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Creation of a New Beer Brand: Methodological Approach

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Abstract: JRC "Baltika Breweries" is the leader of Russian beer market and one of the biggest beer producers in Europe. Creation of new beer brands is based not only on effective business processes, but also on operational perfection of all technological phases for the purpose of stable production quality, taking into account requirements of consumers. Quality function deployment (QFD) is the flexible decision-making method used in new products creation. QFD transforms requirements of clients (a voice of clients) to engineering characteristics of technology, places priorities for each product / services and simultaneously defines problems in the field of production or service development. Yeast basically defines taste and aroma properties of beer. As a result of auxotrofic segregant crossing with the parental strain lacking, mitochondrial DNA we selected the new hi-tech yeast strain, possessing a number of distinctive characteristics: good technological properties, decrease of sulfur substances production, efficient diacetyl reduction, high colloidal stability of beer. This strain was used to produce new sort of beer, serving for client requirements. The newly designed sort of beer got several International prices and brought 250 million dollars in 2007 for JRC "Baltika Breweries".

Keywords: Beer, diacetyl, fermentation, hydrogen sulfate, selection, yeast.

INTRODUCTION

The main aim of any beer producing company is to increase its share of the market. For achievement of such strategy new brands in all segments of the market are strictly needed. Thus, it is necessary to organize research for the purpose of creation of new brands which will take the positions in all price segments. Creation of new beer brands is based not only on effective business processes, but also on operational perfection of all technological phases for the purpose of stable quality of production taking into account requirements of consumers. Quality of production is connected with two main concepts: production property and production advantage. Property defines the objective features of the product without estimation of importance of these properties for the consumer (for example, technological level), and advantage — ability of the product to benefit and satisfy the consumer. In other words quality of production is a set of properties of production causing its ability to satisfy certain requirements. The fact that the consumer plays the main role at an estimation of product quality makes the problem of quality values rather complicated. The main objective of quality assurance is to guarantee that production (service, process) corresponds to the concrete requirements and are reliable, satisfactory and financially steady. In this connection it is necessary to allocate indicators important for the consumer and to offer objective methods of their estimation. For this purpose it model for quality function deployment (QFD) is used.

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QFD as the method has been developed in 1966 by Joji Akao and for the first time was applied in 1972. Quality function development (QFD) is the flexible method of decision-making used in the creation of new products. According to founders of these techniques, QFD can help to allocate the major characteristics of new or existing products for separate consumers groups, a segment of the market, a company, or technology of development. Important result of developing of these techniques including various schemes and matrixes is a possibility of their reuse for creation of other goods. QFD transforms requirements of clients (a voice of clients) to engineering characteristics of production, places priorities for each product / services and simultaneously defines problems in the field of production or service development.

QFD allows to submit data in the compact form on various characteristics of a product, and also to trace their influence on technical decisions. In expanded form QFD includes four phases, and the special matrix (house of quality) is under construction each time [1, 2].

The first QFD phase is the planning of a product. At this stage the buyer requirements are translated into further language of engineering designing in quality indicators terms.

The second QFD is a structurisation of the project. Various concepts of working out of a product are considered and the best variant is formulated. Then the project is detailed, thus the special attention is given to essential characteristics of a product which are calculated under the requirements of the buyer structured in a phase 1. Product components characteristics are formulated at phase 2. The

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Fig. (1). Classification of beer brands of JRC "Baltika Breweries" presented in the market to the price niches.

third QFD phase is the planning of the technological process. After selection of different variants of technology providing product with the account of the structured characteristics of the earlier step 1, the process is detailed, namely, parameters of different technological operations are considered, which is an exit of this QFD phase.

The fourth QFD is a production planning. These management methods should provide manufacture of products according to their major characteristics defined at earlier phases, and, hence, satisfying consumer requirements.

Thus all industrial activity is based on desires of the customer.

MATERIALS AND METHODS

The new yeast strain was constructed as a result of crossing of an auxotroph segregant with yeast strain, witch mitochondrial DNA was eliminated. Fermentation efficiency and ethanol formation were analyzed, using Anton Par Alcolizer. The diacetyl, hydrogen sulfide and the higher spirits and ethers analyses were done, using gas chromatography (HP 6890 Ajilent Technologies).

RESULTS

1. Application QFD Method for Working Out a New Brand of Beer

First of all, by results of the market analysis it is necessary to reveal a segment of population for which the new product with interesting properties is absent. Marketing principles mean market research, studying of consumers and target segmentation of the goods. In the course of marketing researches there is a division of the market into segments to characteristic signs, for example, division at the price, type of packing, packing volume, strength of beer, point of production (a local grade, a national grade) and etc. Results can be presented both in volume, and in cost expression. For example, it is possible to classify all beer brands presented in the market to the following niches (Fig. **1**).

The most significant is dynamics forecast of the market situation at a certain time and the forecast of changes of separate segments of the market. It allows the in time production demanded sorts of beer on the market in expected packing and at the expected price. It is possible to assume that with the population incomes growth the share of license and bonus national brands will increase, and the share of an economic and cheap segment – decrease, though completely it won't disappear.

Thus, the analysis of beer market tendencies and competitors innovations, revealed "a window" - an unoccupied niche in JRC "Baltika Breweries" brand portfolio (Fig. **2**). The market needed a new brand.

The segment of consumers of the new beer has been defined as young men of 18-20 years, basically students, with average income, conducting an active way of life and interested all new. Base requirements for the new beer were: light, easy, freshening, with low intoxication, 11% density, alcohol not less than 4,7 %. Innovative packing has been used: a transparent non-recycling bottle, plastic transparent label, a stopper with a ring or an aluminum jar can issued in fashionable style. Thus the price shouldn't exceed a certain limit as beer intended for the young men who frequently don't have the considerable income. The given condition has demanded serious efforts from brewers-technologists raising a problem of combination of the low cost price and high taste and aroma properties of beer.

According to 1st QFD phase – planning of the new product creation – was established by requirements of the buyer. Target audience expectations have been translated to the engineering designing language to the terms of quality indicators. These indicators for the new brand include such requirements to beer as unique taste and aroma; high colloidal and flavoring stability; use of a stylish innovation in packing (a transparent bottle, a stopper "ring-pool"); high drinkability. As was already discussed, for the achievement of the new brand success all activity of the manufacturer should be based on desires of the consumers (target audience). The basic requirement – drinkability was raised in comparison with others brands. High drinkability can be reached due to unique organoleptic properties: neutral aroma without unpleasant serum impurity and easy taste which associates with the lowered bitterness. First of all such requirements of the consumer assume production of light beer with low extractivity, no more than 12 % and the average alcohol content. On the other hand for manufacture of a product with neutral organoleptic characteristics it is necessary to pick up a unique yeast strain that should basically define the drink aroma. As to the term "easy" taste it can be received by decrease in an indicator of bitterness of the beer reached by reduction of the expensive hop products.

The scientific researches focused on the maintenance of stability of taste, increase in shelf life of new beer and at preservation of physical, chemical and organoleptic properties of the product with simultaneous decrease in the cost price of manufacture was the foundation for the new technological process.

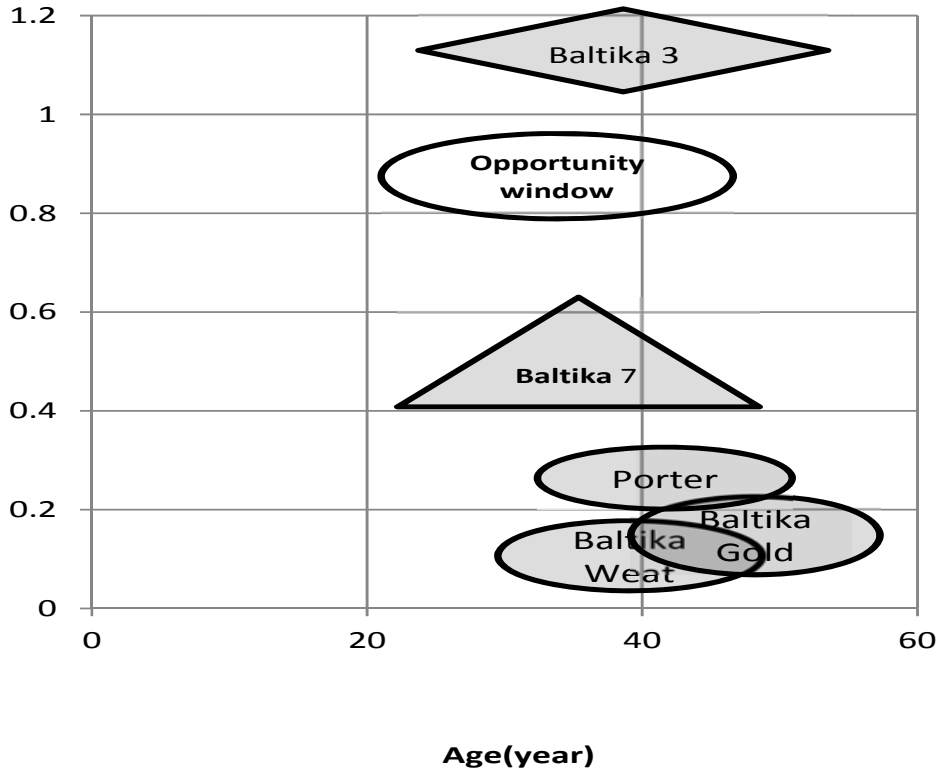


Fig. (2). Unoccupied niche in JRC "Baltika Breweries" brand portfolio.

2. Yeast Strain Selection

Works on construction of the new technological strains for the brewing industry are constantly actual. Modern genetics and molecular biology methods allow a target change of particular genes by means of methods of gene engineering and to receive organisms with the needed properties. Scientists managed to receive yeast with the absence of such unpleasant impurities as diacetyl, dimethyl sulfate and hydrogen sulfide [3-5]. But unfortunately nowadays those strains cannot be used in brewery because of legislation.

However, after studying of a huge database on cultural brewing yeast it became obvious that radical change of the search direction is required. Usage of modern high-capacity devices for fermentation cause constant stress for yeast, resulting in the presence of sulfur aromas in beer. Therefore the decision was made to start selection works using microorganisms, collected on Kamchatka and known laboratory strains for the purpose of introduction the unique genes of stability to extreme conditions in a genotype and to "update" a genotype of the yeast applied in brewing. The region of Kamchatka has been chosen because of its volcanic activity. Throughout many thousand years there is a natural selection of organisms resistant to high temperatures and chemical stresses. The main stages of selection are presented on the Fig. (**3**).

104 new strains were constructed by different crossing and were tested for their organoleptic properties in the laboratory test. 10 perspective strains with good properties were performed for fermentations at JRC "Baltika Breweries" Minibrewery. As a result of huge work the new strain *Saccharomyces cerevisiae* Y-3194 possessing a number of distinctive properties has been received: effective fermentation, less hydrogen sulfide content at the end of fermentation, high speed of a diacetyl and pentatdione (vicinal diketones, VDK) reduction, high beer stability [6, 7].

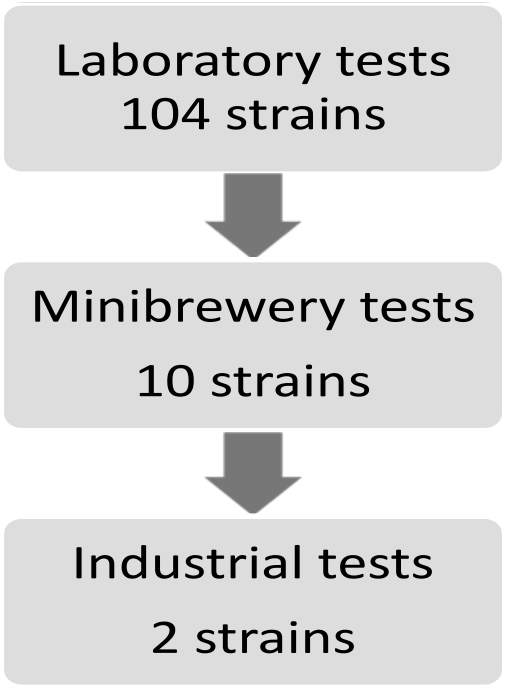


Fig. (3). Main stages of selection.

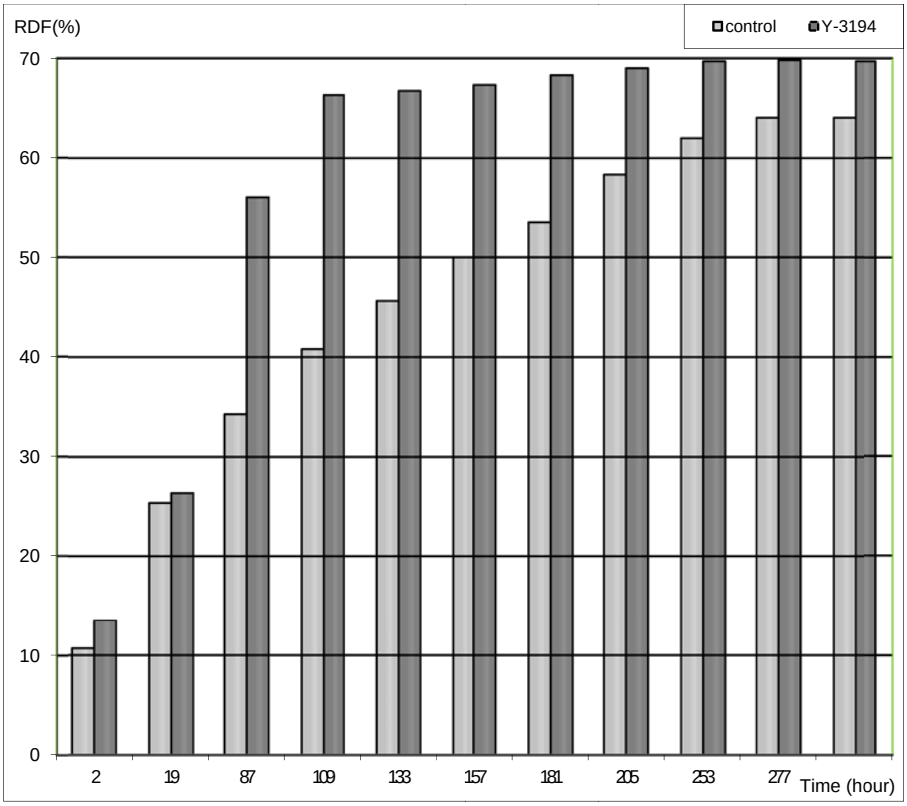


Fig. (4). Real degree of fermentation.

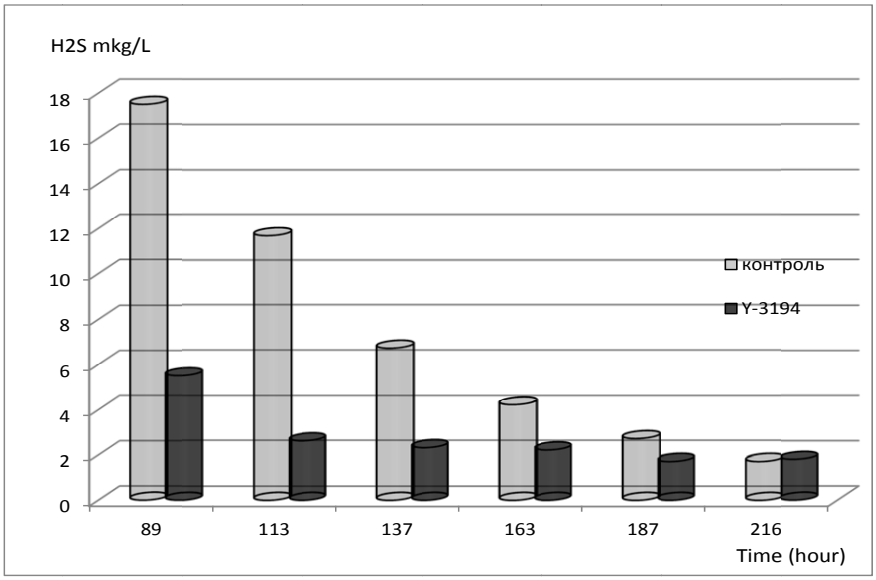


Fig. (5). Elimination of hydrogen sulfide.

Fig. (**4**) presents the diagrams of more efficient extract reduction by yeast Y-3194.

2.1. Sulphureous Substances in Beer

The sulphurorganic compounds formed during fermentation negatively influence aroma properties of beer. One of these compounds is the hydrogen sulfide that gives an unpleasant smell of rotten eggs to beer. The most radical decision of its elimination is to use yeast producing small amounts of hydrogen sulfide, or quickly utilizing it.

New strain Y-3194 possesses unique ability to form the lowered quantity of hydrogen sulfide at the end of fermentation (Fig. **5**) that is probably defined by high speed of its metabolism.

2.2. Diacetyl Reduction

Yeast strains have different ability to reduction of the carbonyl bounds formed in the malting process and mash production. Yeast reductases transform aldehydes into the spirits, that have much lower sensation threshold than aldehydes

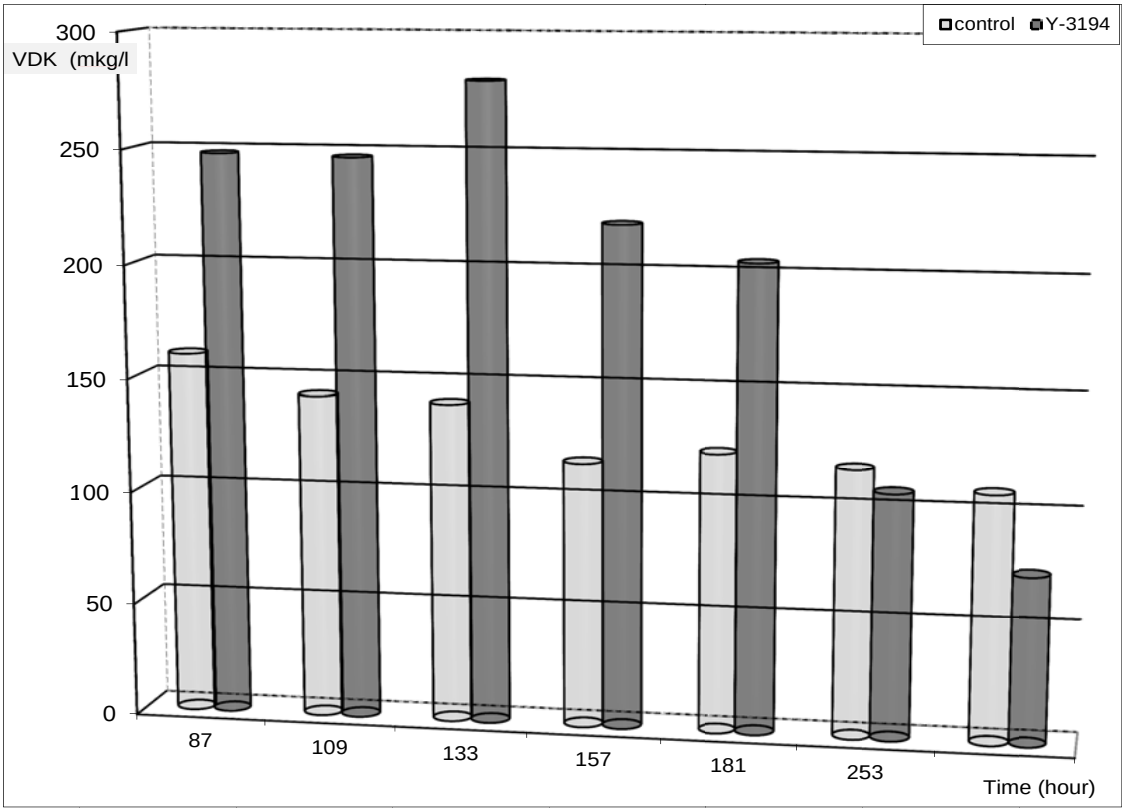
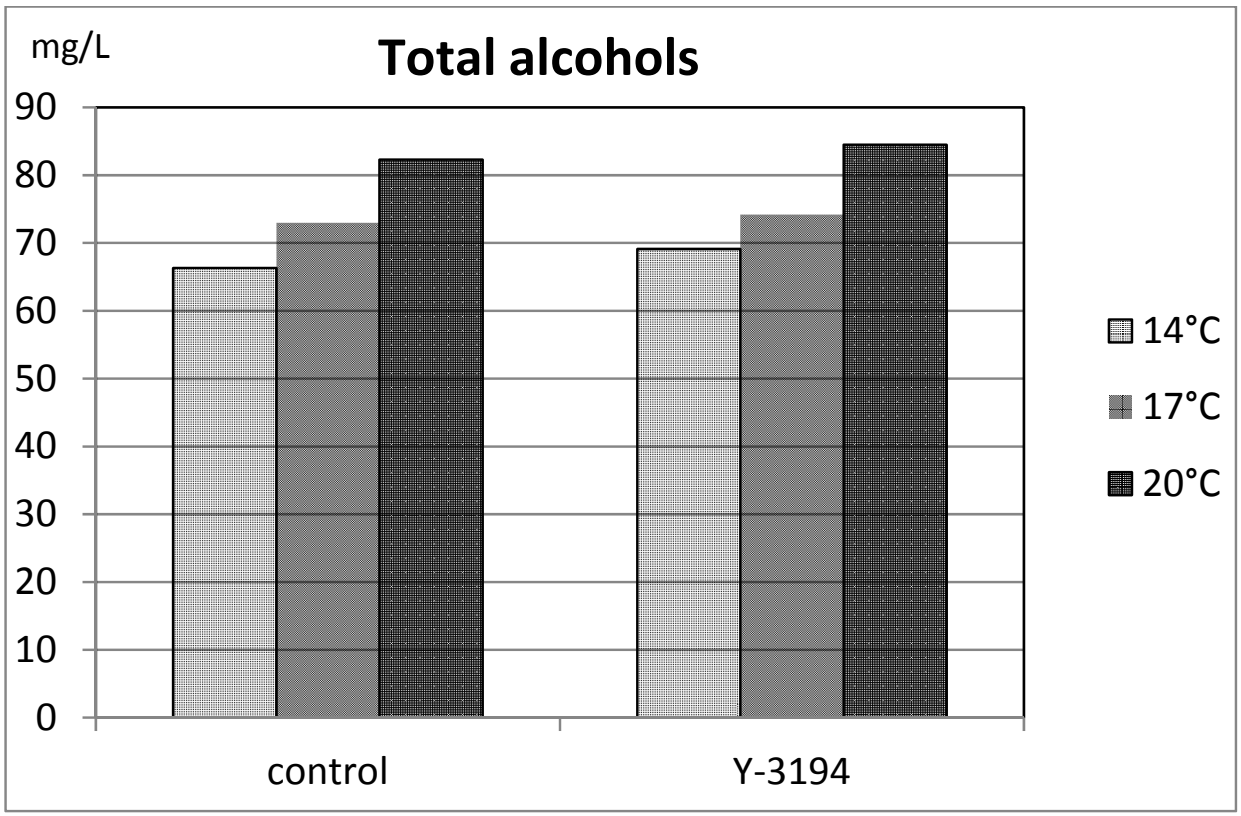
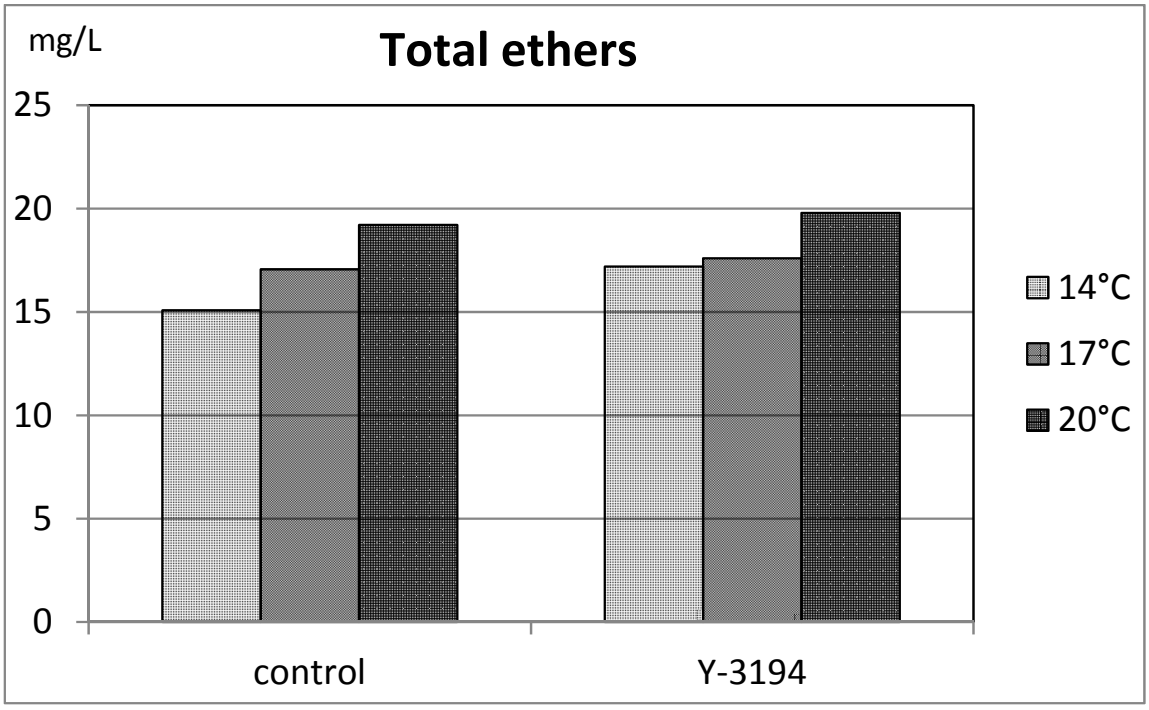


Fig. (6). Diacetyl reduction.



A



B

Fig. (7). Synthesis of higher alcohols (**A**) and ethers (**B**) by the control strain and new strain Y-3194 at different temperatures.

themselves. We assume that new yeast stain Y-3194 has more active reductases then the control, since it more efficiently reduce diacetyl during beer maturing (Fig. **6**). This advantage not only positively affects organoleptic properties of beer, but also allows to decrease the so-called diacetyl pauses during the technological process.

2.3. Unique Taste

Good taste and aroma of beer are connected with biosynthesis of taste-aroma substances. Yeast form a number of the typical substances defining a bouquet of beer, such as ethers, higher spirits and fatty acids during fermentation. Strains have different genetic features concerning formation of these substances, and ability to change metabolic ways of their formation depending on production conditions.

From Fig. (**7**) it is visible that new strain Y3194 possesses higher organoleptic properties as it synthesizes more quantity of higher spirits and ethers giving balanced aroma to beer without obvious organoleptic defects then the control strain at different temperatures.

2.4. Drinkability

Target audience expectation corresponded to easily drinkable beer satisfying thirst. So the simplest technological decision was to decrease bitterness of beer.

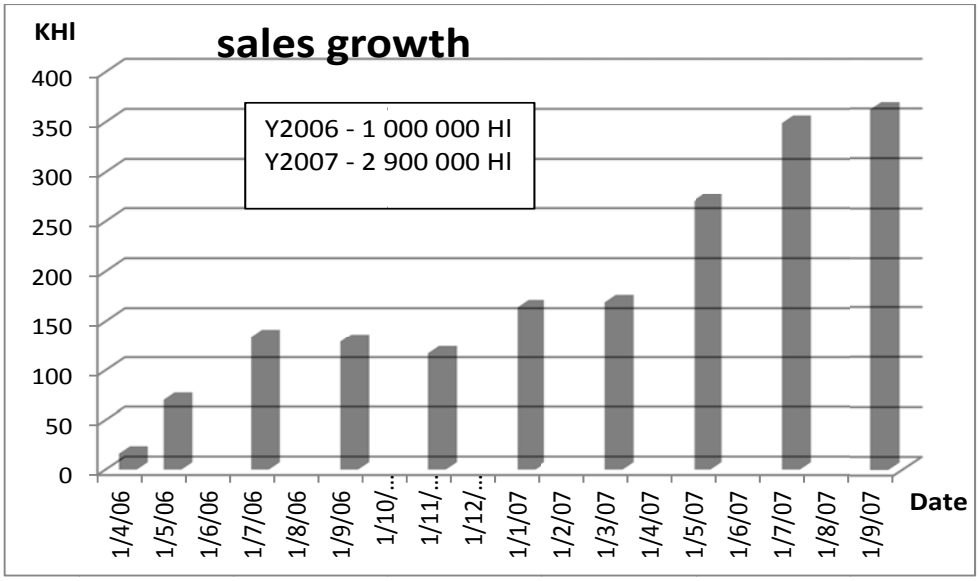
It is known that bitter and aromatic substances of hop, polyphenolic substances of malt, some amino acids and extracted peptides participate in creation of bitter taste of beer forming during boiling of mash with hop. 95 % of the general bitterness of a mash is connected with an isomerization of α - acids during boiling. β - acids have smaller solubility in water then α - acids. In the course of of mash boiling they are not isomerized, and only partially oxidized, forming the products of oxidation possessing considerable solubility and sharp, but pleasant bitterness.

Polyphenolic substances of hop influence taste and quality of beer in complex with bitter substances of hop, fibers and amino acids.

Degree of extraction and isomerization of α - acids is influenced by various physical and chemical factors of boiling (pH, and the boiling mode). It was decided to use hop extracts for more efficient and stable hop addition because the granulated hop gives reduction of losses of a mash with a hop pellet and increase the degree of extraction of bitter substances from hop. Decrease in expenses for logistical operations with extracts is also important. The material of packing is important for a choice of type of hop extract.

2.5. Innovations in Packing

The analysis of the market of innovations of the basic competitors of a new brand has shown substantial growth of demand of beer, in transparent bottles. Only this demand has increased in 3 times for 2 years and has made 14 % from all kinds of packing. In this connection the decision to carry out pouring of a new product in transparent glass bottles was accepted. Besides, the label and stopper material has been changed. Transparent the label was in harmony with a bottle transparency. Application of a new stopper "ring-pool" also corresponded «free and opened» insight of the brand. However, very simple, at first sight, requirement of consumer audience regarding the use of transparent bottle assumed the decision of the serious technological problem connected with organoleptic stability of a drink at its storage. The main problem was that alpha- acid which defines bitterness of a product, decays at light with the length of



A

Fig. (8). New brand sales growth.

wave between 350nm and 500 nms. This phenomenon known in literature already since 1875, is known as influence of the daylight on beer. Riboflavin that synthesized by yeast in the course of fermentation accelerates this process. The presence of amino acids with S-containing groups, for example cysteine, formed at disintegration of alpha-acid start reaction with thyol groups and having an unpleasant smell 3-metil-2-buten-1-tiol (MBT), "skunk" is formed.

For iso-alfa-acids photolysis the decision was made to use tetra-is-hop extracts which are stable to radical process of oxidation and to the influence of a visible spectrum of light. Thus, photostable mashes were produced for new beer.

2.6. Colloidal Stability and a Transparent Bottle

Usage of transparent bottle demanded the increase of beer colloid stability. Sensor stability of beer depends on endogenic antioxidant capacity of beer. All deposits formed in beer could be clearly seen through transparent bottle. The oxidized polyphenols as a result of various reactions promote formation of colloidal deposits, and also "old" taste of beer. On the contrary, the reduced forms of polyphenols promote long preservation of a transparency and "fresh" taste of beer.

Clarification process substantially depends on pH changes and oxidation-reduction ability. These factors, along with technological conditions, also depend on properties of yeast strain used in fermentation. Yeast influence on the colloidal and taste and aroma stability of beer, is also connected with a metabolism and sulfur dioxide formation. The sulfur dioxide has antioxidant and reduction properties and substantially protects beer from negative influence of soluble oxygen and of some carbonyl compounds. Formation of sulfur dioxide appreciably depends on genetic properties used yeast strain.

DISCUSSION

The name of a new brand should reflect the concept: – openness, easy behavior, style. After carrying out researches

Fig. (9). New beer brand International awards.

with target audience, demanding easy, satisfying, thirst beer, the name has been chosen from the new beer brand. Stylish innovations in packing (a transparent bottle, a stopper "ring-pool") corresponded the insight of the brand. The problem of recognition of a brand has been successfully solved by creation of original design. Certification of a new product started, technical and technological documentation and documents on certification were obtained.

New beer appeared in 2006. During 8 months 2006 10 million deco liters (dl) has been sold, 29 million dl – in 2007 Fig. (**8**). Brand distribution on the country was 65 % and brand recognition was 77 %. A share in the segment was 8,4 %. Company gained for 250 million dollars during 2007. Growth of sales of the brand has made 22 % in 2008. The effect has surpassed all expectations – for incomplete year new beer has grasped more than 5 % middle price segment, in 2006 actual sales have exceeded the plan more than twice.

In 2006 the new beer was recognized by "the Innovation of year» and got the main award of competition BRAND of the YEAR/EFFIE 2006.

In 2007 and 2008 the brand got two silver medals at Australian International Beer Awards in the categories Lager

Packaged, and also a bronze award on European Beer Star Awards in Germany (between 500 sorts of beer from 27 countries) Fig. (**9**).

CONCLUSION

So results of the evaluation of the project were unexpectedly high because of synergetic combination of QFD brand planning and constructing a new yeast strain with improved taste and aroma characteristics, giving higher quality to the final product, satisfying customer's demands and raising income of the company.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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Declared none.

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