SRI LANKA STANDARD 571 : 1982

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SPECIFICATION FOR COCONUT SHELL CHARCOAL

BUREAU OF CEYLON STANDARDS

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SLS 571 : 1982

Gr.9

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Sri Lanka.

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This Standard does not purport to include all the necessary provisions of a contract.

SRI LANKA STANDARD
SPECIFICATION FOR COCONUT SHELL CHARCOAL

FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Bureau of Ceylon Standards on 1982-07-12 after the draft, finalized by the Drafting Committee on Coconut Shell Charcoal, had been approved by the Agricultural and Food Products Divisional Committee.

The standard values in this specification are given in SI units.

For the purpose of deciding whether a particular requirement of this specification is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with CS 102. The number of significant places to be retained in the rounded off value should be the same as that of the specified value in this specification.

In the preparation of this specification, the assistance obtained from the publications of the British Standards Institution and the United States Federal Supplies Service, General Services Administration is gratefully acknowledged.

1 SCOPE

This specification prescribes the requirements and methods of sampling and test for coconut shell charcoal.

2 REFERENCES

CS 102 Presentation of numerical values

CS 124 Test sieves

SLS 428 Random sampling methods

3 DEFINITIONS

For the purpose of this specification, the following definitions shall apply:

3.1 **coconut**: The fruit of the coconut palm, *Cocos nucifera Linn.*

3.2 coconut shell: The hard ligneous part of the mature fruit known as endocarp which lies between the husk and the brown skin (testa) of the kernel.

3.3 coconut shell charcoal: The product obtained by charring coconut shells in a limited supply of air.

4 TYPES

Coconut shell charcoal shall be of the following two types:

Type 1 - coconut shell charcoal - *pieces*

Type 2 - coconut shell charcoal - *granulated.*

5 REQUIREMENTS

5.1 Description

Typically good charcoal is uniformly black in colour, non-lustrous and broken edges should show a shiny surface with conchoidal fracture. When dropped on a cement or metal surface, good pieces give a clear ring.

5.2 Freedom from contamination

There shall be not more than 1 per cent by mass of poorly charred coconut shells, trash or other material foreign to the charcoal, when tested in accordance with the method prescribed in Appendix B.

5.3 Size

The size of the charcoal shall comply with the following when tested in accordance with the method prescribed in Appendix C.

a) Type 1 - Not more than 5 per cent (see Note) by mass of charcoal shall pass through a 5.6-mm sieve conforming to CS 124.

b) Type 2 - Granulated coconut shell charcoal may be manufactured to meet the customers' requirements, provided these special grades comply with the other requirements of this specification.

NOTE - Due to unavoidable breakages in handling and transport, this maximum limit is applicable only upto the point of shipment.

5.4 Coconut shell charcoal shall also comply with the requirements given in Table 1, when tested according to the relevant methods given in Column 4 of the Table.

TABLE 1 - Requirements for coconut shell charcoal

Serial No. (1)	Characteristic (2)	Requirement (3)	Method of test (4)
i	Moisture, per cent by mass, max.	10	Appendix D
ii	Volatile matter, on dry basis, per cent by mass, max.	20	Appendix E
iii	Ash, on dry basis, per cent by mass, max.	02	Appendix F
iv	Fixed carbon, on dry basis, per cent by mass, min.	79	Appendix G

6 PACKAGING

Unless otherwise specified, coconut shell charcoal shall be packed in sacks suitable for safe transportation. They shall be of uniform size containing 50 kg of the material.

7 MARKING

Each container shall carry a tag/label clearly marked with the following information:

a) Name and address of the exporter, and/or registered trade mark;

b) Type of material;

c) The words *Product of Sri Lanka;*

d) Net mass, in kilograms ; and

e) Any other information required by the buyer or by the law in force.

8 SAMPLING

The methods of drawing representative samples of the material shall be as specified in Appendix A.

9 METHODS OF TEST

9.1 Tests shall be carried out as specified in Appendices B to G.

9.2 Quality of reagents

Unless otherwise specified chemicals of analytical grade and distilled water shall be employed in tests.

10 CONFORMITY TO STANDARD

A lot shall be declared as conforming to the requirements of this specification if the following conditions are satisfied:

10.1 Size

Each of the test results for the above characteristic shall satisfy the relevant requirement for size given in this specification.

10.2 Freedom from contamination, moisture, volatile matter, ash and fixed carbon

From the results of testing each of the above characteristics, the average $\bar{X}$ and range R or mean range $\bar{R}$ (see Note 2) shall be calculated separately for each requirement,

a) The value of the expression $\bar{x} + 0.4\ R$ or $\bar{x} + 0.4\ \bar{R}$ for each of the requirements for freedom from contamination, moisture, volatile matter and ash is less than or equal to the corresponding value given in 5.2 and Table 1.

b) The value of the expression $\bar{x} - 0.4\ R$ or $\bar{x} - 0.4\ \bar{R}$ for the requirement for fixed carbon is greater than or equal to the corresponding value given in Table 1.

NOTES

1 The average $\bar{X}$ is the value obtained by dividing the sum of observed values by the number of observations.

2 If the number of observations is less than 10, the difference between the maximum and the minimum observations shall be taken as the range (R). If the number of observations is 10 or more, the ranges of sets of five observations shall be determined and the average of these ranges shall be taken as the mean range ($\bar{R}$).

APPENDIX A

SAMPLING OF COCONUT SHELL CHARCOAL

A.1 LOT

In any consignment all the bags containing one type of coconut shell charcoal shall be grouped together to form a lot.

A.2 SCALE OF SAMPLING

A.2.1 The conformity of a lot to the requirements of this specification shall be determined on the basis of the tests carried out on the samples selected from the lot.

A.2.2 The number of bags to be selected from a lot shall depend on the size of the lot and shall be in accordance with Table 2.

TABLE 2 - Scale of sampling

Lot size	Sample size
Upto 300	05
301 to 500	07
501 to 1 000	10
1 001 to 3 000	15
3 001 to 10 000	20
10 001 and above	25

A.2.3 These bags shall be selected at random. To ensure randomness of selection, random number tables as given in SLS 428 shall be used.

A.3 PREPARATION OF INDIVIDUAL SAMPLES

A.3.1 Each bag selected shall be emptied. From different parts of the contents so emptied, a sufficient quantity (not less than 3 kg) of material shall be drawn to form an individual sample and to represent that particular bag.

A.3.2 These individual samples shall be placed in suitable sample containers or polythene bags and shall be sealed air-tight and marked with full details of sampling.

A.4 NUMBER OF TESTS

A.4.1 Each individual sample shall be tested separately for determining the requirements for freedom from contamination, size and moisture.

A.4.2 After testing for the above requirements, at least 500 g from each individual sample shall be ground separately to pass a 212-μm sieve, conforming to CS 124. Tests for determination of the requirements for volatile matter (see Note), ash and carbon content shall be separately done on these individual samples.

NOTE - The determination of volatile matter shall be carried out immediately after the sample is ground.

APPENDIX B

DETERMINATION OF CONTAMINANTS

B.1 PROCEDURE

Weigh to the nearest gram about 3 kg of the material. Separate the poorly charred coconut shells, trash and other foreign matter from the test portion and transfer to a previously weighed vessel and weigh to the nearest 0.1 gram.

B.2 CALCULATION

$$\text{Contaminants, per cent by mass} = \frac{m_2}{m_1} \times 100$$

where,

m_1 = mass, in g, of the sample; and

m_2 = mass, in g, of contaminants.

APPENDIX C

DETERMINATION OF SIZE

C.1 PROCEDURE

Weigh to the nearest gram about 3 kg of the material and sieve through a 5.6-mm sieve conforming to CS 124 in such increments as will allow the pieces to be in direct contact with the meshes after completion of the shaking of each increment. Each piece of charcoal retained on the screen shall be up-ended on the screen to determine if it will in any position pass through the sieve. Transfer the residue to a previously weighed vessel and weigh to the nearest 0.1 gram.

C.2 CALCULATION

$$\text{Material passing through sieve, per cent by mass} = \frac{m_2}{m_1} \times 100$$

where,

m_1 = mass, in g, of sample; and

m_2 = mass, in g, of residue passing through sieve.

APPENDIX D

DETERMINATION OF MOISTURE

D.1 PRINCIPLE

The sample of coconut shell charcoal is heated to constant mass in an air-oven at 105 ± 2 °C and its moisture calculated from the loss in mass of the sample.

D.2 SPECIAL APPARATUS

D.2.1 *Air-oven*

An oven, capable of being controlled at a temperature of 105 ± 2 °C and with a sufficiently rapid rate of atmosphere change, for example, 3 to 5 times per minute. A thermostatically-controlled gas oven, fitted with a governor, a pressure gauge and a flue 2 m tall, will give the rapid rate of air change required; an electrically-heated oven needs to be fitted with a suitable fan.

D.2.2 *Trays*

Non-corrodible metal trays approximately 0.1 m^2 in area and 25-mm deep.

D.3 PROCEDURE

Weigh to the nearest gram from about 2 kg of the sample in the container as received. Weigh a dry empty tray, transfer the sample as completely as possible to the tray and spread evenly (use two trays preferably). Place the charged tray in the oven at a temperature of 105 ± 2 °C. Dry the wet container and brush any dried sample adhering to it into the tray (see Note 1). Weigh the empty container. Heat the tray and its contents until constant in mass (see Note 2), weighing the tray while hot to avoid absorption of moisture during cooling.

NOTES

1 If the sample can be removed completely, leaving a dry empty container, this drying is omitted.

2 Constancy in mass under the prescribed experimental conditions is defined as a change in mass not exceeding 0.1 per cent between two successive weighings carried out at intervals of 15 minutes the sample being returned to the oven between weighings.

D.4 CALCULATION

$$\text{Moisture, per cent by mass} = \frac{(m_1 - m_4) - (m_3 - m_2)}{(m_1 - m_4)} \times 100$$

where,

m_1 = mass, in g, of container plus sample as received;

m_2 = mass, in g, of empty tray;

m_3 = mass, in g, of tray plus sample after heating; and

m_4 = mass, in g, of dry, empty container.

APPENDIX E

DETERMINATION OF VOLATILE MATTER

E.1 PRINCIPLE

The ground sample is heated at 900 °C out of contact with air for 7 minutes. The volatile matter is calculated from the loss in mass of the sample. A deduction is made for the loss in mass due to moisture.

E.2 SPECIAL REAGENT

E.2.1 *Desiccant*

Self-indicating activated alumina or silica gel, or magnesium perchlorate*.

E.3 SPECIAL APPARATUS

E.3.1 *Muffle furnace*

A gas-heated or electrically-heated muffle furnace in which an adequate zone can be maintained at a uniform temperature of 900 ± 5 °C. A muffle with internal dimensions approximately 250-mm long by 100-mm wide by 65-mm high is suitable. It may be of the type closed at one end or fitted at the back with a flue not larger than 25-mm in diameter by 150-mm tall. It shall be provided at the front with a well fitting, readily manipulated door. Its heat capacity shall be such that with an initial temperature of 900 °C a minimum temperature of 885 °C is regained within

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** This is the quality of reagent referred to as magnesium perchlorate (dried) sometimes known as 'Anhydrone'.*

3 minutes of the insertion of a cold stand and its crucible(s), both temperatures being measured with an unsheathed thermocouple as described below. If the furnace is electrically heated, a rating of about 1750 watts is satisfactory and it is preferable for the temperature to be controlled automatically.

A position for the crucible stand shall be chosen within the zone of uniform temperature and this position shall be used in all determinations.

E.3.2 *Thermocouple*

Two thermocouples are required, one sheathed and permanently in position, one unsheathed and inserted periodically for checking the temperature at the base of the crucibles (see Note 1).

The temperature of the uniform zone of the muffle furnace shall be checked periodically by means of an unsheathed thermocouple of wire not thicker than 1 mm. The thermojunction shall be inserted midway between the base of the crucible in its stand and the floor of the muffle furnace and its reading related to that of the sheathed thermocouple, whose position shall be as shown in Fig. 1. If a multiple stand is used, then the thermojunction of the sheathed thermocouple shall be at the mid-point of the centres of the four crucibles. The thermojunction of the unsheathed thermocouple shall be inserted under each crucible in turn and the mean temperature related to that of the sheathed thermocouple. The temperature in the four positions shall be within 900 ± 5 °C.

The sheathed thermocouple also serves to locate the stand in the zone of uniform temperature.

E.3.3 *Crucible and lid*

A cylindrical crucible with capsule type lid, both of translucent silica, having dimensions approximating to those in Fig. 2.

The crucible and lid shall be matched by the operator so that the combined mass lies between 10 grams and 14 grams. The fit of the lid is critical and the lid for a particular crucible shall be selected so that when placed in position the maximum horizontal clearance around the lid of the crucible is 0.5 millimetre. After selection each crucible and lid shall be ground together to give smooth surfaces and then identified with a distinguishing number or mark.

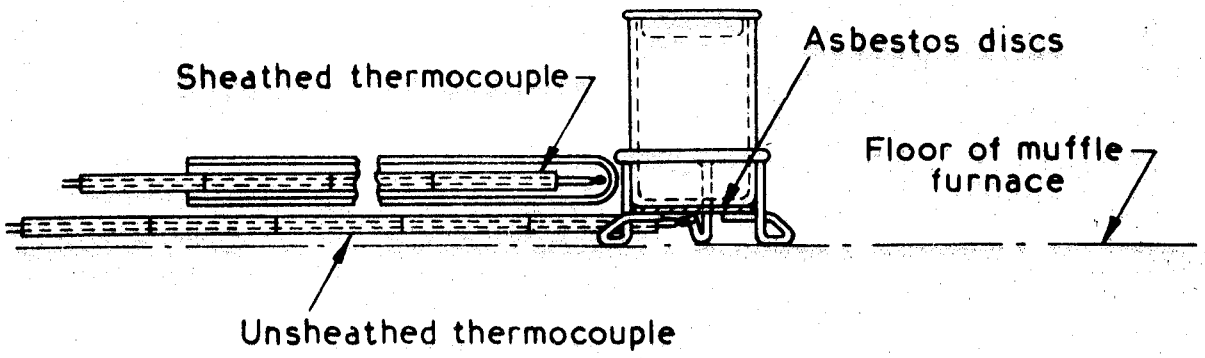
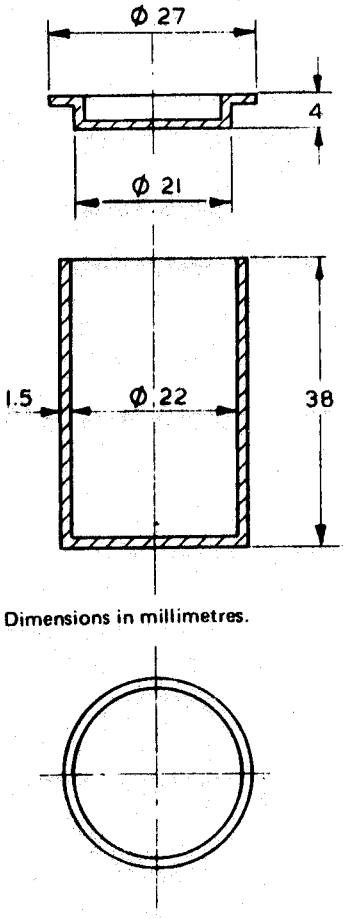


Fig.1 Determination of volatile matter: location of thermocouples for single crucible stands



Dimensions in millimetres.

Fig.2 Silica crucible and lid

E.3.4 *Stand*

A stand constructed from heat-resistant steel wire. Stands for single and for multiple determinations are shown in Fig. 3; in order to facilitate handling with tongs, the upper and lower surfaces of the handle of the single crucible stand are ground flat.

E.3.5 *Asbestos discs*, 25-mm in diameter and 1-mm thick.

E.3.6 *Balance*, with an accuracy to measure 0.1 milligram.

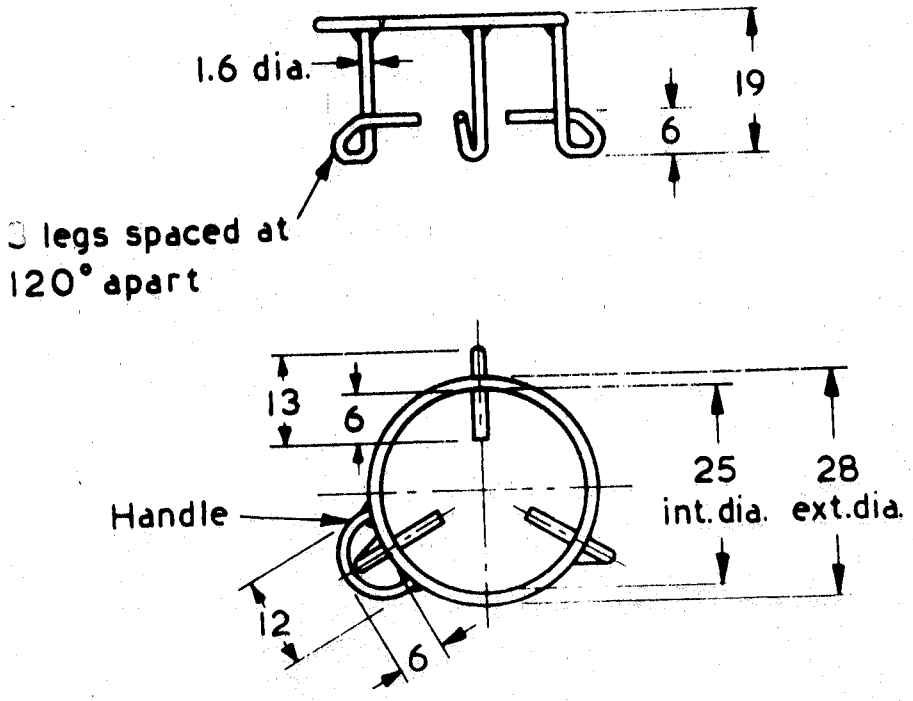
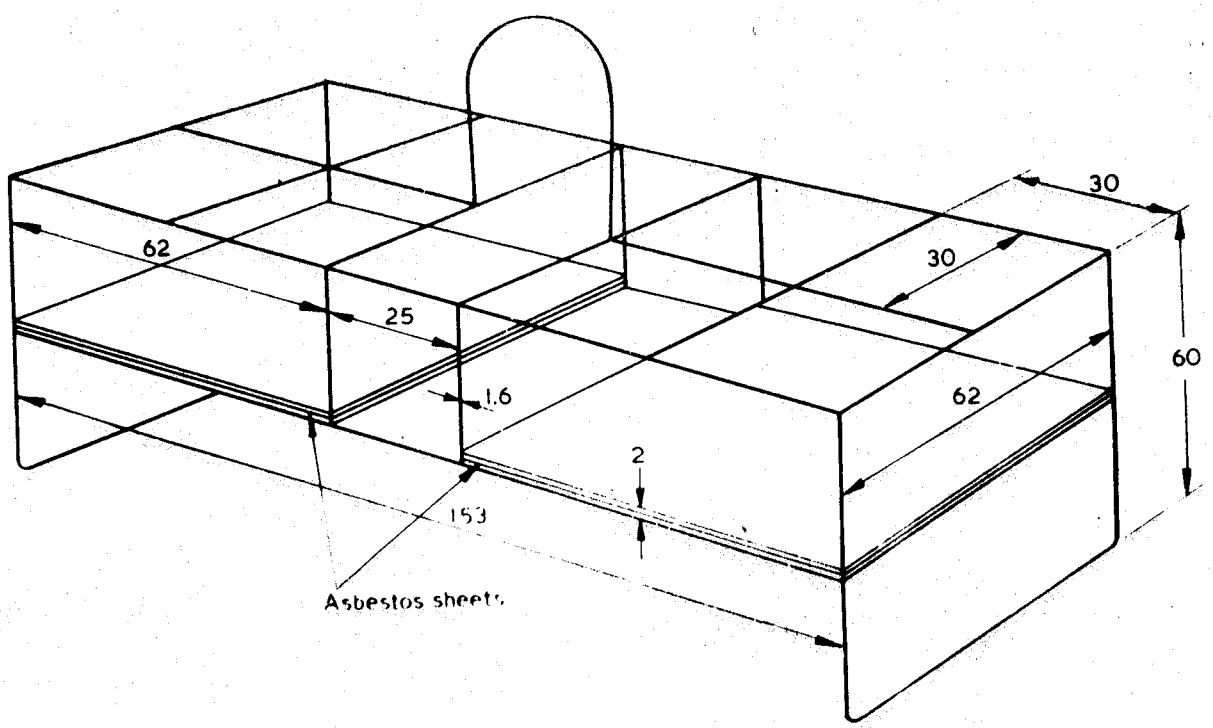


Fig. 3*a*. Single type



Dimensions in millimetres.

Fig. 3*b*. Multiple type

Fig. 3 Crucible stands

E.4 PROCEDURE

The following description applies to a single determination. When carrying out multiple determinations, each crucible is dealt with consecutively with the minimum of delay.

Heat at 900 °C for 7 minutes the crucible and lid supported on two asbestos discs in the stand. Remove the crucible from the furnace and cool, first on a metal slab for not longer than 5 minutes and finally in a desiccator beside the balance. As soon as it is cold, weigh the empty crucible and lid to the nearest 0.1 milligram and introduce into it 1 ± 0.01 gram of the ground charcoal sample (see A.4.2). Weigh the covered crucible and contents to determine the mass of sample taken. Tap the crucible on a clean hard surface until the charcoal forms a layer of even thickness on the bottom of the crucible. Add 2 to 4 drops of kerosene to the charcoal.

Adjust the temperature of the muffle furnace, containing a stand and empty crucible, to 900 °C as indicated by the correctly located unsheathed thermocouple, or to the equivalent temperature as indicated by the sheathed thermocouple. Remove the empty crucible and stand and close the door of the furnace to restore steady conditions. Place the covered crucible containing the sample in a cold stand, fitted with two asbestos discs (see Note 2). Transfer the stand and crucible to the muffle furnace and heat for exactly 7 minutes from the time of insertion. Remove, cool and weigh the crucible in the same manner as described for the empty crucible (see Note 3).

E.5 CALCULATION

$$\text{Volatile matter, on dry basis, per cent by mass} = \left[\left\{\frac{m_2 - m_3}{m_2 - m_1} \times 100\right\} - A\right] \times \frac{100}{(100 - A)}$$

where,

m_1 = mass, in g, of crucible plus lid;

m_2 = mass, in g, of crucible plus lid and sample, before heating;

m_3 = mass, in g, of crucible plus lid and sample, after heating; and

A = percentage of moisture in the analysis sample.

NOTES

1 This method of checking at the base of the crucible is used because the sheathed thermocouple cannot be inserted under the crucible and a thermocouple with a bare junction constantly exposed under the specified conditions may change its characteristics.

2 If the rate of recovery of the furnace is adjusted for multiple determinations, fill any vacant places in the multiple stand with empty crucible.

3 Precisely similar treatment of the crucible before and after the determination minimizes the effect of sorption of moisture by the crucible.

APPENDIX F

DETERMINATION OF ASH

F.1 PRINCIPLE

The ground sample is heated in air at 815 °C to constant mass. The percentage of ash is calculated from the mass of ash remaining after incineration.

F.2 SPECIAL APPARATUS

F.2.1 *Muffle furnace*

A muffle furnace capable of maintaining a zone of substantially uniform temperature at 815 ± 10 °C. The ventilation shall be such as to give at least four atmosphere changes per minute at 815 °C (see Note 1).

F.2.2 *Dish*

A silica dish, 10-mm to 15-mm deep, with cover, of such a size that the loading of the charcoal layer does not exceed 0.10 g/cm^2.

F.2.3 *Plates*

A silica plate, 6-mm thick, of such a size as to be an easy sliding fit into the muffle furnace.

F.2.4 *Balance,* with an accuracy to measure, 0.1 milligram.

F.3 PROCEDURE

Weigh a clean dry empty dish with its cover to the nearest 0.1 milligram. Spread into it in an even layer, about 1 gram of the ground charcoal sample (see A.4.2) and replace the cover. Reweigh to determine the mass of sample taken.

Place the cover in a desiccator and the uncovered dish on the cold silica plate. Insert the plate, with dish, into the muffle furnace previously heated to 815 ± 10 °C and maintain at this temperature until constant in mass (see Note 2). When incineration is complete, remove the dish from the furnace, replace the cover and allow to cool, first on a thick metal plate for 10 minutes and finally

in a desiccator for a further 15 minutes. Weigh the covered dish, brush out the ash completely and reweigh the empty dish and cover. Obtain the mass of the ash by difference.

F.4 CALCULATION

$$\text{Ash, on dry basis, per cent by mass} = (m_3 - m_4) \times \frac{100}{(m_2 - m_1)} \times \frac{100}{(100 - A)}$$

where,

m_1 = mass, in g, of dish plus cover;

m_2 = mass, in g, dish plus cover plus sample;

m_3 = mass, in g, of dish plus cover plus ash;

m_4 = mass, in g, of dish plus cover after ash has been brushed out; and

A = percentage of moisture in the analysis sample.

NOTES

1 The atmosphere changes per minute can be obtained by measurement of the air flow in the flue by means of a pitot-static tube and sensitive manometer.

2 Heating at 815 °C for 75 minutes is sufficient in most cases. If incomplete combustion is suspected for example: with high ash charcoal, do not brush out after the first weighing but re-ignite at 815 °C for further periods of 15 minutes until constant in mass (± 0.3 mg); then brush out and reweigh the empty dish. The brushing out procedure eliminates errors due to the hygroscopicity of the silica dish.

APPENDIX G

DETERMINATION OF FIXED CARBON

G.1 CALCULATION

Fixed carbon, on dry basis, per cent by mass = 100 - B - C

where,

B = per cent by mass, of volatile matter (on dry basis), as determined in Appendix E; and

C = per cent by mass, of ash (on dry basis), as determined in Appendix F.

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