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Research of methods of processing post-spirit drinking enterprises of the central-black-earth district

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Abstract. Ethanol is a valuable product that is widely used in various sectors of the economy. In the alcohol industry, various wastes are generated - post-alcohol distillery stillage, by-products of the distillation of ethyl alcohol, microorganism cells, among which a significant amount is the post-alcohol distillery stillage. Disposal of stillage is an urgent environmental problem, since this waste of alcohol production has a short shelf life. There are methods for processing bards that can be divided into two groups: methods using biotechnology and methods based on physicochemical methods. There are many research projects that focus on the production of biofuels and fodder product from stillage. The most common method for processing post-alcohol stillage in the Central Black Earth Economic Region is drying. We have proposed a method for the integrated processing of post-alcohol stillage of distiller's grains, which includes drying the distiller's grains, aerobic microbiological processing to obtain a protein feed product and the production of hop-vinous fermentation. Getting sourdough is the first proposed method for recycling bards. For drying, it is proposed to use 30% of the stillage of the enterprises of the Central Black Earth Economic Region, to produce protein feed product 50%, and for hop-burgundy starter culture 20%. The method of complex processing expands the use of post-alcohol distillery stillage, and the production of hop-burgundy sourdough allows to increase the assortment of functional food products.

1. Introduction

Ethanol obtained as a result of biodegradation of annually renewable plant substrates (grains of cereals, beets, potatoes, straw, sugarcane, alfalfa, etc.) is a valuable product that is widely used in various sectors of the national economy. In addition, the problem of reducing output and the cost of oil production processes allows us to consider the prospects of using ethanol obtained from plant materials as fuel components [1].



In the alcohol industry, various wastes are generated - post-alcohol distillery stillage, by-products of the distillation of ethyl alcohol, microorganism cells, among which a significant amount is the post-alcohol distillery stillage. Its output reaches 135–150 m³ with the production of 1000 dal ethanol. Fresh bard contains proteins, fiber, hemicellulose, ash substances, fats and vitamins, which makes it possible to use post-alcohol bard as a protein and vitamin supplement, as well as organic fertilizer [1]. Part of the stillage remains unrealized and it is lowered into the storage ponds of distilleries. The number of such ponds, their area and volumes can vary in the range of 250-300 thousand m³ depending on the capacity of the plant. In the absence of such devices, part of the unsold bard is discharged into drains and causes environmental pollution [2].

The prolonged presence of the stillage in the sumps leads to spoilage and the inability to use it in feed. Within 2-3 months, the post-alcohol bard darkens, putrefactive processes occur in it, which causes a sharp unpleasant odor. When the bards are dumped into water bodies, the process of decay causes the death of flora and fauna [1].

To date, recycling methods are known that can be divided into two groups: methods using biotechnology and methods based on physicochemical methods [2].

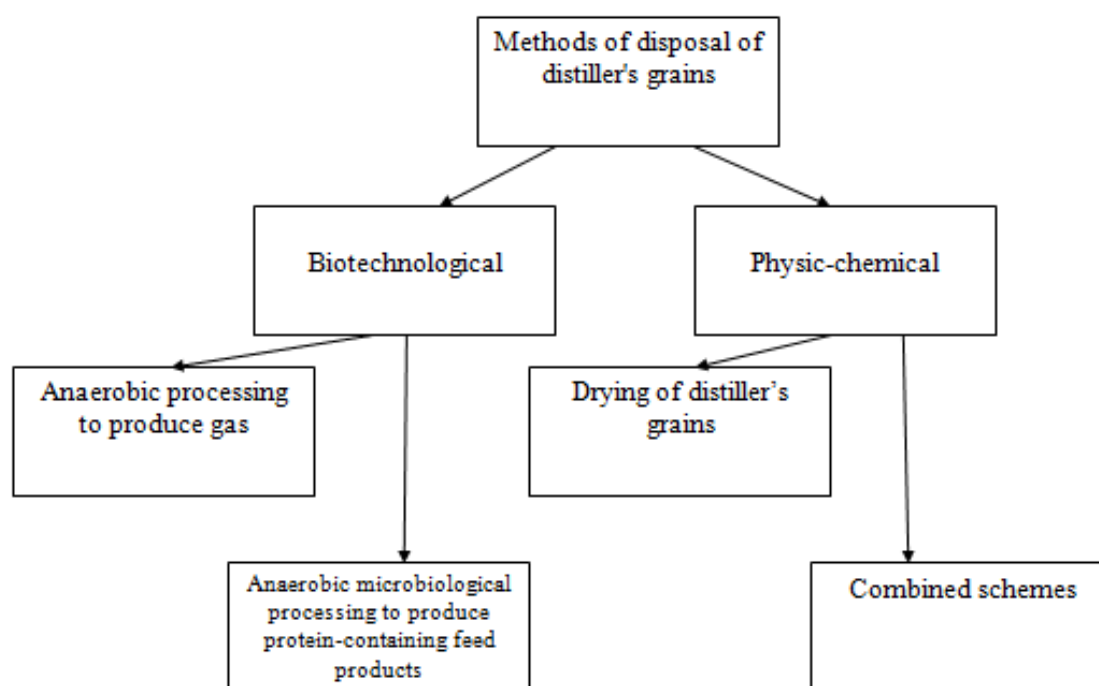


Figure 1. Disposal methods for post-alcohol stillage

One of the promising areas is the processing of post-alcohol distillery stillage in feed products enriched with amino acids and protein. This allows you to fully utilize all the components of the new raw materials, reduce the cost of the target product in the production of alcohol and increase the efficiency of its production [3].

The disadvantage of anaerobic processing is the implementation of a large volume digester and low intensity of the process, in addition, the operation of equipment with combustible gases requires not only serious design approvals, but also personnel with appropriate professional training [5,6]. Dried bard is used as a feed in agriculture, but it is worth noting that the feed product obtained by aerobic microbiological processing has a high protein content in its composition [7,8].



Figure 2. Dry post-alcohol bard with bran

2. Materials and Methods

Depending on the raw materials used to produce alcohol, there are various types of stillage: molasses, potato, barley, rye, oat, etc. Table 1 presents the comparative characteristics of various types of post-alcohol stillage [8].

Table 1. Comparative table of the chemical composition of various types of post-alcohol stillage

Type of bard	Solids content, %	The protein content, %	Fat content, %	Ash content, %	Fiber Content, %	The content of nitrogen-free extractive substances, %
Molasses	5-6	2,1	0,6	-	1,7	3,1
Potato	5	1,3	0,7	0,6	0,5	1,9
Barley	5-10	2,4	0,8	0,4	1,1	3,8
Rye	6-7	1,5	0,3	0,5	0,6	4,5
Oatmeal	8	2,7	0,5	1,2	0,8	3,0

From table 1 we can conclude that in many respects the barley bard is superior to other species. Consider the detailed chemical composition of barley stillage (table 2) [9].

Table 2. The chemical composition of barley post-alcohol stillage

Name of indicator	Value %	Name of indicator	Value%
Solids:		Arginine	0,06
general	5-10	Serine	0,08
soluble	3-5	Threonine	0,08
Ash	0,72	Methionine	0,02
Organic matter	6,78	Glycine	0,10
Crudefat	0,34	Alanine	0,10
Nitrogen-free extractive substances	3,42	Valine	0,07
		Glutamic acid	0,31
Crude protein (on a.c.v. -25-30%)	2,44	Leucine	0,13
Protein according to Barnstein (18-23%)	2,04	Tryptophan	0,01
Vitamins mg / kg		Tyrosine	0,06
Pyridoxine	0,68	Phenylalanine	0,08
Thiamine	0,68	Minerals:	
Riboflavin	1,35	Zincmg / kg	1,65
Pantothenicacid	1,20	Phosphorus g / kg	0,71
Choline	4,20	Ironmg / kg	55
Aminoacids, %		Manganese, mg / kg	5,18
Lysine	0,05	Coppermg / kg	0,6

The aim of the work is to study the existing methods of processing post-alcohol distillery stillage and to propose a new technology.

3. Results

According to the goal, a method for the disposal of post-alcohol distillery stillage with obtaining dry hop-burgundy sourdough is proposed. Based on the technological scheme proposed by E.P. Ivanova in the candidate dissertation; a technology was developed for using post-alcohol distillery stillage for the preparation of dry sourdough [10].

The technological scheme for obtaining dry hop-burgundy sourdough is presented in Figure 3.

A technology is proposed for the integrated processing of post-alcohol distillery stillage, according to which the distillery stillage is used to produce three end products: dry distillery, protein feed and hop-burgundy hop-sourdough fermentation. It is proposed to use 30% of the total stillage produced by the enterprises of the Central Black Earth Economic Region for drying, to produce protein feed product 50%, and for fermentation 20%. The hop-burgundy sourdough is targeted at the baking industry, and agriculture for the other two target products for the integrated processing of stillage.

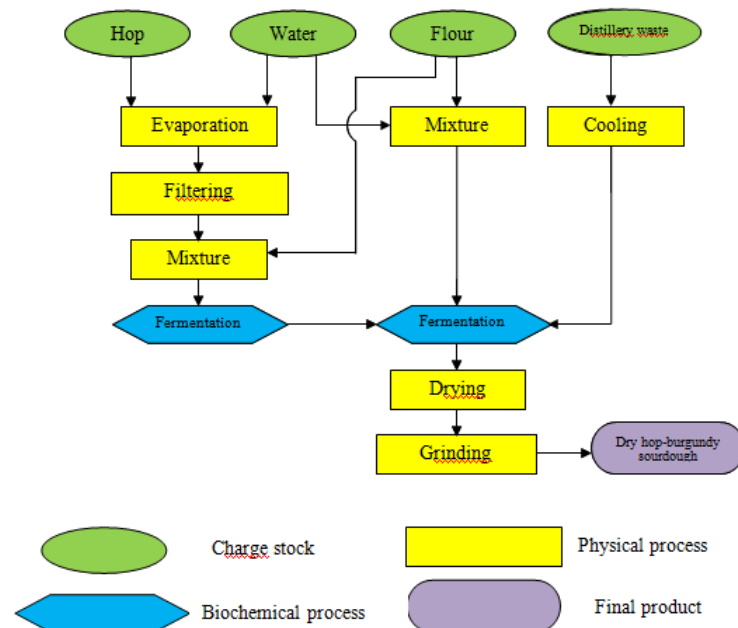


Figure 3. The technological scheme of obtaining dry hop-burgundy sourdough.

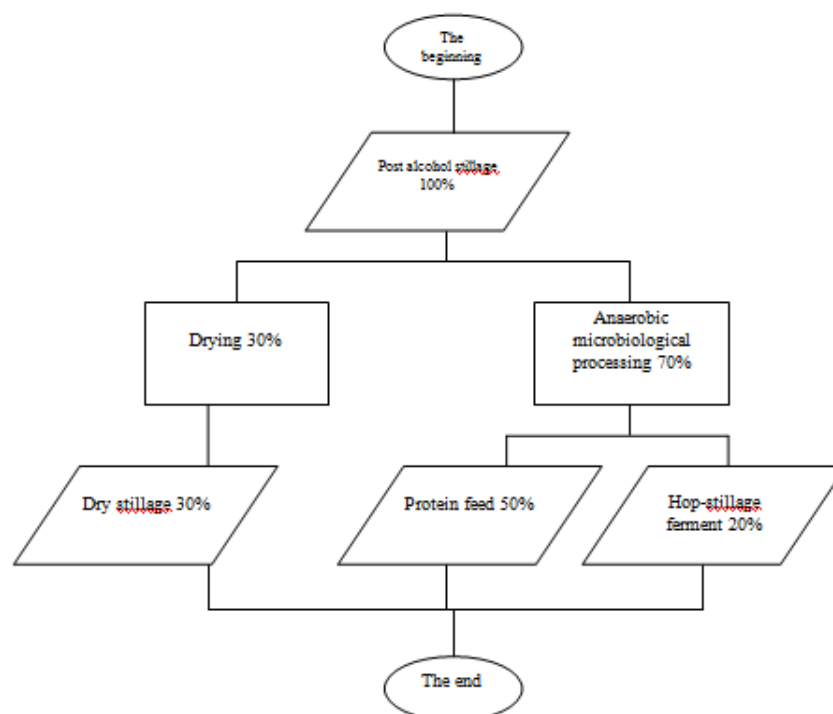


Figure 4. Block diagram of the technology of complex processing of post-alcohol stillage

Thus, the current environmental problem of disposal of post-alcohol stillage can find its solution in the production of feed products for agriculture and dry sourdough, providing the population with the necessary bakery products.

4. Discussion

This work allows us to solve the environmental problem of disposal of post-alcohol = stillage, which is relevant today. Using the technology of complex processing of distiller's grains, one can obtain such

target products as dry distiller's grains, protein feed product, and hop-burgundy ferment. The resulting products can be used in bakery and in agriculture. You can also send them to other areas where it is not possible to produce these products.

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