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RESEARCH MODELS OF HIERARCHICAL STORAGE OF INFORMATION IN RELATIONAL DATABASES

Summary
The object of research is the process of developing application architecture and providing storage for such hierarchies in the database as comments, organizational departments, decision trees. The subject of the research work is popular database management systems and how fast they works with variety of hierarchical structures. The work reveals the relevance of studies in the chosen direction, raises the problem and the purpose of the study, and it also outlines effectiveness of using such relational hierarchies as: «Nested set», «Materialized path», «Adjacency list». The conclusion describes the significance of the results.
Keywords: table, tree, hierarchy, structure, key.

УДК 664:144:641.1

CONFECTIONS WITH A LONG-TERM STORAGE

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The influence of additives and packaging methods for extending the shelf life guaranteed in stamped confectionery and changes their quality during storage. In the process of studies used generally recognized and modern methods. On the basis of these studies was demonstrated that the addition of churned confectionery algae increases the number and diameter of the pores, causing more adsorption properties. Porous samples should be longer soft, that are desirable consumer properties for finished products. Argued the possibility of extending the long-term of storage of the new products from 30 to 90 days by simultaneous use in Lamidan and Cycorlact.
Keywords: active water, adsorption-desorption of water, hydrocolloids, churned confectionery, Lamidan.

Introduction. The term of storage of confectionery is determined by two complex parameters of quality. The first complex indicator of quality can be differentiated on the organoleptic indicators (appearance, taste, smell, texture) products, physico-chemical (moisture content, forms of moisture bond) and indicators that characterize the biological value (content in the product of proteins, fats, carbohydrates, vitamins, minerals). These indicators should remain fairly constant throughout the guaranteed term storage.

The second group includes indicators of safety, especially – microbiological. In the case where at least one parameter of the second group reaches threshold, confectionery are unfit for consumption. To increase the term of storage is necessary to stabilize the indicators of the first group and to slow the changes of the second one.

In evaluating the quality and the term of fitting the food one of the key physical and chemical parameters is content of moisture, which primarily affects the growth of microorganisms. With decreasing the content of moisture decreases the intensity of proliferation of microorganisms and in reaching a certain moisture content stops. However, for microbial development are important not absolute humidity, and the availability of water for microbial development. This indicator is called water activity [1].

Water activity is determined by the value of the equilibrium relative humidity, and serves to quantify the energy of the moisture with the material:

$$a_w = (P.B.B.) / 100 = Pn / Ps \quad (1)$$

where a_w – water activity in decimal fractions;

P.B.B. – equilibrium relative humidity at which the product absorbs moisture and doesn't give it to the environment.

The indicator aw for pure water without additives equal to 1, the stronger bond water in food, the lower the figure to the value [2].

«Water activity» can vary from 0 to 1. The different types of confectionery with water activity vary from 0.4 to 0.95. The control of water activity indicator allows predicting the processes that occur while storage of confectionery. For values of indicators of water activity all confectionary are divided into three groups:

I group – products with the indicators of water activity of 0.65 or less – low humidity 10-13% less. These include sweets with praline, marzipan shells and chocolate.

II group – intermediate moisture products (a_w from 0.65 to 0.95). Moisture products are between 13 and 35%. These include sweets from the churned, jelly, fruit and jelly shells.

III group – product with high humidity – over 35% and 0.9. They are a group of biscuits and sponge cakes.

In products with low humidity suppressed activity of microorganisms. They held the oxidation

processes of fats. In products with intermediate humidity are possible oxidative processes and microbiological spoilage. Many fungi and yeasts develop already at water activity above 0.62. The water activity affects the processes of the oxidation. Maximum rate of oxidation of confectionery ranges a_w from 0.6 to 0.85.

Thus, the determination of the indicator of water activity of the individual components of such complex systems as confectionery mass will help to predict their behaviour in the formation process of structure of semi-finished confectionery and purposefully adjust their technological properties.

Recent Research Analysis. One of the components that can significantly change the value of water activity in dispersed systems is hydrocolloids. With the introduction of high-molecular compounds in the confectionery mass is bond free water, colloidal system loses its mobility and its consistency changes. This should be considered when modelling the structural properties of disperse systems in the formation of different structures of semi-finished confectionery.

The topicality of this study. Accordingly, the Department of merchandise and expertise food KNTEU developed the new pastyl products with the use of dietary supplement Lamidan and biologically valuable supplement cycorlact.

Dietary supplement Lamidan that used in the receipts of the new pastyl products contains in its composition algin acid. Salts of alginic acid, thanks its ability to bind water can affect water activity which is important from the standpoint of microbial development and increase term of storage of foods. Therefore, one of the main tasks of our work was to study the influence of dietary supplements Lamidan and cycorlact on the process of staling of the pastyl products [3].

The purpose of the article. In order to prolong the guaranteed term of storage and preserve the structural indicators and safety indicators of the churned confectionery, were held the studies of the influence of the duration and conditions of storage on the main indicators of quality at the Research Laboratory of the Ukrainian Institute of Physical Chemistry by L.V. Pisarzhevsky NAS of Ukraine.

Presenting main material. One of the methods that make it possible to determine the hydration ability of substances and their thermodynamic parameters is the analysis of sorption isotherms. The sorption characteristics of the pastyl products were defined on sorption-vacuum system by Mac-Ben.

The isotherms of adsorption-desorption of water by pastyl products are shown in Pic. 1. in coordinates in the amount of adsorbed water − its activity, which is directly linked to the relative equilibrium vapour pressure $a_w = P/Ps$ [2].

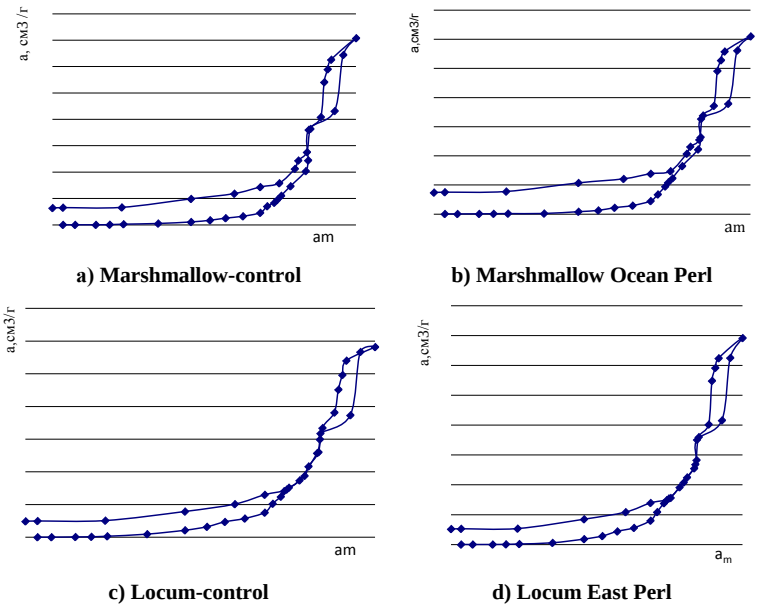
It may be noted that the obtained isotherms of adsorption-desorption of water are S-shaped character and remind multimolecular adsorption isotherms with well-developed hysteresis. These isotherms are characteristic thin porous adsorbents with a rigid porous structure. However, in the case of water adsorption by pastyl products, their porous structure is labile; it means that it changes during swelling polysaccharides.

In a detailed analysis of the adsorption isotherm form according to Pic. 1, we can note the undulating nature of the adsorption curves in the range of activities $a_w = 0,0:0,75$.

This complex nature of the curves can be compared with the gradual development of lenhmiurovsky adsorption isotherm corresponding to the formation of the first and second hydration shells around the centre of the surface active hydrocolloids, which is part of the new pastyl products [4]. Thus, the adsorption isotherm can be divided into three zones, in which the mechanism of adsorption and the amount of the adsorbed water will depend on the structure of hydrocolloid consisting churned developed products.

The first zone I ($a_w = 0-0,35$) corresponds to the hydration of the most active adsorption centres, which include ethyl and carboxyl hydrophilic group -CH_2OH, -COOH. The interaction of water molecules with these groups will lead to the penetration of water into the spaces between the individual chains of polysaccharides and their partial extension. Consequently, it is possible the penetration of water molecules to the other active centres of pastyl products, such as hydroxyl groups of glucose rings. Thus, during the formation of a monomolecular layer (a_m) water is associated with hydrophilic groups' hydrocolloids due to hydrogen bonding and polar water-water and ion-dipole interactions. This most tightly bond water is characterized by physical and chemical properties that are different from the properties of bulk water. It has a different heat capacity, density, viscosity, thermal conductivity, ability to dissolve, lower temperature of the freezing point and so on [6].

The next stage of hydration of polymers, which is a part of the zone II of the pastyl products, similar to the second lenhmyurovsky adsorption, which is manifested in the rise of the adsorption curve in the range of activities $a_w = 0,35-0,75$.



a) Marshmallow-control b) Marshmallow Ocean Perl

c) Locum-control d) Locum East Perl

Pic. 1. Isotherms of adsorption-desorption of water by pastyl products

The zone II – zone of multimolecular adsorption must be considered within the scope of a_w = 0,26–0,70, because the experiments were carried out in the summer period, when the relative humidity of air was 70%. According to our data, the equilibrium moisture marshmallows (control sample) is 14%, according to a recipe – 16%, indicating that at a_w = 0,70 is lost moisture to equilibrium, it means 14%, and the prototype is the equilibrium moisture 16% at a_w = 0,70 will not be lost and absorbed moisture to 17%. The same dependence is observed in the experimental and control samples of lucum (Turkish delight).

In the zone III is the diffusion of moisture in capillary-porous pastyl products which is accompanied by swelling and gelling, this zone corresponds to the water most mobile and least bonded. In gelling products it is physically bonded. The amount of water adsorbed in the third zone is 50-88% of water (at a_w = 1.00). This range of values of relative humidity is due to the fact that there are recommendations for storing most ready confectionary at a relative humidity of 70-75% [7]. However, there might be such storage conditions, the relative humidity is less than or more than the established standards as a range of values of relative humidity has been expanded from 65 to 80%.

The greatest ability to absorb moisture is delight-research as = 0.23 cm^3/g and delight-control as = 0.21 cm^3/g, the lowest – marshmallows control as = 0.14 cm^3/g. In table 1 are the numerical values of free and bonded moisture in the samples of pastyl products in different zones equilibrium. Free water has the enthalpy of vaporization and is almost the same as pure water, it freezes and a solvent.

Table 1

The amount of bound and free water

P ≥ 0.95, n = 5

Pastille products	The amount of bound and free water, cm^3/g		
	zone I and zone II, am+an	zone III, free water av	the total amount of sorption water as=am+an+av
Marshmallow-control	0,02	0,12	0,14
Marshmallow Ocean Perl	0,04	0,11	0,16
Locum-control	0,03	0,18	0,21
Locum East Perl	0,05	0,17	0,23

From the data presented in the table, we can conclude about the ability of hydrocolloids, which is part of pastyl products to bind moisture. The largest number of tightly bonded moisture is typical for the (Turkish delight) lucum with the supplement of Lamidan, compared with control samples. This is due to the presence of starch, which is part of the lucum and the action of alginic acid (consisting Lamidan).

Taking into account that the samples of the fresh-made marshmallow with moisture 16-17%, and the lucum – 22-24% found that the most intense moisture removal, will be observed in control samples marshmallow at a relative humidity of 75% and is 14%. In the prototype with the supplements of the equilibrium humidity φ = 75%, contains 22%, because the intensity of moisture removal is much lower than in the control sample. This leads to the phenomenon of absorption of moisture from samples of marshmallow environment that will lead to an increase in the proportion of the liquid phase of marshmallow and dissolution of crystals of the solid phase. Obviously, the process of moisture absorption effects on the supplement of cycorlact, which contains in its composition fructose. Because of marshmallows with cycorlact and Lamidan should definitely keep packing.

A dosage of cycorlact 7%, instead of sugar, makes it possible to increase the term of packaged pastyl products from 30 days to 90 days. Therefore, we can recommend and use cycorlact and Lamidan in the production of pastyl products of extended term storage.

The comparative analysis of the isotherms according to Pic. 1 indicates that the desorption of isotherm (drying) in all samples were placed above the sorption isotherms (hydration). The nature of the hysteresis loop indicates that the object, along with the typical process of adsorption and capillary condensation occurs swelling and gelling during moisture absorption. Hysteresis loop covers the entire span of the equilibrium vapor pressure. This leads to the fact that the process is completely irreversible. After desorption process in all samples is 0.01-0.03 cm^3/g of wet. These findings may indicate that some of the adsorbed moisture is associated with the sample very strong connection, most probably chemical. This moisture is released during desorption under these conditions. The largest amount of residual moisture contains in researched marshmallow with supplement of Lamidan.

To assess the capillary-porous structure of pastyl products determined their geometrical parameters: specific surface area, sorption pore volume, mean pore radius (Table 2).

Table 2

Geometric parameters of porous structure of pastyl products

P ≥ 0.95, n = 5

№ з\п	Назва зразка	S, $м^2\г$	Vs, $см^3\г$	d, A	R^2
1	Marshmallow-control	1	1,41	56400	0,5319
2	Marshmallow and Lamidan	2	1,22	24400	0,9869
3	Locum-control	2	1,16	23200	0,846
4	Locum and Lamidan	6	1,38	9200	0,4819

The sorption characteristics of the pastyl products were determined on sorption vacuum system by Mac-Ben, where previously dehydrated samples carried the sorption of water vapour until the hygroscopic moisture after desorption was held at steady state.

The sorption process of the studied pastyl products cannot be regarded as typical adsorption and capillary sorption processes. During sorption swelling occurs, which is accompanied by the fact of moving water vapour molecules penetrate into the bulk of the polymer, resulting in high-molecular compounds increased mobility. With increas-

ing amounts of moisture absorbed in the polymer chain of molecular mobility and the number of possible locations increases.

At first during the swelling are filled the large pores, then fine. During the swelling of minimum pore diameter changes their sizes in the diffusion of moisture dilate pores and their size increases. Due to the fact that the control is contained marshmallow mesopores with a large diameter is much larger than in other pastyl products, it has a greater ability to swell and increase in viscosity.

Based on these structural characteristics table 2, it is found that the pore diameter of samples is very high and the pores are almost impossible size, but the sample surface, which in formula decides the fate of pore size is very low, which results impossible pore diameter. The low specific surface of pastyl products we owe the fact that the surface of the samples is really smooth, no pores, the samples are very similar to the consistency of rubber, but porous, bonded sugars so that water will not squeeze back. Therefore, the complete absence of pores gives only surface wettability, which causes a very low surface area of samples. That is why; the informative data are data from the calculations pore distribution along the radius, which can be seen as examples of responding to increasing humidity (in our case – the humidity increases in a vacuum).

The data on the distribution of pore radius, it can be concluded that the addition of output samples as marshmallow and lucum, algae increases their pore diameter, and most importantly, increase their number, causing greater adsorption properties. However, the more porous samples should be longer soft, which have desirable consumer characteristics [5].

The number of microorganisms in all samples of the pastyl products, regardless of the method of packing, during the first 30 days of storage is gradually increased. With further storage their amount decreased. This can be explained by the fact that after 30 days of storage the products lose free water and some of its share passed in a bound state, inaccessible to microorganisms. The quantitative and qualitative composition of the micro flora, as a measure of safety of pastyl products during storage was within the norms established standards, allowing recommending the new pastyl products for safe consumption during 90 days of storage; term storage is increased by 3 times compared to the guarantee period set standard.

Conclusion. Thus, thanks to the addition of dietary supplements Lamidan was performed the stabilization of the structural and physicochemical properties of churned confectionery, which contributed to the increase of aggregative stability of finished products for a long time.

On the basis of these studies were developed the specifications for new types pastyl products with long term of the storage, developed and approved recipes technological instructions.

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ЗБИВНІ КОНДИТЕРСЬКІ ВИРОБИ З ПОДОВЖЕНИМ ТЕРМІНОМ ЗБЕРІГАННЯ

Анотація
Досліджено вплив внесених добавок та способів пакування на подовження гарантованого терміну зберігання збивних кондитерських виробів, а також зміни їх якості у процесі зберігання. У процесі досліджень використано загальноприйняті та сучасні методи. На підставі проведених досліджень доведено, що додавання у збивні кондитерські вироби водоростей збільшує кількість та діаметри пор, обумовлюючи більші адсорбційні властивості. Більш пористі зразки довше зберігають м'яку структуру, що є бажаними споживними властивостями готових виробів. Аргументовано можливість подовження терміну зберігання збивних кондитерських виробів з 30 до 90 діб шляхом одночасного використання у складі Ламідану і цикорлакту.
Ключові слова: активна вода, адсорбція-десорбція води, гідроколоїди, збивні кондитерські вироби, Ламідан.

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СБИВНЫЕ КОНДИТЕРСКИЕ ИЗДЕЛИЯ С УВЕЛИЧЕННЫМ СРОКОМ ХРАНЕНИЯ

Аннотация
Исследовано влияние внесенных добавок и способов упаковки на увеличение гарантийного срока хранения сбивных кондитерских изделий, а также изменения их качества в процессе хранения. В процессе исследований использованы общепринятые и современные методы. На основании проведенных исследований доказано, что добавление в сбивные кондитерские изделия водорослей увеличивает количество и диаметры пор, обуславливая большие адсорбционные свойства. Новые изделия с более пористою структурою дольше сохраняют пышность и мягкость, что характеризует положительные потребительские свойства готовых изделий. Аргументировано возможность продления срока хранения сбиных кондитерских изделий с 30 до 90 суток путем одновременного использования в составе Ламидан и цикорлакт.
Ключевые слова: активная вода, адсорбция-десорбция воды, гидроколлоиды, сбивные кондитерские изделия, Ламидан.

УДК 690.9

МІЖНАРОДНИЙ ДОСВІД З ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ ВИКОРИСТАННЯ ЕНЕРГОРЕСУРСІВ

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Забезпечення ефективного, надійного й екологічно безпечного енергопостачання за ринковими цінами є одним з найважливіших факторів для всіх країн світу. Енергоефективність на міжнародному рівні визнано як основний пріоритет енергетичних стратегій. Головною метою даної статті буде огляд підходів різних країн щодо підвищення енергоефективності споживання паливно-енергетичних ресурсів (ПЕР).
Ключові слова: енергоспоживання, енергоефективність, енергетичні ресурси, економіка, країна.

Постановка проблеми. Сьогодні політика в галузі енергоефективності має три складові – економічний розвиток і конкурентоспроможність, енергетична безпека та попередження зміни клімату. Енергоресурси мають важливе значення для поліпшення якості життя та розширення можливостей для всіх країн. Національні концепції енергетичної безпеки розвинених країн мають такі цілі: прискорений розвиток традиційних внутрішніх джерел енергії (вугілля, нафти, газу) для послаблення залежності від імпорту; скорочення енергомісткості за рахунок підвищення енергоефективності, розвиток енергоощадних, екологічно чистих технологій та альтернативної енергетики; розумне співвідношення ринкових відносин з державним регулюванням, включаючи перспективне планування розвитку галузей; створення та підтримання відповідних обсягів стратегічних запасів ПЕР [1-5, 7]. Особливістю держав Західної Європи є обмеженість запасів первинних джерел енергії і нерівномірність їх розподілу по країнах. Станом на 2012 р. рівень імпортозалежності ЄС становив 53,4% [7]. Для багатьох країн (Данія, Ісландія, Канада, Німеччина, Норвегія) нетрадиційна енергетика сьогодні є важливим компонентом енергозабезпечення [2]. Енергоефективність – це ключовий пункт стратегії «Європа 2020», спрямованої на створення умов для стійкого зростання і розвитку.

Аналіз останніх досліджень і публікацій. Аналіз даних Міжнародного енергетичного агентства (МЕА) свідчить про швидке збільшення обсягів споживання енергетичних ресурсів країнами, а також на зростання їх залежності від імпорту (рис. 1). У дослідженні World Energy Outlook 2014 МЕА визначено енергоефективність як «важливий інструмент» для послаблення напруження в постачанні енергоносіїв.

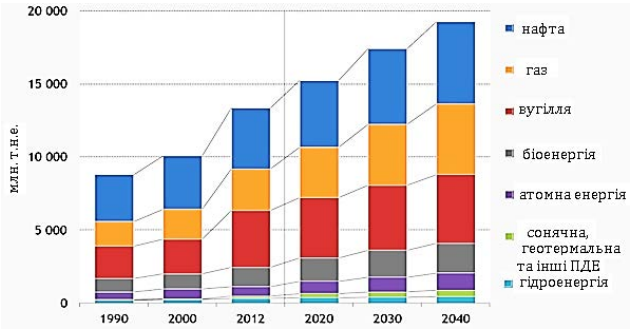

Рис. 1. Світове споживання первинної енергії
Джерело: World Energy Outlook (WEO) 2014

Основні енергоспоживаючі країни проголосили пріоритетні напрями енергоефективності: Китай поставив за мету скоротити енергомісткість на 16% до 2015 року; Сполучені Штати прийняли нові ефективні стандарти з економії енергетичних ресурсів [3]; Європейський Союз зобов'язався скоротити свій попит на енергоресурси у 2020