16.1 Introduction

Water soluble boron is considered to be immediately available to plants. Boron is extracted in a 1:2 soil to water ratio and the boron is determined photometrically by the curcumin method.

16.2 Apparatus

Soda glass Erlenmeyer flasks 50 cm$^3$
Cork stoppers
Plastic measuring cylinder 50 cm$^3$
Plastic funnels
Plastic bottles 50 cm$^3$ capacity
Whatman no 542 and no 41 filter paper
Hotplate
Laboratory oven
Pipettes
Burette 50 cm$^3$
Vitreosil silica crucibles 30 cm$^3$
Spectrophotometer
Balance accurate to 0,1 g

NOTE: Do not use Pyrex, Jena or any other borosilicate glass under any circumstances.

16.3 Reagents

**Calcium chloride, 0,05 mol dm$^{-3}$**: Dissolve 7,35 g CaCl$_2$·2H$_2$O in de-ionised water and make up to 1 dm$^3$. Store in a plastic bottle.

**De-ionised water**: Stored in a plastic bottle

**Curcumin solution**: Dissolve 0,04 g curcumin and 5 g oxalic acid in 100 cm$^3$ ethanol 95%. This solution is stable for 2 to 3 days (5 days if kept in a refrigerator).

**Boron stock standard solution, 100 mg dm$^{-3}$**: Dissolve 0,572 g boric acid (AR) in 1 dm$^3$ de-ionised water. Store solution in a plastic bottle.

**Boron standard solution, 0,5 dm$^3$**: Dilute 5 cm$^3$ of the boron stock solution to 1 dm$^3$ with de-ionised water.
16.4 Procedure

16.4.1 Extraction

- Place 20 g air dry (≤ 2 mm) soil into a soda glass Erlenmeyer flask.
- Add 40 cm$^3$ de-ionised water and shake by rotating the flask.
- Stopper the flask and heat on a hotplate until the temperature reaches 80°C ($±$ 5 minutes).
- Place the Erlenmeyer flask for 5 minutes in an oven set at 80°C.
- Add 3 to 5 drops 0.05 mol dm$^{-3}$ calcium chloride solution and shake the flask.
- Filter through Whatman no 542 filter paper fitted to a plastic funnel into a plastic bottle.
- Run a blank using 40 cm$^3$ de-ionised water and treat in the same manner as the original sample.

**NOTE:** The cork stoppers reduce evaporation to a minimum.

16.4.2 Determination

- Pipette 1, 2, 3 and 5 cm$^3$ of standard solution into crucibles. Use 1 cm$^3$ de-ionised water for the blank.
- Pipette 1 cm$^3$ soil extract for each sample into a crucible.
- Add 4 cm$^3$ curcumin solution to each crucible.
- Place crucibles in oven at 50 $±$ 3°C until dry, leave in oven for an extra 15 minutes to ensure complete dryness.
- Wash the salts (using ethanol) into a 25 cm$^3$ volumetric flask and make up to volume with ethanol.
- Shake the flask and filter through Whatman no 41 filter paper, using plastic funnels.
- Zero the spectrophotometer with the blank sample and read the absorbance for each sample at 540 nm.
- Plot a curve (absorbance against µg cm$^3$ B) and read the µg cm$^3$ B for each sample from the curve.

16.5 Calculation

Let B content of sample be $b$ µg cm$^3$.

$mg \ kg^{-1} \ B \ in \ soil = \frac{b \times 40}{20}$
16.6 Reference