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CREATION OF POWDER DURING COLLECTION OF FRUIT AND VEGETABLE RAW MATERIALS – PRESERVATION OF NUTRITIONAL VALUE ACCORDING TO THE “CONVENIENT FOOD” CONCEPT

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The concept of «CONVENIENT FOOD» involves not only the simplification of the daily diet of the average consumer, but also the creation of favorable conditions for the use of natural preservatives/long-term food, while paying special attention to preserving their nutritional value. This, at least, contribute to factors such as growing fruit at a minimum, attracting unnatural remedies and watering moisture; picking up fruits only at a certain stage of maturity and dry weather; storage of raw materials under certain humidity of the wednesdays and certain contents of dry dissolved substances; production of food/food at minimum low temperature exposure and avoiding the involvement of preservatives; products with minimal loss of food value. The exceptional importance of fruit and vegetable raw materials or products/foods in the absorption of fats, proteins and carbohydrates by the human body is well known. This is at least facilitated by such factors as: fruit growing with a minimum of unnatural means and irrigation moisture; harvesting fruits only at a certain stage of maturity and in dry weather; storage of raw materials in conditions of a certain humidity of the environment and a certain content of dry dissolved substances; production of products/food with minimal low temperature exposure and avoiding the involvement of preservatives; products with minimal loss of nutritional value. But, even taking into account the above, after a few weeks the fruit contains almost no residual nutritional value without the involvement of extremely harmful preservatives. In this regard, it may be attractive to develop an innovative project to create a new type of equipment – a mobile agro-food technology complex – a robotic mini-complex for the production of non-preservative fruit and vegetable powder. Thanks to mobility, it is envisaged not only to intensify the existing agro-food functions, but also to change the perception of the organization of processes: to use not only in harvesting, but also involving additional modules in growing trees and crops; to collect fruits regardless of lighting, even at night; attract evaporated water, the content of which in fresh fruit can be up to 90%, as a cleaning solution.

Keywords: convenient food, saving raw materials, nutritional value, dry powder.

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Introduction

The concept of «CONVENIENT FOOD» [1–3] provides not only to simplify the daily diet of the average consumer, but also to create favorable conditions for the use of natural preservatives/long-term food, while paying special attention to preserving their nutritional value. It is well known [4–6] the exceptional importance of fruit and vegetable raw materials or products/foods in the absorption of fats,

proteins and carbohydrates by the human body. This is at least facilitated by such factors as: fruit growing with a minimum of unnatural means and irrigation moisture; harvesting fruits only at a certain stage of maturity and in dry weather; storage of raw materials in conditions of a certain humidity of the environment and a certain content of dry dissolved substances; production of products/food with minimal low temperature exposure and avoiding the

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involvement of preservatives; products with minimal loss of nutritional value. But, even taking into account the above, after a few weeks the fruit contains almost no residual nutritional value without the involvement of extremely harmful preservatives.

Presenting main material

Among the variety of fruits and vegetables, apple fruits can probably be considered the most difficult in non-preservative storage. Annually in Ukraine the apple harvest exceeds 1 million tons, which is desirable to carefully collect and store until spring [7–9].

Modern technologies provide for a separate implementation of a set of agricultural operations for the collection of fruit and vegetables (Fig. 1,a) and food operations for the production of fruits for sale in their original form (Fig. 1,b) or for the production of processed products (Fig. 1,c).

In addition to the above-mentioned unfavorable factors, typical technological schemes (Fig. 1,a) provide for the involvement of a significant number of temporary workers for manual harvesting, processing, sorting, sorting and packaging, which is not only costly but also dangerous. Establishment of innovative planting and selection of extensive orchards (Fig. 2), where difficult to care for trees are spreading and tall are replaced by flat and low. This allows you to solve most problems, such as the

involvement of unnatural means and irrigation moisture, harvesting fruit only at a certain stage of maturity, but harvesting by hand and several transshipments of fruit injures them and significantly reduces the nutritional value. There are still problems with attracting undisinfected and rough packaging, its overfilling and falling (mechanical damage); cleaning without protection from the nails of collectors and in the hot season; long peduncles; keeping in the sun; re-moistening (after drying in fields/gardens); equipment neglect; rubbing lumps of earth/stones.

One of the most important elements of storage (Fig. 1,b) is the significant cost of energy-intensive refrigeration equipment. At the same time, problems with fruit aging, drying quality, Wednesday humidity before storage and, in general, the lack of clear quality standards and regulations for finishing and cooling remain unresolved (Tab. 1).

But chilled raw materials, even while maintaining external attractiveness for a long time, do not allow ensuring acceptable preservation of nutritional value.

In terms of the ability to retain nutritional value for longer, the scheme of non-preservative preservation by drying looks more attractive (Fig. 1,c). Even the presence of certain disadvantages of extensive orchards (Fig. 2), such as: damage to the

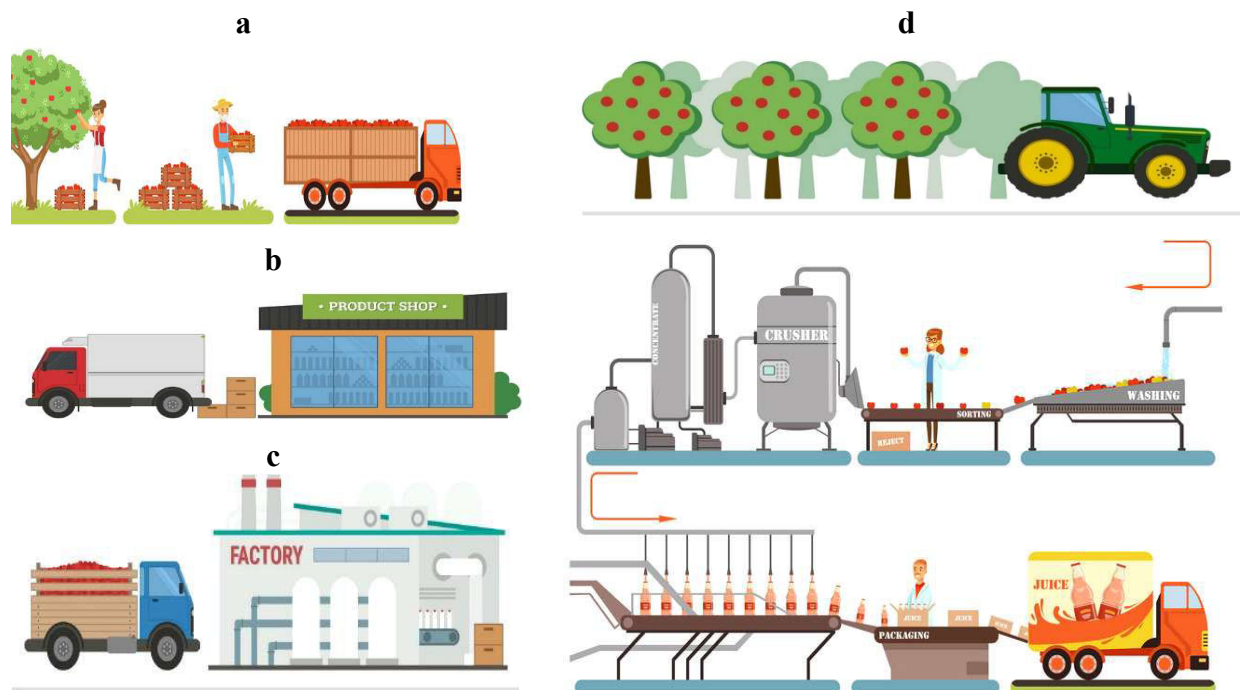


Fig. 1. Schematic diagrams of processing of fruit and vegetable raw materials in a separate agricultural and food operations (a and b or a and c) and the project of joint implementation of agro-food operations (d), where: a – manual harvesting (sorting, warehousing, sorting, storage and several dumping, loading / unloading and transportation); b – sale (storage and several spills, loading / unloading and transportation); in – stationary production (preparation, processing, packing and hermetic packing); d – the robotic mobile minicomplex of production of preservative powder (cleaning, preparation and processing of fruits and packing and hermetic packing of powder)



Fig. 2 Appearance of extensive orchards that are innovative in planning (a), planting and maintenance of breeding trees (b) and accessibility of harvesting (c)

Conditions and terms of storage of fresh fruit and vegetable raw materials at cooling

Table 1

Raw	Storage temperature, °C	Relative humidity of the storage environment, %	Shelf life, days
Cherry	-1...0	85...90	7...10
Grape	0...+1	90...95	30...180
Winter apples	0...+4	90...95	90...270

fruit during overload and poor depreciation of vehicles, unsuitable packaging or transportation in bulk (pressing the lower layers); insufficient ventilation and/or cooling; poor condition of roads; rough handling during loading/unloading; fruit freezing... does not affect the type of finished product, which is a consequence of the recovery of apple powder particles.

Fresh apples submitted for processing [10–12] are sorted, rotten and moldy. Sorted apples are washed in a fan sink and calibrated by size on a drum machine.

The prepared apples are steamed until softened for 10...15 minutes at a temperature of 105 °C in cooking machines at a pressure of 0.02MPa and successively passed through a grid with holes, respectively, 1.5 mm and 0.8 mm on a washing machine. The apple puree is homogenized under a pressure of 10 MPa and dried at a temperature of 145...150°C on a spray or roller dryer with a gap of 0.05 mm. Apple powder is packed and hermetically packed. Recovered with water, apple powder, depending on their ratio, allows you to get products of different consistency, which in color and taste

resembles fresh apples.

The total losses in the production of apple powder are 18...20%.

The process of processing by drying almost any fruit and vegetable raw material has no fundamental difference in machine-hardware design, and some technological features are due to the structure, shape, juiciness, maturity harvested fruits.

The versatility of the evaporation process is demonstrated by the example of softer raw materials - carrots.

Fresh carrots submitted for processing are sorted, rotten, damaged and moldy are separated. Sorted carrots are washed in a cam sink and sized on a drum machine.

Prepared carrots are steamed to soften for 5...10 minutes at a temperature of 105°C in cooking machines at a pressure of 0.01 MPa, peeled on a washing machine, peeled by hand and wiped through a mesh with holes 1.0...1.5 mm on the washing machine. The carrot puree is homogenized under a pressure of 10 MPa and dried at a temperature of 145...150°C on a spray or roller dryer with a gap of 0.05 mm. Carrot powder is packed and hermetically

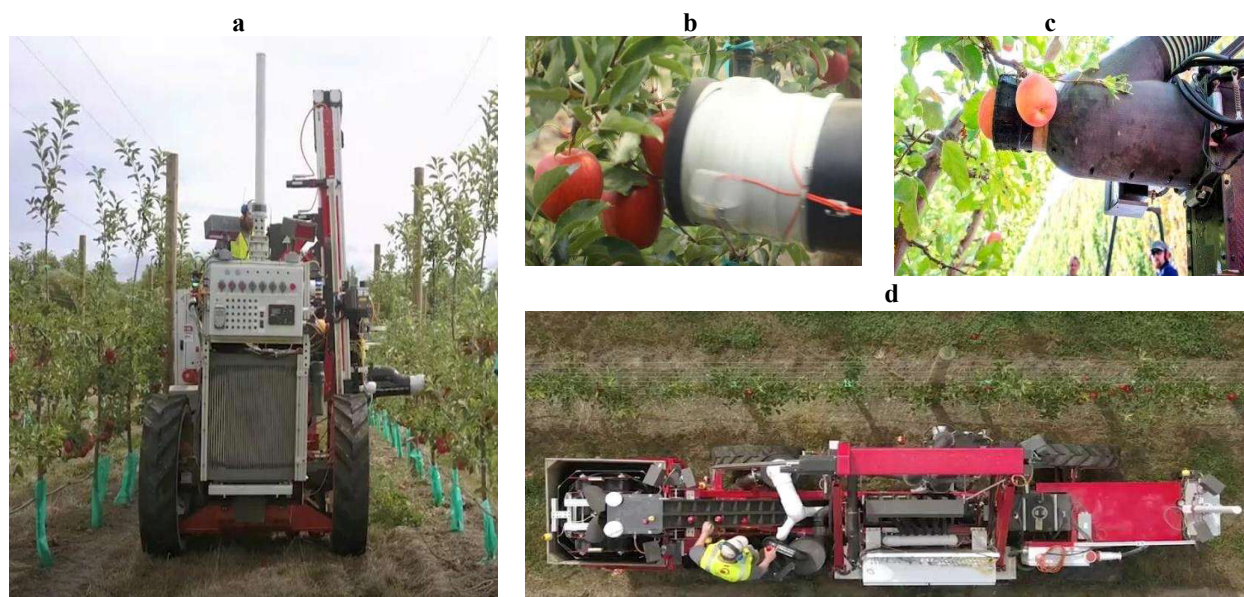


Fig. 3 Appearance of the robotic complex of apple harvesting in extensive orchards (a), vacuum grippers for determining the maturity and removal of apples (b, c) and the conveyor-stacker of removed apples in transport boxes (d)

Table 2

Some useful components of powders of fruit and vegetable raw materials

Raw	Humidity, %	Vitamin C		Carotene		Pectic substances, %	
		Total number, %	% from the original content	Total number, %	% from the original content	Total number	Soluble
Carrots	3.0	29.0	81.0	76.0	90.4	—	—
Tomatoes	3.3	118.7	80.0	—	—	—	—
Apples	3.8	17.0	85.0	—	—	6.9	5.8
Cauliflower	4.9	796.0	89.0	—	—	—	—
Apricot	5.3	31.0	100.0	25.0	96.1	3.8	3.7
Pumpkin	6.0	75.0	84.0	38.0	87.0	—	—

packed. Recovered with water carrot powder allows you to get a product of different consistency, which in color and taste resembles fresh carrots.

The total loss in the production of carrot powder is 20...21%.

Even heat treatment «hot» leaves a high content of useful components in the powder (Tab. 2), which during storage, unlike other preservatives, almost do not change.

Innovative trends in the field of agricultural and food production persistently, in the author's opinion, encourage the search for complementary design and technological solutions, which have, although difficult to implement, but extremely attractive marketing prospects.

Significant recent advances in plant breeding and care are exacerbating the shortage of seasonal workers to harvest, transport, sort, and process crops in a timely and expeditious manner. There are successful developments in the form of [13–15] robotic harvesting systems (Fig. 3), which are significantly more productive and almost independent

of the vagaries of the human factor.

But the given technical decision is limited only by the decision of a question of direct replacement of seasonal workers at harvesting, but problems of its transportation, sorting and processing remain (damages and infringements of technological processes).

For a long time in the agricultural sector, the direction of increasing the capacity of feed production due to [16–18] mobile mini complexes (Fig. 4).

Of course, in contrast to the previous example (Fig. 3), the information provided on the mobile production of feed is not a direct analogy of the existing production of non-preservative fruit and vegetable powder, but can be an innovative basis.

In this regard, it may be attractive to develop an innovative project to create a new type of equipment – a mobile agro-food technology complex – a robotic mini-complex for the production of preservative fruit and vegetable powder on the concept of «convenient food» (Fig. 1,d). The draft takes into account, at a minimum, the following



Fig. 4 Appearance of a mobile mini complex of production and distribution of compound feed trailed to a tractor or car (a), self-propelled on a car chassis (b) and in combination with various additional vehicles (c)

provisions:

- the drive provides selection of power from the engine of the tractor or the car at execution of trailer and from the engine of the automobile chassis at execution self-propelled;

- layout provides unification of connection and installation on the chassis of functional modules (power, assembly, preparation, processing, packing, packing);

- the chassis universal provides use of a standard basis of the truck without fundamental changes of a design (production of a finished product and its delivery);

- specialized chassis involves the use of a special base on the track (row spacing), ground clearance (plant height) and soil pressure (product production only);

- universal wheel engine involves the use of a mechanism to regulate the pressure in the tire of the wheel on the surface of the support (soil of fields or gardens and asphalt highway);

- specialized wheeled engine provides for the distribution of load on each wheel in the need to create a uniform pressure on the soil surface (fields or gardens);

- the energy module provides an autonomous power supply based on an internal combustion engine and a device for updating the washing solution in a closed cycle;

- the harvesting module provides, depending on the humidity and regardless of the lighting, to determine the ripeness of the fruit, its removal without mechanical contact and cleaning from greens;

- the training module provides hydraulic cleaning of solid particles on the fruit, its washing, steaming (if necessary) and peeling (if necessary);

- the processing module provides grinding and thermomechanical vacuum drying of crushed fruits with the formation of dry crumbs and washing solution;

- the module of packing provides giving to a bulk mix of a crumb of a kind of powder of a certain fraction, density, form... and its volume dosing;

- the packing module provides from flat preparation of formation of a packing product transformer, filling with powder, sealing and preparation for transportation.

Conclusions

Thus, the project of the mobile agro-food technological complex of processing of fruit and vegetable raw materials on the concept of «CONVENIENT FOOD» provides not only intensification of existing functions, but also to change representations concerning the organization of processes: to use not only at collecting, but also involving additional modules at cultivation of trees. and harvest; to collect fruits regardless of lighting, ie even at night; attract evaporated water, the content of which in fresh fruit can be up to 90 %, as a cleaning solution.

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СТВОРЕННЯ ПОРОШКУ ПРИ ЗБИРАННІ ФРУКТОВО-ОВОЧЕВОЇ СИРОВИНИ – ЗБЕРЕЖЕННЯ ХАРЧОВОЇ ЦІННОСТІ ЗА КОНЦЕПЦІЄЮ «ЗРУЧНА ЇЖА»

Науменко О.П.

Концепція «ЗРУЧНА ЇЖА» передбачає не тільки спрощення повсякденного харчування пересічного споживача, а й створення сприятливих передумов до вживання ним натуральних безконсервантних продуктів/їжі тривалого зберігання, при цьому приділяючи особливу увагу збереженню ними харчової цінності. Цьому, зокнайменше, сприяють такі фактори, як: вирощування плодів при мінімумі залучення ненатуральних засобів та поливної вологи; збирання плодів виключно певної стадії зрілості та за сухої погоди; зберігання сировини в умовах певної вологості середовища та певного вмісту сухих розчинених речовин; виробництво продуктів/їжі при мінімально низькому температурному впливі та уникаючи залучення консервантів; виробі з мінімальною втратою харчової цінності. Добре відомо виключне значення фруктово-овочевої сировини чи продуктів/їжі у засвоєнні жирів, білків і вуглеводів організмом людини. Цьому, зокнайменше, сприяють такі фактори, як: вирощування плодів при мінімумі залучення ненатуральних засобів та поливної вологи; збирання плодів виключно певної стадії зрілості та за сухої погоди; зберігання сировини в умовах певної вологості середовища та певного вмісту сухих розчинених речовин; виробництво продуктів/їжі при мінімально низькому температурному впливі та уникаючи залучення консервантів. Але, навіть враховуючи наведене, вже через декілька тижнів плоди майже не містять залишків харчової цінності без залучення вкрай шкідливих консервантів. З цього приводу може бути привабливою розробка інноваційного проекту створення нового виду обладнання – мобільний аграрно-харчовий технологічний комплекс – роботизований мінікомплекс виробництва безконсервантного фруктово-овочевого порошку. Завдяки мобільності передбачено не тільки інтенсифікацію існуючих аграрно-харчових функцій, а й змінити уявлення відносно організації процесів:

використовувати не тільки при зборі, а й залучаючи додаткові модулі при вирощуванні дерев та врожаю; здійснювати збирання плодів незалежно від освітлення, тобто навіть вночі; залучати випарену воду, вміст якої у свіжих плодах може складати до 90 %, у якості мийного розчину.

Ключові слова: зручна їжа, економія сировини, харчова цінність, сухий порошок.

СОЗДАНИЕ ПОРОШКА ПРИ СБОРЕ ФРУКТОВО-ОВОЩНОГО СЫРЬЯ – СОХРАНЕНИЕ ПИЩЕВОЙ ЦЕННОСТИ ЗА КОНЦЕПЦИЕЙ «УДОБНАЯ ЕДА»

Науменко А.П.

Концепция «УДОБНАЯ ЕДА» предусматривает не только упрощение ежедневного питания обычного потребителя, а и создание благоприятных условий к употреблению ими натуральных безконсервантных продуктов/еды длительного хранения, при этом уделяя особое внимание сохранению ими пищевой ценности. Этому, как минимум, способствуют такие факторы, как: выращивание плодов при минимуме использования ненатуральных средств и поливной влаги; сбор плодов исключительно определенной стадии зрелости и при сухой погоде; сохранение сырья в условиях определенной влажности среды и определенного содержания сухих растворимых веществ; производство продуктов/еды при минимально низком температурном воздействии и исключая использование консервантов; изделия с минимальной потерей пищевой ценности. Хорошо известного исключительное значение фруктово-овощного сырья или продуктов/еды в усвоении жиров, белков и углеводов организмом человека. Этому, как минимум, способствуют такие факторы, как: выращивание плодов при минимуме использования ненатуральных средств и поливной влаги; сбор плодов исключительно определенной стадии зрелости и при сухой погоде; хранение сырья в условиях определенной влажности среды и определенного содержания сухих растворимых веществ; производство продуктов/еды при минимально низком температурном влиянии и исключая использование консервантов; изделия с минимальной потерей питательной ценности. Однако, даже учитывая представленное, уже через несколько недель плоды почти не содержат остатков пищевой ценности без использования крайне вредных консервантов. Исходя из этого может быть привлекательной разработка инновационного проекта создания нового вида оборудования – мобильный аграрно-продуктовый технологический комплекс – роботизированный мини-комплекс производства безконсервантного фруктово-овощного порошка. Благодаря мобильности предусмотрено не только интенсификацию существующих аграрно-пищевых функций, а и изменить представление относительно организации процессов: использовать не только при сборании, а и используя дополнительный модуль при выращивании деревьев та урожая; осуществлять сбор плодов независимо от освещения, то есть даже ночью; использовать выпаренную воду, содержание которой в свежих плодах может составлять до 90 %, в качестве моющего раствора.

Ключевые слова: удобная еда, экономия сырья, пищевая ценность, сухой порошок.

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The concept of «CONVENIENT FOOD» involves not only the simplification of the daily diet of the average consumer, but also the creation of favorable conditions for the use of natural preservatives / long-term food, while paying special attention to preserving their nutritional value. This, at least, contribute to factors such as growing fruit at a minimum, attracting unnatural remedies and watering moisture; picking up fruits only at a certain stage of maturity and dry weather; storage of raw materials under certain humidity of the wednesdays and certain contents of dry dissolved substances; production of food/food at minimum low temperature exposure and avoiding the involvement of preservatives; products with minimal loss of food value. The exceptional importance of fruit and vegetable raw materials or products / foods in the absorption of fats, proteins and carbohydrates by the human body is well known. This is at least facilitated by such factors as: fruit growing with a minimum of unnatural means and irrigation moisture; harvesting fruits only at a certain stage of maturity and in dry weather; storage of raw materials in conditions of a certain humidity of the environment and a certain content of dry dissolved substances; production of products / food with minimal low temperature exposure and avoiding the involvement of preservatives; products with minimal loss of nutritional value. But, even taking into account the above, after a few weeks the fruit contains almost no residual nutritional value without the involvement of extremely harmful preservatives. In this regard, it may be attractive to develop an innovative project to create a new type of equipment – a mobile agro-food technology complex – a robotic mini-complex for the production of non-preserved fruit and vegetable powder. Thanks to mobility, it is envisaged not only to intensify the existing agro-food functions, but also to change the perception of the organization of processes: to use not only in harvesting, but also involving additional modules in growing trees and crops; to collect fruits regardless of lighting, even at night; attract evaporated water, the content of which in fresh fruit can be up to 90%, as a cleaning solution.

Key words: convenient food, saving raw materials, nutritional value, dry powder.

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