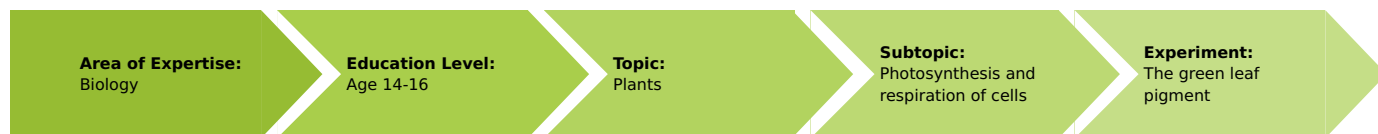


The green leaf pigment (Item No.: P8011900)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



30 Minutes

Recommended Group Size



2 Students

Additional Requirements:

- Pot plant of a green-white variegated ivy

Experiment Variations:

Keywords:

Chlorophyll, Photosynthesis

Task and equipment

Information for teachers

Additional Information

The previous experiment (Experiment "Conditions necessary for photosynthesis ") has shown, that the formation of starch in the plant, the assimilation of carbon dioxide, can only take place when the plant is exposed to light. This process is therefore also called photosynthesis (Grek: phos "light", synthesis "composition"). In this experiment the students are supposed to realize that photosynthesis can only occur with the help of the green leaf pigment, which converts the light of the sun into energy.

The green colour of the leaves is caused by a class of natural dyes, the chlorophylls. The main function of the chlorophylls is to absorb the incident light of the sun, to convert the light into energy and to transport the energy. This energy is necessary to build starch from carbon dioxide and water. In this reaction, which takes place in the so called reaction centre, the chlorophylls ("special pair") are also involved.

When plants are missing the green leaf pigment chlorophyll, so they cannot run photosynthesis, this is caused in most cases by a genetic defect due to mutation. For some plant species, the green leaf pigment is only missing in certain areas of the leaves, it comes to the appearance of multi-colored plants. Often the leaves are green-white or white-yellowish patterned. (The yellow and red colors are caused by embedded carotenoids.) One speaks of variegation.

For some plants variegation is natural, as for example for the clover, and the patterns caused emphasize the flower. For other plants variegation is rarely or caused by breeding, as for example green-white variegated ivy.

Hints on Set-up and Action

- Instead of a green-white variegated ivy you can also use other plants with variegated leaves for this experiment, such as bred species of the tropaeolum, the lily of the valley or the tulips.



Hazards!

- Ethyl alcohol is easily inflammable. Extinguish all flames before handling it!
- Wear protective glasses!

The green leaf pigment (Item No.: P8011900)

Task and equipment

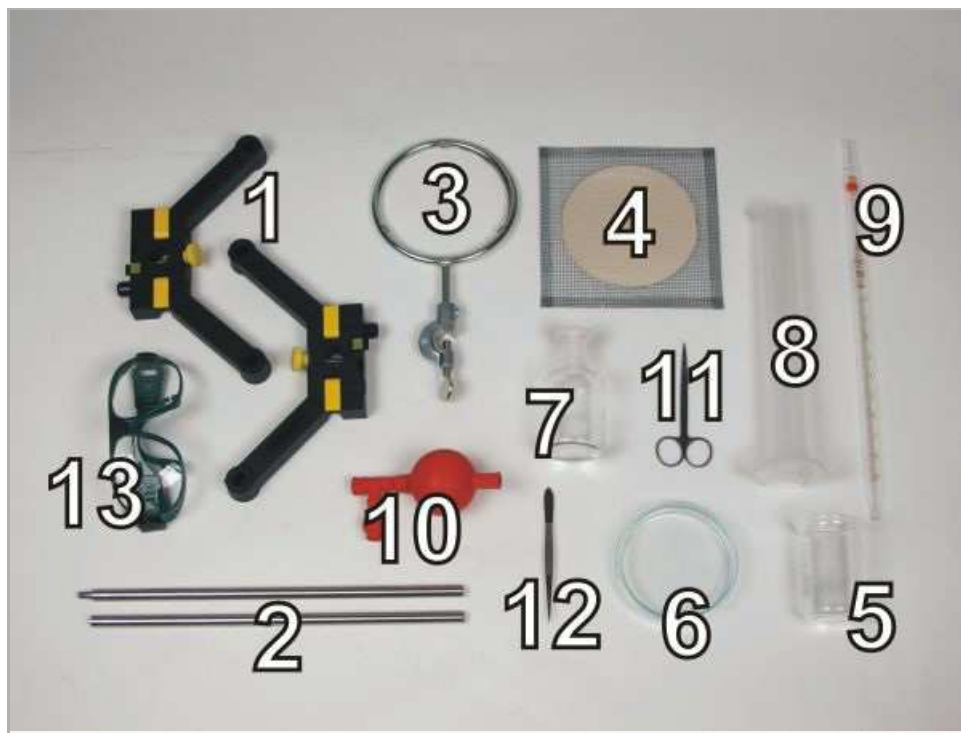
Task

What is the importance of the green leaf pigment?

Determine whether light is the only prerequisite for photosynthesis.



Equipment



Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, l = 600 mm, d = 10 mm, split in 2 rods with	02035-00	1
3	Support ring, i.d. 130mm,w.boss	37722-03	1
4	Wire gauze with ceramic, 160 x 160 mm	33287-01	1
5	Glass beaker DURAN®, tall, 100 ml	36002-00	1
6	Petri dish, d 100 mm	64705-00	1
7	Bottle,nar.mouth,100ml,clear,p.st	41101-01	1
8	Graduated cylinder 100 ml, PP transparent	36629-01	1
9	Graduated pipette 10 ml	36600-00	1
10	Pipettor,bulb,3 valves, 10ml max.	47127-01	1
11	Scissors,straight,pointed,l 110mm	64623-00	1
12	Tweezers,straight,pointed,120mm	64607-00	1
13	Protecting glasses, clear glass	39316-00	1
	Butane burner, Labogaz 206 type	32178-00	1
	Butane cartridge C206, without valve	47535-01	1
	Iodine potass.iodide sol., 250 ml	30094-25	1
	Water, distilled 5 l	31246-81	1
	Denaturated alcohol (spirit for burning), 1000 ml	31150-70	1
Additional material			
	Pot plant of a green-white variegated ivy		

Set-up and procedure

Hazards!

- Ethyl alcohol is easily inflammable. Extinguish all flames before handling it!
- Wear protective glasses!



Place a variegated ivy pot plant in sunlight or illuminate it with a strong light bulb for at least 3 hours.

After this 3 hours exposure, detach one of the green-white patterned leaves from the plant . Draw a sketch on the Results page of how the green and white areas are distributed on the leaf surface (Fig. 1).



Fig. 1

Set up a support stand with the support base and the support rod (Fig. 2 and Fig. 3), fix the support ring to the support rod and lay the wire gauze on it (Fig. 4).

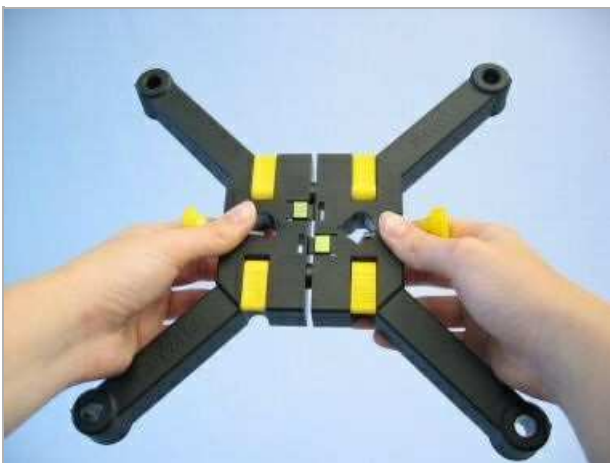


Fig. 2



Fig. 3



Fig. 4

Attach the butane burner to the butane cartridge (Fig. 5-6).



Fig. 5



Fig. 6

Fill a 100 ml beaker with water and place it onto the wire gauze. Using matches light up the butane burner, place it underneath the wire gauze (Fig. 7) and heat the water to boiling.

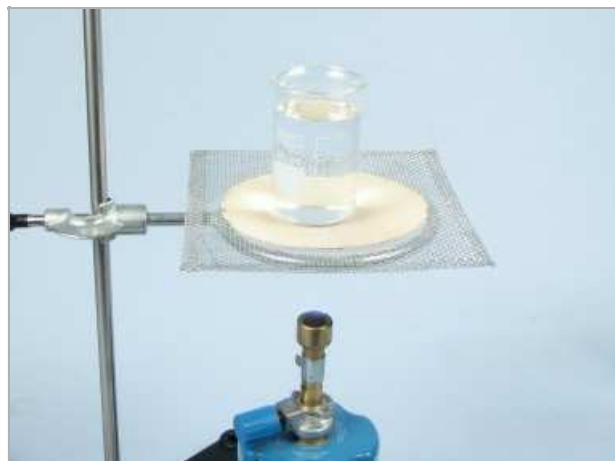


Fig. 7

Drop the leaf into the water in order to kill it (Fig. 8). After about one minute turn off the butane burner.



Fig. 8

Fill a 100 mm diameter petri dish up to two-thirds with 96% ethyl alcohol (ethanol). Make sure all butane burners are switched off before working with ethyl alcohol.

Then, take the leaf out of the water-filled beaker and transfer it to the prepared petri dish (Fig. 9 and Fig. 10).



Fig. 9

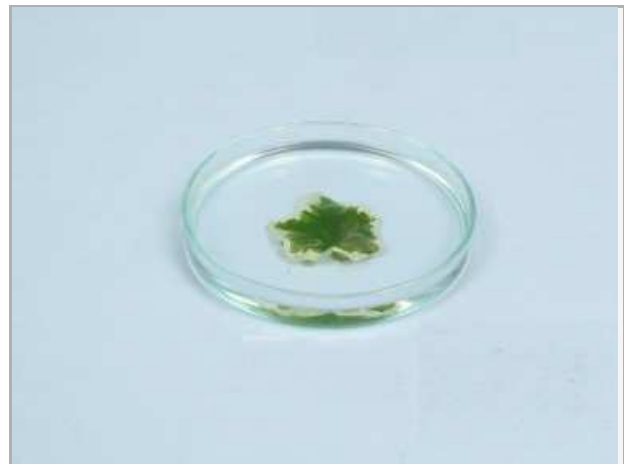


Fig. 10

Take the leaf out of the ethyl alcohol, rinse it with distilled water and pour Lugol's iodine potassium-iodide solution over it in a 100 mm petri dish (Fig. 11).



Fig. 11

After half an hour do a simple sketch of the distribution of blue-violet and white-yellowish areas on the leaf surface in the report.

Waste disposal

The ethyl alcohol should be poured into the container for halogen-free organic substances.

Report: The green leaf pigment

Result - Observations 1

Sketch the distribution of green and white spots in the leaf area.

Result - Observations 2

Describe the distribution of blue-violett and white-yellowish spots in the leaf area.

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Evaluation - Question 1

What is detected by means of the Iodine-potassiumiodine potassium-iodid solution after LUGOL?

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Evaluation - Question 2

Compare the sketch showing the original positions of the green areas on the leaf to the sketch showing the blue-violett areas on the leaf after the treatment with LUGOL's solution. What do you notice?

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Evaluation - Question 3

In which parts of the leaf has starch been formed?

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Evaluation - Question 4

The leaf surface was exposed to light. What else is required for the formation of starch, i.e. the assimilation of carbon dioxide, in addition to light?

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Evaluation - Question 5

The requirements for the formation of starch in the plant are now known. But which plants are capable of it?

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