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MOIST ABSORPTION PROPERTIES OF FRUIT AND VEGETABLE CHIPS, THE CONDITIONS OF THEIR PRESERVATION AND RATES OF SENSITIVITY

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The moist absorption property of apricots, the preservation conditions of apples and rates of sensitivity of apricots and apples have been studied during the experiments. As a result of the research it became clear that the study enables to determine the duration of the further technological processes which is extremely vital for the organization of the processes of chips production. The description of the durations of those processes allows to state that the packaging of the chips during 2-3 hours after their thermal treatment, final production after their flavoring with food additives is of great importance.

Nowadays the packaging materials are very various in food production, for example, the varnished polypropylene napkins which enable to keep the packaged food from 1-2 weeks to 12 months.

Key words: fruit and vegetable chips, fruit and vegetable chips packaging, preservation, relative moisture, physical-chemical properties.

Introduction

In the process of producing fruit and vegetable chips, the vegetable and fruit raw material undergoes various stages of thermal treatment causing its physico-chemical properties to change. They cause changes in the moisture-absorbing properties of the raw materials and especially in the properties of moist absorption from the environment. Their storage and packaging technologies are conditioned by the latter and to reveal the regulations of these technologies experiments were done.

Conflict setting

The moisture-absorbing properties, storage conditions and sensitivity properties of fruit and vegetable chips have not been fully studied. In particular, data on the drying of these raw materials are missing which require special investigations. The aim was to study the moisture absorption properties of Shalakh and Satin apricot chips and apple chips and to clarify their storage conditions and rates of sensitivity.

Research results

The results of half finished apricot chips are shown in Table 1.

Table 1

Change of moisture during the preservation of apricot half finished chips depending on the environment

Preservation period, day	Relative moisture of environment, φ %								
	10	20	30	40	50	60	70	80	90
1	4,2	6,7	6,8	6,9	7,1	7,2	8,9	10,1	12,
2	4,6	8,0	8,1	8,3	8,5	8,7	10,9	13,7	15,3
4	4,6	8,3	9,2	9,4	9,8	10,2	11,5	14,5	17,1
6	4,6	8,3	9,4	10,1	10,5	10,7	12,0	15,3	18,6
8	4,6	8,3	9,4	10,1	10,9	11,2	12,5	15,8	19,9
10	4,6	8,3	9,4	10,1	10,9	11,5	13,1	16,4	20,6
12	4,6	8,3	9,4	10,1	10,9	11,8	13,5	17,0	21,2
14	4,6	8,3	9,4	10,1	10,9	11,8	13,5	17,3	21,7
16	4,6	8,3	9,4	10,1	10,9	11,8	13,5	17,3	22,1

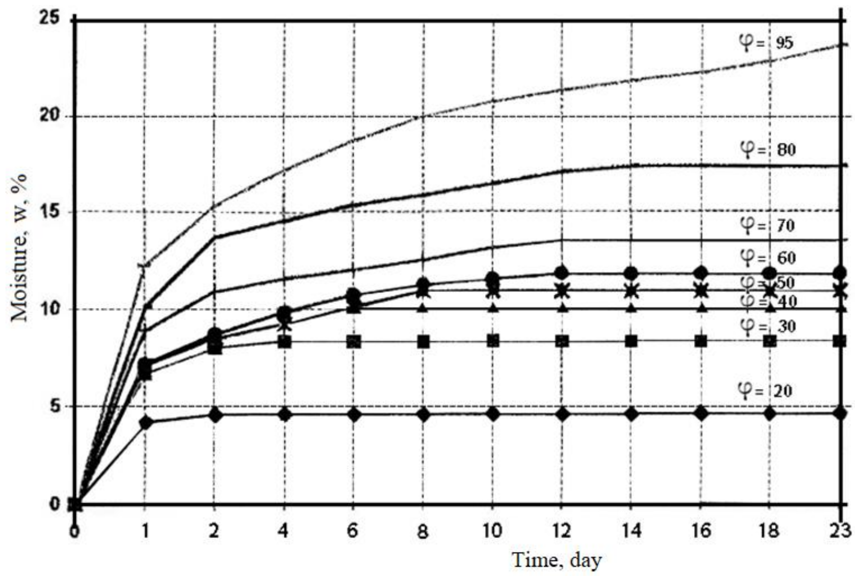

Fig. 1 Change of moisture of half finished product depending on the moisture φ – of environment

The graphs in Figure 1 show that parallel to the increase of surrounding air humidity the moisture content of the half-finished product increases, resulting in intensified biochemical processes in the sample, which, at some point, also result in spoilage of the raw material and in the case of φ = 80% also in mucorales.

Half–finished chips products which consist of proteins and carbohydrates whose atomic groups act as active centers and in co-operation with water molecules, absorb moisture into the inner layers of the material.

To determine the type of dry materials and fluid relationship in the apricot sample, the isotherm of moistening the test sample was made according to the results of Table 1 (Fig. 2).

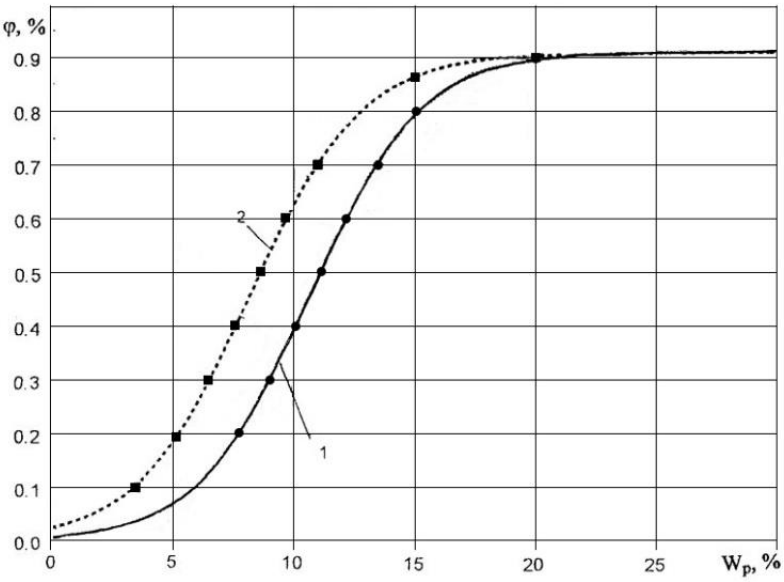

Fig. 2 Moistening isotherm of apricot half-finished chips

The moistening isotherm of half-finished product shown in Figure 2 coinsides with the regularities adopted in the thoery by appearance [1,5] which prove that the material of our experiment (half-finished product of apricot) is typical colloid, porous body. It also shows that molecules of the material are connected with the molecules of the water passing through thermal processing. The obtained results also show that in the conditions of φ=60-70% of the store the moist content of the sample fluctuates between 13,5 % - 9,8 % which is necessary to take into account while developing the normative – technical documents of the production of half-finished chips.

Experiments have shown that the thermal treatment of the half finished chips which is done for the final product results in a substantial increase in the specific surface area of the sample as the sample is dehydrated. The high temperatures used during the thermal treatment of sample lead to a distort of its balanced moisture content which results in moisture on the surface of the sample occurred from the environment.

The long lasting contact of the chips with the surrounding air is accompanied by the loss of chip crunching and the stickiness of the surface as well, in other words, by altering the organoleptic properties of the chips [3]. Therefore great attention should be paid to the moisture content of the chips before packaging.

Experimental studies were carried out at t = 20°C air temperature and φ = 60% air humidity with dynamic study of chip weight changes at different time intervals to get the answer.The results of these experiments of two varieties of apricot chips are presented in Table 2. The analysis of the data in Table 2 shows that apricot chips actively absorb air moisture by increasing their weight. Thus, Satin apricot chips absorb such amount of humidity in the room with 60% humidity during four hours that the increase of moisture content is 5.4% and Shalakh apricot chips moisture in the same conditions comprises 12.5%. For comparison it turns out that if the rates of the same comparisons for Satin chips are 11.8%, then for Shalakh chips they are 9.5%.

Table 2

The picture of absorbing water vapors from the air of Shalakh and Saten apricot chips having thermal treatment in the conditions of t=20°C temperature and φ=60 % relative humidity

Sample	Rate	Duration of sample staying in the open air and time				
Saten apricot chips	-	0,5	1,0	5	10	24
	Weight, g	3,5	3,7	3,9	3,93	3,97
	Increase of weight, g	-	0,2	0,4	0,43	0,47
	Increase of weight mass, %	-	5,4	10,3	10,9	11,8
Shalakh apricot chips	Weight, g	4,2	4,8	5,1	5,25	5,8
	Increase of weight, g	-	0,6	0,3	0,15	0,55
	Increase of weight mass, %	-	12,5	5,9	2,86	9,5

The chips in these very conditions, as the results of experimental research show, started to soften during five hours.

In the end of computer processing of the results of experiments it turned out that the relation of time and humidity may be expressed by simple mathematical model as

$$W = \frac{a + b\tau}{c + \tau} \tag{1}$$

where W- is the moisture of the chips, %; τ - is the time, a, b and c – are the coefficients of correlations of the function equal to 0,995 a=3,67; b=3,9; c=9,28.

The results of the experiments are shown in Figures 3 and 4 the first of which is the graph of moisture absorption and the second is the speed of absorption.

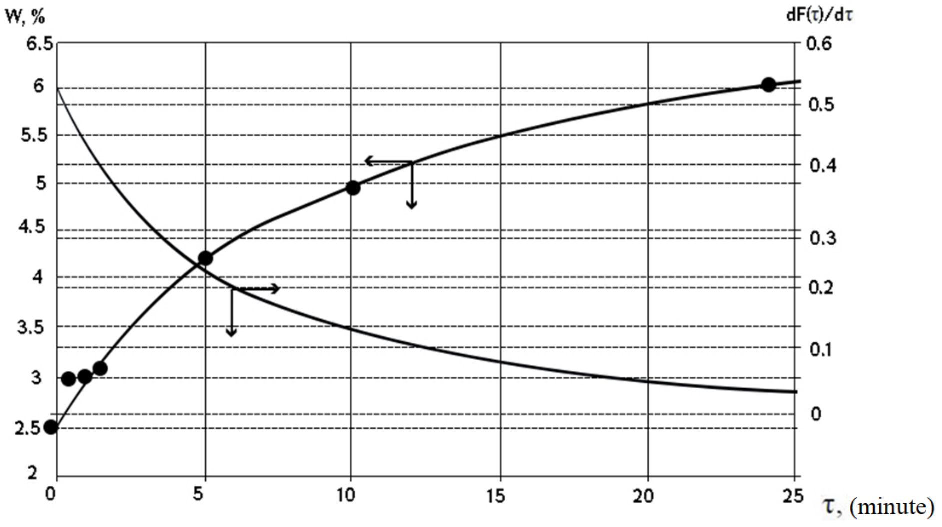

Fig. 3 The graph of moisture absorption of Saten apricot chips

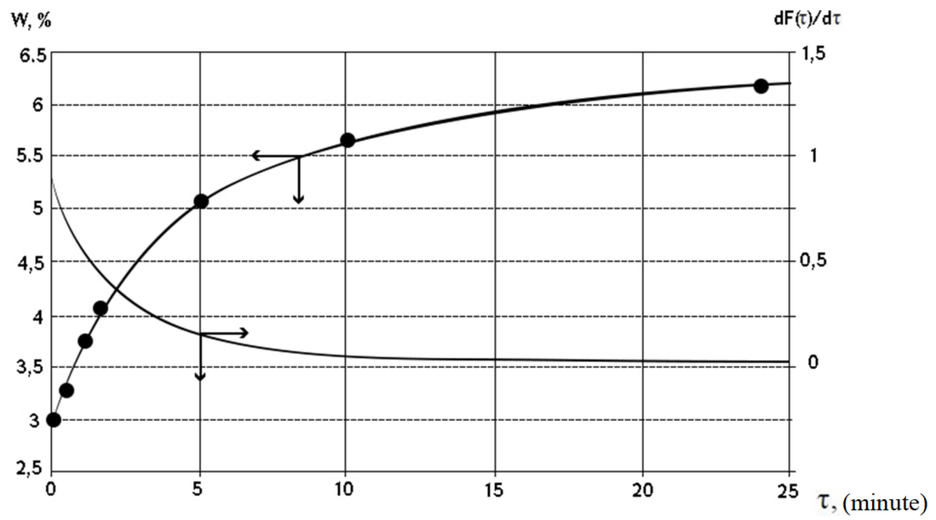

Fig. 4 The graph of moisture absorption of Shalakh apricot chips

The analysis of graphs 3 and 4 shows that the research allows to determine the duration of subsequent technological processes which is very important for the organization of the processes of chips production. The characteristics of the duration of these processes allows to state that it is very important to pack them within 2-3 hours after thermal treatment, formation as well as enrichment with food additives of the chips.

For the development of the technology of preservation and packaging of fruit and vegetable chips we have considered it appropriate to observe the technological details of preserving and packaging apple chips since chips made from this fruit have similarities to other fruits and can be common for them too.

For example, the solar drying process of apples usually lasts 2-3 days if the epicarp of the fruit is removed. During this drying it is necessary to turn the apple pieces being dried from time to time (once in 1-2 hours). Experiments have shown that if apple round pieces are dried for 3 to 6 days with removed epicarp, the rings with non-removed epicarp dry for 8-12 days.

In the drying process, the evaporation of liquid from the apple rings is accompanied by an increase in the concentration of sugar in them which makes them sweeter and tasty which in turn impedes the drying process and takes longer time for the raw material to dry.

Due to high levels of amino acids and high concentration of sugar in the apple in order to make the drying process quick the application of high temperatures leads to caramelization and occurring of melanid as a result of which the taste properties of the raw materials are significantly deteriorated, the color is darkened, the organoleptic properties of the food are also worsened which should be taken into account when choosing drying modes of apple slices. For this purpose it should be remembered that the results of numerous studies to avoid caramelization and melanids in chips during apple drying the preference should be given to sour and sour sweet apple sorts which are late autumn and early winter sorts. To orient in this easily, let us be introduced to the chemical composition of fresh and dried apple chips [2, 4, 6].

Table 3

Chemical indicators of fresh apple, dried and chips «slices»

Indicators	Drying unit /100 grams/	Fresh apple	Dried apple	Apple chips
Solvent dry substance	g	15,5	80,0	97,0
Proteins	g	0,26	2,2	2,6
Lipids	g	0,17	0,1	1,14
Carbohydrates	g	13,81	59,0	92,38
Vitamin C	mkg	4,60	2,0	1,66
Ca	mg	6,0	31,0	37,6
P	mg	11,0	56,8	68,87
K	mg	107,0	552,26	669,6
Na	mg	1,0	12,0	14,55
Mg	mg	5,0	30,0	33,45
Fe	mg	3,3	6,0	22,08

The data of Table 3 show that apple chips and generally chips of drupes from the point of view of their nutritional values and chemical composition are preferred to other fresh and dry fruits mainly due to their high content of dry substances. The content of vitamin C in apple chips is comparatively low the main reason of which is high temperature during primary dehydration of apples.

To determine the rates of sensitivity of fruit and vegetable chips we found it comfortable to observe apple and apricot chips. For this purpose apple and apricot chips were prepared by two different technologies. The results are shown in Tables 4 and 5.

Table 4

Relative rating assessment of sensitivity of dried apricot

Indicators	Rates of sensitivity of dry apricot	
	Convective drying	Convective microwave drying (chips)
Appearance and structure	The slices are complete, strong, with surface main frame, slightly slicy in the cutting	The slices are complete, dry, slightly crispy, thin, surface frame, slightly porous in the cutting
Color	Dark yellow, heterogeneous, unsaturated, yellow reddish shades	Light yellow, homogeneous typical to fresh apricot, bright saturated
Taste and smell	Typical taste and smell to dried apricot	Typical taste and smell to fresh apricot

Table 5

Relative rating assessment of sensitivity of dried apple

Indicators	Rates of sensitivity of dry apricot	
	Convective drying	Convective microwave drying (chips)
Appearance and structure	The slices are complete, strong, with surface main frame, slightly slicy in the cutting	The slices are complete, dry, slightly crispy, thin, surface frame, slightly porous in the cutting
Color	Dark milky, heterogeneous, unsaturated, dark brown shade	Dark milky, homogeneous typical to fresh apple, bright saturated
Taste and smell	Typical taste and smell to dried apple	Typical taste and smell to fresh apricot

Conclusion

So, as a result of analysis of rates corresponding to high quality product, we can conclude that the best method for drying chip half finished products is the convective-microwave drying method.

Fruit and vegetable chips are a type of food whose moisture is lower than the balanced humidity of the surrounding air. For this reason, this variety of food should first of all be protected from moisture which can lead to its rapid spoilage. The fluctuations in moisture content in packaged chips are almost unacceptable and their packaging must be so perfect to exclude such event. At the same time, the loss of odorants from the chips should also be excluded which is almost always accompanied by occurring other odors and flavors in the package. The desired result can be achieved by making the package multilayer (2-3 layers), one or two of which will become opaque and the chips will also be protected from the harmful effects of light.

Currently packaging materials are extremely diverse in the food industry. For example, the varnished polypropylene napkins which enable to keep the packaged food from 1-2 weeks to 12 months.

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ՊՏՈՒՂԲԱՆՋԱՐԵՂԵՆԱՅԻՆ ՉԻՊՍԵՐԻ ԽՈՆԱՎԱԿԼԱՆԻՉ ՀԱՏԿՈՒԹՅՈՒՆՆԵՐԸ, ՊԱՀՊԱՆՈՒԹՅԱՆ ՊԱՅՄԱՆՆԵՐԸ ԵՎ ԶԳԱՅԱԲԱՆԱԿԱՆ ՑՈՒՑԱՆԻՇՆԵՐԸ

Վ.Ա. Կարապետյան
Հայաստանի ազգային ագրարային համալսարան

Փորձերի ընթացքում ուսումնասիրվել է ծիրանի պտուղների խոնավակլանիչ հատկությունները, խնձորի պտուղների պահպանման պայմանները, ինչպես նաև ծիրանի և խնձորի պտուղների զգայաբանական ցուցանիշները:

Ուսումնասիրությունից հետո պարզ է դարձել, որ կատարված հետազոտությունը թույլ է տալիս որոշել հաջորդող տեխնոլոգիական գործընթացների տևողությունը, ինչը խիստ կարևոր է չիպսերի արտադրական պրոցեսների կազմակերպման համար: Այդ գործընթացների տևողությունների բնութագիրը թույլ է տալիս պնդել, որ ջերմային մշակումից ու չիպսերի ձևավորումից, ինչպես նաև նրանց սննդահամային հավելումներով հարստացումից հետո խիստ կարևոր է 2-3 ժամվա ընթացքում իրականացնել նրանց փաթեթավորումը:

Ներկայումս փաթեթավորման նյութերը սննդարդյունաբերությունում խիստ բազմազան են: Օրինակ՝ լաքապատված պոլիպրոպիլենային թաղանթապատումը, որը թույլ է տալիս փաթեթավորված մթերքը պահպանել 1-2 շաբաթից մինչև 12 ամիս:

Բանալի բառեր. պտուղբանջարեղենայինչիպսեր, պտուղբանջարեղենայինչիպսերի փաթեթավորում, պտուղբանջարեղենայինչիպսերի պահպանում, հարաբերականխոնավություն, ֆիզիկա - քիմիական հատկություններ:

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ВЛАГОПОГЛОЩАЮЩИЕ СВОЙСТВА ПЛОДООВОЩНЫХ ЧИПСОВ, ИХ ОРГАНОЛЕПТИЧЕСКИЕ СВОЙСТВА И УСЛОВИЯ ХРАНЕНИЯ

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Во время опытных исследований изучались влагопоглощающие и органолептические свойства и условия хранения чипсов из яблок и абрикосов. Проведенные исследования позволяют определить продолжительность последующих технологических процессов, что необходимо для правильной организации производства чипсов. Определение временного интервала технологических процессов позволяет утверждать, что после формирования и тепловой обработки чипсов, а также после обогащения их пищевыми добавками необходимо в течении 2-3-х часов произвести упаковку.

В настоящее время в промышленности используют много видов упаковок, например лакированные полипропиленовые пленочные упаковки, которые позволяют хранить в них продукт от 1-2-х недель до 12-ти месяцев.

Ключевые слова: плодоовощные чипсы, упаковка плодоовощных чипсов, хранение плодоовощных чипсов, относительная влажность, физико-химические свойства.

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