

SCI-CONF.COM.UA

CURRENT CHALLENGES OF SCIENCE AND EDUCATION



**PROCEEDINGS OF VI INTERNATIONAL
SCIENTIFIC AND PRACTICAL CONFERENCE
FEBRUARY 12-14, 2024**

**BERLIN
2024**

CURRENT CHALLENGES OF SCIENCE AND EDUCATION

Proceedings of VI International Scientific and Practical Conference

Berlin, Germany

12-14 February 2024

Berlin, Germany

2024

UDC 001.1

The 6th International scientific and practical conference “Current challenges of science and education” (February 12-14, 2024) MDPC Publishing, Berlin, Germany. 2024. 517 p.

ISBN 978-3-954753-05-5

The recommended citation for this publication is:

Ivanov I. Analysis of the phaunistic composition of Ukraine // Current challenges of science and education. Proceedings of the 6th International scientific and practical conference. MDPC Publishing. Berlin, Germany. 2024. Pp. 21-27. URL: <https://sci-conf.com.ua/vi-mizhnarodna-naukovo-praktichna-konferentsiya-current-challenges-of-science-and-education-12-14-02-2024-berlin-nimechchina-arhiv/>.

Editor

Komarytskyy M.L.

Ph.D. in Economics, Associate Professor

Collection of scientific articles published is the scientific and practical publication, which contains scientific articles of students, graduate students, Candidates and Doctors of Sciences, research workers and practitioners from Europe, Ukraine and from neighbouring countries and beyond. The articles contain the study, reflecting the processes and changes in the structure of modern science. The collection of scientific articles is for students, postgraduate students, doctoral candidates, teachers, researchers, practitioners and people interested in the trends of modern science development.

e-mail: berlin@sci-conf.com.ua

homepage: <https://sci-conf.com.ua>

©2024 Scientific Publishing Center “Sci-conf.com.ua” ®

©2024 MDPC Publishing ®

©2024 Authors of the articles

2-FURFURAL CONTENT IN BEER

Kiriyenko Serhiy Konstantinovich

Master's student

Mukoid Roman Mykolayovych

associate professor

National University of Food Technologies

Kyiv, Ukraine

Introduction.

During the production of beer, there are defects associated with raw materials, incorrect management of the technological process, which subsequently leads to violations of the biological, physico-chemical and, in fact, organoleptic properties of beer. Therefore, research, detection and elimination of defects in brewing, which are formed as a result of oxidation and aging of beer, are relevant.

Project purpose.

Today, it is very difficult to impress the consumer with a specific type of beer or an interesting aroma and taste. Small breweries around the world produce thousands of unique varieties, both local and world famous. But the original taste of such beer can be felt only by going to the region where it is made.

Big beer producers, which fill the main niche of the mass market, have other challenges, because they have no chance to fight against the variety of tastes of mini-breweries.

For large producers, the task is to deliver their beer to every corner of the world. But beer can travel for months, so how do you preserve its taste after months. How to know that the produced batch will retain its properties over time.

Materials and methods.

Definition 2 of furfural in beer. The method is based on determining the total content of oxidation products, the basis of which is 2-furfural. Absorption peak on ultraviolet spectrophotometry for 2-furfural (the smallest) lies within the wavelength range of 277 nm, and 5-hydroxymethyl-2-furaldehyde (the largest) 310 nm.

Reagents and preparation methods. Standard solution of 2-furfural: weigh 1 g of furfural and quantitatively transfer it to a 1000 ml volumetric flask at 20 °C and bring to the mark with distilled water.

Construction of a calibration schedule. Preparation of calibration solutions. Take 4 cm³ of a standard furfural solution in a 1000 cm³ volumetric flask and bring it up to the mark with distilled water, we get a solution with a concentration of 4000 µg/dm³.

Calibration solutions are prepared from it. Select with pipettes 1; 2; 2.5; 3.5; 5; 10; 15; 20 and 25 cm³ and placed in 100 cm³ volumetric flasks, brought up to the mark with water, respectively, obtaining calibration solutions with a concentration of: 40, 80, 100, 140, 200, 400, 600, 800 and 1000 µg/dm³.

Measure the optical density of all calibration solutions on a spectrophotometer in a 50 mm quartz cuvette relative to air at 310 and 277 nm. A calibration graph of the dependence of the difference in optical densities at 277 and 310 nm on the concentration of 2-furfural is constructed.

Preparation for tests. Beer is degassed by shaking and filtering the sample through a paper filter. 40 cm³ of beer is measured with a cylinder, poured into a distillation flask and distilled on a distillation unit with steam. Collect 40 cm³ of distillate in a measuring cylinder, mix the sample.

Measure optical densities at 277 and 310 nm in 50 mm quartz cuvettes relative to air.

Find the difference in optical densities and determine the concentration of the total oxidation products according to the calibration graph. The result is rounded up to dozens of µg/dm³.

Results and discussion.

Before conducting research, it is necessary to calibrate the spectrophotometer operating in the ultraviolet spectrum. For this, it is necessary to construct a calibration curve with a known concentration of 2-furfural. This curve is shown in table. 1 and fig. 1.

Table 1**Indicators of the calibration curve**

Indicator	results								
Concentration of 2-furfural in water, $\mu\text{g}/\text{dm}^3$	40	80	100	140	200	400	600	800	1000
Spectrophotometer readings at a wavelength of 310 nm	0,144	0,069	0,071	0,073	0,073	0,085	0,093	0,098	0,106
Spectrophotometer readings at a wavelength of 277 nm	0,188	0,142	0,160	0,196	0,240	0,401	0,566	0,723	0,874
Difference between measurements (x)	0,044	0,073	0,089	0,122	0,166	0,315	0,472	0,624	0,768
Recalculation (check) concentration of 2-furfural $\mu\text{g}/\text{dm}^3$	43,3	79,1	99,1	140,7	195,5	381,8	578,3	767,7	947,6

We translate the results into a graphic form and apply them to the graphic plane of fig. 1.

After plotting the graph by points, we see a direct relationship.

The equation describing this curve:

$$y = \frac{(-0.0101 + x)}{0.0008};$$

Where, x is the difference between the readings of the spectrophotometer between the wavelengths of 310 nm and 277 nm.

The accuracy of the construction of the curve shows:

$R^2 = 0.9999$ - mean square deviation;

The closer the root mean square deviation is to 1.0, the better the model fits the data and the more effectively it explains the variation in the dependent variable.

After constructing the calibration curve, the content was studied 2-furfural in experimental samples.

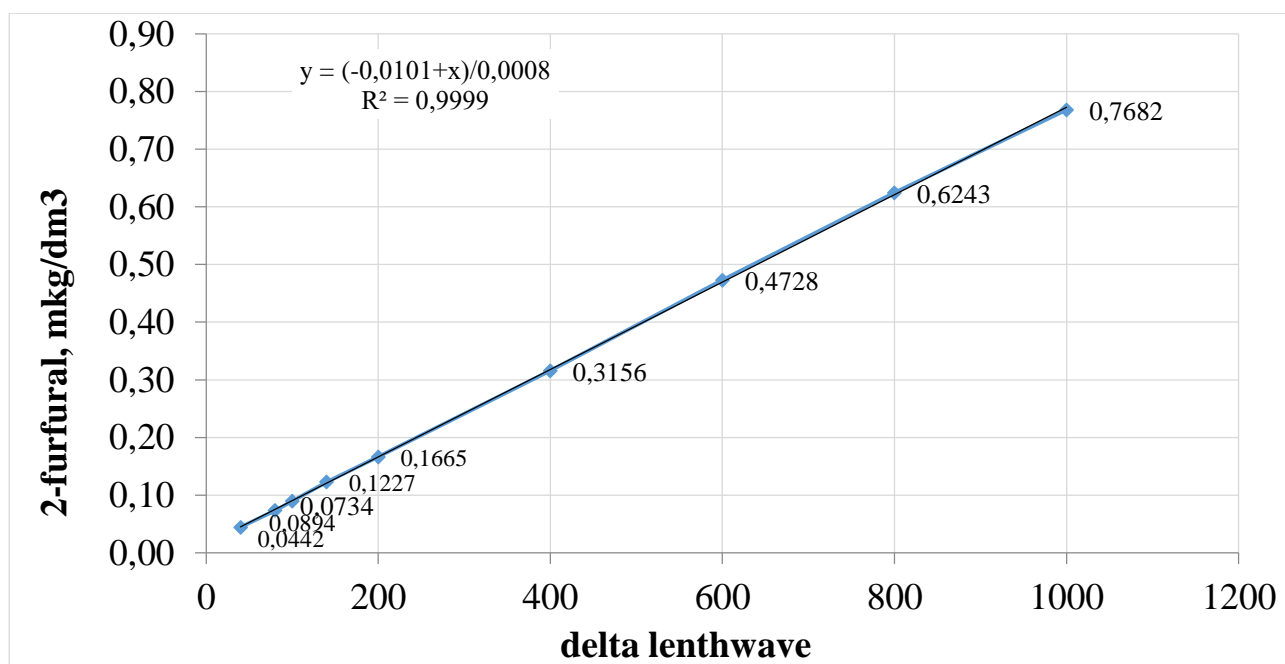


Figure 1 – Calibration curve

During the experimental part of the work, the following materials were used: "Light" beer filtered 10.0% SR after fermentation. Beer samples with different content of 2-furfural in finished beer. Physico-chemical indicators of beer are given in table. 2.

Table 2.

Physico-chemical parameters of finished beer

Parameters	Units	Results
OG	% m.	10,0
Alcohol	% v.	4,5
Color	EBC	6
Bitterness	BU	13
CO ₂	ppm	5,0
O ₂ disolved.	ppb	20
O ₂ total	ppb	50
pH	-	4,2
Acidity	-	1,80

The study of the content of 2-furfural in filtered beer was carried out depending on the oxygen content of the table. 3 and Fig. 2. Light beer filtered 10% SR was used in the study. A series of experimental studies was conducted to determine the dependence of the concentration of 2-furfural on the oxygen content of artificially saturated air. For this, the following samples were studied:

For the study, a control beer with the indicators indicated in the table was used.

2. Control sample - beer with the lowest oxygen content, which was achieved - 20 $\mu\text{g}/\text{dm}^3$, was taken.

The test samples were saturated with air by bubbling through the tube. Until the following values are obtained:

- sample #1 – 40 $\mu\text{g}/\text{dm}^3$;
- sample #2 – 60 $\mu\text{g}/\text{dm}^3$;
- sample #3 – 80 $\mu\text{g}/\text{dm}^3$;
- sample #4 – 100 $\mu\text{g}/\text{dm}^3$;
- sample #5 – 120 $\mu\text{g}/\text{dm}^3$;
- sample #6 – 140 $\mu\text{g}/\text{dm}^3$.

Table 3

Dependence of 2-furfural concentration on the oxygen content in beer

Parameters	control	№ 1	№ 2	№ 3	№ 4	№ 5	№ 6
Concentration of 2-furfural in water, $\mu\text{g}/\text{dm}^3$	20	30	40	60	80	100	120
Spectrophotometer readings at a wavelength of 310 nm	0,1813	0,2135	0,2315	0,2474	0,2786	0,2885	0,3021
Spectrophotometer readings at a wavelength of 277 nm	0,1299	0,1285	0,1343	0,1387	0,1436	0,1456	0,1438
Difference between measurements (x)	0,0514	0,0850	0,0972	0,1087	0,1350	0,1429	0,1583
Recalculation (check) concentration of 2-furfural $\mu\text{g}/\text{dm}^3$	56,6	89,0	108,8	123,2	156,1	166,0	185,2

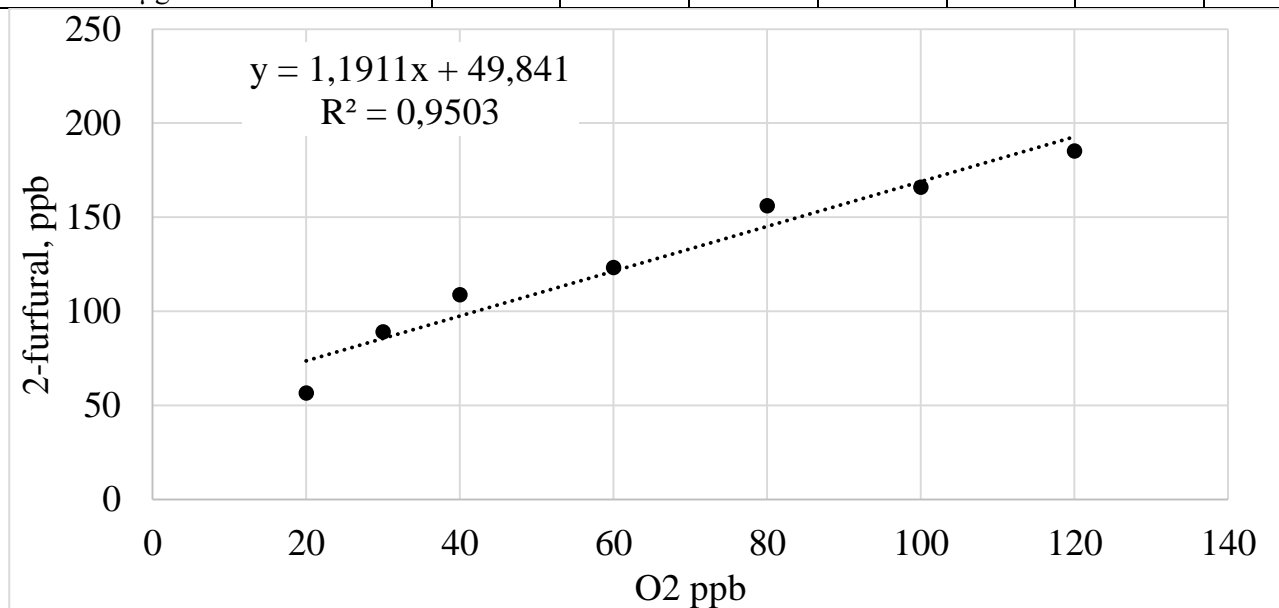


Figure 3 – Dependence of 2-furfural concentration on the oxygen content in beer

Summary. According to the research results shown in Table 3, it can be seen that there is a direct dependence of the formation of 2-furfural on the oxygen content in beer. Therefore, by measuring the content of 2-furfural in beer, it is possible to determine how much it was oxidized during production. The higher the 2-furfural content, the higher the oxygen content of the beer during production.