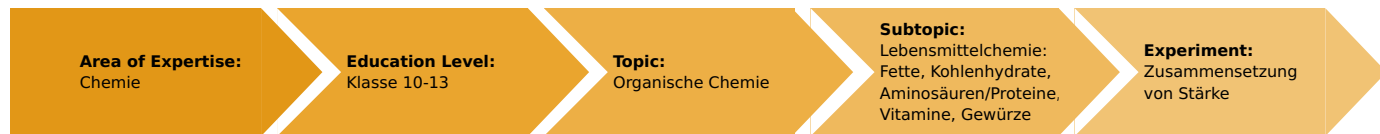


Composition of starch (Item No.: P7187400)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



20 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

carbohydrates, starch

Task and equipment

Information for teachers

Additional Information

Starch has different solubilities in water. One part dissolves in warm water, the other only in hot water.

Notes on content and learning objectives

- Starch is not a single unit, but is composed of amylose and amylopectin.
- Amylose consists of unbranched chains, while amylopectin is a highly branched polysaccharide.

Notes on the method

The structure of starch should be illustrated with molecular models to deepen the understanding.



Hazards

- Water can splash when being heated!
- Wear protective glasses!

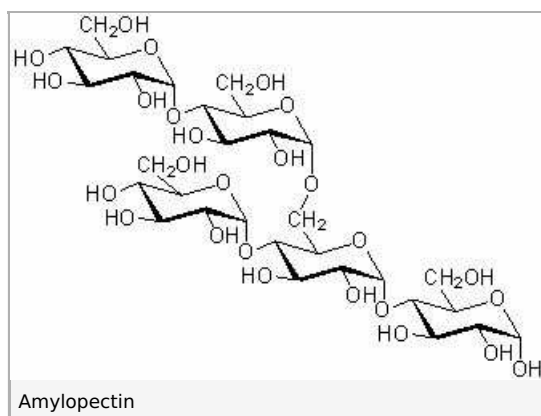
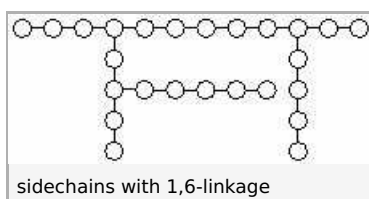
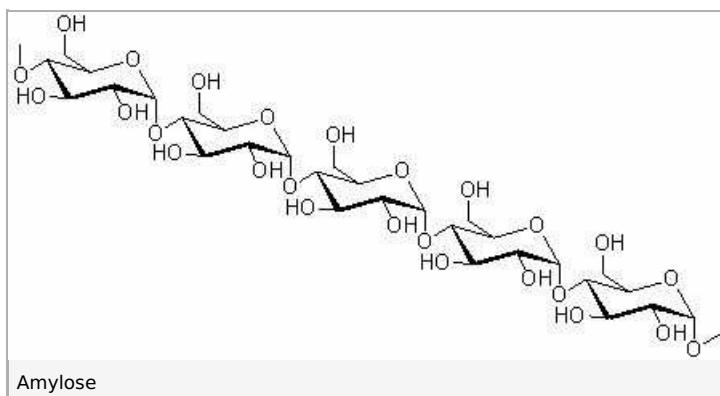
Fundamentals and remarks

Starch is composed of the polysaccharides amylose and amylopectin. Each of these is based on D-glucose.

The glucose molecules of amylose are connected to each other in chains by α -1,4-glycosidic linkages. An amylose molecule is built up from approx. 200-1000 glucose residues.



The molecules of amylopectin are highly branched. The glucose molecules of the main chains are linked to each other by a α -1,4-glycosidic linkages. The side chains consist of α -1,6-glycosidic linkages. Amylopectin molecules are built up from approx. 1000 to 12000 glucose residues.



Vegetable starch consists of 20 % amylose and 80 % amylopectin. Starch can be modified by changing this relationship.

Hints on going deeper

- Representation of starch molecules with a molecular model kit.

Notes on set-up and procedure

Preparation:

Starch such as potato starch, which has been extracted from parts of plants can also be used in this experiment.

Notes on the students experiment:

Should a thermostated water bath or a drying oven be available, then the heating of the starch solutions can be carried out in this.

Ensure that the washing of the residue is carried out thoroughly.

Waste disposal

Pour the solutions to drain.

Composition of starch (Item No.: P7187400)

Task and equipment

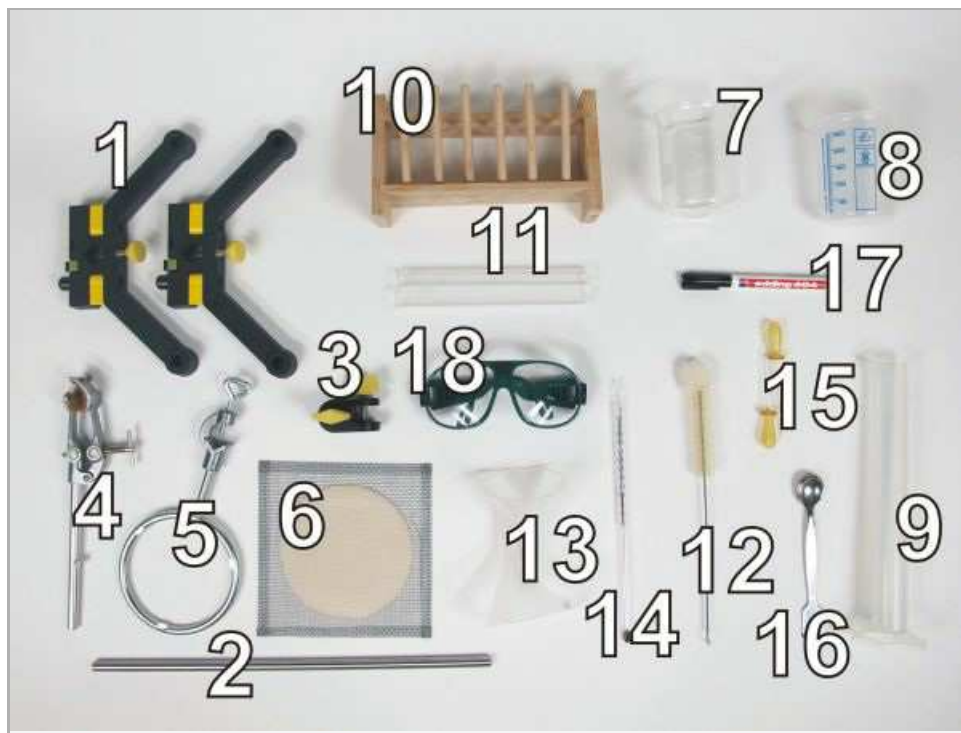
Task

What are the components of starch?

Determine the composition of starch.



Equipment



| Position No. | Material | Order No. | Quantity |
|--------------|---|-----------|----------|
| 1 | Support base, variable | 02001-00 | 1 |
| 2 | Support rod, stainless steel, l=370 mm, d=10 mm | 02059-00 | 1 |
| 3 | Boss head | 02043-00 | 1 |
| 4 | Universal clamp | 37715-00 | 1 |
| 5 | Ring with boss head, i. d. = 10 cm | 37701-01 | 1 |
| 6 | Wire gauze with ceramic, 160 x 160 mm | 33287-01 | 1 |
| 7 | Glass beaker DURAN®, short, 250 ml | 36013-00 | 1 |
| 8 | Beaker, 250 ml, low form, stackable, plastic | 36082-00 | 1 |
| 9 | Graduated cylinder 100 ml, PP transparent | 36629-01 | 1 |
| 10 | Test tube rack for 12 tubes, holes d= 22 mm, wood | 37686-10 | 1 |
| 11 | Test tube, 180x18 mm,100pcs | 37658-10 | (2) |
| 12 | Test tube brush w. wool tip,d25mm | 38762-00 | 1 |
| 13 | Filter funnel, d = 75 mm, PP | 46895-00 | 2 |
| 14 | Students thermometer,-10...+110°C, l = 180 mm | 38005-02 | 1 |
| 15 | Pipette with rubber bulb | 64701-00 | 1 |
| 16 | Spoon, special steel | 33398-00 | 1 |
| 17 | Labor pencil, waterproof | 38711-00 | 1 |
| 18 | Protecting glasses, clear glass | 39316-00 | 1 |
| | Butane burner f.cartridge 270+470 | 47536-00 | 1 |
| | Butane cartridge CV 300 Plus, 240 g | 47538-01 | 1 |
| | Iodine potass.iodide sol., 250 ml | 30094-25 | 1 |
| | Starch,soluble 250 g | 30227-25 | 1 |
| | Water, distilled 5 l | 31246-81 | 1 |
| | Boiling beads, 200 g | 36937-20 | 1 |
| | folded filter,qual.,150 mm,100pcs | 47580-04 | 2 |

Set-up and procedure

Set-up

Hazards

- Water can splash when being heated!
- Wear protective glasses!



Set-up

Number two test tubes from 1 to 2 and stand them next to each other in the test tube rack (Fig. 1).



Assemble the stand as shown in figures 2 to 6. Fasten the support ring to the support rod and place the wire gauze on it. Adjust the height of the support ring so that the flame of the burner just reaches the wire gauze.



Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6

Procedure

Put two spatula tips of starch into a 250 ml glass beaker (Fig. 7). Add 100 ml of distilled water and a few boiling stones. Heat the

mixture to between 50 °C and 55 °C with a small bunsen burner flame (Fig. 8), checking the temperature with the thermometer. Hold the solution at this temperature for approx. 10 minutes.



Fig. 7



Fig. 8

Filter the warm solution through a fluted filter into a 250 ml lab beaker (Fig. 9).



Fig. 9

Transfer sufficient filtrate from the lab beaker to give 1 cm height of liquid in test tube 1. Pour five times this amount of water to the filtrate in test tube 1.

Wash the precipitate in the filter twice with 20 ml distilled water (Fig. 10). Put a spatula tip of the precipitate into test tube 2. Add distilled water up to a height of 6 cm. Carefully heat the mixture to boiling in the prepared hot water bath (Fig. 11). As soon as the mixture in the test tube is boiling, extinguish the bunsen burner flame, place the test tube in the test tube rack and allow the solution in the test tube to cool.



Fig. 10



Fig. 11

Pipette two drops of iodine potassium iodide into each of the test tube (Fig. 12). Compare the colours. When the colours are too intensive, dilute the solutions with distilled water.

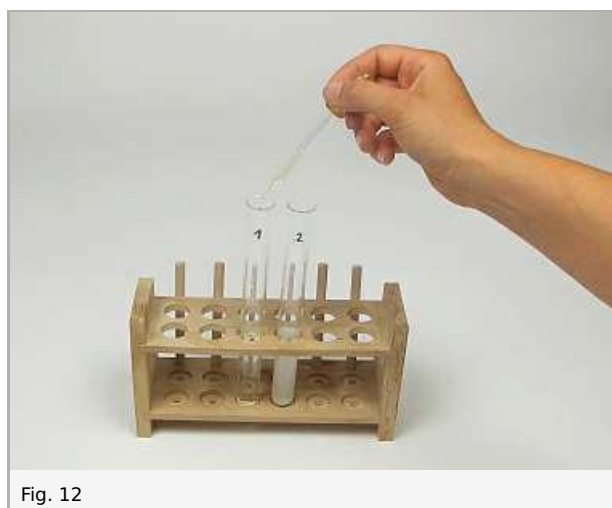


Fig. 12

Waste disposal

Pour the solutions to drain.

Report: Composition of starch

Result - Table 1

Note your observations.

| Test tube | Substance | Colouration |
|-----------|-----------|-------------|
| 1 | | 1 |
| 2 | | 1 |

Evaluation - Question 1

Draw conclusions from your observations.

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Evaluation - Question 2

Summarize the properties of the starch components in the following table:

| Starch component | Amylose | Amylopektin |
|-------------------------------------|---------|-------------|
| Solubility | 1 | 1 |
| Colour with iodine potassium iodide | 1 | 1 |
| Molecular structure | 1 | 1 |

Evaluation - Question 3

Complete the following statements:

1. Starch is in cold water.
2. It consists of two components and, which give characteristic colours with iodine potassium iodide solution.
3. The amylose dissolves in warm water. The amylopectin dissolves in hot water and forms a paste-like colloidal mixture.