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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 21510-2024

**Antimicrobial property testing and evaluation methods for
nano-inorganic materials**

纳米无机材料抗菌性能检测方法及评价

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Table of Contents

1 Scope
2 Normative references
3 Terms and definitions
4 Test method
4.1 Procedure
4.3 Calculation of test results
5 Antibacterial property evaluation
6 Test report
7 Safety operation requirements
Appendix A
Appendix B
Appendix C

1 Scope

GB/T 21510-2024 gives the Chinese methods for testing and evaluating the antimicrobial performance of nano-inorganic materials, the silver, zinc oxide, copper and titanium dioxide nanomaterials sold into textiles, coatings, plastics and ceramics on an antibacterial claim. The claims are widespread and the evidence behind them is often not comparable, because a result depends entirely on the test organisms, the contact time, the carrier and whether the material was tested as a powder or as incorporated into a product. The standard fixes those. It sets the test strains and their preparation, the culture media and reagents, the specimen preparation for powders and for materials incorporating them, the test procedures with the contact conditions, the enumeration of survivors and the controls that make the result valid, the calculation of the antibacterial rate and the logarithmic reduction, and then the evaluation criteria and grading by which a claim may be made, together with the report. It takes effect on 1 February 2025.

This document specifies the test methods, antimicrobial property evaluation, test report and safety operation requirements for the antibacterial property of nano-inorganic materials. This document applies to nano-inorganic materials with antibacterial functions, as well as products with nano-inorganic materials as antibacterial components (structural units), such as fibers, fabrics, plastics, coatings and ceramics. The antibacterial property testing and evaluation of other materials can also be carried out in accordance with this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the version corresponding to that date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB 4789.2, National food safety standard -Microbiological examination of food. Aerobic plate count

GB/T 30544 (all parts), Nanotechnologies - Vocabulary

3 Terms and definitions

For the purposes of this document, the following terms and definitions, as well as those given in GB/T 30544 (all parts), apply.

3.1 antibacterial The process of killing microorganisms such as bacteria and fungi and/or hindering their growth, reproduction and activity by chemical or physical methods.

4.1 Procedure

4.1.1 The test of the antibacterial property of powdered nano-inorganic materials shall be carried out according to the method specified in Appendix A.

4.2 Test data processing Multiply the number of colonies on each plate by the dilution factor to get the actual number of colonies recovered from the sample.

4.3 Calculation of test results

4.3.1 Calculation of colony counts Multiply the colony counts on each plate by the dilution factor to get the actual number of bacteria recovered from the sample.

4.3.3 Calculation of antibacterial logarithm value Calculate the antibacterial logarithm value according to Formula (2).

5 Antibacterial property evaluation

The antibacterial property evaluation of products using nano-inorganic materials as antibacterial components (structural units) shall comply with the following regulations and indicate the bacterial species.

6 Test report

The test report shall include the following.

7 Safety operation requirements

7.1 All microbiological testing operations shall be carried out in a biological safety cabinet.

7.2 When dripping the bacterial liquid onto the sample, do not let it overflow outside the sample.

7.3 Before shaking, the conical flask shall be firmly fixed on the shaking table to avoid breakage.

Appendix A

(Normative) Test method for antibacterial property of powdered nano-inorganic materials -

Oscillation method A.1 Applicability This test method applies to the determination of antibacterial property of powdered nano-inorganic materials. A.2 Test equipment and materials A.2.3 Culture medium and reagents A.2.3.1 Ordinary nutrient broth culture medium A.3 Test procedure A.3.1 Preparation of bacterial slants A.3.1.1 Bacterial activation Take a tube of dry culture; open it under sterile operation; add an appropriate amount of nutrient broth with a capillary pipette; gently pipette several times to melt and disperse the culture. Take a test tube containing

10.0 mL of nutrient broth; drop a small amount of bacterial suspension into it; culture it at $37^{\circ}\text{C} \pm 1^{\circ}\text{C}$ for 18 h ~ 24 h. A.4 Test requirements A.4.1 The colony count of the control group at "0" contact time shall be between 1×10^4 cfu/mL and 5×10^4 cfu/mL. The negative control shall show no sterile growth. A.4.2 The control sample shall not have obvious antibacterial effect. After shaking, the number of colonies recovered in the control group shall not be less than 1×10^3 cfu/mL, otherwise the test will be invalid.

Appendix B

(Normative) Test method for antibacterial properties of porous and non-porous materials

containing nano-inorganic antibacterial components - Oscillation method B.1 Applicability This test method is applicable to the determination of the antibacterial property of porous and non-porous materials (including dissolvable and non-dissolvable fibers, fabrics, plastic powders, microporous filter materials, etc.) containing antibacterial components of nano-inorganic materials. B.2 Test equipment and materials B.3 Test procedure B.3.1 Preparation of bacterial slants The preparation of bacterial slant shall comply with the requirements of A.3.1. B.3.2 Test steps B.4 Test requirements The test requirements shall comply with the provisions of A.4.

Appendix C

(Normative) Test method for antibacterial property of non-porous materials containing nano-inorganic antibacterial components - Film method C.1 Applicability This test method is

applicable to the determination of the antibacterial property of non- porous materials (such as plastics, ceramics, paint films, plates, metals and other hard surface materials) containing antibacterial components of nano-inorganic materials. C.2 Test equipment and materials C.3 Test procedure C.3.1 Preparation of bacterial slants The preparation of bacterial slant shall comply with the requirements of A.3.1. C.3.2 Test steps C.3.2.1 Preparation of covering film The covering film is made of polyethylene film with a size of (40 ± 2) mm x (40 ± 2) mm and a thickness of 0.05 mm ~