

### Phytoremediation investigation

#### Aim

Phytoremediation is when plants remove toxic materials from the soil.

Some plants take up and accumulate copper from copper sulphate. In this experiment you will compare the ability of two different plants, lettuce and radish, to accumulate copper from copper sulphate solutions of different concentrations.

In this experiment you will grow 125 lettuce seeds. You will put 25 seeds in each of five growth chambers. You will water the seeds with dilute copper sulphate solution. You will do the same with 125 radish seeds.

Then you will do exactly the same but this time use more concentrated copper sulphate solution.

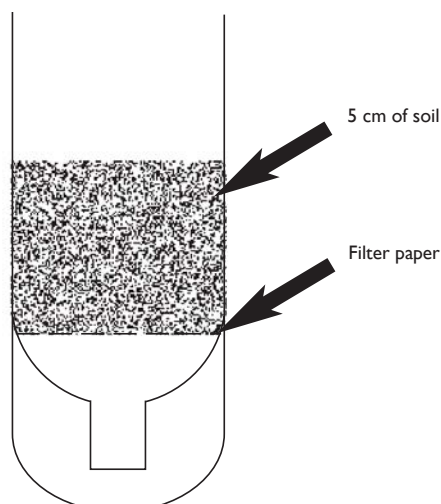
This experiment will also have a control. For this you will water the seeds with distilled water instead of copper sulphate solution.

#### Plan

Spread 375 lettuce seeds and 375 radish seeds on damp paper towels. Cover them with more paper towels. Store them in a warm dark place for three days so that they can germinate.

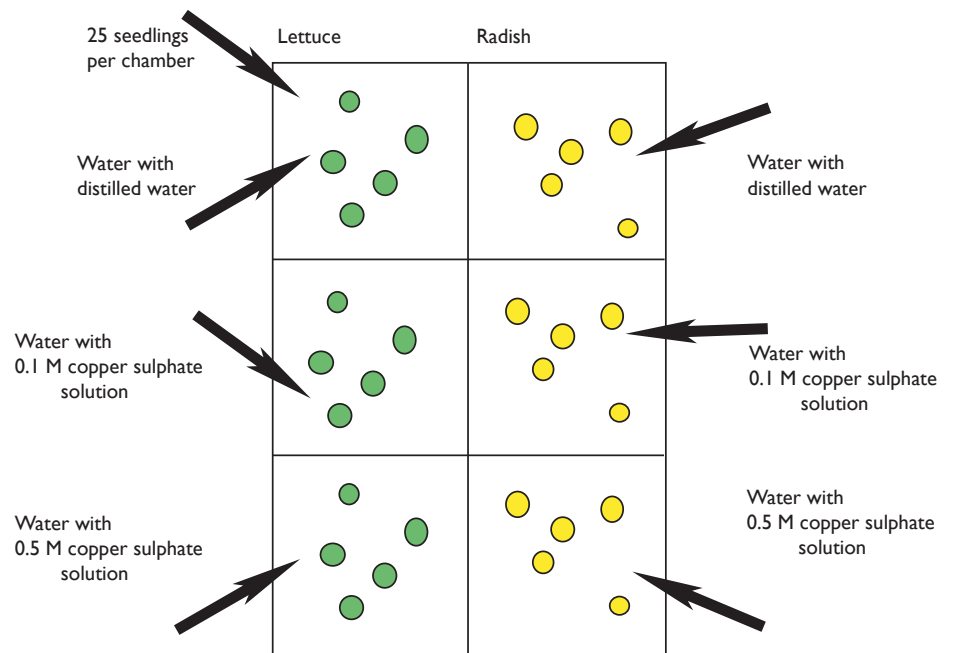
Collect your solutions of dilute copper sulphate solution (0.1 M) and more concentrated copper sulphate solution (0.5 M).

Remove the cap and cut the top third off a 2 litre clear plastic bottle. Then turn the top section upside down and place it in the bottom part of the bottle. Put some filter paper in the bottom of the upside down section and fill it with autoclaved soil to a depth of 5 cm. Congratulations - you have made a growth chamber! Now make 29 more.



Make sure you only use autoclaved soil - this controls the amount of bacteria.

After three days the seedlings should have grown into the paper towel. Cut out small squares so that each square has 25 seedlings. Plant each square into a growth chamber. You do not need to remove the paper towel.



Water the growth chambers every day with 50 cm<sup>3</sup> of either water or 0.1 M copper sulphate solution or 0.5 M copper sulphate solution. Do this for between four and seven days.

Some of the copper sulphate solution or water will go through the soil and filter paper into the bottom of the bottle. After the fourth day take a 1 cm<sup>3</sup> sample from the bottom of the 0.1 M copper sulphate growth chamber. Add 99 cm<sup>3</sup> of distilled water. Find the concentration of copper in the solution by following the instructions on the copper test kit. Multiply your answer by 100. Repeat this process for all of your growth chambers.

### **Finding out the concentration of copper in plants**

To find out the amount of copper in the plants, remove the plants from the soil and heat them in a microwave for 5 minutes. This dehydrates the plants.

**Caution:** watch them as they dehydrate because the plants can catch fire in the microwave. This will leave you with dried plants. Take a sample of each plant. Make sure that each of the samples is the same mass, for example 0.1 g.

Then place each dried sample into a solution of 5 cm<sup>3</sup> of 1 M hydrochloric acid. Grind it in a mortar and pestle and leave it overnight to set. Clean out your mortar and pestle after each sample.

Next day add 1 cm<sup>3</sup> the solution to 99 cm<sup>3</sup> of distilled water and use the copper test kit.

Record the results for each growth chamber then find the average copper uptake for each group of five growth chambers. Multiply the number of mg/l by 100 and plot the results on a graph of mg/l (biomass) against plant type.

### **Conclusions**

Our results showed that both lettuce and radish accumulated copper at both concentrations. Lettuce was the more effective accumulator at both concentrations. The lettuce accumulated more copper and the filtrate contained less copper. Our results have been included. The original researchers' results can also be viewed on the website

**[www.woodrow.org](http://www.woodrow.org)** where the effect of a wider range of plants has also been studied.