



DRAFT TANZANIA STANDARD

MEDC 12 (1323) DTZS - Solid biofuel — Sustainable charcoal and carbonized briquettes for household and commercial use — Specification.

NATIONAL FOREWORD

This draft Tanzania Standard has been prepared under Clean Cooking Stoves and Clean Cooking Solutions (MEDC 12) Technical Committee, under supervision of Mechanical Engineering Standards Divisional committee.

Access to clean cooking fuels has been identified as an important area of international development. Millions of households in low- and middle-income countries rely on burning solid fuels to meet their basic energy needs. The resultant vicious cycle of poverty and ill-health can be broken by promoting clean cooking fuels as an alternative to polluting inefficient cooking fuels.

In this standard, carbonized briquettes that are derived from forest, plantation, sustainably harvested wood and other forest products, by-products and residues from wood processing industry, chemically untreated wood, herbaceous biomass, fruit biomass, aquatic biomass, agro-industrial residues (e.g. sugarcane bagasse, rice husks etc.), treated faecal sludge and organic market wastes will be used as clean cooking fuel to reduce environmental pollution.

During the preparation of this standard, reference was made to the following documents:

SANS 1399:2008, South African Standard, Wood charcoal and carbonized briquettes for household use.

KS 2912:2020, Kenyan Standard, Solid biofuel — Sustainable charcoal and carbonized briquettes for household and commercial use — Specification.

Solid biofuel — Sustainable Charcoal and carbonized briquettes for household and commercial use — Specification

1. Scope

This Tanzania Standard specifies requirements and test methods for sustainably produced charcoal and carbonized briquettes that are derived from forest, plantation, sustainably harvested wood and other forest products, by-products and residues from wood processing industry, chemically untreated wood, herbaceous biomass, fruit biomass, aquatic biomass, agro-industrial residues (e.g. sugarcane bagasse, rice husks etc.), treated faecal sludge and organic market wastes, in lump and briquette form that is intended for household and commercial use.

2. Normative references

The following referenced documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3310-2, Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate.

3. Terms and definitions L

For the purposes of this document, the following terms and definitions apply.

3.1

acceptable

in compliance with the provision of this standard, acceptable to the authority administering this standard, or to the parties concluding the purchase contract as relevant

3.2

ash content

residue when charcoal or carbonized briquettes are incinerated in air under standardized conditions

3.3

binder

organic material that, when added to biochar (see 3.3.1) and compacted, holds the granules together in a solid mass (such as but not limited to starch, gum arabic, molasses, vegetable oil, lignin)

3.3.1

biochar

carbonized organic material

3.4

charcoal

lump carbonaceous residue material from incomplete combustion or pyrolysis of organic materials

3.5

sustainable charcoal

charcoal produced from sustainable feedstock with efficient carbonization technology

3.6

sustainable feedstock

natural resources that are established and managed to ensure long-term provision of raw materials with no negative impact to the environment and the people

3.7

efficient carbonization technology

efficient carbonization is a process by which solid materials with increasing content of the element carbon are formed from organic material usually by pyrolysis in proficient technology that do not harm the environment and minimize material and energy losses

3.8

carbonized briquette

briquette produced by compressing, compacting, densification and rolling biochar with a suitable binder

3.9

fixed carbon content

carbon content that remains after the removal of the ash content and volatile matter content from dry charcoal or carbonized briquettes under standardized conditions

3.10

moisture content

water contained by charcoal or carbonized briquettes and that will be removed by heating at 105 °C

3.11

untreated wood

wood that has, since felling, not been in contact with a pesticide or a wood preservative

3.12

volatile matter content

gasses other than water vapours lost when charcoal or carbonized briquette are heated under standardized conditions (see 5.8)

3.13

foreign matter

any material other than the prescribed ingredients of the sustainable charcoal and carbonized briquettes that compromises the product integrity e.g. sand, sticks, paper stones etc

3.14

additives

acceptable materials used to aid production, delivery or combustion (e.g. pressing aids, staging inhibitors or any other additives like starch, gum Arabic, molasses, vegetable oil, and lignin)

3.15

defective

sustainable charcoal or carbonized briquettes that fail, in one or more respects, to comply with the relevant requirements of this standard

3.16**calorific value**

energy contained in a fuel determined by the heat energy released by the complete combustion of specified quantity fuel material expressed in MJ/kg

3.17**density**

mass per unit volume (kg/m³)

4. Requirements**4.1 Type of raw material**

The biomass material used to produce sustainable charcoal and carbonized briquettes shall be such as to be acceptable.

4.2 Foreign matter and additives

4.2.1 Sustainable charcoal and carbonized briquette shall be free from foreign matter.

4.2.2 Additives materials shall be such as to be acceptable.

4.2.3 A binder used shall be such as to be acceptable.

4.3 Physical requirements**4.3.1 General**

The organic material used to produce sustainable charcoal or carbonized briquettes shall be such as to be acceptable.

The shape and size of sustainable charcoal or carbonized briquettes shall be such as to be acceptable.

4.3.2 Sieve analysis**4.3.2.1 Charcoal**

When lump sustainable charcoal are tested in accordance with 5.2, not more than 5 % (by mass) shall be retained on a test sieve of aperture size 106 mm, and the quantity that passes through a test sieve of aperture size 15.0 mm shall not exceed 5 % (by mass).

4.3.2.2 Carbonized briquettes

When carbonized briquettes are tested in accordance with 5.3, the amount that passes through a test sieve of aperture size 15.0 mm shall not exceed 2.5 % (by mass).

4.3.3 Resistance to dropping

4.3.3.1 When an unopened container of carbonized briquettes is tested in accordance with 5.4, the proportion of the contents that passes through a test sieve of aperture size 9.5 mm shall not exceed 5 % (by mass).

4.3.3.2 When an unopened container of sustainable charcoal is tested in accordance with 5.4, the proportion of the contents that passes through a test sieve of aperture size 9.5 mm shall not exceed 7.5 % (by mass).

4.4 Chemical requirements

4.4.1 Moisture content

When determined in accordance with 5.5, the moisture content of sustainable charcoal and carbonized briquettes shall not exceed 10 %.

4.4.2 Volatile matter content

When determined in accordance with 5.7, the volatile matter content shall not exceed 20 % in the case of sustainable charcoal, and in the case of carbonized briquettes shall not exceed 25 %.

4.4.3 Ash content

When determined in accordance with 5.8, the ash content of sustainable charcoal shall not exceed 5 % in the case of charcoal, and in the case of carbonized briquettes shall not exceed 27 %.

4.4.4 Fixed carbon content

When determined in accordance with 5.9, the fixed carbon content of sustainable charcoal shall not be less than 75 % in the case of charcoal, and 44 % in the case of carbonized briquettes.

4.4.5 Calorific value

When determined in accordance with 5.10, the calorific value of sustainable charcoal and carbonized briquettes shall not be less than 18Mj/kg.

5 Inspection and methods of test

5.1 Inspection

Visually inspect each container in the sample drawn in accordance with B.2.2.1 (see Annex B) for compliance with those requirements of the standard for which tests to assess compliance are not given in 5.2 to 5.9 (inclusive).

5.2 Sieve analysis for sustainable charcoal

5.2.1 Apparatus

5.2.1.1 Weight apparatus, of suitable capacity, that have scale divisions at intervals not exceeding 1 g and 20 g, respectively.

5.2.1.2 Two round test sieves, that comply with the requirements of ISO 3310-2, each equipped with a cover and a receiver, and that have square apertures of nominal size 106 mm and 9.5 mm, respectively.

5.2.2 Test specimens

Take, at random, two containers from the sample under test (see B.2.2.2 of Annex B).

5.2.3 Procedure

Determine the mass of the contents of one container to the nearest 20 g. Using a horizontal to and fro movement, sieve the contents of the container on the 106 mm test sieve (see 5.2.1.2) in such increments as to ensure that, on completion of the sieving of each increment, each piece in the increment has been in direct contact with the sieve plate. Then turn each piece of sustainable charcoal retained on the sieve to determine whether it passes, in any position (without applying force), through the sieve. Before the next increment is sieved, remove all the pieces retained on the sieve and keep them for the determination of their mass.

Using the 9.5 mm test sieve, sieve, as above, the charcoal that passed through the 106 mm test sieve, but do not turn each piece retained on the sieve. Retain the charcoal that passed through the 9.5 mm test sieve. Determine the mass of this quantity and the pieces retained on the 106 mm test sieve separately to the nearest 1 g.

Repeat the test on the second container. After completion, retain all the fractions from each container (see 5.5.3 and 5.6).

5.2.4 Expression of results

5.2.4.1 For each container calculate, to the nearest 0.1 %, the retention on the 106 mm test sieve, as follows:

$$\frac{M_1}{M_2} \times 100$$

Where,

M_1 is the mass of the pieces retained on the 106 mm test sieve, in grams; and

M_2 is the mass of the total contents of the container before sieving, in grams.

Record the mean of the two results.

5.2.4.2 For each container calculate, to the nearest 0.1 %, the quantity that passed through the 9.5 mm test sieve, as follows:

$$\frac{M_3}{M_2} \times 100$$

where

M_2 is the mass of the total contents of the container before sieving, in grams; and

M_3 is the mass of the quantity that passed through the 9.5 mm test sieve, in grams.

Record the mean of the two results.

5.2.4.3 Check for compliance with 4.3.2.

5.3 Sieve analysis for carbonized briquettes

5.3.1 Apparatus

5.3.1.1 Balances, as in 5.2.1.1.

5.3.1.2 Round test sieve, that complies with the requirements of ISO 3310-2, that is equipped with a cover and a receiver, and that has square apertures of nominal size 9.5 mm.

5.3.2 Test specimens

Take, at random, two containers from the sample under test (see B.2.2.2 of Annex B).

5.3.3 Procedure

Determine the mass of the contents of one container to the nearest 20 g. Separate all the unbroken briquettes from the broken briquettes and fines. Using a horizontal to and fro movement, sieve the broken briquettes and fines on the test sieve in such increments as to ensure that, on the completion of the sieving of each increment, each piece in the increment has been in direct contact with the sieve plate.

Determine the mass of the quantity that passed through the test sieve to the nearest 1 g.

Repeat the test on the second container. Retain all the unbroken briquettes from each container (see 5.5.3 and 5.6).

5.3.4 Expression of results

5.3.4.1 For each container calculate, to the nearest 0.1 %, the quantity that passed through the test sieve, as follows:

$$\frac{M_4}{M_5} \times 100$$

where

M_4 is the mass of the quantity that passed through the 15.0 mm test sieve, in grams; and

M_5 is the mass of the total contents of the container, in grams.

Record the mean of the two results.

5.3.4.2 Check for compliance with 4.3.2.

5.4 Drop resistance of container content

5.4.1 Apparatus

5.4.1.1 Dropping device, comprising a divided table (or single-leaf device), fitted with a release mechanism, that is so spring-operated as to produce, from a height of 750 mm, free fall of the container without rotational or sideways motion of the container.

5.4.1.2 Impact surface, comprising a rigid and level concrete surface (or a steel plate embedded in concrete) of sufficient strength and rigidity to withstand repeated impacts of test material without significant deflection or movement.

5.4.2 Test specimens

Take, at random, two of the remaining containers from the sample under test (see B.2.2.2 of Annex B).

5.4.3 Procedure

So position one of the containers upright that, when released, it will fall on its base. Operate the release mechanism and drop the container. Unless the container has failed, invert it, gently distribute the contents as symmetrically as possible and repeat the drop. Repeat this procedure with the container positioned on its right-hand side and on its left-hand side.

Repeat the test on the second container. If a container fails, take a new container from the remainder of the sample under test (see B.2.2.2 of Annex B), and repeat the procedure.

For each container determine, as in 5.2 or 5.3 (as relevant), the percentage (by mass) of the contents that passed through a 9.5 mm test sieve.

5.5 Moisture content

5.5.1 Principle

A test specimen is heated to a constant mass in an air-oven at a temperature of 105 °C and the percentage moisture content is calculated from the loss in mass of the test specimen.

5.5.2 Apparatus

5.5.2.1 Air oven, capable of maintaining a substantially uniform temperature of 105 °C, and such that the rate of atmosphere change is sufficiently rapid for the test.

5.5.2.2 Balance, accurate to 1.0 g.

5.5.2.3 Tray, of area approximately 0.1 m² and of depth 25 mm, made of non-corrodible material such as stainless steel, tinned steel or aluminium. The tray shall be clean, dry and accurately tared.

5.5.3 Test specimen

Approximately 500 g in triplicates of charcoal or carbonized briquettes. For the test on briquettes, take at random a similar number of unbroken briquettes from each container retained in terms of 5.3.3 until approximately 500 g is obtained and, for the test on charcoal, take a test mass of 250 g from the contents of each container retained in terms of 5.2.3.

5.5.4 Procedure

Determine the mass M_1 of the dry empty tray. Transfer the specimen as completely as possible to the tray and spread the specimen evenly. Determine the initial mass M_2 of the tray and contents. Place the charged tray in the oven, preheated to 105 °C, until constant mass is obtained. Determine the mass M_3 of the heated tray and contents while they are still hot, to avoid absorption of moisture during cooling.

5.5.5 Expression of results

5.5.5.1 The moisture content M of the charcoal, expressed as a percentage (by mass), is given by the equation

$$M = \frac{M_2 - M_3}{M_2 - M_1} \times 100$$

where

M_1 is the mass of the empty tray, in grams;

M_2 is the initial mass of the tray plus the test specimen, in grams;

M_3 is the mass of the tray plus the test specimen after heating, in grams.

Report the result (preferably the mean of duplicate determinations) to the nearest 0,1 % (by mass).

5.5.5.2 Check for compliance with 4.4.1.

5.5.6 Precision of results

The results of triplicate determinations shall not differ by more than the appropriate of the values given in table 1.

Table 1 — Precision of results

1	2
Moisture content (by mass) %	Same laboratory, repeatability
<5	0.5% absolute
≥5	0.5% absolute
NOTE limits for reproducibility (different laboratories) have not yet been established because results obtained in different laboratories depend on the humidity condition, which can vary from laboratory to laboratory.	

5.6 Preparation of test material for volatile matter content and ash content

Take, at random, eight of the unbroken briquettes (four from each container) retained in terms of 5.3.3 or, in the case of charcoal, a specimen of mass at least 200 g from the contents of each container retained in terms of 5.2.3. Quickly (to avoid heat build-up) pulverize or grind the specimen such that it passes through a 250 µm sieve, mix well, and store in an airtight container.

5.7 Volatile matter content

5.7.1 Principle

A test specimen from which the moisture content has been extracted, is heated for 7 min at 900 °C out of contact with air. The percentage of the volatile matter is calculated from the loss in mass of the test specimen.

5.7.2 Apparatus

5.7.2.1 Muffle furnace, heated by electricity, in which a zone of adequate size is maintained at a constant and uniform temperature of $900\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$. The furnace may be of the stop-ended type, or fitted at the back with a flue of diameter approximately 25 mm and of length approximately 150 mm.

The heat capacity of the furnace is such that, with an initial temperature of $900\text{ }^{\circ}\text{C}$, a minimum temperature of $885\text{ }^{\circ}\text{C}$ is regained within 4 min (and preferably within 3 min) of the insertion of a cold stand and its crucible(s), the temperature being measured with the unsheathed thermocouple (see 5.7.2.2) by inserting its thermojunction midway between the floor of the furnace and the base of the crucible in its stand. If the stand holds more than one crucible, the temperature under each crucible is checked in the same manner.

Normally, the furnace will have been designed specifically for receiving either one crucible and its stand or a number of crucibles in one stand.

NOTE 1 The position of the crucible stand is chosen within the zone of uniform temperature and this position is used for all determinations.

NOTE 2 The temperature of $900\text{ }^{\circ}\text{C}$ is attained as closely as possible and the tolerance of $\pm 10\text{ }^{\circ}\text{C}$ is specified to compensate for inherent errors in the temperature measurement and lack of uniformity in the temperature distribution.

5.7.2.2 Where applicable, **pyrometer**, with an unsheathed thermocouple, of wire of diameter not exceeding 1 mm, for checking the temperature characteristics of the muffle furnace.

NOTE 1 A sheathed thermocouple can be permanently installed in the furnace with its thermojunction as close as possible to the centre of the zone of uniform temperature. In this case, its temperature readings are correlated at frequent intervals with those of the unsheathed thermocouple. (Because of the thickness of the sheathed thermocouple, it cannot be inserted under a crucible.)

NOTE 2 The temperature/electromotive force relationship of a thermojunction maintained at elevated temperatures gradually changes with time.

5.7.2.3 Cylindrical crucible, with a well-fitting lid, both made of fused silica. The crucible and lid have a combined mass of between 10 g and 14 g, and their dimensions approximate those shown in figure 1.

The fit of the lid to the crucible is critical for the determination and a lid is so selected to match the crucible that the gap between the lid and the crucible does not exceed 0.5 mm. After selection, the crucible and the lid are ground together to give smooth-fitting surfaces and are thereafter used solely as a matched pair.

NOTE Crucibles of other refractory materials or of platinum may be used, provided that they give, within the prescribed limits of precision (see 5.7.6), the same results as the silica crucibles.

5.7.2.4 **Suitable stand**, in which to place the crucible(s) in the muffle furnace, and such that the appropriate rate of heating can be achieved.

5.7.2.5 **Desiccant**, of fresh or freshly regenerated self-indicating gel.

5.7.2.6 **Desiccator**, of suitable dimensions, that contains the desiccant.

5.7.2.7 **Analytical balance**, accurate to within 0.1 mg.

5.7.2.8 **Stopwatch**.

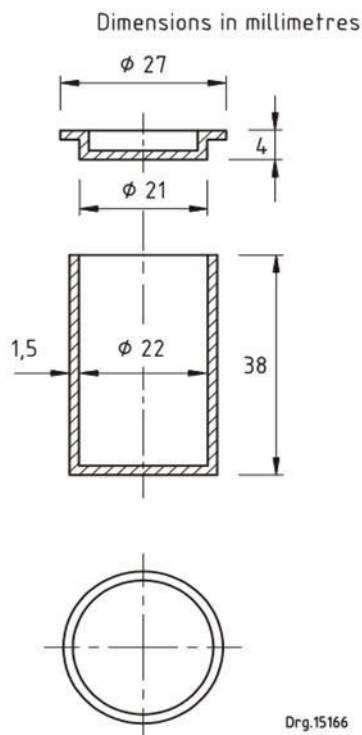


Figure 1 — Silica crucible and lid

5.7.3 Test specimen

A test specimen taken from the material prepared in accordance with 5.6. Ensure that the pre-prepared material is thoroughly mixed (preferably by mechanical means) for at least 1 min.

5.7.4 Procedure

Heat the crucible and lid (or the set of crucibles and lids (as relevant)) in the muffle furnace at $900\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ for 7 min. Remove the crucible(s) from the furnace, allow to cool on a thick metal plate for 10 min and then for 15 min in the desiccator located next to the balance.

When cooled to room temperature, determine (in turn) the mass m_1 of each clean empty crucible and lid, to the nearest 0.1 mg, and return the lid to the desiccator. Weigh, to the nearest 0.1 mg, into each crucible, 1.00 g to

1.01 g of the test specimen, and heat the crucible and test specimen, without the lid, in an air oven (see 5.6.2.1) at $105\text{ }^{\circ}\text{C}$ for 1 h. (This initial action is critical, since the result has to be expressed on a dry basis.) Cool the crucible and test specimen in the desiccator for 15 min. Replace the lid and determine, to the nearest 0.1 mg, the initial mass m_2 of each crucible plus lid plus dried specimen.

Tap each crucible on a clean, hard surface until the specimen forms a layer of uniform thickness at the bottom of the crucible.

Place the charged crucible(s) in the stand and, in the case of multiple determination, fill the vacant places in the stand with empty crucibles. Place the stand within the zone of uniform temperature in the furnace, preheated to $900\text{ }^{\circ}\text{C}$, for exactly 7 min, remove the crucible(s), allow to cool on a thick metal plate for 10 min

and then in the desiccator for 15 min. When the crucible(s) has (have) cooled to room temperature, determine the mass of each charged crucible to the nearest 0.1 mg and record the final mass m_3 of each.

NOTE Precisely similar treatment of a crucible before and after determination minimizes the effect of any film of water absorbed on its surface, and the rapid cooling reduces absorption of moisture by the charcoal residue.

5.7.5 Expression of results

5.7.5.1 The volatile matter content V , expressed as a percentage (by mass), is given by the equation:

$$V = \frac{M_2 - M_3}{M_2 - M_1} \times 100$$

where

M_1 is the mass of the empty clean crucible plus lid, in grams;

M_2 is the mass of the crucible plus lid plus specimen after drying at 105 °C for 1 h, in grams;

M_3 is the mass of the crucible plus lid plus residue after heating, in grams.

Report the result (preferably the mean of duplicate determinations), to the nearest 0.1 % (by mass).

5.7.5.2 Check for compliance with 4.4.2.

5.7.6 Precision of result

The results of duplicate determinations shall not differ by more than the appropriate of the values given in table 2.

5.8 Ash content

5.8.1 Principle

A test specimen from which the moisture content has been extracted, is heated in air at a specified rate up to a temperature of 710 °C \pm 10 °C and maintained at this temperature until constant in mass. The percentage of the ash is calculated from the mass of the residue after incineration.

5.8.2 Apparatus

5.8.2.1 Analytical balance, accurate to within 0.1 mg.

5.8.2.2 Muffle furnace, capable of giving a zone of substantially uniform temperature at the temperature levels required by the procedure and of reaching these levels in the specified times. The ventilation through the muffle furnace should be such as to give more than five air changes per minute.

NOTE The number of air changes per minute can be assessed by measurement of the air flow from the muffle furnace flue, using a pilot-static tube and a sensitive manometer.

5.8.2.3 Dish, of silica, porcelain or platinum, of depth 8 mm to 15 mm. The diameter of the dish is such that the surface (mass) density of the specimen layer does not exceed 0.15 g/cm².

5.8.2.4 Insulating plate, of silica of thickness 6 mm, or of heat-resistant steel of such size as to be an easy sliding fit into the muffle furnace (see 5.8.2.2).

5.8.2.5 Desiccant, of fresh or freshly regenerated self-indicating gel.

5.8.2.6 Desiccator, of suitable dimensions, that contains the desiccant.

5.8.3 Test specimen

A test specimen taken from the material prepared in accordance with 5.6. Ensure that the prepared material is thoroughly mixed (preferably by mechanical means) for at least 1 min.

5.8.4 Procedure

Heat the dish (see 5.8.2.3) in the muffle furnace to $710\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ and maintain it at this temperature for 15 min. Remove the dish from the furnace and allow the dish to cool on a thick metal plate for 10 min and then for 15 min in the desiccator located next to the balance. When cool, determine the mass m_1 of the dish to the nearest 0.1 mg.

Spread ± 1 g of the test specimen evenly in the dish and heat the dish and test specimen in an air oven (see 5.5.2.1) at $105\text{ }^{\circ}\text{C}$ for 1 h. (This initial action is critical, since the result has to be expressed on a dry basis.) Cool the dish and test specimen in the desiccator for 15 min. Determine the initial mass m_2 of the dish plus dried specimen to the nearest 0.1 mg.

Place the dish, plus test specimen, in the cold muffle furnace and raise the temperature to $250\text{ }^{\circ}\text{C}$ within 30 min, then from $250\text{ }^{\circ}\text{C}$ to $500\text{ }^{\circ}\text{C}$ within another 30 min, and finally from $500\text{ }^{\circ}\text{C}$ to $710\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ within 60 min.

When incineration is complete, remove the dish plus test specimen from the furnace, and allow to cool on a thick metal plate for 10 min and then in a desiccator for 15 min. When the dish and test specimen have cooled, determine the mass m_3 of the dish plus incinerated test specimen to the nearest 0.1 mg.

Reheat at $710\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$ for further 15 min periods, allow to cool, and determine the mass until any change in mass does not exceed 1 mg.

5.8.5 Expression of results

5.8.5.1 The ash content A, expressed as a percentage (by mass), is given by the equation

$$V = \frac{M_3 - M_2}{M_2 - M_1} \times 100$$

where

M_1 is the mass of the dish, in grams;

M_2 is the mass of the dish plus specimen after drying at $105\text{ }^{\circ}\text{C}$ for 1 h, in grams;

M_3 is the mass of the dish plus ash after incineration, in grams.

Report the result, as the arithmetic mean of duplicate determinations, to the nearest 0.1 % (by mass).

5.8.5.2 Check for compliance with 4.4.3.

5.8.6 Precision of results

The results of duplicate determinations shall not differ by more than the appropriate of the values given in Table 3.

1	3	3
Ash content (by mass) %	Same laboratory, repeatability	Different laboratory, repeatability
<10	0.2% absolute	0.3% absolute
≥10	2% of the mean	3% of the mean

5.9 Fixed carbon content

5.9.1 Principle

The fixed carbon is the carbon that remains after the removal of the volatile matter content and the ash content in accordance with 5.7 and 5.8 respectively.

5.9.2 Expression of results

5.9.2.1 The fixed carbon content FC, expressed as a percentage (by mass), is given by the equation

$$FC = 100 - (A + V + M_C)$$

where

A is the ash content determined in accordance with 5.8, as a percentage (by mass);

V is the volatile matter content determined in accordance with 5.7, as a percentage (by mass),

M_C is the moisture content determined in accordance with 5.5, as a percentage (by mass).

5.9.2.2 Check for compliance with 4.4.4.

5.10 Calorific value

5.10.1 Principle

This procedure determines the heat of combustion or calorific value of several materials. Heats of combustion, as determined in an oxygen bomb calorimeter, are measured by a substitution procedure in which the heat obtained from the sample is compared with the heat obtained from a control material. In this test, a representative sample is burned in a high-pressure oxygen atmosphere within a metal pressure vessel or “bomb”. The energy released by the combustion is absorbed within the calorimeter and the resulting temperature change is recorded.

Test results are commonly expressed in calories per gram (KCal/g), British thermal units per pound (Btu/lb) or in the large Calorie per gram units commonly used for foods. They may also be expressed in joules per kilogram (J/kg) as used in the SI system of international units.

5.10.2 Procedure

A weighed sample is burned in an oxygen-filled metal bomb while the bomb is held in a measured quantity of water within a thermal insulating jacket. By observing the temperature rise of the water and knowing the energy equivalent of the calorimeter, the amount of heat released from the sample is calculated by multiplying the change in temperature by the Instrument Heat Capacity(IHC) and then deducting the calorific value of the all the other components used to ignite the sample.

5.10.3 Expression of results

The calorific value content, expressed as Kcal/g, is given by the equation;

$$Kcal/g = \frac{(\Delta \text{ in temp } \times IHC) - \text{Cal. Value of thread + wire used}}{\text{Weight of the sample}}$$

where

$\Delta \text{ in Temp}$ is the temperature change in water,

IHC is the Instrument Heat Capacity.

To express results into Megajoules per kilograms, the following expression should be used;

$$1Kcal/g=4.19Mj/Kg$$

5.10.4 Check for compliance with 4.4.5.

5.11 Test report

The test report shall contain the following particulars:

- a) the identification of the product or sample tested;
- b) a reference to this standard;
- c) the test results;
- d) any deviations from the test methods in this standard;
- e) any unusual features noted during the determinations; and
- f) the date(s) of the tests.

6 Packing

Sustainable Charcoal and briquettes shall be packed and sealed in:

- a) multi-wall bags, corrugated board containers or any suitable packaging material such as to be acceptable to maintain product integrity.
- b) units of 1 kg to 50 kg as required.

7 Marking

Each container shall be legibly and indelibly marked with the following information:

- a) the manufacturer's name or trade name or trade mark;
- b) the description of the contents of the container, i.e. "Carbonized briquettes";
- c) the batch identification or the date of packing (which may be in code);
- d) the net mass of the contents;
- e) country of origin;
- f) county of origin (optional);
- g) raw material used e.g. char dust; and source;
- h) handling and storage information; and
- i) Information on usage specifying that it should be used under a well-ventilated environment.

Annex A
(informative)

Notes to purchasers

A.1 The following may be agreed upon between the supplier and the purchaser, but shall be approved by the Tanzania Bureau of Standards:

- a) the moisture content, if other than as specified (see 4.4.1);
- b) the volatile matter content, if other than as specified (see 4.4.2);
- c) the ash content, if other than as specified (see 4.4.3); and
- d) the fixed carbon content, if other than as specified (see 4.4.4).

Annex B
(normative)

Quality verification of charcoal and carbonized briquettes

B.1 Quality verification

B.1.1 When a purchaser requires on-going verification of the quality of sustainable charcoal and carbonized briquettes produced to this standard, it is suggested that instead of concentrating solely on the evaluation of the final product, he also direct his attention to the manufacturer's quality system. In this connection it should be noted that ISO 9001 covers the provision of an integrated quality system.

B.1.2 If no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of a lot, and a purchaser wishes to establish, by inspection and testing of samples of the final product, whether a lot (see B.2.1.2) of the product complies with this standard, use the sampling plan given in B.2.2.

NOTE 1 The sampling plan applies to the final product only.

NOTE 2 A lot that in terms of the sampling plan is deemed to comply with the standard, could contain defective charcoal and carbonized briquettes.

In cases of dispute, the lot shall be available for inspection by the Tanzania Bureau of Standards.

B.2 Assessment of compliance

B.2.1 Definitions

B.2.1.1

defective

charcoal that fails or carbonized briquettes that fail, in one or more respects, to comply with the relevant requirements of this standard

B.2.1.2

lot

quantity of charcoal or carbonized briquettes of the same form, packed in containers of the same type and size, and bearing the same batch identification or date of packing, from one manufacturer, and submitted at any one time for inspection and testing

B.2.2 Sampling

The following sampling procedure shall be used to determine whether a lot complies with the requirements of this standard. The sample so taken shall be deemed to represent the lot for the respective properties.

B.2.2.1 Sample for inspection

From the lot, draw at random the greater of the following numbers of containers:

Twelve containers or the number of containers calculated (to the nearest whole number) by the following:

$$\sqrt{\frac{A}{2}}$$

Where,

A is the number of containers in the lot.

B.2.2.2 Sample for testing

After inspection of the sample taken in accordance with B.2.2.1, take from it, at random, 10 containers.

B.3 Criteria of compliance

The lot shall be deemed to comply with the relevant requirements of the standard if, after inspection and testing of the sample taken in accordance with B.2.2, defect does not exceed 1 container of sample.