

Model SOPs for EC measurement

Acid Deposition and Oxidant
Research Center

Electric Conductivity

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(1) Applicable samples

This SOPs are applicable to electric conductivity (EC) measurement of precipitation samples.



(2) Principles and summary of the measurement method

- The electric conductivity of a solution is the reciprocal value of its resistance and can be directly measured by using a conductivity bridge with a measuring cell.
- The conductivity varies with the temperature of the solution and is proportional to the concentrations and the species of free ions in the solution. Since the conductivity also depends on the electrode area and its spacing, the measuring apparatus should be calibrated to obtain the cell constant or the meter should be adjusted



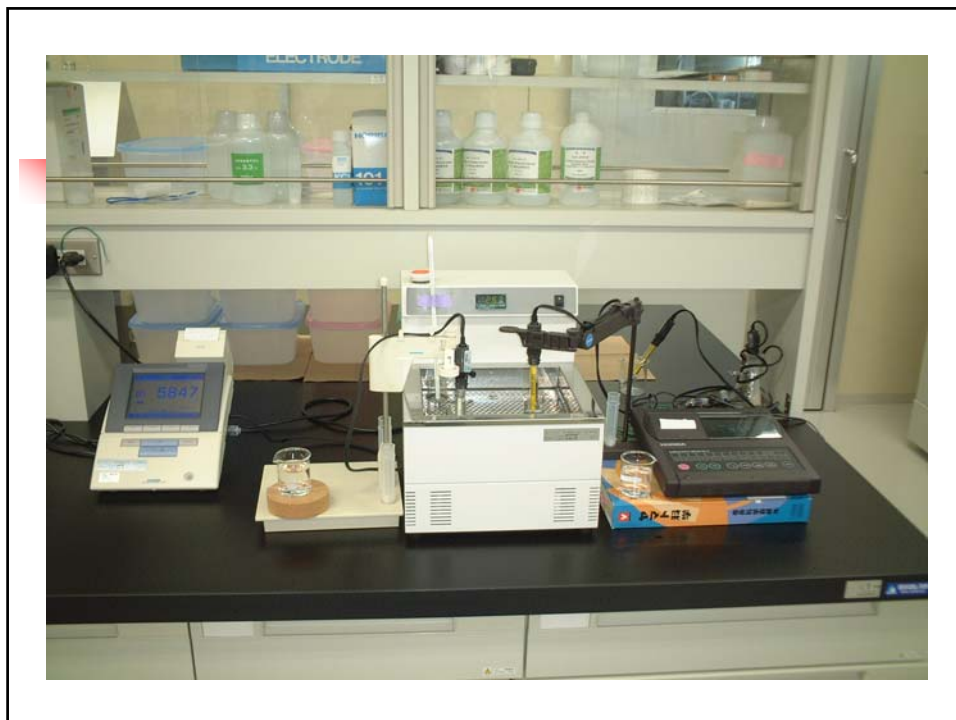
(3) References

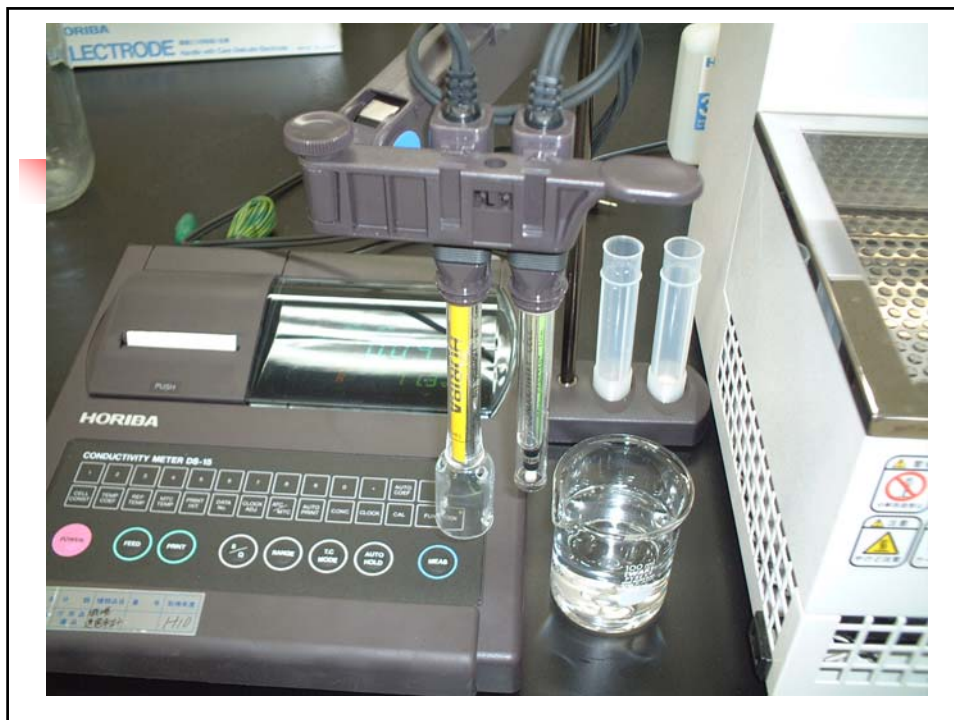
- This SOP is based on the following references.
 - Guidelines and Technical Manual for Wet Deposition Monitoring in East Asia
 - Wet deposition monitoring manual (Japan Environment Agency, May 1998; available only in Japanese)
 - Handling Manuals for EC meter (DS-series, basic operation) (1993, Horiba Co. Ltd.)



(4) Major instruments and apparatus

- Electric Conductivity Meter: HORIBA Co. Ltd. EC Meter DS-15
- Electric Conductivity Cell: HORIBA Co. Ltd. EC cell model 3551-10D (0.1~10000 μ S/cm)
- Electric Conductivity Cell: HORIBA Co. Ltd. EC cell model 3552-10D (1~100000 μ S/cm)
- Water bath □ Micro-circulator PMC-015 (Iuchi Seieido Co. Ltd.)
- 20 ml and 50 ml glass beaker
- Washing bottle (with deionized water)
- Kim wipe





(5) Reagents

- KCl (Kanto Chemicals Co. Ltd. EC measurement, Cat. No.32326-33)



(6) Preparation of working reference solutions

- Prepare the raw working reference solutions according to the Wet Deposition Monitoring Manual (Appendix 1, Japan Environment Agency, May 1988, pp.23) and keep it in the refrigerator at 4°C.
- Dilute it 100 times when it is used (add 10 ml of the raw working standard to a 1000 ml volumetric flask, and fill to the mark with deionized water).



(7) Preparation of standard solution for calibration

- a. Raw standard solution (0.01 M KCl)
- Dry KCl powder for 2 hours at 105°C, and cool it in a desiccator with Silica Gel.
 - After cooling, dissolve 0.7455 g of dried KCl in deionized water by using volumetric flask, fill deionized water to the mark and mix them thoroughly.

Dried KCl powder 0.7455 g
↓ ← deionized water
1 L
↓
final concentration 0.01 M



b. Standard solution(0.001 M KCl)

- Take 20 ml of raw standard solution (0.01 M KCl) into 200 ml volumetric flask by using 20 ml volumetric pipet, and fill deionized water to the mark.
- Prepare this solution at each calibration.

0.01 M KCl Calibration standard solution, 20 ml

↓ ← deionized water

200 ml

↓

final concentration 0.001 M

(8) Measurement procedures

- It is desirable to measure EC by using a cell of 0.1 \square 10000 μ S/cm (described in (4) 1) above) as far as sample volume allows.
- However, when sample volume is less than 30 ml, the measurement should be done by using other EC cell (Model 3552-10D). As pH may be measured by using EC measurement samples, the consumption volume of the sample measurement of EC should also be taken into account.

Criteria for Selecting Cells

Sample volume (ml)	Cell
30 <	Model 3551-10D
10 \square 30	Model 3552-10D



(9) Preparation of EC meter

- Prepare the EC meter as follows, according to the Instruction Manual (DS-series, basic operation) (1993, Horiba Co. Ltd.)
 - cancel the auto hold function
 - fix the temperature at 25 °C by manual
 - temperature conversion function: off

(10) Calibration of a cell

- Power on the EC meter and warm up it for 30 minutes, after filling suitable amount of water in the water bath.
- Rinse the cell with deionized water.
- Measure the working reference solution as follows.
 - Take about 20 ml of sample solution in a beaker, immerse the EC cell, and stir it gently for a few seconds.
 - Then, take about 20 ml of another sample solution in the same beaker and soak it in the water bath.
 - Immerse the cell into the beaker. After confirming that the temperature of the sample solution is 25 ± 0.5 °C and the indication value of EC meter is stable, read the indication value and record it in a notebook with the water temperature.
 - Repeat this operation until the measurement value agree with the previous value within ± 3 %.

(11) Measurement of samples

- Fill deionized water in glass beaker, immerse the EC cell and rinse it sufficiently. Repeat this operation.
- Take about 20 ml of sample solution in a beaker, immerse the EC cell, and stir it gently for a few seconds.
 - Then, take about 20 ml of another sample solution in the same beaker and soak it in water bath.
 - Immerse the cell into the beaker.
 - After confirming that the temperature of the sample solution is 25 ± 0.5 °C and the indication value stable, read the value and record it in a notebook with the water temperature.

(12) Duplicate measurement



Carry out the duplicate EC measurement for about 5% of routinely analyzed samples.

Samples containing a large quantity of precipitation should be separated into two;


one half should be analyzed and the other half should be kept in the refrigerator at about 4 °C and should be analyzed within a week.

Report the results by filling in the data format.



(13) Sensitivity test of the EC meter

- Once in every 20 samples, a working reference solution should be measured to confirm that their values are within 5% of the initially measured data.
- If the sensitivity fluctuates over this range, the reasons should be found and removed, and then the samples should be measured again.



(14) Measurement of not detected and lowest determination limit

- Fill deionized water in a 100 ml polyethylene bottle and put on the cap. Put the bottle in the water bath set at 25 ± 0.5 °C. After confirming that the temperature of the deionized water in the bottle is within 25 ± 0.5 °C, take 20 ml of the deionized water in a beaker and measure it quickly. Confirm that the measurement value agree with that of the next measurement values within 0.02 mS/m. This test should be carried out more than once in every three months.



(15) Reporting of results

- The measured results should be recorded in the database in accordance with the reporting formats. They should also be reported to Data Management Department.