



**American Water Works
Association**

ANSI/AWWA B200-07
(Revision of ANSI/AWWA B200-03)

The Authoritative Resource on Safe Water®

AWWA Standard

Sodium Chloride



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AWWA Standard

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA B200.

I. Introduction.

I.A. *Background.* Bedded salt* deposits are the remains of ancient seas that have evaporated. Bedded deposits occur in horizontal layers of the mineral halite. These layers range from several to hundreds of feet (meters) in thickness and are between several and several thousand feet (meters) below the surface of the earth. Some bedded deposits between 25,000 and 50,000 ft (7,600 and 15,200 m) below the surface of the earth have been subjected to pressures that have caused the salt to move upward through overlying sedimentary layers toward the earth's surface. Presently, these deposits exist as domes of nearly pure salt that may be as large as 2 mi (3.2 km) in diameter and are sometimes found within a few feet of the earth's surface.

Concentrated brine* is found in surface lakes or underground pools. Along seacoasts, the oceans provide a virtually unlimited source of salt.

Rock salt is produced by the conventional room-and-pillar mining method. After sinking a shaft to the salt level, the face, or vertical area, is drilled and may be undercut. The drill holes are loaded with explosives, and the explosives are detonated. The fragmented salt that results is crushed, screened, transported to the shaft, and hoisted to the surface.

Solar salt is produced by the natural evaporation of seawater or more concentrated brine from surface lakes or underground formations in shallow ponds.

Solution-mined brine, from which evaporated salt is produced, is obtained by drilling wells into bedded or domal rock-salt deposits and injecting water into the deposit. The water dissolves the rock salt to produce a saturated brine. Salt deposits can be solution-mined through a single set of concentric pipes or through two or more separate pipes within the same deposit. The brine can then be evaporated to produce dry salt by vacuum-pan evaporation or modifications of vacuum-pan evaporation, grainer evaporation, or the Alberger process.

In vacuum-pan evaporation, cubic "vacuum-granulated" salt crystals form in the brine during evaporation and are removed as a slurry, which is then dewatered and dried.

*The terms salt and brine are used to describe the chemical compound sodium chloride (NaCl).

In the grainer process, small hoppers of salt form on the surface of a concentrated brine solution. These drop to the bottom of the grainer pan once they become large enough to overcome forces that hold them to the surface. The resultant flake salt is removed from the grainer by rakes and dried in a rotary dryer.

The Alberger process is a part vacuum-pan, part grainer operation in which cubic crystals are formed in a flash chamber and fed to the grainer pans. The seed crystals in the grainer pan produce a product that is a mixture of grainer-type flakes and flakes grown on seed crystals. The salt is centrifuged from the brine and dried as in the grainer process. Screens are used to separate the salt into specific grades.

Any of the three types of salt (rock, solar, or vacuum-granulated and their compressed forms) can be used for regeneration of ion-exchange resins. The greater quantity of insoluble matter in some rock salt may require clarification of the brine. The accumulation of insolubles in the brine tank is a disadvantage, because periodic removal is necessary. Vacuum-granulated salt has the highest purity and leaves no insoluble residue.

Salt for regeneration of ion-exchange units should be selected on the basis of the brine purity required. Cation-exchange processes usually require that the saturated brine contain less than 2,000 mg/L of calcium sulfate (CaSO_4). Anion-exchange processes require brine with low calcium and magnesium (Mg) content to produce a consistent quality of effluent water. When caustic soda or soda ash is added to the brine makeup, saturated brine with a calcium level of 0 to 10 mg/L (as Ca) should be used. The magnesium level should be 0 to 2 mg/L (as Mg).

I.B. *History.* The first edition of the AWWA standard for sodium chloride was approved as tentative by the AWWA Board of Directors on July 6, 1949. ANSI/AWWA B200 was made a standard on May 15, 1953. Revisions approved on June 5, 1964, provided new sections on information to be supplied by the purchaser and on an affidavit of compliance. The revisions also provided for the use of the ethylenediaminetetraacetic acid (EDTA) titrimetric method for determining calcium and magnesium, the permanganate titrimetric method for calcium, and the gravimetric method for magnesium.

The 1969 revisions of the standard provided for two types of salt that were not included in earlier standards: evaporated and compressed evaporated salt. At that time, the impurity limits for certain constituents were revised, the definitions section was revised and enlarged, the physical characteristics were modified in regard to fineness requirements, and minor changes were made in the test methods. The 1978 edition

combined evaporated salt and compressed evaporated salt and added a specification for compressed solar salt. The 1988 edition included an acceptance clause in the foreword and revised definitions, limits, and test procedures. The 1993 edition included a revised acceptance statement and definitions. The 1998 edition of ANSI/AWWA B200 was revised to conform to AWWA standard style. This ninth edition of ANSI/AWWA B200 was approved by the AWWA Board of Directors on June 11, 2006.

I.C. Acceptance. In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.* Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including two standards developed under the direction of NSF, NSF[†]/ANSI[‡] 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI 60. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, “Toxicology Review and Evaluation Procedures,” to NSF/ANSI 60 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of “unregulated contaminants” are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

*Persons outside the United States should contact the appropriate authority having jurisdiction.

†NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48113.

‡American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

ANSI/AWWA B200 addresses additives requirements in Sec. 4.3 of the standard. The transfer of contaminants from chemicals to processed water or the residual solids is becoming a problem of great concern. The language in Sec. 4.3.3 is a recommendation only for direct additives used in the treatment of potable water to be certified by an accredited certification organization in accordance with NSF/ANSI 60 Drinking Water Treatment Chemicals—Health Effects. However, users of the standard may opt to make this certification a requirement for the product. Users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.
2. Determine the status of certifications by all parties offering to certify products for contact with, or treatment of, drinking water.

3. Determine current information on product certification.

II. Special Issues. Currently, there are no special issues related to this standard.

III. Use of This Standard. It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives.* The following items should be provided by the purchaser:

1. Standard used—that is, ANSI/AWWA B200, Sodium Chloride, of latest revision.
2. Whether compliance with NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, is required.
3. When rock salt is readily available with values for moisture, calcium, magnesium, sulfates, or water-insoluble impurities lower than those shown in Table 1 of the standard, purchasers may prefer to modify the limits set in the table for these substances (Sec. 4.3.2).
4. Details of other federal, state, local, and provincial requirements (Sec. 4.3.3 and Sec. 6.2).
5. Quantity of sodium chloride required and method of packaging and shipping (Sec. 6.2).
6. If bulk shipments of sodium chloride are accompanied by weight certificates of certified weighers (Sec. 6.2.4).
7. Whether or not an affidavit of compliance (Sec. 6.3) is required.

III.B. *Modification to Standard.* Any modification to the provisions, definitions, or terminology in this standard must be provided by the purchaser.

IV. Major Revisions. The standard was revised to conform to AWWA standard style with reference to consideration of NSF and other federal, state, local, and provincial requirements.

V. Comments. If you have any comments or questions about this standard, please call the AWWA Volunteer and Technical Support Group at 303.794.7711, FAX at 303.795.7603, write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or e-mail standards@awwa.org.

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AWWA Standard

Sodium Chloride

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes sodium chloride in the form of rock, vacuum-granulated, compressed vacuum-granulated, solar, or compressed solar salt for use in the recharging of cation-exchange materials in water supply service for softening municipal and industrial water supplies. Additionally, sodium chloride is used in the recharging of anion-exchange materials for nitrate removal or dealkalization of municipal and industrial supplies.

Sec. 1.2 Purpose

The purpose of this standard is to provide purchasers, manufacturers, and suppliers with the minimum requirements for sodium chloride, including physical, chemical, packaging, shipping, and testing requirements.

Sec. 1.3 Application

This standard can be referenced in contract documents for purchasing and receiving sodium chloride and can be used as a guide for testing the physical and chemical properties of sodium chloride samples. The stipulations of this standard apply when this document has been referenced and only to sodium chloride used in water supply service.

SECTION 2: REFERENCES

This standard references the following documents. In their latest editions, they form a part of this standard to the extent specified within the standard. In any case of conflict, the requirements of this standard shall prevail.

ASTM* E11—Standard Specification for Wire Cloth and Sieves for Testing Purposes.

Occupational Health Guideline for 1,1,2-Trichloro-1,2,2-Trifluoroethane. USDHHS–NIOSH† Publication No. 81-123.

Standard Methods for the Examination of Water and Wastewater. APHA,‡ AWWA, and WEF.§ Washington, D.C. (21st ed., 2005).

SECTION 3: DEFINITIONS

The following definitions shall apply in this standard:

1. *Compressed salt:* A product made into various sizes and shapes by mechanically compressing vacuum-granulated or solar salt.
2. *Day:* A day is defined as a 24-hour period.
3. *Manufacturer:* The party that manufactures, fabricates, or produces materials or products.
4. *Purchaser:* The person, company, or organization that purchases any materials or work to be performed.
5. *Rock salt:* A mined salt that is crushed and screened.
6. *Salt:* A stable compound with the chemical formula NaCl.
7. *Solar salt:* Salt produced by evaporating, via the action of sun and wind, seawater, lake brine, or saline groundwater in shallow ponds.
8. *Supplier:* The party that supplies materials or services. A supplier may or may not be the manufacturer.
9. *Vacuum-granulated salt:* Salt produced by evaporation of brine under special conditions designed to control crystal size and purity.

*ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

†US Department of Health and Human Services National Institute for Occupational Safety and Health, Cincinnati, OH 45226.

‡American Public Health Association, 800 I Street, N.W., Washington, DC 20001.

§Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314.

SECTION 4: REQUIREMENTS

Sec. 4.1 Physical Requirements

4.1.1 *General.* The material shall be homogenous and in a crystalline, granular, or compressed form.

4.1.2 *Foreign matter.* The material shall be free from dirt, fibers, lint, chips, trash, or other foreign matter.

4.1.3 *Color.* The material shall be white or grayish pink, brown, brownish white, or of a distinguishing color added by the producer.

4.1.4 *Fineness.**

4.1.4.1 Rock salt shall be of such fineness that 100 percent of it shall pass a $\frac{3}{4}$ -in. (19-mm) sieve and not more than 5 percent of it shall pass a No. 60 (0.25-mm) sieve.

4.1.4.2 Vacuum-granulated salt shall be of such fineness that 100 percent of it shall pass a No. 10 (2-mm) sieve and not more than 5 percent shall pass a No. 100 (0.15-mm) sieve.

4.1.4.3 Compressed vacuum-granulated and compressed solar salt shall be of such fineness that not more than 10 percent of it shall pass a No. 30 (0.59-mm) sieve.

4.1.4.4 Solar salt shall be of such fineness that 100 percent of it shall pass a $1\frac{1}{4}$ -in. (31-mm) sieve and not more than 5 percent of it shall pass a No. 100 (0.15-mm) sieve.

Sec. 4.2 Chemical Requirements

4.2.1 *NaCl content.* The material shall have the following minimum NaCl content by weight (dry basis), as determined by the test methods given in Section. 5: rock salt, 96 percent; vacuum-granulated and compressed vacuum-granulated salt, 99.5 percent; or solar and compressed solar salt, 98 percent.

4.2.2 *pH of solution.* The solution formed by dissolving 10 g of the salt in 190 mL distilled water to make a 5 percent solution shall have a pH value greater than 5 and less than 9.5.

*Sieve numbers referred to in this standard are US Standard Sieve Series numbers, as specified in ASTM E11.

Sec. 4.3 Impurities

4.3.1 *General impurities.* The sodium chloride shall contain no substances in quantities capable of producing deleterious or injurious effects on the health of those consuming the water treated by a material that has been properly regenerated with sodium chloride. The specified sodium chloride shall contain no contaminants that would cause treated water to fail to meet the requirements of US Environmental Protection Agency (USEPA) drinking water regulations. In addition, the sodium chloride shall contain no constituents that, if released into treated water after regeneration and rinsing, will impair the usefulness of the water for domestic consumption.

4.3.2 *Specific impurity limits.* The sodium chloride shall not exceed the maximum impurity limits listed in Table 1.

4.3.3 *Regulatory requirements.* Materials shall comply with the requirements of the Safe Drinking Water Act and other federal requirements.

Table 1 Maximum impurity limits

	Maximum Limit— <i>percent by weight</i>				
	Rock Salt	Vacuum-Granulated Salt	Compressed Vacuum-Granulated Salt	Solar Salt	Compressed Solar Salt
Moisture	3.00	0.20	0.50	3.00	0.50
Dry Basis					
Water-soluble impurities					
Calcium and magnesium (Ca and Mg)	1.50	0.15	0.15	0.60	0.60
Sulfate (SO ₄)	3.00	0.35	0.35	1.40	1.40
Water-insoluble impurities	2.00	0.05	0.05	0.15	0.15
Total impurities (soluble + insoluble)	4.00	0.50	0.50	2.00	2.00
Grease, fat, or oil	0.01	0.01	0.01	0.01	0.01

SECTION 5: VERIFICATION

Sec. 5.1 Inspection

If desired by the purchaser, the shipment shall be inspected at the point of destination for evidence of foreign matter, such as dirt, fibers, lint, chips, or trash, which would be detrimental to the use of the salt.

Sec. 5.2 Sampling

If an inspection is performed as specified in Sec. 5.1 and the shipment passes the inspection, sampling shall be as specified in this section.

5.2.1 *Sampling.* Samples shall be taken at the point of destination.

5.2.2 *Number of packages.* If the material is packaged, not less than 5 percent of the packages shall be sampled. No sample shall be taken from a broken package.

5.2.3 *Bulk shipments.* When delivered in bulk, the samples shall be representative of all parts of the bulk loads and shall not contain a disproportionate share of the top or bottom layers. Coarse material taken from bulk loads shall comprise at least 10 shovelfuls from different parts of the load, and the total material shall weigh not less than 100 lb (45 kg). The material shall be mixed and divided to make a sample of approximately 10 lb (4.5 kg) and handled as described in Sec. 5.2.5.

5.2.4 *Device.* Finely divided material, whether in bulk or packages, may be sampled using a sampling tube that is at least $\frac{3}{4}$ in. (19 mm) in diameter. Special precautions shall be used to avoid taking a disproportionate amount of the sample from the top or the bottom layers of the material. If the sodium chloride is handled by conveyor or elevator, a mechanical sampling arrangement may be used.

5.2.5 *Handling.* The gross sample, weighing at least 10 lb (4.5 kg), shall be thoroughly mixed and split to provide three 500-g material samples. Each material sample shall be sealed in an airtight, moisture-proof glass or plastic container. Each sample container shall be labeled to identify it, and the label shall be signed by the sampler.

5.2.6 *Test samples.* One of the 500-g material samples (Sec. 5.2.5) shall be designated as the test sample for use by the purchaser. The two remaining material samples shall be retained for use according to Sec. 5.13, if necessary. Material samples shall be unsealed only when necessary to remove quantities of the material for testing.

Immediately before testing, the particles of the 500-g test sample may be reduced by mechanical grinding or by hand in a mortar to such size that all of it passes a No. 8 sieve. Samples selected for testing should be weighed rapidly to avoid changes in moisture content.

5.2.6.1 Rock, solar, and compressed solar salt.

1. Obtain a dry sample (use procedure in Sec. 5.4.1).
2. Mix well and weigh out a 25-g representative portion of rock salt or a 50-g representative portion of solar or compressed solar salt.

3. Place 200 mL of distilled water in a two-speed blender and start at low speed.
4. Slowly add salt to blender and then blend for 5 min at high speed with cover in place.
5. Test for water insolubles (see Sec. 5.5.1).
6. Save filtrate from water-insoluble test, dilute in a volumetric flask to a 1-L stock solution for subsequent analyses.

5.2.6.2 Vacuum-granulated and compressed vacuum-granulated salt.

1. Obtain a dry sample (use procedure in Sec. 5.4.1).
2. Transfer 100-g sample to a 1-L volumetric flask.
3. Add 800 mL of distilled water and dissolve the salt.
4. Add 2 mL of concentrated hydrochloric acid (HCl) to solubilize water-insoluble calcium salts, particularly calcium carbonate (CaCO_3).
5. Dilute to volume and mix to make stock solution for subsequent analyses.

Sec. 5.3 Test Procedures—General

Sampling shall be conducted according to Sec. 5.2 of this standard. The purchaser shall complete the laboratory examination of the sample within five working days after the shipment is received. Methods of testing sodium chloride shall conform to the procedures presented in the following sections. Alternative procedures shall only be used with the written approval of the purchaser. In any case of conflict, the methods of this standard shall prevail.

Sec. 5.4 Moisture

5.4.1 Procedure.

1. Weigh (to the nearest 0.01 g) 50 g of rock or solar salt, or 100 g (to the nearest 0.01 g) of vacuum-granulated, compressed vacuum-granulated, or compressed solar salt, in an as-received condition, into a previously dried and tared moisture dish.
2. Place in an oven at 110°C. After 2 hr, remove to a desiccator; cool and weigh. Repeat until constant weight is obtained.

5.4.2 Calculation.

$$\frac{\text{loss of weight} \times 100}{\text{weight of sample}} = \text{percent moisture} \quad (\text{Eq 1})$$

Sec. 5.5 Insoluble Matter

5.5.1 Procedure for rock, solar, and compressed solar salts.

1. Transfer a 200-mL prepared sample from Sec. 5.2.6.1(6) to a 1-L Erlenmeyer flask. Wash blender with 100 mL of distilled water. Add blender wash and 300 mL of distilled water to flask to obtain a total of 600 mL of water.
2. Stir on a magnetic stirrer for 1 hr. Adjust the stirrer speed to give maximum agitation without losing any sample as a result of splashing. Place beaker over top of flask while stirring.
3. Filter through a Gooch crucible and quantitatively recover insolubles on a previously dried (110°C for 1 hr) and weighed (analytical balance) glass-fiber filter paper or equivalent. Wash until free of chlorides as determined by testing small portions of filtrate with approximately *N*/10 silver nitrate (AgNO₃). Filtrate tested should be disposed of separately, without combining with the total filtrate.
4. Dilute filtrate and washings to 1 L in volumetric flask.
5. Dry the glass-fiber filter paper at 110°C for 1 hr.
6. Cool in a desiccator and weigh on an analytical balance.
7. Save the filtrate for subsequent analytical procedures.

5.5.2 Procedure for vacuum-granulated and compressed vacuum-granulated salt.

1. Place 100 g of the sample in a beaker and add 750 mL of distilled water.
2. Agitate with mechanical stirrer until the solution is complete. Filter through a Gooch crucible and quantitatively recover insolubles on a previously dried (110°C for 1 hr) and weighed (analytical balance) glass-fiber filter paper or equivalent. Wash until free of chlorides as determined by testing small portions of filtrate with approximately *N*/10 silver nitrate (AgNO₃). The filtrate tested should be disposed of separately, without combining with the total filtrate.
3. Dry the glass-fiber filter paper at 110°C for 1 hr.
4. Cool in a desiccator and weigh on an analytical balance.
5. Dilute the filtrate to 1 L and save the filtrate for subsequent analytical procedures.

5.5.3 Calculation.

$$\frac{\text{increase in weight of filter paper} \times 100}{\text{grams of sample}} \quad (\text{Eq 2})$$

$$= \text{percent of insoluble matter (dry basis)}$$

Sec. 5.6 Calcium

The test procedure for calcium uses the ethylenediaminetetraacetic acid (EDTA) titrimetric method.

5.6.1 Reagents.

1. Sodium hydroxide solution, 1*N*. Dissolve 40 g NaOH and dilute to 1 L with distilled water.
2. Ammonium purpurate indicator. A ground mixture of the dry powder and sodium chloride provides a stable form of indicator. Mix 0.20 g ammonium purpurate (murexide) with 100 g of reagent-grade NaCl and grind the mixture to pass a No. 40 to No. 50 sieve.
3. EDTA titrant, 0.0100*M*. Dissolve 3.72 g of the reagent grade of the disodium salt of EDTA in 1,000 mL of distilled water. Standardize against standard calcium solution using the procedure described in Sec. 5.6.2. Standard EDTA titrant, exactly 0.0100*M*, is equivalent to 0.4008 mg Ca per 1.00 mL of titrant used. Titrant should be kept in heat-resistant glass or plastic bottles. Molarity *M* is used in the Sec. 5.6.3 calculation.
4. Standard calcium solution. Dry several grams of calcium carbonate powder (primary standard or special reagent low in heavy metals, alkalies, and magnesium) at 110°C overnight or longer. Weigh 1.000 g into a 500-mL Erlenmeyer flask. Slowly add 1:1 HCl until all the CaCO₃ has dissolved. Add 200 mL of distilled water; boil to expel CO₂. Cool, add a few drops of methyl red indicator, and adjust to the intermediate orange color by adding 3*N* NH₄OH or 1:1 HCl, as required. Transfer quantitatively to a 1-L volumetric flask and fill to the mark with distilled water. This standard solution is equivalent to 0.4008 mg Ca per 1.00 mL. Also, the standard solution is equivalent to 1.000 mg CaCO₃ per 1.00 mL.

5.6.2 Procedure.

NOTE: Because the indicator is unstable at the high pH in this procedure, the titration should be performed immediately after adding indicator to the alkaline solution.

1. Pipette a 50- to 100-mL aliquot of stock into a separate 400-mL beaker for rock-salt analyses (depending on purity), 50 mL for vacuum-granulated and 100 mL for solar and compressed salt, so that the calcium content is 5 to 100 mg.
2. Dilute to 200 mL with water, if necessary. Add 2.0 mL NaOH solution or a volume sufficient to produce a pH of 12 to 13. Stir for a few minutes before titrating. The target pH for titration is 12.5, but this is measurable only with a “low-sodium error” glass electrode.

3. Add 0.1 to 0.2 g of the Sec. 5.6.1(2) indicator mixture. Without delay, add EDTA titrant slowly and stir continuously until the color of the solution changes from pink to purple at the end point. Record the milliliters of EDTA titrant and use for calculation (Sec. 5.6.3).

4. Check the end point by adding 1 or 2 drops of titrant in excess to make certain that no further color change takes place.

5.6.3 Calculation.

$$\frac{M \text{ of EDTA} \times \text{mL EDTA} \times 4.008}{\text{grams of sample in aliquot}} = \text{percent calcium (Ca, dry basis) (Eq 3)}$$

Sec. 5.7 Magnesium

5.7.1 *Principle.* Magnesium content can be determined by the EDTA titrimetric method using the difference between the calcium content and total hardness (TH). TH measures the sum of the calcium and magnesium. The procedures for determining TH and magnesium are presented in this section.

5.7.2 Reagents.

1. Buffer solution. Dissolve 16.9 mg ammonium chloride (NH_4Cl) in 143 mL of concentrated ammonium hydroxide (NH_4OH); add 1.25 g magnesium salt of EDTA and dilute to 250 mL with distilled water. Keep the solution in a tightly stoppered plastic container.

2. Indicator. Mix together approximately 0.5 g of Eriochrome Black T dye (sodium salt of 1-[1 hydroxy-2-naphthylazo]-6-nitro-2-naphthol-4-sulfonic acid) and 100 g reagent-grade NaCl to prepare a dry-powder mixture.

3. Inhibitor. Dissolve 5.0 g $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ (sodium sulfide nonahydrate) or 3.7 g $\text{Na}_2\text{S} \cdot 5\text{H}_2\text{O}$ in 100 mL of distilled water. Exclude air with a tightly fitting rubber stopper. This inhibitor deteriorates through air oxidation and should be prepared fresh weekly.

4. Standard EDTA titrant, 0.01M. The same EDTA solution used in the calcium determination may be used (Sec. 5.6.1[3]).

5.7.3 Procedure.

NOTE: The aliquot of sample taken for the titration should require less than 15 mL of titrant. The duration of titration should not exceed 5 min, measured from the time of the buffer addition.

1. Take a 50-mL aliquot, or if necessary, a smaller aliquot, from the diluted filtrate (Sec. 5.6.2[1]) and place it in a tall, clear-glass cylinder or casserole.

2. Add 1 to 2 mL of buffer solution (or sufficient buffer to give a pH of 10.0 to 10.1). Add a small amount of powder indicator to produce a moderate color. Titrate slowly with continuous stirring until the last reddish tinge disappears. The end point should appear as clear blue. Daylight or a daylight fluorescent lamp is highly recommended for observation of the final end point.

3. If the reddish tint does not disappear, take another aliquot and add approximately 1 mL of inhibitor to the sample before adding the buffer and indicator. This serves as an inhibitor to interfering ions.

5.7.4 Calculation.

$$\frac{M \text{ of EDTA} \times \text{mL EDTA} \times 10^5}{\text{mL of aliquot titrated}} = \text{mg/L total hardness (TH) as CaCO}_3 \quad (\text{Eq 4})$$

From Sec. 5.6.3,

$$\frac{M \text{ of EDTA} \times (\text{mL EDTA} \times 4.008) \times 10^4}{\text{mL of aliquot titrated}} = \text{mg/L Ca} \quad (\text{Eq 5})$$

$$\frac{(\text{TH} - 2.5\text{Ca})(2.432)(10^{-5})(\text{mL aliquot titrated})}{\text{grams of sample in aliquot}} \quad (\text{Eq 6})$$

= percent magnesium (Mg, dry basis)

Sec. 5.8 Sulfate

5.8.1 Reagents.

1. Hydrochloric acid, 2 percent by weight, in distilled water.
2. Barium chloride, 10 percent by weight, in distilled water.

5.8.2 Procedure.

1. To exactly 100 mL of the test solution (Sec. 5.2.6.1 and 5.2.6.2), add 2 mL of 2 percent hydrochloric acid and boil. While the solution is boiling, add a slight excess of barium chloride solution with rapid stirring and set aside at room temperature for approximately 18 hr.

NOTE: According to recognized authorities, 1-hr digestion of sulfate on a steam bath produces a precipitate of as high a quality as 18 hr standing at room temperature.

2. Filter through a tight quantitative (Whatman No. 42 or equivalent) filter paper and wash precipitate with hot distilled water until a 25-mL portion of the filtrate shows no more than a slight opalescence with silver nitrate.

3. Place the filter paper containing the precipitate in an ignited, cooled, and weighed platinum or dried porcelain crucible and heat slowly over a low flame to char the filter paper without allowing it to catch fire. After complete charring, ignite to constant weight over an ordinary burner with the crucible uncovered, cooling in a desiccator between weighings.

NOTE: If charring of the paper is too rapid, some of the barium sulfate will be reduced to barium sulfide. If so, moisten the precipitate with concentrated sulfuric acid, carefully heat to expel the acid, and ignite.

5.8.3 Calculation.

$$\frac{\text{grams of BaSO}_4 \text{ residue} \times 41.16}{\text{grams of sample in aliquot}} = \text{percent sulfate (SO}_4\text{, dry basis)} \quad (\text{Eq 7})$$

Sec. 5.9 Grease, Fat, and Oil

5.9.1 *Reagent.* Trichlorotrifluoroethane.*

5.9.2 *Procedure.*

1. Weigh approximately 25 to 50 g of the sample, dried to constant weight, and place in a 70-mL Soxhlet tube.

2. Using approximately 100 mL of trichlorotrifluoroethane, extract the sample for 2 hr.

3. At the end of the extraction, recover the trichlorotrifluoroethane by distillation and dry the residue at 110°C to constant weight.

4. Evaporate 100 mL of trichlorotrifluoroethane in a tared evaporating dish and subtract the weight of the residue from the weight of the residue obtained in Sec. 5.9.2(3).

*For safety considerations regarding this chemical, see *Occupational Health Guideline for 1,1,2-Trichloro-1,2,2-Trifluoroethane*, USDHHS-NIOSH Publication No. 81-123.

5.9.3 Calculation.

$$\frac{\text{net weight of residue, in grams} \times 100}{\text{grams of sample}} \quad (\text{Eq 8})$$

= percent grease, fat, and oil (dry basis)

Sec. 5.10 pH Value

5.10.1 *Reagent.* Freshly boiled and cooled distilled water (avoid reaeration as much as possible).

5.10.2 Procedure.

1. The pH value shall be determined on a 5 percent salt solution at 25°C, prepared by completely dissolving 10 g of salt in approximately 190 mL distilled water, using gentle stirring.

2. The pH of the solution is determined by using any reliable pH meter equipped with a standard calomel electrode and a glass electrode. The meter and electrodes are standardized using pH standard solutions as described in Sec. 4500-H⁺ of *Standard Methods for the Examination of Water and Wastewater*. Commercially available buffer tablets, powders, or solutions of tested quality may also be used. Standardization of the pH meter shall be with buffers in the range of pH 5 to 10, preferably within two pH units of the salt solution being measured.

3. Rinse electrodes with the 5 percent salt solution, discard rinse, then place electrodes into solution. Stir gently for 3 to 4 min to allow the electrodes to equilibrate, then read pH value to ± 0.1 . This equilibration process will occur much more rapidly if the electrodes have been previously stored in a 5 percent salt solution made from reagent-grade sodium chloride.

Sec. 5.11 Total Impurities

5.11.1 *Water-soluble impurities.* The calcium (Ca), magnesium (Mg), and sulfate (SO₄) determined by chemical analysis shall be converted to CaSO₄, MgSO₄, Na₂SO₄, CaCl₂, and MgCl₂. Convert sulfate to calcium sulfate (CaSO₄) and the unused calcium to calcium chloride (CaCl₂). If the sulfate in the sample exceeds the quantity necessary to combine with the calcium, convert the calcium to calcium sulfate (CaSO₄) and the unused sulfate first to magnesium sulfate (MgSO₄), and the remaining sulfate, if any, to sodium sulfate (Na₂SO₄). Convert the unused magnesium to magnesium chloride (MgCl₂). Each salt impurity shall be reported in percent by weight (dry basis) to the third decimal place.

5.11.2 *Conversion factors.*

$$\text{BaSO}_4 \times 0.4115 = \text{SO}_4$$

$$\text{BaSO}_4 \times 0.5832 = \text{CaSO}_4$$

$$\text{BaSO}_4 \times 0.6086 = \text{Na}_2\text{SO}_4$$

$$\text{Ca} \times 3967 = \text{CaSO}_4$$

$$\text{Ca} \times 0.6068 = \text{Mg}$$

$$\text{CaSO}_4 \times 0.2944 = \text{Ca}$$

$$\text{CaSO}_4 \times 0.8153 = \text{CaCl}_2$$

$$\text{CaSO}_4 \times 0.8842 = \text{MgSO}_4$$

$$\text{CaSO}_4 \times 1.0434 = \text{Na}_2\text{SO}_4$$

$$\text{Mg} \times 3.9159 = \text{MgCl}_2$$

$$\text{MgCl}_2 \times 1.4296 = \text{CaSO}_4$$

$$\text{MgCl}_2 \times 1.2641 = \text{MgSO}_4$$

$$\text{MgSO}_4 \times 1.1309 = \text{CaSO}_4$$

$$\text{MgSO}_4 \times 0.7911 = \text{MgCl}_2$$

$$\text{MgSO}_4 \times 1.1800 = \text{Na}_2\text{SO}_4$$

$$\text{SO}_4 \times 1.4173 = \text{CaSO}_4$$

5.11.3 *Total impurities.* The sum of the soluble impurities (either calcium and magnesium sulfate or chloride) plus the insoluble matter (Sec. 5.5) shall constitute the total impurities in the salt.

Sec. 5.12 Sodium Chloride Assay

5.12.1 *Rock, solar, and compressed-solar salt.* Report assay by difference to the first decimal place.

5.12.2 Vacuum-granulated and compressed-vacuum-granulated salt. Report assay by difference to the second decimal place.

5.12.3 *Calculation.* One hundred minus percent total impurities equals percent NaCl (dry basis).

Sec. 5.13 Notice of Nonconformance

5.13.1 *Notice of nonconformance.* Notice of nonconformance of a material shipment because of failure to meet the requirements of this standard must be in the possession of the supplier within 10 days after receipt of the shipment at the point of destination. If determination of nonconformance of the shipment is based on the chemical and physical characteristics of the material, the results of the purchaser's

tests shall prevail, unless the supplier notifies the purchaser within five days of the notice of nonconformance that a retest is desired. On receipt of the request for a retest, the purchaser shall forward to the supplier one of three sealed samples taken according to Sec. 5.2. If the results obtained by the supplier on retesting do not agree with the results obtained by the purchaser, the other sealed sample shall be forwarded, unopened, for analysis to a referee laboratory agreed on by both parties. The results of the referee's analysis shall be accepted as final.

SECTION 6: DELIVERY

Sec. 6.1 Marking

6.1.1 *Required.* Each shipment of material shall carry with it some means of identification. Each package shall bear a legible statement giving a description and the net weight of the contents, the name of the manufacturer, and the brand name, if any.

6.1.2 *Optional.* The package may also bear the statement: "This material meets the requirements of ANSI/AWWA B200, Sodium Chloride," provided that the requirements of this document are met and the material is not of a different quality as provided for in separate agreement between the supplier and purchaser.

Sec. 6.2 Packaging and Shipping

Packaging and shipping of sodium chloride shall conform to current federal, state, and local regulations.*

6.2.1 *Packaging.* Sodium chloride may be shipped in bulk or in 100-lb (45.4-kg) bags or other commercial packages as specified by the purchaser. Unless otherwise specified, the material shall be packaged in new substantial containers of the type, size, and kind commonly used for the purpose. The containers shall be constructed to ensure acceptance and safe delivery by common or other carriers at the lowest rate to the point of delivery called for in the contract or purchase order. Packages shall be strong enough to permit coarse crushing of the salt if the material becomes caked during storage.

*Governmental packaging and marking references reflect US requirements. Users of ANSI/AWWA B200 in outside the US should verify applicable local and national regulatory requirements.

6.2.2 *Bulk container inspection.* Bulk or semibulk containers, such as rail-cars, trailers, and unit hoppers, shall be carefully inspected by the supplier to ensure the absence of contaminating material before loading the sodium chloride.

6.2.3 *Net weight.* The net weight of packages shall not deviate from the recorded weight by more than ± 2.5 percent. If exception is taken to the weight of the material received, the exception shall be based on a certified unit weight of not less than 10 percent of the packages shipped and selected at random from the entire shipment.

6.2.4 *Weight certificate.* The purchaser may require that bulk shipments be accompanied by certified-weight certificates, or the weights may be checked by the purchaser at the point of delivery.

Sec. 6.3 Affidavit of Compliance

The purchaser may require an affidavit from the supplier that the sodium chloride provided according to the purchaser's requirements complies with applicable requirements of this standard.

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