Metrohm

Application Bulletin 221/3 e

Standard methods in water analysis

Branch

General analytical laboratories; water analysis

Keywords

Water analysis; standard methods; ASTM; DIN; ISO; USP; EPA; SLMB; EN; SCA; titration; ion chromatography; voltammetry; branch 1; branch 2

Summary

This bulletin gives a survey of standard methods from the field of water analysis. You will also find references to the corresponding Metrohm Application Bulletins and Application Notes. The following parameters are dealt with: electrical conductivity, pH value, fluoride, ammonium and Kjeldahl nitrogen, anions and cations by means of ion chromatography, heavy metals by means of voltammetry, chemical oxygen demand (COD), water hardness, free chlorine as well as a few other water components.

Abbreviations

ASTM	American Society for Testing and Materials
DIN	German Institute for Norms
EPA	United States Environmental Protection Agency
EN	European Norm
ISO	International Organization for Standardization
USP	United State Pharmacopoeia
SLMB	Swiss Book for the Analysis of Food
SCA	Standing Committee of Analysts (Blue Books)

Electrical conductivity

Standard Methods

- ASTM D 1125

  Standard test methods for electrical conductivity and resistivity of water
- EPA 120.1

  Conductance, specific conductance
- ISO 7888, DIN EN 27888

  Water quality – determination of electrical conductivity
- SCA, Blue book 14

  The measurement of electrical conductivity and the laboratory determination of the pH value of natural, treated and waste waters
- USP 645

  Water conductivity

Metrohm Application Bulletins and Notes

- AB 102

  Conductometry

pH value

Standard Methods

- ASTM D 5464

  Standard test method for pH measurement of water of low conductivity
- EPA 150.2

  pH, electrometric (continuous monitoring)
- DIN EN ISO 10523

  Water quality – determination of pH
- SCA, Blue book 14

  The measurement of electrical conductivity and the laboratory determination of the pH value of natural, treated and waste waters
- SLMB 602.1

  pH-value of drinking water

Metrohm Application Bulletins and Notes

- AB 188

  pH measurement technique

Fluoride

Standard Methods

- ASTM D 1179

  Standard test methods for fluoride ion in water

- ASTM D 3868

  Standard test method for fluoride ions in brackish water, seawater and brines
- DIN 38405-4

  German standard methods for the examination of water, waste water and sludge; anions (group D); determination of fluoride (D 4)
- EPA 340.2

  Fluoride (potentiometric, ion selective electrode)
- ISO 10359-1

  Water quality – determination of fluoride – part 1: electrochemical probe method for potable and lightly polluted water
- SCA, Blue book 62

  Fluoride in waters, effluents, sludges, plants and soils
- SLMB 626.1

  Fluoride in drinking water, potentiometric

Metrohm Application Bulletins and Notes

- AB 82

  Determination of fluoride with the ion-selective electrode

Ammonium and Kjeldahl nitrogen

Standard Methods

- ASTM D 1426

  Standard test methods for ammonia nitrogen in water
- ASTM D 3590

  Standard test methods for total Kjeldahl nitrogen in water
- DIN 38406-5

  German standard methods for the examination of water, waste water and sludge; cations (group E); determination of ammonia-nitrogen (E 5)
- EPA 350.2

  Nitrogen, ammonia (colorimetric; titrimetric; potentiometric – distillation procedure)
- EPA 350.3

  Nitrogen, ammonia (potentiometric, ion selective electrode)
- EPA 351.3

  Nitrogen, Kjeldahl total (colorimetric; titrimetric; potentiometric)
- EPA 351.4

  Nitrogen, Kjeldahl total (potentiometric, ion selective electrode)
- ISO 5663, DIN EN 25663

  Water quality – determination of Kjeldahl nitrogen – method after mineralization with selenium
- ISO 5664

  Water quality – determination of ammonium – distillation and titration method
- ISO 6778

  Water quality – determination of ammonium – potentiometric method
- SCA, Blue book 126

  Kjeldahl nitrogen in waters

Metrohm Application Bulletins and Notes

- AB 53

  Determination of ammonium or Kjeldahl nitrogen
- AB 133

  Determination of ammonium with the ion-selective electrode
- AN I-2

  Low levels of ammonia in distilled water

Anions and cations by means of ion chromatography

Standard Methods

- ASTM D 4327

  Standard test method for anions in water by suppressed ion chromatography
- ASTM D 5085

  Standard test method for determination of chloride, nitrate, and sulfate in atmospheric wet deposition by chemically suppressed ion chromatography
- ASTM D 5257

  Standard test method for dissolved hexavalent chromium in water by ion chromatography
- ASTM D 5542

  Standard test methods for trace anions in high purity water by ion chromatography
- ASTM D 5996

  Standard test method for measuring anionic contaminant in high purity water by on-line ion chromatography

- ASTM D 6581

  Standard test method for bromate, bromide, chlorate, chlorite in drinking water by suppressed ion chromatography
- ASTM D 6919

  Standard test method for determination of dissolved alkali and alkaline earth cations and ammonium in water and wastewater by ion chromatography
- EPA 218.6

  Determination of dissolved hexavalent chromium in drinking water, groundwater, and industrial wastewater effluents by ion chromatography
- EPA 300.0

  Determination of inorganic anions by ion chromatography
- EPA 300.1

  Determination of inorganic anions in drinking water by ion chromatography
- EPA 314.0

  Perchlorate in drinking water by ion chromatography
- EPA 317.0

  Oxyhalide DPBs and bromide by ion chromatography
- EPA 326.0

  Inorganic oxyhalide disinfection byproducts in drinking water by ion dhromatography with postcolumn reagent for trace bromate analysis
- DIN EN ISO 10304-1

  Water quality – determination of dissolved anions by liquid chromatography of ions – part 1: determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate
- DIN EN ISO 10304-3

  Water quality – determination of dissolved anions by liquid chromatography of ions – part 3: determination of chromate, iodide, sulfite, thiocyanate and thiosulfate
- DIN EN ISO 10304-4

  Water quality – determination of dissolved anions by liquid chromatography of ions – part 4: determination of chlorate, chloride, chlorite in water with low contamination
- DIN EN ISO 14911

  Water quality – determination of dissolved, Li^+, Na^+, NH_4^+, K^+, Mn^{2+}, Ca^{2+}, Mg^{2+}, Sr^{2+} and Ba^{2+} using ion chromatography -- method for water and waste water
- DIN EN ISO 15061

  Water quality - determination of dissolved bromate - method by liquid chromatography of ions
- SLMB 631.1

  Chloride, nitrate, sulfate in drinking water; IC
- SLMB 658.1

  Chlorite, chlorate in drinking water; IC

Metrohm Application Bulletins and Notes

- AN S-217
  Ultratrace-level perchlorate in reagent water, ground water, surface water and water containing 3000 ppm of total dissolved solids (USEPA method 314.0)
- AN S-235
  Determination of anions and oxyhalides by US EPA method 300.1 A and B in a single analysis (standard solution)
- AN S-236
  Determination of anions and oxyhalides by US EPA method 300.1 A and B in a single analysis (sample)
- AN S-239
  Oxyhalides and standard anions according to EPA 300.1 applying the A Supp 5 – 250
- AN U-18
  Bromate determination using post column reaction (o-dianisidine method, EPA 317.0
- AN U-57
  Chromate in drinking water by ion chromatography with PCR and UV/VIS detection according to EPA method 218.7
- AN N-47
  Bromate determination using post column reaction (triiodide method) in tap water according to EPA 326.0

Polarographic/voltammetric determinations

Standard Methods

- ASTM D 3557

  Standard test methods for cadmium in water
- ASTM D 3559

  Standard test methods for lead in water
- DIN 38406-16

  German standard methods for the examination of water, waste water and sludge; cations (group E); determination of zinc, cadmium, lead, copper, thallium, nickel, cobalt by voltammetry (E 16)

- DIN 38406-17

  German standard methods for the examination of water, waste water and sludge; cations (group E); determination of uranium - method using adsorptive stripping voltammetry in surface water, raw water and drinking water (E 17)
- EPA 7063

  Arsenic in aqueous samples and extracts by anodic stripping voltammetry (ASV)
- EPA 7198

  Hexavalent chromium by differential pulse polarography
- EPA 7472

  Mercury in aqueous samples and extracts by anodic stripping voltammetry (ASV)
- SLMB 613.1

  Copper, lead, cadmium, zinc in drinking water, polarographic

Metrohm Application Bulletins and Notes

- AB 70

  Polarographic determination of nitrate in water samples, soil and plant extracts, vegetable juice, meat and sausages, fertilizers, liquid manure, etc.
- AB 113

  Determination of lead, cadmium, and copper in foodstuffs, wastewater, and sewage sludge by anodic stripping voltammetry after digestion
- AB 114

  Polarographic determination of five metals (copper, cobalt, nickel, zinc, and iron) in a single run
- AB 123

  Voltammetric determination of iron and manganese in water samples
- AB 146

  Direct polarographic determination of trace amounts of molybdenum in water
- AB 186

  Determination of aluminum in water samples by adsorptive voltammetry
- AB 231

  Voltammetric determination of zinc, cadmium, lead, copper, thallium, nickel, and cobalt in water samples according to DIN 38406 Part 16
- Application Notes

  V-45, V-68, V-69, V-71, V-82, V-83, V-84, V-86, V-87, V-88, V-89, V-90, V-91, V-106, V-107, V-108, V-109, V-110, V-121, V-122

Chemical oxygen demand (COD)

Standard Methods

- DIN 38409-41

  German standard methods for the examination of water, waste water and sludge; summary action and material characteristic parameters (Group H); determination of the chemical oxygen demand (COD) in the range over 15 mg/L (H 41)
- DIN 38409-44

  German standard methods for the examination of water, waste water and sludge; parameters characterizing effects and substances (Group H); determination of the chemical oxygen demand (COD), ranging from 5 to 50 mg/L (H 44)
- DIN 38414-9

  German standard methods for the examination of water, waste water and sludge; sludge and sediments (group S); determination of the chemical oxygen demand (COD) (S 9)
- EPA 410.1

  Chemical oxygen demand (titrimetric, mid-level)
- EPA 410.2

  Chemical oxygen demand (titrimetric, low level)
- EPA 410.3

  Chemical oxygen demand, titrimetric, high-level for saline water
- ISO 6060

  Water quality – determination of the chemical oxygen demand
- SCA, Blue book 215

  The determination of chemical oxygen demand in waters and effluents

Metrohm Application Bulletins and Notes

- AB 178

  Fully automatic water analysis

Water hardness

Standard Methods

- ASTM D 511

  Standard test methods for calcium and magnesium in water
- ASTM D 1126

  Standard test methods for hardness in water
- ASTM D 1067

  Standard test methods for acidity or alkalinity of water
- ASTM D 3875

  Standard test methods for alkalinity in brackish water, seawater, and brines
- DIN 38406-3

  German standard methods for the examination of water, waste water and sludge – cations (group E) – part 3; determination of calcium and magnesium, complexometric method (E 3)
- DIN 38409-6

  German standard methods for the examination of water, waste water and sludge; summary indices of actions and substances (group H); water hardness (H 6)
- DIN 38409-7

  German standard methods for the examination of water, waste water and sludge; summary indices of actions and substances (group H); determination of acid and base-neutralizing capacities (H 7)
- DIN EN ISO 9963-1

  Water quality – determination of alkalinity – part 1: determination of total and composite alkalinity
- EPA 130.2

  Hardness, total (mg/L as $CaCO_3$) (titrimetric, EDTA)
- EPA 215.2

  Calcium (titrimetric, EDTA)
- EPA 310.1

  Alkalinity (titrimetric, pH 4.5)
- ISO 6058

  Water quality – determination of calcium content – EDTA titrimetric method
- ISO 6059

  Water quality – determination of the sum of calcium and magnesium – EDTA titrimetric method
- ISO 9963-2

  Water quality – determination of alkalinity – Part 2: determination of carbonate alkalinity
- SCA, Blue book 43

  Total hardness, calcium hardness and magnesium hardness in raw and potable waters by EDTA titrimetry
- SCA, Blue book 44

  The determination of alkalinity and acidity in water
- SLMB 639.1

  Total hardness in drinking water
- SLMB 640.1

  Alkalinity of drinking water, pH 4.3 and 8.2

Metrohm Application Bulletins and Notes

- AB 125

  Simultaneous determination of calcium, magnesium, and alkalinity by complexometric titration with potentiometric or photometric indication in water and beverage samples
- AB 178

  Fully automatic water analysis
- AN H-74

  Determination of calcium and magnesium in sea water
- AN T-84

  Fully automatic determination of the total, calcium and magnesium hardness of water samples using photometric titration

Free chlorine

Standard Methods

- ASTM D 512

  Standard test methods for chloride ion in water
- ASTM D 1253

  Standard test method for residual chlorine in water
- DIN 38405-1

  German standard methods for the examination of water, waste water and sludge; anions (group D); determination of chloride ions (D 1)
- EPA 330.1

  Chlorine, total residual (titrimetric, amperometric)
- EPA 330.2

  Chlorine, total residual (titrimetric, back, iodometric (starch or amperometric))
- EPA 330.3

  Chlorine, total residual (titrimetric, iodometric)

- DIN EN ISO 7393-1

  Water quality – determination of free chlorine and total chorine – part 1: titrimetric method using N,N-diethyl-1,4-phenylenediamine
- DIN EN ISO 7393-3

  Water quality – determination of free chlorine and total chlorine – part 3: iodometric titration method for the determination of total chlorine

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- AB 249

  Titrimetric determination of total and residual chlorine in drinking and process water

Other titrimetric determinations

Standard Methods

- ASTM D 1246

  Standard test method for bromide ion in water
- ASTM D 4658

  Standard test method for sulfide ion in water
- DIN 38405-5

  German standard methods for the examination of water, waste water and sludge; anions (group D); determination of sulfate ions (D 5)
- EPA 320.1

  Bromide (titrimetric)
- EPA 376.1

  Sulfide (titrimetric, iodine)

Metrohm Application Bulletins and Notes

- AB 125

  Simultaneous determination of calcium, magnesium, and alkalinity by complexometric titration with potentiometric or photometric indication in water and beverage samples
- AB 130

  Chloride titrations with potentiometric indication
- AB 178

  Fully automatic water analysis
- AN I-6

  Chloride content of water samples
- AN I-8

  Sulfide content of wastewater
- AN H-33

  Determination of low levels of chloride in water
- AN H-110

  Determination of sulfate in drinking water by barium chromate displacement
- AN T-7

  Sulfate in water samples
- AN T-32

  Hydrogen sulfide or sulfide in water
- AN T-77

  Photometric determination of sulfate in aqueous solutions
- AN T-101

  Fully automated determination of chloride in tap water

Comments

- We recommend the webpage www.nemi.gov for the download of standards issued by EPA.
- For a fully automated system, taking into account some of the mentioned parameters here, see also:

  Metrohm Application Bulletin No. 178

  Metrohm Application Note T-73

  Metrohm Application Note T-74

  Metrohm Application Note T-75

  Metrohm Application Note T-76

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