BRITISH STANDARD

BS EN
12873-3:2006

Influence of materials on water intended for human consumption — Influence due to migration —

Part 3: Test method for ion exchange and adsorbent resins

The European Standard EN 12873-3:2006 has the status of a British Standard

ICS 13.060.20; 67.250

BSI
British Standards

National foreword

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The UK participation in its preparation was entrusted to Technical Committee EH/6, Effects of materials on water quality, which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 13 and a back cover.

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English Version

Influence of materials on water intended for human consumption - Influence due to migration - Part 3: Test method for ion exchange and adsorbent resins

Influence des matériaux sur l'eau destinée à la consommation humaine - Influence due à la migration - Partie 3 : Méthode d'essai des résines absorbantes et échangeuses d'ions

Einfluss von Materialien auf Wasser für den menschlichen Gebrauch - Einfluss infolge der Migration - Teil 3: Prüfverfahren für Ionenaustauscher und Adsorberharze

This European Standard was approved by CEN on 23 January 2006.

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Foreword

This document (EN 12873-3:2006) has been prepared by Technical Committee CEN/TC 164 “Water supply”, 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of an identical text or by endorsement, at the latest by September 2006, and conflicting national standards shall be withdrawn at the latest by September 2006.

This draft will result in one of a series of standards on test methods which support the appropriate standards.

It has been drawn up with the objective to describe a test method to determine the migration of substances from ion exchange and absorbent resins.

Evaluation of the efficiency of resins, in removing contaminants, is not included.

Annex A, provides a flow diagram of the steps in the test procedure.

Annex B, describes a test apparatus.

Annex C, provides information on resin pre-treatment.

This draft standard is the third in a series of standards dealing with the influence of migration from materials on water intended for human consumption, including:

— Part 1 Test method for non-metallic and non-cementitious factory made products;

— Part 2 Test method for non-metallic and non-cementitious site-applied materials;

— Part 3 Test method for ion exchange and adsorbent resins;

— Part 4 Test method for water treatment membranes.

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

Introduction

In respect of potential adverse effects on the quality of water intended for human consumption caused by materials, it is to be remembered that, while awaiting the adoption of verifiable European acceptance criteria, the relevant national regulations remain in force.

1 Scope

This European Standard specifies a procedure to determine the migration of substances from ion exchange and adsorbent resin materials for use in contact with water intended for human consumption.

Resins comprise synthetic organic macromolecular materials.

The standard is applicable to resins of the following types:

— Ion exchange resins: used to modify the composition of water (e.g. softening by removal of calcium ions). They can be in either an anionic or cationic state.

— Adsorbent resins: used to lower the concentration of undesirable substances (usually organic pollutants) from water. They are used in a neutral state.

2 Terms and definitions

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

2.1
test
technical operation that consists of the determination of one or more characteristics of a given product.

2.2
test procedure
specified technical method for performing a test

2.3
test report
document that presents test results and other information relevant to a test

2.4
testing laboratory
laboratory that performs tests

2.5
product
material, in its finished form that comes into contact with water

2.6
test sample
sample of a product submitted for testing

2.7
test water
water for migration testing (4.1)

2.8
blank water
test water (4.1) which has been kept at the same specified conditions as migration water (see clause 8) but without contact with the test sample.

2.9
migration
movement of a substance or substances from a test sample into the test water

2.10
bed volume
volume in litres of wet resin, tapped to a constant volume, used in the test

2.11
regeneration
part of the operating cycle of an ion-exchange resin process in which a specific chemical solution is passed through the resin bed to prepare it for a service run

2.12
exhaustion
process in which a specific chemical solution is passed through the regenerated ion exchange resin bed to exchange the ions in this solution for an equivalent amount of ions from the resin bed to simulate an accelerated service run

2.13
disinfection
procedure, normally using chemicals, such as sodium hypochlorite or peracetic acid, carried out on a resin to inactivate microorganisms

3 Principle

If relevant, at the beginning of the test, the test sample is subjected to pretreatment procedures according to the manufacturer's instructions.

The test sample is brought into contact with test water during a static/dynamic procedure carried out at (23 ± 2) °C.

Test water samples are collected for analysis after contact with the resin.

4 Reagents

4.1 General

Only reagents of analytical grade shall be used, except where specified otherwise. All reagents shall be of sufficient purity to ensure that they do not give rise to interferences during the analysis of the extracts.

NOTE Contamination can arise from various sources, e.g. plastics or rubber materials. The use of procedural blanks and laboratory blanks assists in detecting any contamination and identifying its source.

The test water shall be chlorine free water with a conductivity of < 20 µS/cm at 25 °C and a total organic content (TOC) of < 0,2 mg/l C, e.g. prepared by reverse osmosis, deionization or distillation, followed by activated carbon filtration.

4.2 Cleaning liquids for glassware

4.2.1 hydrochloric acid, concentrated (30 % mass per volume) analytical reagent grade.

4.2.2 hydrochloric acid solution, prepared by slowly adding (0,5 ± 0,01) l of concentrated hydrochloric acid (4.2.1) to (0,5 ± 0,01) l of test water (4.1).

NOTE Care is needed because the solution may generate heat.

4.2.3 nitric acid, concentrated (65 % mass per volume) analytical reagent grade.

4.2.4 nitric acid solution, prepared by slowly adding (0,5 ± 0,01) l of concentrated nitric acid (4.2.3) to (0,5 ± 0,01) l of test water (4.1).

NOTE Care is needed because the solution may generate heat.

5 Apparatus

5.1 Vessels, containers, stoppers and connections, consisting of a material, such as glass, PTFE or stainless steel, that is inert under the specified test conditions (see clause 8).

NOTE The material PTFE should only be used when there is a small contact area with the test water. Thus PTFE is unsuitable for containers

5.2 Test apparatus. An example testing arrangement is given in annex B.

5.3 Temperature control facility, such as a temperature-controlled laboratory, capable of maintaining the test apparatus at (23 ± 2) °C.

5.4 Laboratory glassware, cleaned by washing with a biodegradable laboratory detergent, followed by rinsing with either hydrochloric acid solution (4.2.2) or nitric acid solution (4.2.4) and finally by thoroughly rinsing with test water (4.1).

6 Test samples

A representative sample of the resin shall be taken and treated according to manufacturer's instructions.

7 Pretreatment of test samples

Exhaustion/regeneration of wet resins, if relevant, shall be carried out according to manufacturers instructions (see annex C).

Do not carry out any regeneration procedure in the test apparatus.

8 Test procedure

8.1 General

The temperature shall be maintained at (23 ± 2) °C throughout.

NOTE 1 The actual number of leachate samples to be taken, their analysis and assessment will be specified in national or other regulations.

NOTE 2 Whether single or multiple testing is to be carried out on a product will be specified in national or other regulations. The method assumes single testing.

8.2 Preparation of leachate sample

8.2.1 Measure (500 ± 5) ml of tapped resin (see 2.10), after any pretreatment if relevant, and add slowly to the glass column containing test water (see annex B) ensuring that the test water level does not fall below the level of the bed of resin. Ensure that there are no air spaces in the bed. Connect to the test water vessel (see annex B) and pass (20 ± 0,5) bed volumes of test water through the column at a rate of (10 ± 1) bed volumes per hour.

NOTE Resins are normally supplied wet. If not then the resins should be added to the column as a slurry in test water in order to overcome problems of wetting and air entrainment.

8.2.2 Leave to stand for 24 h in the absence of light with the test water level (20 ± 5) mm above the top of the bed of resin.

8.2.3 Start the flow of test water through the column at a rate of (5 ± 0,5) bed volumes per hour. Pass and collect the first 3 bed volumes (water sample T_1).

8.2.4 Leave to stand for 24 h in the absence of light with the test water level (20 ± 5) mm above the top of the bed of resin.

8.2.5 Start the flow of test water through the column at a rate of (5 ± 0,5) bed volumes per hour. Pass and collect the first 3 bed volumes (water sample T_2).

8.2.6 Leave to stand for 24 hours in the absence of light with the test water level (20 ± 5) mm above the top of the bed of resin.

8.2.7 Start the flow of test water through the column at a rate of (5 ± 0,5) bed volumes per hour. Pass and collect the first 3 bed volumes (water sample T_3).

To prevent air getting into the bed ensure that the test water level does not fall below 20 mm above the bed during the flow of test water.

8.3 Procedural blanks

Prior to adding the resin, add test water (500 ± 5) ml to the test apparatus.

Carry out step 8.2.1 with no resin. Collect the 24 h stored test water (sample B).

8.4 Analysis

The analyses to be carried out on the samples will be specified in the relevant regulations.

9 Calculation of test results

Determine the concentration of analyte C_1, C_2 and C_3 mg/l in samples T_1, T_2, and T_3 respectively. Determine the concentration of analyte in the blank, B mg/l, and subtracted from C_1, C_2 and C_3 to give C^*_1, C^*_2 and C^*_3 mg/l respectively, where C^* is the blank-corrected concentration of analyte.

Convert the concentrations C^*_1, C^*_2 and C^*_3 to R_1, R_2 and R_3 mg/l wet resin respectively using the following equation:

$$R = \frac{V \times C^*}{V^*}$$

where

R is the concentration of analyte expressed as mg/l of wet resin.

C^* is the blank-corrected concentration of analyte in mg/l of collected test water.

V is the volume of water collected in litres.

V^* is the resin bed volume in litres.

10 Test report

The dated test report shall include the following information:

a) general information
   1) name and address of test laboratory and location where the test was carried out when different from the address of the testing laboratory;
   2) unique identification of report (such as serial number) and of each page, and total number of pages of the report;
   3) name and address of client;
   4) description and identification of the test item;
   5) proposed use of the product;
   6) signature and title or an equivalent marking of person(s) accepting technical responsibility for the test report and date of issue;
   7) statement to the effect that the test results relate only to the items tested;
   8) statement that the report shall not be reproduced except in full without the written approval of the testing laboratory;

b) information on the test material
   1) trade name or designation of manufactured material;
   2) complete identification and date of receipt of test item and date of performance of test;
   3) details of the test sample preparation;
   4) name of the manufacturer of the product;
   5) batch number and date of manufacture;
   6) organisation submitting the product;
   7) description of sampling procedure;

c) information on the test samples:
   1) date and time of receipt of the test samples by the test laboratory;
   2) sample description (including particle size);
   3) date and time of the start of testing;

d) information on the test procedure
   1) reference to this standard and (if applicable) to the referring standard or national regulation;
   2) regeneration procedure (if applicable);
   3) disinfection procedure (if applicable);
   4) preparation of test waters;
   5) any deviation from the test procedure specified in this standard;
   6) any factors which may have affected the results, such as any incidents or any operating details not specified in this standard;
   7) dates of start and completion of the test;

e) test results C_1, C_2, C_3, C^*_1, C^*_2, C^*_3, R_1, R_2, R_3 and B, preferably in tabular form.

Annex A
(informative)

Flow diagram

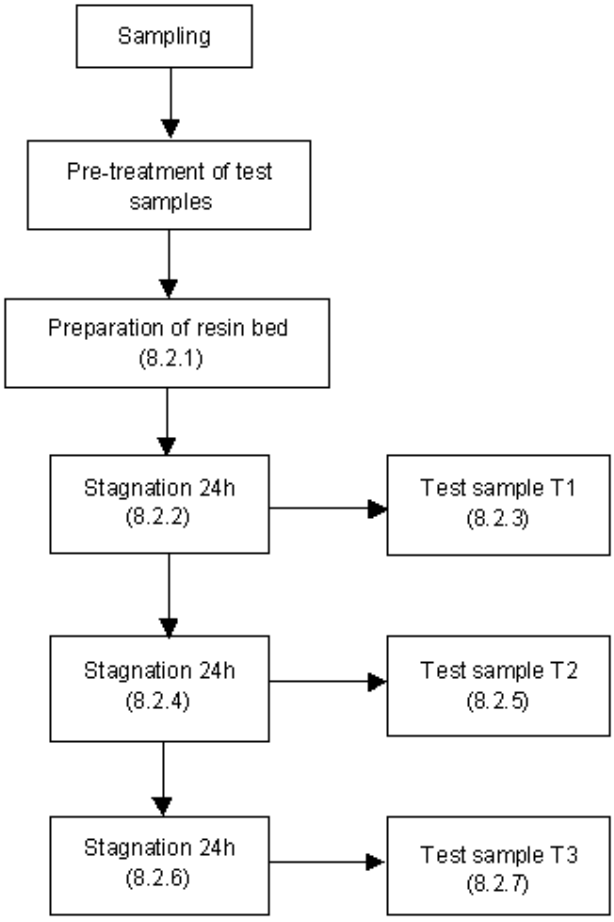
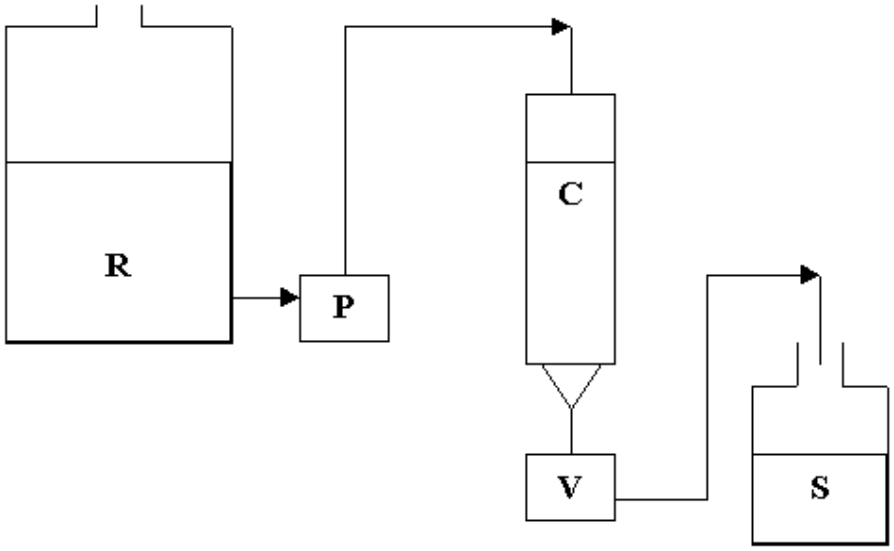


Figure A.1

Annex B
(informative)

Test apparatus



Key

R Reservoir: capacity at least 10 l. Borosilicate glass. Fitted with air inlet to prevent ingress of contamination of test water.
P Pump: preferably peristaltic type, capable of maintaining required test water flow.
C Column: borosilicate glass. Typical diameter 50 mm and height 400 mm fitted with porous glass frit (porosity 160 µm to 250 µm. Marked to indicate level of required volume of resin.
V On/off and drain valve
S Sampling vessel. 1500 ml capacity.

Figure B.1

All materials in contact with test water and resin (tubing, fittings, pump, column etc) shall not lead to significant contamination (see 5 and 8.3).

Annex C
(informative)

Resin pre-treatment

Depending on the resin type and its intended application, pre-treatment procedures can involve merely washing with a specified volume of water and/or a specified number of exhaustion and regeneration cycles. In certain special situations, it may be necessary to include a disinfection procedure.

The exhaustion and regeneration procedures normally simulate the process used in the life cycle of the resin. It is regarded as 'good manufacturing practice' to adopt these procedures in the installation of a resin for food or potable water applications, since extractables can develop in resins with storage and resin storage times are unpredictable.

Disinfection of the resin is not normally required on a new installation, particularly if the above cycling is carried out, since this in itself will kill any bacteria. However, if such a procedure is required, the normal disinfectants are peracetic acid (0,2 % mass-per-mass), formaldehyde (0,5 % mass-per-mass) or sodium hypochlorite (1 % mass-per-mass available chlorine). Peracetic acid is the preferred reagent since it has a minimal effect on the ion exchange properties of the resin.

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