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OBTAINING SWEET MOLASSES BY THE METHOD OF HYDROMECHANICAL AND ENZYMATIC PROCESSING OF GRAIN

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Abstract: *Methods of hydrolysis of grains to starch under the influence of hydrodynamic and enzymatic processes are logically based. Polysaccharides derived from starchy grains are known and popular in the food industry for their thickening and stabilizing properties. To date, studies that allow for a deeper understanding of the mechanism of interaction of polysaccharide-containing products with their main components, the effect on the set of rheological, organoleptic, physico-chemical properties of food products that determine their functions are relevant.*
Keywords: *starch-rich pulp, fermentation, hydrolysis, hydrodynamic effect, thickener, food, rheological, organoleptic, physicochemical properties.*

Annotatsiya. *Gidrodinamik hamda fermentativ jarayonlar ta'sirida kraxmalga donlarning gidrolizlash usullari mantiqiy asoslangan. Kraxmalga boy donlardan olingan polisaxaridlar oziq-ovqat sanoatida quyuqlashtiruvchi va barqarorlashtiruvchi xususiyatlari bilan ma'lum va mashhurdir. Bugungi kunga kelib, polisaxarid tarkibli mahsulotlarning asosiy tarkibiy qismlari bilan o'zaro ta'siri mexanizmini, ularning funksiyalarini belgilaydigan oziq-ovqat mahsulotlarining reologik, organoleptik, fizik-kimyoviy xususiyatlari majmuasiga ta'sirini chuqurroq tushunishga imkon beradigan tadqiqotlar dolzarbdir.*
Tayanch so'zlar: *kraxmalga boy yanchilma, fermentatsiya, gidroliz, gidrodinamik ta'sir, quyuqlashtiruvchi, oziq-ovqat, reologik, organoleptik, fizik-kimyoviy xususiyatlar.*

Аннотация: *Логически обоснованы методы гидролиза зерна на крахмал под действием гидродинамических и ферментативных процессов. Полисахариды, полученные из крахмалистых зерен, известны и популярны в пищевой промышленности благодаря своим загущающим и стабилизирующим свойствам. На сегодняшний день актуальны исследования, позволяющие глубже понять механизм взаимодействия полисахаридсодержащих продуктов с их основными компонентами, а также влияние на комплекс реологических, органолептических, физико-химических свойств пищевых продуктов, определяющих их функции.*
Ключевые слова: *крахмальная мезга, ферментация, гидролиз, гидродинамический эффект, загуститель, пищевые продукты, реологические, органолептические, физико-химические свойства.*

Goals and Tasks of the Research:

Hydroacoustic effects are widely used in the food industry: especially in the production of cellulose, glucose and molasses [1]. The widespread use of cavitation impact devices in industry arouses interest in the theoretical foundations of hydroacoustic impact in various technological processes [2].

Several approaches, sometimes mutually exclusive, are proposed to explain the mechanisms of technological processes enhancement that occur with the application of cavitation effects. Perhaps this is due to the fact that the theoretical study of these processes takes place at the intersection of several disciplines and belongs to new areas of knowledge. It should be noted that the improvement of technological processes in the conditions of hydroacoustic effects is carried out through the complex effect of a number of factors on raw materials. Including fluid flow pressure, mechanical vibrations in a wide frequency range, cavitation phenomena and related. Shock waves and cavitation currents,

temperature effects, high shear stresses, etc. It is impossible to exclude the chemical component of cavitation processes, as well as crosslinking and oxidation reactions when highly active radical particles are formed.

Theoretical and Practical Basis of Research:

Empirical approach prevails in choosing cavitation equipment and exposure regimes for technological processes related to food and feed production, and existing recommendations are prescriptive in nature. The situation is complicated by the variety of biochemical reactions, their degree and complexity. Hydrodynamic, thermal, diffusion and other processes are added to these interactions. All these factors significantly complicate the correct selection of technological modes in the processing of plant and animal raw materials, their optimization and the possibility of increasing economic efficiency. However, examples of effective intensification of various processes, including biochemical processes, in the conditions of hydrodynamic effects will be the impetus for successful application and collection of new statistical materials.

Bioconversion of starch and starch-containing raw materials into sugar starch products is associated with various structural-mechanical and biochemical processes. At the same time, various machines and apparatuses, mixers, homogenizers, decanters, separators, various types of fermenters, etc. are used for coarse and fine grinding of raw materials during processing of raw materials. According to our assumption, the processes occurring in the hydroacoustic disperser, which cause cavitation phenomena, can replace some processing methods and simplify the set of technological methods used in modern technologies, which will reduce the time of bioconversion of raw materials containing starch and technological can lead to a reduction in metal consumption of equipment, and in some cases exclude some technological operations.

Bioconversion of starch-containing grain raw materials to sugar products differs from the processing of native starches. This is determined by the more complex structure of cereals. Technologically, complete enzymatic hydrolysis of native starch requires initial erosion of starch grains, which is classically done in fermenters under the influence of water and temperature. The cavitation processes carried out in the rotor pulsation apparatus can probably enhance the processes of erosion of starch granules due to the dispersion effect: breaking up of monolithic semi-crystalline particles with starch granules.

In order to pass the bioconversion of the whole grain, the deagglomeration stage must first be carried out - the breakdown of the components of the grain agglomerate. In our case, agglomerate is a whole grain, the main components of which are cellulose, fats, proteins and starch. It is known that starch granules are formed in a protein matrix and form very strongly bound agglomerates, breaking them up is one of the most difficult tasks in the preparation of native starches. To break up protein-starch agglomerates, in our opinion, the most effective device is a rotor-pulsation apparatus, in which two types of disintegration are carried out: mechanical cavitation, which leads to effective deagglomeration of particles.

Several mechanisms of cavitation decomposition have been proposed in the literature: separation under liquid pressure (Pulter effect), chemical decomposition of materials with highly active radical particles formed as a result of water sonolysis (Taylor effect), dispersion under the influence of mechanical fatigue phenomena, two electric layer generation (triboelectric) and other effects. In our opinion, during the dispersion of starch-containing materials, the main contribution is carried out by crushing under the influence of cumulative flows formed during the collapse of cavitation bubbles (Fig. 1).

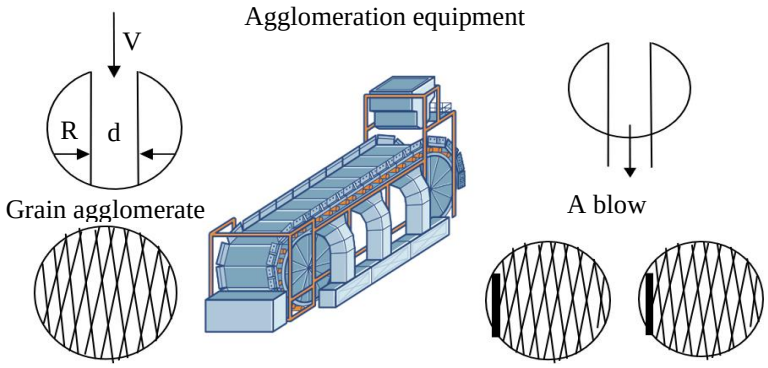

Fig.1. ***The principle scheme of dispersion (erosion) of grain agglomerates under the influence of cavitation impact:*** *R - radius of curvature of cumulative flow; d - the diameter of the cumulative flow; V is the speed of the cumulative flow.*

Starch -containing materials under the influence of fine currents is primarily related to the size ratio of cavitation bubbles and dispersed phase particles [3]. If the size of the cavitation bubbles is larger than the size of the particles of the dispersed material, the separation effect of the cumulative flows becomes negligible. If the size of the particles exceeds the size of the bubbles, their spherical shape is broken, and the cumulative small streams formed during the collapse of the bubbles have a high speed and increase the separation ability.

Results and Disscussion:

Enzymatic bioconversion of corn and wheat raw materials was carried out in the RPA-4N rotor pulsation apparatus. The ratio of water and dry matter was 2:1. Hydrolysis of raw materials in the presence of multienzyme compositions continues at a temperature of 60-65 ° C and rN = 4.5-5.5 [4]. As a result of controlled hydrodynamic processing, directed hydrolysis of starches occurs with the production of glucose-maltose solutions - carbohydrate food additives. The results of the study are presented in table 1 and Figure 1.

Table 1

Dynamics of enzymatic bioconversion of starchy grain raw material in RPA.

№ p/p	Raw / grinding level	Processing time, hour	The amount of carbohydrates,%	Bioconversion of starch, %
1	*2*	*3*	*4*	*5*
1	Whole grain corn *	1	6.2	24,32
2	-«-«-«-«-	2	12.1	47,46
3	-«-«-«-«-	3	17.6	69.04
4	-«-«-«-«-	5	22.1	86.69
5	-«-«-«-«-	7	23.6	92.57
6	-«-«-«-«-	10	23.2	91.00
7	-«-«-«-«-	12	22.8	89.44
8	-«-«-«-«-	15	21.6	84.73
9	Crushed Corn Cereal **	1	8.9	34.91
10	-«-«-«-«-	2	14.2	55.70
11	-«-«-«-«-	3	19.8	77.67
12	-«-«-«-«-	5	24.2	94.93
13	-«-«-«-«-	7	24.0	94.14
14	-«-«-«-«-	10	23.4	91.79
15	-«-«-«-«-	12	23.0	90.22
16	-«-«-«-«-	15	22.4	87.87
17	Whole Cereal*	1	5.6	23.83
18	-«-«-«-«-	2	10.7	45.54
19	-«-«-«-«-	3	16,5	70,22
20	-«-«-«-«-	5	21,0	89,38

21	-«-«-«-«-	7	21,9	93,21
22	-«-«-«-«-	10	21,4	91,08
23	-«-«-«-«-	12	19,8	84,27
24	-«-«-«-«-	15	19,2	81,70
25	Shredded Wheat Cereal **	1	10.8	45.96
26	-«-«-«-«-	2	15.2	64,69
27	-«-«-«-«-	3	19.8	84.27
28	-«-«-«-«-	5	22.4	95.33
29	-«-«-«-«-	7	22.2	94.48
30	-«-«-«-«-	10	21.6	91,93
31	-«-«-«-«-	12	21.4	91.08
32	-«-«-«-«-	15	21.1	89.80

** 10–12 hours at T=18–22 ° C, rN =2–3 before processing whole grain during in the water ivitil gan.*
*** Grinded grain No. 6 sieve using DKD-2 industry in the grinder received*

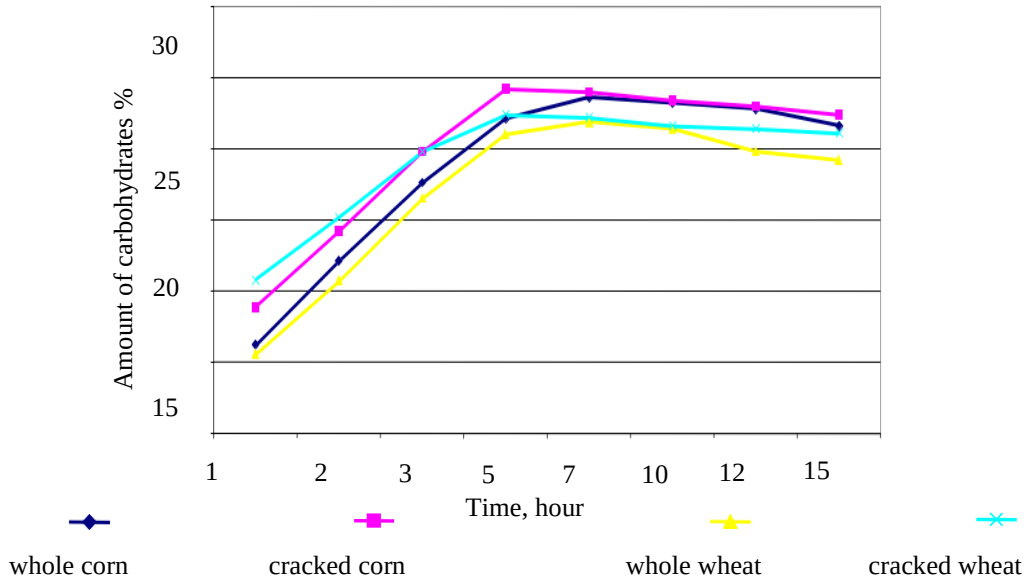

Fig. 1. ***Dynamics of enzymatic bioconversion of starchy grain raw materials in RPA.***

Of carbohydrates common product basically contains starch kept raw of the item bioconversion on time, raw the item preparation and grind level dependent (Table 1). Starch of bioconversion the highest percentage crushed grain from 5 hours after when using observed and this raw material type - makkaj o' hori or to wheat dependent not Whole grain contained of starches fermentative hydrolysis during of bioconversion the highest percentage corn for 7 hours after and wheat for 10 hours after observed.

These carbohydrate foods and nutritional supplements are natural components to compensate for the lack of sugar in the diet. The technology of obtaining feed additives has been introduced in a number of patented farms [5]. It should be noted that only cereal starch is purposefully biodegradable when taking carbohydrate foods and nutritional supplements. All other biologically active components of the grain remain in their original state. Enzymatic bioconversion under hydroacoustic conditions can affect any cereal starch, as well as any waste containing starch[6].

It is economically feasible to use these carbohydrate foods and feed additives in cattle rations with a total carbohydrate content of 15% in the mixture and 5% in human rations. Therefore, enough time to process raw materials to obtain marketable food additives is 3 hours.

Conclusion:

Thus, the proposed method of obtaining carbohydrate food and feed additives from local raw materials allows to balance the consumption ration according to the sugar-protein ratio, while the raw

materials containing starch in the food and nutritional grain can be further processed will be directed. The entire process of bioconversion of grain raw materials into carbohydrate food molasses can be carried out in one apparatus, where the processes of homogenization, deagglomeration, heating and hydrolysis of raw materials are carried out.

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