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பொதுசனக் கருத்துரைக்கான கட்டளை வரைவு

DRAFT STANDARD FOR PUBLIC COMMENT

(වෙනස්වීමට ඉඩ ඇත. திருத்தத்திற்குட்படக்கூடியது. Liable to alteration)

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Latest Date for Receipt of Comments } 2022-12-20

Draft Sri Lanka Standard
SPECIFICATION FOR BIOCHAR
(DSLS..... : .....)

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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.

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Introduction

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
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17, Victoria Place,
Elvitigala Mawatha,
Colombo 08.

Draft Sri Lanka Standard
SPECIFICATION FOR BIOCHAR

SLS ------ :

Gr.

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Draft Sri Lanka Standard
SPECIFICATION FOR BIOCHAR

FOREWORD

This Standard was approved by the Sectoral Committee on Agriculture and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on …….

This Standard prescribes the requirements for biochar intended to use as a soil amendment for agriculture.

Biochar shall not contain any materials hazardous to plant, animal or human health. It improves cation exchange capacity of the soil or any other alternative planting media and enhances physical, chemical and biological properties of the soil.

This Standard is subjected to the restrictions imposed under the Regulation of Fertilizer Act No. 68 of 1988, Fauna and Flora Protection Act No. 44 of 1964, Plant Protection Act No 35 of 1999, Animal Diseases Act No. 59 of 1992, National Environmental Act No. 47 of 1980 and Quarantine and Prevention of Diseases Ordinance (chapter 222), their amendments and the regulations framed thereunder, and any other regulatory and statutory requirements.

For the purpose of deciding whether a particular requirement of this Standard 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 figures retained in the rounded off value shall be the same as that of the specified value in this Standard.

Guidelines for the determination of a compliance with the requirements of this Standard based on statistical sampling and inspection are given in Appendix **A**.

In the preparation of this Standard, valuable assistance derived from related publication of the European Directive (2009/28/EE, The International Biochar Initiative (IBI) Standardized Product Definition and Product Testing Guidelines for Biochar That Is Used in Soil Forestry and Fisheries and Bureau of Indian Standards IS 2752 : 1995 is greatly acknowledged.

1 SCOPE

This Standard prescribes the requirements, methods of sampling, testing and packaging for biochar manufactured from the plant biomass, intended to use as a material for soil amendments. This does not cover biochar made from materials with animal origin or their wastes/sludges.

2 REFERENCES

SLS	102	Rules for rounding off numerical values
SLS	428	Random sampling method
SLS	516	Part 5: Horizontal method for detection of *Salmonella* spp. Part 12:Horizontal method for the detection of enumeration of presumptive *Escherichia coli*
SLS	544	Code of practice for handling and storage of bagged fertilizers
SLS	559	Method for sampling fertilizers
SLS	645	Standard test method for chemical analysis of wood Standard practice for proximate analysis of coal and coke Standard test method for determination of iodine number of activated carbon Standard test Method for rapid determination of carbonate content of soils Standard practice for collection and preparation of coke samples for laboratory analysis Standard practice for ultimate analysis of coal and coke Standard practice for calculating coal and coke analyses from as-determined to different bases
SLS	1324	Requirements for organic agriculture production and processing
SLS	1526	Test methods for determination of soil pH
SLS	1635	Specification for compost made from raw materials of Agriculture origin

3. DEFINITIONS

3.1 biochar: The solid material obtained from the thermochemical conversion of biomass in an oxygen-limited environment at temperatures between 300-700 °C

3.2 cation exchange capacity (CEC): A measure of the substances potential quantity of readily exchangeable cations that are able to neutralize negative charges from soil surfaces

3.3 foreign matter: Any material which are not accepted to use for organic agriculture such as metal, stones, plastic, textile, pieces and any other undecomposed material

3.4 germination inhibitors: Substances that inhibit or delay the germination of seeds of the same or other species

3.5 pathogens: Organisms causing any disease to human, animals or plants

3.6 plant biomass: All vegetative and reproductive material from the wide and varied group of plant parts from many species

3.7plant macro-nutrient: Group of nutrients needed by plants in large amounts (usually greater than 1g / per kg in dry weight of a plant

3.8 plant micro-nutrient: Group of nutrients which are essential for plant growth but are required in small amounts (usually less than 0.1 g / kg in dry weight of a plant)

3.9 product: Solid material resulted from the pyrolysis of plant materials intended to use as a soil amendment and to incorporate with any solid or liquid planting media
The solid material obtained from the thermochemical conversion (pyrolysis) of biomass in an oxygen-limited environment at temperatures between 300-700 °C

3.10 feed stock: Any materials with plant origin which has not been contaminated with prohibited substances prescribed in **SLS 1324**

3.11 soil amendments: Substrate or materials that are applied to the soil to benefit the soil or plant growth

4 REQUIREMENTS

4.1 Mandatory general requirements

4.1.1 *Colour*
The colour of the product shall be characteristic uniformly black similar to common charcoal.

4.1.2 *Moisture content*
The product shall not contain more than 30 percent of moisture, when tested as prescribed in ASTM 3172-13**.**

4.1.3 *Odour*
The product shall be free from any foul odor.

4.1.4 *Cation exchange capacity*
Cation exchange capacity of the product shall not be less than 10 meq/ 100 g when tested according to the AOAC test method 9081.

4.1.5 *Germination Inhibitors and plant toxicity*

The product shall have minimum 90% germination percentage when tested according to the method prescribed in **Appendix C** of this standard.

4.1.6 *Feed stock*
Feed stock used for biochar shall be in accordance with the requirements of **SLS 1324.**

4.1.7 The manufacturer / processor shall declare the particle size distribution of the product.

4.2 Mandatory physical requirements

The product shall also be conforming with the physical requirements given in Table **1** when tested in accordance with the relevant methods given in Column **4** of the table.

TABLE 1 – Physical requirements

Sl No. (1)	Characteristic (2)	Requirement (3)	Method of test (4)
i)	Adsorption capacity in terms of iodine number mg/g min.	150	ASTM D 4607-94
ii)	Foreign matter/ visible contaminants	Free from visible non-biodegradable materials	ASTM D1762-84
iii)	Volatile matter content, max,	20	ASTM 3172-13
iv)	Total sand content, max	5	Appendix **E**
v)	Particle size	0.5 mm - 50 mm	Appendix **A**

4.3 Chemical requirements

The product shall be conforming with the chemical requirements given in **Table 2** when tested in accordance with the relevant methods given in Column **4** of the table.

TABLE 2 - Chemical requirements

Sl No. (1)	Characteristics (2)	Requirement (3)	Method of test (4)
i)	pH	6.05-10.0	Appendix D
ii)	Electrical Conductivity dSm^{-1}, max.	1.0	Appendix D
iii)	Organic Carbon (C_{org}) per cent by total carbon	Class 1 : ≥60 Class 2 : ≥30% and <60%40-60 Class 3 : ≥10% and <30%Minimum 10%	ASTM D 4373
iv)	Hydrogen carbon ratio ($H:C_{org}$) max	0.7	ASTM D 4373
v)	Total ash content by proximate analysis, per cent by mass, on dry basis, max.	Class 1 : ≥10% and <30%Minimum 10% Class 2 : ≥30% and <60%40-60 Class 3 : ≥60	ASTM 3172-13

4.4 Microbiological limits

The product shall also be conforming with the maximum allowable microbiological limits as given in **Table 3** when tested in accordance with the relevant methods given in Column **4** of the table. Imported bio char should be free from alien organisms.

TABLE 3 –Maximum allowable microbiological limits

Sl. No. (1)	Organism (2)	Limit (3)	Method of test (4)
i)	*E. coli* MPN/ g	Absent	SLS 516 part 12
ii)	Salmonella spp. per 25 g	Absent	SLS 516 part 5

4.5 Limits for potentially toxic elements

The product shall not be exceeding the limits for potentially toxic elements given in Table **4** when tested in accordance with the relevant methods given in Column **4** of the table.

TABLE 4 – Limits for potentially toxic elements

Sl No. (1)	**Potentially toxic element** (2)	**Limit** (3)	**Method of test** (4)
i)	Cadmium as Cd, mg/ kg dry basis, max.	1.5	AOAC 2006.03
ii)	Chromium as Cr, mg/ kg dry basis, max.	50	AOAC 2006.03
iii)	Lead as Pb, mg/ kg dry basis, max.	30	AOAC 2006.03
iv)	Mercury as Hg, mg/ kg dry basis, max.	0.5	AOAC 2006.03
v)	Arsenic as As, mg/ kg dry basis, max	3	AOAC 2006.03

Note: (Graphite furnace, ICP-OES, ICP-MS and MP-AES can be used to determine the concentration.)

4.6 Maximum allowed thresholds of micro plant nutrients

The product shall not be exceeding the limits for potentially toxic elements given in **Table 5** when tested in accordance with the relevant methods given in Column 4 of the table.

TABLE 5 – Maximum allowed thresholds of micro plant nutrients

Sl No. (1)	**Micro nutrient element** (2)	**Limit** (3)	**Method of test** (4)
i)	Copper as Cu, mg/ kg dry basis, max.	150	AOAC 2006.03
ii)	Zinc as Zn, mg/ kg dry basis, max.	450	AOAC 2006.03

4.7 Provisional requirements

4.7.1 Limits for organic pollutants

The product should not be exceeding the limits for organic pollutants given in Table **6** when tested in accordance with the relevant methods given in Column **4** of the table.

TABLE 6 – Limits for organic pollutants

Sl No. (1)	Organic pollutant (2)	Limit (3)	Method of test (4)
i)	Polycyclic Aromatic Hydrocarbons (PAHs), mg/ kg dry basis, max.	12	US EPA 8270 (2007)

5 PACKAGING

Biochar shall be packed in sound, strong and moisture proof packages or containers. For bio charcoal weighing 5 kg or more shall be packaged in polypropylene bags with an inner lining of low density polyethylene having a minimum thickness 50 µm or any other material with barrier properties superior (High Density Polyethylene) or equal to low density polyethylene of 50 µm thickness to afford maximum protection from normal hazard of transportation and handling. Those weighing 5 kg or less must be packaged in polyethylene bag with a suitable thickness. Suitable packages include polypropylene, of mass 1-50 kg. The product may also be supplied in bulk containers as agreed between the purchaser and the supplier.

6 MARKING AND LABELLING

The package shall be legibly and indelibly have marked and labelled with the following information and shall comply with Fertilizer Act and regulations in Sri Lanka.

a. Name, type and class of the product;

b. Name and address of the manufacturer, including country of origin;

c. Brand name and/ or trade mark, if any;

d. Date of packaged;

e. Net mass in kilograms;
f. Instructions for storage and use
g. Batch No;
h. Total organic Carbon as C to total dry mass per cent by dry basis; Ash content (% w/w); to total dry mass per cent by dry basis ,Moisture content (% w/w)
i. Raw material composition : e.g. 100% gliricdia wood; 80% rice husk and 20% gliricidia wood
j. The statement “Use no hooks”.

k. Pyrolysis temperature
l. Type of reactor/kiln & method of quenching
m. Price

7 HANDLING AND STORAGE

The handling and storage of the material shall be as prescribed in **SLS 544.**

8 SAMPLING

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

9 METHODS OF TEST

9.1 Test shall be carried out as prescribed in **Part 5 and 12 of SLS 516 ,** Part **2** of **SLS 645**, **SLS 1549, SLS 1526**, Appendices **B, C D** of this Standard and **AOAC** Method **2006. 03, US EPA 8270 :2007, ASTM D 4373, OCED 1984 and AOAC 9881**

9.2 Unless otherwise stated, use only reagents of analytical grade and only distilled water or water of equivalent purity.

APPENDIX A
COMPLIANCE OF A LOT

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

A.1 LOT

In any consignment, all the packages of same size belonging to one batch of manufacture or supply shall constitute a lot.

A.2 SCALE OF SAMPLING

A.2.1 The sampling shall be carried out as prescribed in **SLS 559**.

A.3 NUMBER OF TESTS

A.3.1 Each package selected as in **SLS 559** shall be inspected for packaging and marking requirements.

A.3.2 Tests for the requirements specified in clause **4** shall be carried out on the composite samples prepared as in **SLS 559**.

A.4 CRITERIA FOR CONFORMITY

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

A.4.1 Each package inspected as in **A.3.1** satisfies the relevant requirements.

A.4.2 The composite sample, when tested as in **A.3.2** satisfies the relevant requirements.

APPENDIX B

B.2 Sample

B.2.1 Sample Selection—The sample shall be selected so as to be representative of all of the material contained in a lot. Sample selection shall be carried out in accordance with Practices D346, D3176, and D3180.

Passing Sieve	Retained on Sieve	Sample, %
50 mm	50 mm	
25-50 mm	25-50 mm	
16-25 mm	16-25 mm	
8-16 mm	8-16 mm	
4-8 mm	4-8 mm	
2-4 mm	2-4 mm	
1-2 mm	1-2 mm	
0.5-1 mm	0.5-1 mm	
0.5 mm	0.5 mm	

APPENDIX C
Germination Inhibition Assay

C.1 Materials

C.1.1 DI (De-ionized) water

C.1.2 Germination paper

C.2 PROCEDURE

C.2.1 Mix boichar and water in a ratio of 1:30 in 50mL plastic bottles and leave for 24 hrs to make an aqueous mixture. Filter the biochar suspension first using paper filter No. 2 and then then using 0.45-µm filter to collect the aqueous solution Moisten two 30 by 30 cm germination papers with the aqueous biochar extract and DI (De-ionized) water separately using approximately 2.6 ml liquid /g paper. Place 12 corn seeds on two moisten sheets, cover with a third moisture sheets and roll into a cylinder. Prepare four replicates. Place prepared cylinders in a buckets which are covered with clear plastic bags and place in a dark place, $25C^0$ for 7 days. Spray additional liquid biocar extract or DI water on the cylinders every 2days. Calculate the germination percentage after incubation. A seed is considered germinated if the length of shoot and radicle is at least 5 mm each.

C.3 CALCULATION

$$\text{Germination } \% \ = \ \frac{\text{Average number of germinated seeds (sample)}}{\text{Average number of germinated seeds (control)}} \times 100$$

APPENDIX D
DETERMINATION OF pH AND CONDUCTIVITY

Generic pH and EC analysis procedures have been drawn from the TMECC methodologies (US Composting Council and US Department of Agriculture (2001)). These procedures for the use of control and reference pH samples and electrode probes have been adapted for use with biochar, as follows:

where the TMECC methodology recommends a 1:20 (w:v) solution of biochar: deionized water should be used for pH and EC analysis, following Rajkovich et al (2011). Similarly, additional time should be allotted for solution equilibration after the combination of deionized water and biochar. Following Rajkovich et al (2011), 1.5 hours should be provided for the shaking and equilibration of biochar-deionized water solutions prior to pH and EC analysis. Upon completion of the shaking and equilibration phase, pH and EC analysis may be conducted on the same

samples, rather than making separate replicates for pH and EC. To complete the pH and EC analysis follow methodologies 04.10 and 04.11 of the TMECC methodology (US Composting Council and US Department of Agriculture (2001)).

APPENDIX E
DETERMINATION OF SAND CONTENT

E.1 APPARATUS

E.1.1 Beaker, 500 ml

E.1.2 Oven, maintained at 105 $\pm$ 2 ^{0}C

E.1.3 Weighing balance, accuracy 1 mg

D.2 PROCEDURE

E.2.1 Weigh to the nearest milligram, 100 g of the sample. Transfer into a 500 ml beaker with a stopper. Add distilled water up to the mark and stir well by glass rod. Leave to settle.

E.2.2 Carefully decant the water and the floating particles, leaving the sand at the bottom. Wash the residue thoroughly with water. Repeat washings until all the other particles are removed.

E.2.3 Transfer the sand into a Petri dish and dry in an oven maintained at 105 $\pm$ 2 ^{0}C for one hour. Cool in desiccators and weigh to the nearest milligram. Repeat the process of heating,cooling and weighing and 30 minute intervals until the difference between two consecutive readings does not exceed 0.002 g. Record the final mass.

E.3 CALCULATION

$$\text{Sand content per cent by mass} = \frac{m_1}{m_0}$$

Where;

m_0 is the mass, in grammes, of the sample; and
m_1 is the mass, in grammes, of sand.