

Testing aggregates —

Part 118: Methods for determination of sulphate content

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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Definitions	1
3 Principle	1
4 Sampling	1
5 Determination of the sulphate content of a 2 : 1 water/aggregate extract	1
6 Determination of the total sulphate content by acid extraction	5
7 Precision	7
8 Test report	7
Appendix A Semi-quantitative test for the presence of sulphate ions	8
Appendix B Details of experiments for determining precision of tests for water-soluble sulphate and total sulphate contents of aggregates	8
Figure 1 — Ion-exchange column for water-soluble sulphates	3
Table 1 — Minimum mass of preliminary sub-sample for water-soluble sulphate method	4
Table 2 — Minimum mass of preliminary sub-sample for total sulphate content method	6
Table 3 — Precision data, water-soluble sulphate determination	9
Table 4 — Precision data, total sulphate determination	9
Table 5 — Results excluded from calculation of precision data in Table 3	10
Table 6 — Results excluded from calculation of precision data in Table 4	10
Publications referred to	Inside back cover

Foreword

This Part of BS 812 has been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee. In the revision of BS 812-2:1975, BS 812-3:1975 and BS 812-4:1976 each test, or collection of related tests, is being revised separately and is being issued as a separate Part or Section of BS 812.

This Part of BS 812 contains methods for determination of total sulphate content and water-soluble sulphate content of aggregates, neither of which was previously included in BS 812, but are included now because of the problems that may arise if aggregates containing high concentrations of sulphates are used in concrete or placed close to concrete structures.

It is intended that other British Standards should call up BS 812 test methods as the basis of compliance. Nevertheless it is *not* intended that aggregates should be subjected regularly to all the listed tests. Specifications in other standards, should call up only relevant test methods.

Advice on the use of simpler qualitative tests is given for a preliminary sorting of aggregates to see whether more precise and expensive testing is justified.

Reference should be made to BS 812-101 for general guidance on testing aggregates, precision of test methods and variance arising from sampling errors.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of BS 812 describes two methods for determining the sulphate content of aggregates.

The first method determines the water-soluble sulphate content of aggregates, which applies to natural and synthetic aggregates to be used as drainage materials or for fill or hard core, e.g. unbound roadbases or sub-bases or foundations.

The second method determines the total sulphate content of aggregates, which applies to aggregates used in concrete and cement bound materials.

NOTE 1 The second method for the determination of total sulphate by acid extraction is specified as it is impractical to produce a method for the determination of total water-soluble sulphate because of low water solubility of calcium sulphate. For practical purposes for aggregates in concrete the total sulphate content determined by this method is taken to be the same as the total water-soluble sulphate content.

NOTE 2 In Appendix A two procedures for a semi-quantitative test are described. It is strongly recommended that one of these is used as a preliminary check before resorting to the test described in the main text, which may be needed for compliance with a specification.

NOTE 3 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 812, the definitions given in BS 812-101 and BS 812-102 apply.

3 Principle

3.1 Method for water-soluble sulphates

An aggregate sample is extracted with twice its own mass of distilled or demineralized water to remove water-soluble sulphate ions. The water-soluble sulphate content is determined by either an ion-exchange method or a gravimetric method in one of the following ways.

- a) Some of the extract is transferred to an ion-exchange column and the eluate is titrated with standardized sodium hydroxide solution.
- b) Some of the extract is treated with diluted hydrochloric acid. Barium chloride solution is added and the precipitate is collected, dried and weighed.

The ion-exchange method measures the presence of sulphate ions. When other anions (see note) are present this method is precluded. The gravimetric method is applicable when aggregates containing sulphides (i.e. slags) are being analysed.

NOTE Anions of strong acids, e.g. chlorides, nitrates and phosphates, interfere with the ion-exchange method and are apparently measured as sulphate. However, when chloride is the only other ion present, and it has been quantitatively determined, the ion-exchange method described can be used provided the result is corrected as shown in 5.6.2.

3.2 Method for total sulphate content

The sulphates are extracted from a crushed sample of aggregate by dilute hydrochloric acid. Barium chloride solution is added to the extract. The precipitate of barium sulphate is collected, dried and weighed and the total sulphate content is calculated.

4 Sampling

The sample to be used for the test (the laboratory sample) shall be taken in accordance with the procedure described in clause 5 of BS 812-102:1984.

Ensure that the sample is representative of the moisture content as well as the solids by preventing loss of moisture, except through evaporation, throughout the sampling procedure and at any subsequent stage up to the point of test.

NOTE This is necessary because where the aggregate to be tested carries surface water the sulphates will normally be dissolved, at least partly, in both this and the absorbed water and hence the sulphate content will be affected by migration of water through the bulk materials.

5 Determination of the sulphate content of a 2 : 1 water/aggregate extract

NOTE Calcium sulphate is relatively harmless because of its limited solubility and the extraction conditions have been chosen so that aggregates containing only calcium sulphate are classified as falling in class 1 of Table 6.1 in BS 8110-1:1985.

5.1 Apparatus

5.1.1 Apparatus for preparation of test portion and extraction of the sulphate (see 5.4 and 5.5.1)

5.1.1.1 Well ventilated oven, capable of being controlled to maintain a temperature of 105 ± 5 °C.

5.1.1.2 Balance, capable of weighing up to 5 kg accurate to 5 g. The balance shall be regularly calibrated as specified in BS 5781-1.

5.1.1.3 Test sieve, 20 mm square hole perforated plate complying with BS 410.

5.1.1.4 Pestle and mortar, or suitable mechanical crusher.

NOTE This is not required for aggregate all passing the 20 mm sieve.

5.1.1.5 Two plastics or metal bottles, wide-mouthed, screw-capped. The bottles shall be 5 L capacity when testing coarse aggregates or 2 L when testing fine aggregate.

5.1.1.6 Mechanical shakers or rollers, to take the extraction bottles (5.1.1.5).