SLOVENSKI STANDARD
SIST-TS CEN ISO/TS 20049-2:2022

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Trdna biogoriva - Določanje samosegrevanja peletiziranih biogoriv - 2. del: Preskusi ogrevanja košare (ISO/TS 20049-2:2020)

Solid biofuels - Determination of self-heating of pelletized biofuels - Part 2: Basket heating tests (ISO/TS 20049-2:2020)

Biogene Festbrennstoffe - Bestimmung der Selbsterhitzung von pelletierten biogenen Brennstoffen - Teil 2: Warmlagerungsprüfungen im Drahtnetzkorb (ISO/TS 20049-2:2020)

Biocombustibles solides - Détermination de l'auto-échauffement des granulés de biocombustibles - Partie 2: Essais utilisant la méthode du point de croisement (ISO/TS 20049-2:2020)

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75.160.40	Biogoriva	Biofuels

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Solid biofuels - Determination of self-heating of pelletized biofuels - Part 2: Basket heating tests (ISO/TS 20049-2:2020)

Biocombustibles solides - Détermination de l'auto-échauffement des granulés de biocombustibles - Partie 2: Essais utilisant la méthode du point de croisement (ISO/TS 20049-2:2020)

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This Technical Specification (CEN/TS) was approved by CEN on 27 March 2022 for provisional application.

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European foreword

The text of ISO/TS 20049-2:2020 has been prepared by Technical Committee ISO/TC 238 "Solid biofuels” of the International Organization for Standardization (ISO) and has been taken over as CEN ISO/TS 20049-2:2022 by Technical Committee CEN/TC 335 “Solid biofuels” the secretariat of which is held by SIS.

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Endorsement notice

The text of ISO/TS 20049-2:2020 has been approved by CEN as CEN ISO/TS 20049-2:2022 without any modification.

TECHNICAL SPECIFICATION

ISO/TS 20049-2

First edition
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Solid biofuels — Determination of self-heating of pelletized biofuels —

Part 2:
Basket heating tests

Biocombustibles solides — Détermination de l'auto-échauffement des granulés de biocombustibles —

Partie 2: Essais utilisant la méthode du point de croisement

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 238, *Solid biofuels*.

A list of all parts in the ISO 20049 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

There is a continuous global growth in production, storage, handling, bulk transport and use of solid biofuels especially in the form of pelletized biofuels.

The specific physical and chemical characteristics of solid biofuels, their handling and storage can lead to a risk of fire and/or explosion, as well as health risks such as intoxication due to exposure to carbon-monoxide, asphyxiation due to oxygen depletion or allergic reactions.

Heat can be generated in solid biofuel by exothermic biological, chemical and physical processes. Biological processes include the metabolism of fungus and bacteria and occur at lower temperatures; the oxidation of wood constituents increases with temperature and dominates at higher temperatures; the heat production from biological and chemical processes leads to transport of moisture in the bulk material, with associated sorption and condensation of water, which both are exothermic processes. In, for example, a heap of stored forest fuel or a heap of moist wood chips, all of these processes can be present and contribute to heat production.

Solid biofuels such as wood pellets, however, are intrinsically sterile[6] due to the conditions during manufacturing (exposure to severe heat during drying, fragmentation during hammermilling and pressure during extrusion) but can attract microbes if becoming wet during handling and storage resulting in metabolism and generation of heat. Leakage of water into a storage of wood pellets can also lead to the physical processes mentioned above. Non-compressed wood like feedstock and chips typically have a fauna of microbes which under certain circumstances will result in heating. All the processes mentioned above contribute to what is called self-heating although oxidation is likely to be one of the main contributing factors in the temperature range under which most biofuels are stored. The heat build-up can be significant in large bulk stores as the heat conduction in the material is low. Under certain conditions the heat generation can lead to thermal runaway and spontaneous ignition.

The potential for self-heating seems to vary considerably for different types of solid biofuel pellets. The raw material used, and the properties of these raw materials have proven to influence the propensity for self-heating of the produced wood pellets. However, the production process (e.g. the drying process) also influences the potential for self-heating. It is therefore important to be able to identify solid biofuel pellets with high heat generation potential to avoid fires in stored materials.

Two intrinsically different types of tests methods can be used to estimate the potential of self-heating:

a) in the isothermal calorimetry method described in ISO 20049-1, the heat flow generated from the test portion is measured directly;

b) in the basket heating tests described in this document, the temperature of the test portion is being monitored and the critical ambient temperature (CAT), where the temperature of the test portion just does not increase significantly due to self-heating, is used for indirect assessment of self-heating.

These two methods are applied at different analysis temperature regimes. The operating temperature for an isothermal calorimeter is normally in the range 5 °C to 90 °C whereas basket heating tests are conducted at higher analysis (oven) temperatures. For basket heating tests with wood pellets, the CAT is found for a 1 l sample portion in the range 150 °C to 200 °C.

NOTE 1 The two types of test methods referred to above do not measure heat production from physical processes such as transport of moisture.

NOTE 2 It is likely that oxidation reactions taking place in the low respective high temperature regimes for solid biofuel pellets are of different character and thus have different reaction rates and heat production rates. In such a case, extrapolation of the data from a high temperature test series can lead to non-conservative results and might not be applicable without taking the low temperature reactions into account. In the general case of two reactions with different activation energies, the high activation energy is "frozen out" at low temperatures and the low activation energy reaction is "swamped" at higher temperatures[7].

NOTE 3 It has been shown for a limited number of different types of wood pellets that the reaction rates in the lower temperature regime measured by isothermal calorimetry were higher compared to the reaction rate data determined from basket heating tests in the higher temperature regime[8].

Basket heating tests have been used traditionally for characterization of the tendency for spontaneous ignition of predominantly coals, but also for other reactive organic materials such as, for example, cottonseed meal, bagasse and milk powder[9]. The principle used in this type of tests is to find the CAT for a self-heating sample material of specific size and geometry.

There are several different methods described in the literature with different degrees of sophistication. The variations span from simple pass and fail tests to more advanced tests from which data on reaction rates can be extracted[10].

Basket heating tests are useful for assessment of self-heating of solid biofuel pellets. The test method selected can be evaluated for its applicability based on the information given in this document.

A compilation of available basket heating test methods is given in this document. Guidance on the suitability for application of these methods for tests with pelletized biofuels is provided.

Basic theory of the use of basket heating test data for calculations of critical conditions in storages is provided in Annex B.

