

STUDY ON WHITE POTATO DEHYDRATION AND SWEET POTATOES

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Abstract

Dehydration is the technological process by which the natural water content is reduced to a level that prevents the activity of microorganisms, without destroying tissues or depreciating the nutritional value of products that are dehydrated.

Dehydrated potatoes are obtained from fresh potatoes, in different forms, dehydrated by natural or artificial processes, or by combining them, in order to eliminate most of the water content from their composition.

The potato is considered to be 'man's second bread', it is a nutritious, tasty and cheap vegetable product, which is the staple food of many people and holds an important share in the economic balance of many countries.

Sweet potatoes are rich in complex carbohydrates, dietary fiber, beta-carotene, vitamin C and vitamin B6. Vitamin A (in the form of beta-carotene) is an important component of the composition of sweet potatoes: 100 grams provide three times the daily requirement of the body for this vitamin despite its sweet taste.

The study that looks at the drying process of white potatoes and sweet potatoes was carried out in laboratory conditions using two types of appliances: the electric oven and the domestic dehydrator.

Key words: dehydration, organoleptic characteristics, sweet potatoes, beta-carotene

INTRODUCTION

Drying or dehydration as a method of preserving horticultural products is based on removing a certain amount of water from vegetables and fruits with the help of heat, until reaching the physico-chemical state that blocks the vital activities of microorganisms, but which maintains nutritional and organoleptic qualities. (Lazăr V., 2006).

The most common method of drying is by convection at atmospheric pressure (hot air drying). During hot air drying, it is the vector that supplies the surface of the product with energy and also the vector for removing water vapor (Banu C., 2008).

The method used for dehydrating fruits and vegetables is drying with hot air, with different types of dryer machines (tunnel, tape, with zones). Depending on the characteristics of the raw material and the finished product, certain technical conditions are required to achieve dehydration with hot air, which in the case of potatoes drying temperature is 85-70°C, product humidity 7%, yield 12-16%. C., 2009).

At the beginning of the dehydration process, when the humidity is still high, water evaporates from the surface of the product through external diffusion - its intensity is determined by several factors such as the evaporation surface, the temperature and the speed of air circulation. Simultaneously, the process of internal diffusion begins, a movement of water from inside to outside, as a direct consequence of the difference in osmotic pressure caused by the different concentration in soluble substances of cellular juice inside and on the surface of the product. Thus, the moisture is equalized in all the layers subjected to dehydration (Beceanu D., A.Chira, 2003).

The speed of dehydration is faster if: the temperature is higher, the diffusion resistance and the thickness of the product are lower, the ratio between the surface of the product and its water content is higher and the speed of movement of hot air is higher.(Potec I.et all, 1983).

If the optimal technological conditions are not observed during the drying process, transformations of sugars, nitrogenous substances, aroma, vitamins and color can take place. Sugar losses are caused by two main factors: caramelization, when drying is done at high temperatures, for a prolonged period of time; melanoid formation following Maillard-type reactions between sugars and amino acids. As a result of these two processes, the products darken in color and take on an unpleasant appearance. The oxidation reactions of tanning substances to quinones and the oxidations of anthocyanins also contribute to the darkening of color (Nour Violeta, 2014).

Dehydrated potatoes are the most widespread variety of vegetables preserved in this way. Dehydration is done in the form of rounds, flakes, granules, and certain amounts of dehydrated potatoes are processed in the form of flour. Not all varieties are suitable for dehydration, some darken and others are prone to crushing during operations in the technological flow (Marca Gh., 2004).

In readiness for dehydration, the potatoes must be ripe, with a juicy and hard pulp, whole, unpeeled, uncultivated and without traces of rot. The raw material destined for dehydration is successively subjected to the following operations: washing, cleaning, checking before cutting, bleaching, sulfitation, drying, packaging (Mănescu S., I Juduc, 1970).

The main physical transformations suffered by vegetables during processing are: decrease in volume, weight loss, migration of soluble components and peeling. Weight loss is the natural consequence of eliminating water from a content of 85-90% of fresh vegetables to 4-6% in the case of root vegetables (Gherghi A.).

At the end of the dehydration period, after cooling for 2-3 minutes, check the degree of dehydration, when the slices or cubes of dehydrated

potatoes must be hard, break when bent, in a glassy and transparent section and moisture 8 %. (Mănescu S., 1973).

MATERIAL AND METHOD

For the study, two varieties of potatoes were used: white potatoes and sweet potatoes. They were subjected to the dehydration process in: the electric oven and in the household dehydrator, an operation that took place in the laboratory of the Faculty of Environmental Protection - Food preservation methods.

The products intended for the study were washed, cleaned and cut into 3-4 mm thick slices using a grater, and then blanched (scalded) at a temperature of 90-95°C for 4-5 minutes.

The samples taken for the study were weighed, the weight of each sample being 100g, and they were placed on baking paper and in the dehydration spaces: the electric oven and the household dehydrator.

The end weight of the samples used during dehydration was determined by weighing them every 15 minutes.

RESULTS AND DISCUSSIONS

In the study of the dehydration process of white potatoes and sweet potatoes we observed the following: the losses resulting from the non-essential parts in the cleaning process; the weight of the products used, and the time required to remove water from the products, starting from the initial weight of 100 g for each sample, and reaching their final weight; the organoleptic properties of dehydrated potatoes in the electric oven and household dehydrator, and the total and percentage weight loss during the dehydration process.

1. Determination of losses in the cleaning operation

To determine the losses resulting from the cleaning operation, the two varieties of potatoes were weighed before and after cleaning. The results were recorded in table 1.

Table 1

Potato Variety	Initial quantity (g)	Weight after cleaning (g)	Losses	
			g	%
White potato	338	318	20	5.91
Sweet potatoes	368	289	79	21.46

The results obtained, presented in the table above show that for white potatoes the amount of the inedible part is 20 g, and for sweet potatoes the inedible part is much higher, 79 g. In percentages, for white potatoes the losses are 5.91% , and for sweet potatoes of 21.46%.

The percentages of inedible parts are quite small for white potatoes, because the potatoes used are early potatoes and have a thin skin, and for sweet potatoes the inedible part is quite large, 21.46%, because their skin is quite thick and hard.

2. Determining the weight of dehydrated potatoes in the electric oven, as a measure of time

To determine the weight of dehydrated potatoes, they were weighed every 15 minutes for both white and sweet potatoes. The data obtained when determining the initial and final weight of the two varieties of potatoes used in the electric oven as a measure of time, are presented in Table 2.

Table 2

The weight of dehydrated potatoes in an electric oven

Potato Variety	Weight										
	Initial	15 min	30 min	45 min	60 min	75 min	90 min	105 min	120 min	135 min	150 min
White potato	100	90	81	70	61	52	43	35	28	24	22
Sweet potatoes	100	90	79	70	55	47	40	34	27	25	23

The graphical representation of the weight of dehydrated potatoes in the electric oven as measure of time is presented in Fig.1.

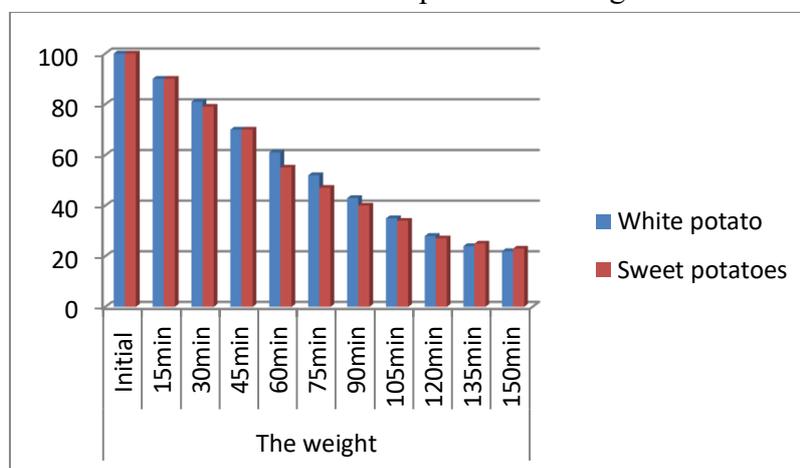


Figure 1 - Graphical representation of potato dehydration in the electric oven

As a result of the data derived from the study of dehydrating the potatoes in the electric oven, it is observed that their weight decreases progressively, depending on the drying time, which is 150 minutes. The initial weight of the two samples used: white potatoes and sweet potatoes

was 100 g, and after 150 minutes the weight reached 22 g for white potatoes and 23 g for sweet potatoes.

During the dehydration of potatoes, the weight is variable: in the first half of the time, total lost water is of a greater quantity, so after 75 minutes of dehydration, the weight of white potatoes reaches from 52 g from 100 g, and that of sweet potatoes, 47 g.

The intensity of the dehydration process is reduced in the interval of 75-150 minutes, when the weight of the two samples used reaches 22 grams in the case of white potatoes, and 23 grams in the case of sweet potatoes respectively.

For the organoleptic properties, the dehydrated potatoes in the electric oven have the following characteristics:

- potato slices took the form of chips by losing water in the composition, uniform in size, yellowish, translucent, some with brown areas, browned, no foreign odor, strong consistency;
- slices of sweet potatoes are shaped like uneven chips in size, orange in color, with whiter areas, no foreign smell, characteristic taste and aroma, good texture, no browned portions.

3. Determining the weight of dried vegetables in the dehydrator as a measure of time

The data obtained for the determining the initial and final weight of the two varieties of potatoes used in the dehydrator as a measure of time are presented in Table 3.

Table 3

Weight of dried potatoes in the dehydrator

Potato Variety	Weight											
	Initial	15 min	30 min	45 min	60 min	75 min	90 min	105 min	120 min	135 min	150 min	165 min
White potato	100	89	80	72	64	55	50	40	35	29	24	21
Sweet potatoes	100	90	80	73	64	57	46	44	38	35	29	25

The graphical representation of the weight of dehydrated potatoes in the domestic dehydrator as a measure of time is presented in Fig.2.

In the case of the dehydration of potatoes in the dehydrator, the dehydration time was 15 minutes longer than in the electric oven, so that from the initial weight of 100g of the two samples used, after 165 minutes, the final weight reached was: 21 g for white potatoes and 25 g for sweet potatoes.

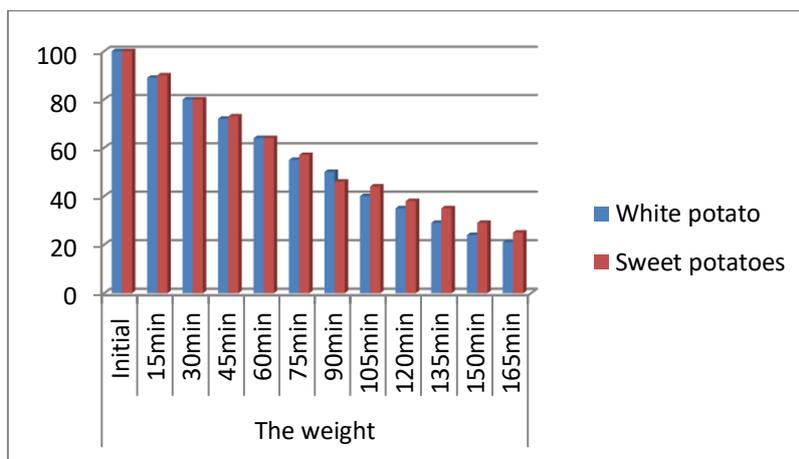


Figure 2 - Graphic representation of potato dehydration in the dehydrator

In the case of the dehydrator method, there is a smaller decrease in the weight of the samples used in comparison with the electric oven, in the first part of the interval 0-75 minutes, when the weight reaches 55 g from 100 g for white potatoes and 57 g from 100 g for sweet potatoes.

During the interval of 75-165 minutes, the weight loss is moderate, so for white potatoes the weight reaches 21 g after 165 minutes, and for sweet potatoes, 25 g.

In terms of organoleptic properties, dehydrated potatoes in the dehydrator have the following characteristics:

- the potato slices are uniform in size and color, with a smooth surface, have a yellowish-whitish color, matte, no foreign smell, good texture, no brownish portions;
- the sweet potato slices are uneven in size, the surface is rough, orange - whitish, without foreign smell, characteristic taste and smell, similar to pumpkin, good texture, no brownish portions.

4. Determining the total weight loss and percentage weight loss

Based on the data obtained from weighing the samples, the total and percentage weight losses of potato mass and the amount of water evaporated in the dehydration process in the electric oven and dehydrator, are presented in Table 4.

Table 4

Potato Variety	Total weight loss in the electric oven		Total weight loss in the dehydrator	
	g	%	g	%
White potato	78	78	79	79
Sweet potatoes	77	77	75	75

The graphical representation of the total and percentage weight losses of the potato samples used is presented in Fig.3.

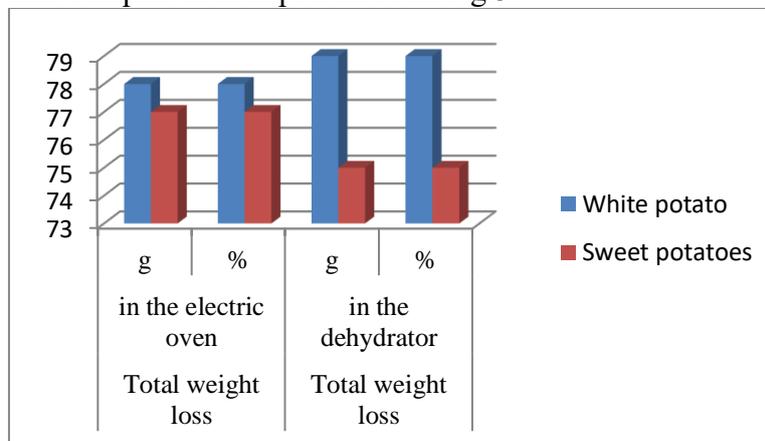


Figure 3 - Graphical representation of weight loss

The weight losses recorded during the process of dehydration in the electric oven are close for the two samples of potatoes used, compared to the dehydration in the dehydrator, where the differences are relatively larger.

The weight of the potatoes in the electric oven is quite uniform in the unit of time, the weight loss being 78% in the case of white potatoes and 77% in the case of sweet potatoes, compared to dehydration in the dehydrator, where the dehydration time is longer and the losses they are 79% in the case of white potatoes and 75% in the case of sweet potatoes.

CONCLUSIONS

Potatoes are a staple in food, in various forms, easily accessible and handy throughout the day.

Along with white or red potatoes, sweet potatoes are an alternative in the diet, due to the beta-carotene content it contains.

An advantage of foods preserved by dehydration is that they maintain their nutritional value, taste, smell, flavor, and their volume, while their weight decreases by up to 10 times, so they occupy a small storage space.

Another advantage of dehydrated products is easy handling, and storage costs are lower than the storage costs of fresh vegetables or even those preserved using other methods.

In the case of dehydration of potatoes in the dehydrator, the dehydration time was 15 minutes longer than in the electric oven, so that from the initial weight of 100g of the two samples used, after 165 minutes, it reached 21 g for white potatoes and 25 g for sweet potatoes, compared to the electric oven where from the initial weight of 100 g, it reached 22g for white potatoes and 23g for sweet potatoes.

The organoleptic characteristics of the two samples of dehydrated potatoes in the dehydrator are better than those dried in the electric oven, this being due to the ventilation of the air circulating over the products during dehydration.

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