BUREAU OF INDIAN STANDARDS  
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Draft Indian Standard  
SOLID BIOFUELS — FUEL SPECIFICATION AND CLASSES — BRIQUETTES  
FROM AGRO AND HERBACEOUS RESIDUES  
(ICS 27.190; 75.160.40)  

Solid Mineral Fuels and Solid Biofuels Sectional Committee, PCD 7  
Last date for Comments  
10 December 2023  

FOREWORD  
(Formal Clause to be added later)  

Briquettes from agro and herbaceous residues are manufactured from biomass originating from  
agriculture, herbaceous, fruit, and other renewable organic matter derived from trees, plants, crops,  
animal, municipal, agro-residue and agro-industrial waste or aquatic biomass as well as blends or  
mixtures of woody and non-woody biomass.  

This standard covers the use of biomass briquettes for domestic and industrial use.  

In general, agro and herbaceous residues have higher content of ash forming elements and produce  
ashe with lower melting temperature compared to most woody biomass. Different growing and  
soil conditions of the herbaceous or fruit biomass may influence the fuel ash composition  
differently. This may result in fouling, slagging and corrosion inside boilers. These problems are  
especially related to materials that have high content of potassium (K) and silicate (Si) and low  
content of calcium (Ca). The content of chlorine (Cl), phosphorous (P) and potassium (K) in the  
material may form chlorides and phosphates and other chemical compounds resulting in high  
hydrochloric acid emissions and chemically active ash causing corrosion. Special attention should  
be paid to the risk of corrosion in boilers and flue gas systems. Blending of agro and herbaceous  
residues with woody biomass can improve the combustion characteristics.  

Considerable assistance has been derived from ISO 17225-7 ‘Solid biofuels Fuel specifications  
and classes Part 7: Graded non-woody briquettes’ in development of this standard. Since, only  
agro-residues and herbaceous residues are generally used non woody biomass in our country, the  
title, scope and the requirements have been modified when compared with ISO 17225-7. Terminology, few requirements and sampling are same as mentioned in ISO 17225-7. Assistance  
has also been derived from report “Development of Standards and Guidelines for densified  
biomass products in Indian Context”, produced under Indo-German Technical operation project.  

The composition of the Committee, responsible for the formulation of this standard is given at  
Annex A (will be added later).
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 analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (second revision)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard prescribes the fuel quality classes and specifications of briquettes produced from agro residues and other herbaceous residues.

NOTES

1 Blends and mixtures include blends and mixtures from the main origin-based solid biofuel groups woody biomass, herbaceous biomass, fruit biomass and aquatic biomass. Blends are intentionally mixed biofuels, whereas mixtures are unintentionally mixed biofuels. The origin of the blend and mixture is to be described using ISO 17225-1:2021, Table 1. If solid biofuel blend or mixture contains chemically treated material, it shall be reported.

2 Thermally treated biomass briquettes (for example, torrefied briquettes) are not included in the scope of this document.

2 REFERENCES

The following standards contain provisions, which through reference in the text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement, based on the standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<table>
<thead>
<tr>
<th>IS No. /Other Publications</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 17833 : 2022/ ISO 16994 : 2016</td>
<td>Solid biofuels – Determination of total content of sulfur and chlorine</td>
</tr>
</tbody>
</table>
ISO 14780 : 2017  Solid biofuels – Sample preparation  
PCD07(19505)  Solid biofuels – Terminology, definitions and descriptions  
ISO 16968 : 2015  Solid biofuels – Determination of minor elements  
ISO 17225-1:2021  Solid biofuels – Part 1 – General requirements  
ISO 18135 : 2017  Solid biofuels – Sampling  
ISO 18847 : 2016  Solid biofuels – Determination of particle density of pellets and briquettes  
ISO 21945 : 2020  Solid biofuels – Simplified sampling method for small scale applications  

3 TERMINOLOGY

For the purpose of this standard, the definitions given in PCD 07 (19505) and in addition to, the following definitions shall apply.

3.1. Additive — Material which is intentionally introduced into the fuel feed stock to improve quality of fuel (for example, combustion properties), to reduce emissions or to make production more efficient.

NOTE – Trace amounts of grease or other lubricants that are introduced into the fuel processing stream as part of normal mill operations are not considered as additives.

3.2 Biofuel Briquette — Densified biofuel made with or without additives in pre-determined geometric form with at least two dimensions of more than 25 mm, produced by compressing biomass.

3.3 Chemical Treatment — Any treatment with chemicals other than air, water or heat (for example, glue and paints).

NOTE – Examples of chemical treatment are listed in ISO 17225-1.

3.4 Non-woody Biomass — Biomass originating from agriculture, herbaceous, fruit or aquatic biomass as well as blends or mixtures of woody and non-woody biomass.

3.6 Non-woody Briquette — Biofuel briquette (see 3.2) made from non-woody biomass (see 3.4)

4 REQUIREMENTS

4.1 The material shall comply with the requirements of briquettes given in Table 1 and Fig 1.
where

\[ D = \text{diameter}; \]
\[ L_1 = \text{length}; \]
\[ L_2 = \text{width}; \text{and} \]
\[ L_3 = \text{height} \]

4.2 In general, chemical treatment of biomass before harvesting need not to be reported.

4.2.1 However, the process of chemical treatment before harvesting need to be mentioned in the following cases:

a) If any operator in the fuel supply chain has reason to suspect serious contamination of the biomass;

b) The soil (for example, coal slag heaps) or if planting has been done specifically for the chemical sequestration; and

c) Biomass has been fertilized by sewage sludge (originating from waste water treatment or chemical process).

In such cases, fuel analysis shall be done to identify chemical impurities such as halogenated organic compounds or heavy metals.

4.2.2 In case of raw materials belonging to chemically treated herbaceous residue as per Table 1 of ISO 17225-1, the actual origin of the raw material shall be clearly reported.

4.3 Further analysis may not be required, if data for chemical or physical properties are available.
Table 1 Requirements of biomass briquettes derived from agro and herbaceous residues

*(Clauses 4.1 and 7.1)*

<table>
<thead>
<tr>
<th>SI No.</th>
<th>Characteristics</th>
<th>Requirements</th>
<th>Methods of test, Ref. to</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>A (3)</td>
<td>B (4)</td>
</tr>
<tr>
<td>1.</td>
<td>Origin and Source(^1)</td>
<td>Agro residues and other herbaceous biomass</td>
<td>—</td>
</tr>
<tr>
<td>2.</td>
<td>Diameter (D); length (L(_1)); width (L(_2)) and height (L(_3)), mm</td>
<td>Dimension and shape to be reported.</td>
<td>Dimension and shape to be specified as per Fig 1.</td>
</tr>
<tr>
<td>3.</td>
<td>Moisture (M), percent by mass, wet basis</td>
<td>≤ 15</td>
<td>≤ 15</td>
</tr>
<tr>
<td>4.</td>
<td>Ash (A), percent in mass dry</td>
<td>≤ 20</td>
<td>≤ 20</td>
</tr>
<tr>
<td>5.</td>
<td>Density of briquettes, Mg/m(^3)</td>
<td>A(_1): ≥ 0.5 to &lt; 0.7</td>
<td>B(_1): ≥ 0.5 to &lt; 0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A(_2): ≥ 0.7 to &lt; 0.9</td>
<td>B(_2): ≥ 0.7 to &lt; 0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A(_3): ≥ 0.9</td>
<td>B(_3): ≥ 0.9</td>
</tr>
<tr>
<td>6.</td>
<td>Additives, percent by mass(^2))</td>
<td>Type and amount to be reported</td>
<td>Type and amount to be reported</td>
</tr>
<tr>
<td>7.</td>
<td>Gross Calorific value, kcal/kg</td>
<td>≥ 2500 to ≤ 3000</td>
<td>≥ 3000 to &lt; 3500</td>
</tr>
<tr>
<td>8.</td>
<td>Nitrogen (N), percent by mass in dry</td>
<td>To be reported</td>
<td>IS 17832</td>
</tr>
<tr>
<td>9.</td>
<td>Sulfur (S), percent by mass in dry</td>
<td>To be reported</td>
<td>IS 17833</td>
</tr>
<tr>
<td>10.</td>
<td>Chlorine (Cl), percent by mass in dry</td>
<td>To be reported</td>
<td>IS 17833</td>
</tr>
<tr>
<td>11.</td>
<td>Arsenic (As), mg/kg, dry</td>
<td>To be reported</td>
<td>—</td>
</tr>
<tr>
<td>12.</td>
<td>Cadmium (Cd), mg/kg,</td>
<td>To be reported</td>
<td>—</td>
</tr>
</tbody>
</table>
13. Chromium (Cr), mg/kg, dry To be reported — ISO 16968
14. Copper (Cu), mg/kg, dry To be reported — ISO 16968
15. Lead (Pb), mg/kg, dry To be reported — ISO 16968
16. Mercury (Hg), mg/kg, dry To be reported — ISO 16968
17. Nickel (Ni), mg/kg, dry To be reported — ISO 16968
18. Zinc (Zn), mg/kg, dry To be reported — ISO 16968

NOTES
1) Name and proportion (in percent) of the feedstock material or blend and mixtures used for preparation of the briquette shall be reported. Saw dust and other permitted woody biomass may be used in the blend to achieve the desired quality.

2) Type and amount of additive(s) to aid production, delivery or combustion (for example, pressing aids, slagging inhibitors or any other additives like starch, corn flour, potato flour, vegetable oil, and lignin) shall be reported.

5 PACKING AND MARKING

5.1 The material shall be as agreed to between the purchaser and the supplier.

5.2 Marking

5.2.1 When the material is packed in packages, packages shall be marked with the following:

a) Name of the feedstock material or blend and mixtures;
b) Name of manufacturer and his recognized trade-mark, if any;
c) Month and Year of manufacture;
d) Net mass of the material;
e) Dimensions of the briquette;
f) Lot number; and
g) Any other statutory requirements.

5.2.2 If briquettes are available in general market for sale, in addition to above information the following basic quality parameters shall be stated:

a) Gross Calorific Value;
b) Proximate Analysis; and
c) Name and proportion (in percent) of the feedstock material or blend and mixtures used for preparation of the briquettes.
5.2.3  BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the Bureau of Indian Standards Act, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

6  SAMPLING

The sampling and sample preparation shall be done as per ISO 18135 or ISO 21945 and ISO 14780 respectively.

7 TEST METHODS

7.1 Tests shall be conducted according to the method of test referred in col 6 and col 7 of Table 1.