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Standard Guide for Water Analysis for Electrodialysis/Electrodialysis Reversal Applications[1]

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1. Scope

1.1 This guide covers the determinations that should be performed on any given water if processing by electrodialysis/electrodialysis reversal is being considered.

1.2 This guide is applicable to all waters but is not necessarily complete for wastewaters.

1.3 This is a guide only and should not be construed as a complete delineation of all analysis required for a specific application.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D511 Test Methods for Calcium and Magnesium In Water
D512 Test Methods for Chloride Ion In Water
D516 Test Method for Sulfate Ion in Water
D857 Test Method for Aluminum in Water
D858 Test Methods for Manganese in Water
D1067 Test Methods for Acidity or Alkalinity of Water
D1068 Test Methods for Iron in Water
D1125 Test Methods for Electrical Conductivity and Resistivity of Water
D1129 Terminology Relating to Water
D1179 Test Methods for Fluoride Ion in Water
D1253 Test Method for Residual Chlorine in Water
D1293 Test Methods for pH of Water
D1889 Test Method for Turbidity of Water (Withdrawn 2007)[3]
D2579 Test Method for Total Organic Carbon in Water (Withdrawn 2002)[3]
D3352 Test Method for Strontium Ion in Brackish Water, Seawater, and Brines
D3370 Practices for Sampling Water from Closed Conduits
D3561 Test Method for Lithium, Potassium, and Sodium Ions in Brackish Water, Seawater, and Brines by Atomic Absorption Spectrophotometry
D3867 Test Methods for Nitrite-Nitrate in Water
D3920 Test Method for Strontium in Water
D4189 Test Method for Silt Density Index (SDI) of Water
D4191 Test Method for Sodium in Water by Atomic Absorption Spectrophotometry
D4192 Test Method for Potassium in Water by Atomic Absorption Spectrophotometry
D4327 Test Method for Anions in Water by Suppressed Ion Chromatography
D4382 Test Method for Barium in Water, Atomic Absorption Spectrophotometry, Graphite Furnace
D4658 Test Method for Sulfide Ion in Water
D4839 Test Method for Total Carbon and Organic Carbon in Water by Ultraviolet, or Persulfate Oxidation, or Both, and Infrared Detection

2.2 *American Public Health Association Standards:*

Standard Methods for the Examination of Water and Wastewater, Eighteenth Edition, 1992, pp. 4-123 to 4-128[4]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminology D1129.

4. Summary of Guide

4.1 This guide consists of recommended water analyses for ions, gases, suspended materials, organics, temperature, and pH for potential applications of electrodialysis/electrodialysis reversal.

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

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American Public Health Association (APHA), 800 I Street, NW, Washington, DC 20001, http://www.apha.org.

5. Significance and Use

5.1 The design of an electrodialysis/electrodialysis reversal system is determined by the composition of the feedwater and the desired composition of the product water. The determinations and measurements performed in this guide will provide the necessary information for making design projections of staging and power consumption.

5.2 The recovery at which an electrodialysis/electrodialysis reversal system can be safely operated is dependent on the composition of the feed solution. The determinations measurements performed in this guide will provide data for the calculation of the maximum recovery of a system utilizing a specific feed water.

5.3 The determinations and measurements performed in this guide will be valuable for determining needed pretreatment for meeting specific product water requirements with the specific feed water.

6. Procedure

6.1 Collect a sample of the water to be tested in accordance with Practices D3370.

6.2 Determine the concentration of:

Sodium—Test Methods D3561, D4191	(Na^+)
Calcium—Test Methods D511	(Ca^{++})
Magnesium—Test Methods D511	(Mg^{++})
Potassium—Test Methods D3561, D4192	(K^+)
Chloride—Test Methods D512, D4327	(Cl^-)
Bicarbonate—Test Methods D1067	(HCO_3^-)
Carbonate—Test Methods D1067	(CO_3^{--})
Sulfate—Test Methods D516, D4327	(SO_4^{--})
Nitrate—Test Methods D3867, D4327	(NO_3^{--})
Manganese—Test Methods D858	(Mn) total and dissolved
Iron—Test Methods D1068	(Fe) total and dissolved
Aluminum—Test Methods D857	(Al)
Barium—Test Methods D4382	(Ba^{++})
Strontium—Test Methods D3352, D3920	(Sr^{++})
Fluoride—Test Methods D1179	(F^-)

The results may be expressed as (*a*) milligrams per litre (mg/L) as the ion; (*b*) milligrams per litre (mg/L) as calcium carbonate; or (*c*) as milliequivalents per liter (meq/L).

NOTE 1—The total cations and total anions (expressed as milliequivalents per liter calcium carbonate) should balance within 5 %. A larger difference indicates an error in analysis or the presence of a significant quantity of an ionic species not listed in this guide.

6.3 Determine the organic carbon content of the water using Test Methods D2579 or D4839.

6.4 Determine the concentration of:

Sulfide ion—(Test Method D4658 or see 2.2) (S^{--})
Free and total chlorine—(Test Method D1253) (Cl_2)

6.4.1 Free and total chlorine should be determined on site at the time the sample is collected.

6.5 Determine the:

pH (Test Methods D1293)
Temperature
Turbidity (Test Method D1889, Sections 10 through 16)
Conductivity (Test Methods D1125)
Silt density index (Test Method D4189)

6.5.1 Silt density index is applicable only to relatively low turbidity waters (less than 1 NTU) such as well water, filtered water, or clarified effluent samples.

6.5.2 pH, temperature, and silt density index should be measured on site at the time the sample is collected.

7. Precision and Bias

7.1 The precision and bias of this guide are a function of each individual determination and are given where applicable in the documents that are referenced.

8. Keywords

8.1 desalination; desalting; electrodialysis