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பொதுசனக் கருத்துரைக்கான கட்டளை வரைவு

DRAFT STANDARD FOR PUBLIC COMMENT

(වෙනස්වීමට ඉඩ ඇත. திருத்தத்திற்குட்படக்கூடியது. Liable to alteration)

නිකුත් කළ දිනය
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Date of Issue } 2024-03-15

අදහස් එවියයුතු අවසාන දිනය
அபிப்பிராயங்களை தெரிவிப்பதற்கான இறுதித்திகதி
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Draft Sri Lanka Standard
Specification for coconut husk based substrates
(DSLS 1219 :.....) (First Revision)

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මෙම කෙටුම්පත ශ්‍රී ලංකා ප්‍රමිතියක් ලෙස නොසැලකිය යුතු මෙන් ම භාවිතා නොකළ යුතු ද වේ.
இவ்வரைவு இலங்கைக் கட்டளையெனக் கருதப்படவோ அன்றிப் பிரயோகிக்கப்படவோ கூடாது
This draft should not be regarded or used as a Sri Lanka Standard.

අදහස් එවිය යුත්තේ : ශ්‍රී ලංකා ප්‍රමිති ආයතනය, 17, වික්ටෝරියා පෙදෙස, ඇල්විටිගල මාවත, කොළඹ 08.

Comments to be sent to: SRI LANKA STANDARDS INSTITUTION, 17, VICTORIA PLACE, ELVITIGALA MAWATHA, COLOMBO 08.

<u>හැඳින්වීම</u>

මෙම ශ්‍රී ලංකා ප්‍රමිති කෙටුම්පත , ශ්‍රී ලංකා ප්‍රමිති ආයතනය විසින් සකසන ලදුව, සියලුම උද්‍යෝගී අංශ වලට තාක්ෂණික විවේචනය සඳහා යවනු ලැබේ.

අදාල අංශ භාර කමිටු මාර්ගයෙන් ආයතනයේ මහා මණ්ඩල වෙත ඉදිරිපත් කිරීමට පෙර , ලැබෙන සියලුම විවේචන ශ්‍රී ලංකා ප්‍රමිති ආයතනය විසින් සලකා බලා අවශ්‍ය වෙතොත් කෙටුම්පත සංශෝධනය කරනු ලැබේ.

මෙම කෙටුම්පතට අදාල යෝජනා හා විවේචන නියමිත දිනට පෙර ලැබෙන්නට සැලැස්වුවහොත් අගය කොට සලකමු. තවද, මෙම කෙටුම්පත පිළිගත හැකි බැව් හැගෙන අය ඒ බව දන්වන්නේ නම් එය ආයතනයට උපකාරී වනු ඇත.

මේ පිළිබඳව එවන සියලුම ලිපි පහත සඳහන් ලිපිනයට එවිය යුතුය.

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<u>Introduction</u>

This Draft Sri Lanka Standard has been prepared by the Sri Lanka Standards Institution and is now being circulated for technical comments to all interested parties.

All comments received will be considered by the SLSI and the draft if necessary, before submission to the Council of the Institution through the relevant Divisional Committee for final approval.

The Institution would appreciate any views on this draft which should be sent before the specified date. It would also be helpful if those who find the draft generally acceptable could kindly notify us accordingly.

All Communications should be addressed to:

The Director General
Sri Lanka Standards Institution,
17, Victoria Place,
Elvitigala Mawatha,
Colombo 08.

Draft Sri Lanka Standard
SPECIFICATION FOR COCONUT HUSK BASED SUBSTRATES
(***First Revision***)

DSLS 1219:

Gr.

SRI LANKA STANDARDS INSTITUTION
17, Victoria Place,
Elvitigala Mawatha,
Colombo 8,
Sri Lanka.

Draft Sri Lanka Standard
SPECIFICATION FOR COCONUT HUSK BASED SUBSTRATES
(***First Revision***)

FOREWORD

This standard was approved by the Sectoral Committee on Chemicals and Polymer Technology and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on……

Coconut husk based substrate products are manufactured by using raw materials from the coconut husks which are environmentally friendly are being used for several agricultural purposes. Because of the high-water holding capacity and retention of added nutrients are now being widely used as a media in horticulture and floriculture. Physical and mechanical, chemical, microbiological, and phytosanitary requirements for coconut husk based substrates intended to be used for plant growth are specified in this Standard.

This Standard was first published in 2001. In this first revision, the title and scope has been expanded to accommodate all types of coconut husk based substrates available in the market. The definitions have been revised and the products have been categorized into six types. General requirements, physical requirements, physico-chemical requirements have been revised to ensure proper quality control of coconut husk based substrates. Methods of tests were enhanced and updated to align with coconut husk based industry.

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 an analysis, shall be rounded off in accordance with **SLS 102**. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this specification.

This Standard is subjected to the provisions under the Regulation of Fertilizer Act No. 68 of 1988, the National Environmental Act No. 47 of 1980, the Soil Conservation Act No. 25 of 1951, the Fauna and Flora Protection Ordinance No. 02 of 1937, the Plant Protection Act No. 35 of 1999, the Food Act No. 26 of 1980, the Animal Diseases Act No. 59 of 1992 and Quarantine and Prevention of Diseases Ordinance No. 3 of 1897, and the regulations and amendments framed thereunder, and any other regulatory and statutory requirements wherever applicable.

In the preparation of this standard, the assistance obtained from the following publication is gratefully acknowledged:

BS 4156: 1990 British Standard Recommendations for peat for horticultural and landscape use.
ISPM 5 International Standards for phytosanitary measures, Glossary of phytosanitary terms

1 SCOPE

This specification prescribes the requirements and methods of test for coconut husk based substrates used for growing plants.

2 REFERENCES

SLS	102	Rules for rounding off numerical values
SLS	115	Part 1: Coconut fibre – Brown fibre and mixed fibre
SLS	124	Test sieves
SLS	428	Random sampling method
SLS	516	Method of test for microbiology of food and animal feeding stuffs Part 5: Horizontal method for the determination of *Salmonella* spp. Part 12: Horizontal method for the detection and enumeration of presumptive *Escherichia coli*

3 DEFINITIONS

For the purposes of this specification the following definitions shall apply:

3.1 air filled porosity: The percentage of air space created in the saturated substrate after complete drainage of gravitational water

3.2 breakout volume (outturn): Reconstituted volume of loose material obtained when compressed coconut husk based substrate is loosen up for use

3.2.1 wet breakout volume: Reconstituted volume of loose material obtained when compressed coconut husk based substrate is loosen up with water

3.3 coconut fibre / coir: A natural fiber extracted from the mesocarp tissue of the coconut fruit

3.4 coir fibre pith: A spongy binding material of coir fibre in the mesocarp of the coconut fruit and which formed the by-product from the coir fibre extraction process

3.5 coconut husk: The outer cover (exocarp and mesocarp) of the coconut fruit

3.6 coconut husk based substrates: Substrates which are originated from coconut husk and intended to be used as a growing medium

3.7 coconut husk chips: Pieces of the coconut husk which consists of long fibers and sponge like pith particles, processed to a specified size

3.8 compression factor: Ratio of final bulk density of loosen material to initial bulk density of compressed material

3.9 expanded volume: Increase in volume when the coconut husk based substrates are hydrated or soaked in water

3.10 extraneous matter : Anything other than coconut husk based substrates including heavy particles such as metal pieces, gravel etc. and light particles such as organic matter, plant debris etc.

NOTE
Unless otherwise declared by the supplier/manufacturer.

3.11 field capacity: The amount of moisture or water content held in the coconut husk based substrates after excess water has drained away

3.12 non-quarantine pests: Pest that is not a quarantine pest for an area.

3.13 package: A unit or bundle of units of similar products, that are packed or wrapped.

3.14 phytosanitary measures: Any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests

3.15 quarantine pests: A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled

3.16 water holding capacity: The amount of water that the coconut husk based substrate can hold up at the field capacity.

4 TYPES

4.1 Coconut husk based substrates shall be of the following major types:

a) Compressed; and
b) Uncompressed.

4.2 Above major types may be categorized into following value-added sub types:

a) Nutrients added;
b) Washed with water;
c) Treated/ buffet; and
d) Any other value-added products.

5 REQUIREMENTS

5.1 General requirements

5.1.1 Coconut husk based substrates shall be in the form of briquettes, bales, planks, discs, grow bags, blocks, bulk bags, cubes, pellets, pads or any other form as agreed to between the supplier and the customer.

5.1.2 The compression factor of coconut husk based substrates shall be as agreed to between the supplier and the customer, when tested as in Appendix **B**.

5.1.3 Coconut husk based substrates shall be free from live insects, their all stages of life cycle, animal matter and excreta. Presence of live insects, their all stages of life cycle, shall be determined when tested as in Appendix **C**.

5.1.4 Coconut husk based substrates shall be free from nematodes when tested as in Appendix **D**.

5.1.5 Coconut husk based substrates may be treated with and/or incorporated with organic, inorganic matter and/or additives upon the request of a customer.

5.1.6 Wet break out volume of compressed coconut husk based substrates shall be as agreed to between the supplier and the customer when tested as in Appendix **E**.

5.1.7 The coconut husk based substrates shall be free from sand when tested as in Appendix **L**, unless otherwise not specified by the customer and/or regulatory body of the importing country.

5.2 Physical requirements

5.2.1 *Dimensions*

The dimensions of coconut husk based substrate products shall be as agreed to between the supplier and the customer.

5.2.2 *Moisture content*

The moisture content of coconut husk based substrates shall be as agreed to between the supplier and the customer. The declared moisture content shall be tested as in Appendix **F**.

5.2.3 *Water holding capacity*

Water holding capacity of coconut husk based substrates shall be as agreed to between the supplier and the customer. Water holding capacity shall be tested as in Appendix **G**.

5.2.4 *Particle size distribution*

Particle size distribution of coconut husk based substrates shall be as agreed to between the supplier and the customer, when tested as in Appendix **M**.

5.2.5 *Air filled porosity*

Air filled porosity of coconut husk based substrates shall be as agreed to between the supplier and the customer, when tested as in Appendix **N**.

5.2.6 *Expanded volume*

Expanded volume of coconut husk based substrates shall be as agreed to between the supplier and the customer, when tested as in Appendix **P**.

5.3 Physico-Chemical requirements

The product shall conform to the requirements given in Table **1**, when tested according to the methods given in Column **4** of the Table **1**.

TABLE 1 - Physico-chemical requirements of coconut husk based substrates

Sl No. (1)	**Characteristic** (2)	**Requirement** (3)	**Method of test** (4)
i	pH value	5.5 to 6.8	**Appendix H**

5.3.1 *Electrical conductivity*

Electrical conductivity of coconut husk based substrates shall be as agreed to between the supplier and the customer, when tested as in Appendix **H**.

5.4 Nutrient content

In the case of nutrient added or treated coconut husk based substrates, the added nutrient content shall be as agreed to between the supplier and the customer.

5.5 Extraneous matter

5.5.1 Coconut husk based substrates shall be free from viable seeds, when tested according to the method described in Appendix **J**.

NOTE
Unless otherwise specified by the regulatory body.

5.5.2 Coconut husk based substrates shall not contain visually identified extraneous matter when tested as in Appendix **K**.

5.6 Microbiological requirements

Coconut husk based substrates shall comply with the microbiological limits given in Table **2** when tested as in Column **7** of Table **2**

TABLE 2 – Microbiological requirements

Sl No. (1)	Test organism (2)	Limit				Method of Test (7)
		n (3)	c (4)	m (5)	M (6)	
i)	*E. coli*, MPN per g	5	2	10^2	10^3	**SLS 516 : Part 12**
ii)	*Salmonella* spp., per 25 g	5	0	absent	-	**SLS 516 : Part 5**

Where,

n is the number of samples to be tested;
c is the maximum allowable number of samples yielding values between m and M;
m is the limit below which a count is acceptable for any sample; and
M is the limit above which a count is unacceptable for any sample.

NOTE

*Test for the requirements given in Table **2** may not be necessary for routine analysis. These tests shall be carried out only if required or requested.*

6 PACKAGING, MARKING AND/OR LABELLING

6.1 Packaging

The coconut husk based substrates shall be packed as agreed to between the customer and the supplier.

6.2 Marking

Each package of coconut husk based substrates shall be marked or labeled legibly and indelibly with the following or as agreed to between the supplier and the customer:

a) Name of the product;
b) Type of the product ;
c) Manufacturer's name or registered trade mark, if any;
d) Date of manufacture;
e) Batch or code number;
f) The amount of nutrient added (in case of types add);
g) The mass of the product; and
h) Country of origin.

7 SAMPLING

Representative samples of the product for ascertaining conformity to the requirements of this Standard shall be drawn as prescribed in Appendix **A**.

8 METHODS OF TEST

8.1 Tests shall be carried out as prescribed in Appendices **B** to **P** given in this Standard, **Part 5** of **SLS 516** and **Part 12** of **SLS 516**.

APPENDIX A
COMPLIANCE OF A LOT

The sampling scheme given in Appendix A should be applied where compliance of a lot to the requirements of this Specification is to be assessed based on statistical sampling and inspection.

Where compliance with this Specification is to be assured, appropriate schemes of sampling and inspection shall be adopted based on manufacturer's control systems coupled with type tests and testing procedures.

A.1 GENERAL REQUIREMENTS OF SAMPLING

In drawing, preparing, storing and handling samples, following precautions and directions shall be taken.

A.1.1 Sampling shall be carried out by a trained and experienced person as it is essential that the sample should be representative of the lot to be examined.

A.1.2 Samples in their original unopened containers shall be drawn and sent to the laboratory to prevent possible contamination of sample during handling and to help in revealing the true condition of the material.

A.1.3 If samples are transferred to another container, they shall be kept in clean and dry suitable containers.

A.1.4 The samples shall be protected against extraneous contamination while drawing and handling the samples and to preserve them in their original condition till they are ready for examination in the laboratory.

A.1.5 Samples shall be drawn from a protected place not exposed to dampness, air, light, dust or soot.

A.1.6 The sample containers shall be sealed air-tight after filling and marked with necessary details of sampling.

A.1.7 When drawing samples for microbiological examination, additional protections shall be maintained as follows.

A.1.7.1 Samples shall be drawn under aseptic conditions.
A.1.7.2 The sampling instrument and sample containers shall be sterilized using an appropriate method and held in suitable containers to prevent re-contamination.

A.2 SAMPLING MECHANISM

A.2.1 Continuation of lot compliance of coconut husk based substrates of compressed (type a) product categories are incorporated under compressed products scheme (**A.3**) and uncompressed (type b) product categories are integrated under uncompressed products scheme (**A.4**).

A.3 COMPRESSED PRODUCTS

A.3.1 Lot

In any consignment, all the coconut husk based substrates packages of the same mass and the same form belonging to one batch of manufacture or supply shall constitute a lot.

A.3.2 Scale of sampling

A.3.2.1 Samples shall be tested from each lot for ascertaining the conformity of the lot to the requirements of this Specification.

A.3.2.2 The number of packages to be selected as the sample from a lot shall be in accordance with Column **(1)** and Column **(2)** of Table **3**. If quantity of the material in the sample does not meets the minimum total sample weight (5 kg), sampling personnel shall take random additional packages to fulfill the requirement of minimum total sample weight.

A.3.2.3 If the package consists more than one unit and total weight of the selected packages as in **A.3.2.2** exceeds 5 kg, sufficient quantity of sample shall be drawn from each selected package by applying respective safety precautions. Sample units shall be randomly drawn from the top, middle and bottom portions of each selected package separately to form final sample for tests. The sample shall be put into sample containers separately and marked with necessary details of sampling.

A.3.2.4 The number of packages to be selected as the sub sample from the selected packages as in **A.3.2.2** or **A.3.2.3** shall be in accordance with Column **(1)** and Column **(3)** of Table **3**.

TABLE 3 - Scale of sampling

Number of packages in the lot (1)			Number of packages to be selected * (2)	Size of sub – sample (3)
Up	to	500	08	02
501	to	3 200	13	05
3 201	to	35 000	20	05
35 001	and	above	32	08

** Minimum total sample weight shall be 5 kg*

A.3.2.5 Unopened five (05) packages (comprising minimum of 250 g each) shall be selected at random from the lot in order to carryout microbiological test requirements if required/requested.

A.3.2.6 If the package consists more than one unit and total weight of the selected packages as in **A.3.2.5** exceeds 250 g, sufficient quantity of sample shall be drawn from each selected package by applying respective safety precautions. Sample units shall be randomly drawn from the top, middle and bottom portions of each selected package separately using an appropriate sterilized sampling instrument under aseptic condition to form final sample for microbiological tests. The sample shall be put into sterile sample containers separately and marked with necessary details of sampling.

A.3.2.7 The packages shall be selected at random. In order to ensure randomness of selection, tables of random numbers as given in SLS **428** shall be used.

A.3.3 Number of tests

A.3.3.1 Each package selected as in **A.3.2.2** or **A.3.2.3** shall be inspected for packaging and marking requirements.

A.3.3.2 The required number of unit of coconut husk based substrate shall be selected from each package in the sub sample selected as in **A.3.2.4** and tested for wet break out volume.

A.3.3.3 One (01) unit of coconut husk based substrate shall be selected from each package in the sub sample (comprising minimum of three (03) units) selected as in **A.3.2.4** and measured for dimensional requirements.

NOTE
*In case of a package containing only one unit of coconut husk based substrate, three sub samples shall be selected as in **A.3.2.4** for the testing of dimensional requirements.*

A.3.3.4 Three (03) units of coconut husk based substrate shall be selected from the sub sample selected as in **A.3.2.4** and tested for expanded volume.

NOTE
*In case of a package containing only one unit of coconut husk based substrate, three sub samples shall be selected as in **A.3.2.4** for the testing of expanded volumes.*

A.3.3.5 The substrates from each remaining package of the sample selected as in **A.3.2.2** or **A.3.2.3** and composite sample shall be prepared, and used to carryout tests for remaining requirements specified as in **5.1**, **5.2**, **5.3** and **5.5**.

A.3.3.6 The required amount of coconut husk based substrate for each test shall be drawn from the composite sample prepared as in **A.3.3.5** and tested for each requirement according to the methods prescribe in the Specification.

A.3.3.7 The required amount of coconut husk based substrate shall be drawn from each package selected as in **A.3.2.5** or **A.3.2.6** and tested as per **Part 5** and **Part 12** of **SLS 516** for microbiological requirements.

A.3.4 Criteria for conformity

A.3.4.1 Each package inspected as in **A.3.3.1 s**atisfies the relevant requirements.

A.3.4.2 Each unit of coconut husk based substrate tested as in **A.3.3.2** satisfies the relevant requirements.

A.3.4.3 Each unit of coconut husk based substrate measured as in **A.3.3.3** satisfies the relevant requirement.

A.3.4.4 Each unit of coconut husk based substrate tested as in **A.3.3.4** satisfies the relevant requirement.

A.3.4.5 The test results on other requirements when tested as in **A.3.3.5** and **A.3.3.6** satisfy the relevant requirements.

A.3.4.6 The test results on *E. coli* limits tested as in **A.3.3.7** satisfies the relevant requirement.

A.3.4.7 The test results on *Salmonella* limits tested as in **A.3.3.7** satisfies the relevant requirement.

A.4 UNCOMPRESSED PRODUCTS

A.4.1 Lot

In any consignment, all the coconut husk based substrates packages of the same mass belonging to one batch of manufacture or supply shall constitute a lot.

A.4.2 Scale of sampling

A.4.2.1 Refer **A.3.2**

A.4.3 Number of tests

A.4.3.1 Each package selected as in **A.3.2.2** or **A.3.2.3** shall be inspected for packaging and marking requirements.

A.4.3.2 The substance from each remaining package of the sample selected as in **A.3.2.2** or **A.3.2.3** shall be mixed to form a composite sample, and used to carryout applicable tests for remaining requirements specified as in **5.1**, **5.2**, **5.3** and **5.5**.

A.4.3.3 The required amount of coconut husk based substrate for each test shall be drawn from the composite sample prepared as in **A.4.3.2** and tested for each applicable requirement according to the methods prescribe in the Specification.

A.4.3.4 The required amount of coconut husk based substrate shall be drawn from each package selected as in **A.3.2.5** or **A.3.2.6** and tested as per **Part 5** and **Part 12** of **SLS 516** for microbiological requirements.

A.4.4 Criteria for conformity

A.4.4.1 Each package inspected as in **A.4.3.1** satisfies the relevant requirements.

A.4.4.2 The test results on other requirements when tested as in **A.4.3.2** and **A.4.3.3** satisfy the relevant requirements.

A.4.4.3 The test results on *E. coli* limits tested as in **A.4.3.4** satisfies the relevant requirement.

A.4.4.4 The test results on *Salmonella* limits tested as in **A.4.3.4** satisfies the relevant requirement.

APPENDIX B
DETERMINATION OF COMPRESSION FACTOR

B.1 DETERMINATION OF FINAL BULK DENSITY (D_2)

B.1.1 *Apparatus*

B.1.1.1 Top loading balance, sensitivity 0.1 g

B.1.2 *Procedure*

B.1.2.1 Measure the volume of the compressed sample in cubic centimeter / milliliter (cm3 / ml) using an appropriate method (v_1). Record the mass of it in grams (m_0).

B.1.2.2 Measure the moisture content of the sample specified in **Appendix F**.

B.1.3 *Calculation*

Moisture fraction (M_f) of the sample:

$$M_f = \frac{MC}{100}$$

Moisture factor of the sample (MF) = 1+ M_f

Where,
MC is the moisture content (**B. 1.2.2**)

At 20 per cent moisture content, the weight of the sample (m_1) in grams;

$$m_1 = \frac{m_0}{MF} \text{ X } 1.2$$

Final bulk density in g ml^{-1} or g cm^{-3} $= \frac{m_1}{v_1}$

Where,
m_1 is the mass in g of the compressed sample at 20 per cent moisture content and;
v_1 is the volume in cm^{-3} or ml of the compressed sample.

B.2 DETERMINATION OF INITIAL BULK DENSITY (D_1)

B.2.1 *Apparatus*

B.2.1.1 Top loading balance, sensitivity 0.1 g

B.2.1.2 Beaker, 12 cm diameter, 2 l

B.2.1.3 Steel ruler, 1.0 mm

B.2.1.4 500 g standard /reference weight

B.2.1.5 Circular plate, 11 cm diameter

B.2.2 ***Procedure***

B.2.2.1 Weigh approximately 50 g of air-dried substrate (m_0) and transfer into the beaker.

B.2.2.2 Put the circular plate on the substrate and place the 500 g weight on it.

B.2.2.3 Measure the average height of the substrate and calculate the volume (v_2) of the substrate.

B.2.2.4 Measure the moisture content of the sample specified in **Appendix F**.

B.2.3 ***Calculation***

Moisture fraction (M_f) of the sample:

$$M_f = \frac{MC}{100}$$

Moisture factor of the sample (MF) = 1+ M_f

Where,
MC is the moisture content (**B.2.2.4**)

At 20 per cent moisture content, the weight of the sample (m_1) in grams;

$$m_1 = \frac{m_0}{MF} \text{ X } 1.2$$

Initial bulk density g ml^{-1} or g cm^{-3} = $\frac{m_1}{v_2}$

Where,
m_1 is the mass in g of the sample at 20 per cent moisture content and;
v_2 is the volume in *ml* or cm^3 of the sample.

B.4.2 Compression factor = D_2: D_1

Where,
D_1 is the initial bulk density as determined in **B.2** ; and
D_2 is the final bulk density as determined in **B.1.**

APPENDIX C
DETERMINATION OF INSECTS THEIR LARVAE AND EGGS

C.1 DETERMINATION OF INSECT AND THEIR LARVAE

C.1.1 Apparatus as shown in Figure C.1.1

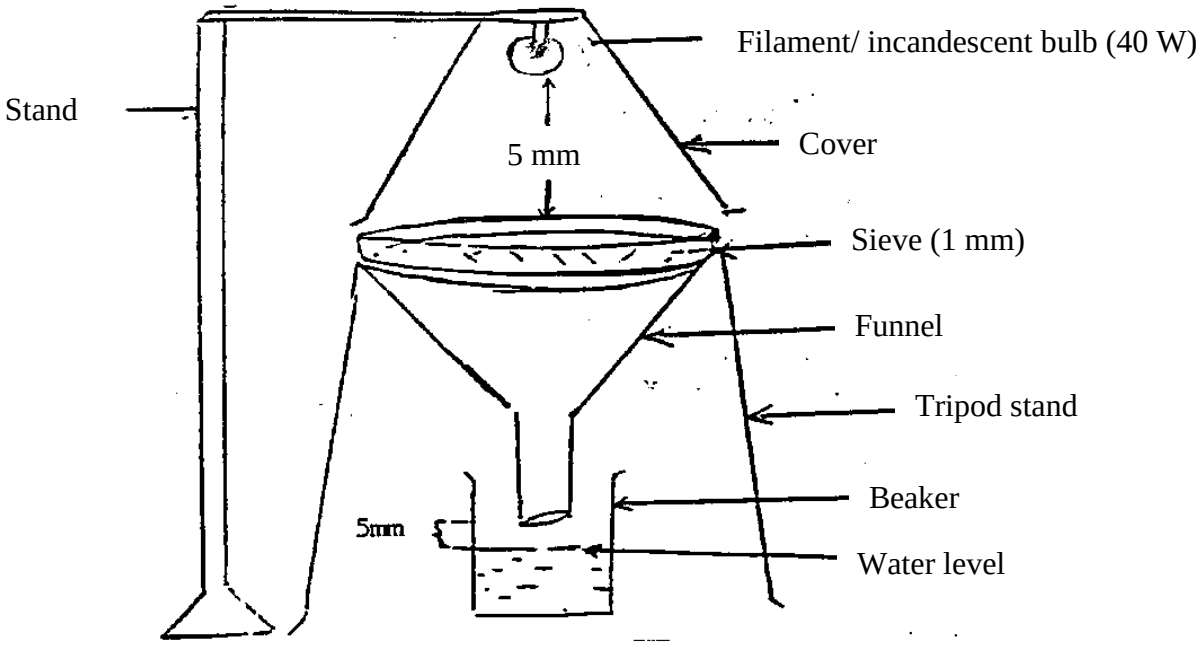

FIGURE C.1.1 Apparatus for determination of insects, their larvae and eggs

C.1.2 Procedure

Place about 30 g of the sample on a sieve with mesh size of 3 mm. Compressed coconut husk based substrates must be gently broken into pieces before placing on the sieve. If it is difficult to break with fingers, add little amount of water to loose the material. Place the sieve on a funnel. Switch the bulb on and keep for 2 hours. Examine the water taken from the beaker for the presence of any insects and their larvae under microscope.

C.2 DETERMINATION OF INSECT EGGS

C.2.1 Place 100 g of sample in an incubator under room temperature for 2 weeks. Observe daily for two weeks to see whether any insect larvae are emerging. If no emergence was observed during the two weeks period, carry out the procedure **C.1.2.**

APPENDIX D
DETERMINATION OF NEMATODES

D.1 Apparatus

D.1.1 *Funnel,* 45° *slope with a piece of soft silicone tube attached to the stem and closed with a squeezer clip*

D.1.3 *Cheesecloth*

D.1.4 *Stand*

D.1.5 *Nematode counting dish*

D.1.5 *Stereo microscope,* X10

D.1.6 *Sieve,* 2 mm

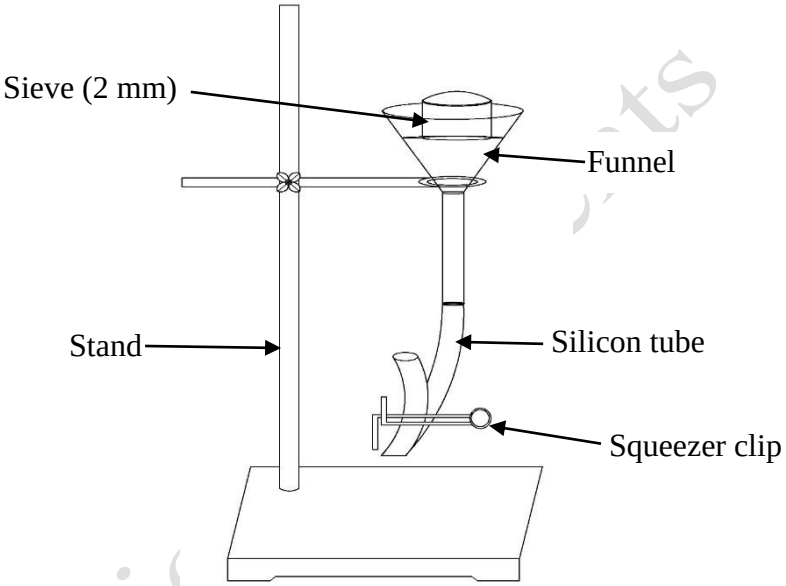

Figure D.1

D.2 Procedure

D.2.1 Take 10 g of sample and wrap it in a piece of cheesecloth, forming a loose ball.

D.2.2 Fix the funnel to the stand as per the **Figure D.1** and fill it with water until it reaches up to 1 cm below the rim. Avoid formation of air bubbles.

D.2.3 Make sure that clip closes well and that the rubber tube does not leak.

D.2.3 Place the cheesecloth with the sample on the sieve and into the funnel submerged without touching the bottom of the funnel. Allow nematodes to crawl out from the material into the water and settle.

D.2.4 After keeping 24 hrs, collect initial 20 ml (approximately) of the nematode suspension by opening the squeezer clip to the nematode counting dish.

D.2.5 Examine the presence of nematodes of the suspension (**D.2.4**) through a stereo microscope.

APPENDIX E
DETERMINATION OF WET BREAK OUT VOLUME (OUT TURN)

E.1 Apparatus

E.1.1 *Large container*, minimum *20 l*

E.1.2 *Graduated measuring container, 20 l*

E.1.3 *Top loading balance, sensitivity 0.1 g*

E.2 Procedure

E.2.1 Weigh 1 kg of representative sample into a large container.

E.2.2 Add 2.5-3 liters of water until the sample is saturated at room temperature (25 ºC-32 ºC), wait for 15 minutes.

E.2.3 Loosen up the material after the water absorption completed.

E.2.4 Drain off excess water for 15 minutes.

E.2.5 Transfer the material into the 20 l graduated container and even the upper surface without applying the mechanical force.

E.2.6 Measure the final volume and record. Express the value in liters per kilogram.

APPENDIX F
DETERMINATION OF MOISTURE CONTENT

F.1 Apparatus

F.1.1 *Moisture can with air tight lid, heat resistant and large enough to accommodate approximately 10 g of sample.*

F.1.2 *Top loading balance with a sensitivity 0.1 g*

F.1.3 *Desiccators, with suitable desiccants (Silica Gel)*

F.1.4 *Oven, maintaining at 103 ± 2 °C*

F.2 Sample preparation

F.2.1 Draw representative composite sample. If the sample is compressed, break the aliquot mechanically or by hand and prepare a composite sample (100 g).

F.3 Procedure

F.3.1 Weigh, to the nearest 0.1 g, 10 g of sample in to a previously dried and weighted container (m_1) (**F.1.1**).

F.3.2 Place the container (**F.1.1**) with the sample into the oven maintained at 103 ± 2 °C and dry the sample for 6 hrs. Cool in a desiccator and weigh.

F.3.3 Repeat the drying, cooling and weighing until the difference in mass between two successive weighing does not exceed 0.1 g. Record the mass (m_2).

NOTE

All weighing should be at room temperature.

F.4 Calculation

Moisture content (MC), per cent by mass= $\frac{m_1 - m_2}{m_1}$ X 100%

Where,
m1 is the mass, in grams, of the sample before drying and;
m2 is the mass, in grams, of the sample after drying.

APPENDIX G
DETERMINATION OF WATER HOLDING CAPACITY

G.1 APPRATUS

G.1.1 *Top loading balance, sensitivity 0.1 g*

G.1.2 *Sieve, 1 mm*

G.1.3 *Desiccator, with suitable desiccants (Silica Gel)*

G.1.4 *Oven, maintained at 103 ±2 °C*

G.2 Sample Preparation

Break the aliquot mechanically or by hand and prepare a composite sample (500 g).

G.3 Procedure

G.3.1 Wet thoroughly about 100 g of sample for 1 hour.

G.3.2 Allow the sample to drain off excess water under gravity through the sieve. Weigh approximately 50 g of drained sample (m_1). Weigh it to the nearest 0.1 g.

G.3.3 Heat the sample at 103 $\pm$ 2 ^{o}C, cool in a desiccator and re-weigh.

G.3.4 Repeat **G.3.3**, until the difference between two successive weight readings does not exceed 0.1 g. Record the mass (m_2). Calculate the loss in mass as a percentage of the dry mass.

G.4 Calculation

Water holding capacity, percent by mass $= \frac{m_1 - m_2}{m_2} \times 100\%$

Where,
m_1 is the mass, in g of the drained sample; and
m_2 is the mass, in g of the dry sample.

APPENDIX H
DETERMINATION OF pH AND ELECTRICAL CONDUCTIVITY

H.1 Apparatus

H.1.1 *pH meter, temperature compensated*

H.1.2 *Magnetic stirrer/mechanical shaker*

H.1.3 *Conductivity meter, readable range 0 to 5 000 µS/cm*

H.1.4 *Measuring cylinder, 250 ml*

H.1.5 *Beaker, 500 ml*

H.1.6 Sieve, *75 µm*

H.2 Sample Preparation

Break the aliquot mechanically or by hand and prepare a composite sample (500 g).

H.3 Procedure

H.3.1 Take 10 g loose sample and transfer to 500-ml beaker

H.3.2 Add 150 ml of distilled water to the beaker

H.3.3 Stir for 5 minutes on a magnetic stirrer/mechanical shaker and keep for 30 minutes.

H.3.4 Measure the pH and conductivity after filtering the suspension within 10 minutes of stirring following the instructions of pH meter and conductivity meter.

APPENDIX J
DETERMINATION OF VIABLE SEEDS

J.1 Apparatus

J.1.1 *Top loading balance,* sensitivity 0.1 g

J.1.2 *Plastic trays*, height of 5cm, min

J.1.3 *Hand lenses*

J.2 Sample preparation

Take 500 g of representative composite sample.

J.3 Procedure

J.3.1 Take the sample into a tray and add sufficient amount of water to loosen the material until obtaining field capacity. The final depth of the substrate layer is about 0.5 - 1.5 cm.

J.3.2 Place the plastic trays on tables/high surfaces. The minimum height of the tables/high surfaces shall be 1 m. The trays may cover with a clear film having few holes to accelerate the seed germination.

J.3.3 Maintain the temperature 25-30 ^{0}C and moisture in field capacity level by adding water periodically.

J.3.4 Optimum lighting shall be 12 hours of light and 12 hours darkness per day.

J.2.5 Keep the trays for 21 days in a protected site.

J.3.6 Observe the samples carefully (Most preferably daily) and record any emerging seedlings.

J.3.7 Count total sprouts (emerging seedlings) by observing the tray using hand lenses. The counting practice shall avoid the double counting.

J.3.8 Record the results as monocotyledons and dicotyledons.

J.3.9 Once a seedling is observed, leave them for additional two days and remove seedling after the two days.

J.4 Expressing of results

Calculate the number of seedlings per kg of substrate. Express the final result as viable seeds per kg.

APPENDIX K
DETERMINATION OF EXTRANEOUS MATTER EXCEPT SAND

K.1 Apparatus

K.1.1 *Sieve, 2mm*

K.1.2 *Top loading balance, sensitivity 0.1 g*

K.2 Sample preparation

Break the aliquot mechanically or by hand and prepare a composite sample (500 g).

K.3 Procedure

K.3.1 Take 100 g of 3-5 sub-samples as prepared in **K.2** and weigh to the nearest 0.1 g.

K.3.2 Put the samples onto sieve separately. Shake the sieve manually for 5-10 minutes to screen out the sample.

K.3.3 Check visually the presence of extraneous matter in each sample.

APPENDIX L
DETERMINATION OF SAND CONTENT

L.1 Apparatus

L.1.1 *Calibrated bucket, 8-10 L*

L.1.2 *Moisture can*

L.1.3 *Oven, maintained at 103 ±2 °C*

l.1.4 *Top loading balance, sensitivity of 0.1 g*

L.1.5 *Sieve, 2 mm*

L.1.6 *Desiccator, with suitable desiccants (Silica Gel)*

L.2 Sample Preparation

Break the substrate mechanically or by hand and take few representative sub samples and prepare a composite sample (500 g).

L.3 Procedure

L.3.1 Take 100 g of sub sample and dry in an oven maintained at 103 ±2 °C until constant weight (m_0) obtained.

L.3.2 Transfer the sample (m_0) into 8-10 L calibrated bucket. Add adequate volume of water (5L) and stir. Leave to settle for 30 minutes.

L.3.3 Decant the water and the floating particles, leaving the residue at the bottom.

L.3.4 Transfer the residue to a moisture can and dry in an oven maintained at 103 ±2 °C until constant weight obtained. Cool in a desiccator and weigh to the nearest milligram.

L.3.5 Separate and collect the sand by sieving (2 mm) and record the final mass (m_1).

L.4 CALCULATION

Sand content per cent by mass $= \frac{m_1}{m_0}$ X 100%

Where,
m_1 is the mass in grams, of the sand; and
m_0 is dry mass in grams, of sample.

APPENDIX M
DETERMINATION OF PARTICLE SIZE DISTRIBUTION

M.1 Apparatus

M.1.1 *Sieve shaker*

M.1.2 *Stacking sieves,0.2 mm, 0.5 mm, 1 mm, 2 mm, 4 mm, 6 mm, 8 mm, 10 mm,12 mm, 16 mm, 18 mm, 25 mm*

M.1.3 *A receiving pan for the set of sieves*

M.1.4 *Top loading balance, sensitivity of 0.1 g*

M.2 Sample preparation

M.2.1 If the sample is compressed, loose the material by addition of adequate water over until the substrates drenched and saturated. Then, dry the loosen wet material at 103±2 °C for 24 hours and then measure the weight in 1 hour intervals, until obtain a constant weight. Condition the dried sample for 24 hours at room temperature.

M.2.2 If the sample is uncompressed, dry at 103±2 °C for 6 hours and then measure the weight in 1 hour intervals, until obtain a constant weight. Condition the dried sample for 24 hours at room temperature.

M.3 Procedure

M.3.1 Weigh 50 g from the conditioned material sample to the nearest 1 g.

M.3.2 Select the set of sieves from the list (**L.1.2**) depending on the requirement and stack in descending order of aperture size

M.3.3 Place the entire dry material sample on a set of sieves, comprising the largest sized sieve on top and the receiving pan at the bottom.

M.3.4 Shake in a horizontal plane for 1 to 2 min until no more material falls through the largest sized sieve mechanically.

M.3.5 Separately weigh material retained by each sieve including the receiving pan, and record the weights to nearest 1 g.

M.4 Calculation

Calculate each sieved fractions as a retained percentage (%) by weight of the total dry material sample

$$\text{Sieve fraction} = \frac{m_i}{\Sigma\, m_i} X\ 100\ \%$$

Where,
mi – weight of the retained sieve fraction on the respective sieve or the receiving pan

APPENDIX N
DETERMINATION OF AIR FILLED POROSITY

N.1 Apparatus

N.1.1 *Air filled porosity apparatus consisting two sections;*

N.1.1.1 Base section consisting length of 120 mm, diameter of 90 mm uPVC pipe, 90 mm End cap with 5 holes of 9 mm size in diameter each.

N.1.1.2 Top section consisting of 120 mm length of 90 mm uPVC pipe with a 90 mm double socket.

N.1.1.3 *Stand*

N.1.2 *water permeable membrane and rubber band*

N.1.3 *Flat dish*

N.1.4 *Knife*

N.1.5 *Bucket*, 18-20 l

N.1.6 *Graduated measuring cylinder*, 250 ml

N.1.7 *Tray or flat container*

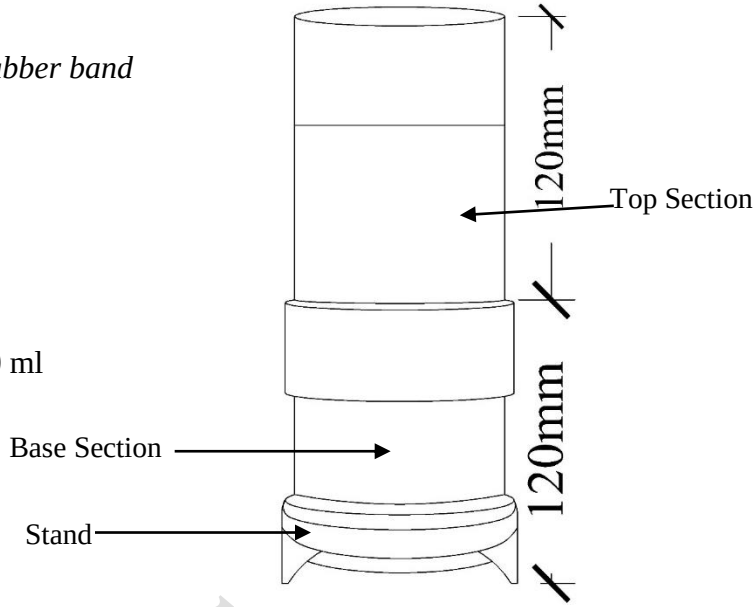

Figure N.1 Air filled porosity Apparatus

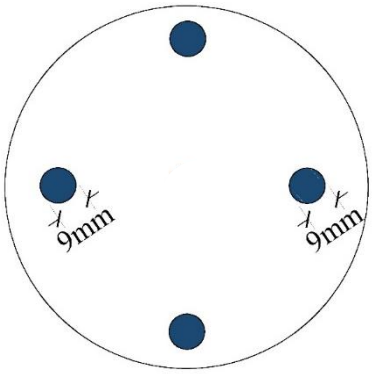

Figure N.1.1.1 Bottom of the Base Section

N.2 Sample Preparation

N.2.1 Take few representative sub-samples from the substrate and prepare a composite sample of about 3 l.

N.2.1.1 If the sample is compressed, loose the material by addition of adequate water over until the substrates drenched and saturated. Break the aliquot by hand and prepare a composite sample.

N.2.1.2 If the sample is uncompressed, add adequate water over the substrate until drenched and saturated.

N.3 Procedure

N.3.1 Fix two sections of the air filled porosity apparatus together and take 2 l of moisten sample and fill the container to the top.

N.3.2 Then drop the apparatus to an evenly leveled surface from 5cm height, 5 times to settle the sample.

N.3.3 Place the apparatus into the empty bucket and slowly fill with water up to 200 mm carefully to ensure the base section is covered by water and then leave for 30 minutes.

N.3.4 Take out the apparatus and placed on the tray, let it drain for 5 minutes.

N.3.5 Then place the apparatus gently into the water and repeat the process of soaking and draining (**N.3.3** and **N.3.4**) 3 times (until free drain ceases).

N.3.6 Take the apparatus out of the water and allow to drain. Remove the top of the apparatus and slice up the substrate to level with the top of the base section using a knife.

N.3.7 Place the stocking over the top of the base section and secure with a rubber band.

N.3.8 Then place the base section in the empty bucket and fill the bucket to cover the top of the base section with 30-40 mm height of water over the base section's top level and allow to soak for 10 minutes.

N.3.9 Close the holes of the base section by using fingers.

N.3.10 Lift out the base section from the bucket and allow excess water drops to drain off.

N.3.11 Place the base section in shallow container and remove fingers to allow to drain water for 30 minutes.

N.3.12 Take out the base section and measure the volume of drained water (V_2).

N.3.13 Calculate the volume of the base section (V_1).

N.4 CALCULATION

$$\text{Air filled porosity \%} = \frac{V_2}{V_1} \times 100\ \%$$

Where,
V1 is the volume in ml of the base section (**N.1.1.1**), and;
V2 is the volume in ml of the drained water (**N.3.12**).

APPENDIX P
DETERMINATION OF EXPANDED VOLUME OF FINISH PRODUCT

P.1 Apparatus

P.1.1 *Ruler*, 1 mm.

P.1.2 *Vernier caliper, if necessary.*

P.1.3 *Container which compatible with customer requirement, if the final product is not primary packed. (Such as discs, cubes, etc.).*

P.2 Procedure

P.2.1 Measure the dimensions needed (height, width, length or diameter) to calculate initial volume of the dry product in triplicates. Calculate the initial volume.

P.2.2 If the test product is not primary packed, place it in the container. If the test product has cover, prepare a hole/s on the cover to add water.

P.2.3 Add water gradually to the sample until saturate.

P.2.4 Allow to drain off excess water and to expand for 30 minutes and calculate the expanded volume.

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