ICFNH 2022

1st International Congress on Food, Nutrition & Public Health

Towards a sustainable future

Instituto Nacional de Saúde Doutor Ricardo Jorge

17th November 2022 | Lisbon | Portugal

Osmotic dehydration: an emerging technology applied to the fruit and vegetable sector

Sousa, S. 1 ; Lima, M. G. 2,3* ; Raimundo, D. 5 ; Neves, A. 2,3 ; Henriques, M. 2,3 ; Oliveira, A. 2,3 ; Oliveira, M. 2,3,4

1 Escola Superior Agrária, IPSantarém

2 Escola Superior Agrária, UI_IPS, IPSantarém

3 Centro de Investigação em Qualidade de Vida (Life Quality Research Center), IPSantarém

4 Linking Landscape, Environment, Agriculture and Food Research Centre, ISA, ULisboa

5 CAMPOTEC - Comercialização e Consultadoria em Hortofrutícola, Torres Vedras

In recent decades, there has been a growing concern regarding food waste and environmental sustainability. This has led industries to try to respond to this concern by finding new ways to take advantage of the subproducts resulting from food technological processes.

On the other hand, there has been an increase in consumer demand for processed foods that are healthy, natural, and tasty. Fruits and vegetables play a fundamental role in human nutrition as indispensable sources of nutrients, vitamins, and minerals.

Many fruit and vegetables, due to production surpluses and/or those that do not have the necessary characteristics for fresh marketing, in particular their size, are channeled to the food industry for processing. One way to increase their consumption as a value-added product is to use new processing technologies.

Combining these facts mentioned above, dehydrated products arise, especially dehydrated fruit.

It is pertinent to explore a new technology to obtain horticultural products since it allows another option of consumption of these products, putting on the market a new product and at the same time makes possible a utilization of the production surplus that is inadequate for the consumer of fresh fruits and vegetables.

In Portugal the dehydrated fruit market is still very small and that of dehydrated vegetables is even smaller. This is due not only to the fact that this type of product is still "strange" to the consumer, but also to its economic cost that does not attract its acquisition.

Osmotic food dehydration (OD)

OD is a mass transfer process that occurs across membranes and cell walls that allows the partial removal of water from the cellular material of food by immersion in a hypertonic solution without causing damage to the food or adversely affecting its quality.

The use of this technique before conventional drying, allows the use of milder temperatures and relatively short times, enabling energy savings and giving the product characteristics that are closer to its fresh state.

The process consists in putting the product in direct contact with a hypertonic solution (sugar or salt). Since the osmotic agent and the product have different concentrations, two simultaneous countercurrent flows are created through the cell walls: one of water from the product into the solution, and another of solute from the solution into the product.

These two mass flows cause a decrease in the product's water activity, which increases its shelf life. Figure 1 represents the OD process.

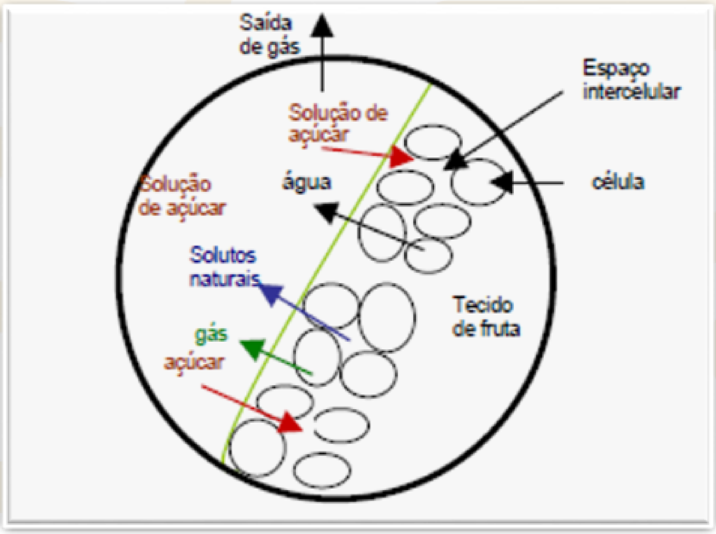


Figure 1 - Mass transfer flows in osmotic dehydration

Some of the advantages of using OD are:

- Preservation of the product's nutritional and sensory characteristics;
- Product browning is minimized;
- Inhibition of microbial activity due to reduced water activity;
- Reduction of thermal process cost and temperature;
- Lower energy application due to water reduction without state change.

The biggest disadvantage of this process is that it does not reduce the water content to such an extent that it does not rehydrate at room temperature

Materials and Methods

To develop this work we used apple, zucchini, carrot, and butternut squash. The osmotic agent used for the apple was sugar, and for the others, salt. For osmotic dehydration and in order to be able to produce a larger quantity, we adapted a craft beer vat, since it has a capacity of 50L, allows us to control the temperature and time, and has continuous agitation of the solution.

The following methodology was used:

- Food preparation

The food is washed and cut into circular slices of equal thickness (about 4 mm) and varying in diameter.

- Preparation of the osmotic solution

Osmotic solutions are prepared with distilled water at different concentrations. Subsequently, a magnetic stirrer is used to dissolve and homogenize the solution.

- Experimental methodology

The slices are immersed in the osmotic solution (figure 2).

At the end of the immersion time, the slices are removed from the solution, rinsed with distilled water to remove excess solution, and dried with absorbent paper. They are then dried in an oven (figure 3).

.

Figure 2 - Osmotic dehydration

Figure 3 - Slices ready to go to the oven

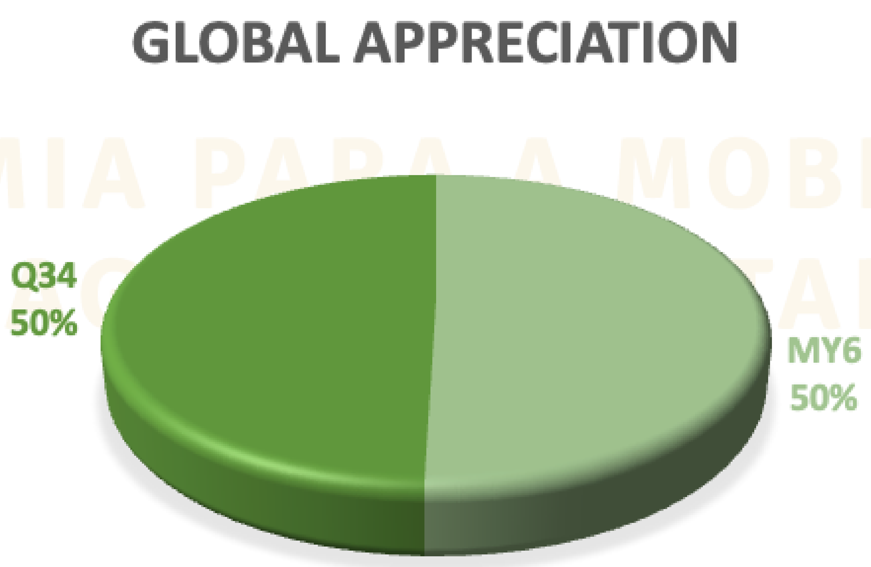
Sensory Analysis

Sensory tests were performed on two prototypes of dehydrated zucchini with concentrations of 2% and 3% salt.

The panel of tasters was asked to evaluate visual appearance, aroma, taste, texture and crunchiness.

The results of the global appreciation were very similar as we can see in graph 1. So we decided to opt for the prototype with lower salt concentration (2%) because it is healthier.

The sensory tests of the remaining foods will take place over the next few weeks.



Graph 1 - Global appreciation graph of dehydrated zucchini with 2% and 3% of salt

Stability and microbiological tests

At the moment the stability and microbiological tests are being developed. We highlight the most relevant analyzed parameters: moisture content, activated water and total solids content. In the microbiological tests we analyze the count of total microorganisms, *Enterobacteriaceae*, molds and yeasts, *Salmonella* spp. and *Escherichia coli*.

We expect to have the results processed by the beginning of February.

Final considerations

Through sensory analysis, the tasters were unanimous in preferring the osmotically dehydrated and dried products over the untreated dried products, which gives a clear indication that osmotic dehydration allowed the characteristics of the dehydrated food not to deviate too much from the taste of the fresh food, so this technology can be considered a promising pre-treatment process to be applied before drying.

It should be noted that osmotic dehydration followed by drying allows these products to be made more acceptable than drying without pre-treatment, thus contributing to their valorization and adding greater economic value.

Cofinanciado por