

S1-Supplementary Materials:

Recommended international regulations on solid biofuels

The committee responsible for biomass standardization in Spain is the CTN 164 "Solid Biofuels," established within UNE, with CIEMAT fulfilling the secretariat role. Within the committee, there are only three purely national standards without European or international counterparts. 76% of the standards are international and also European (EN-ISO), while the remaining 17% are European standards without ISO counterparts (EN). Essentially, the standards related to solid biomass fall into three types:

- Standards for sampling and characterization
- Standards for specifications and classes
- Standards for quality.

Table S1. Recommended international regulations.

Standard	Title
General rules on solid biofuels	
UNE-EN ISO 16993:2017	Solid biofuels. Conversion of analytical results from one base to another (ISO 16993:2016)
UNE-EN ISO 16559:2022.	Solid biofuels. Vocabulary. (ISO 16559:2022).
UNE-EN ISO 19743:2018	Solid biofuels. Determination of the content of heavy foreign materials of more than 3.15 mm. (ISO 19743:2017).
Sampling	
UNE-EN ISO 14780:2018	Solid biofuels. Preparation of sample. (ISO 14780:2017).
UNE-EN ISO 18135:2018	Solid biofuels. Sampling. (ISO 18135:2017).
UNE-EN ISO 14780:2018/A1:2020	Solid biofuels. Preparation of sample. Modification 1. (ISO 14780:2017/Amd 1:2019).
UNE-EN ISO 21945:2021	Solid biofuels. Simplified sampling method for small-scale applications. (ISO 21945:2020).
Humidity	
UNE-EN ISO 18134-1:2023	Solid biofuels. Determination of moisture content. Part 1: Reference method. (ISO 18134-1:2022).
UNE-EN ISO 18134-2:2017	Solid biofuels. Determination of moisture content. Oven drying method. Part 2: Total humidity. simplified method. (ISO 18134-2:2017).
UNE-EN ISO 18134-3:2016	Solid biofuels. Determination of moisture content. Oven drying method. Part 3. Sample moisture for general analysis. (ISO 18134-3:2015).
Ashes	
UNE-EN ISO 18122:2023.	Solid biofuels. Determination of ash content. (ISO 18122:2022).
UNE-EN ISO 21404:2021	Solid biofuels. Determination of the behavior of the fusion of the ashes. (ISO 21404:2020).
Volatile matter	
UNE-EN ISO 18123:2016	Solid biofuels. Determination of the volatile matter content. (ISO 18123:2015).
Calorific value	
UNE-EN ISO 18125:2018	Solid biofuels. Calorific value determination. (ISO 18125:2017).
Elemental composition analysis	
UNE-EN ISO 16948:2015	Solid biofuels. Determination of total carbon, hydrogen and nitrogen content. (ISO 16948:2015).
UNE-EN ISO 16967:2015	Solid biofuels. Determination of majority elements. Al, Ca, Fe, Mg, P, K, Si, Na and Ti. (ISO 16967:2015).
UNE-EN ISO 16968:2015	Solid biofuels. Determination of minority elements. (ISO 16968:2015).
UNE-EN ISO 16994:2017	Solid biofuels. Determination of total sulfur and chlorine content. (ISO 16994:2016).
Bulk density and particle size	
UNE-EN ISO 17828:2016	Solid biofuels. Determination of bulk density. (ISO 17828:2015).
UNE-EN ISO 17827-1:2016	Solid biofuels. Determination of the particle size distribution for uncompressed fuels. Part 1: Oscillating sieve method with mesh opening equal to or greater than 3.15 mm. (ISO 17827-1:2016).

UNE-EN ISO 17827-2:2016	Solid biofuels. Determination of the particle size distribution for uncompressed fuels. Part 2: Vibrating sieve method with mesh opening less than or equal to 3.15 mm. (ISO 17827-2:2016).
UNE-CEN/TR 15149-3:2015 IN	Solid biofuels. Determination of the particle size distribution. Part 3: Rotary sieve method.
Solid biofuel classes	
UNE-EN ISO 17225-1:2022.	Solid biofuels. Specifications and classes of fuels. Part 1: General requirements. (ISO 17225-1:2021).
UNE-EN ISO 17225-2:2021.	Solid biofuels. Specifications and classes of fuels. Part 2: Kinds of wood pellets. (ISO17225-2:2021).
UNE-EN ISO 17225-3:2021.	Solid biofuels. Specifications and classes of fuels. Part 3: Kinds of wood briquettes. (ISO 17225-3:2021).
UNE-EN ISO 17225-4:2021.	Solid biofuels. Specifications and classes of fuels. Part 4: Kinds of wood chips. (ISO 17225-4:2021).
UNE-EN ISO 17225-5:2022.	Solid biofuels. Specifications and classes of fuels. Part 5: Kinds of wood fire. (ISO 17225-5:2021).
UNE-EN ISO 17225-6:2022.	Solid biofuels. Specifications and classes of fuels. Part 6: Classes of pellets of non-woody origin. (ISO 17225-6:2021).
UNE-EN ISO 17225-7:2022.	Solid biofuels. Specifications and classes of fuels. Part 7: Classes of briquettes of non-woody origin. (ISO 17225-7:2021).
UNE-EN ISO 17225-8:2023.	Solid biofuels. Specifications and classes of fuels. Part 8: Classes of densified and thermally treated biomass fuels for commercial and industrial use. (ISO 17225-8:2023).
UNE-EN ISO 17225-9:2022.	Solid biofuels. Specifications and classes of fuels. Part 9: Classes of shredded fuel and wood chips for industrial use. (ISO 17225-9:2021).
UNE 164004:2022.	Solid biofuels. Specifications and classes of biofuels. Fruit shells.
UNE 164003:2022.	Solid biofuels. Specifications and classes of biofuels. Olive pits.
Quality assurance	
UNE-EN 15234-1:2011	Solid biofuels. Fuel quality assurance. Part 1: General requirements.
UNE-EN 15234-2:2012	Solid biofuels. Fuel quality assurance. Part 2: Wood pellets for non-industrial use.
UNE-EN 15234-3:2012	Solid biofuels. Fuel quality assurance. Part 3: Wood briquettes for non-industrial use.
UNE-EN 15234-4:2012	Solid biofuels. Fuel quality assurance. Part 4: Wood chips for non-industrial use.
UNE-EN 15234-5:2012	Solid biofuels. Fuel quality assurance. Part 5: Firewood for non-industrial use.
UNE-EN 15234-6:2012	Solid biofuels. Fuel quality assurance. Part 6: Non-woody pellets for non-industrial use.