

Determination of soil CEC using methylene blue

Teacher and technician sheet

Equipment and materials

Each student or pair of students will require:

Obtaining a calibration curve

- Burette x 2
- Test tube x 6
- Colorimeter and suitable filter (red). A methylene blue solution displays maximum absorption at 668 nm.
- Methylene blue solution containing 5×10^{-5} mol dm⁻³ methylene blue (30 cm³)

Determining cation exchange capacity

- Balance, 2 decimal place
- 100 cm³ conical flask with bung
- Burette
- Filter funnel and paper
- 50 cm³ beaker
- 5 cm³ pipette
- 100 cm³ volumetric flask
- Colorimeter and suitable filter (red) - methylene blue solution displays maximum absorption at 668 nm.
- Soil sample (1 g)
- Methylene blue solution, 0.01 mol dm⁻³ (10 cm³)

Solid methylene blue is harmful and an eye irritant, wear eye protection when measuring out. Make sure that students wear eye protection.

Preparation of solutions

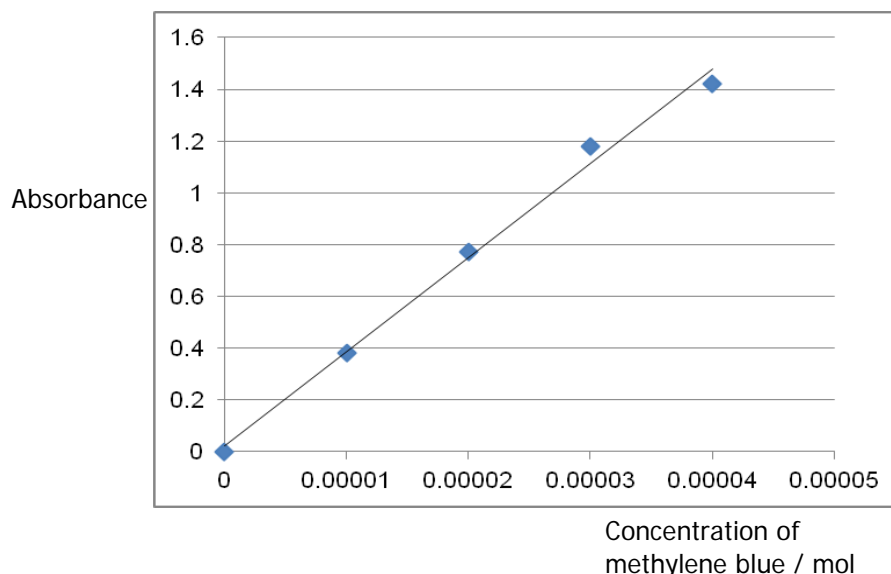
- 0.01 mol dm⁻³ solution of methylene blue

Weigh out 3.20 g of methylene blue, dissolve in deionised water and make up to the mark in a 1 dm³ volumetric flask to produce a 0.01 mol dm⁻³ solution.

- 5×10^{-5} mol dm⁻³ solution of methylene blue

Dilute 5 cm³ of the 0.01 mol dm⁻³ solution of methylene blue to 1 dm³ in a volumetric flask. This solution has a concentration of 5×10^{-5} mol dm⁻³.

Example of calibration graph obtained



Indicative data

Rating	CEC (meq/100 g)	Comment
Very low	0-10	Very low nutrient holding capacity indicating sandy soils with little or no clay or organic matter. Nutrients will be easily leached and foliar applied nutrients are strongly recommended.
Slightly low	10-15	Slightly low nutrient holding capacity indicating a more loamy mineral soil. Leaching may still be a problem and therefore foliar applications should be considered.
Normal range	15-40	Adequate to high nutrient holding capacity indicating soils with increasing clay content.
High	>40	Very high level normally found in very heavy soils with a high clay content or soils with a high organic matter level. Nutrients can be bound very tightly to the soil particles and availability can be restricted.

Source: <http://www.megalab.net/pmedia/analysis-tech-cationexchange.pdf>

Soil texture	CEC (meq/100 g)
Sands (light coloured)	3-5
Sands (dark coloured)	10-20
Loams	10-15
Silt loams	15-25
Clay and clay loams	20-50
Organic soils	>50

Source: <http://soils.tfrec.wsu.edu/webnutritiongood/soilprops/04CEC.htm>