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BSI Standards Publication

Nanotechnologies — Performance evaluation of nanosuspensions containing clay nanoplates for quorum quenching

National foreword

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Abbreviations **2**
5 Characteristics and measurement methods **3**
5.1 General 3
5.2 Chemical composition 3
5.3 Mineral composition 3
5.4 Specific surface area 3
5.5 Cation exchange capacity 4
5.6 Hydrodynamic size 4
5.7 Zeta potential 4
6 Performance of quorum quenching **4**
6.1 Quantification of quorum quenching ability by surfactants 4
6.2 Antibacterial activities 5
6.2.1 Determination of MIC 5
6.2.2 Determination of MBC 5
7 Test report **6**
Annex A (informative) **Relationship between clay nanoplate characteristics and antibacterial performance** **7**
Annex B (informative) **Correlation between quorum quenching ability and antibacterial performance** **9**
Annex C (informative) **Safety of clay nanoplates** **10**
Bibliography **12**

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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 229, *Nanotechnologies*.

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.

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Introduction

Among the abundant minerals in the earth's crust, the naturally occurring clays in the class of phyllosilicates such as smectite, talc and mica are layer silicates existed as laminated mass. The stacks of smectite can be exfoliated into individual clay nanoplates of high surface area and high charge density on the surface. Due to the presence of the surface charges, the clay nanoplate gives rise to a strong electrostatic and charge attraction on microbial surface. The clay nanoplates can be further modified by introducing various surfactants to enhance their functions for inhibiting bacterial growth through quorum quenching interactions. The clay nanoplate suspension in water is designed to inhibit the growth of pathogenic bacteria for crop protection from diseases. Moreover, as an additional benefit, harvesting yield increased.

The antibacterial efficacy is attributed to the unique combinations of chemical and physical properties including the nanoplate shape and size dimension, high surface area, ionic charge attraction and water dispersion stability. These combined characteristics in a single nanoplate enable for a long-term antibacterial effect. The inter-relation between clay nanoplate characteristics and antibacterial performance are described in Annex A. The quorum quenching ability depends on the interaction of clay nanoplates with bacterial signaling molecules and bacterial surfaces. It can be used as the standard for quality control for the clay nanoplate, and more importantly, the antimicrobial efficacy by using clay nanoplates can be measured and predicted. The correlation between quorum quenching ability and antibacterial performance is described in Annex B.

This document does not cover safety and environmental aspects. Some safety of clay nanoplate regarding the cytotoxicity and genotoxicity toward human cell, oral lethal dose (LD_{50}), and aquatic toxicity are described in Annex C.

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TECHNICAL SPECIFICATION **ISO/TS 4971:2023**

Nanotechnologies — Performance evaluation of nanosuspensions containing clay nanoplates for quorum quenching

1 Scope

This document specifies the performance evaluation of nanosuspensions containing clay nanoplates for quorum quenching in crop production. This document does not cover safety and environmental aspects.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
nanosuspension
fluid nanodispersion where the dispersed phase is a solid

Note 1 to entry: The use of the term “nanosuspension” carries no implication regarding thermodynamic stability.

[SOURCE: ISO/TS 80004-4:2011, 3.5.1]

3.2
clay
naturally occurring or synthetically manufactured material composed primarily of fine-grained minerals, which is generally plastic at appropriate water contents and will harden when dried or fired

Note 1 to entry: Taken from Reference [1].

Note 2 to entry: Although clay usually contains phyllosilicates, it may contain other materials that impart plasticity and harden when dried or fired. Associated phases in clay may include materials that do not impart plasticity and organic matter. Different disciplines have uniquely defined the size of clay particles, and it is for this reason that “fine grained” is used in the definition rather than a precise value. However, because of these size variations from discipline to discipline, it is important that the particle size be specified in the context of the application.

[SOURCE: ISO/TS 21236-1:2019, 3.4]

3.3
nanoplate
nano-object with one external dimension in the nanoscale and the other two external dimensions significantly larger

[SOURCE: ISO/TS 80004-2:2015, 4.6]

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