STUDIES REGARDING THE BEHAVIOR OF SOME POTATO VARIETIES PROCESSING BY DEHYDRATION

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Abstract. The nutritional value of vegetables is given by the high content of vitamins, minerals, carbohydrates, proteins, etc., with curative and medicinal properties (biopharmaceuticals). The potato, being rightly considered the "second bread of mankind" is used in large-scale processing with a growing trend of global growth, being an attribute of modern civilization. Potato tubers should retain their light flavor, firm texture and should break easily. At present, dehydration of cut potatoes is the main processing method. To be dehydrated potatoes can be sliced in different ways into rounds, prism cubes of different sizes. Another process is to obtain flakes (intended for the rapid preparation of puree). The vast majority of dehydrated potato production is destined for the bakery industry. Based on the laboratory analyzes and the results obtained in the case of the four potato varieties, the destination of the finished product will be taken into account when choosing the varieties for dehydration, and in case the aim is not to obtain a rehydration capacity, yielding varieties increased processing.

Keywords: Solanum tuberosum L., potato tubers, analysis, dehydration, blanching

INTRODUCTION

Like any resource of vegetable origin, potatoes are processed in different production phases, on which occasion we start the analysis of the study from the definition of primary and secondary processing (Țane, 2016). In the case of potato tubers intended for industrial processing, the quality requirements imposed on the finished product obtained are very strict and can only be met by maintaining a rigorous level of concentration of the main chemical components.

For dehydrated potatoes, which appear as compact parts of the tissue of fresh potato tubers, without the addition of other substances, the quality being determined to a large extent by the raw material. However, there are potato varieties in which the tissue often breaks and their outer layers turn into a floury texture. In the case of dehydration, the raw material cannot be improved, being allowed only one technological treatment, namely blanching.

Changes in the color of dehydrated potatoes compared to the color of fresh ones are also determined by the chemical composition specific to each variety and some technological inputs, with reference to soil fertilization. The color of the dehydrated product is largely determined by the color of the pulp of fresh potatoes, which differs greatly from white to deep yellow, characteristic of each variety (Morar, 1999).

The intensity of enzymatic oxidative browning that occurs in freshly cut tissues is different depending on the content of phenolic substances, specific to each variety. Non-enzymatic, saccharoprotein browning is manifested during dehydration during storage.

The thermal effect on starch causes the cells to swell and crack. This process can cause glue and softening when processing and cooking potatoes (Šmálik, 1987; Zgórska and Frydecka-Mazurczyk, 2000).

The culinary quality indicates the possibilities of using potato tubers in culinary preparations, based on their boiling behavior. It is appreciated the general appearance of the boiled tubers, the taste, the crushing when boiling, the consistency of the pulp, the flouriness, the humidity, the structure of the starch granules, the blackening after boiling. These properties are specific to the variety and are very little modified depending on climatic factors and agrotechnical measures (Mureșan, 1998). Blackening after boiling is another type of non-enzymatic change, due to the reaction between orthodiphenolic compounds and iron ions in the potato pulp.

Because special chemical treatments are required to prevent blackening after boiling, they cannot be dehydrated without these preliminary treatments. Also, potatoes that have a beginning of greening cannot be dehydrated, because chlorophyll and solanine give an unpleasant taste and smell.

Another characteristic that influences the quality of the product is the dry matter content. The resulting dry matter content and density have been shown to mainly influence the starch content (Reeve, 1977). The higher the dry matter content, the better their culinary qualities, but if it is higher than 25%, they become crumbly. If the dry matter is too small, they remain as a hard structure even after boiling.

Deficiency of water in the soil during the formation of potato tubers can prevent this process or can stagger it, resulting in a small number of tubers with uneven size, which leads to uneven production quality and thus boiling resistance (Vogel, 1996).

The large number of processed products obtained from chips, pommes frites, flakes, dehydrated potatoes, preserves, have contributed to the specialization of production at product level and the development of research in the field for the creation of specialized varieties and approval of new cultivation technologies.

Research in the field shows that dehydration of fruits and vegetables before preservation keeps a firmer texture and provides a higher density of packaging (Mathur et al. 1973, Andreotti et al. 1982).

Therefore, in this study we looked at the effect of partial dehydration before preservation on the quality of the raw material in the case of the four potato varieties, from different precocity groups.

MATERIAL AND METHODS

The biological material used in the study conducted in 2020, consisted of four potato varieties, namely: two semi-early varieties 'Asinaria' and 'Sevastia', respectively two semi-late varieties 'Nemere' and 'Productiv'. The description of the biological material used in the quality determinations of the finished product is given through genetic, phenological, morphological and technical characteristics.

'Asinaria' is a kind of semi-early potato created at I.N.C.D.C.S.Z. Brașov, with genealogy 'Solara' x 'Victoria' forming long-oval tubers with yellow skin and creamy flesh. The starch content of the tubers is 15.58%, which gives them a good culinary quality (quality class B), being destined for autumn-winter consumption and industrialization (www.gazetadeagricultura.info).

'Sevastia' is a semi-early potato variety created at I.N.C.D.C.S.Z. Brașov, having genealogy 'Colette' x 'Laura' which forms oval tubers with yellow skin and intense yellow flesh. The finished product has a starch content of 13.42% and falls into quality class A (good culinary quality) for autumn and winter consumption.

'Nemere' is a potato variety created at S.C.D.C. Târgu Secuiesc, having genealogy 'M.P.I. 61-516-20' x 'True'. It is a semi-late variety that forms round tubers with yellow skin and pulp, the starch content being 16-17%, falling into the group with good culinary quality (quality class C) and with suitability for autumn-winter consumption and industrialization (www.asas.ro).

'Productiv' is also a semi-late variety created S.C.D.C. Târgu Secuiesc, with genealogy 'Heidrun' x 'Manuela'. This variety forms round-oval tubers with yellow skin and white-yellow pulp, with a starch content of 17-20%. The finished product falls into good culinary quality (quality class A / B) and is suitable for summer-autumn consumption, respectively industrialization.

The culture technology applied in the comparative experiment was the standard one, specific to the summer-autumn production. The chemical parameters evaluated were dry matter, starch content and reducing sugars, these being determined according to standardized and approved methods of analysis, as follows: specific mass, dry matter the amount of starch by the Stohman method (Marca et al., 2001), reducing sugar content (%) was determined by the Luff-Schoorl method.

The technological process followed the standard links imposed on the processing enterprises (washing, cleaning), and then the tubers were sliced to a thickness of 5.0 mm, in the form of washers with a diameter of 30.0 mm for uniformity and a bleaching was performed with NaCl (1.5%) for 5 minutes, to keep the color and texture as close as possible to those of the original product.

Dehydration was done in a continuous hot air dryer, with an initial temperature of 85 °C and a final temperature of 50 °C. The washers were dehydrated to a moisture content of 7%, then the obtained color was followed and the dehydration ratio was calculated.

The rehydration capacity was determined by soaking the dehydrated product in cold water for 15 minutes, followed by boiling for a further 15 minutes. The weight of the sample after boiling was divided by the weight of the initial sample resulting in the rehydration ratio which for marketing is an indicator of quality.

RESULTS AND DISCUSSION

The dry matter content is between 21.7 and 24.6% (Table 1). In recent years there has been a lower content of dry matter in potato tubers, the main reason being that of climate change, amid the unadaptability of varieties of foreign origin.

Another reason is the better supply for early versus late varieties. Semi-late and late varieties are suitable for storage, because they tend to emit fangs in a small

proportion, respectively they have stability and uniformity in composition (Korenko et al., 2009).

The higher starch content exerts some influence due to its water absorption power. This phenomenon is reflected in the higher rehydration coefficient in the starch richer varieties.

The content in reducing sugar is preferable not to exceed 0.25%, but from the comparative analysis of the studied varieties it is observed that only the semi-early Sevastia variety registers a value of 0.36%.

Table 1

Physico-chemical and technological properties of studied potato varieties

Analyzed characteristics	Semi-early varieties		Semi-late varieties	
	Asinaria	Sevastia	Nemere	Productiv
Pieces / kg	10	9	8	8
Specific mass	1.091	1.074	1.088	1.077
Dry substance (DM %)	24.6	21.7	24.2	22.0
Starch (%)	18.2	16.7	17.0	15.4
Reducing sugars in DM	0.84	1.66	0.93	1.02
Reducing sugar content (%)	0.21	0.36	0.23	0.22
Pulp color	cream	intense yellow	yellow	white-yellow
Dehydration ratio	4.5	5.5	4.3	5.2
Rehydration ratio	3.66	4.00	3.65	3.92
Rehydration coefficient	76	72	81	75

Starch in potato tubers is considered to be the most important energy substance, accounting for about 68% of the total dry matter of tubers (Šmálik, 1987). In the analyzed varieties, the starch storage capacity is good regardless of the variety, the semi-early varieties register a slight increase, having a very good energy value (Figure 1).

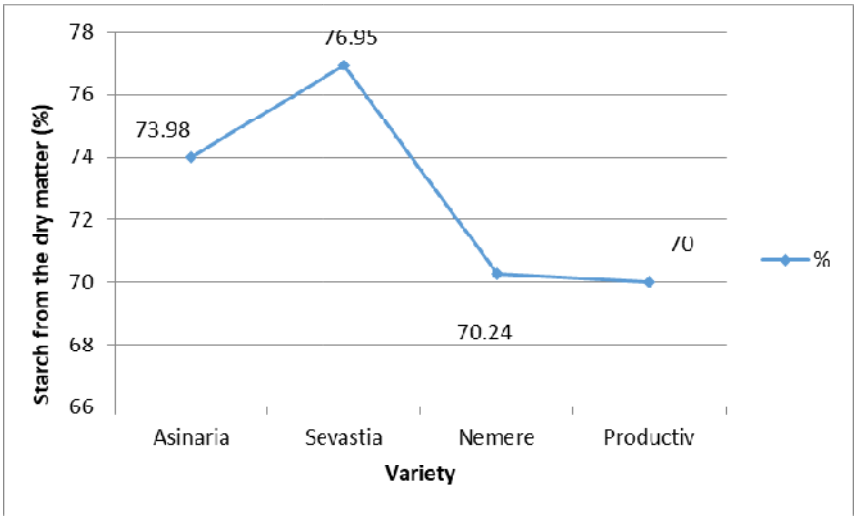

Fig. 1. Percentage of starch from the dry matter

The studied varieties have a different moisture content, require a different dehydration time. In order to analyze correctly the four varieties, a standard humidity of 7% was reached. It is important that the slicing of the raw material is uniform, in order to make a uniform dehydration.

In this sense, two batches were formed with the dehydration ratio of 4.1 and the second with 5.6 and considering the preparation losses (peeling, cutting) of 25% for both batches, the specific consumption will be in the first case of 5.41 kg / kg, and in the second case 7.57 kg / kg. The dehydration ratio is directly influenced by the dry matter content (Figure 2). From the analysis of the values presented in this figure it is observed that the dehydration ratio is the smaller the higher the specific mass.

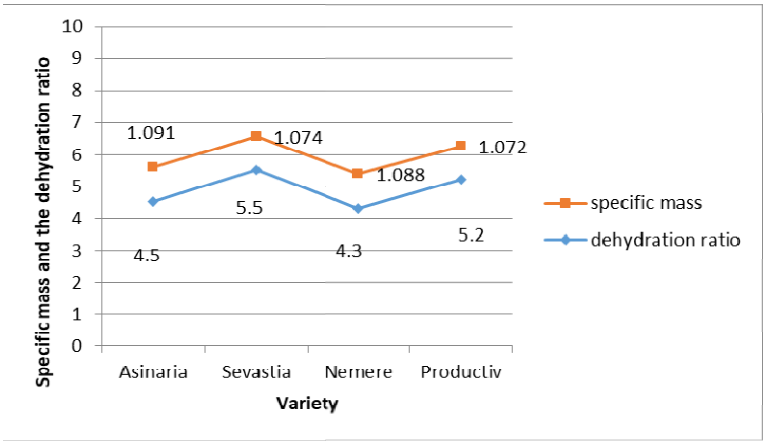

Fig. 2. The relation between the specific mass and the dehydration ratio

On the other hand, in general, dehydrated potatoes from varieties with a high specific mass have a rehydration capacity, expressed by the low dehydration ratio (Figure 3). This can be explained by the fact that losing a smaller amount of water during dehydration creates a smaller network of capillary spaces during rehydration. The relationship is not linear here involving some structo-textural properties.

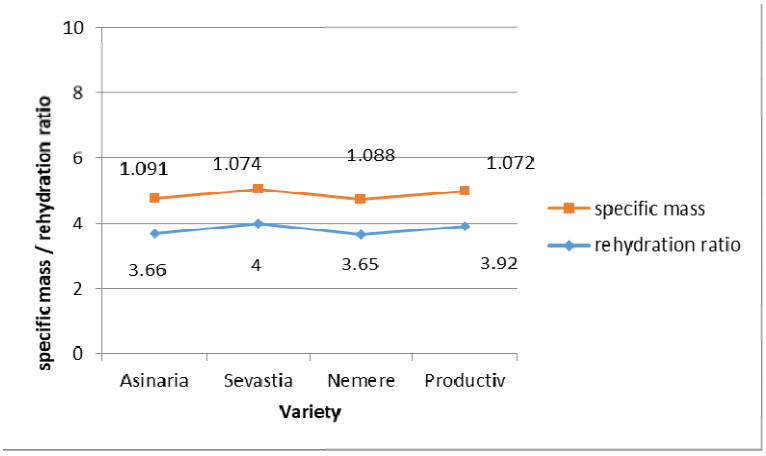

Fig. 3. The relationship between specific mass and rehydration ratio

CONCLUSIONS

Based on the laboratory analyzes and the results obtained for the four potato varieties, the following conclusions and recommendations can be issued:

- ✓ when choosing varieties for dehydration, the destination of the finished product will be taken into account;
- ✓ in case the aim is not to obtain a rehydration capacity, varieties with increased processing efficiency can be recommended;
- ✓ it is recommended that the varieties be dehydrated separately to ensure uniformity of the finished product in terms of moisture and rehydration power.

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