मानकः पथप्रदर्शकः

COMPENDIUM OF INDIAN STANDARDS ON

SOLID BIOFUELS

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INTRODUCTION

Solid biofuels play a pivotal role in India's transition towards sustainable energy systems, particularly in the context of energy access, rural livelihoods, and environmental sustainability. Derived from biomass resources such as wood, agricultural residues, forest residues, and organic waste, solid biofuels are renewable and offer a viable alternative to fossil fuels in both domestic and industrial applications.

India, with its vast agricultural base and diverse agro-climatic zones, generates a substantial quantity of biomass every year. Harnessing this biomass through appropriate conversion technologies into densified solid fuels such as briquettes, pellets, and woodchips not only provides a cleaner energy source but also promotes rural entrepreneurship, supports decentralized energy solutions, and contributes to waste management.

To ensure quality, safety, efficiency, and compatibility in the production, trade, and utilization of solid biofuels, the development and adoption of national standards are essential. Indian Standards for solid biofuels provide technical specifications and testing methods covering various aspects such as raw material classification, physical and chemical properties, sampling procedures, and sustainability criteria. These standards facilitate uniformity in quality across the value chain and help enhance the market acceptability of solid biofuels, both domestically and internationally.

Bureau of Indian Standards (BIS), through the Petroleum, Coal and Related Products Department (PCD), has been actively engaged in the development of standards for solid biofuels. The standards are aligned, with international practices, while also considering indigenous materials, technologies, and user needs.

This compendium presents an overview of the current Indian Standards on solid biofuels, aiming to serve as a reference for manufacturers, users, researchers, policymakers, and other stakeholders engaged in the solid biofuel sector. It is hoped that this publication will contribute to the wider adoption of quality standards and the promotion of solid biofuels as a reliable and sustainable energy option for India's future.

1. TERMINOLOGY STANDARD

1.1 *IS 18721 : 2024 Solid Biofuels - Vocabulary*

This standard prescribes the vocabulary used for solid biofuels, encompassing raw and processed material including woody, herbaceous, fruit and aquatic biomass, originating from agriculture, horticulture, forestry, arboriculture and aquaculture.

The terms and definitions in this standard are categorized based on the origin and source of solid biofuels in the supply chain; traded forms and biofuels produced during preparation; relevant properties, sampling, testing, classification, and specification; handling and processing based on biomass sources; and bioenergy resulting from solid biofuel conversion.

2. SAMPLING STANDARD

2.1 *IS 18640 : 2024 Solid Biofuels - Sample Preparation*

This standard prescribes two basic methods used during the sample preparation that are sample division and particle size-reduction of the sample. It also establishes procedures for reducing samples (or increments) to laboratory samples and further into sub-samples and general analysis samples.

The samples prepared through these procedures are then used for various analyses, including calorific value, moisture content, ash content, bulk density, durability, particle size distribution, ash melting behavior, etc.

3. PRODUCT STANDARDS

3.1 *IS 18724 : 2024 Solid Biofuels - Fuel Specifications and Classes - Pellets from Agro and Herbaceous Residues*

A biomass pellet is a small, cylindrical, and compressed form of organic material sourced from renewables, with specification standards set to ensure desired quality.

This standard specifies requirements of solid biofuels pellets produced from agro and other herbaceous residues, including blends and mixtures of woody and non-woody biomass. It does not cover thermally treated biomass pellets like torrefied pellets.

The parameters as outlined include origin and source, diameter and length, moisture content, ash content, mechanical durability, fines, additives, gross calorific value, particle size, and bulk density. It also specifies requirements for reporting nitrogen, sulphur, chlorine, and various elements like arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

3.2 *IS 18725:2024 Solid Biofuels - Fuel Specifications and Classes - Briquettes from Agro and Herbaceous Residues*

A biomass briquette is a compact, block-shaped form of organic material made from renewable sources, with specification standards established to ensure consistent quality.

This standard specifies requirements of solid biofuels briquettes produced from agro and other herbaceous residues, including blends and mixtures of woody and non-woody biomass. It does not cover thermally treated biomass pellets like torrefied pellets.

The parameters as outlined include origin and source, diameter and length, moisture content, ash content, additives, gross calorific value, and density. It also specifies requirements for reporting nitrogen, sulphur, chlorine, and various elements like arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

4. TEST METHODS STANADARDS

4.1 Physical Characteristics

4.1.1 *IS 17642:2021/ ISO 17828 : 2015 Solid biofuels - Determination of bulk density*

This standard defines a method of determining the bulk density of solid biofuels by the use of a standard measuring container. The method is applicable to all pourable solid biofuels with a nominal top size of maximum 100 mm.

The standard emphasizes that bulk density is not an absolute value and is subject to variations from vibration, shock, pressure, biodegradation, drying, and wetting. Therefore, measured bulk density can therefore deviate from actual conditions during transportation, storage, or transhipment.

4.1.2 *IS 17643:2021/ ISO 17829 : 2015 Solid biofuels - Determination of length and diameter of pellets*

This standard focuses on determination of diameter and length of pellets including methods for determination of the proportion of oversized pellets and average length.

The method states use of calliper to measure the length and diameter of pellets. The length of a pellet shall be measured along the axis of the cylinder, while the diameter shall be measured perpendicular to the axis.

4.1.3 *IS 17653:2021/ISO 18122 : 2015 Solid biofuels - Determination of ash content*

The standard provides a method to determine the ash content for all solid biofuels. The method involves heating a sample in air under controlled conditions and then calculating the mass of the remaining residue.

4.1.4 *IS 17655 (Part 1) : 2025/ISO 18134-1 : 2022 Solid biofuels - Determination of moisture content Part 1 Reference method (First Revision)*

This part of IS 17655 describes the method for determining the moisture content of solid biofuels using an oven dry method and may be used when high precision of the determination of moisture content is necessary.

The procedure involves drying a test portion of the solid biofuel at 105 °C in an air atmosphere until a constant mass is achieved. The moisture content is then calculated based on the mass loss of the test portion, with a correction for buoyancy effects. While biomass materials may contain small quantities of volatile organic compounds (VOCs) that can evaporate during oven drying, their contribution to overall mass loss is minimal and therefore disregarded in this method.

4.1.5 *IS 17655 (Part 2):2021/ISO 18134-2 : 2017 Solid biofuels - Determination of moisture content - Oven dry method: Part 2 Total moisture - Simplified method*

This part of IS 17655 describes the method of determining the total moisture content of a test sample of solid biofuels by drying in an oven and is used when the highest precision is not needed, e.g. for routine production control on site.

The portion is dried at 105 °C until a constant mass is achieved, and the moisture percentage is calculated from the mass loss. This simplified method neglects the effect of buoyancy and requires only a single determination, unlike the reference method IS 17655 (Part 1). The weight of a tray when still hot is less than the weight of the cold tray due to buoyancy. The magnitude of the buoyancy effect depends of the size and the weight of the tray.

4.1.6 *IS 17655 (Part 3) : 2025/ISO 18134-3 : 2023 Solid biofuels - Determination of moisture content Part 3 Moisture in general analysis sample (First Revision)*

This part of IS 17655 describes the method of determining the moisture in the analysis test sample by drying in an oven. It is intended to be used for general analysis samples.

Since biofuels in small particle size are very hygroscopic, their moisture content will change with humidity in the atmosphere and therefore, the moisture of the test portion is determined simultaneously with determination of for example calorific value, carbon content, and nitrogen content.

The test portion of solid biofuel is dried at a temperature of (105 ± 2) °C in air atmosphere until constant mass is achieved and the percentage moisture is calculated from the loss in mass of the test portion. Automatic equipment, including gravimetric analysers, may be used if validated using reference biomass samples of a similar type, provided all criteria related to sample size, drying temperature, atmosphere, and weighing accuracy are met.

4.1.7 *IS 17656 : 2021/ISO 18846 : 2016 Solid biofuels - Determination of fines content in samples of pellets*

This standard focuses on the determination of fines content, defined as the percentage in mass of material below 3.15 mm in size, when passed through a sieve with 3.15 mm diameter round hole.

4.1.8 *IS 18557 (Part 1) : 2024/ISO 17831-1 : 2015 Solid Biofuels - Determination of Mechanical Durability of Pellets and Briquettes: Part 1 Pellets*

This part of IS 18557 defines a determination method for testing the mechanical durability of pellets.

The standard determines durability by subjecting a test portion to controlled shocks in a rotating test chamber. After tumbling, the durability is calculated based on the mass of the test portion after separation by sieving.

The document outlines the required apparatus, including a pellet tester and sieves, and details the sample preparation and testing procedures.

4.1.9 *IS 18557 (Part 2) : 2024/ ISO 17831-2 : 2015 Solid Biofuels - Determination of Mechanical Durability of Pellets and Briquettes: Part 2 Briquettes*

This part of IS 18557 defines a determination method for testing the mechanical durability of briquettes.

The standard determines durability by subjecting a test portion to controlled shocks in a rotating test chamber, which is then calculated from the mass of the sample remaining after separation of abraded and fine broken particles.

The document outlines the required apparatus, including a briquette tester and sieves, and details the sample preparation and testing procedures.

4.2 Chemical Characteristics

4.2.1 *IS 17654:2021/ISO 18125: 2017 Solid biofuels - Determination of calorific value*

This standard specifies a method for the determination of the gross calorific value of a solid biofuel at constant volume and at the reference temperature 25 °C in a bomb calorimeter calibrated by combustion of certified benzoic acid. The net calorific value is then calculated from the gross calorific value.

The determination involves two separate experiments: combustion of the calibrant (benzoic acid) and combustion of the biofuel, both performed under the same conditions.

4.2.2 *IS 17844 : 2025/ ISO 18123 : 2023 Solid biofuels - Determination of volatile matter (First Revision)*

This standard prescribes method used to determine the volatile matter content of solid biofuels.

It describes the method of heating a general analysis sample at 900 °C ± 10 °C for 7 minutes, mostly without air contact, and calculating the volatile matter percentage from the mass loss after deducting moisture. Automatic equipment is permitted if validated.

4.2.3 *IS 17832 : 2022/ISO 16948 : 2015 Solid biofuels - Determination of total content of carbon, hydrogen and nitrogen*

This standard describes a method for the determination of total carbon, hydrogen and nitrogen contents in solid biofuels.

The method involves combusting a sample in oxygen or an oxygen/carrier gas mixture, converting it into ash and gaseous products like carbon dioxide, water vapor, and nitrogen. These products are then treated to remove interfering components, and the mass fractions of carbon dioxide, water vapor, and nitrogen are determined quantitatively using instrumental gas analysis.

4.2.4 *IS 17833 : 2022/ISO 16994 : 2016 Solid biofuels - Determination of total content of sulfur and chlorine*

This standard describes methods for the determination of the total sulfur and total chlorine content in solid biofuels. It specifies two methods for decomposition of the fuel and different analytical techniques for the quantification of the elements in the decomposition solutions. The use of automatic equipment is also included in the standard, provided that a validation is carried out as specified and that the performance characteristics are similar to those of the method described in the standard.

4.2.5 *IS 17834 : 2022/ISO 16995 : 2015 Solid biofuels - Determination of the water-soluble chloride, sodium and potassium content*

The standard specifies a method for determining the content of water-soluble chloride, sodium, and potassium in solid biofuels. This is achieved through water extraction in a closed container, followed by quantification using various analytical techniques.

Join the Future of Standardization!

Make your mark on national and international standards.

We invite experts and professionals to contribute to the advancement of standards in the Solid Biofuels sector.

Get Involved:

For national level:

https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/dgdashboard/committee_sso/

For international level:

https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/balot_data_public?param=jexpt

Or

📩 Email us at pcd7@bis.gov.in

📝 Mention your area of specialization and interest.

Together, let's shape the standards of tomorrow!