SOILS AS ELECTRICAL SYSTEMS

From: Vernier Lab Earth Science Lab 7

Electrical conductivity is the electrolytic conductivity of an extract from saturated soil paste. Electrical conductivity is a measure of the concentration of water-soluble salts in soils. It is used to indicate saline soils. High concentrations of neutral salts, such as sodium chloride and sodium sulfate, may interfere with the absorption of water by plants because the osmotic pressure in the soil solution is nearly as high or higher than that in the plant cells. Salts may also interfere with the exchange capacity of nutrient ions, thereby resulting in nutritional deficiencies in the plants.

Soil can become saline by the natural weathering of minerals, irrigation, or run-off from salted roads. Poor drainage and hot, dry weather also contribute to the build-up of salt in the soil. Sodium chloride, NaCl, is the most common salt, but others such as calcium chloride, $CaCl_2$, and magnesium sulfate, $MgSO_4$, are often present as well. Soil salinity is determined by measuring the electrical conductivity of a soil-water mixture. The higher the salinity of the soil, the higher the conductivity of this mixture will be. In this experiment, you will use a Conductivity Probe to measure the salinity of several soils. The unique units of soil salinity require a special note. Soil salinity is commonly reported in units of dS/m, deciSiemens per meter.

OBJECTIVES

In this experiment, you will
- Use a Conductivity Probe to measure the salinity of soil samples.
- Explain and compare response of the salinity content in the soil samples.

MATERIALS

LabQuest	distilled water
Conductivity Probe	2 soil samples
2 beakers	2 plastic spoons
100 mL graduated cylinder	wash bottle with distilled water
waste container	paper towels
tissue	10 dS/m salinity standard (optional)

PROCEDURE

1. Prepare the water-soil mixture in a 2:1 ratio. Note: If your samples have already been prepared, proceed directly to Step 2.
   a. Label two beakers "A" and "B".

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      b.   Place 50 g of Soil A into Beaker A. To avoid cross-contamination of the soils, leave this spoon in the beaker.

      c.   Using a new spoon, place 50 g of Soil B into Beaker B. Leave the spoon in the beaker.

      d.   Add 100 mL of distilled water to each beaker.

      e.   Stir both mixtures thoroughly.

      f.   Stir once every three minutes for 15 minutes. Continue with Steps 2–4 while waiting.

2. Connect the Conductivity Probe to Channel 1 of the LabQuest. The switch on the Conductivity Probe should be on the 0–20000 µS/cm setting .

3. You can now use the stored calibration.

4. You are now ready to collect salinity data.
    a. Place the tip of the electrode into Sample A. The hole near the tip of the probe should be completely covered by the water-soil mixture.
    b. Monitor the salinity value in the meter.
    c. When stable, record the salinity in your data table.
    d. Rinse the Conductivity Probe with distilled water.

5. Repeat Step 4 for sample B.

DATA

	Sample A	Sample B
Soil Salinity (dS/m)		

PROCESSING THE DATA

1. Describe two ways in which soil can become saline.

2. Were the soil samples taken from the same area (field)? Defend your answer.

EXTENSIONS

1. Test soil samples from your backyard or another environment and compare to your first results. Are the results the same or different? Try to explain why.