SCOPE

These methods determine the electrical conductivity (EC) of water extract at soil/water ratio of 1:1 and 1:5.

Aqueous extracts of the soil samples are usually made at higher-than-normal water content for routine characterization purposes since obtaining water samples at typical field water contents are not very practical. Considering that the amounts of various solutes are influenced by the soil/water ratio at which the extract is made, the soil: water ratio should be standardized to obtain results that can be applied and reasonably interpreted. The extraction ratios of 1:1, 1:5, etc. may be used. The 1:1 and 1:5 soil:water ratio is selected since salinity and compositional errors from dispersion, hydrolysis, cation exchange, and mineral dissolution increase as the water/soil ratio increases.

PRINCIPLE

The electrical conductivity yields a measure of the soil extract's capacity to convey an electric current. Electrical conductivity is generally related to the total solute concentration and can be used as a quantitative expression of dissolved salt concentration, even though it is also affected by the mobilities, valences, and relative concentrations of the individual ions present in the solution.

The determination of EC generally involves the physical measurement of resistance (R). The reciprocal of R is conductance (C). When the cell constant is applied, the measured conductance at a specified temperature is converted to specific C, the reciprocal of the specific R is called electrical conductivity.

Electrical conductivity increases with temperature. Conductivity ideally should be determined at 25°C. However, EC can be measured at other known temperatures and corrected to the 25°C reference using appropriate temperature coefficients (usually based on NaCl).

The presence of the major dissolved inorganic solutes, essentially Na^+, Mg^{2+}, Ca^{2+}, K^+, Cl^-, SO_4^{2-}, HCO_3^- and CO_3^{2-}, in aqueous samples refers to the term salinity which is measured through electrical conductivity. The EC determination is often sufficient for purposes of diagnosing, surveying, and monitoring soil salinity, and for assessing the adequacy of leaching and drainage. It also, in other cases minimize the number of samples requiring compositional analyses because correlations frequently exist between salinity and the concentrations of individual solutes and their ratios within the same general area of the landscape.

TEST PRECAUTIONS

Soil samples should not be oven-dried before extracting for determination of soluble salts, because heating to 105ºC converts at least a part of the gypsum ($CaSO_4 \cdot 2H_2O$) to plaster of paris ($CaSO_4 \cdot 1/2H_2O$). The latter hydrate has a higher solubility in water than does the former. The solubilities of other salts and minerals may also be affected.

EQUIPMENT

a) Analytical Balance, precision of at least 0.001 g
b) Mechanical Reciprocating shaker
c) Electrical Conductivity meter

LABORATORY WARE

a) Pipet or Bottle Top dispenser, 10 mL
b) Plastic Beakers, 500 mL or 1000 mL
c) Wash Bottles
d) Centrifuge tubes or Polyethylene container, 50 mL or 100 mL capacity

CHEMICALS AND REAGENTS

a) NIST Traceable EC Standard: 147 and 1413 uS/cm at 25°C
b) Deionized Water

HEALTH AND SAFETY

Wear proper personal protective equipment. Use laboratory coat, close shoes, gas mask or dust masks, and appropriate [illegible] chemicals.

For Laboratory Use: always check the SDS and COA for [illegible]ered chemical as to confirm if it is compliant with the specifications provided.

PROCEDURE

Calibration of the Conductivity Meter

1. Calibrate the conductivity meter according to the equipment's instructions using NIST traceable EC Standard Solution 147µS/cm. When EC of soil samples is equal to or greater than 700 µS/cm, recalibrate using 1413 µS/cm EC standard solution and determine again EC of soil samples.
2. Rinse the probe between samples and remove excess water.
3. Use EC standard 147 µS/cm for intermediate standard checking. If the reading is within the specified limits on the EC standard's Certificate of Analysis, continue to sample analysis. Otherwise, recalibrate until it is within the limits.

A. Electrical Conductivity (H_2O 1:1) *(Rhoades, 1996)*

1. Weigh 10.0 g of air-dry soil into a 50 mL centrifuge tubes/polyethylene bottle.
2. Add 10.0 mL of deionized water to the soil in the container and place a stopper
3. Using a mechanical reciprocal shaker, shake for 60 minutes at 250 rpm.
4. Stand for 30 minutes.
5. Read EC of samples and record. Rinse the electrode between samples and remove excess water.
6. Read EC Standard every 10th sample for intermediate Standard Check.
   Note: Complete EC measurements within 3 to 4 hours of obtaining the aqueous supernatant.
7. Rinse the electrode thoroughly and immerse in water when not in use.