

## Lyophilisation of truffles

*Lyovapor™ L-200 Pro: Lyophilisation of fresh truffle slices*

### 1. Introduction

Truffles are products with limited shelf life and their sensory properties are rapidly lost. Hence, the expensive fungi become less valuable within a few days. Losses of volatile compounds, oxidation and enzymatic reactions are a considerable problem during their storage. Furthermore, the aroma profile is commonly modified as a result of elevated temperature processes or enzymatic reactions.

Freeze drying the fungi avoids loss and degradation of volatile compounds due to the low temperatures applied during drying. The aromatic profile of truffles are maintained. Freeze dried truffles can either be rehydrated or directly used in dry form [1].

### 2. Experimental

The fresh summer truffle was cut into pieces of approximately 1 mm width (Figure 1). The slices were placed on the stainless steel tray and frozen for 24 hours in a deep freezer at -24°C.

After 24 hours of deep freezing, the truffle slices were transferred with the tray into the Lyovapor™ L-200 for freeze drying in the cube drying chamber and under ambient air atmosphere. The shelf temperature itself was chosen such that it does not exceed 20 and 25°C at the end of the primary and secondary drying (temperature set point), respectively. For more information about the drying sequence, please see reference [2].

After drying of the truffle (see Figure 2), the residual moisture content of five truffle slices were analyzed using a halogen moisture balance heated to 110°C. Therefore, the samples were transferred to the moisture analyzer immediately after removing the dried truffle from the Lyovapor™. The switch-off criterion on the moisture analyzer refers to a change of no more than 1 mg / 140 s.

### 3. Results and Discussion

Figure 1 and 2 shows the tray with the truffle slices before and after freeze drying process, respectively. All truffle pieces showed a homogenous freeze dried structure and appearance. No change of their size and morphology could be observed during the drying.



Figure 1: Tray with fresh cut truffle slices.



Figure 2: Tray shelf with truffle slices after freeze drying.

To determine the drying efficiency of the Lyovapor™ L-200, the residual moisture content of five truffle slices, were analyzed using a halogen moisture analyzer. The results of the measured moisture contents are shown in Table 1.

Table 1: Results of the residual moisture analysis after freeze drying with the Lyovapor™ L-200.

Truffle piece	Weight of freeze-dried sample [g]	Weight of halogen dried sample [g]	Moisture content [%]
1	0.187	0.179	<b>4.28</b>
2	0.119	0.115	<b>3.36</b>
3	0.165	0.161	<b>2.42</b>
4	0.211	0.204	<b>3.32</b>
5	0.153	0.147	<b>3.92</b>

The analyzed samples contained  $3.46 \pm 0.63$  % moisture after freeze drying process. The initial water content of the summer truffle was  $66.33 \pm 0.94$  % (n=3). Hence, applying the described freeze drying method on the Lyovapor™ L-200 lead to an average water removal of 94.78 %. With a water removal of approx. 80 %, the freeze dried truffle has a shelf life of more than 24 months [3]. In general, applying the freeze drying process on foods such as truffle slices, have the following advantages and disadvantages [4]:

#### Advantages

- The process at low temperature and low pressure makes freeze drying an effective way to keep color, smell, flavor and heat-sensitive nutrients of food.
- Eliminates the surface hardening of the food.
- Freeze-dried food is porous and easy to rehydrate and/or dissolve. It can be consumed directly or after rehydration.
- Since freeze-dried food contains very low moisture, it has relatively small density and is easy to be transported. The freeze-dried food can be preserved at room temperature for a long time, while the cost of transportation is much lower than that of frozen food.
- No additives are added into the food during freeze drying process.

#### Disadvantage

- If exposed directly to air, freeze-dried food will be rehydrated quickly, resulting in deterioration of food.
- The freeze-dried products have to be vacuum- or vacuum-nitrogen packed and the packaging material must not be permeable to water vapor.
- During transportation and sale process, freeze-dried food is easy to be powdered or cracked for its loose porous structure.
- Freeze-drying is a time- and energy-consuming process, which leads to higher production costs.

### 4. Conclusion

Freeze dried truffles are a promising alternative to out of season fresh truffles because flavors, smells and nutritional content remain mostly unchanged in comparison to other drying techniques [1, 3, 5].

With the Lyovapor™ L-200, a high drying efficiency was achieved for the water removal. In summary, the Lyovapor L-200 enables to freeze dry fungi samples such as truffle slices.

## 5. References

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[1] I. Palacios, E. Guillamón, A. García-Lafuente, A. Villares; Effects of Freeze-Drying Treatment on the Aromatic Profile of Tuber spp. Truffles. Journal of Food Processing and Preservation, Volume 38, Issue 3, Pages 768–773, (2014).

[2] Application Note, 269/2016 Lyophilisation of truffle.

[3] <http://www.tartuflanghe.com/en/tartufo-bianco/dehydrated-white-truffle/>

[4] H. Tse-Chao Hua, L. Bao-Lin, Z. Hua; Freeze-Drying of Pharmaceutical and Food Products, Woodhead Publishing Series in Food Science, Technology and Nutrition, pages 141–169 (2010).

[5] <https://www.sialparis.com/Catalogue/Catalogue-Sial-Paris-2016/Products-list/freeze-dried-truffles-GEOFOODS-ITALIAN-TRUFFLES>