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Microbiology of food and animal feeding stuffs — Guidelines on preparation and production of culture media —

Part 2: Practical guidelines on performance testing of culture media

Microbiologie des aliments — Guide pour la préparation et la production des milieux de culture —

Partie 2: Guide général pour les essais de performance des milieux de culture

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 11133-2 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 9, *Microbiology*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO/TS 11133 consists of the following parts, under the general title *Microbiology of food and animal feeding stuffs — Guidelines on preparation and production of culture media*:

— *Part 1: General guidelines on quality assurance for the preparation of culture media in the laboratory*

— *Part 2: Practical guidelines on performance testing of culture media*

This corrected version of ISO/TS 11133-2:2003 incorporates the following corrections:

— 4.2.3.1: addition of “a recently released batch”;

— 4.2.3.3: Note 1 is deleted;

— 5.1, last paragraph: “sensitivity” is replaced by “selectivity”;

— 5.2.1.1: subclause is replaced;

— 5.2.1.2: “per ml” is deleted;

— 5.4.2.2, a)-c): “should” is replaced by “shall”;

— Annex B: “equivalent strains” is replaced by “same strains”.

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Foreword

This document (CEN ISO/TS 11133-2:2003) has been prepared by Technical Committee CEN/TC 275 “Food analysis - Horizontal methods”, the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 34 “Food products”.

This document "Microbiology of food and animal feeding stuffs – Guidelines on preparation and production of culture media" consist of two parts:

— *Part 1: General guidelines on quality assurance for the preparation of culture media in the laboratory*

— *Part 2: Practical guidelines on performance testing of culture media*

Annex A is informative. Annex B is normative.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

It is essential to use culture media of proven quality to carry out microbiological analysis of food reliably. For all media described in standardized methods it is essential to define the minimum acceptance criteria required to ensure media reliability. It is recommended that in the determination of the performance characteristics of a culture medium tests are carried out that conform with this Technical Specification. This applies to:

a) commercially prepared ready-to-use or dehydrated media;

b) culture media prepared from basic constituents in the user's laboratory.

The establishment of widely accepted minimum performance criteria for media should lead to more consistent quality of commercially made products and thus reduce the extent of testing necessary in the user's laboratory.

Furthermore the minimum acceptance criteria measured by the methods defined in this Technical Specification can be used by all microbiological laboratories to evaluate the productive, selective and/or elective properties of a culture medium.

In the microbiological analysis of food and animal feeding stuffs the requirements of this Technical Specification have priority in the assessment of media quality.

1 Scope

This Technical Specification sets criteria and methods for the performance testing of culture media. This Technical Specification applies to:

— commercial bodies producing and/or distributing ready-to-use or semi-finished reconstituted or dehydrated media to microbiological laboratories;

— non-commercial bodies supplying media to third parties;

— microbiological laboratories preparing culture media for their own use and evaluating the performance of these media.

2 Normative references

This Technical Specification incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Technical Specification only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

ENV ISO 11133-1:2000, *Microbiology of food and animal feeding stuffs – Guidelines on preparation and production of culture media – Part 1: General guidelines on quality assurance for the preparation of culture media in the laboratory (ISO/TR 11133-1:2000).*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ENV ISO 11133-1:2000 apply.

4 Criteria for routine quality control

4.1 General quality criteria

4.1.1 Quality of culture media

The quality of culture media depends on the quality of the basic ingredients, correct formulation, quality of preparation procedures, elimination of contaminant microbial agents and appropriate packaging and storage conditions (see ENV ISO 11133-1).

The manufacturer or producer in the laboratory shall comply with the physico-chemical characteristics of the culture media as specified in the corresponding standard. Furthermore, quality assessment shall ensure that the culture medium conforms to stated recommendations, including:

— distributed quantity and/or thickness;

— appearance, colour and homogeneity;

— gel consistency;

— moisture content;

— pH value;

— buffering capacity;

— microbial contamination.

The individual components and any nutritive or selective supplements shall also undergo suitable quality assessment procedures.

4.1.2 Quality of basic media components

Culture media described in the International Standards were judged satisfactory; however, due to the variability of their quality, it may be acceptable for media manufacturers to modify the concentration of some basic biological ingredients, as listed below:

— peptones and meat or yeast extracts variable in their nutritive properties;

— agar variable in its gelling properties;

— buffering substances;

— bile salts, bile extract and desoxycholate, antibacterial dyes, depending on their selective properties;

— antibiotics depending on their activity.

4.2 Microbiological quality criteria

4.2.1 General

The microbiological performance tests shall be carried out on a sample which is representative of a batch of end product.

4.2.2 Microbial contamination

An appropriate quantity, depending on the size of the batch of culture medium, shall be tested for microbial contamination by incubation under appropriate conditions. Target limits for the percentage of contaminated plates or containers of liquid medium should be established for each medium or specified by the manufacturer. Manufacturers should draw up specifications based on media components, processing limits and type of packaging.

NOTE 1 The samples to be tested should be at least 1 plate or tube or 1 % of plates or tubes from the beginning and 1 plate or tube or 1 % of plates or tubes from the end of a pouring or dispensing process. The plates or tubes should be incubated for at least 18 h at 37ºC or under the incubation conditions which are used routinely for this medium according to the specific standard.

NOTE 2 For statistical sampling plans refer to the ISO 2859-1:1999.

4.2.3 Growth

4.2.3.1 General

To evaluate each batch of complete culture medium, nutrient components or supplements, growth shall be appropriately assessed by either:

a) quantitative; or

b) semi-quantitative; or

c) qualitative methods.

Quantitative, semi-quantitative or qualitative evaluations shall be performed by the methods described in this Technical Specification or by another generally accepted technique. For interpretation of the results of testing, it is necessary to compare the amount of growth on the test medium with that on a reference medium. The use of a specific reference medium is therefore mandatory for quantitative methods (see the specific standard or Annex B)

For semi-quantitative or qualitative methods, the use of a specific reference medium (see corresponding specific standard or Annex B) or a culture medium giving a "positive" reaction helps to interpret results. The reference medium must be of known good quality chosen from a recently released batch, or, if comparing long term stability, a recently released batch, a batch from another supplier, or a ready-to-use medium, etc.

In addition, growth of the target strains shall be typical in appearance, size and morphology of the colonies and growth of the non-target strains shall be partly or completely inhibited.

4.2.3.2 Productivity

Solid, semi-solid or liquid culture media shall be inoculated with an appropriate inoculum (5.2.1.1) of the working culture of each of the defined test microorganisms using an appropriate device.

Productivity shall reach a defined minimum limit (see corresponding specific standard or Annex B).

For quantitative methods the Productivity Ratio P_R (1) is determined as follows:

$$P_R = \frac{N_S}{N_O} \quad (1)$$

where

N_s is the total colony count obtained on the culture medium under test (obtained from one or more plates);

N_o is the total colony count obtained on the defined reference culture medium obtained from one or more plates, and shall be ≥ 100 cfu.

NOTE The Productivity Ratio of a non selective medium is at least 0,7 for microorganisms that can grow easily on that medium. The P_R of the target microorganisms on a selective medium should be at least 0,1. These values are generally achievable, however less rigorous criteria can be accepted for certain combinations of media and test microorganisms (see corresponding specific standard or Annex B)

For semi-quantitative methods, the scores of consecutive sectors of a plate inoculated by the ecometric technique are summed to obtain the growth index G_I, which varies according to the culture medium. It is therefore important to compare them with previous indices and/or G_I of a reference medium and to ensure that variations are not excessive. The expected range of variations for each culture medium can also be established once sufficient experience of the method has been gained.

Qualitative evaluations shall be carried out visually by allocating growth scores.

4.2.3.3 Selectivity

To assess selectivity quantitatively, selective culture media and a reference medium are inoculated with an appropriate inoculum (5.2.1.2.) of the defined test microorganism using an appropriate device. Selectivity has to reach defined values (see corresponding specific standard or Annex B).

The Selectivity Factor S_F (2), is calculated as follows:

$$S_F = D_O - D_S \quad (2)$$

where

D_O is the highest dilution showing growth of at least 10 colonies on the reference medium;

D_S is the highest dilution showing comparable growth on the test medium.

S_F, D_O and D_S are expressed in $\log_{10}$ units.

NOTE The S_F of non-target microorganisms on a selective medium should be at least 2. This value is generally achievable. However, less rigorous criteria can be accepted for certain combinations of media and test microorganisms (see corresponding specific standard or Annex B).

For semi-quantitative and qualitative methods the growth of the non-target strain(s) shall be inhibited partly or completely.

4.2.4 Biochemical and physiological characteristics (selectivity and specificity)

The colony morphology and the diagnostic features together with the degree of selectivity should be established in order to obtain a complete picture of the performance of a medium.

The essential characteristics of specificity shall be defined and achieved. For differential media the quality of biochemical / physiological characteristics of the target microorganism(s) and the degree of inhibition of non-target microorganisms should be determined with an appropriate set of test strains.

4.2.5 Antimicrobial testing characteristics

The antimicrobial action of antibiotics depends upon their agar diffusion characteristics and any antagonistic effects from the components present. Media for testing the presence or absence of antimicrobial substances in food samples should conform to reference methods.

4.3 Performance evaluation and interpretation of results

A batch of culture medium performs satisfactorily if all the test microorganisms used perform according to the given specifications. It shall be accepted if both general and microbiological quality criteria are met.

5 Methods for use in performance testing of culture media

5.1 General

Examples of quantitative, semi-quantitative and qualitative testing methods for solid culture media and liquid media are described. In most cases in the user's laboratory semi-quantitative and qualitative techniques will meet the performance testing requirements of a batch of culture medium.

For special cases, e.g. evaluation of a new medium or a new manufacturer, etc., quantitative testing methods shall be performed by the user's laboratory.

Familiarity with general microbiological techniques is assumed and therefore the methods are not given in exhaustive detail.

Suitable test microorganisms are listed in Annex B (see also ENV ISO 11133-1).

NOTE It is the intention in the future, that new and revised individual standards for detection or enumeration of specific microorganisms or groups of microorganisms will describe the relevant test microorganisms to be used, together with the acceptance criteria for each culture medium in the standard.

In liquid media the interactions leading to the successful growth of microorganisms are more complex, hence defining performance testing methods is less straightforward than for solid media.

For the successful isolation of targeted microorganisms in a multistage method, for example detection of *Salmonella,* several complex interactions take place at each growth stage. Here a control test using appropriate samples, culture and reference materials should be set up, so that the productivity or the selectivity, respectively, of the whole method is demonstrated. This is in addition to demonstrating that each component medium is fit for purpose.

5.2 Test microorganisms

The appropriate reference strains of target (productivity) and non-target (selectivity) microorganisms for each culture medium are given in Annex B. The test microorganisms should meet the requirements given in 5.2.2 of ENV ISO 11133-1:2000, e.g. robust, weakly growing, biochemically unreactive or injured strains, as appropriate.

Guidance on the preservation and maintenance of reference strains is given in Annex B of ENV ISO 11133-1.

