STUDY OF GRAPE JUICE LYOPHILISATION OBTAINED FROM ROSE AND WHITE GRAPES

Viorela-Maria CODOI¹, Ovidiu TITA¹, Otto KETNEY¹, Ramona IANCU¹

Abstract
Lyophilization is a fast drying process of grape juice, previously frozen by ice sublimation in a vacuum with controlled heat input. Lyophilization juice is made according to its triple point, the grape juice is in its thr

-45 C. For begining we determined the amount of dry substance, the evidence originally obtained with HANNA Instruments HI96801 portable refractometer (% Bx) and we obtained the following values: grape juice rose 15.4% Bx and white grape juice 16.1% Bx. Lyophilization of juice samples was performed at 4 hours and at different temperature ranges (-50, -45, -40, -35, -30, -25, -20, -15, -10, -5, 0 ) and at different pressures, after that is perfom - C for 1 hour under vacuum. In the first phase of lyophilization (4 hours), reduce the amount of water up to 87%, then the secondary drying water quantity is reduced to 2%. This values ranging from 77-85% and the amount of dry substance ranging from 15-17%. Lyophilization process used on grape juice has many advantages and disadvantages. It is recommended to use the freeze drying process because does not change the product features and eliminates whereby the greatest amount of water from product.

Key words: grape juice, lyofilization, freezing, dry substance.

Grape is an important fruit of the world’s largest fruit crops. Grape can be classified into four groups; table grapes, wine grapes, raisin grapes and juice grapes (Faostat,2002). Chemical composition is one of the most important quality criteria for fruit products. ( C an, M. P. (1996))

Grape juice is the liquid obtained by extraction from suitably grapes. Grape juice has minimal composition differences from the grapes except for the content of crude fiber and the oils that are primarily present in the seed (Patiil, V. K., s.a. 1995).

The process of producing natural grape juice can also have soe impact on the concentrations of various components in grape juice.(Fuleki, 1993)

Freeze drying (lyophilization) is removing water from frozen samples held in a vacuum chamber. The frozen water is converted directly into water vapor without an intermediate stage involving liquid water – this is the process of sublimation. Although slower and less controlled than freeze drying, sublimation is what happens when ice cubes “disappear” after being stored in a domestic freezer for a long time, or frozen foods appear to be partially dehydrated. (Lorentzen, J. (1981), Unger, H. G. A. (1982))

Freezing is the unit operation in which the temperature of a grape juice is reduced below its freezing point. Lyophilization is a non-destructive method of preserving biological samples. It can even preserve viable samples of viruses and certain microorganisms, such as yeast. (Jul, M. (1984), Heap, R. D. (1997))

In grape juice, slow freezing is used to form an ice crystal lattice, which provides channels for the movement of water vapour. The next stage is to remove water during subsequent drying and hence dry the food. (Fennema, O. R. (1996))

The freezing point of a grape juice may be described as “the temperature at which a minute crystal of ice exists in equilibrium with the surrounding water”. (Jennings, B. (1999))

The temperature at which a crystal of an individual solute exists in equilibrium with the unfrozen parts and ice is its eutectic temperature. Maximum ice crystal formation is not possible until this temperature is reached. (Miller, J. (1998))

The rate of freeze-drying is directly proportional to the vapor pressure of water in the

¹ Faculty of Agricultural Sciences, Food Industry and Environmental Protection “Lucian Blaga” University, 5-7 Ion Rațiu Street, 550012, Sibiu, Romania;
sample, which is dependent on chemical type and solute concentration of the sample. The most important factor is the eutectic temperature of the grape juice. A eutectic or eutectic mixture is a mixture at such proportions that the melting point is as low as possible, and that furthermore all the constituents crystallize simultaneously at this temperature from molten liquid solution. (Sahagian, M. E. And Goff, H. D. (1996))

In grape juice the formation of a glassy vitreous state on freezing causes difficulties in vapour transfer. Therefore the grape juice is lighter frozen as a foam. (Mellor, J.D. (1978))

Lyophilization of grape juice have a retention of sensory characteristics and nutritional qualities. Volatile aroma compounds are not entrained in the water vapour produced by sublimation and are trapped in the grape juice matrix. As a result, aroma retention of 80% is possible. (Flink, J. M. (1982), Thijssen, H. A. C. (1974))

During lyophilization (controlled sublimation) samples are held at about −50°C in a vacuum of at least 133 x 10⁻³ mBar (one Bar is about one atmosphere of pressure).

**MATERIALS AND METHODS**

Grape juice is made from two types of grapes: white and rose. Grapes were processed in laboratory conditions with no added of sulfur dioxide or addition of pectin / enzymes. The grapes were pressed and crushed by the method, all components were removed and the juice separated.

Methods

**Determination of dry substance with Instruments HI96801 HANNA refractometer (% Bx).**

Lyophilization and concentration of grape juice was performed using LD freezer alpha1-4 plus following the next method. We weighed balloons bottomless, we put 10 g of juice and we left to freeze for 4 hours at different temperature ranges:

- - C 0.040 mbar;
- - C 0.070 mbar;
- - C 0.12 mbar;
- - C 0.22 mbar;
- - C 0.37 mbar;
- - C 0.63 mbar;
- - C 1.00 mbar;
- - C 1.60 mbar;
- - C 2.50 mbar;
- C 6.10 mbar.

- - C for 1 hour under vacuum. In the first phase of lyophilization (4 hours), reduce the amount of water up to 87%, then the secondary drying water quantity is reduced to 2%. These determinations were made within 14 days. During this time the juice was stored at a temperature C in refrigerator. (Rahman, M. S. (1999))

**RESULTS AND DISCUSIONS**

Amount of dry substance initially obtained with Instruments HI96801 HANNA refractometer (% Bx) (Figure 1).

From the results obtained shows that the smallest amount of evaporated water from Rose grape juice is at 0 C and that is 76.13% water, and the largest amount of evaporated water is at -10 C, namely 85 30% water. And as an average value of these results shows that the best evaporation takes place at -25 °C when it evaporates a quantity of 83.6% water.

From the results obtained shows that the small amount of water evaporated from white grape juice is at - C, namely 82.05% water, and the largest amount of evaporated water is - C, namely 84.33% water. And as an average value of these results shows that the best evaporation takes place at - C when it evaporates a quantity of 83.11% water.

Variation amount of evaporated water according with the temperature is observed in Figure 2.
From the results obtained shows that the small amount of dry substance evaporated from Rose grape juice is at -10 °C, namely 14.69% dry substance, and the largest amount of evaporated water is at -5 °C, namely 23.86% dry substance. And as an average value of these results shows that the best evaporation takes place at -25 °C when it evaporates a quantity of 16.35% dry substance.

From the results obtained shows that the small amount of dry substance evaporated from white grape juice is at -10 °C and is 15.66% dry substance and the largest amount of dry substance evaporated is at -25 °C, namely 17.94% dry substance. And as an average value of these results shows that the best evaporation takes place at -5 °C when it evaporates a quantity of 16.88% dry substance.

Variation amount of evaporated dry substance according with the temperature is observed in Figure 3.

CONCLUSIONS

From this paper we observed that factors that control the water evaporation are:
- the pressure in the lyophilization chamber;
- the temperature of ice at the sublimation front;
- the temperature of the vapour condenser;
- the eutectic point of grape juice.

From all the results is very important to note the temperature at which the lyophilization at different temperatures varies like as the quantity of water evaporated and the amount of dry substance evaporated and helps to establish the optimum temperature that the lyophilization of grape juice can occur.

Lyophilization process used on grape juice has many advantages and disadvantages. It is
recommended to use the freeze drying process because does not change the product features and eliminates whereby the greatest amount of water from product.

The advantages of utilization of lyophilization are:

- Is the only process by which water is extracted from grape juice without loss of volatile substances;
- Provides grape juice superior proprieties and keeps the sensory properties (texture, taste, smell).
- Reduction of weight and volume: because water is almost completely eliminated, the weight of juice powder is 1/4, 1/10 of the original weight.
- Compared to freezing, freeze-dried products do not require cold temperature for storage.

REFERENCES


