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COMMITTEE FOR TRADE, INDUSTRY AND
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Working Party on Standardization
of Perishable Produce and
Quality Development

Specialized Section on Standardization
of Dry and Dried Produce (Fruit)
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Item 7 of the provisional agenda

REVISION OF THE STANDARD LAYOUT FOR DRY AND DRIED FRUIT

ANNEX II: DETERMINATION OF THE MOISTURE CONTENT FOR DRY FRUIT

Proposal transmitted by Spain

Introduction: At the last session it had been agreed to revise the Standard Layout for UN/ECE Standards for Dry and Dried Fruit (rapporteur: Germany) and its annexes (rapporteur: Spain) (see TRADE/WP.7/GE.2/1998/14, para. 48). This project was approved by the Working Party (see TRADE/WP.7/1998/9, para. 19).

Since the proposed methods differ from those contained in the current Standard Layout, textual changes have not been highlighted. A number of points and figures have nevertheless been underlined in this text to bring out the main issues requiring discussion.

No proposals have thus far been made to revise annex I, "Determination of the Moisture Content for Dried Fruit", since its future direction will depend on the decisions taken with respect to annex II.

ANNEX II

DETERMINATION OF THE MOISTURE CONTENT FOR DRY FRUIT

METHOD 1 - LABORATORY REFERENCE METHOD

1. Scope and application

This reference method serves to determine the moisture content for both unshelled and shelled dry fruit.

2. Reference ¹

This method is based on the method prescribed by AOAC: AOAC Official Method 925.40, Moisture in Nuts and Nut Products, First Action; AOAC *Official Methods of Analysis*, XVith edition, 1995.

3. Definition

Moisture content for dry fruit: loss in mass after completion of the heating process specified in this standard. The moisture content is expressed in grams per 100 grams.

4. Principle 1/

Evaporation of water from the portion to be examined at a temperature of 95-100° C in a temperature-controlled oven at reduced pressure (≤ 100 mm Hg <> 13.3 kPa) until a constant mass is obtained.

5. Apparatus

Ordinary laboratory apparatus, specifically:

- 5.1 Ceramic mortar with appropriate pestle, or food chopper.
- 5.2 Analytical balance sensitive to 1 mg.
- 5.3 Desiccator containing an effective desiccant (e.g. freshly dried moisture-indicating silica gel).

¹*Rapporteur's note: One of three options should be selected:*
Option (a) Drying at 103° C (± 2° C) in a temperature-controlled oven at ambient pressure (the method currently provided for in the Standard Layout, without any technical reference)
Option (b) Drying at 95-100° C in a temperature-controlled oven at reduced pressure (≤100 mm Hg <>13.3 kPa). (Reference AOAC 925.40 - Moisture in Nuts and Nut Products)
Option (c) Drying at 70° C in a temperature-controlled oven at reduced pressure (≈ 22.5 mm Hg <>3 kPa). (Reference ISO 1026 - Determination of dry matter content and water content in fruit and vegetable products)
The Rapporteur has initially selected option (b) as the basis for this report.

- 5.4 Temperature-controlled oven with a thermostat and a vacuum device capable of maintaining a temperature of 95-100° C throughout the working area and a reduced pressure of \leq 100 mm Hg.
- 5.5 Glass, porcelain or non-corrosive metal containers approximately 20 mm in depth and 80 mm in diameter, provided with well-fitting lids.

6. Procedure

6.1 Preparation of sample

- 6.1.1 Homogenize the laboratory sample and take approximately 100 g of dry fruit as a portion to be examined. The cuticle or spermoderm of the kernel is included in this portion, unless indicated otherwise by the product description. If required, first remove the unshelled dry fruits from their shells using a nutcracker or hammer.
- 6.1.2 If the determination of the moisture content is to be performed on the kernel (shelled dry fruit), crush the kernels in the mortar, or chop them finely, to obtain fragments of less than 3 mm across.
- 6.1.3 If the determination of the moisture content is to be performed on the whole of the shelled dry fruit, first crack the shells using a nutcracker or hammer and mix the whole before taking the portion to be examined and crushing it in the mortar.

6.2 Determination of moisture content

Carry out the determination on two test portions of approximately 10 g each.

- 6.2.1 Dry the containers and their lids in the oven (5.4) at 95-100° C for at least one hour.

Note: The drying phases referred to in 6.2.1, 6.2.5 and 6.2.7 start when the oven temperature reaches 95° C.

- 6.2.2 Transfer the containers and their lids to the desiccator (5.3) and let them cool for at least 30 minutes to the temperature of the room containing the balance (5.2).
- 6.2.3 Weigh each empty container and its lid (M_0) to within 1 mg.
- 6.2.4 Take as a test portion approximately 10 g of the sample and spread the material all over the base of the container. Close the container with its lid and weigh the whole (M_1) to within 1 mg. Perform these operations as quickly as possible after the operation described in 6.2.3.

- 6.2.5 Place the open containers, with their lids beside them, in the oven pre-set to 95-100° C at a reduced pressure of ≥ 100 mm Hg, and dry for at least six hours. Avoid opening the oven during this period.
- 6.2.6 Cover each container with its lid and transfer it to the desiccator. Let it cool for at least 30 minutes to the temperature of the room containing the balance, and weigh to within 1 mg. Perform this latter operation as quickly as possible.
- 6.2.7 Repeat the drying process every hour, cooling and weighing each time as indicated in 6.2.5 and 6.2.6 until a constant mass (M_2) is obtained; this occurs when the variation in mass does not exceed 2 mg.

Note: In the event of an increase in mass, take the lowest mass recorded as a basis for calculation.

7. Expression of results

7.1 Method of calculation and formula

Calculate the moisture content W as a percentage of the mass using the expression

$$w = \frac{m_1 - m_2}{m_1 - m_0} \times 100$$

where

m_0 is the mass in grams of the container and its lid (6.2.3);

m_1 is the mass in grams of the test portion, the container and its lid before drying (6.2.4);

m_2 is the mass in grams of the test portion, the container and its lid after drying (6.2.7).

Take as a result the arithmetic mean of the results from the two test portions (6.2), provided that the conditions of repeatability are satisfied (7.2). Transcribe the result to within one decimal place.

7.2 Repeatability

The difference in absolute value between the respective results of two determinations performed simultaneously, or one immediately after the other, by the same operator under the same conditions on identical test material must not exceed 0.2%.

7.3 Reproducibility

The difference in absolute value between two results obtained respectively by two operators working in different laboratories on identical test material must not exceed 0.3%.

8. Test report

The test report must state the method used and the results obtained. It must also indicate any operational details which are not specified in this standard or which are considered optional, and provide details of any incident which may have affected the results. The report must contain all information necessary for the full identification of the sample.

METHOD 2: RAPID METHODS "A" AND "B"

1. Principle

Determination of the moisture content using measuring apparatus based on the principle of electrical conductivity (rapid method "A") or on the principle of loss of mass by heating with apparatus including an infra-red lamp and a built-in analytical balance (rapid method "B"), always provided that the apparatus and operational procedures are standardized with respect to the laboratory method.

2. Apparatus

2.1 Apparatus common to methods "A" and "B"

2.1.1 Ceramic mortar with appropriate pestle, or food chopper.

2.2 Apparatus specific to method "A"

2.2.1 Measuring instrument based on the principle of electrical conductivity.

2.3 Apparatus specific to method "B"

2.3.1 Infra-red oven with built-in analytical balance sensitive to 1 mg.

3. Procedure

3.1 Preparation of sample

Follow the same directions as for the laboratory methods (6.1.1, 6.1.2 and 6.1.3), unless indicated otherwise by the instructions for use of the apparatus, particularly with regard to the diameter of the fragments.

3.2 Determination of moisture content

Carry out the determination on two test portions of approximately 5 to 10 g each, unless indicated otherwise by the instructions for use of the apparatus.

3.2.1 Procedure specific to method "A"

Fill the test receptacle, thoroughly cleaned in advance, with the test portion, tighten the press until a constant pressure is obtained, and read the values on the scale. Make any corrections or conversions indicated in the introductions for use of the apparatus, if required, for the substance to be examined.

3.2.2 Procedure specific to method "B"

Spread the test portion over the base of the test receptacle, thoroughly cleaned in advance, and note the weight of the test portion to within 1 mg. Switch on the infra-red lamp and follow the procedure indicated in the instructions for use of the apparatus for the substance to be examined, in particular as regards the adjustment of the apparatus, the duration of the test and the recording of the weight readings.

4. Expression of results

4.1 Result

Take as a result the arithmetic mean of the results from the two test portions (3.2), provided that the conditions of repeatability (4.2) are satisfied. Transcribe the result to within one decimal place.

4.2 Repeatability

The difference in absolute value between the respective results of two determinations performed simultaneously, or one immediately after the other, by the same operator, under the same conditions on identical test material must not exceed 0.2%.

5. Test report

The test report must state the method used and the results obtained. The report must contain all information necessary for the full identification of the sample.
