,

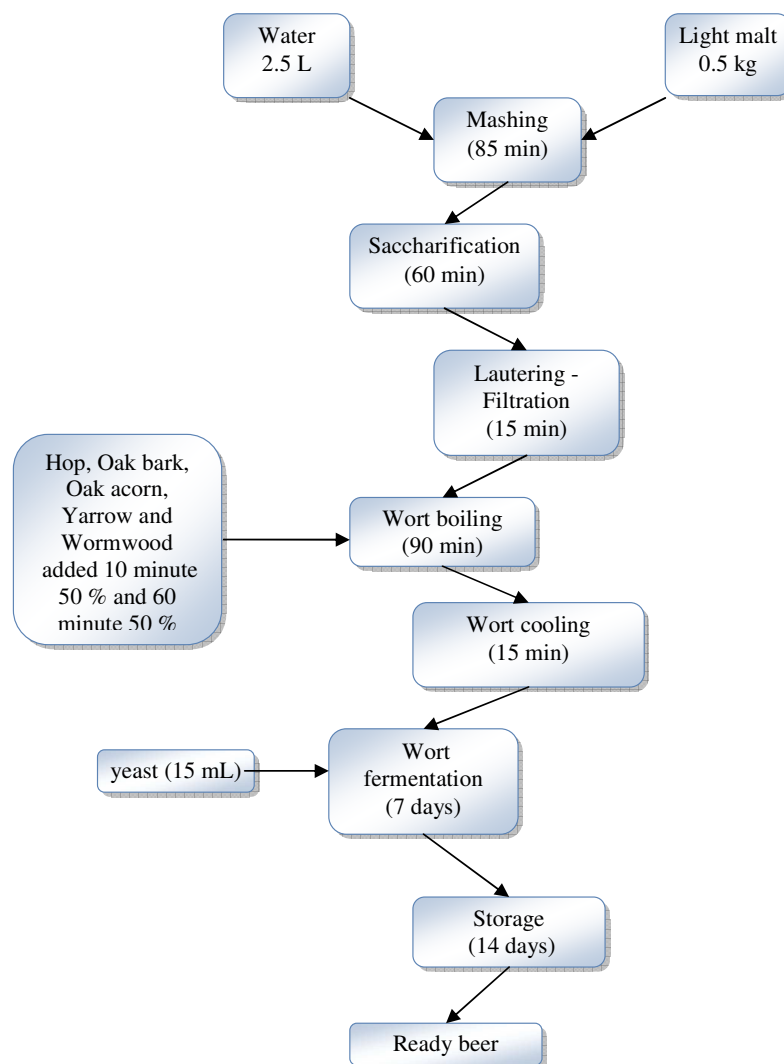


Figure 1. The scheme of the technological process of beer and untraditional beer drinks production.

chocolate, coffee, etc. The brewery 'Würzgrund' in Karlstad in 1997 began to produce oak leaf beer without adding hop in a specially made wort pot. The brewery of brothers Williams 'Heather Brewery' produces beer without hop, too, using pine tree twigs and fir tree shoots and call it *Alba scots* pine ale, (<http://www.heartherale.co.uk>). In Egypt, not far from the pyramids, Pharaonen beer obtained from wheat malt, millet, hulled wheat, dates, figs, citrususes, cloves, and cinnamon, can be purchased (Bach, 1998).

The purpose of the present research is to find out a possibility of substituting hops by oak bark, acorn, yarrow and wormwood of Latvia flora.

## Materials and Methods

Five series of experiments have been carried out with adding different additives of the Latvia's flora such as oak bark, acorn, yarrow, wormwood, and hops as the control sample during the wort boiling process. The conditions of obtaining untraditional beer drinks and traditional beer have been standardized according to the scheme in Figure 1.

To characterize the influence of the yarrow, wormwood, oak bark and acorn additives on the quality of the obtained untraditional beer drinks and to evaluate it comparing with the indices of beer with hops obtained in analogous standardized conditions, there were made the following analyses: vicinal diketone content (VDC), pH, color, alcohol quantity, and content

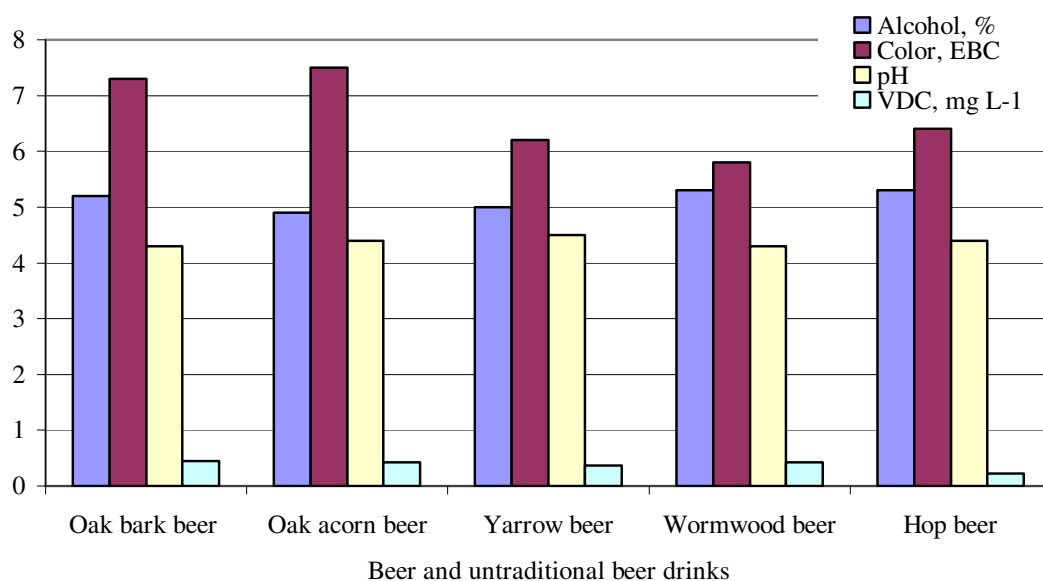


Figure 2. Physicochemical indices of beer and untraditional beer drinks.

Table 1

## Color, aroma, taste, and froth stability of the obtained beer and untraditional beer drinks

No.	Beer and untraditional beer drinks	Quality indices of the obtained beer drinks
1	Wormwood beer	Clear, light golden-greenish, aromatic, but with very bitter taste. Small froth stability because the obtained beer is not saturated with carbon dioxide.
2	Yarrow beer	Clear, light golden-greenish, tender aroma, slighty bitter taste. Small froth stability because the obtained beer is not saturated with carbon dioxide.
3	Oak bark beer	Clear, light reddish, pronounced tannin aroma and taste. Changes its taste features depending on the amount of extract substances: smaller amount of extract substances gives soft taste, larger amount gives – softly-sweet taste. Middle froth stability notwithstanding the fact that the beer is not saturated with carbon dioxide.
4	Oak acorn beer	Turbid, opalescing, paste – type consistence that most possibly has arisen in the wort boiling process from the insufficiently saccharized (30%) starch present in oak acorn. Average tannin aroma and taste. More tender than oak bark beer. Small froth stability.
5	Hop beer	Clear, light golden, pronounced hop aroma with pleasant malt taste, small froth stability because the obtained beer is not saturated with carbon dioxide.

of bitter substances was determined in hop beer, but for the rest ones this method has not been standardized and therefore the evaluation of the presence of bitter substances is expressed in the evaluation of taste features in Table 1.

## Materials

1. Oak bark (*Cortex quercus*) and acorn (*Quercus kerrii*).
2. Yarrow (*Achillea millefolium*).
3. Wormwood (*Artemisia absinthium*).
4. Hop (*Humulus lupulus*).
5. Light malt.
6. 'Livu' source water:  $\text{Ca}^{2+}$  – 50-75  $\text{mg L}^{-1}$ ,  $\text{Mg}^{2+}$  – 10-25  $\text{mg L}^{-1}$ ,  $\text{SO}_4^{2-}$  – 5-20  $\text{mg L}^{-1}$ ,  $\text{Cl}^{-1}$  – 5-15  $\text{mg L}^{-1}$ , and  $\text{Fe}^{2+}$  – 0.01-0.05  $\text{mg L}^{-1}$ .
7. Beer yeast (*Saccharomyces carlsbergensis*)

## Methods

Physicochemical indices of ready beer were determined content of ethanol using beer analyzing system "Anton Paar beer Alcoalyzer Plus" analyzer, color and VDC – with spectrophotometer "Jenway" UV/VIS 6400/6405, but pH was analyzed potentiometrically at the Department of Chemistry of the Faculty of Food Technology, LLU, by employing WTW pH meter (pH 338) with electrode (Sen Tix 97T), using the AOAC 945.10 method.

Aroma, taste and froth stability of the obtained beer drinks were defined by tasting in brewery "Lāčplēša alus".

## Results and Discussion

Hop, yarrow, wormwood, oak bark, and acorn contain bitter substances but their chemical composition, quantity, and sensoral features differ. Hops contain  $\alpha$ - and  $\beta$ -acids, yarrow contain achilin, and wormwood contain absinth (Ternes, 2006).

In the experiments, using dry yarrow, wormwood, oak bark, and acorn, in the wort boiling, all the above mentioned basic conditions that refer to the obtaining of qualitative wort have been taken into account.

The color of beer and untraditional beer drinks was from 4.3 to 7.6 EBC points. Color changes can be explained by the use of different additives: boiling oak bark and acorn in water makes a pronounced brownish reddish color, whereas yarrow, wormwood and hop make it light brownish green.

The content of alcohol varied from 4.9 to 5.3 %, which complies with the indices of light beer and is directly connected with the result of extract substances in the wort.

The lowest content of total vicinal dicetons (0.22  $\text{mg L}^{-1}$ ) was defined for the beer in which production hop was used in the wort boiling process; however, this indice approximately 0.05  $\text{mg L}^{-1}$  higher than the amount of vicinal dicetons in the products of Latvia breweries. Using oak bark, acorns, yarrow, and wormwood as the sources of bitter substance, the content of vicinal dicetons varied from 0.37 to 0.45  $\text{mg L}^{-1}$  exceeding the admissible norm by 0.05 – 0.10  $\text{mg L}^{-1}$ . Formation of vicinal diceton is connected with various technological factors of beer production (Kunze, 1998) therefore, for example, even small fluctuations in the temperature of beer brewed in small amounts in laboratory conditions, can change the temperature of the fermenting wort in a short time, which occurs slowly in beer produced in large quantities.

For all the obtained beer drinks and hop beer, after fermentation pH was within the range of 4.2 – 4.6, which corresponds with the indices of a qualitative beer.

Quality indices of the products obtained in the experiments prove that not depending on the bitter substances in the plants used in the research, they can be used in the obtaining of untraditional beer drinks with different taste and specific aroma.

## Conclusions

1. Wormwood can be added in the wort boiling process to obtain untraditional beer drinks which quality indices comply with those of traditional hop beer obtained in standardized conditions.
2. The wormwood beer drink is characteristic of an aromatic but very bitter taste therefore, compared to other plants used in the experiment, a smaller amount of wormwood is needed in the wort boiling process.
3. Yarrow beer drink is lightly bitter with the aroma characteristic of yarrow.
4. Oak bark beer drink has pleasant taste with a light reddish color and compact froth.
5. Oak acorn beer drink differs from the other beer drinks with its turbid consistence, and additional research on the stages of its technological production process is needed.

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