Research on Drying of Waste Brewer's Yeast

Cercetări privind uscarea drojdiilor de bere reziduale

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ABSTRACT

Brewer's yeast is rich in protein, amino acids, water soluble vitamins (thiamine, riboflavin, niacin, folic acid, vitamin B12 and pyridoxine), which is also a rich source of minerals, chromium (an essential mineral that helps the body maintain normal blood sugar levels), copper, zinc, selenium. The paper proposes processes for processing waste brewer's yeast that can be used in the food, cosmetic and medical industries. Brewer's yeast is a complex of general nutrients, a metabolic regenerator, a dietary supplement recommended for all ages, with multiple medical applications, being an important factor for human health.

Keywords: *drying processes; brewer's yeast; rotary drum drying machine.*

REZUMAT

Drojdia de bere este bogată în proteine, aminoacizi, vitamine hidrosolubile (tiamină, riboflavină, niacină, acid folic, vitamina B12 și piridoxină), este, de asemenea, o sursă bogată de minerale: crom (un mineral esențial care ajută organismul să mențină un nivel normal al glicemiei), cupru, zinc, seleniu. Lucrarea propune procedee de prelucrare a drojdiilor de bere reziduale care pot fi utilizate în industria alimentară, în cea cosmetică, precum și în medicină.

Drojdia de bere constituie un complex de nutrienți generali, un regenerator metabolic, un supliment alimentar recomandat la toate vârstele, cu multiple aplicații medicale, fiind un factor important pentru sănătatea umană.

Cuvinte-cheie: *procese de uscare; drojdie de bere; mașină de uscare cu tambur rotativ.*

1. Introduction

Currently the need to use waste products from the brewing industry has arisen as a result of the increasing volume of beer production worldwide. Most of these products are spent grains and brewer's yeast. The present work is dedicated to the study of drying methods of waste brewer's yeast.

1. General characteristics of brewer's yeast

Brewer's yeast contains such components as water, nitrogenous substances, carbohydrates, fats and minerals (Table 1).

Table 1

Composition of brewer's yeast

Types of substances	Content %
Protein substances	40...60
Carbohydrates	25...35
Fats	4...7
Mineral substances	6...9

Source: *Prepared by the author*

Currently only a small proportion of brewer's yeast waste undergoes processing. The most mass of the yeast, is used as fodder or stored at the special deposits. But, yeast products contain a large amount of the necessary connections for the functional and vital activity of the human body.

Brewer's yeast therefore, contains biologically active substances needed by the human body, which can be used in various branches of industry for e.g. in medicine - as biologically active additives, in the food industry - as supplements in food products, to supplement the body with vitamins.

2. The yeast processing methods of residual beer

In brewing technology, residual yeast is obtained from the fermentation process of beer. The yeast processing stages are: dehydration of the yeast by using centrifugal separators, drying by using different methods and packaging of the yeast according to its use. Roller separators, rotary drum dryer and fluidized bed dryer are used for drying yeast.

The presented work includes the kinetics study of the drying brewer's yeast process.

The actual moisture content of the product was calculated as the ratio of the mass of moisture in the product to the mass of the absolutely dry substance:

$$W_i = \frac{G_i - g_c}{g_c} \cdot 100\,\%$$

This formula allows us to obtain the values of the current humidity Wi from the experimental data of the current reading of Gi weights, according to which the drying curve is built into the coordinates W – τ.

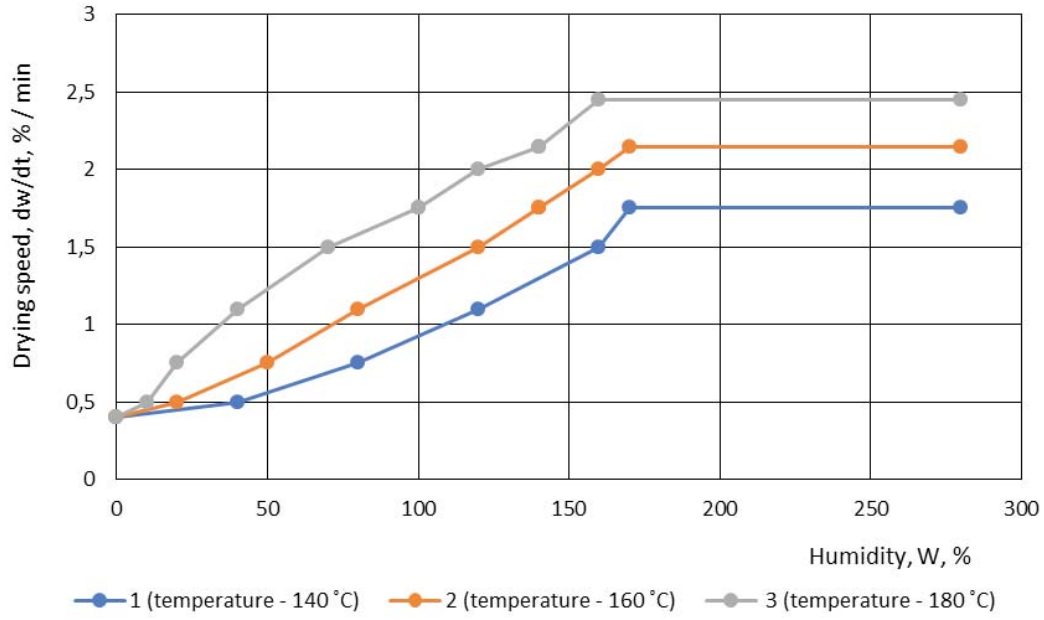

Figure 1. ***Drying curves of brewer's yeast at different temperatures:*** $t_1 = 140^oC; t_2 = 160^oC; t_3 = 180^oC$

Source: *Prepared by the author*

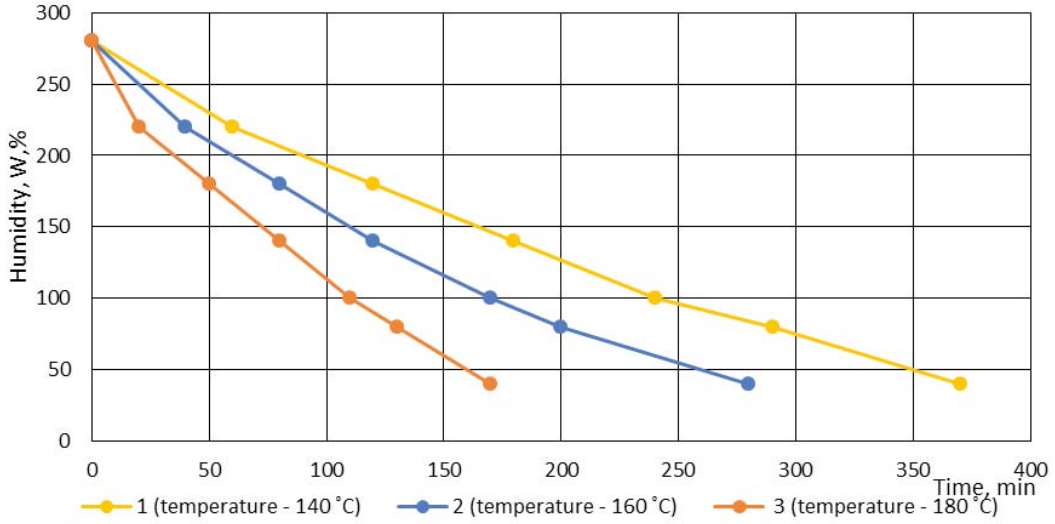

Figure 2. ***Speed drying curves of brewer's yeast at different temperatures:*** $t_1 = 140^oC; t_2 = 160^oC; t_3 = 180^oC$

Source: *Prepared by the author*

The curve of convective drying of excess brewer's yeast - the change in humidity in relation to the absolutely dry substance WC is gradually shown in fig. 1 and 2.

On the drying curve, the following periods are highlighted:

- free moisture removal period-during this period, free moisture evaporates intensively from the surface (up to 10-15%), reducing the internal energy in the product, and the temperature of the product decreases continuously.

- drying period at constant speed - during this period intensive evaporation of moisture occurs. Moisture is mainly removed from the surface layers of the product, constant heat resistance and moisture transfer are concentrated on the surface, therefore, the drying curve does not change during this period.

- period of decreasing drying speed - the layers of the product on the surface begin to heat up, so in 30 – 60 min The temperature of the corresponding layer increases to the surface temperature.

With the increase in the thickness of the product layer, the duration of the drying process increases, in addition, there is a deterioration in quality due to the increased temperature of the surface layer. Thin layer drying is optimal, but it is necessary to determine the optimal thickness to increase the productivity of the dryer. From the drying curve in Fig. 1 it can be seen that the optimal layer thickness is 8-10 mm, because at a given thickness, the drying intensity is higher (by 15 – 20%) compared to a thin layer and the product quality is higher, because there is no damage due to increased temperature of the surface layer.

The proposed rotary drum dryer machine uses vapor as the warmth source and uses indirect heat transfer to heat the material and evaporate moisture. This installation consists of the drying drum, beater, transmission system, scraper mechanism, dosing device and steam system. The installation is equipped with an electric control panel and a steam evacuation device.

Factors influencing the drying process are:

1. steam pressure (0.1-0.4 MPa) or heating temperature;

2. drum rotation speed (4-10 rot/min);

3. thickness of the yeast layer;

4. yeast moisture.

Drum rotation speed can be adjusted using the installed frequency converter. Brewer's yeast is dosed onto the outer surface of the drum. Steam is injected inside the drum with a working pressure of 0.15- 0.3 MPa.

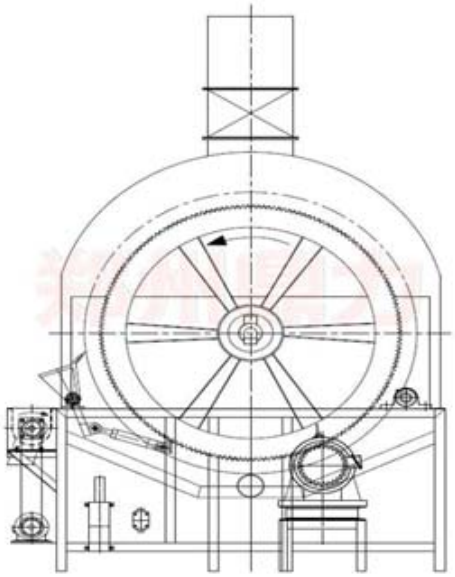

Figure 3. ***Structural scheme of the brewer's yeast drying machine***
Source: *Prepared by the author*

Operating principle of the yeast drying machine

Moisture from the drying process is removed through the ventilation system. The dried yeast is discharged (removed) from the outer surface of the drum with scraper mechanism.

Conclusions

Following the study the residual beer yeast processing methods were analysed . The yeast separation and drying processes were analysed. The use of the drum plant for drying of waste brewer's yeast was proposed. The processes of separation and drying of the yeast were analysed. It was proposed to use the drum installation for drying residual brewer's yeast.

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