



SLOVENSKI STANDARD
SIST EN 12728:2001

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Surface active agents - Determination of foaming power - Perforated disc beating method

Grenzflächenaktive Stoffe - Bestimmung des Schäumvermögens - Lochscheiben Schlagverfahren

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Agents de surface - Détermination du pouvoir moussant - Méthode par battage a l'aide d'un disque perforé

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 12728

November 1999

ICS 71.100.40

English version

Surface active agents - Determination of foaming power - Perforated disc beating method

Agents de surface - Détermination du pouvoir moussant -
Méthode par battage à l'aide d'un disque perforé

Grenzflächenaktive Stoffe - Bestimmung des
Schäumvermögens - Lochscheiben Schlagverfahren

This European Standard was approved by CEN on 17 September 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 276 "Surface active agents", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2000, and conflicting national standards shall be withdrawn at the latest by May 2000.

Annex B is normative.

Annexes A, C and D are informative.

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

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Introduction

In any assessment of surface active agents and formulations prepared from them, a knowledge of their foaming power can be an important factor; frequently, a particular level of foam formation should be demanded, whilst in other cases foam formation should be required to be minimal.

The special advantage of this beating method of foam determination is to yield comparable, parallel values for up to six solutions of surface active agents. In the same manner the stability/foam decomposition of this wet-foam, or its behaviour under stress, can be observed (water hardness, defoamer, fats etc). Serial trials can economically be carried out.

Usually, diluted solutions of 0,01 % (*m/m*) to 0,2 % (*m/m*) of the product under test are used, but low foaming agents can require contents of up to 1 % (*m/m*).

The interpretation and assessment of the foam character for practical use requires experience and sometimes use of other methods. Therefore, other methods exist, for example for fire extinguishing foam, dish washing liquids, shampoos etc., which are specifically adapted to the mechanical conditions of foam producing.

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1 Scope

This European Standard specifies a test method for the determination of foaming power of surface active agents diluted in water with different degree of calcium hardness and a content of surface active agent less than or equal to 1 % (*m/m*).

2 Normative references

This European Standard 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 European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 12829, *Surface active agents – Preparation of water with known calcium hardness (ISO 2174:1990 modified)*.

EN ISO 862, *Surface active agents – Vocabulary – Trilingual version (ISO 862: 1984/Cor. 1:1993)*.

EN ISO 3696, *Water for analytical laboratory use – Specification and test methods (ISO 3696:1987)*.

ISO 607, *Surface active agents and detergents – Methods of sample division*.

ISO 3585, *Borosilicate glass 3.3 – Properties*.

3 Term and definition

For the purposes of this European Standard, the following term and definition apply:

3.1

foam

a mass of gas cells separated by thin films of liquid and formed by the juxtaposition of bubbles, giving a dispersion in which a large proportion of gas by volume is dispersed in a liquid

[EN ISO 862]

NOTE These bubbles (foam) are produced by (fine) dispersion of, for example, air in water.

4 Principle

A foam is produced by beating 200 ml of solution in a glass cylinder, using a perforated disc attached to a marking punch. The volume of foam produced is measured immediately, and the stability is recorded after 1 min or 3 min but preferably after 5 min, or is plotted against time. The foaming is generally measured in distilled water and at different temperatures. A solution of sodium dodecyl sulfate in distilled water is used as a standard solution.

Chemical and physical parameters which influence foam production are the purity of the surface active agent and the concentration of active matter (sodium dodecyl sulfate).

The test is carried out using six glass cylinders in parallel or two glass cylinders in parallel. A manual method with one glass cylinder is only used as pre-determination because its test results are not reproducible.

5 Reagents

All reagents shall be of recognized analytical grade and the water used shall conform to grade 3 in accordance with EN ISO 3696.

5.1 **Water**, with known calcium hardness conforming to the requirements of EN 12829.

5.2 Sodium dodecyl sulfate, $C_{12}H_{25}OSO_3Na$, with a minimum purity of 99 % (by titration $M(C_{12}H_{25}OSO_3Na) = 288,4$ g/mol).

5.3 Sodium dodecyl sulfate stock solution, 1 % (*m/m*): Weigh into a beaker e. g. 10,0 g of sodium dodecyl sulfate (5.2) and dilute to 1 000 g with water.

5.4 Sodium dodecyl sulfate standard solution : Dilute the sodium dodecyl sulfate stock solution (5.3) to the appropriate concentration with water, e. g. 20,0 g of stock solution (5.3) with 980 g of water for a 0,02 % (*m/m*) standard solution.

6 Apparatus

6.1 Foam-beating apparatus, comprising glass cylinders made of borosilicate glass of suitable chemical and thermal properties, preferably borosilicate glass 3.3 conforming to the requirements of ISO 3585, with an internal diameter of $60 \text{ mm} \pm 1,5 \text{ mm}$ and a length of $450 \text{ mm} \pm 1 \text{ mm}$, with automatic operated pistons capable of operating at one stroke (down-and-up movement) per second to which perforated beating discs shall be fitted such that the lowest position of the discs is 5 mm from the bottom of the glass cylinders.

NOTE Examples of a floor mounted model with thermostat (for series test) and a portable table model without temperature control are shown in Annex A.

6.2 Perforated discs, made of a suitable synthetic material, e. g. acrylic glass, or of stainless steel, with a thickness of $5 \text{ mm} \pm 1 \text{ mm}$, a diameter of $55 \text{ mm} \pm 0,15 \text{ mm}$ and 40 perforations each of $3,5 \text{ mm} \pm 0,05 \text{ mm}$ diameter (see Annex B).

6.3 Cylinder with hand piston, only to be used for pre-determinations (manual method), with a length of $95 \text{ mm} \pm 0,3 \text{ mm}$, a thickness of $5 \text{ mm} \pm 0,05 \text{ mm}$, a length of stroke of $330 \text{ mm} \pm 1 \text{ mm}$. The lowest position of the perforated disc shall be 5 mm from the bottom (see Annex C).

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7 Sampling and preparation of test sample

A laboratory sample of the surface active agent to be tested shall be taken in accordance with ISO 607.

Use this laboratory sample to prepare aqueous test solutions, with e.g. hard water (5.1) and in such a concentration which shall be agreed upon between the parties.

If surface active agents which are sensitive to water hardness are tested, then precipitation of insoluble salts can occur. In this case, the solution shall be allowed to stand for 30 min before use.

8 Procedure

8.1 Calibration

Ensure that the glass cylinders are clean.

Fill the glass cylinders with 200 ml of sodium dodecyl sulfate standard solution (5.4) and place them in the foam-beating apparatus (6.1). Take care to prevent foam formation. Activate the apparatus and allow it to run for a complete cycle.

Immediately after completion of the beating cycle, read off the foam volume after 1 min, 3 min or 5 min.

NOTE 1 The level of the 200 ml solution in the cylinder is defined as the zero point for the lower limit of the height of the foam.

Carry out the calibration for one concentration or for a series of concentrations of sodium dodecyl sulfate standard solution (5.4) at 60 strokes within 60 s, i. e. 60 cycles in 1 min. Plot the foam curve for the sodium dodecyl sulfate (5.2) (see Annex D).

NOTE 2 The number of strokes per minute is important to reach a certain foam height.

NOTE 3 The calibration/foam measurement is usually carried out at 25 °C or, in the case of the two-cylinder apparatus, at room temperature without temperature control.

NOTE 4 The effectiveness of the foam development depends fundamentally on the flow conditions (turbulence) within the flow section (perforations of the disc and the annular gap at the cylinder wall).

NOTE 5 The annular gap between the circumference of the perforated discs and the inner circumference of the glass cylinders can vary within the glass cylinder tolerances. Usually, the diameter of the perforated discs is 55 mm and the width of the annular gap between disc and wall approximately 2,5 mm.

If the foam results obtained with one particular solution in the various test cylinders differ, they can be made more uniform by replacing the perforated discs. If the amount of foam formed is inadequate, a perforated disc of greater diameter is used. Conversely, a disc of smaller diameter is employed if the foam column is too high.

The perforated discs used to ensure uniformity in foam levels are available in two sizes smaller than the standard diameter of 55,0 mm, namely 54,5 mm and 54,0 mm, and in two larger sizes of 55,5 mm and 56,0 mm.

NOTE 6 Detailed construction plans can be placed at disposal¹⁾.

8.2 Determination

Repeat procedure given in 8.1 replacing the sodium dodecyl sulfate standard solution (5.4) with the test solution. Note the volume of foam in milliliters from the scale on the glass cylinder with reference to the 200 ml mark as the zero point (see 8.1) as soon as the beating ceases.

NOTE The tests are usually carried out at temperatures of $(25 \pm 2)^\circ\text{C}$ or $(40 \pm 2)^\circ\text{C}$, although any other measuring temperature, for example 10 °C to 70 °C, can be used by mutual agreement. Usually, the test is carried out with 60 strokes within 60 s.

In comparative tests, fill carefully one of the measuring cylinders with 200 ml of the sodium dodecyl sulfate standard solution (5.4) and the remaining glass cylinders with 200 ml of the test solution, care being taken in all cases to prevent foam formation.

Make sure that the solutions have the desired temperature before the tests are carried out.

9 Expression of results

Calculate the volume of foam, V_s , expressed as percent, using the following equation.

$$V_s = \frac{V_2}{V_1} \cdot 100$$

where

V_1 is the foam volume of the sodium dodecyl sulfate standard solution (5.4), in milliliters ;

V_2 is the foam volume of the test solution, in milliliters.

Report the result to the nearest 1 ml as the mean of ten determinations. Note any turbidity.

NOTE 1 The foam volume can be recorded immediately, after 1 min, 3 min or 5 min, or as a function of time.

NOTE 2 In a series of tests of different concentrations it can be useful to plot the results graphically.

1) Information on supply are given by Normenausschuß Materialprüfung (NMP) im DIN Deutsches Institut für Normung e. V., Burggrafenstraße 6, D-10787 Berlin.