



Designation: D8106 – 17

Standard Test Methods for Determining the Oil Sorption Capacity of Organophilic Clay¹

This standard is issued under the fixed designation D8106; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This standard covers two test methods (Method A for granular material, Method B for powdered material) that can be used as an index test for the evaluation of the oil sorption capacity of a representative sample of organophilic clay. The test method is not intended to be a performance test and the oil specified in the test methods may yield different results than other non-aqueous phase liquids (for example, coal tar, creosote, crude oil) encountered in the field. Method A should only be used on granular organophilic clay; otherwise finer particles may pass through the test sieve.

1.2 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice [D6026](#).

1.2.1 The procedures used to specify how data are collected/recorded or calculated in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of the reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analysis methods for engineering design.

1.3 *Units*—The values stated in SI units are to be regarded as the primary units for the standard. For information only, non-SI units of measurement are also included in this standard to describe some equipment (bucket, sieve).

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the*

Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 *ASTM Standards:*²

[D653 Terminology Relating to Soil, Rock, and Contained Fluids](#)

[D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction](#)

[D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing](#)

[D6026 Practice for Using Significant Digits in Geotechnical Data](#)

[D6913 Test Methods for Particle-Size Distribution \(Gradation\) of Soils Using Sieve Analysis](#)

[E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves](#)

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of common technical terms in this standard, refer to Terminology [D653](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *granular organophilic clay, n*—a manufactured oleophilic material consisting of base clay to which an organic compound has been chemically bonded to the clay surface with at least 95 % material, by dry mass, retained on a 210 μm (No. 70) sieve in accordance with [D6913](#).

3.2.2 *powdered organophilic clay, n*—a manufactured oleophilic material consisting of base clay to which an organic compound has been chemically bonded to the clay surface with at least 65 % material, by dry mass, passing a 75 μm (No. 200) sieve.

¹ This test method is under the jurisdiction of ASTM Committee [D18](#) on Soil and Rock and is the direct responsibility of Subcommittee [D18.21.07](#) on Groundwater and Vadose Zone Remediation Technologies.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Summary of Test Method

4.1 In Method A, a granular organophilic clay is mixed with a specified classification of commercial oil and then gravity drained for a period of time to determine the oil sorption capacity.

4.2 In Method B, a powdered organophilic clay is mixed with a specific classification of commercial oil and then centrifuged to determine the oil sorption capacity.

5. Significance and Use

5.1 This standard test method is intended as an index test to determine the relative oil sorption capacity of an organophilic clay. Organophilic clay is used for remediation of contaminated sediment, soil, and groundwater. Results of this standard test method can be used for *a*) evaluating whether product meets a manufacturing quality control specification, and *b*) evaluating acceptance of a product per a construction quality assurance material specification. The organophilic clay specified may be either granular or powder. There are two test methods; a gravity test method for granular specimens and a centrifuge test method for powdered specimens.

NOTE 1—The quality of the result produced by this standard is dependent on the competence of the personnel performing it, and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice **D3740** are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice **D3740** does not in itself assure reliable results. Reliable results depend on many factors; Practice **D3740** provides a means of evaluating some of those factors.

6. Interferences

6.1 Motor oil with polymer or detergent additives (for example, 10W30, API SN) may alter the interaction of the oil and the organophilic clay. This can result in different test result values than the prescribed single-grade motor oil, SAE 30/API SA. Upon request by client, a motor oil with additives may be used, but the motor oil must be identified in the report.

7. Apparatus

7.1 *Balance*—A balance conforming to **D4753** with a minimum 1-kg capacity.

7.2 *Graduated Cylinder*—A 500-mL glass graduated cylinder.

7.3 *Beaker*—A 600-mL glass beaker.

7.4 *Spatula*—A metal spatula.

7.5 *Plastic Bucket*—A 8-L (2-gal) open top plastic bucket.

7.6 *Sieve*—A 0.21-mm (No. 70 mesh) sieve conforming to **E11** large enough to cover the open top of the 8-L plastic bucket.

7.7 *Centrifuge*—A centrifuge of such a size and so driven that a relative centrifugal force (RCF) equal to 3000 times the force of gravity may be exerted on the center of gravity of the specimen for 1 h. The centrifuge chamber shall be capable of maintaining a controlled temperature of $20 \pm 1^\circ\text{C}$. The centrifuge shall be such that the test tubes can be mounted and articulate (swing) during the applied force.

7.8 *Centrifuge Test Container*—Minimum 50-mL test containers that fit into the centrifuge.

8. Reagents and Materials

8.1 Oil, conforming to the specification of SAE 30 viscosity classification and American Petroleum Institute (API) SA service category. Alternatively, mineral oil conforming to USP with ISO 100 grade viscosity.

NOTE 2—SAE J300 Standard, SAE International, Warrendale, PA, www.sae.org. API Oil Categories, American Petroleum Institute, Washington, D.C., www.api.org. United States Pharmacopoeia and National Formulary, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD, www.ups.org.

9. Hazards

9.1 Appropriate eye and hand protection is recommended for direct work with the oil and apparatus.

10. Sampling

10.1 Obtain a minimum 500-mL representative sample of organophilic clay.

11. Conditioning

11.1 Allow the oil and organophilic clay to equilibrate to test temperature of 20°C ($\pm 1^\circ\text{C}$) before using.

12. Procedure

12.1 *Test Method A—Granular Organophilic Clay Gravity Test:*

12.1.1 Fill a 500-mL graduated cylinder to about the 250-mL mark with granular organophilic clay. Tap the sides of the cylinder to level specimen. Add or remove organophilic clay until it is level with the 250-mL mark.

12.1.2 Tare a 600-mL beaker on the balance. Pour the organophilic clay specimen into the beaker and determine and record the mass of organophilic clay, M_{1A} , to the nearest 0.1 g.

12.1.3 Using clean 500-mL graduated cylinder measure an equal volume, 250-mL, of oil.

12.1.4 Transfer the oil from the graduated cylinder into the beaker with the organophilic clay specimen and determine and record the total mass of organophilic clay and oil, M_{2A} , to the nearest 0.1 g.

12.1.5 Determine and record the mass of open top 8-L plastic bucket, M_{3A} , to the nearest 0.1 g.

12.1.6 Place a 0.210 mm (No. 70 mesh) sieve screen over the 8-L plastic bucket.

12.1.7 Gently blend the oil and organophilic clay specimen throughout by hand with spatula for 2 min.

12.1.8 After 24 h (± 5 minutes) gently mix with the spatula again for 2 min and then spread the oil-organophilic clay mixture over the 0.210-mm sieve.

12.1.9 Allow the oil-organophilic clay to drain by gravity for 24-h (± 5 minutes). Then remove the screen and determine and record the mass of the drained oil and bucket, M_{4A} , to the nearest 0.1 g.

12.2 *Test Method B—Powdered Organophilic Clay Centrifuge Test:*

12.2.1 Determine and record the mass of a 50-mL graduated centrifuge test container without cap and record as M_{1B} , to the nearest 0.01 g.

12.2.2 Fill the test container with 10-mL of organophilic clay. Tap the sides of the test container to level specimen. Determine and record the mass of the test container and organophilic clay specimen and record as M_{2B} , to the nearest 0.01 g.

12.2.3 Add oil to the 35-mL mark on the test container. Determine and record the mass and record as M_{3B} , to the nearest 0.01 g.

12.2.4 Blend the oil and organophilic clay specimen thoroughly by hand with spatula for 2 min then cap the test container.

12.2.5 After 2 h (± 5 min) of contact time, mix the organophilic clay specimen and oil again for 30 s and cap the test container.

12.2.6 Place the test container into the centrifuge and maintain the centrifuge for 30 min at a constant speed which for the diameter head used, will exert a centrifugal force 3000 (± 10) times the force of gravity upon the center of gravity of the test specimen.

12.2.7 Remove cap and decant the free phase oil from the test container with pipet. Wipe inside of test container to remove oil adhered to inside above the solids on bottom.

12.2.8 Determine and record the mass of test container (without cap) with organophilic clay specimen and sorbed oil, and record as M_{4B} , to the nearest 0.01 g.

13. Calculation or Interpretation of Results

13.1 *Test Method A—Granular Organophilic Clay by Gravity Method—*

13.1.1 Calculate the oil sorption capacity, to the nearest 0.1 %, per the following equation:

$$\text{Oil Sorption Capacity (\%)} = \frac{(M_{2A} - M_{1A}) - (M_{4A} - M_{3A})}{M_{1A}} \times 100 \quad (1)$$

13.2 *Test Method B—Powdered Organophilic Clay by Centrifuge Method—*

13.2.1 Calculate the oil sorption capacity, to the nearest 0.1 %, per the following equation:

$$\text{Oil Sorption Capacity (\%)} = \frac{(M_{4B} - M_{2B})}{(M_{2B} - M_{1B})} \times 100 \quad (2)$$

14. Report: Test Data Sheet

14.1 The report shall include the following:

14.1.1 Date(s) that the test was performed.

14.1.2 Identification of the organophilic clay sample being tested, by product name and lot number.

14.1.3 Identification of commercial oil used in the test by product name, SAE or ISO viscosity classification and, if motor oil, API service category.

14.1.4 Identification of procedure (Test Method A or B) which was performed.

14.1.5 If Test Method B was performed, identification of centrifuge model and revolutions per minute setting during test procedure.

14.1.6 Room temperature during the procedure or temperature at which the procedure was performed if it was done in temperature-controlled equipment or in a temperature-controlled chamber, in °C.

14.1.7 Oil sorption capacity of the organophilic clay, in %, to the nearest 0.1 %.

15. Precision and Bias

15.1 *Precision*—Test data on precision is not presented due to the nature of the organophilic clay materials tested by this test method. It is either not feasible or too costly at this time to have ten or more laboratories participate in a round-robin testing program.

15.1.1 Subcommittee D18.21 is seeking any data from the users of this test method that might be used to make a limited statement on precision.

15.2 *Bias*—There is no accepted reference value for this test method, therefore, bias cannot be determined.

16. Keywords

16.1 oil sorption capacity; organophilic clay; remediation

APPENDIXES

(Nonmandatory Information)

X1. EXAMPLE DATA SHEET—METHOD A

X1.1 See [Fig. X1.1](#).

OIL SORPTION CAPACITY OF ORGANOPHILIC CLAY TEST		
Sample Product Name:	Sample Lot No.:	Project:
Oil Product Name:	Oil SAE or ISO Classification:	Oil API Service Category: (motor oil only)
Tested by: Date(s):	Computed by: Date:	Checked by: Date:
Bucket No.:		
Oil Sorption Capacity Determination – Method A, Gravity Drain		
(1) Room temperature or temperature at which the procedure was performed if it was done in temperature-controlled equipment or in a temperature-controlled chamber		_____ (°C)
(2) Mass of organophilic clay, M _{1A}		_____ (g)
(3) Mass of oil and organophilic clay, M _{2A}		_____ (g)
(4) Mass of bucket, M _{3A}		_____ (g)
(5) Mass of bucket and drained oil, M _{4A}		_____ (g)
(8) Oil Sorption Capacity, % = $\frac{((3-2)-(5-4))}{(2)} \times 100$		_____ (%)

FIG. X1.1 Example Data Sheet—Method A

X2. EXAMPLE DATA SHEET—METHOD B

X2.1 See Fig. X2.1.

OIL SORPTION CAPACITY OF ORGANOPHILIC CLAY TEST		
Sample Product Name:	Sample Lot No.:	Project:
Oil Product Name:	Oil SAE or ISO Classification:	Oil API Service Category: (motor oil only)
Centrifuge Manufacturer:	Centrifuge Model:	Revolutions per minute setting:
Tested by: Date(s):	Computed by: Date:	Checked by: Date:
Container No.:		
Oil Sorption Capacity Determination – Method B, Centrifuge		
(1) Room temperature or temperature at which the procedure was performed if it was done in temperature-controlled equipment or in a temperature-controlled chamber		_____ (°C)
(2) Mass of test container, M_{1B}		_____ (g)
(3) Mass of test container and organophilic clay, M_{2B}		_____ (g)
(4) Mass of test container and organophilic clay and oil, M_{3B}		_____ (g)
(5) Mass of test container and organophilic clay and sorbed oil, M_{4B}		_____ (g)
(8) Oil Sorption Capacity, % = $\frac{(5 - 3)}{(3 - 2)} \times 100$		_____ (%)

FIG. X2.1 Example Data Sheet—Method B

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