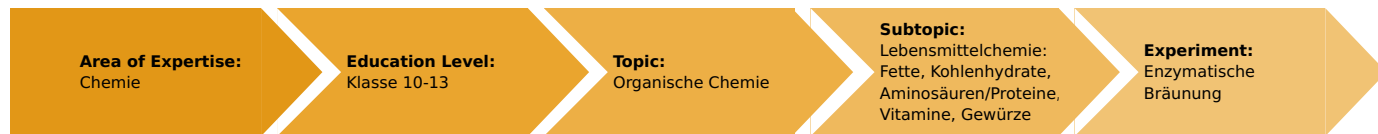


Enzymatic browning (Item No.: P7188500)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



20 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

food chemistry, enzymatic browning

Task and equipment

Information for teachers

Additional Information

A cut apple very quickly turns brown at the position of the cut. Some sorts of fruit change their colour when cooked. Why does the addition of vinegar prevent the change in colour?

Notes on content and learning objectives

- When cut fruit or vegetables become brownly coloured within a short time, this colour change is known as "enzymatic browning".
- "Enzymatic browning" can be prevented by adding acid or reducing agent, as well as by excluding oxygen.
- Vinegar or lemon juice are old household remedies, which prevent the discolouration of fruit when it is preserved.

Notes on the method

The various methods which can be used to deactivate enzymes, or to protect from them, can be gone into more deeply in a classroom discussion.

In the food industry, sulphite is also used to prevent enzymatic browning, e.g. during the industrial removal of peel from potatoes. The reducing effect can be demonstrated by the addition of a solution of sulphite to cut-up fruit.



Hazards

- Wear protective glasses!

Fundamentals and remarks

Fruit, vegetables, potatoes and mushrooms contain up to 1 % of phenolic ingredients. After cutting, oxygen can be carried to the colourless phenols by enzymes. After numerous further reactions and polymerizations, a spoiling brown colouration is formed. This enzymatic browning can be extensively prevented by inactivation of the enzymes.

Hints on going deeper

- This theme can be taken to introduce the theme "Action of enzymes". Further experiments on means of inactivating enzymes are correctly placed here.

Notes on the set-up and procedure

Preparation:

Potatoes can also be used in this experiment, or instead of apples.

Lemon juice, or a 5 % solution of fruit acid, can be used instead of vinegar.

Notes on the students experiment:

When reducing agents such as ascorbic acid are used, not only is the brown colouration prevented, but brown coloured foods are also lightened in colour.

Ascorbic acid can be added to the apple puree as a freshly prepared solution.

Waste disposal

Pour the solutions to drain and discard solid waste in the normal waste bin.

Enzymatic browning (Item No.: P7188500)

Task and equipment

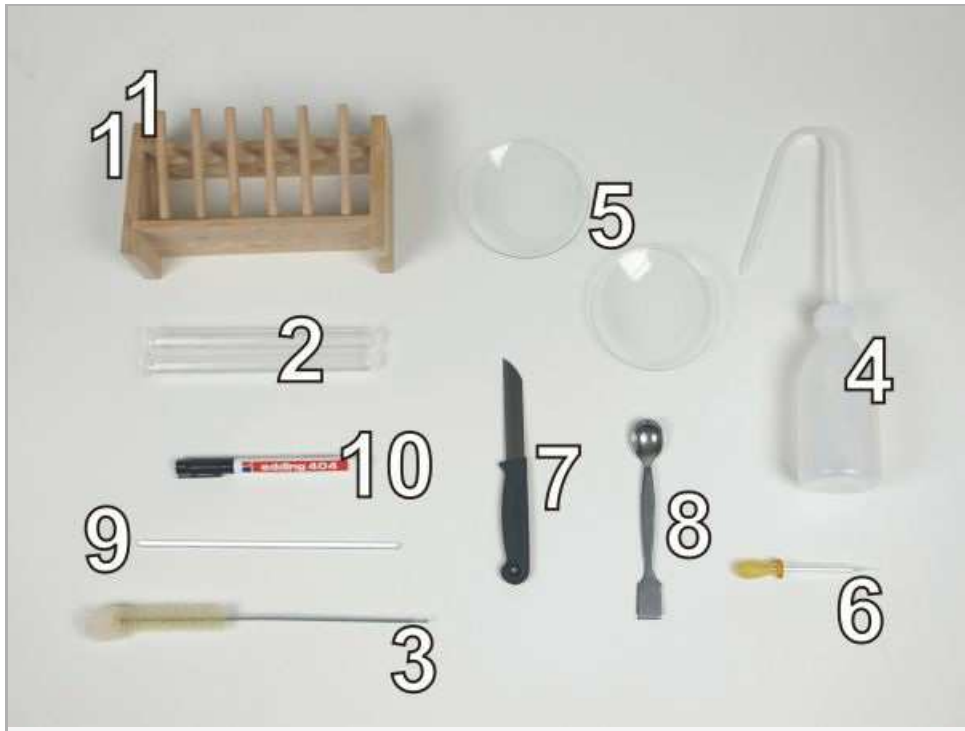
Task

How can cut-up fruit and vegetables be prevented from going brown?

Try to suppress the enzymatic browning of grated apple by various reactions.



Equipment



| Position No. | Material | Order No. | Quantity |
|---------------------|---|-----------|----------|
| 1 | Test tube rack for 12 tubes, holes d= 22 mm, wood | 37686-10 | 1 |
| 2 | Test tube, 180x18 mm,100pcs | 37658-10 | (2) |
| 3 | Test tube brush w. wool tip,d25mm | 38762-00 | 1 |
| 4 | Wash bottle, 250 ml, plastic | 33930-00 | 1 |
| 5 | Watch glass, dia.100 mm | 34574-00 | 2 |
| 6 | Pipette with rubber bulb | 64701-00 | 1 |
| 7 | Knife, stainless | 33476-00 | 1 |
| 8 | Spoon, special steel | 33398-00 | 1 |
| 9 | Glass rod, boro 3.3, l=200mm, d=6mm | 40485-04 | 1 |
| 10 | Labor pencil, waterproof | 38711-00 | 1 |
| | L(+) ascorbic acid,cryst. 100 g | 31067-10 | 1 |
| | Water, distilled 5 l | 31246-81 | 1 |
| Additional material | | | |
| | Apple | | |
| | Vinegar | | |

Set-up and procedure

Set-up

Hazards

- Wear protective glasses!



Set-up

Number the two watch glasses 1 and 2.

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



Fig. 1

Procedure

Peel the apple (Fig. 2) and grate it with the grater.



Fig. 2

Transfer two heaped spatula tips of grated apple to each of the watch glasses (Fig. 3). Distribute the apple mass on watch glass 1 over the watch glass with a glass rod.



Fig. 3

Add a spatula tip of ascorbic acid to the apple mass on watch glass 2. Mix the ascorbic acid into the grated apple and distribute the mixture over the watch glass.

Put two spatula tips of grated apple into each of the two test tubes.

Add so much distilled water into test tube 1, that the apple is just covered.

Pipette approx. 10 drops of vinegar into test tube 2 (Fig. 4).



Fig. 4

Examine the colour of the apple puree on the watch glasses and in the test tubes.

Waste disposal

Pour the solutions to drain and discard solid waste in the normal waste container.

Report: Enzymatic browning

Result - Table 1

Note your observations in the following table.

| Vessel | Reagent | Colour of the apple puree |
|---------------|---------------------------|---------------------------|
| Watch glass 1 | - | 1 |
| Watch glass 2 | Addition of ascorbic acid | 1 |
| Test tube 1 | Covering with water | 1 |
| Test tube 2 | Addition of vinegar | 1 |

Evaluation - Question 1

Draw conclusions from your observations.

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Evaluation - Question 2

Name further sorts of fruit or vegetables with which enzymatic browning can also be seen after cutting them up.

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Evaluation - Question 3

Complete the following statements:

1. Some sorts of fruit are turned brown after being cut up.
2. This reaction can be prevented by adding or
3. Reducing agents such as or lighten the colour.
4. Using or to exclude air prevents the discolouration.