In this experiment we are going to investigate one of the limiting factors of photosynthesis - wavelength of light.

We will need:

Four universal bottles.

Hydrogencarbonate indicator, also known as bicarbonate indicator.

Immobilised algal balls.

A lamp as a light source.

Green, blue and red filter sleeves to cover the universal bottles.

A colorimeter, set to 580 nanometres.

Cuvettes and a pipette.

You may already have experimented with the water plant elodea, hydrogencarbonate indicator and coloured filters.

In that experiment, it was established that photosynthesizing plants decrease the levels of carbon dioxide in the indicator.

The indicator changed colour dependent upon increased or decreased levels of carbon dioxide, which was an effect of using the different coloured filters on the bottles containing elodea.

Using immobilised algae in this experiment gives greater control making the results more valid.

Quantifying the results using the colorimeter will also ensure more accurate results.

Let's start the experiment.

First, transfer 15 algal balls into each of the four universal bottles.

Using a syringe, add 4 cubic centimetres of hydrogen carbonate indicator to each of the four universal bottles.

Hydrogencarbonate indicator measures carbon dioxide levels in aquatic systems.

Now place the red, blue and green filters around 3 of the universal bottles and leave one bottle without a filter.

Record on each bottle lid which filter is in place on each bottle.

No filter.

Green.

Blue.

Or red.

Place all 4 bottles in front of the lamp, making sure that all samples are close to, and equidistant from, the lamp.

Leave the samples in front of the lamp for around 90 minutes.

After 90 minutes thoroughly mix the contents of each universal bottle.

Switch on the colorimeter and set the filter to 580 nanometres.

Rinse out a cuvette with distilled water and then add about 3 cubic centimetres of distilled water to it.

Use this cuvette to zero the colorimeter.

Take the universal bottle with no filter, which received 100% of the incident light and remove the indicator from the bottle using a pipette.

Then put the indicator into a cuvette.

Using the colorimeter, measure and record the absorbance.

Repeat this for the bottles with the green the red and the blue filters, measuring and recording each result.

Visually the results can be described as colours.

Hydrogencarbonate indicator becomes more orange or yellow with increased carbon dioxide levels, and changes from red through magenta to deep purple as carbon dioxide is removed.

If algae are photosynthesizing more than respiring, we would expect the indicator to change towards deep purple, indicating decreased carbon dioxide.

We can see this most in the bottle with no filter.

The bottles with the red and blue filters show a colour of red, also showing decreased carbon dioxide.

Plants require light to photosynthesize and mainly make use of red and blue light wavelengths.

Plants are green because they absorb red and blue light and reflect green light.

The bottle with the green filter shows a colour change to yellow.

Because the plants reflect the green spectrum of light, we would expect the rate of photosynthesis to be limited, indicating increased CO2.

Using the colorimeter we can record our result for each filter.

In conclusion, the wavelength of light is an important limiting factor for photosynthesis.

We can see that the algae were able to photosynthesise more effectively with red and blue light compared to green light.