

Exploring water in soils: Cation Exchange Capacity [CEC]



• EXPLORE
SOILS •

Summary:

The constituent parts of a soil determine how the soil functions within a landscape. There are 3 main divisions in division a soil ingredients: living matter, dead/decaying matter and matter derived from geological processes. Each of these groups affects the functioning of the soil, as is partly explored in the soil texture modeling exercise.

Organic matter comprising of the decaying remains of plants, soil organisms and above ground organisms which have been deposited within the soil. Organic matter [OM] comes in many shapes and sizes as it undertakes the complicated and often long process of decomposition by bacteria, fungus and many other life forms. These chunks of OM have many negatively charged sites which bind with cations entering and travelling through the soil in solutions. In this demo we use a soil that is high in OM and a soil that is low in OM, it is useful to use the same soil with added compost so that different clay contents do not overshadow the impact of OM. A dye called Methylene Blue is used to demonstrate the cation absorption capacity of the soils and can be bought from a number of lab providers, as it is commonly used as a cell stain.

Learning Objectives:

- The mechanism of CEC
- How soils act as water filters within a landscape

Equipment:

- Methylene Blue dye (powder form)
- Water
- Measuring cylinder x2
- Teaspoon
- Plastic funnel x2
- Kitchen roll
- Pint glass x2
- Sample soils x2
- Tablespoon

Preparation:

Estimated time ~10 minutes.

Gathering soil samples and mixing with compost if required.

Folding kitchen roll -see images in pdf but essentially to create a coffee filter style cone of paper, to act a block of the soil falling through into the glass with the dye.

Mixing dye.

Time Required:

Introduction 2-5 mins

Demonstration 5-10 minutes

Total timing ~15 minutes.

Background Learning Needs:

- Understanding of constituent parts of soil
- Some level of basic chemistry
- Understanding of soil function as a filter of freshwater

Risk Assessment:

Hazard	Likelihood	Severity	Mitigation
Illness from ingestion or or contact with eyes of dye	Low	Low	Use gloves when mixing and pouring dye
Injury from broken glass	Low	Medium/High	Clean away broken glass immediately
Site/local specific risks	Unknown	Unknown	Anyone running this activity is advised to conduct a risk assessment for the specific site and conditions

Description of Activities:

1. Mix $\frac{1}{2}$ teaspoon of Methylene Blue dye within 500ml of cold water.
2. Divide this into 2 lots of 250ml within the measuring cylinders.
3. Place the pre-folded kitchen roll into the funnel and place these in the pint glasses.
4. Take an equal volume of soil ~8 tablespoons of crumbled soil of both samples into the kitchen roll.
5. Pour the dye through each of the soils, the dye may take a while to be absorbed, be patient and top it up when there is space, try not to let it run over the edge or escape down the side of the kitchen role.
6. Observe both the time it takes for the dye to move through the samples and the difference in the clarity of the liquid that appears within the pint glass. The clearer the liquid the more of the dye has been absorbed onto the soil particles.



