Sodium, atomic absorption spectrometric, direct

Parameters and Codes:
Sodium, dissolved, I-1735-85 (mg/L as Na): 00930
Sodium, total recoverable, I-3735-85 (mg/L as Na): none assigned
Sodium, recoverable-from-bottom-material, dry wt, I-5735-85 (mg/kg as Na): 00934

1. Application

1.1 This method may be used to analyze atmospheric precipitation, water, brines, and water-suspended sediment.

1.2 Two analytical ranges for sodium are included: from 0.01 to 1.0 mg/L and from 0.10 to 80 mg/L. Sample solutions containing sodium concentrations greater than 80 mg/L need to be diluted.

1.3 This method may be used to analyze bottom material containing at least 10 mg/kg of sodium.

1.4 Total recoverable sodium in water-suspended sediment needs to undergo preliminary digestion-solubilization by method I-3485, and recoverable sodium in bottom material needs to undergo preliminary digestion-solubilization by method 1-5485 before being determined.

2. Summary of method

2.1 Sodium is determined by atomic absorption spectrometry by direct aspiration of the sample solution into an air-acetylene flame (Fishman and Downs, 1966).

2.2 The procedure may be automated by the addition of a sampler and either a strip-chart recorder or a printer.

3. Interferences

None of the substances commonly occurring in natural water interfere with this method.

4. Apparatus

4.1 *Atomic absorption spectrometer* equipped with electronic digital readout and automatic zero and concentration controls.

4.2 Refer to the manufacturer's manual to optimize instrument for the following:

Grating ---------- Visible
Wavelength ---------- 588.8 nm
Source (hollow-cathode lamp) ---------- Sodium
Oxidant ---------- Air
Fuel ---------- Acetylene
Type of flame ---------- Oxidizing

4.3 The 50-mm (2-in.), flathead, single-slot burner, rotated 90°, allows working ranges of 0.01 to 1.0 mg/L and 0.1 to 80 mg/L. Different burners may be used according to manufacturers' instructions.

5. Reagents

5.1 *Sodium standard solution*, 1.00 mL = 1.00 mg Na: Dissolve 2.542 g NaCl in demineralized water and dilute to 1,000 mL.

5.2 *Sodium working standards:* Prepare a series of at least six working standards containing either from 0.01 to 1.0 mg/L or from 0.10 to 80 mg/L sodium by appropriate dilutions of sodium standard solution. The preparation of an intermediate standard solution is desirable when preparing working solutions of extreme dilution.

6. Procedure

While aspirating the blank use the automatic zero control to set the digital display to read zero concentration. While aspirating standards use the automatic concentration control to set the digital display to read concentrations of standards. Use at least six standards. Calibrate the instrument each time a set of samples is analyzed and check calibration at reasonable intervals.

7. Calculations

7.1 Determine the milligrams per liter of dissolved or total recoverable sodium in each sample from the digital display or printer while aspirating each sample. Dilute those samples containing sodium concentrations that exceed the working range of the method and multiply by the proper dilution factors.

7.2 To determine milligrams per kilogram of sodium in bottom-material samples, first determine the milligrams per liter of sodium as in paragraph 7.1, then:

$$\text{Na (mg/kg)} = \frac{\text{mg/L Na} \times \frac{\text{mL original digest}}{1000}}{\text{wt of sample (kg)}}$$

8. Report

8.1 Report sodium, dissolved (00930), and total-recoverable (none assigned, concentrations as follows: less than 1.0 mg/L, two decimals; 1.0 to 10 mg/L, one decimal; 10 mg/L and above, two significant figures.

8.2 Report sodium, recoverable-from-bottom-material (00934), concentrations as follows: less than 1,000 mg/kg, nearest 10 mg/kg; 1,000 mg/kg and above, two significant figures.

9. Precision

9.1 Precision for dissolved sodium for 33 samples within the range of 0.20 to 222 mg/L may be expressed as follows:

$$S_T = 0.046X + 0.186$$

where

S_T = overall precision, milligrams per liter, and

X = concentration of sodium, milligrams per liter.

The correlation coefficient is 0.9461.

9.2 Precision for dissolved sodium for six of the 33 samples expressed in terms of the percent relative standard deviation is as follows:

Number of laboratories	Mean (mg/L)	Relative standard deviation (percent)
22	0.20	35
36	2.76	13
25	15.4	6
35	56.0	5
31	96.9	5
19	222	6

9.3 Precision for dissolved sodium within the range of 0.01 to 1.0 mg/L in terms of the percent relative standard deviation by a single operator is as follows:

Number of replicates	Mean (mg/L)	Relative standard deviation (percent)
8	0.009	26.5
8	0.028	16.8
8	0.136	3.8
8	0.540	1.0

9.4 It is estimated that the percent relative standard deviation for total recoverable sodium and for recoverable sodium from bottom material will be greater than that reported for dissolved sodium.

References

Fishman, M. J., and Downs, S. C., 1966, Methods for analysis of selected metals in water by atomic absorption: U.S. Geological Survey Water-Supply Paper 1540-C, p. 38-41.