

CRD-C 148-69

**METHOD OF TESTING STONE FOR EXPANSIVE BREAKDOWN
ON SOAKING IN ETHYLENE GLYCOL**

1. Scope

1.1 This method covers a procedure for subjecting samples of stone to immersion in ethylene glycol and observation of the effects of such immersion.

2. Principle of Method

2.1 Ethylene glycol is one of the materials that reacts with swelling clays of the montmorillonite group to form an organo-clay complex having a larger basal spacing than that of the clay mineral itself. Hence a sample of stone containing swelling clay of the montmorillonite group will be expected to undergo expansive breakdown upon soaking in ethylene glycol, if the amount, distribution, state of expansion, and ability to take up glycol is such as to cause such breakdown to occur. If such breakdown does occur, it may be expected that similar breakdown may occur if similar rock samples are exposed, for longer times, to wetting and drying or freezing and thawing in a water-soaked condition in service.

3. Reagent

3.1 Ethylene Glycol.- The reagent used in this method shall be ethylene glycol meeting requirements of ASTM Designation: D 2693 of the issue in effect at the time the testing is arranged for (Note 1).

Note 1.- As mentioned in Section 2.1, ethylene glycol is one of the materials that form organo-clay complexes. Another such material is glycerol. Glycerol has a higher viscosity and hence a longer time is required for it to penetrate a susceptible sample of stone and produce equivalent expansive breakdown. However, for research purposes, glycerol or other reagents may be used.

4. Apparatus

4.1 Container.- A container, of glass or suitable plastic, nonreactive with the reagent, of sufficient size to hold the test sample and sufficient reagent to cover all particles of the sample to a depth of not less than 1/2 in. (1 cm, approximately), and with a tight-fitting cover, shall be provided for use in this test.

4.2 Balance or Scales.- A balance or scales having a capacity adequate for weighing the test sample to an accuracy of at least 0.1 percent of the weight of the sample.

4.3 Drying Oven.- An oven as described in CRD-C 115, of the air-circulating type, and of sufficient capacity for containing the sample.

5. Samples

5.1 Samples for use in this test should weigh 11 ± 1 lb (5 ± 2 kg, approximately) and should include no particles that will be retained on a 3-in. (76.1-mm) or will pass a 3/4-in. (19.0-mm) sieve (Note 2).

Note 2.- Since, as noted in Section 2.1, this method is based on the reaction of ethylene glycol with clay minerals of the montmorillonite group, it is highly desirable that information on the type, amount, distribution, and state of expansion of such clay minerals in the material of which the sample is composed be known. Information on the physical state, structure, and texture of the material is also important. Such data can be developed using procedures of the sort cited in CRD-C 127.

6. Preparation of Samples

6.1 Samples will be prepared by sieving, crushing, or breaking; or by combinations of these processes as required to meet the requirements of Section 5. When a sample of the stipulated weight and particle size has been prepared, it shall be washed in distilled water to remove dust, loosely adherent coatings, and chips. After being washed, it shall be weighed to at least 0.1 percent of its weight, and then dried in the drying oven to constant weight. Constant weight shall be regarded as having been attained when the loss in weight between successive weighings at intervals of not less than 4 hr does not exceed 0.1 percent of the later weight. The dry weight shall be recorded, and the sample should preferably be photographed (Note 3).

Note 3.- Under certain conditions, it may be desirable to begin the testing of the sample in a moisture condition other than that obtained by drying to constant weight. In such cases, either the washing or the drying, or both procedures, as described in Section 6.1, may be omitted. When only qualitative observation of the effects of the treatment are desired, the weighing of the sample may be omitted. When a greater degree of quantitative evaluation is desired, the sample, after having been prepared as described in Section 6.1, shall be sieved using the 3-, 2-1/2-, 2-, 1-1/2-, 1-, and 3/4-in. (76.1-, 64.0-, 50.8-, 38.1-, 25.4-, and 19.0 mm) sieves and the individual sieve fractions tested separately.

7. Procedure

7.1 A sample shall be placed in the container

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and immersed in the reagent so that all particles are covered to a depth of at least 1/2 in. (1 cm, approximately).

7.2 At intervals not to exceed 3 days, the sample shall be removed from the container, examined, changes noted, and, if significant changes have taken place, preferably photographed. The normal duration of the test shall be 15 days (Note 4).

Note 4.- Further information of value may be obtained in certain cases by continuing the treatment beyond 15 days; in other cases expansive breakdown may have been so extensive at earlier periods that no information of value will be obtained by continuing the treatment for the full 15 days.

7.3 When the exposure has been terminated, and the sample has been photographed, if desired, the sample shall be thoroughly washed over a 3/4-in. (19.0-mm) sieve to remove the reagent from the surfaces of the particles and to remove fragments that will pass a 3/4-in. (19.0-mm) sieve. The material remaining on the sieve shall be dried to constant weight as

described in Section 6.1 and weighed (Note 5).

Note 5.- If the procedure of drying was not used in specimen preparation, it should not be used after the test. If the sample was sieved and tested in sieve fractions, each fraction should be washed over the sieve retained on before test.

8. Report

8.1 The report of the results of this test shall include the following:

8.1.1 Identification and description of the source of material including information developed as suggested in Note 2.

8.1.2 Qualitative and, if obtained, quantitative data on the effect of the treatment on the sample developed as described in Section 7.

9. Results and Interpretation

9.1 The results of this test and the interpretation thereof shall be as described in the applicable portions of Sections 7 and 8 of CRD-C 144.