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OBTAINING MELON AND WATERMELON CONCENTRATES

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The article is devoted to solve the issue of increasing of efficiency of using of local cucurbits crops. It is offered to obtain melon and watermelon concentrates and then to apply them as additives to confectionery products, desserts, ice-cream. There is review of scientific investigations in processing of melon and watermelon is conducted. Cucurbits crops (melon and watermelon) have high food value and complex of biological active substances, they possess by therapeutic action on human organism. Technology of concentrates from melon and watermelon is developed. Their sensory indicators and physical-chemical composition are determined in laboratory conditions. Melon and watermelon consumption rates to produce concentrates are defined. Due to sweet taste of the melon and watermelon concentrates quantity of sugar in a receipt of confectionery products, desserts, ice-cream may be decreased.

Key words: technology, concentrate, additives, melon, watermelon, product.

ҚАУЫН МЕН ҚАРБЫЗ КОНЦЕНТРАТТАРЫН АЛУ

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Мақала жергілікті бақша дақылдарын пайдалану тиімділігін жоғарылату мәселесін шешуге арналған. Қауын мен қарбыз концентраттарын алып, оларды қоспа ретінде кондитер өнімдері, десерт, балмұздақ және өнімдердің өндірісінде қолдануға ұсынылады. Қауын мен қарбызды өңдеу саласындағы ғылыми зерттеулердің шолуы жүргізілген. Бақша дақылдары (қауын мен қарбыз) жоғары тағам құндылығы мен биологиялық белсенді заттардың жиынтығына ие, олар адам ағзасына емдік есер береді. Қауын мен қарбыз концентраттарының технологиясы құрастырылды. Зертханалық жағдайда олардың органолептикалық көрсеткіштері және физика-химиялық құрамы анықталды. Қауын мен қарбыз концентраттары тәтті дәміне ие болғандықтан, кондитер өнімдері, десерт, балмұздақ және өнімдердің рецептураларында қант мөлшерін төмендетуге болады.

Негізгі сөздер: технология, концентрат, қоспа, қауын, қарбыз, өнім.

ПОЛУЧЕНИЕ ДЫННОГО И АРБУЗНОГО КОНЦЕНТРАТОВ

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Статья посвящена решению проблемы повышения эффективности использования местного бахчевого сырья. Предложено получать дынный и арбузный концентраты и затем применять их в качестве добавок к кондитерским изделиям, десертам, мороженому. Про-веден обзор научных исследований по переработке дыни и арбузов. Бахчевые культуры (дыня и арбуз) имеют высокую пищевую ценность и комплекс биологически активных веществ и обладают терапевтическим действием на человеческий организм. Разработана технология дынного и арбузного концентратов. В лабораторных условиях определены их органолепти-ческие показатели и физико-химический состав. Определены нормы расхода дыни и арбузов на изготовление концентратов. Благодаря сладкому вкусу дынного и арбузного концентратов количество сахара в рецептурах кондитерских изделий, десертов, мороженого может быть снижено.

Ключевые слова: технология, концентрат, добавки, дыня, арбуз, продукт.

Introduction

Cucurbits crops have high food value and complex of biological active substances varying by chemical composition and, consequently, by therapeutic action on human organism. It is found out, that pectin substances of cucurbits crops are able to bond ions of the heavy metals and remove them from human organism [1]. Furthermore, cucurbits crops are reach by macro-, micronutrients and vitamins necessary for a productive life. For example, a half of daily need in vitamin E and ascorbic acid is satisfied factually at including in a daily ration 500 g of melon. Microelements and vitamins presented in watermelon stipulate metabolic processes in a liver, improve fel composition, prevent stone formation in a gall bladder and ducts, possess by antisclerotic action. Therefore a watermelon is used as an effective remedy for chronic hepatitis, cholecystitis etc [2,3].

Melon (Cucumis melo**)** and watermelon (Citrullus lanatus) are the most distributed and cultivated kinds of cucurbits crops in Kazakhstan. South Kazakhstan is a basic region for cultivation cucurbits crops in the country because a lot of heat and sun light are needed for

growing cucurbits crops and the weather should be hot and dry in their mature stage.

Mostly newly-grown cucurbits crops are used mostly in Kazakhstan. A sun-dried product, honey, jam, compotes etc are made from melon in home conditions. Industrial processing of melon has not used widely yet but scientific interest in the field of melon investigation is increased significantly last years. Issues in this field of study are devoted to researching of chemical composition, developing of methods and devices for storage and processing of melon, creation of new melon products.

Franko E.P. investigated chemical composition of melon of grades Uzhanka and Kolkhozniza 74a/753 and their seeds [4]. The analysis of results shows that melon flesh contains a complex of biologically active substances and nutrients. Amino acid composition of melon is represented by irreplaceable acids. There till 60% of proteins, from 23 to 30% of fats in melon seeds.

Hui Y.H. investigated influence of such disinfecting substances as hydric dioxide, chlorine dioxide and organic acids [5]. As a part of the study it is found that processing of melons by hydric dioxide elongates shelf life of field-fresh yield on 4-5 days compare to processing by chlorine dioxide.

Thompson A. K. offered applying of differential colorimeter for measuring melon peel colour. Peel colour depends on content of chlorophyll in it, which quantity is changed during fruit maturating process. Therefore, it is possible to determine degree of melon maturity by peel colour [6].

Cirulli M. and Ciccarese F. revealed that applying of potassium fertilizer promotes decreesing a breathing rate of watermelons in postharvest phase [7].

Yerkebayev M.Zh. et al created a device for peeling pieces of melon which has simple and reliable construction [8].

Ali Mohamadi Sani et al [9] studied effect of temperature and concentration on density and rheological properties of melon. Results showed that the four-term polynomial model is the best model for computing density values from temperature and concentration. The measured shear stress was within 1.69-780 Pa, corresponding to viscosity range of 0.016-0.237 Pa·s. Within the tested conditions, the concentrate exhibited a pseudo plastic behavior. Temperature had an inverse effect on shear stress and apparent viscosity.

Karina G. Angilelli et al [10] studied multicomponent diffusion during osmotic dehydration process in melon pieces. The transfer of sucrose and fructooligosaccharides (FOSs) to melon and water to solution was modeled based on generalized form of Fick's second law for simultaneous diffusion and resolved by the finite element method using the software package COMSOL Multiphysics 3.2. The developed system for diffusion simulating water and solutes will enable control and modulation of the sucrose and FOS content in melon pieces.

G.A. Makanjuola [11] designed a machine for shelling the seeds. Based on a large number of measurements, empirical equations are proposed to express the correlation between the 3 principal dimensions for the 2 most common types of melon seed produced in the Western State of Nigeria. Another set of equations are suggested to estimate the surface area of the flat side with reasonable degree of accuracy from the measurement of either the length or the breadth of the seed.

The biggest range of researches is devoted to developing various melon products.

Admaeva A.M. et al [12-14] worked out nectars and soft drinks on the base of melon juice. Composition of these products includes juices of fruit and berries, honey and dogrose extract as well that gives increased food and biological value.

The method of preparation dessert includes grading, inspection, washing and removing of inedible parts [15]. Melon is cut on pieces, plum is cut in half and bones are removed. Then melon and plum are mixed, cooled at the temperature 3-5ºC during 8-24 hours and frozen at the temperature -35^0C. The frozen dessert is stored at the temperature -18^0C during 12 months.

Another method of the same name involves grading, inspection and washing of melon, removing of inedible parts, cutting on cubes (30×30 mm) or plates (15×50 mm). Simultaneously puree is prepared from melon and other raw materials, mixed with pectin solution till achieving mass with uniform consistency [16]. Prepared melon pieces are packed according to a formulation in polyethylene packets which are moisture-proof and stable to low temperatures. Then mixture of melon and/or plum puree and pectin solution is added. Filled packets are closed, cooled and frozen.

Pento V.B. et al developed a method for production food from melon provided its preparation, cutting, convective drying till intermediate humidity, holding under pressure at heating till temperature not low than 100°C, releasing of a pressure till atmospheric one, completion of drying in the field of microwave frequencies till content of dry substances not low than 85%, adding taste agents and filling in polymer or composite material packages [17]. Alteration of pressure leads to evaporation of part of residual moisture and swelling of melon and absence of contact with oxygen decelerates nonenzymatic oxidizing and elongates shelf life of the food.

Zolotarev A.G. processed watermelon juice into paste by the method of vacuum drying [18].

Gish A.A. created technology of complex processing of cucurbits crops including cutting of raw material by focused hydro-beam, blanching raw material under pressure of gaseous carbon dioxide, vacuum SHF-drying, cold concentration [19]. At that such new products as watermelon paste, watermelon-sea-buckthorn-apple cocktail, watermelon-cherry drink, pumpkin jam, melon paste, dry melon concentrate, melon juice.

Described above investigation results allow to make next conclusion. Melon and watermelon owing to wealthy composition by essential macro-, micronutrients and vitamins became an object of many researches. It is efficiently to produce concentrated melon and watermelon products that may be applied independently or included into composition of floury confectionery products, drinks, desserts, ice-cream, sweets etc.

For these purposes a technology of melon and watermelon concentrates was developed.

Objects and Methods of Research

Melon and watermelon grown in South Kazakhstan are used as a basic object of research. Flesh-free melon concentrate and concentrate with flesh were developed.

Physical-chemical analysis

Physical-chemical composition of the concentrates was determined by standard physical-chemical and sensory analysis:

- content of dry substances by government standard GOST 8756.2 «Concen-trated food products. Methods of determination of dry substances or moisture»;
- content of ash by GOST 27494 – 87 «Flour and bolting. Methods of determination of ash content»;
- content of carbohydrates by GOST 5903-89 «Confectionery products. Methods of determination of sugar content»;
- titrable acidity by ST RK 1621-2007 «Horticultural products. Determination of titrated acidity»;
- content of proteins by Kjedahl method [20].

Making concentrates from melon and watermelon was conducted in next way. Medium-size melon and watermelon were washed thoroughly, bisected with removing seeds, cut on pieces with sizes 3-4 cm, peeled. Obtained mixture of juice and flash was boiled down at the temperatures 65-70 ^{0}C during 120-130 minutes till achieving dense consistency. The height of layer of the raw mixture was 8-10 cm. Ready melon and watermelon concentrates had dense and runny consistency. The hot ready products were filled in glass containers, closed and cooled till 18-20 ^{0}C. Then containers were stored at the temperatures 5-6^{0}C.

Sensory indicators of the concentrates were determined by standard organoleptic analysis.

Results and their Discussion

Melon and watermelon concentrates possess by following sensory (table 1) and physical-chemical indicators (table 2). Melon and watermelon consumption rates to produce concentrates are given in the table 3.

Table 1 - Sensory indicators of melon and watermelon concentrates.

Kind of product	Sensory indicators				
	colour	smell	taste	consistency	appearance
melon concentrate	light-brown	peculiar to melon	very sweet	dense and runny	dense liquid with flash
watermelon concentrate	vinous	peculiar to watermelon	sweet	dense and runny	dense liquid with flash

Both concentrates have runny consistency that is appropriable for their applying as additives for confectionery products, ice-cream, desserts etc.

Table 2 - Physical-chemical indicators of melon and watermelon concentrates

Kind of product	Proteins, %	Dry substances, %	Carbohydrates, %	Ash, %	titrable acidity, %
melon concentrate	1,86	24,1	15,21	0,53	0,56
watermelon concentrate	0,7	21,15	15,91	1,11	0,87

Physical-chemical indicators of ready concentrates give evidence that they are rich by carbohydrates and proteins and they will boost composition of confectionery products, ice-cream, desserts etc. At that, at almost equal quantity of carbohydrates, concentrates are differed by amount of proteins: in melon concentrate it is more than twice higher compare to watermelon one.

Table 3 - Melon and watermelon consumption rates to produce concentrates

Kind of raw material	Consumption rate for 1 ton of ready product, kg
melon	3842
watermelon	6294

As it is seen from table 3, compare to melon concentrate, quantity of processed watermelon to produce concentrate is higher on 40% approximately. It is explained with more liquid consistency and higher moisture content.

Conclusions

It should be noted that the concentrates from melon and watermelon are prepared without adding of sugar, but they have sweet taste. Due to their taste quantity of sugar in a receipt of a confectionery product, dessert, etc. may be decreased. It is possible to apply developed concentrates as a stuffing and additives at production of confectionery products, sweet dishes, ice-cream etc. The following stage of this research is development of optimal receipts of various products with melon and watermelon concentrates.

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ТАҒАМ ӨНДІРІСТЕРІНІҢ ОБЪЕКТІЛЕРІ МЕН ҮДЕРІСТЕРІН КОМПЬЮТЕРЛІК МОДЕЛЬДЕУ

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Тағам өндірістеріндегі объектілер мен процестерге математикалық модельдеуді кеңінен қолдану қажеттілігі көрсетілген. Объектілер мен процестерді компьютерлік модельдеудің мысалдары және математикалық модельдердің негізгі процестері келтірілген. Лимон, Апорт, Столовка алмаларынан берілген параметрдегі композитті шырын алу мысалы келтірілген. Нәтижесінде, Microsoft Excel бағдарламасында перспективті-нормативті модельдеу әдісін қолдану арқылы титрлеу қышқылдығы 0,3%, С дәрумені 0,02% болатындай шырындардың қосылатын пайыздары есептелді.

Негізгі сөздер: компьютерлік модельдеу, математикалық модель, тағам өндірісі, композитті шырындар, С дәрумені, титрлеу қышқылдығы.

КОМПЬЮТЕРНОЕ МОДЕЛИРОВАНИЕ ОБЪЕКТОВ И ПРОЦЕССОВ ПИЩЕВОЙ ПРОМЫШЛЕННОСТИ

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В статье показана необходимость широкого применения математического моделирования объектов и процессов в пищевых производствах. Приводятся основные принципы компьютерного моделирования, примеры математических моделей процессов и объектов. Приведен пример моделирования яблочного сока с заданными параметрами из композитных соков из яблок сортов Лимон, Апорт, Столовка. В результате с помощью перспективно-нормативного моделирования на Microsoft Excel получен расчет процентов добавляемых соков для обеспечения титруемой кислотности 0,3% и витамина С 0,02%.