INTERNATIONAL STANDARD

ISO 8967

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Dried milk and dried milk products — Determination of bulk density

Lait sec et produits laitiers en poudre — Détermination de la masse volumique

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Foreword

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International Standard ISO 8967 was prepared by Technical Committee ISO/TC 34, *Agricultural food products*, Sub-Committee SC 5, *Milk and milk products*, in collaboration with the International Dairy Federation (IDF) and the Association of Official Analytical Chemists (AOAC), and will also be published by these organizations.

Annex A of this International Standard is for information only.

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Introduction

Different steps during production can influence the volume taken up by a certain mass of milk powder. The most important parameters affecting the volume of milk powder and hence its bulk density (see the definitions in clause 2) are the dry matter content, the viscosity and the temperature of the concentrate. Also, homogenization of the concentrate and the spray-drying conditions, such as the inlet and outlet temperatures of the air and the peripheral velocity of the atomizer wheel or the pressure during nozzle atomization, are important steps. Special spray-drying conditions, such as recirculation of the fines to the wet zone in the spray drier (straight-through atomization), two-stage drying or rewetting for the production of instant milk powder, also have an influence on the volume.

In an inter-laboratory study involving seven laboratories and nine samples, two methods for the determination of bulk density were tested. In one method the cylinder was dropped manually and in the other a mechanical apparatus was used for the tapping. The aim of this work was not only to establish the repeatability and reproducibility of the methods but also to determine the number of tappings needed to achieve reasonably constant volume. From this work it was clear that the mechanical operation gives far better results than the manual operation. For the mechanical test the same apparatus as that specified in ISO 787-11 was used.

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Dried milk and dried milk products — Determination of bulk density

1 Scope

This International Standard specifies a method for the determination of the bulk density of dried whole milk, dried partly skimmed milk and dried skimmed milk (as defined in FAO/WHO Standard A-5[1]), whether non-instant or instant.

The method is also applicable to dried whey, dried buttermilk and dried milk-based infant food, as well as to any of the dried products indicated above in which milk fat has been replaced by another fat or which has been roller-dried instead of spray-dried.

2 Definitions

For the purposes of this International Standard, the following definitions apply.

2.1 poured bulk density: Quotient of the mass and volume of a powder after transferring it to a specific cylinder.

For dried milk and dried milk products it is expressed in grams per millilitre.

2.2 loose bulk density: Quotient of the mass and volume of a powder after 100 tappings under the conditions specified in this International Standard.

For dried milk and dried milk products it is expressed in grams per millilitre.

2.3 bulk density: Quotient of the mass and volume of a powder after 625 tappings under the conditions specified in this International Standard.

For dried milk and dried milk products it is expressed in grams per millilitre.

NOTE 1 In the Système international d'unités the concepts of density as defined above are expressed in kilograms per cubic metre. In commercial practice, however, these densities of dried milk and dried milk products are traditionally expressed in grams per millilitre.

3 Principle

Tapping of a test portion of the dried product in a measuring cylinder. After a specified number of taps, recording of the volume of the product and calculation of its bulk density.

4 Apparatus

Usual laboratory equipment and, in particular, the following.

4.1 Balance, accurate to the nearest 0,1 g.

4.2 Measuring cylinder, of 250 ml capacity, graduated from 0 ml to 250 ml, of scale length 245 mm ± 4 mm, of mass 190 g ± 15 g, and capable of being fixed on the apparatus (4.3).

4.3 Bulk density apparatus (see figure 1), having the components specified in 4.3.1 to 4.3.3.

4.3.1 Screwing device, to fasten the measuring cylinder on the apparatus, of 450 g ± 10 g mass.

4.3.2 Tapping device, capable of lifting up the screwing device (4.3.1) and the measuring cylinder (4.2) to a height of 3 mm ± 0,1 mm, and capable of tapping at a frequency of 250 ± 15 per minute.

4.3.3 Interval-counting device, capable of recording from 0 to 625 taps, fitted with an automatic stop, capable of being regulated to stop after a previously defined number of taps.

1) FAO/WHO Standard A-5 for whole milk powder, partly skimmed milk powder and skimmed milk powder, elaborated under the *Code of principles concerning milk and milk products*, 8th edition (1984), Rome: Food and Agriculture Organization of the United Nations/World Health Organization.

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4.4 Laboratory spatula.

4.5 Beaker, of 250 ml capacity.

4.6 Powder funnel, with short tube, in glass or antistatic material, having the following dimensions:

total height, 100 mm;

length of tube, 30 mm;

diameter of tube, 20 mm;

upper diameter of funnel, 100 mm.

4.7 Laboratory brush.

5 Sampling

Sampling should have been carried out in accordance with ISO 707.

Place the laboratory sample in a clean, dry, airtight container. The intact unopened retail container may be used.

6 Preparation of the test sample

Keep the laboratory sample at ambient temperature (20 °C to 25 °C). Thoroughly mix the sample (avoid the breakage of particles) by repeatedly rotating and inverting the container. The container should be not more than two-thirds full. If the container is too full to allow thorough mixing, transfer all the laboratory sample to a clean, dry, airtight container of adequate capacity and mix as described above.

In the case of instant dried milk, the mixing shall be very gentle to avoid reducing the particle size of the sample.

7 Procedure

7.1 Test portion

Weigh into a beaker (4.5) 100 g ± 0,1 g of powder. If 100 g of powder does not fit into the measuring cylinder (4.2), reduce the mass to 50 g ± 0,1 g.

7.2 Determination

7.2.1 Place the funnel (4.6) on the measuring cylinder (4.2) and transfer the powder to the cylinder using the spatula (4.4). If necessary, use the brush (4.7) to transfer all traces of powder to the measuring cylinder.

In order to make the reading easier, level off the surface with the spatula (4.4) and record the volume in millilitres (V_0).

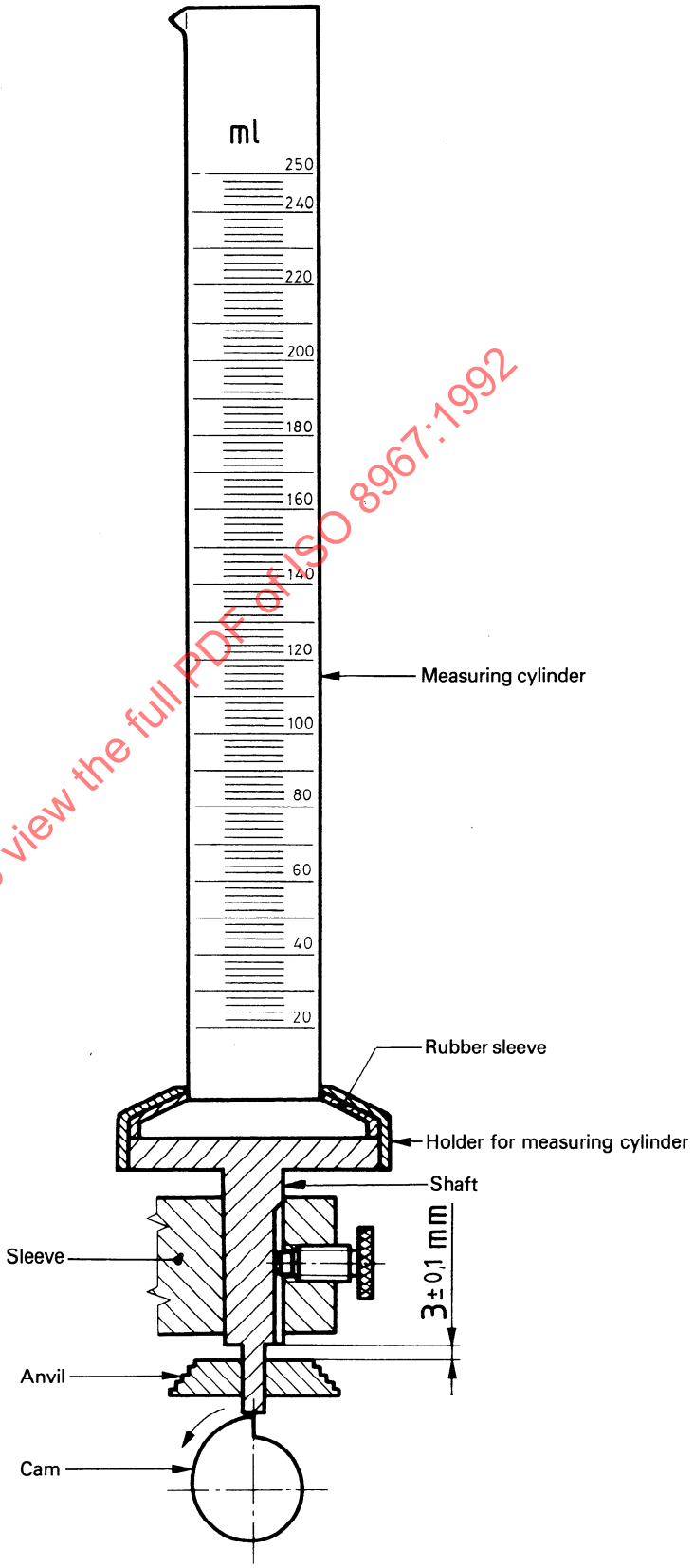

Figure 1 — Bulk density apparatus

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7.2.2 Fix the measuring cylinder (4.2) in the bulk density apparatus (4.3) and tap 100 times. Level off the surface with the spatula and record the volume in millilitres (V_{100}).

7.2.3 Regulate the number of taps to 625 (the 100 taps of 7.2.2 included). After tapping, level off the surface with the spatula and record the volume in millilitres (V_{625}).

8 Expression of results

Calculate the result, expressed in grams per millilitre, according to the appropriate formula given below.

Poured bulk density

$$\rho_0 = m/V_0$$

Loose bulk density

$$\rho_{100} = m/V_{100}$$

Bulk density

$$\rho_{625} = m/V_{625}$$

where

ρ_0, ρ_{100} and ρ_{625} are the densities, in grams per millilitre, after transfer, after 100 tappings and after 625 tappings, respectively;

m is the mass of the test portion, in grams;

V_0, V_{100} and V_{625} are the volumes, in millilitres, after transfer, after 100 tappings and after 625 tappings, respectively.

Express the result to the third decimal place.

9 Precision

NOTE 2 The values for repeatability and reproducibility were derived from the results of an inter-laboratory test carried out in accordance with ISO 5725.

9.1 Repeatability

The absolute difference between two single test results, obtained using the same method on identical test material in the same laboratory by the same operator using the same equipment within a short interval of time, should not be greater than $0{,}025\overline{\rho}$ g/ml, where $\overline{\rho}$ is the arithmetic mean of the two results.

Take $\overline{\rho}$ as the result if the repeatability is satisfactory. Reject both results if the difference exceeds $0{,}025\overline{\rho}$ g/ml and carry out two new single determinations.

9.2 Reproducibility

The absolute difference between two single test results, obtained using the same method on identical test material in different laboratories with different operators using different equipment, should not be greater than $0{,}04\overline{\rho}$ g/ml, where $\overline{\rho}$ is the arithmetic mean of the two results.

10 Test report

The test report shall specify the method used and the test result obtained. It shall also mention all operating details not specified in this International Standard, or regarded as optional, together with details of any incidents which may have influenced the test result.

The test report shall include all information necessary for the complete identification of the sample.

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Annex A
(informative)

Bibliography

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[2] ISO 787-11:1981, *General methods of test for pigments and extenders — Part 11: Determination of tamped volume and apparent density after tamping.*

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