

6.1 Detection of vitamin C

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Task

Task

Which foods contain vitamin C?

Detect vitamin C in various foods.



Use the space below for your own notes.

Logged in as a teacher you will find a button below for additional information.

Additional Information

Vitamins are an indispensable part of our diet. They regulate the course of life.

Notes on content and learning objectives

- Fruit and vegetables such as citrus fruit and potatoes contain vitamin C.
- Vitamin C can be detected by the decolourization of Tillmann's reagent.

Notes on the method

References to further reading are possibly necessary for some of the questions to be answered.

This experiment enables vitamin C to be detected in various foods. When evaluating the vitamin C content of individual foods, the quantity consumed and the method of preparation should be taken into consideration.

Fundamentals and remarks

Vitamin C (ascorbic acid) was determined with dichlorophenol indophenol by Tillmann in 1920. The dye is pink in acidic solution and blue in alkaline or neutral solution. The determination is carried out in acidic solution, usually at pH 3.5. Food extracts must therefore partly be pre-adjusted to the required pH with acetic acid or sodium acetate.

2,6-Dichlorophenol indophenol (see figure, left side) is reduced by ascorbic acid to a colourless leuco form (see figure, right side).



Hints on going deeper

- Vitamins have gone down in history. Scurvy, a seaman's illness, was prevented by eating pickled cabbage.

Notes on set-up and procedure

Preparation

Tillmann's reagent

Dissolve 100 mg of 2,4-dichlorophenol indophenol (sodium salt, dehydrated) in 500 ml of distilled water.

This reagent should be freshly prepared, as the dissolved substance is only stable for a short time when exposed to light.



Hazards

Wear protective glasses!

Waste disposal

Pour the solutions in the test tubes to drain.

Material

Material from "TESS advanced Chemistry Set Food Chemistry, FCH" (Order No. 15306-88)

Position No.	Material	Order No.	Quantity
1	Support base variable	02001-00	1
2	Support rod, $l = 370$ mm, $d = 10$ mm	02059-00	1
3	Boss head	02043-00	1
4	Universal clamp	37715-00	1
5	Glass beaker DURAN®, short, 250 ml	36013-00	1
6	Beaker, 100 ml, low form, stackable, plastic	36082-00	1
7	Graduated cylinder, 100 ml, plastic	36629-01	1
8	Test tube rack for 12 tubes, holes $d = 22$ mm, wood	37686-10	1
9	Test tube, 180x18 mm, 100 pcs	37658-10	(4)
10	Test tube holder, up to $d 22$ mm	38823-00	1
11	Test tube brush w. wool tip, $d 25$ mm	38762-00	1
12	Filter funnel, PP, $d = 75$ mm	46895-00	2
13	Pipette with rubber bulb	64701-00	3
14	Spoon, special steel	33398-00	1
15	Lab. pencil, waterproof	38711-00	1
16	Protecting glasses, clear glass	39316-00	1

Chemicals, Additional Material

Position No.	Material	Order No.	Quantity
	L(+) ascorbic acid, cryst. 100 g	31067-10	
	Water, distilled 5 l	31246-81	
	2,6-Dichlorophenol indophenol, 5 g	31277-02	
	Circular filter, $d 125$ mm, 100 pcs	32977-05	
	Orange		
	Potato		

Setup

Hazards

- Wear protective glasses!



Setup

Number four test tubes from 1 to 4 and stand them next to each other in the test tube rack (Fig. 1).



Fig. 1

Assemble the stand as shown in figures 2 to 5.

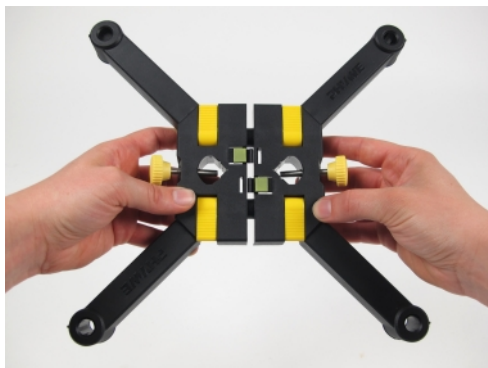


Fig. 2



Fig. 3



Fig. 4



Fig. 5

Attach the funnel so, that it hangs vertically (Fig. 6).

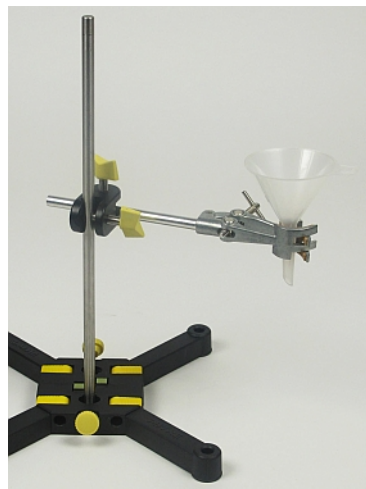


Fig. 6

Wash a medium sized potato, use the grater to grate it down and transfer the resulting potato paste to a 250 ml glass beaker (Fig. 7).

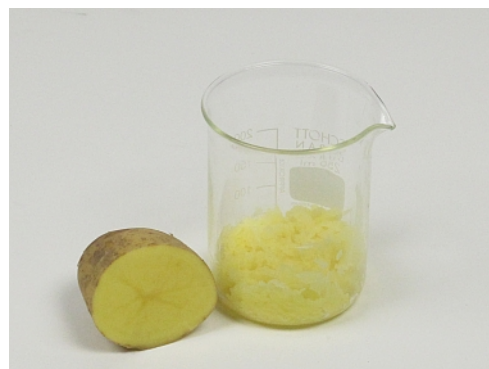


Fig. 7

Squeeze out the citrus fruit and pour the juice into an empty 250 ml lab beaker (Fig. 8).



Fig. 8

Action

Procedure

Put a spatula tip of ascorbic acid in test tube 1. Add distilled water to a height of 5 cm and dissolve the chemical in it.

Pipette Tillmann's reagent into test tubes 2, 3 and 4, each to a height of 3 cm.

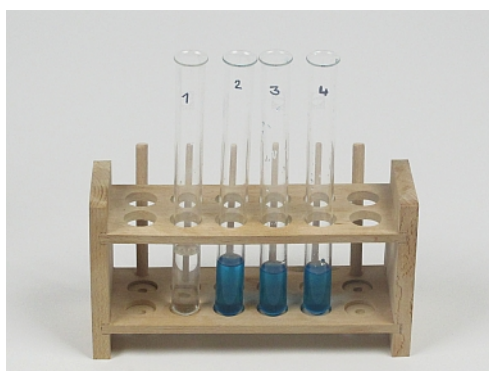


Fig. 9

Add ascorbic acid solution, dropwise and under gentle shaking, to test tube 2 until the solution is decolourized.

Filter dropwise the juice, which has separated from the grated potato, through a fluted filter into test tube 3, as shown in figure 10.

Then filter in the same way some citrus fruit juice through a second fluted filter into test tube 4.



Fig. 10

Waste disposal

Pour the solutions in the test tubes to drain.

Results

Note your observations.

Test tube 2, ascorbic acid:

Test tube 3, potato juice:

Test tube 4, citrus fruit juice:

Test tube 2, ascorbic acid:

The bluecoloured Tillmann's reagent is decolourized on the addition of ascorbic acid.

Test tube 3, potato juice:

The blue coloured Tillmann's reagent is decolourized on the addition of potato juice.

Test tube 4, citrus fruit juice:

The blue coloured Tillmann's reagent is decolourized on the addition of citrus fruit juice.

The blue coloured Tillmann's reagent is decolourized on the addition of ascorbic acid, potato extract and citrus fruit juice.

Evaluation

Question 1

Draw conclusions from your observations.

Vitamin C (ascorbic acid) reacts with dichlorophenol indophenol to form a leuco form. Ascorbic acid is thereby oxidized to dehydro-ascorbic acid.

Potato extract and citrus fruit juice show the same reaction, and therefore contain vitamin C.

Question 2

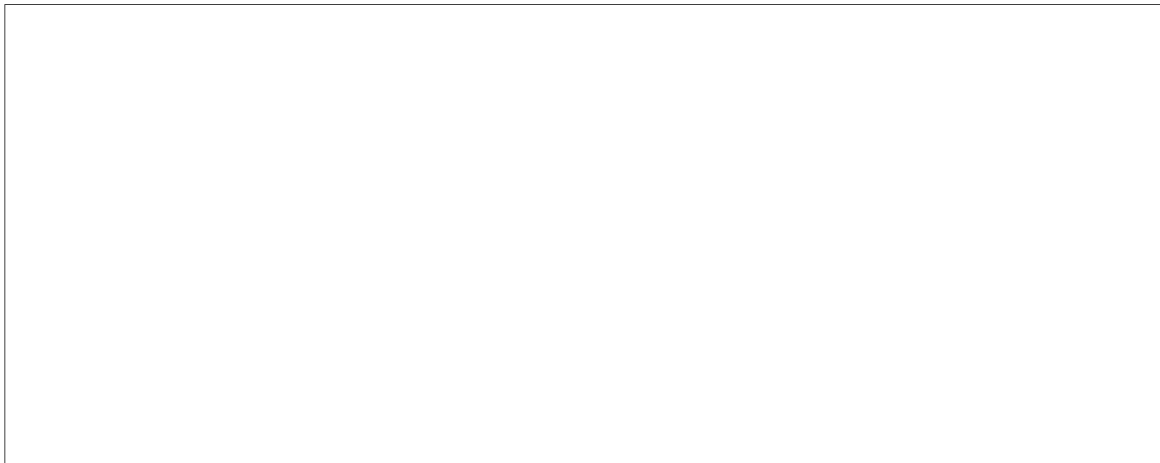
Explain the term "vitamin".



Vitamins are essential for our nutrition. They are active substances which are indispensable for the normal course of life. They can mostly not be synthesized by animal or human organisms. They are required in small amounts (frequently a few mg per day). Insufficient vitamin intake results in deficiency symptoms (hypovitaminosis). Vitamins, like enzymes and hormones, are necessary for many functions of human organisms.

Question 3

Name fruits and vegetables which are particularly rich in vitamin C.



Foods particularly rich in vitamin C include:

- Vegetables such as curly kale, kohlrabi, brussel sprouts, spinach, lettuce and white cabbage.
- Fruits such as rose-hips, sea buckthorn berries, citrus fruits, kiwi, blackcurrants and strawberries.

Question 4

Complete the following statements:

1. Vitamin C decolourizes reagent.
2. Potato extract and fruit juice show the reaction.
3. Vitamins are for our nutrition and indispensable for the course of life.

1. Vitamin C decolourizes *pink* coloured *Tillmann's* reagent.
2. Potato extract and fruit juice show the *same* reaction.
3. Vitamins are *essential* for our nutrition and indispensable for the *normal* course of life.