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An American National Standard

Standard Test Method for Estimating the Organic Fouling of Particulate Anion Exchange Resins[1]

This standard is issued under the fixed designation D 5042; 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 reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method provides a general estimate of the organic fouling of an anion exchange resin based upon total organic carbon measurements.

1.2 *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 and health practices and determine the applicability of regulatory limitations prior to use.* For a specific hazard statement, see Note 1.

2. Referenced Documents

2.1 *ASTM Standards:*

D 1129 Terminology Relating to Water[2]
D 1193 Specification for Reagent Water[2]
D 2187 Test Methods for Physical and Chemical Properties of Particulate Ion Exchange Resins[3]
D 2579 Test Methods for Total and Organic Carbon in Water[3]
D 2687 Practices for Sampling Particulate Ion-Exchange Materials[3]
D 4839 Test Method for Total Carbon and Organic Carbon in Water by Ultraviolet, or Persulfate Oxidation, or Both, and Infrared Detection[3]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D 1129.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *organic fouling*—buildup of organic material in or on anion exchange resins by sorption during the service cycle and incomplete removal during regeneration.

4. Summary of Test Method

4.1 A sample of particulate anion exchange material is contacted with a sodium chloride/sodium hydroxide solution at an elevated temperature. After a specified contact time, the concentration of organic material in the aqueous phase is measured as total organic carbon[4] (TOC).

5. Significance and Use

5.1 One of the major factors in the unsatisfactory performance of anion exchange resins is their fouling by organic material. Knowledge of the degree of fouling can be used to assess the condition of the resin and may indicate the need for pretreatment of the influent, remedial cleaning procedures, or resin replacement.

5.2 It is recognized that this test method may not remove and detect cation sloughage products or declumping agents. It is not intended to remove all organic compounds from the resin.

5.3 Since the chemical structures of organics compounds fouling the resin are generally unknown and are expressed only on the basis of their carbon content, interpretation of test results to form a basis for predictions for resin performance or cleaning procedures should be approached with caution.

5.4 Samples may be taken before or after plant regeneration, or both, depending on the type of information desired. This decision is left to the judgment of the user.

6. Interferences

6.1 The high sodium chloride (NaCl) concentration of the test solutions may interfere with the response of the total organic carbon analyzer. The response of the instrument should be determined using standards prepared in this matrix.

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[1] This test method is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.08 on Membrane and Ion Exchange Materials.

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[2] *Annual Book of ASTM Standards*, Vol 11.01.

[3] *Annual Book of ASTM Standards*, Vol 11.02.

[4] Fisher, S., and Otten, G., "Standardization of Methodology for Estimating the Organic Fouling of Ion Exchange Resins," *Proceedings of the International Water Conference*, October 1989.

7. Apparatus

7.1 Instrument to determine total organic carbon are as specified in Test Methods D 2579, Oxidation—Infrared Detection test method, or D 4839. TOC instruments using conductivity detection have also been found to be suitable. The instrument must be capable of measuring CO_2 formed without NaCl interference.

8. Reagents

8.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[5] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

8.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water conforming to Specification D 1193, Type IV. In addition, its concentration of total organic carbon should not exceed 0.5 mg/L as C.

8.3 *Sodium Chloride/Sodium Hydroxide Solution*—Dissolve 100 g of NaCl and 10 g of NaOH in 800 mL of water and dilute to 1 L in a volumetric flask.

NOTE 1—**Warning:** Eye and skin protection should be used with caustic solution.

8.4 *Sulfuric Acid* (1 + 49)—Cautiously add 1 volume of concentrated sulfuric acid (sp gr 1.84) to 49 volumes of water.

9. Sampling

9.1 Collect the sample in accordance with Practices D 2687.

9.2 Use three samples of 2.0 g each of wet, drained resin in each test (see 10.2).

10. Procedure

10.1 Drain the sample, if necessary, with the draining apparatus described in Test Methods D 2187 (8.2), according to the procedure in Test Methods D 2187 (10.12), but without any pretreatment.

10.2 Weigh three 2.0-g portions of the drained sample into 125-mL Erlenmeyer flasks. Add 20 mL of sodium chloride/sodium hydroxide solution (see 8.3) to each. Cover the flask with a small inverted beaker. Place flasks in a water bath at 90 ± 2°C for 1 h.

10.3 After 1 h of heating, remove the flasks from the water bath. Add 50 mL of water and cool to room temperature. Filter the supernatant solution through a sintered glass funnel and neutralize to pH 3 to 5 by the dropwise addition of sulfuric acid (see 8.4). Dilute to 100 mL in a volumetric flask. For some TOC instruments, further dilution may be required.

10.4 Determine the total organic carbon content in milligrams per litre of each of the three replicates in accordance with Test Methods D 2579, Oxidation—Infrared Detection test method, or D 4839, or in accordance with manufacturer's instructions if another TOC instrument is used. It is important in this application of the TOC test method to correct for blanks containing all reagents and to calibrate using standards containing 20 mL of sodium chloride/sodium hydroxide solution per 100 mL total volume with pH adjustment as described in 10.3.

11. Calculation and Interpretation of Results

11.1 Calculate the organic carbon removed by averaging the values determined in 10.4 and dividing by 20 to give the milligrams of carbon per gram of wet resin.

11.2 Determine the degree of organic fouling as follows:

Organic Carbon Removed, mg C/gram wet resin	Degree of Organic Fouling
0 to 1	very low
1 to 2	low
2 to 5	moderate
5 to 10	heavy
greater than 10	severe

NOTE 2—Values above 20 milligrams of carbon per gram are extremely rare and should be carefully checked for possible errors.

12. Report

12.1 Report the degree of organic fouling in descriptive terms according to 11.2. Some users may prefer to use the mg C/gram wet resin values in order to plot trends.

13. Precision and Bias

13.1 No statement is made about either the precision or the bias of this test method since the result merely states whether there is conformance to the criteria for success specified in the procedure. Typical precision and bias for the total organic carbon analysis are found in Test Method D 2579.

14. Keywords

14.1 anion resin; organic carbon; organic fouling

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[5] *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Convention, Inc. (USPC), Rockville, MD.

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