SPECIFICATION FOR
COCONUT FIBRE (COIR FIBRE)
PART 1: BROWN FIBRE AND MIXED FIBRE
(Second Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard
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Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

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

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FOREWORD

This Sri Lanka Standard Specification was approved by the Sectoral Committee on Textiles, Clothing and Leather and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2009-03-30.

This specification was first published in 1971 and revised in 1981. Taking in to consideration the new development, a revision of this specification was considered necessary. In this second revision, technological advances made in the processing of coconut fibre have been given due consideration. In the preparation of this standard title and scope of the standard were extended to cover all the types of brown fibre and mixed fibre.

Coir fibre is one of the important items exported from Sri Lanka. One of broad objective of this standard will be of help in promoting export of this product. This specification prescribes the requirements for brown coir fibre types and mixed fibre for different end uses.

This specification is one of the series of Sri Lanka Standard relating to coconut fibres. Other standard in the series is Part 4 Retted white fibre.

All values given in this specification are 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 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 the specification.

In the preparation of this standard, the assistance derived from the following publication is gratefully acknowledged.

IS 9308 (Part 1 to 3): 1987 Indian Standard Specification for Mechanically extracted Coir fibres

1   SCOPE

This specification prescribes the requirements and methods of sampling and test for brown coir fibre and mixed coir fibre.

2   REFERENCES

SLS   16   Standard atmospheres for conditioning and testing of textiles
SLS   102   Rules for rounding of numerical values
SLS   428   Random sampling methods

3   DEFINITIONS   .

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

3.1 brown fibre : Fibre extracted from soaked matured brown husk of coconut.

3.1.1 *bristle fibre*   : *Average length of the fibres which are 135 mm or more in length.*
3.1.1.1 Non hackled Bristle fibre 1 – Tie : Bundle of fibres, with one knot before combing .

3.1.1.2 Hackled Bristle fibre   2 - Tie : Bundle of fibres, with two knots after combing.

3.1.1.3 Hackled Bristle fibre   3 – Tie : Bundle of fibres, with three knots after combing.

3.1.2 *omat fibre* : *Average length of the fibres which are between 70 mm and 134 mm in length*

3.1.3 *mattress fibre* : *Average length of the fibres which are between 30 mm and 69 mm in*

length

3.2   mixed fibre : Fibre extracted from matured green husk or brown husk of coconut.

3.3   impurities : Anything other than coir (including husk pieces, pith and foreign particles.)

3.3.1 *husk pieces* : Thick fibrous mesocarp greater than 3 mm in thickness and the bundles of fibre which are not properly separated and giving a rigid structure.

3.3.2 *pith* :   Binding material of coir fibre found in the mesocarp resulted as by product of coir fibre extraction process.

3.3.3 *foreign particles* : Anything other than extractives of coconut husk.

4   TYPES

4.1   Brown fibre

4.1.1 *Bristle fibre*

4.1.1.1 Non hackled Bristle fibre   1 - Tie

4.1.1.2 Hackled Bristle fibre   2 - Tie

4.1.1.3 Hackled Bristle fibre   3 - Tie

4

4.1.2   *Omat fibre*

4.1.3   *Mattress fibre*

4.2   **Mixed fibre**

5. REQUIREMENTS

5.1 General requirements

5.1.1   *Moisture*

The moisture content of the Bristle fibre shall be maximum of 20 per cent and the moisture content of Omat fibre, Mattress fibre and Mixed fibre shall be maximum of 18 per cent when tested in according to the method given in Appendix **B,** unless otherwise agreed upon between the purchaser and the supplier.

5.1.2   *Impurities*

Impurities of the Bristle fibre and Omat fibre shall not exceed the limits given in Table **1,** when tested in accordance with the method given in Appendix **C**. Impurities of the Mattress fibre and Mixed fibre shall be based on the agreement between the purchaser and the supplier.

TABLE 1 –**Limits of impurities in various types of fibre**

Sl No (1)	Fibre type (2)	Impurities (3)
i)	Hackled Bristle fibre 3 – Tie Per cent by mass, max.	1.5
ii)	Hackled Bristle fibre 2 – Tie Per cent by mass, max.	2.0
iii)	Non hackled Bristle fibre 1 – Tie Per cent by mass, max.	4.0
iv)	Omat fibre Per cent by mass, max.	5.0

5.2   Physical requirements

5.2.1 Coir fibres, shall comply with the requirements specified in Table **2** when tested in accordance with to the method given in Column **8** of the Table**.**

TABLE 2 - Physical requirements of different fibre types

Sl No. (1)	Characteristics (2)	Bristle fibre		Omat fibre (5)	Mattress fibre (6)	Mixed fibre (7)	Method of test (8)
		Hackled (3)	Non hackled (4)				
i)	Average length, mm.	182 (min.)	135 (min.)	70 -134	30 - 69	36-119	Appendix D
ii)	Fineness, tex (g/km), min.	45	37	24	14	18	Appendix D
iii)	Weighted average diameter in mid point of coir fibre strand, mm, min.	0.17	0.17	0.12	0.11	0.10	Appendix E
iv)	Weighted average breaking load, N , min.	4.0	3.8	2.6	1.6	2.2	Appendix F
v	Weighted average elongation at break per cent , min.	20.0	18.0	18.1	17.0	21.2	Appendix F

5.2.3   Hackled Bristle fibre shall comply with the requirements given in Table **3** when tested in accordance with the method given in Appendix **G**.

TABLE 3 – Requirements for types of Hackled Bristle fibre based on length

Sl No. (1)	Fibre type (2)	Per cent by mass of fibre		
		Length 220 mm and above (min.) (3)	Length between 180 mm and 219 mm (min.) (4)	Length between 179 mm and 80 mm (max.) (5)
i)	Hackled Bristle fibre 3 –Tie	70	15	14
ii)	Hackled Bristle fibre 2 –Tie	65	15	18

6   PACKAGING AND MARKING

6.1 Packaging

The coir fibre shall be suitably packed in bales, ballots/coils or as otherwise agreed between the purchaser and the supplier.

6.2 Marking

The following information shall be marked legibly and indelibly on a label securely attached to each package.

a)   Product as " Coir Fibre" ;
b)   Type ;
c)   Net mass in kg ;
d)   Batch or Code number ;
e)   Name or Identification number of the exporter (Unless otherwise agreed between the supplier and the purchaser.) ; and
f)   Country of origin

7   METHODS OF TEST

7.1   Tests shall be carried out as prescribed in Appendices **B** to **G** of this specification.

7.2   The conditioning and testing atmosphere shall be the standard atmosphere for conditioning and testing of textiles as defined in **SLS 16,** i.e. a relative humidity of 65 ± 4 per cent and a temperature of 27 ± 2°C.

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 is to be assessed based on statistical sampling and inspection.

Where compliance with this standard is to be assessed based on manufacturer's control systems coupled with type testing and check tests or any other procedure, appropriate scheme of sampling and inspection should be adopted.

A.1 LOT

In any consignment, all the bales, ballots or coils of coir fibres of the same type belonging to one batch of supply shall constitute a lot.

A.2 SCALE OF SAMPLING

A.2.1 Samples shall be tested from each lot for ascertaining the conformity of the lot to the requirements of this standard.

A.2.2 The number of bales, ballots or coils to be selected from a lot shall be in accordance with Table **4**.

TABLE 4 - Scale of sampling

Sl No (1)	Number of bales, ballots or coils (2)	Number of bales, ballots or coils to be selected (3)
i)	Up to 50	3
ii)	51 to 100	4
iii)	101 to 150	5
iv)	151 to 300	7
v)	301 to 500	10
vi)	501 to 2000	15
vii)	2001 and above	20

A.2.3 The bales, ballots or coils 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   PREPARATION OF INDIVIDUAL SAMPLES

A.3.1   From each of the bales, ballots or coils selected in **A.2.2** draw a quantity of fibre to form an individual sample.

A.3.2   The following method shall be used to draw individual samples.

A.3.2.1 *Bales*

Bales shall be split into four slabs of about the same size. From the upper side of each slab, eight samples of equal mass (50 g to 100 g) shall be taken at equally spaced intervals so that they are representative of the surface of the slab, the aggregate sample from each bale weighing 1600 g to 3200 g.

A.3.2.2 *Ballots or Coils*

Approximately 500 g each shall be drawn from the upper, middle and bottom parts of the ballot or coil.

A.3.3   All samples from each bale, ballot or coil shall be bulked and sealed into air - tight containers.

A.4   NUMBER OF TESTS

A.4.1   Each bale, ballot or coil selected as in **A.2.2** shall be inspected for marking requirements given in **6.2**.

A.4.2   A sufficient amount of coir fibres shall be drawn from each individual sample prepared as in **A.3** and tested for moisture and impurities separately for each individual sample.

A.4.3   A sufficient amount of coir fibres shall be separately drawn from each individual sample prepared as in **A.3** and categorized separately in accordance with the relevant length fraction as described in Appendix **D**.

A.4.3.1 Each sample categorized as in **A.4.3** shall be tested for the requirements given in **5** except tests carried out in **A.4.2** and **A.4.3.**

A.5   CRITERIA FOR CONFORMITY

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

A.5.1 Each package inspected as in **A.4.1** satisfies the packaging and marking requirements.

A.5.2 Each sample tested as in **A.4.3.1** satisfies the relevant requirement.

A.5.3 From the results of moisture content and impurities the average ($\overline{x}$) (*see Note 1*) and the range (**R**) (*see Note 2*) are calculated separately for each requirement and the value of the expression ($\overline{x}$ + 0.4 R) for each requirement is found to be less than or equal to the corresponding specified values.

NOTE

1   The average ($\overline{x}$) is the value obtained by dividing the sum of observed values by the number of tests.

2   The range (R) *is the difference between the maximum and minimum in a set of observed values.*

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APPENDIX B
DETERMINATION OF THE MOISTURE IN COIR FIBRE

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B.1   APPARATUS

B.1.1 Any heat resistant container with air tight lid, large enough to accommodate approximately 50 g of coir.

B.1.2   Weighing balance -Electronic weighing balance with an accuracy of 0.01 g.

B.1.3   Desiccators, with suitable desiccants (Silica Gel).

B.1.4   Oven capable of maintaining $105 \pm 2\ ^{0}C$.

B.2   PROCEDURE

Draw three samples each from individual samples as in **A.3**.

Weigh, to the nearest 0.1 g, 50 g of sample in to a previously dried and weighted container. Transfer the container with the sample to oven maintained at $105 \pm 2\ ^{o}C$ and dry the sample for 6 hrs. Cool in a dessicator and weigh. Repeat the drying, cooling and weighing until the difference in mass between two successive weighing does not exceed 0.1 g .Record the mass.

NOTE *: All weighing should be at room temperature.*

B.3   CALCULATION

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

where;

m_1 is the mass, in grams, of the sample before drying; and

m_2 is the mass, in grams, of the sample after drying.

Calculate mean value of the moisture content of the three samples.

NOTE :

1.   Mean values of individual samples shall be used to determine the range as required in A.5.3.

APPENDIX C
METHOD FOR DETERMINATION OF THE IMPURITIES IN COIR FIBRE

C.1   APPARATUS

C.1.1 Any heat resistant and non corrosive container with air tight lid large enough to accommodate 50 g of coir.

C.1.2 Weighing balance - Electronic weighing balance with an of accuracy of 0.01 g.

C.1.3 Drying oven capable of maintaining $105 \pm 2\ ^0C$.

C.1.4 Standard sieve, with nominal aperture 4.0 mm.

C. 2   PROCEDURE

Draw three samples each from individual samples as in **A.3**.

Weigh approximately 50 g of the sample in to a previously dried and weighted container. Transfer the container with the sample to an oven maintain at $103 \pm 2\ ^0C$ and dry for 6 hrs. Cool in a desiccator to room temperature and weigh to nearest 0.01 g. Separate husk pieces and foreign particles manually. Place approximately 2 g of coir on 4.0 - mm sieve and rub to separate impurities. Repeat sieving till the total mass (50 g) is cleaned. Collect any fibre fallen on to the collecting pan and place on the sieve and repeat rubbing in order to remove all impurities. Collect the material retained on the sieve cleaned coir in to the previously dried and weighted container, and dry in an oven at $105 \pm 2\ ^0C$ for 2 hrs. Cool in a desiccator to room temperature and weigh. Repeat the drying, cooling and weighing until the difference in mass between two successive weighing does not exceed 0.01g .Record the mass.

C.3   CALCULATION

$$\text{Impurities, per cent by mass} \quad = \quad \frac{(m_0 - m_1)}{m_0} \quad x \ 100$$

where;

m_0 is the mass, in grams, of the dry weight of sample; and
m_1 is the mass, in grams, of the dry weight of cleaned coir (material retained on the sieve).

Calculate the mean value of the impurities of the three samples.

NOTE : *Mean values of individual samples shall be used to determine the range as required in A.5.3*

APPENDIX D
DETERMINATION OF AVERAGE LENGTH AND FINENESS

D.1 APPARATUS

D .1.1   Stainless steel ruler 500 - mm, with an accuracy of 1 mm.

D .1.2   A container partitioned in order to collect fractions of fibre according to the following length categories;

* Length Categories: mm

(1 - 25) (26 - 50) (51 - 75) (76 - 100) (101 - 125) (126 - 150) (151 - 175) (176 - 200) (201 - 225) (226 - 250) (251 - 275) (276 - 300) (> 300).

D.1.3   Drying Oven.

D.1.4   Analytical weighing balance, with an accuracy of 0.000 1 g.

D.1.5   Glass weighing bottles with stoppers.

D.2 PROCEDURE

Condition the bulk coir sample (approximately 500 g) in as per **SLS 16.** Determine the moisture per cent by using 2 g of sample.

Weigh 2 grams of coir from the original sample. Measure the length of each individual fibre and categorize according to the relevant length fraction. Count the number of fibres in each length category and record the number .Weigh fibres in individual length category and record the mass.

NOTE : In the case of short fibre, reduce the sample size as 1 g for determination of average length and fineness.

D.3 CALCULATION

$$\textit{Average length of coir fibres} \ = \ \frac{\Sigma(f_i \ x \ l_i)}{\Sigma \ f_i}$$

where ,

f_i is the number of fibres in i th length category (i th class); and
l_i is the mid value of the length category (i th class).

D.3.2   Fineness of coir

$$\textit{Dry factor} \quad (D) \ = \ \frac{(\ 100 \ - \ M \ )}{100}$$

where,

M   is the percentage moisture content of the specimen

$$\textit{Fineness of coir , g/km} \quad = \quad D \ x \ 10^6 \ \frac{\Sigma \ m_i}{\Sigma \ (f_i \ x \ l_i)}$$

where ,

D is the dry factor
m_i is the total mass in grams of the fibres in i th length category; and
$\Sigma \ (f_i \ x \ l_i)$ is the total length of the specimen in millimeters.

APPENDIX E
DETERMINATION OF WEIGHTED AVERAGE DIAMETER
OF THE MID POINT OF COIR FIBRE STRAND

E.1 APPARATUS

Digital micrometer, mounted on a stand having a resolution of 0.001 mm with measuring force 5 - 10 N or equivalent.

E.2 PROCEDURE

Take 50 fibres from each length category and measure the diameter at mid point of the fibre strand (d_i), if 50 fibres are not in the length category, measure all strands of fibres.

E.3 CALCULATION

Average diameter of fibres in ith length category (class) $\quad D_i \; = \; \dfrac{\Sigma \; d_i}{f_i}$

where,
Σd_i is the sum of diameter of fibres in ith length category; and
f_i is the number of fibres measured for diameter in ith length category.

Weighted average diameter of fibres $\; = \; \dfrac{\Sigma \; (\; D_i \; x \; F_i \;)}{\Sigma \; F_i}$

where ,

D_i is the average diameter of ith length category as calculated in millimeters; and
F_i is the number of fibres measured for length in ith length category.

APPENDIX F
DETERMINATION OF WEIGHTED AVERAGE BREAKING LOAD
AND WEIGHTED AVERAGE ELONGATION

F.1 APPARATUS

Constant rate of specimen extension (CRE) tester, which complies with the following requirements:

a) The maximum error of indicated force shall not exceed 2 per cent of the true force.

b) The tester shall be equipped with an autographic force/elongation recording device.

c) The clamps for gripping the specimens shall prevent slipping or cutting of the specimens and breaks at the jaws.

F.2 PROCEDURE

Condition the fibres as per **SLS 16.**

Follow test condition as in Table **5**, by using 10 fibres. If 10 fibres are not available, measure all strands of fibres.

TABLE 5 - Test conditions

Length class (mm) (1)	Test Length between grips (mm) $[l_i]$ (2)	Strain rate mm/min (3)
1 – 50	20	40
51 – 100	40	40
101 - 150	90	40
151 - 200	100	40
201 - 250	100	40
> 250	100	40

Record the breaking force and elongation at break. Discard the readings, if breaking occurs at the contact line of the jaw.

F.3   CALCULATION

Average breaking load of ith length category (B_i) $=$ $\dfrac{\Sigma\, b_i}{f_i}$

where,

$\Sigma\, b_i$ is the sum of breaking load in i^{th} length category in Newton; and
f_i is the number of the fibres analysed for breaking load in i^{th} length category.

Weighted average breaking load, N $=$ $\dfrac{\Sigma\,(B_i \ x \ F_i)}{\Sigma F_i}$

where,

B_i is the average breaking load in i^{th} length category; and
F_i is the number of fibres tested for length i^{th} length category.

Average elongation of ith length category, per cent (E_i) $=$ $\dfrac{\Sigma e_i}{f_i\, x\, l_i}$ $x\ 100$

where,

e_I is the elongation of fibre in i^{th} length category in millimeter;
l_i is the test length between the grips in millimetre in i^{th} length category;
Σe_i is the sum of elongation of fibres in i^{th} length category; and
f_i is the number of fibres analysed for elongation in i^{th} length category.

Weighted average elongation, per cent $=$ $\dfrac{\Sigma\ (E_i \ x \ F_i)}{\Sigma\ F_i}$

Where,

E_i is the average elongation of fibres in i^{th} length category; and
F_i is the number of fibres analysed for length i^{th} length category.

APPENDIX G
DETERMINATION OF THE PER CENT BY MASS OF LENGTH IN
VARIOUS GRADES OF BRISTLE FIBRES

G.1 APPARATUS

G.1.1 Flat table, marked with a scale with 10 - mm graduations to measure up to 300 mm, shall be used.

G.2   PROCEDURE

G.2.1 Draw 3 test specimens weighing approximately 2 g each from the individual samples (see **A.4.3.1**). Take one of the test specimens and measure the length of its individual fibre on the scale marked on the table by holding one end of each fibre with the forefinger of the one hand and stretching the other end with the fingers of the other hand. Categories the fibres so measured in to three groups according to their length as given below.

TABLE 6

Length of the fibre	Group
220 mm and above	1
Between 180 mm and 219 mm	2
Between 179 mm and 80 mm	3

G.2.2 Weigh the fibres in each group and calculate the percentage of the mass of fibres in each group to the total mass of fibres in all the three groups.

G.2.3 Repeat the test with the remaining two test specimens.

G.2.4 Average of the percentage by mass, of fibres in Groups 1, 2 and 3 (Group i) shall be deemed to be the proportion by mass of different lengths in the individual sample.

G.3   CALCULATION

Percentage of mass of fibre in i^{th} *group in* $= \dfrac{m_i}{\sum m_i} \times 100$
each specimen

Where,

i = Group number, 1,2 or 3 ; and

$\sum m_{i.,}$ = total mass of the fibres in i^{th} group.

Calculate the mean value of the three samples.

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SRI LANKA STANDARDS INSTITUTION

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The principal objects of the Institution as set out in the Act are to prepare standards and promote their adoption, to provide facilities for examination and testing of products, to operate a Certification Marks Scheme, to certify the quality of products meant for local consumption or exports and to promote standardization and quality control by educational, consultancy and research activity.

The Institution is financed by Government grants, and by the income from the sale of its publications and other services offered for Industry and Business Sector. Financial and administrative control is vested in a Council appointed in accordance with the provisions of the Act.

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All members of the Technical and Sectoral Committees render their services in an honorary capacity. In this process the Institution endeavours to ensure adequate representation of all view points.

In the International field the Institution represents Sri Lanka in the International Organization for Standardization (ISO), and participates in such fields of standardization as are of special interest to Sri Lanka.

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