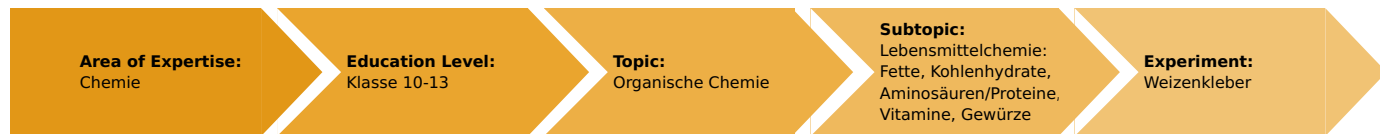


Wheat gluten (Item No.: P7187500)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



30 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

carbohydrates, wheat gluten

Task and equipment

Information for teachers

Additional Information

Wheat flour is mostly used to make bread, cakes and pastries. This is particularly true for yeast dough.

Notes on content and learning objectives

- The major constituents of wheat flour are starch and gluten.
- Wheat gluten is a mixture of proteins, which influences the baking characteristics.

Notes on the method

This experiment is particularly suitable for working as partners.
The reactions used to detect starch and protein are described in specific experiments.

Fundamentals and remarks

In the production of wheat flour, the outer grain layer and the embryo are removed and the endosperm finely ground. Gluten is a speciality of wheat flour, and gives it outstanding baking characteristics (rheological properties) compared to other cereal flours. Wheat gluten is made up to 90 % by proteins, 8 % lipids and 2 % carbohydrates. It is of considerable importance for the hydration and gas holding capacity of wheat-based baked products.

Hints on going deeper

- Production of simple pastries using baking powder or yeast

Notes on the set-up and procedure

Preparation:

The students can get very sticky hands when carrying out this experiment, so be sure that there are sufficient possibilities to wash them.

Notes on the students experiment:

Superfine flour should be used, and not wholemeal flour, as the separation of the gluten from the husks is otherwise difficult. The starch which is extracted can be used in other experiments.

Should the students not be familiar with the reactions for detecting starch or amino acids, make appropriate comparison substances available to them.



Hazard and Precautionary statements

Ninhydrin:

H302: Harmful if swallowed.

H315: Causes skin irritation.

H319: Causes serious eye irritation.

H335: May cause respiratory irritation.

P261: Avoid breathing dust/fume/gas/mist/vapours/spray.

P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do

- continue rinsing.

Hazards

- Ninhydrin can cause damage to health when absorbed into the body.
- Avoid contact with the chemicals.
- Wear protective gloves and protective glasses.

Waste disposal

Pour the solutions to drain and put the residues in the normal waste bin.

Wheat gluten (Item No.: P7187500)

Task and equipment

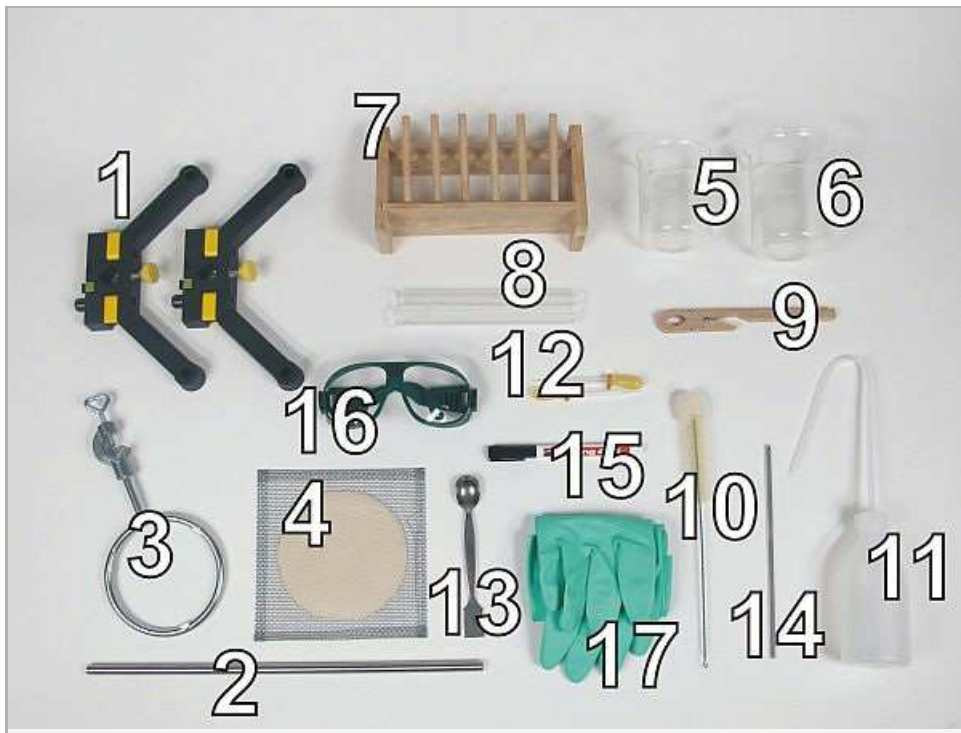
Task

Why is wheat flour mostly used for baking?

Separate wheat flour into its major components.



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 | Ring with boss head, i. d. = 10 cm | 37701-01 | 1 |
| 4 | Wire gauze with ceramic, 160 x 160 mm | 33287-01 | 1 |
| 5 | Glass beaker DURAN®, short, 250 ml | 36013-00 | 1 |
| 6 | Glass beaker DURAN®, short, 400 ml | 36014-00 | 1 |
| 7 | Test tube rack for 12 tubes, holes d= 22 mm, wood | 37686-10 | 1 |
| 8 | Test tube, 180x18 mm, 100pcs | 37658-10 | (2) |
| 9 | Test tube holder, up to d 22mm | 38823-00 | 1 |
| 10 | Test tube brush w. wool tip, d25mm | 38762-00 | 1 |
| 11 | Wash bottle, 250 ml, plastic | 33930-00 | 1 |
| 12 | Pipette with rubber bulb | 64701-00 | 2 |
| 13 | Spoon, special steel | 33398-00 | 1 |
| 14 | Glass rod, boro 3.3, l=200mm, d=6mm | 40485-04 | 1 |
| 15 | Labor pencil, waterproof | 38711-00 | 1 |
| 16 | Protecting glasses, clear glass | 39316-00 | 1 |
| 17 | Rubber gloves, size S (7) | 39325-00 | 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 |
| | Water, distilled 5 l | 31246-81 | 1 |
| | Ninhydrin 10 g | 31666-03 | 1 |
| Additional material | | | |
| | Tablespoon | | |
| | Linen cloth | | |
| | Drinking water | | |
| | Wheat flour | | |

Set-up and procedure

Set-up

Hazards

- Ninhydrin can cause damage to health when absorbed into the body.
- Avoid contact with the chemicals.
- Wear protective gloves and protective glasses.



Setup

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

Fill a 250 ml glass beaker up to $\frac{2}{3}$ with water and add a few boiling stones (Fig. 7). Heat it to boiling, then put it aside. Extinguish the bunsen burner flame!



Procedure

Put four tablespoons of wheat flour in a 400 ml glass beaker. Stir the flour while adding a little water to obtain a heavy dough (Fig. 8-9). Allow the mixture to stand for 10 minutes.



Put the dough in a linen cloth (Fig. 10). Half-fill a 250 ml lab beaker with cold water. Immerse the wrapped dough in the beaker for some minutes (Fig. 11). Remove the cloth with the dough from the beaker and squeeze out the liquid from the linen cloth into the beaker (Fig. 12). Transfer a few ml of the liquid from the beaker to test tube 1.



Fig. 10



Fig. 11

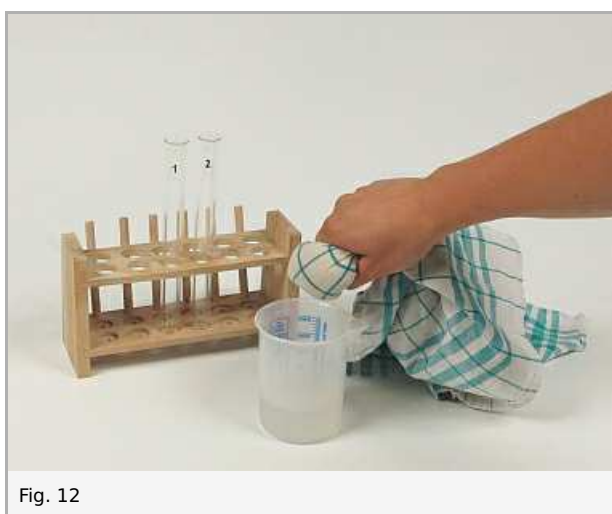


Fig. 12

Now hold the linen cloth with the dough under a weak flow of water and knead the remaining dough until the water dropping out of it is clear.

Determine the colour and consistency of the residue in the linen cloth. Transfer a spatula tip of the residue to test tube 2. Pipette distilled water onto it to a height of 4 cm (Fig. 13).

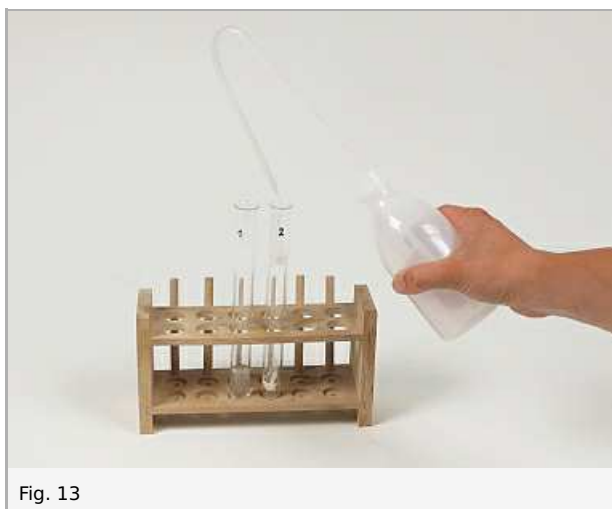


Fig. 13

Add three drops of iodine potassium iodide solution to the solution in test tube 1. Add a few crystals of ninhydrin to test tube 2. Place test tube 2 in the prepared water bath. Watch out for colour changes.

Waste disposal

Pour the solutions to drain and put the residues in the normal waste bin.

Report: Wheat gluten

Result - Observations

Note your observations in the following succession:

- a) Flour washing solution
- b) Flour residue
- c) Test tube 1
- d) Test tube 2

.....

.....

.....

.....

Evaluation - Question 1

Draw conclusions from your observations.

.....

.....

.....

.....

Evaluation - Question 2

Which job does the residue in the linen cloth do in the baking process?

.....

.....

.....

.....

Evaluation - Question 3

Complete the following statements:

1. Wheat flour consists mainly of (detection with) and (detection with).
2. The water insoluble proteins of wheat endosperm are called
3. Gluten is when dry, and when wet.