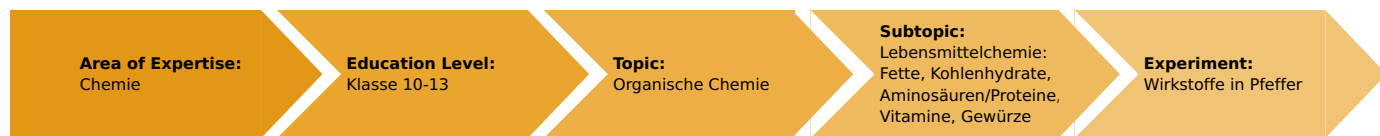


# Active agents in pepper (Item No.: P7186500)

## Curricular Relevance



### Difficulty



Intermediate

### Preparation Time



10 Minutes

### Execution Time



20 Minutes

### Recommended Group Size



2 Students

### Additional Requirements:

### Experiment Variations:

### Keywords:

food chemistry, pepper, spice

## Task and equipment

## Information for teachers

## Additional Information

The saying "My mouth is watering" is directly connected with spices. The senses of smell and taste are irritated by the ingredients of spices. The irritation is transformed by the brain and led, e.g. to the salivary glands in the mouth. Spices stimulate the digestion.

Most of the ingredients are compounds which belong to the alkaloid group.

## Notes on content and learning objectives

- Pepper contains starch and protein.
- The substance which makes pepper "hot" is piperine.
- Piperine can be detected with sulphuric acid after extracting it with an organic solvent.
- Piperine, like caffeine, belongs to the biologically active alkaloids.

## Notes on the method

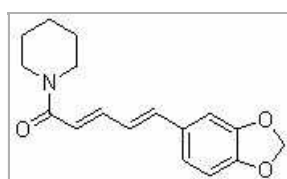
The students should get to know the three commercial forms of pepper. The importance of the spice trade in the Middle Ages should be pointed out.

If a microscope is available, the various cell fragments of pepper, such as stone cells, oil cells and starch cells, can be identified.

## Fundamentals and remarks

Pepper is the most important spice in world trade. It consists of approx. 55 % starch, 12 % protein, 10 % fat, 10 % water, 6 % minerals, 5 % pungent substances and 2 % ethereal oils.

As pungent substances, pepper contains piperine (see figure), piperanine and piperyline, three alkaloids with similar chemical structures.



Green pepper is also available commercially. This is raw pepper which has not been dried but is conserved in brine or vinegar.

## Hints on going deeper

- Research on natural or synthetic flavourings.
- Use a cookery book to draw up a list of spices.

## Notes on set-up and procedure

### Preparation:

Iodine potassium iodide solution can be self-prepared by dissolving 20 g of potassium iodide and 10 g of elementary iodine in 100 ml of distilled water.

### Notes on the students experiment:

Should the students not be familiar with the methods for the detection of starch and protein, the methods should be carried out on appropriate reference substances.

The reaction of pepper with iodine can also be carried out on a microscope slide. The stained starch cells should then be examined under the microscope.



## 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.

### Petroleum ether:

H225:	Highly flammable liquid and vapour.
H304:	May be fatal if swallowed and enters airways.
H315:	Causes skin irritation.
H361f:	May cause drowsiness or dizziness.
H336:	Suspected of damaging fertility or the unborn child.
H373:	May cause damage to organs through prolonged or repeated exposure.
H411:	Toxic to aquatic life with long lasting effects.
P210:	Keep away from heat/sparks/open flames/hot surfaces – No smoking.
P233:	Keep container tightly closed.
P240:	Ground/bond container and receiving equipment.
P273:	Avoid release to the environment.
P281:	Use personal protective equipment as required.
P301 + P310:	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P302 + P352:	IF ON SKIN: Wash with soap and water.
P304 + P340:	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P308 + P313:	IF exposed or concerned: Get medical advice/attention.
P331:	Do NOT induce vomiting.
P403 + P235:	Store in a well ventilated place. Keep cool.

Sulphuric acid:

H314: Causes severe skin burns and eye damage.

H290: May be corrosive to metals.

P280: Wear protective gloves/protective clothing/eye protection/face protection.

P301 + P330 + P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.

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

P309 + P310: IF exposed or you feel unwell: Call a POISON CENTER or doctor/physician.

## Hazards

- Petroleum ether is highly inflammable. Extinguish all open flames before handling it!
- Sulphuric acid is corrosive. Avoid skin contact with the liquid.
- Wear protective glasses and protective gloves!
- Carry out the experiment in a fume cupboard whenever possible.

## Waste disposal

Pour the solutions to drain after diluting them.

## Active agents in pepper (Item No.: P7186500)

### Task and equipment

#### Task

#### How can the substances which make pepper so pungent be detected?

Detect various ingredients of pepper.



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, 400 ml	36014-00	1
6	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
7	Test tube, 180x18 mm,100pcs	37658-10	(4)
8	Test tube brush w. wool tip,d25mm	38762-00	1
9	Wash bottle, 250 ml, plastic	33930-00	1
10	Filter funnel, d = 75 mm, PP	46895-00	1
11	Watch glass, dia.100 mm	34574-00	1
12	Rubber stopper, d=22/17 mm, without hole	39255-00	3
13	Pipette with rubber bulb	64701-00	3
14	Spoon, special steel	33398-00	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
	Petroleum ether, 40-60 gr 1000 ml	30184-70	1
	Sulphuric acid, 95-98% 500 ml	30219-50	1
	Water, distilled 5 l	31246-81	1
	Ninhydrin 10 g	31666-03	1
	Boiling beads, 200 g	36937-20	1
	folded filter,qual.,150 mm,100pcs	47580-04	1
Additional material			
	Pepper, white, ground		



## Set-up and procedure

### Set-up

### Hazards

- Petroleum ether is highly inflammable. Extinguish all open flames before handling it!
- Sulphuric acid is corrosive. Avoid skin contact with the liquid.
- Wear protective glasses and protective gloves!
- Carry out the experiment in a fume cupboard whenever possible.



### 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 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.

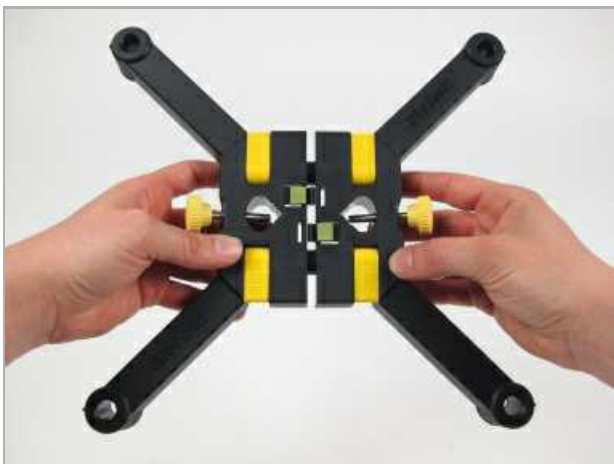


Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6

Half-fill a 400 ml beaker with water and add a few boiling stones (Fig. 7). Heat it to boiling, then put it aside. Extinguish the bunsen burner flame!





Fig. 7

## Procedure

Add a spatula tip of the white, ground pepper into each of the test tubes 1 and 2. Fill both of them up to height of 4 cm with distilled water (Fig. 8) and shake the test tubes (Fig. 9).



Fig. 8



Fig. 9

Pipette a few drops of iodine potassium iodide solution into test tube 1.



Fig. 10

Add a few crystals of ninhydrin to test tube 2. Place this test tube in the prepared hot water bath for approx. 5 minutes.

Put four spatula tips of pepper into test tube 3. Pipette petroleum ether to a height of 2 cm (Fig. 11). Carefully shake the mixture for about 2 minutes, then filter the mixture and collect the filtrate in test tube 4 (Fig. 12).



Fig. 11



Fig. 12

Pour the filtrate on a watch glass (Fig. 13) and place this in the fume cupboard so that the solvent can evaporate off. Pipette 3 drops of concentrated sulphuric acid onto the residue.

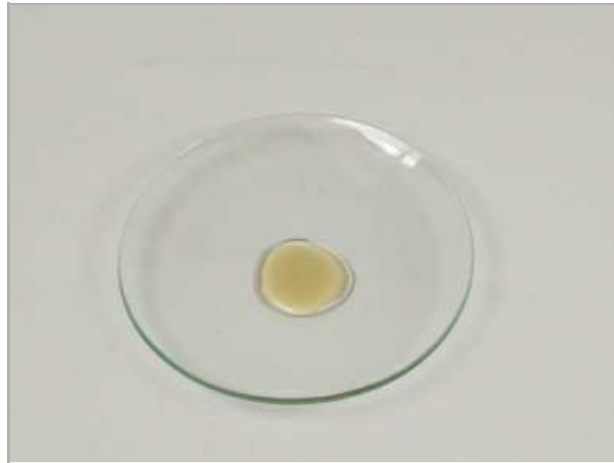


Fig. 13

**Waste disposal**

Pour the solutions to drain after diluting them.

## Report: Active agents in pepper

### Result - Observations

Note your observations.

- a) Pepper with iodine potassium iodide solution
- b) Pepper with ninhydrin
- c) Pepper extract with sulphuric acid

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### Evaluation - Question 1

Draw conclusions from your observations. Which substances have been detected?

- a) Pepper with iodine potassium iodide solution.
- b) Pepper with ninhydrin.
- c) Pepper extract with sulphuric acid.

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### Evaluation - Question 2

What is the difference between black and white pepper?

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### Evaluation - Question 3

Name other spices which have such a pungent taste.

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### Evaluation - Question 4

Complete the following statements:

1. Pepper contains ....., which react with ninhydrin to a ..... dye.
2. Pepper contains ....., which reacts with iodine potassium iodide solution to give the typical deep ..... colouration.
3. Pepper contains the substance ....., which makes it so pungent and which dissolves in petroleum ether. The extract reacts with sulphuric acid under formation of a ..... colouration.