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Test methods for sterile medical device package - Part 14: Testing the microbial barrier for porous packaging materials under moist conditions and with passage of air

无菌医疗器械包装试验方法

第 14 部分：透气包装材料湿性和干性微生物屏障试验

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Test methods for sterile medical device package - Part 14: Testing the microbial barrier for porous packaging materials under moist conditions and with passage of air

1 Scope

This Part specifies the methods for testing the microbial barrier for porous packaging materials under moist conditions and with passage of air.

The test methods given in this Part apply to the packaging materials for terminally sterilized medical devices.

2 Normative references

The following documents are essential for the application of this document. For dated references, only the dated editions apply to this document. For undated references, the latest editions (including all amendments) apply to this document.

GB/T 450-2008 *Paper and board -- Sampling for testing and identification of machine and cross direction, wire side and felt side*

Pharmacopoeia of the People's Republic of China (2015 Edition)

3 Testing the microbial barrier for porous packaging materials under moist conditions

3.1 Method summary

ADD dropwise the microorganism droplets onto the test sample. After the droplets are dried, an experiment is performed to determine whether microorganisms have penetrated to the other side of the sample.

3.2 Sampling

TAKE samples in accordance with the GB/T 450-2008.

3.3 Sample preparation and quantity

The number of microorganisms in the microbial suspension used for the test shall be 10^7 to 10^8 per milliliter.

3.6 Test implementation

3.6.1 General

PLACE test samples of each of the packaging material treated as 3.3 on a sterilized substrate, e.g., in a Petri dish or on its lid. In actual use, the side that may be subject to contamination is facing up.

If there is no indication of the contaminated surface of the packaging material, both surfaces shall be tested with the same number of test samples.

TAKE 5 drops from the 1:100 dilution of broth series dilution (3.5), 0.1 mL per drop. ADD dropwise to the upper surface of each test sample. Each drop shall not be in contact with each other and should be equally spaced.

The droplets shall be allowed to dry completely under sterile conditions for 6 h to 16 h. The temperature at this stage shall be maintained at (22 ± 3) °C.

Each sample should be placed on the surface of a blood agar plate (3.4.4) with the inoculation surface facing up so that the entire test surface is in contact with the agar (lightly smoothed with a coating bar). REMOVE the test samples after 5 s to 6 s. The plate should be cultured at 37 °C for 16 h to 24 h.

3.6.2 Positive spot check

In order to check the growth of the test microorganisms used, an additional test sample of the packaging material treated as 3.3 is also inoculated and dried as described in 3.6.1. The inoculation surface of the test sample is surface-contacted with a blood agar plate as a positive check. After culture (3.6.1), the test microorganisms on the plate shall grow significantly.

3.6.3 Negative spot check

As a negative check, an additional test sample parallel to the inoculated test sample should be treated as described in 3.6.1, but not inoculated with the microbial suspension. At the end of culture, there shall be no colony growth on the blood agar plate.

3.7 Test evaluation

3.7.1 General

This test is designed as a “Conforming/Non-conforming” type test. Therefore, the precision of the measured values is not reported in principle. If the positive and negative checks of 3.6.2 and 3.6.3 are passed, the sensitivity of the method

conditioned for at least 24 h at an ambient temperature of (23 ± 1) °C and a relative atmospheric humidity of (50 ± 2) %.

TEST the side of the packaging material that may be contaminated in actual use. If both sides are tested, the number of test samples prepared should be doubled. It also applies when the tester does not know which side the contaminated surface is.

4.4 Appliances and consumables

4.4.1 General

All appliances and consumables in contact with the medium should be sterilized in a steam sterilizer at 121 °C for 15 min.

4.4.2 Appliances

4.4.2.1 10 sets of microbial barrier test components, including:

— 1 thread mouth test bottle with a nominal volume of 250 mL; and

— 1 thread lid that can withstand sterilization and is covered with a 34 mm diameter opening. It shall be ensured that the thread lid does not release any substances that may affect the packaging material or microorganisms in the test during the sterilization process.

4.4.2.2 20 seal rings with a diameter of 34 mm that can withstand sterilization, made of polytetrafluoroethylene (PTFE) or with PTFE coating. These seal rings do not release any substances that may affect the packaging material or microorganisms in the test.

4.4.2.3 Steam sterilizer.

4.4.2.4 Refrigerator.

4.4.2.5 Incubator.

4.4.2.6 Aluminum foil.

4.4.2.7 Filter paper.

4.4.2.8 Laboratory thermometer.

4.4.2.9 Tools for shearing or punching samples.

4.4.2.10 Measuring cylinder.

4.5 Medium

POUR 20 mL of the medium prepared as 4.5 into each clean test bottle, and COOL to solidify. The medium temperature shall be at least 50 °C during filling.

4.7.2 Loading test samples

Each test sample should be placed between two seal rings on the top of the test bottle and then secured with a thread lid to hold the test sample and seal rings tightly against the top of the test bottle. If the seal ring used has only one coating, the coated surface shall face the test sample.

4.7.3 Sterilization

The microbial barrier test kit prepared in accordance with 4.7.1 and 4.7.2 should be sterilized in a steam sterilizer at 121 °C for 20 min. The thread lid should be covered with aluminum foil before sterilization.

4.7.4 Air flow generation

After sterilization and cooling of the microbial barrier test kits to room temperature, each test sample is covered with 0.25 g of powdered quartz. In order to avoid cross-contamination in the laboratory, filter paper should be used to cover the thread lid.

Each microbial barrier test kit is then placed in an incubator and heated to (50 ± 3) °C. Thereafter, the microbial barrier test kits are placed in a refrigerator which is set to a temperature of (10 ± 3) °C. The process of heating to cooling (from 50 °C to 10 °C) should be carried out a total of 5 times.

For ease of operation, it is recommended to measure the heating time and cooling time before the start of the test. Each cycle should be no less than 40 min.

It is advisable not to shake the test kits as much as possible during the test.

4.7.5 Culture

The microbial barrier test kits are incubated at 37 °C for 24 h.

4.7.6 Test evaluation

This test is designed as a “Conforming/Non-conforming” type test. Therefore, the precision of the measured values is not reported in principle. If the positive and negative checks of 4.9 are passed, the sensitivity of the method is sufficiently reliable.

After culture, the microbial barrier test kits should be removed from the incubator. Colonies formed on the medium are counted.

Appendix A

(Informative)

Precision and bias

A.1 Overview

In 2013, the Sterile Barrier Association (SBA) conducted a laboratory synergy test to evaluate the precision (repeatability and reproducibility) of the test method.

A total of 5 German laboratories participated in the test, and one of the laboratories was independently tested by two groups of testers. In this way, a total of 6 sets of test data were obtained.

The test samples used in this test include various kinds of materials, including materials that are expected to prevent microbial penetration, as well as materials that are expected to penetrate microorganisms. There are 3 samples for the microbial barrier test under moist conditions, numbered F1 to F3. There are 4 samples for the microbial barrier test with passage of air, numbered L1 to L4.

All samples are sterilized at 121 °C for 15 min. TEST separately according to the test methods specified in the standard. The only deviation is that no additional 20 test samples are taken for retesting in the microbial barrier test under moist conditions.

A.2 Results

Since the test method is designed as a “Conforming/Non-conforming” type test, the statistical total mean as well as the intra-laboratory and inter-laboratory precision data are not practical and are only used to provide information.

The test samples are simultaneously judged as “Conforming/Non-conforming”.

If the number of colonies in a single plate or sample exceeds 100 CFU, 100 CFU is counted for the result evaluation.

Statistical evaluation is performed according to DIN ISO 5725-1ff.

Mandel’s h-statistics test is used for outlier testing.

Corresponding results of laboratories considered to be outliers do not participate in statistical evaluation.

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