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Solid biofuels — Determination of particle density of pellets and briquettes

Titre manque

ICS: 75.160.10; 27.190

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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Foreword

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The committee responsible for this document is ISO/TC 238, *Solid biofuels*, Working Group WG 4, *Physical and Mechanical Test Methods*.

Introduction

Particle density is a fuel parameter of pellets and briquettes which is often considered when describing the degree of compaction of the raw material used. Particle density can be highly specific for the respective type or species of biomass, and thus it also characterizes the material's general ability to be compacted. High particle density is often associated with high resistance to abrasion or low susceptibility towards fracturing during handling and storage. A high particle density also generally leads to reduced storage volume demands and to lower filling levels in combustion chambers at constant fuel mass flow. Particle density can also affect the heat transfer rate within the fuel and thus it can have an impact on fuel ignition and on the dynamics of gasification.

Apart from the buoyancy method which is described in this standard as reference method, larger particles (briquettes) are sometimes easier tested by simple stereometric means. For internal laboratory practices such a procedure is also presented in the informative annex. For small particles (pellets) this procedure is not suggested.

Solid biofuels — Determination of particle density of pellets and briquettes

1 Scope

This standard describes the method for determining the particle density of compressed fuels such as pellets or briquettes. Particle density is not an absolute value and conditions for its determination have to be standardized to enable comparative determinations to be made.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 16559, *Solid biofuels — Terminology, definitions and descriptions*

ISO CD 18135, *Solid biofuels — Sampling*

ISO CD 14780, *Solid biofuels — Sample preparation*

ISO 18134-1, *Solid biofuels — Determination of moisture content — Oven dry method — Part 1: Total moisture — Reference method*

ISO 18134-2, *Solid biofuels — Determination of moisture content — Oven dry method — Part 2: Total moisture — Simplified procedure*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 16559 apply.

3.1
test sample
laboratory sample after an appropriate preparation made by the laboratory

3.2
test portion
sub-sample either of a laboratory sample or a test sample (3.1)

4 Principle

Both mass and volume of an individual particle or a group of particles are determined. The volume is measured by determining the buoyancy in a liquid. This procedure follows the physical principle that the buoyancy of a body is equal to the weight of the displaced volume of a liquid. The apparent loss in weight between a measurement in air and a subsequent measurement in liquid marks its buoyancy. The volume of the test portion body is calculated via the density of the applied liquid.

NOTE The particle density of briquettes could also be estimated by stereometric means (see informative Annex A).

5 Reagents

5.1 Water with low content of ions (e.g. drinking water quality) in a temperature range of 10 to 30°C.

5.2 A detergent named O-[4-(1,1,3,3-Tetramethylbutyl)-phenyl]-deca(oxyethylen), Octylphenoldecaethylen-glycolether, Polyethylenglycol-mono-[p-(1,1,3,3-tetramethylbutyl)-phenyl]-ether.

NOTE The exclusive use of this specific detergent with given characteristics allows to apply a fixed value for the density of the liquid (mixture with water) and ensures constant properties as wetting agent. The detergent is traded for example under the name Triton® X-100. The density at +20°C is 1,07 g/ml.

5.3 Paraffin with a melting point of +52 to +54°C.

6 Apparatus

6.1 General apparatus requirements

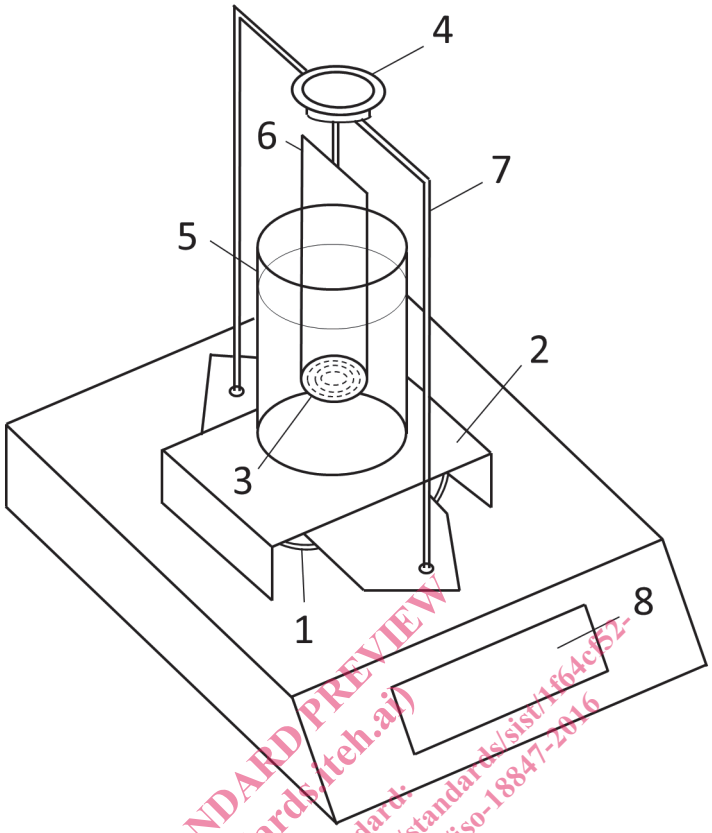
A thermometer capable of reading to the nearest 1°C.

6.2 Apparatus for pellet testing

6.2.1 A balance, having sufficient accuracy to determine the weight to the nearest 0,001 g. Due to the high sensitivity of the balance the test rig shall be placed into a wind protection cabinet to allow undisturbed and immediate reading of the displayed values.

6.2.2 A transparent beaker glass of about 200 ml filling volume.

6.2.3 A density determination rig placed on a balance. The rig consists of a bridge, which overstretches the weighing plate of the balance in order to prevent the balance from being loaded. The bridge is capable of carrying the beaker glass (6.2.2). Through a supporting frame with suspension rods a weighing dish ("submergence dish") is hung into the beaker glass (Figure 1), which is filled with liquid. The dish shall be able to accommodate at least four pellets at once. Both, the supporting frame and the submergence dish are directly loaded on the balance plate. The submergence apparatus (the dish and the suspension) can be removed for being loaded with pellets. Through the dish suspension the submergence depth is always kept constant. The bottom of the submergence dish is perforated by openings, which are smaller in diameter than the diameter of the pellets. This perforation allows the liquid to fill the dish from underneath when it is submerged. If test portion material of low density shall be applied (below 1,0 g/cm^3) a modified suspension having an inverted submergence dish is required; this is to force the pellets underneath the liquid surface and prevent them from floating atop of the liquid. For the determination of the mass in air it is useful to use a combined test rig where an additional upper weighing dish is fixed to the suspension (Figure 1).



Key

1 Weighing plate of balance
2 Bridge
3 Perforated submergence dish (for weighing in water)
4 Dish (for weighing in air)
5 Beaker glass
6 Dish suspension
7 Supporting frame
8 Display of balance

Figure 1 — Buoyancy determination rig on a balance (method for pellets) (submergence dish for pellets with density below 1,0 g/cm^3 is not shown in the figure)

6.3 Apparatus for briquette testing

6.3.1 A balance, having sufficient accuracy to determine the weight to the nearest 0,01 g. If briquettes of more than 500 g each are tested the accuracy of the balance can be reduced to 0,1 g. The balance must have a connecting point for hanging a weight to its load cell.

6.3.2 A transparent container for liquids having a sufficient filling volume to accommodate the liquid and the submerged briquette.

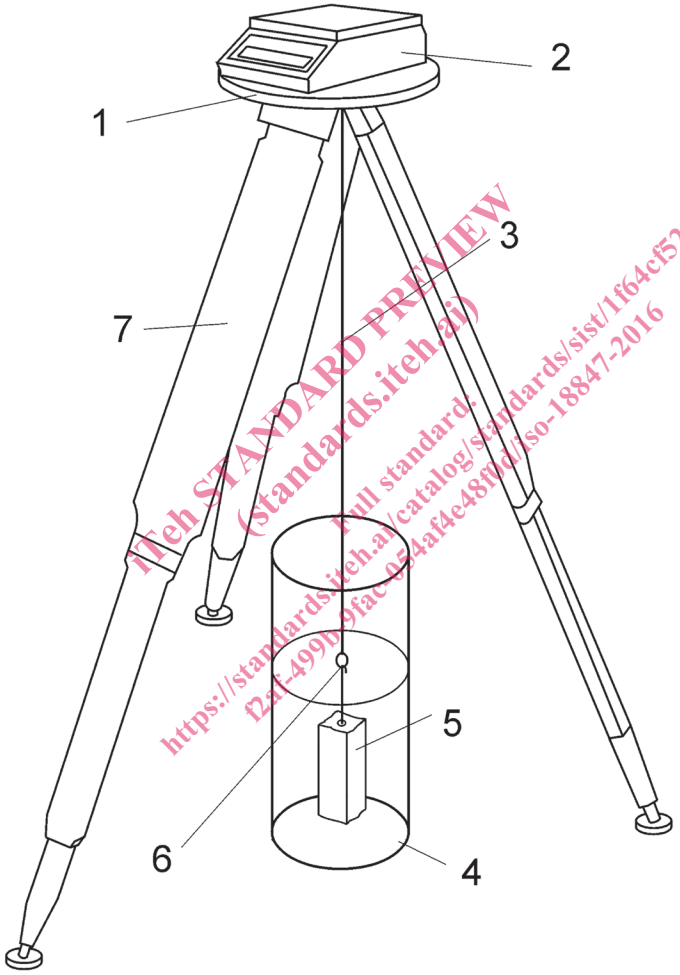
NOTE A sufficient filling volume is usually achieved when the container's cross section is about 8 times larger than the cross section of the briquette. In this case any effects by level changes of the liquid caused by submersion of the briquette are negligible. Such error would be due to a larger part of the holding steel string (see 6.3.3) being submerged.

6.3.3 A non-absorbent thin steel string which can be hung to the connecting point of the balance. The end of the string is equipped with a hook or a ring, which allows an easy appending of the briquette.

6.3.4 A tripod where the balance can be placed on. The tripod must have a plate with an opening which allows the string to pass through unhindered while hanging to the balance (Figure 2).

6.3.5 A steel loop or any other steel support device to which the briquette can be fixed while freely hanging and which allows to be fix to the lower connecting point of the steel string.

6.3.6 If test material of low density shall be tested (below 1,0 g/cm^3) a removable weight is required, which is positioned onto the briquette in a way which prevents the briquette from floating atop of the liquid.



Key

1 Carrying plate with opening
2 Balance
3 Steel string
4 Liquid container
5 Test sample (briquette)
6 Connecting ring or hook
7 Tripod

Figure 2 — Buoyancy determination rig using a hanging load to a balance (method for briquettes)