Soil/water distribution coefficient for Zn^{2+}

Student worksheet

Principle

The soil-water distribution coefficient has the symbol K_d. It has no units.

$$K_d = \frac{[\text{Metal ions adsorbed in the soil}]_{eq}}{[\text{Metal ions dissolved in water}]_{aq}} = \frac{C_{soil}\ (\text{mg kg}^{-1}\ \text{of soil})}{C_{aq}(\text{mg dm}^{-1}\ \text{of solution})}$$

In this basic method you will leave a solution of zinc sulfate in contact with soil for a few days, filter it and then determine the concentration of Zn^{2+} ions in it using a zincon assay.

Equipment and materials

- Soil (0.1 g)
- Electronic balance
- Boiling tube
- 5 cm^3 pipette or burette
- −10 – 110°C thermometer
- Filter funnel and filter paper
- Narrow range pH indicator paper
- Zinc sulfate solution containing 0.01 g dm^{-3} Zn^{2+} (10 ppm) (5 cm^3)
- Equipment and materials for zincon assay (see *Zinc by zincon assay*)

Method

Care: Wear eye protection

1. Weigh 0.1 g of solid growing medium into a boiling tube. Note: Growing medium should be homogeneous soils so remove pieces of vermiculite, larger pebbles or pieces of organic materials.
2. Add 5.0 cm^3 of a solution of zinc sulfate (containing 10 ppm Zn^{2+}) to the boiling tube, followed by 1.0 cm^3 of deionised water.
3. Leave the tube for 3-4 days, occasionally shaking it. Record the temperature each day and calculate the average value.
4. Filter the contents of the tube through folded paper in a funnel.
5. Measure the pH of the filtrate using a narrow range indicator.
6. Use a zincon assay to determine the concentration of zinc ions in the filtered solution (see *Zinc by zincon assay*).

Calculations

1. Calculate the mass (in mg) of zinc ions in 5 cm^3 of the filtrate.
2. Calculate the mass (in mg) of zinc ions bound to the growing medium in the sample.
3. Calculate K_d for zinc ions and soil under the conditions used (temperature and pH).