

Soil Lessons



Instructional Value

Determine if soil has a positive or a negative charge.

Type of Lesson

Hands-on

Materials Needed

A 6 volt battery, some copper wire, and a clay-water slurry will be used in this experiment. The clay can be purchased from the Purdue Agronomy Club, Department of Agronomy, 1150 Lilly Hall, Purdue University, West Lafayette, Indiana 47907.

Time

15 minutes

Soil has a Charge

Summary

How does soil keep fertilizers and pesticides from leaching out of the surface soil where they are needed? Soil behaves as an ion exchange column. This means that soil has a charge and can attract chemicals (ions) that have the opposite charge.

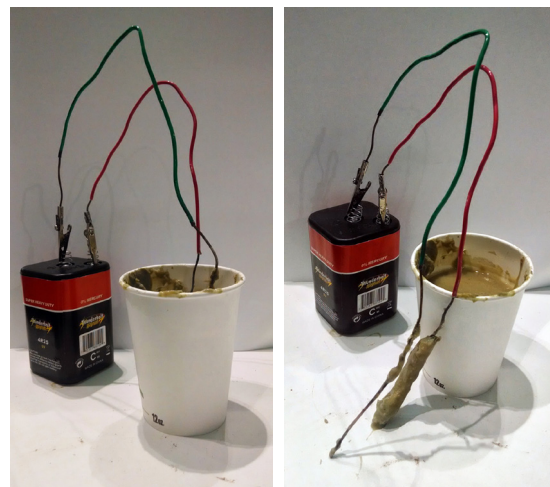
1. Cut two lengths of copper wire about 8 inches long.
2. Attach one copper wire to the positive pole of the battery and attach the second copper wire to the negative pole (see photos). Be sure that the insulation is off the wire at the points of contact to the battery and in the clay slurry. (Any size battery will do, but a higher voltage battery works faster and better).
3. Place the ends of the wires in a flask or cup filled to the top with clay which has been mixed with water to the consistency of glue. If you decide not to use the clay supplied by the Purdue Agronomy Club make sure you use the stickiest clay you can find. An alternative to the clay could be a surface soil high in organic matter and clay.
4. After 10 minutes check to see whether the clay particles have moved to the wire attached to the positive or negative pole. Remember, unlike charges are attracted to each other. (Organic matter has the same charge as clay).

Discussion

These ions are commonly added from limestone, fertilizers and acid rain to garden and farm soils:

H+	Hydrogen
NH ₄ ⁺	Ammonium
NO ₃ ⁻	Nitrate
K ⁺	Potassium
Cl ⁻	Chloride
Ca ⁺⁺	Calcium
Mg ⁺⁺	Magnesium
SO ₄ ⁼	Sulfate
Mn ⁺⁺	Manganese

Based on the results of the above demonstration, put a check behind those plant nutrient ions in the list above that will attach to the charge sites (exchange sites) on the soil. These ions will not leach out of the soil or will do so only very slowly.



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