

Tests for chemical properties of aggregates —

Part 3: Preparation of eluates by leaching of aggregates

The European Standard EN 1744-3:2002 has the status of a
British Standard

ICS 91.100.15

National foreword

This British Standard is the official English language version of EN 1744-3:2002, which is included in a package of new European Standards being prepared by CEN/TC 154 relating to aggregates. Although the English text versions of these European Standards will be adopted as British Standards as they become available, the existing British Standards for aggregates will be retained, but only until such a time that the completed package of European Standards becomes available. The original group of British Standards will then be withdrawn and this will be noted in *BSI Standards Update*.

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- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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English version

Tests for chemical properties of aggregates - Part 3: Preparation of eluates by leaching of aggregates

Essais pour déterminer les propriétés chimiques des granulats - Partie 3: Préparation d'éluats par lixiviation des granulats

Prüfverfahren für chemische Eigenschaften von Gesteinskörnungen - Teil 3: Herstellung von Eluaten durch Auslaugung von Gesteinskörnungen

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Foreword

This document EN 1744-3:2002 has been prepared by Technical Committee CEN/TC 154 "Aggregates", the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by January 2003, and conflicting national standards shall be withdrawn at the latest by January 2003.

This standard forms part of a series of tests for chemical properties of aggregates. Test methods for other properties of aggregates will be covered by Parts of the following European Standards:

EN 932	Tests for general properties of aggregates
EN 933	Tests for geometrical properties of aggregates
EN 1097	Tests for mechanical and physical properties of aggregates
EN 1367	Tests for thermal and weathering properties of aggregates
EN 13179	Tests for filler aggregate used in bituminous mixtures

The other parts of EN 1744 are, or will be:

- Part 1: Chemical analysis
- Part 2: Determination of resistance to alkali reaction
- Part 4: Water susceptibility of fillers for bituminous mixtures

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies a method for the preparation of eluates, by leaching of aggregates, for subsequent investigation of physical and chemical properties by existing standard methods for the purpose of compliance testing. It applies to unbound aggregates that have a particle size below 32 mm with or without size reduction (see clause 8).

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 (including amendments).

EN 932-1, *Tests for general properties of aggregates — Part 1: Methods for sampling.*

EN 932-2, *Tests for general properties of aggregates — Part 2: Methods for reducing laboratory samples.*

EN 932-5, *Tests for general properties of aggregates — Part 5: Common equipment and calibration.*

EN 933-2, *Tests for geometrical properties of aggregates — Part 2: Determination of particle size distribution — Test sieves, nominal size of apertures.*

EN 1097-5, *Tests for mechanical and physical properties of aggregates — Part 5: Determination of the water content by drying in a ventilated oven.*

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

3 Terms and definitions

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

3.1

leachant

liquid used in a laboratory leaching procedure

3.2

eluate

solution remaining after the laboratory leaching procedure of a solid material in contact with a leachant

3.3

constant mass

successive weighings after drying at least 1 h apart not differing by more than 0,1 %.

NOTE In many cases constant mass can be achieved after a test portion has been dried for a pre-determined period in a specified oven at (110 ± 5) °C. Test laboratories can determine the time required to achieve constant mass for specific types and sizes of sample dependent upon the drying capacity of the oven used.

3.4

laboratory sample

sample intended for laboratory testing

3.5

test portion

sample used as a whole in a single test

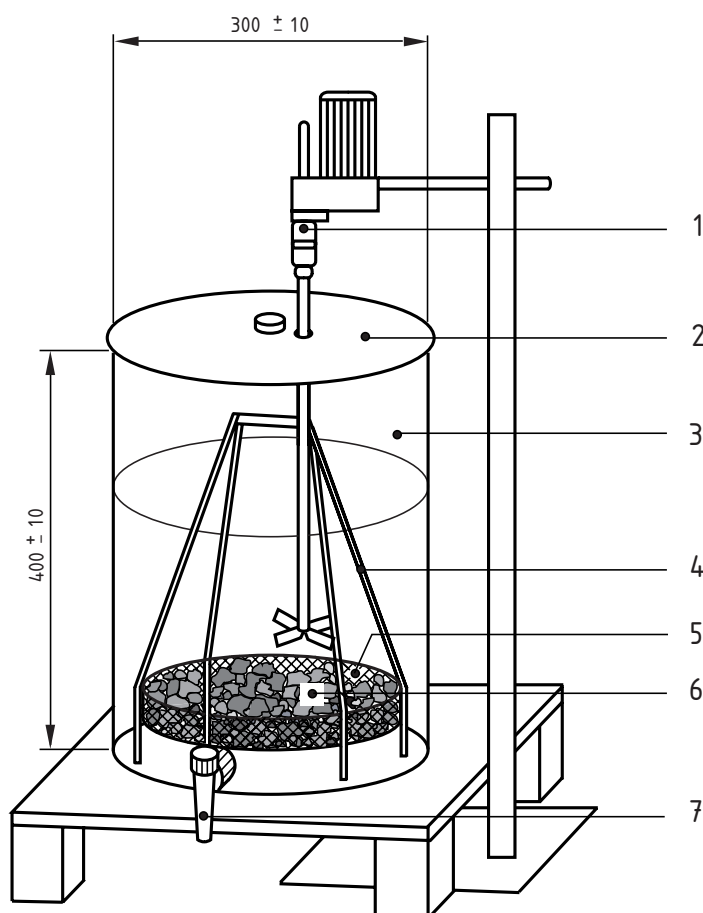
4 Principle

The aggregate to be examined is placed on a screen insert and leached in a tank (see Figure 1). The liquid solid ratio is 10:1 (in mass proportion) and the leaching time is 24 h. The water is agitated by a motor driven dip stirrer.

NOTE During the test procedure the leachant is agitated but the solid material is not.

The method is based on the assumption that equilibrium or near-equilibrium is achieved between the liquid and solid phases during the test period. The solid residue is drawn off. The properties of the eluate are measured using methods developed for water analysis adapted to analysis of eluates.

Dimensions in millimetres



NOTE Drawing not to scale.

Key

- 1 Motor driven dip stirrer
- 2 Cover
- 3 Tank
- 4 Screen support
- 5 Screen insert (mesh size 2 mm)
- 6 Test portion
- 7 Stop cock

Figure 1 — Example of tank with screen support

5 Reagents

5.1 Distilled water, demineralized water, deionized water or water of an equivalent purity ($5 < \text{pH} < 7,5$) with a conductivity less than 0,5 mS/m conforming to grade 3 of EN ISO 3696.

5.2 0,1 mol/l nitric acid, analytical grade.

6 Apparatus

6.1 All apparatus, unless otherwise stated, shall conform to the general requirements of EN 932-5.

6.2 Balance, capable of weighing 2 kg with an accuracy of 0,1 g.

6.3 Thermometer, range 0 °C to 50 °C and accurate to 1 °C for air and leachant temperature measurement.

6.4 Centrifuge, operating at 3 000 m/s² to 4 000 m/s².

6.5 pH meter, readable to 0,1 pH units.

6.6 Electrical conductivity meter.

6.7 Filtering apparatus, either a vacuum filtering device (between 2,5 Pa to 4,0 Pa) or a high pressure filtration apparatus (< 500 kPa), capable of rinsing.

6.8 Pre-rinsed 0,45 µm membrane filters, for filtration (rinsed with nitric acid, 0,1 mol/l (5.2) and water (5.1)).

6.9 Tank for leaching. A one piece glass tank of external dimensions, height (400 ± 10) mm and diameter (300 ± 10) mm, with the following:

- a) cover;
- b) screen support, made of PTFE or glass (or stainless steel for the determination of organic parameters only or polypropylene for the determination of inorganic parameters only) with a screen mesh size 2 mm, dimensions of height (50 ± 10) mm and diameter such that the support is (20 ± 2) mm from the edge of the tank. The distance between the base of the screen and the base of the tank should be (50 ± 5) mm. For lightweight aggregates, the test portion shall be covered by a second screen;
- c) motor driven dip stirrer with a stirring rod and propeller [diameter (60 ± 10) mm] made of PTFE or PTFE-covered material that is inserted through a small hole in the cover of the tank.

6.10 Crushing equipment, jaw crusher or a cutting device, for particles retained on the 32 mm sieve.

6.11 Sieves, of nominal sizes 16 mm and 32 mm conforming to EN 933-2, for sieving recrushed or cut particles.

7 Sampling

Sampling shall be carried out in accordance with EN 932-1.

8 Preparation of test portions

Aggregates shall be tested in the particle size distribution in which they are normally delivered. Particles retained on the 32 mm sieve shall be crushed and the fraction 16/32 mm sieved out. This material is returned to the sample under preparation in the percentage in which the fraction larger than 32 mm was present in the original sample.

If the sample is wet it shall be air dried at room temperature ($< 40\text{ }^{\circ}\text{C}$) to constant mass to allow dividing and screening. The water content of the sample used for leaching shall be determined on a parallel sample by drying at $110\text{ }^{\circ}\text{C}$ in accordance with EN 1097-5.

Reduce the size of the laboratory sample in accordance with the procedures specified in EN 932-2 to give a test portion with a mass of about 2 kg and weigh the test portion to the nearest 0,1 g. For lightweight aggregates, the mass of the test portion shall be reduced in proportion to the density of the aggregate. It may also be necessary to increase the liquid/solid ratio in 9.2 in order that a lightweight aggregate test portion is covered with water.

NOTE 1 Contamination of the sample can occur to an extent, which affects the leaching of some constituents of concern, for example from tungsten carbide equipment or stainless steel apparatus. Care should be taken to ensure that such contamination of samples is minimised.

NOTE 2 In the case of lightweight aggregates with a bulk density less than 200 kg/m^3 ($0,2\text{ Mg/m}^3$), the mass of the sample should be reduced to 500 g.

9 Procedure

9.1 Testing conditions

The leaching shall be carried out at room temperature ($20\text{ }^{\circ}\text{C}$ to $25\text{ }^{\circ}\text{C}$)

9.2 Test procedure

After filling the tank with a mass of leachant equal to 10 times the dry mass of the test portion, place the appropriate screen into the tank in such a way that it is completely covered with water. Slowly distribute the test portion, which is to undergo leaching, uniformly over the screen so that as much air as possible is removed from the test portion. When the test portion is arranged on the screen, the water cover shall be at least at 20 mm. Then lower the screen support to the bottom of the tank. Place the screen insert in the leaching tank in such a way that a uniform distance from the walls of the vessel is maintained.

Cover the leaching tank. Insert the motor-driven dip stirrer through the small hole in the cover of the tank and fix it in such a way that the propeller is closely above the test portion. Set the motor-driven dip stirrer to a rotational speed of $(500 \pm 20)\text{ min}^{-1}$. After $24\text{ h} \pm 10\text{ min}$ switch off the stirrer and draw off the required quantity of eluate, as specified in 9.3, for analysis.

NOTE In the case of lightweight aggregates with a bulk density less than 200 kg/m^3 ($0,2\text{ Mg/m}^3$), the amount of leachant should be equal to forty times the dry mass of the sample.

9.3 Further preparation of the eluate for analysis

Immediately after the test, allow the coarse particles suspended in the leachant to settle for 10 min and then draw off the eluate from the tank.

If inorganic parameters together with the pH value and electrical conductivity are to be determined, filter the eluate through a membrane filter of pore size $0,45\text{ }\mu\text{m}$.

If organic parameters are to be determined (e.g. phenol index), centrifuge the liquid. Care shall be taken to ensure that the material of the centrifuge does not influence the results of the analysis.

During the centrifuging operation, remove the suspended particulate matter from the eluate for 10 min at a relative centrifugal acceleration of $3\ 500\text{ m/s}^2$.

NOTE The filtrate or centrifugate should be analysed immediately. If this is not possible, it should be preserved.

10 Test report

The test report shall include the following information:

- a) reference to this European Standard;
- b) source of the sample;
- c) method of preparation;
- d) aggregate grading;
- e) mass of dry sample tested, in grams;
- f) pH value and electrical conductivity of the eluate;
- g) type of tank used for the test;
- h) observations/remarks on carrying out the test (e.g. gas evolution, sample dilutions applied, unavoidable deviations from the specification);
- i) date of the test.

Bibliography

EN 933-1, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method.*

EN 27888, *Water Quality — Determination of electrical conductivity (ISO 7888:1985).*

ISO 5667-3, *Water Quality — Sampling — Part 3: Guidance on the preservation and handling of samples.*

ISO 10523, *Water Quality — Determination of pH.*

ISO 11464, *Soil Quality — Pre-treatment of samples for physico-chemical analysis.*

ISO 11465, *Soil Quality — Determination of dry matter and water content on a mass basis — Gravimetric method.*

ISO/TR 13530, *Water Quality — Guide to analytical quality control for water analysis.*

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