INTERNATIONAL STANDARD

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Green and roasted coffee — Determination of free-flow bulk density of whole beans (Routine method)

Café vert et café torréfié — Détermination de la masse volumique sans tassement des grains entiers (méthode pratique)

Reference number
ISO 6669:1995(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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Introduction

Knowledge of the bulk density of green and of roasted whole coffee beans is important for their trade, since it determines the volume occupied by a given mass of beans, which is a factor in their packaging, storage and transport.

Bulk density is defined as the ratio of mass to volume occupied. Measurement of the mass which occupies a fixed known volume under precise conditions of filling is a widely practised technique for determining the bulk density of both green and roasted coffee beans. The bulk density of coffee beans determined in this manner will vary according to the mass, size and shape of the individual beans and, to a lesser extent, their moisture content at the time of measurement. The filling of a container of known volume in free fall will be influenced by the free-flowing conditions established in the method; the accuracy of the method is influenced by a correct levelling procedure of the beans in the container.

Botanic, horticultural, processing, storage and handling factors, including the effect of age, variously influence the bulk density of green coffee beans, whilst their roasting behaviour and conditions additionally influence the bulk density of the roasted beans.

The method adopted for a routine method needs to be as simple as possible and subject as little as possible to human error in use; the equipment should be easy to make wherever coffee is produced, sold or bought.

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Green and roasted coffee — Determination of free-flow bulk density of whole beans (Routine method)

1 Scope

This International Standard specifies a method for the determination of the bulk density of whole green or roasted coffee beans under free-flow conditions from one container to another. It is to be distinguished from any method determining packed bulk density.

The determination of either percentage moisture content or loss in mass on oven heating is also important and should be carried out at the same time as that of the bulk density determination.

The method is not recommended for measurement of the bulk density of ground roasted coffee.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1447:1978, *Green coffee — Determination of moisture content (Routine method).*

ISO 3509:1989, *Coffee and its products — Vocabulary.*

ISO 6673:1983, *Green coffee — Determination of loss in mass at 105 °C.*

ISO 11817:1994, *Roasted ground coffee — Determination of moisture content — Karl Fischer method (Reference method).*

ISO 11294:1994, *Roasted ground coffee — Determination of moisture content — Method by determination of loss in mass at 103 °C (Routine method).*

3 Definition

For the purposes of this International Standard, the definitions given in ISO 3509 and the following definition apply.

3.1 free-flow bulk density: Ratio of the mass of green or roasted coffee to the volume it occupies (mass per unit volume) after it has been allowed to pour freely into a measuring receptacle, under the conditions specified in this International Standard, at a given moisture content (or a given value for loss in mass on oven heating).

It is conventionally expressed in grams per litre (or, equivalently, kilograms per cubic metre).

4 Principle

Allowing a sample to flow freely from a specified hopper into a specified receptacle of known volume, and weighing the contents of the receptacle.

5 Apparatus

Usual laboratory apparatus and, in particular, the following.

5.1 Analytical balance, capable of weighing to an accuracy of ± 0,1 g.

5.2 Apparatus for determination of free-flow density, consisting of the following.

5.2.1 Funnel-shaped hopper, having a slide gate at its lower extremity, of stainless steel or other corrosion-resistant metal, firmly mounted on a support attached to a rigid base (not shown in figure 1). The dimensions of the hopper shall conform to those given in figure 1.

5.2.2 Measuring receptacle, of stainless steel or rigid plastic (of at least 6,35 mm thickness), of approximate capacity 1 000 ml. The capacity of the receptacle shall be known to the nearest millilitre, and its exact dimensions shall conform to those given in figure 1. The distance between the slide gate of the hopper and the top of the receptacle shall be kept constant at 76,2 mm ± 1,5 mm.

5.3 Spatula, or other suitable tool for levelling, having a straight edge.

6 Sampling

It is important that the laboratory receive a sample which is truly representative and has not been damaged or changed during transport and storage.

Sampling is not part of the method specified in this International Standard. A recommended sampling method for green coffee is given in ISO 4072.[1)]

7 Preparation of test sample

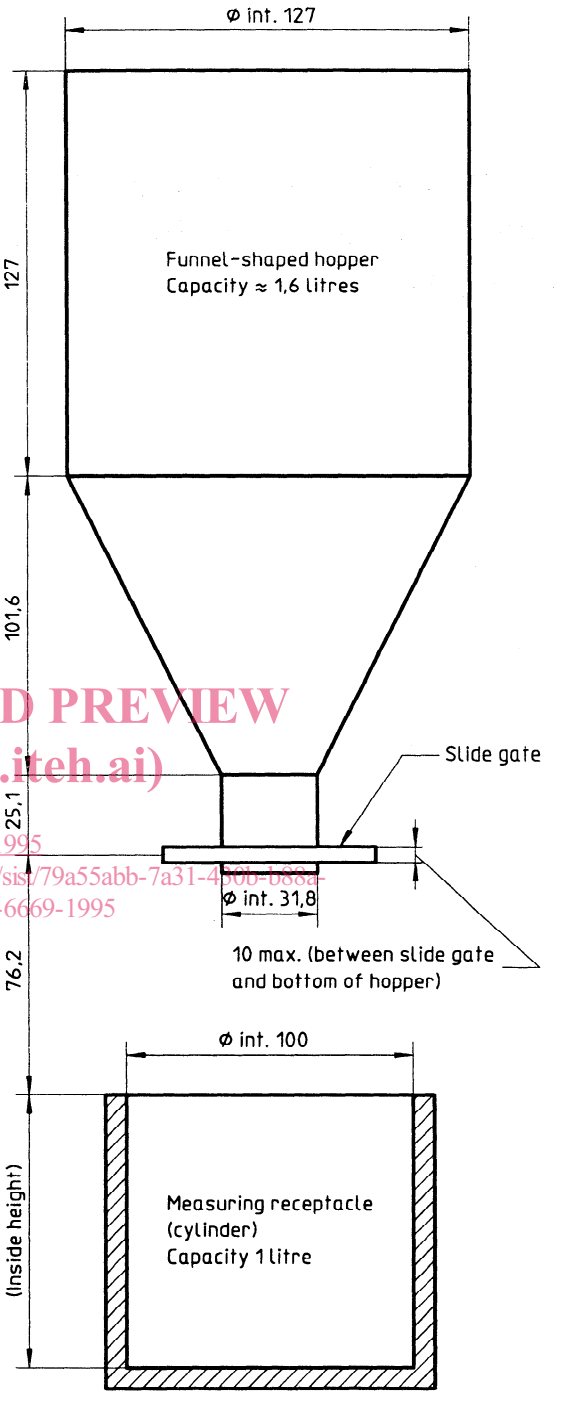
From the laboratory sample, take at least three test samples of 300 g each.

8 Procedure

8.1 Carry out determinations on two test samples.

8.2 Close the slide gate of the hopper (5.2.1) and ensure that the distance between the slide gate and the top of the receptacle is as specified.

Dimensions in millimetres



NOTE — Both hopper and measuring cylinder have circular cross-sections.

Figure 1 — Apparatus for the determination of the free-flow bulk density of coffee in whole bean form (green or roasted)

1) ISO 4072:1982, *Green coffee in bags — Sampling.*

8.3 Fill the hopper with the test sample to within 2,5 mm of the top of the hopper.

8.4 Weigh the measuring receptacle (5.2.2) to the nearest 0,1 g. Centre the measuring receptacle under the discharge of the hopper and open the slide gate. Allow the hopper to empty and the measuring receptacle to overflow freely (the coffee beans should flow at a constant rate, without forcing).

Remove rapidly the excess coffee beans using the spatula (5.3), held in a horizontal position, to form a level surface that is even with the top of the receptacle. Avoid moving, shaking or vibrating the measuring receptacle before the excess beans are removed.

Weigh the measuring receptacle and its contents to the nearest 0,1 g.

8.5 Determine the moisture content of the third test sample in accordance with ISO 1447 for green coffee or ISO 11817 for roasted coffee, or determine the loss in mass on heating in accordance with ISO 6673 for green coffee or ISO 11294 for roasted coffee.

9 Calculation

The free-flow density, expressed in grams per litre, is given by

$$\frac{m_2 - m_1}{V}$$

where

m_1 is the mass, in grams, of the empty measuring receptacle;

m_2 is the mass, in grams, of the measuring receptacle full of coffee beans;

V is the capacity, in litres, of the measuring receptacle.

Take as the result the arithmetic mean of the values obtained in the two determinations, provided that the repeatability condition (clause 10) is satisfied.

10 Repeatability

The absolute difference between two independent 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 1 % of the mean.

11 Test report

The test report shall specify

— the method in accordance with which sampling was carried out, if known,

— the method used,

— the test result(s) obtained, and,

— if the repeatability has been checked, the final quoted 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(s).

The test report shall include the value of the percentage moisture content, or loss in mass on oven heating, and the method used to determine it (8.5).

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

ICS 67.140.20

Descriptors: agricultural products, plant products, coffee, coffee beans, tests, determination, bulk density.

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