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Материал поступил в редакцию 11.12.2023 г.

DOI: 10.53360/2788-7995-2023-4(12)-17

ISTIR: 68.35.71

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JUSTIFICATION OF PROGRESSIVE TECHNOLOGY FOR DRYING VEGETABLES AND CORN

Abstract: *Today, from the industrial applications point of view, getting dry food products by infrared radiation is considered the most relevant and perspective. Such properties of any object as absorption and emission of radiation in the infrared spectrum give possibility to dry them at moderate temperatures and rapidly. This technology makes it possible to gain dry items with high shelf-life due to their resistance to microorganisms. Infrared drying of products reduces drying time several times. As a result, the quality of ready items is very high and in addition ecologically pure. Also the form of cutting of raw materials before drying has some influence on time of process. The objects of study were samples of vegetables and corn planted in the experimental plot Kainar Bulak (Shymkent).During the drying process, vegetables as carrot and beet which were broken in the form of shavings reached required moisture 12.30% and 11.50% accordingly in two and half hours. Samples in the form of cubes were dried to these numbers only in three hours. Additionally, performed experiments indicate that there is no need for preliminary heat treatment (blanching) of samples. Reducing the time and temperature of heat treatment for corn also gave positive results. Thus, drying chopped vegetables and corn for further use in the food industry using infrared radiation is promising and cost-effective.*

Key words: *drying; vegetables; corn; cutting; form; preliminary; treatment; infrared.*

Introduction

Current requirements for optimal drying parameters for fruit and vegetable preservation should be cost effective, decrease process time and without any destruction of the product [1]. Drying of food products may be performed by ordinary sun or wind ways and advanced drying techniques with infrared spectrum, vacuum, microwave and freeze. Various advanced drying methods are considered optimal to get high-value products in short duration and with prolonged storage time [2].

The quality of dried products depends to a large extent on the preliminary preparation of the raw material for drying. In this aspect brief heat treatment to inactivate enzymes, eliminate

appearance of foreign flavours and reduce possible initial contamination improve the quality of the ready products [3-5].

Progressive drying by infrared radiation according to the authors of [6] is considered the most relevant and promising because it has a stronger effect on food products, both due to greater penetration depth and a more effective effect on the molecular structure of products and as a result infrared radiation removes free water contained in the product. Furthermore, this method excludes the preliminary heat treatment (blanching) of samples before drying and allows almost completely preserving vitamins, biologically active substances, natural color, taste and aroma of dried products [7].

Beetroot, carrots and corn were planted on the experimental field by students of the Agroindustry Faculty of M.Auezov SKRU. The named vegetables are widely used to produce dried vegetable products, and corn is used in industry to produce a wide range of snacks as flour, cereals, and flakes.

The yield of the dried product depends, first of all, on such an indicator as the dry matter content substances in the original product. Carrot varieties with dry matter content of at least 13%, of which sugars make up 4-6% and beet varieties intended for drying contain dry matter of at least 14%, of which sugars must make up at least 8% [8]. So, the qualitative characteristics of carrots and beets fully comply with the requirements for varieties of vegetables intended for drying.

The moisture content of corn grain during harvesting is about 40%, so it can be preserved mainly only by drying. Seed grain drying is characterized by a long process and high specific energy costs. At the same time, drying objects, like most food plant raw materials, are thermolabile or require the use of a drying agent of low thermodynamic potential [9,10].

The purpose of the research is to determine the optimal range of safe and permissible heating temperatures of infrared drying and optimal preliminary preparation way of vegetables and corn grains.

Objects and methods of research

In order to provide the work vegetables and corn planted in the experimental plot Kainar Bulak (Shymkent) were used. Land area: 2.8 hectares. The works on cultivation of vegetables and corn were carried out from April to September.

An experimental study of the process of infrared drying of vegetables and corn was carried out on an infrared drying installation ShS-80 of the Scientific Research Laboratory "Problems of Agro-Industrial Complex and Energy Information Resources" of M. Auezov SKRU. The work used generally accepted organoleptic, physicochemical methods for studying the properties of raw materials and dried vegetable products.

Results and discussion

The process of getting dried products from vegetables and corn includes three main stages: pre-processing, drying and post-drying. Usually the pre-treatment step is used to increase the rate of dewatering at performing the process and obtain items of high quality [11]. To speed up the process of drying vegetables, it is necessary to break down the fiber that retains moisture, for which we also provide preliminary processing of raw materials. It was necessary to define sufficient shape of subjected to heating raw materials and necessity of preliminary treatment (blanching) in this study.

At the first stage, samples were dried to determine the optimal range of safe and permissible heating temperatures for vegetables and corn grains in convective and infrared drying modes. The results of the comparative analysis showed that, in terms of organoleptic characteristics, drying vegetables at a temperature of 40-50°C was the most acceptable. Reducing the time and temperature of heat treatment for corn also gave positive results. At high temperatures, the number of cracked grains with lower strength increased. In addition, ingrains dried at high temperatures, the outer tissues become denser faster than the inner tissues. So, the movement of moisture from the internal parts became difficult, which leads to destructive changes in the corn grain (Figure 1). But we must take into account the fact that the moisture content of corn grains at a heating temperature of 40-50°C must be performed in two stages: from 40 to 26% and from 26 to 14%.

Next, the effect of slicing on changes in the moisture content of the samples was investigated. The final result of the obtained values was taken arithmetic mean of three parallel moisture values obtained under repeatability conditions. Figures 2 and 3 show a characteristic pattern of changes in the mass fraction of moisture in dewatered vegetables (carrot and beet) of various shapes. During the drying process, vegetables as carrot and beet which were broken in the form of shavings reached required moisture 12.30% and 11.50% accordingly in two and half hours. Samples in the form of

cubes were dried to these numbers only in three hours. Indeed, the larger the dried pieces of material, the slower the moisture are removed at the stage of decreasing drying speed.

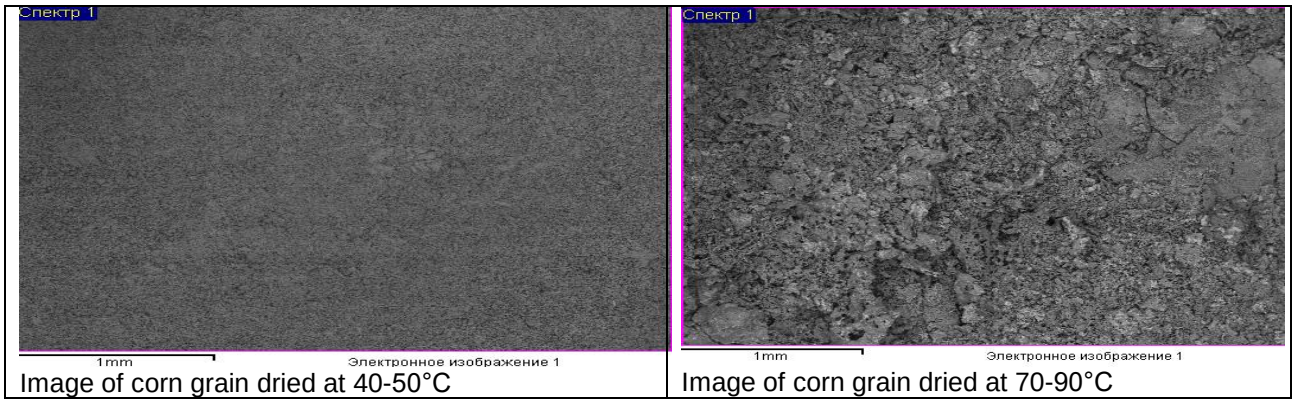

Image of corn grain dried at 40-50°C

Image of corn grain dried at 70-90°C

Figure 1 – Image of corn grain dried at various temperatures

Additionally, performed experiments indicate that there is no need for preliminary heat treatment (blanching) of samples.

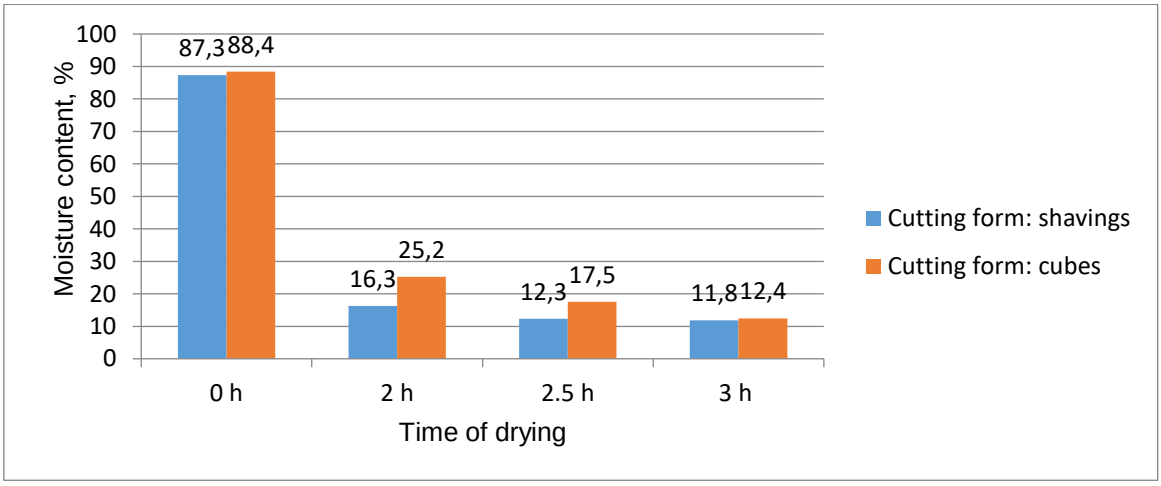

Figure 2 – Influence of the carrot drying time on moisture content

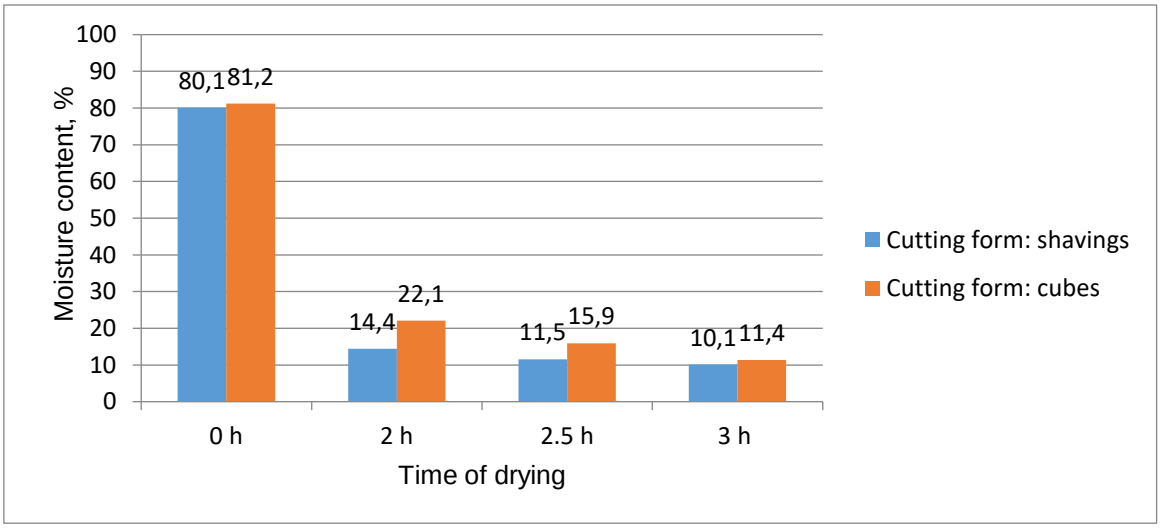

Figure 3 – Influence of the beet drying time on moisture content

The follow stage was definition of sensory characteristics of samples to define the most perspective shape of cutting vegetables. According to the results of sensory analysis of dried

vegetables, shown in the table 1, the advantages of shavings as a cutting form over cubes are insignificant, but they exist. The product cut into shavings has a more attractive, bright, uniform color.

Table 1 – Sensory analysis of dried vegetables

Parameters	Shavings form	Cubes form
Appearance	The particles of dried carrot and beet are whole without breaks, dry, some fragile, porous at the fracture	The particles of dried carrot and beet are whole without breaks, dry, hard, slightly compacted particles
Color of carrot	Orange-red, uniform, bright saturated	Red, heterogeneous, saturated, with minor orange shades
Color of beet	Dark burgundy, uniform, bright, rich	Dark burgundy, heterogeneous, rich, with minor lighter shades

As a result, the comparison of the form of cutting vegetables for drying between shavings and cubes, then in all quality indicators, shavings are certainly preferable.

Next, experimental studies were realized to determine the effectiveness of the ShS-80 infrared drying unit for vegetables – carrots and beets, as well as corn grains in comparison with convective drying. The standard moisture content of corn grains after drying does not exceed 13-14%. The results of the research work on two types of drying various samples are shown in Figure 4.

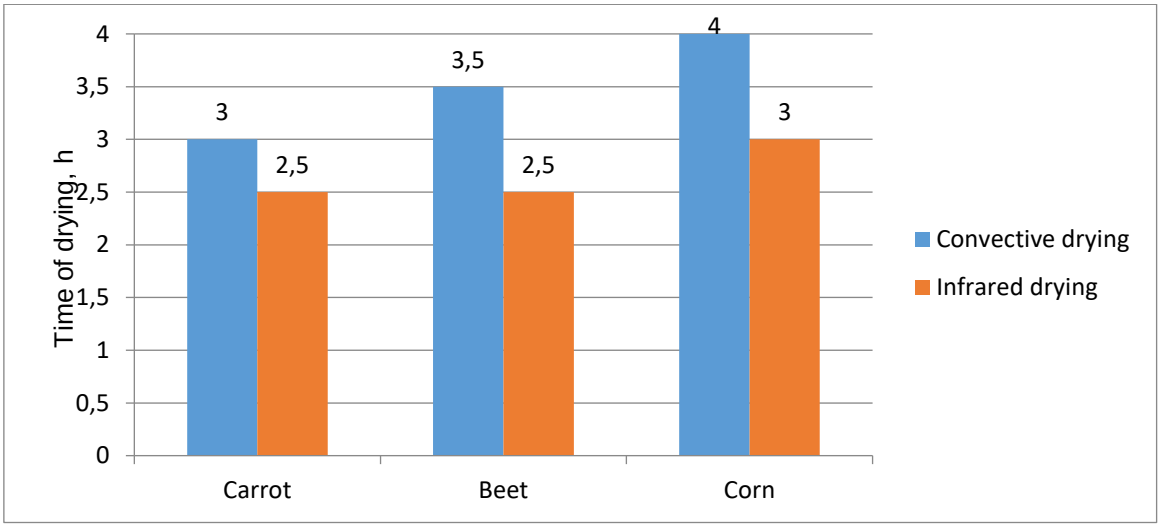

Figure 4 – The results of the research work on two types of drying various samples

The results of the research work on two types of drying various samples by convective and infrared drying show the advantages of last one. Because of moisture removal at low temperatures (40-50°C) and in short duration dried samples preserve natural color, taste, flavour of initial raw material and texture. A number of studies on infrared drying of fruits and vegetables confirm our findings [12].

Conclusion

Therefore, dehydrating chopped vegetables and corn for further use in the food industry using infrared radiation is promising and cost-effective. The next stage of the work will be to perform a full analysis of the biologically active substances (vitamins, antioxidants and others) content in the dried products.

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КӨКӨНІСТЕР МЕН ЖҮГЕРІ ДӘНІН КЕПТІРУ ПРОГРЕССИВТІ ТЕХНОЛОГИЯСЫН НЕГІЗДЕУ

Қазіргі уақытта өнеркәсіптік қолдануда инфрақызыл сәулеленуді пайдаланып тамақ өнімдерін кептіруге арналған кептіру жабдықтары ең өзекті және перспективалы болып табылады. Бұл кез келген объектінің инфрақызыл спектрдегі сәулеленуді жұту және шығарумен байланысты қасиеттеріне байланысты. Материалдар мен заттардың мұндай қасиеттері төмен температурада және қысқа мерзімде кептіруге (инфрақызыл) мүмкіндік береді. Бұл технология сақтау жағдайлары үшін маңызды емес және микрофлораның

дамуына төзімді өнімді алуға мүмкіндік береді. Өнімдерді инфрақызыл кептіру кептіру уақытын бірнеше есе қысқартады. Нәтижесінде энергия ресурстарына және кептіру қондырғыларына қызмет көрсетуге жұмсалатын қаражатты айтарлықтай үнемдей отырып, жоғары сапалы дайын өнім аламыз. Сондай-ақ кесу түріне қарай шикізатты алдын ала өңдеудің артықшылықтары анықталды. Зерттеу объектілері Қайнар бұлақ (Шымкент) тәжірибелік учаскесінде егілген көкөністер мен жүгері үлгілері болды. Кептіру процесінде жоңқаларға кесілген тамыр көкөністер ылғалдың стандартталған массалық үлесіне 2,5 сағатта жеткізілді (сәбіз үшін 12,30%, қызылша үшін 11,50%), текше түріндегі үлгілер қажетті ылғалдылыққа дейін кептіруден кейін ғана кептірілді. 3 сағат. Сонымен қатар, жүргізілген тәжірибелер үлгілерді алдын ала термиялық өңдеу (бланширлеу) қажет еместігін көрсетеді. Жүгеріні термиялық өңдеу уақыты мен температурасын қысқарту да оң нәтиже берді.Осылайша, туралған көкөністер мен жүгеріні тамақ өнеркәсібінде одан әрі пайдалану үшін инфрақызыл сәулелендіруді пайдалана отырып кептіру перспективалы және экономикалық тиімді болып табылады.

Түйін сөздер: *кептіру, көкөністер, жүгері, кесу, пішін, алдын ала өңдеу, инфрақызыл.*

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ОБОСНОВАНИЕ ПРОГРЕССИВНОЙ ТЕХНОЛОГИИ СУШКИ ОВОЩЕЙ И КУКУРУЗЫ

На сегодня с точки зрения промышленного применения получение сухих пищевых продуктов с помощью инфракрасного излучения считается наиболее актуальным и перспективным. Такие свойства любых предметов, как поглощение и излучение излучения в инфракрасном спектре, дают возможность сушить их при умеренных температурах и в короткие сроки. Данная технология позволяет получать сухие изделия с высокими сроками хранения за счет их устойчивости к микроорганизмам. Инфракрасная сушка продуктов сокращает время сушки в несколько раз. В результате качество готовой продукции очень высокое, а также экологически чистое. Также некоторое влияние на время процесса оказывает форма нарезки сырья перед сушкой. Объектами исследования были образцы овощей и кукурузы, посаженные на опытном участке Кайнар Булак (Шымкент). В процессе сушки овощи моркови и свеклы, измельченные в виде стружки, достигли необходимой влажности 12,30% и 11,50% соответственно в двух экземплярах. и полчаса. Образцы в виде кубиков высыхали до этих цифр всего за три часа. Кроме того, проведенные эксперименты свидетельствуют об отсутствии необходимости предварительной термообработки (бланширования) образцов. Сокращение времени и температуры термообработки кукурузы также дало положительные результаты. Таким образом, сушка измельченных овощей и кукурузы для дальнейшего использования в пищевой промышленности с использованием инфракрасного излучения является перспективной и экономически эффективной..

Ключевые слова: *сушка, овощи, кукуруза, нарезка, форма, предварительная, обработка, инфракрасное излучение.*

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Material received on 12.12.2023 г.

DOI: 10.53360/2788-7995-2023-4(12)-18

МРНТИ: 65.63.33; 68.03.07

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ИССЛЕДОВАНИЯ СОСТАВА КИСЛОМОЛОЧНОГО ПРОДУКТА, ПОЛУЧЕННОГО ИЗ КОМБИНИРОВАННОГО МОЛОЧНОГО СЫРЬЯ С ПРИМЕНЕНИЕМ МЕЗО-ТЕРМОФИЛЬНОЙ ЗАКВАСКИ И РАСТИТЕЛЬНОГО ЭКСТРАКТА

Аннотация: *Молочная отрасль, как одна из основных составляющих отраслей пищевой промышленности Республики Казахстан должна не только обеспечивать население традиционными видами молока и продуктов его переработки, но и участвовать в формировании концепции здорового питания путем производства молочных продуктов с новыми пищевыми и биологическими свойствами, ориентированных на оздоровление населения всех возрастных категорий. Одними из таких направлений являются обогащение состава таких продуктов биологически активными веществами из растительного сырья местного произрастания.*

Проведенные нами предыдущие исследования показали, что комбинирование исходного молочного сырья, представленного коровьим и кобыльим молоком в соотношении 85% и 15% соответственно, улучшает физико-химический, минеральный и аминокислотный состав кисломолочного продукта, полученного из этого сырья за счет присутствия в нем кобыльего молока.

Использование экстракта растительного сырья для обогащения кисломолочного продукта, следующий этап наших исследований по получению молочных продуктов функционального действия. В статье, приведены результаты проведенных