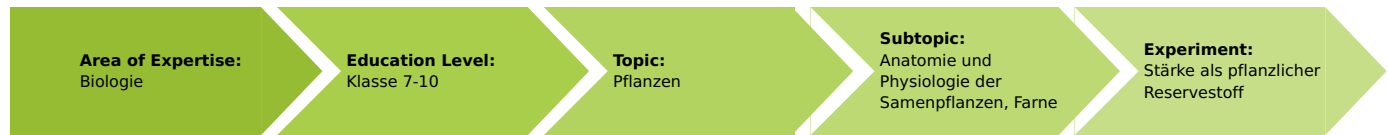


Starch as a nutritional reserve substance in plants

(Item No.: P1442601)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



30 Minutes

Recommended Group Size



1 Student

Additional Requirements:

- Potato starch
- Potato
- Water

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Information

The most significant process on earth takes place inside the chloroplasts of the cell, i.e. photosynthesis. Energy-rich glucose (dextrose) and oxygen are synthesized from the energy-poor substances carbon dioxide and water. The energy comes from the sun. The plant converts glucose into starch for storage.

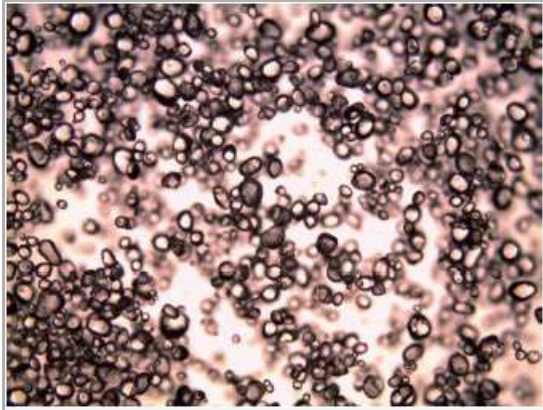
Information on obtaining materials

Starch is an important reserve substance in plants. Potato starch is available at food stores. Alternatively, one can make one's own pure starch (see item 2 under "Additional information and ideas").

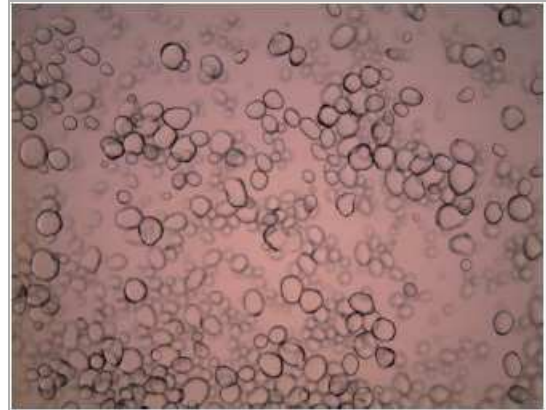
Information on how to proceed

ad 1. Microscopy without staining

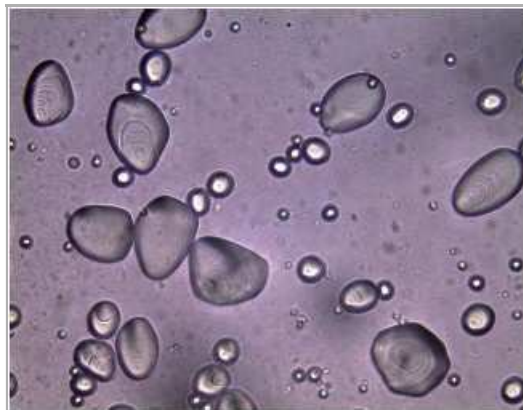
Innumerable elongated granules of various sizes can even be seen on the dry-mounted slide. Their mytiliform shape is more distinctive on the wet-mounted slide. The outer edge is seen rich in contrast, whereas the eccentric rings are less recognizable. The students will practice visualizing the various depth resolutions of a specimen by variation of the fine focusing adjustment.



Starch (100x), dry



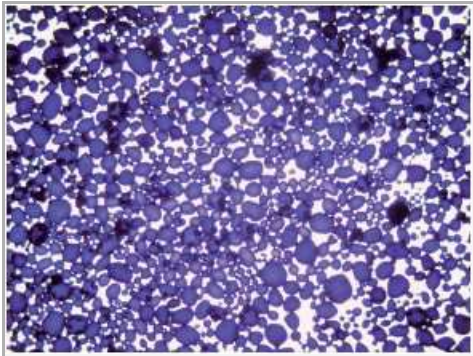
Starch (100x), wet



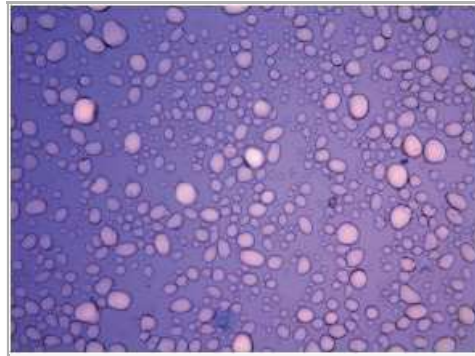
Starch (400x), wet

ad 2. Microscopy with staining

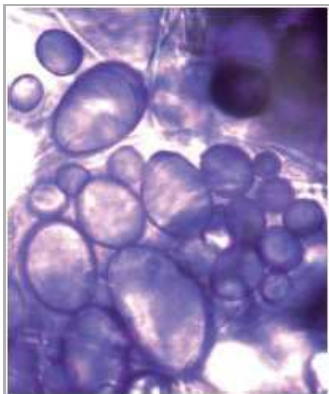
The positive starch analysis with iodine-potassium iodide solution is a common, very sensitive experiment most often performed on a macroscopical level only. Starch takes on a blue-black stain. The iodine molecules are incorporated into the coiled structure of amylose, thereby changing the absorption of light and hence the color.



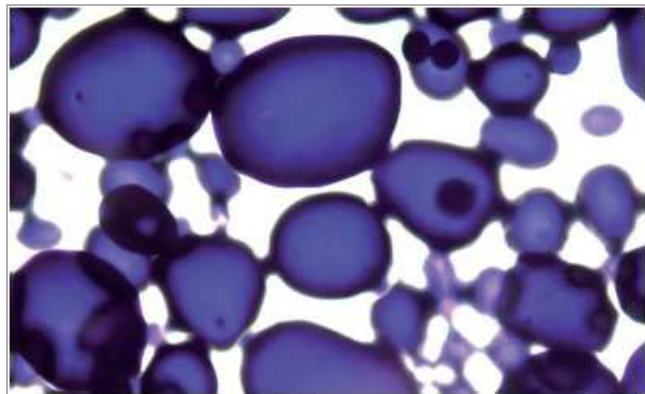
Starch (100x), Lugol's solution



Starch (100x), Methylene Blue (background)



Starch (400x), Lugol's solution



Starch (400x), Lugol's solution

ad 3. Examining a potato

Naturally, the determination of starch can also be done on the macroscopical level. Various plant parts (the tuber of a potato according to the worksheet) can be examined this way. Depending on the starch content, the emerging juice will be stained more or less intensively.

Additional information and ideas

Making your own starch:

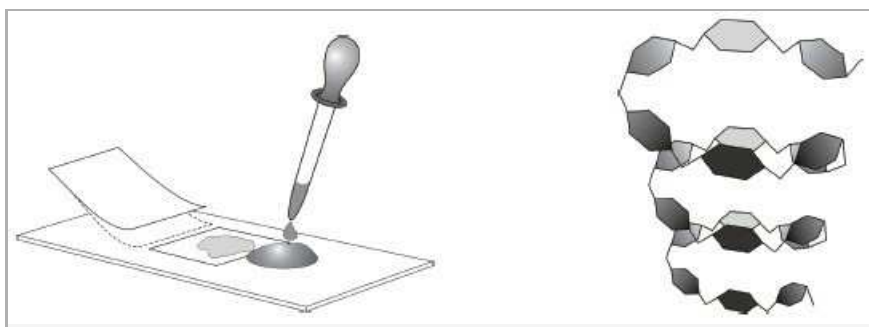
1. Grate or fragment a raw potato and separate the juice from the solid matter (by either squeezing or straining). The starch will settle in the liquid. Stir up the sediment with clear water, allow to settle again, and discard the supernatant liquid. Allow the sediment (potato starch) to dry.
2. Plants contain different types of starch:
Isolate the starch granules from different plant species (e.g. oat or wheat), view them under the microscope and compare their shapes with the already known shape of potato starch.

Starch as a nutritional reserve substance in plants (Item No.: P1442601)

Task and equipment

Task

The nutritional reserve substance, starch, which plants contain is made distinctly visible by changing the illumination and by means of staining.



Equipment

Position No.	Material	Order No.	Quantity
1	Euromex BioBlue BB.4250 microscope	EUR-BB-4250	1
2	Microscopic slides, 50 pcs	64691-00	1
3	Cover glasses 18x18 mm, 50 pcs.	64685-00	1
4	Beaker, low form, plastic, 100 ml	36011-01	1
5	Dropping pipette with bulb, 10pcs	47131-01	1
6	Knife, stainless	33476-00	1
7	Chemicals set for TESS advanced Microscopy	13290-10	1

Set-up and procedure



Information

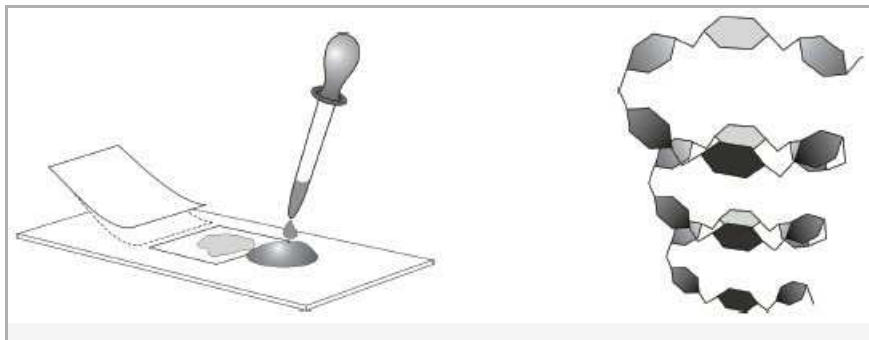
The most significant process on earth takes place inside the chloroplasts of the cell, i.e. photosynthesis. Energy-rich glucose (dextrose) and oxygen are synthesized from the energy-poor substances carbon dioxide and water. The energy comes from the sun. The plant converts glucose into starch for storage.

1. Starch can be viewed under the microscope either dry or in a solubilized state. Compare the images you obtain!

- First, place some pure, dry potato starch on a slide and view it under the microscope with lowest and intermediate power (do not apply a cover slip).
- Then apply one drop of water onto the starch and cover it with a cover slip. View it again under the microscope with lowest and intermediate power.
- Compare size and shape of the starch granules! Note down your observations in the report!
- Now you are supposed to look at the interior of a starch granule. Modify the distance of the intermediate power objective slightly by turning the fine focusing adjustment back and forth. Vary the intensity of the illumination if your microscope is equipped with this feature in order to vary contrasts. Draw a starch grain with its visible structures in the report.

2. Staining with iodine-potassium iodide solution

- Note: Staining will turn out most successful if only a little amount of the staining agent is applied to the starch granules.
- Use your ready-to-use starch-water specimen. A small drop of the iodine-potassium iodide solution is placed alongside the edge of the cover slip using a glass rod or pipette. The solution will flow under the glass all by itself and stain the starch granules.
- Note: If you dry up the opposite edge with blotting or tissue paper, you will speed up the process.
- Information: The figure on the right shows the structure of a starch molecule.



What could you observe under the microscope? Note down your observations in the report.

3. Examining a potato

- Cut a raw potato in half.
- Apply a little bit of Lugol's solution to the cut surface.
- Describe and explain your observations in the report.

Report: Starch as a nutritional reserve substance in plants

Result - Observations 1

Compare size and shape of the starch granules! Note down your observations.

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Result - Observations 2

Draw a starch grain with its visible structures.

Result - Observations 3

What could you observe under the microscope after staining with iodine-potassium iodide solution?

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Result - Observations 4

Describe and explain your observations on examining a potato.

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