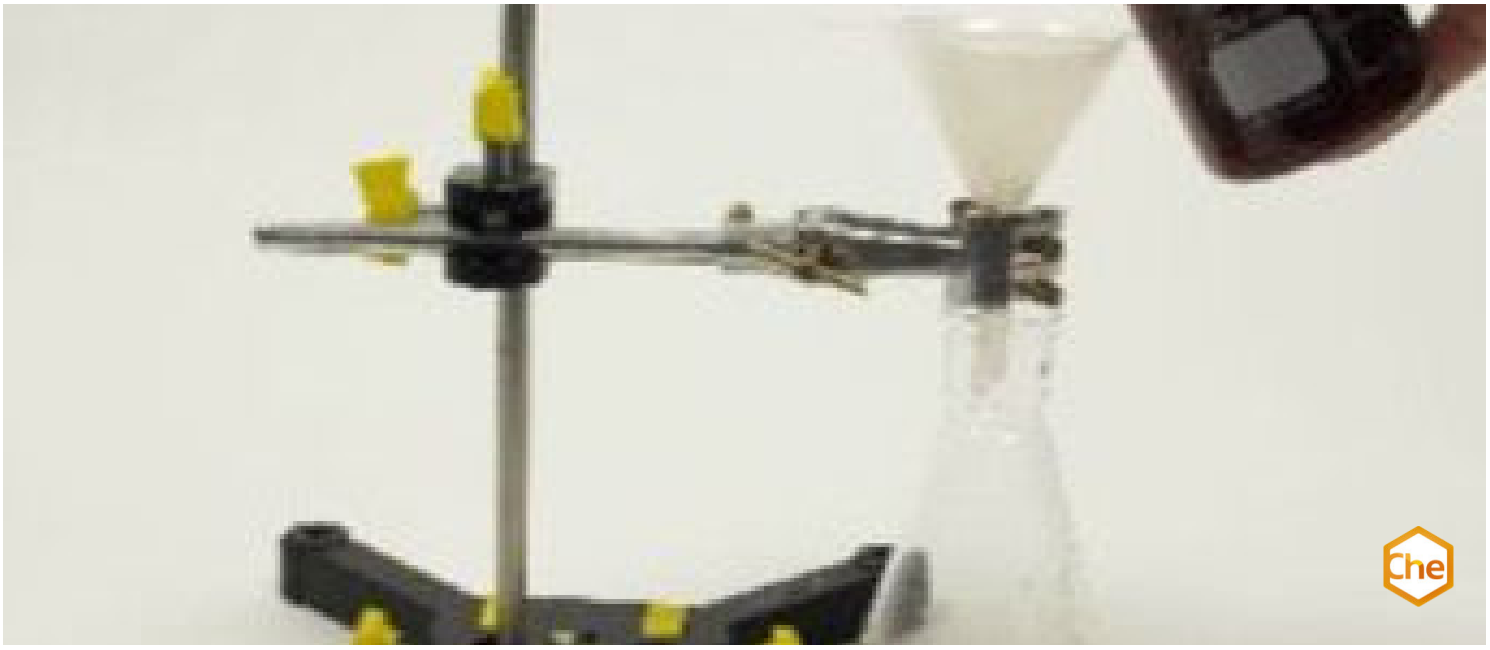
Plant pigments as indicators



Chemistry | Inorganic chemistry | Acids, bases, salts

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/5f56b0ca742d0c00034be2cf

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Teacher information

Application

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Filtration of the red cabbage juice

To determine the pH (or the acidic or basic character) of an aqueous solution, pH meters or indicators can be used; when indicators are used, the pH or pH range can be determined by the colour of the indicator. Well-known indicators are e.g. phenolphthalein or litmus. pH-indicators can also be extracted from flowers or some vegetables, such as red cabbage juice. In this student experiment, different natural substances (e.g. beetroot or red cabbage) are examined and it is tested whether ingredients of these natural substances are suitable as indicators for acids. The experiment uses the extraction method described in the separation procedures, which can be discussed in more detail here.

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Other teacher information (1/2)

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Prior knowledge

- The pH value of a solution is a measure of the concentration of hydroxonium ions.
- A solution is neutral at pH=7, acidic at pH <7 and alkaline at pH >7.
- The pH value of a solution can be determined based on the colour change of an indicator.

Scientific principle

- The plant dyes produced are cyanines or cyanine-like systems that have different absorption maxima in the acid or basic range.
- Yellow or reddish-yellow flower dyes are not suitable, as these mostly consist of carotenoids, which are unsuitable as indicators.

Other teacher information (2/2)

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Learning objective

- Dyes can be extracted from flowers or some vegetables.
- These dyes are suitable as acid detection agents (indicators).

Tasks

- Production of various acid indicators, by dissolving and filtering out the plant dyes from rose petals and red cabbage.

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Safety Instructions

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- Methylated spirits are highly flammable. Extinguish all open flames!
- Always wear protective goggles!
- The general instructions for safe experimentation in science lessons apply to this experiment.
- For H- and P-phrases please consult the safety data sheet of the respective chemical.

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Student Information

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Motivation

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pH value determination with indicator

We constantly encounter acids and bases in our everyday life. Often, however, we are not able to tell visually whether an unknown aqueous solution is an acid or a base. Therefore, in order to determine the pH value (or the acidic or basic character) of an aqueous solution, we can use a pH meter or indicators. When using indicators, the pH value or pH range can be determined by the colour of the indicator. Well-known indicators are e.g. phenolphthalein or litmus. pH indicators can also be extracted from flowers or some vegetables, such as red cabbage juice.

Tasks

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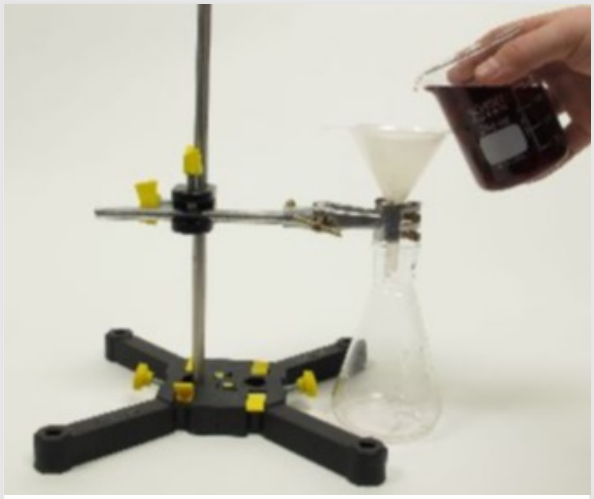

Filtration of red cabbage juice

How can acids be recognized?

- Produce vegetable dyes that can be used for acid identification.

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Equipment

Position	Material	Item No.	Quantity
1	Denaturated alcohol (spirit for burning), 1000 ml	31150-70	1
2	Sea sand, purified 1000 g	30220-67	1
3	Support base, variable	02001-00	1
4	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
5	Boss head	02043-00	1
6	Mortar w. pestle, 70ml, porcelain	32603-00	1
7	Knife, stainless	33476-00	1
8	Funnel, diameter = 60 mm, plastic (PP)	47318-00	1
9	Graduated cylinder, 10 ml, plastic	36636-00	1
10	Beaker, Borosilicate, low form, 250 ml	46054-00	1
11	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
12	Universal clamp	37715-01	1
13	Protecting glasses, clear glass	39316-00	1
14	Scissors, l = 110 mm, straight, point blunt	64616-00	1
15	Test tube brush w. wool tip,d20mm	38762-00	1
16	Laboratory pen, waterproof, black	38711-00	1
17	Erlenmeyer flask, stopper bed, 250 mlSB 29	MAU-EK17082306	2
18	Circular filter,d 110 mm,100 pcs	32977-04	1
19	Test tube, 180x18 mm,100pcs	37658-10	1
20	Spatula, powder, steel, l=150mm	47560-00	1

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Additional equipment

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Position	Equipment	Quantity
1	beetroot	1
2	petals	1
3	Rotkohl	1
4	water, hot	1

Set-up (1/2)

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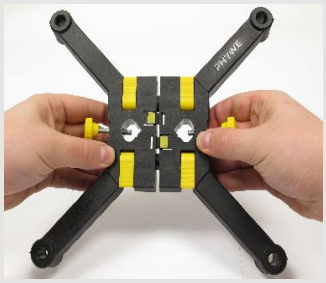
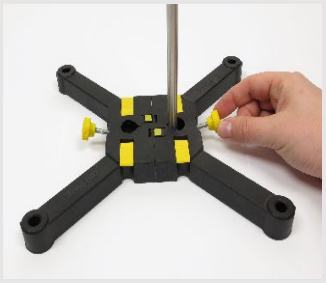
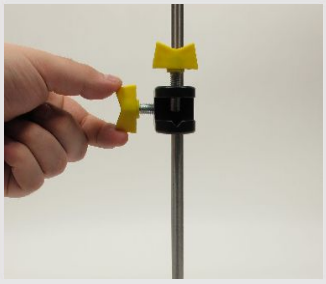
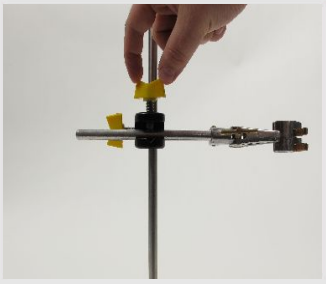
- Assemble the tripod from the tripod base and the tripod rod. See the two illustrations above.





- Attach the universal clamp to the stand rod. See the two illustrations below.





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Set-up (2/2)

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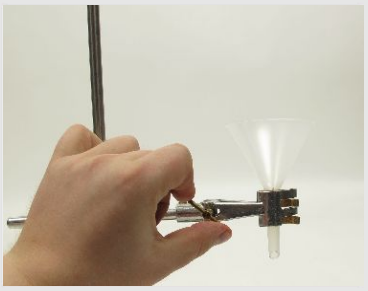

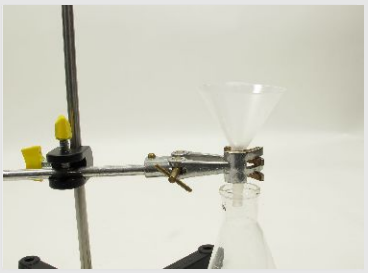

- Clamp the funnel into the stand clamp.
- Place an Erlenmeyer flask under the funnel.

Procedure (1/6)

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- Cut the beetroot into thin slices and cut these again into pieces.
- Put the beetroots in the beaker.
- Pour hot water over it, stir several times and leave the beaker to stand for about 10 minutes.

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Procedure (2/6)

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- Take petals of the same kind and cut them into pieces as well.
- Put the pieces in the mortar.



Procedure (3/6)

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- Add four spoons of sand and 10 ml methylated spirits.
- Grate the leaves for about 5 minutes, then add another 5 ml methylated spirits and grate for another 3 minutes.



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Procedure (4/6)

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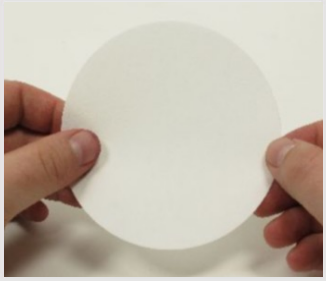
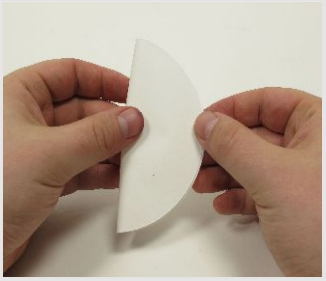
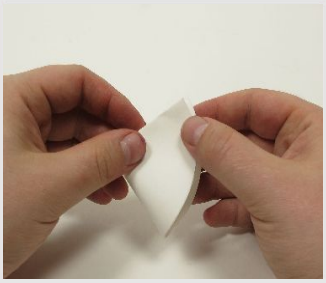
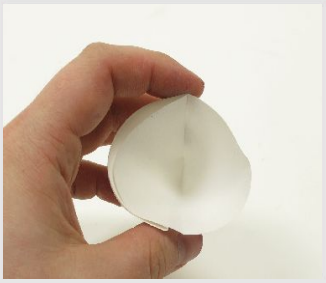
- Fold a round filter paper into a funnel.
- Please refer to the adjacent illustrations.

Procedure (5/6)

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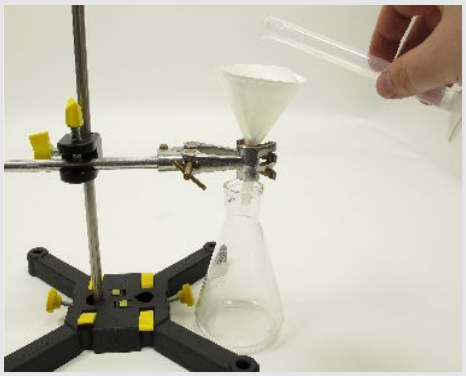
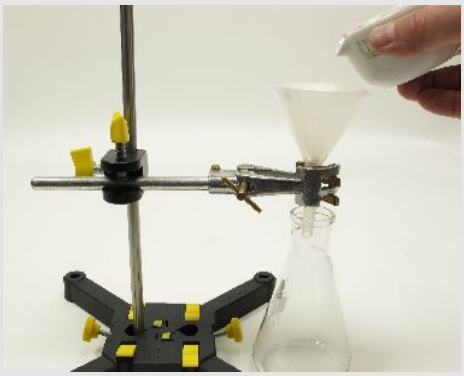
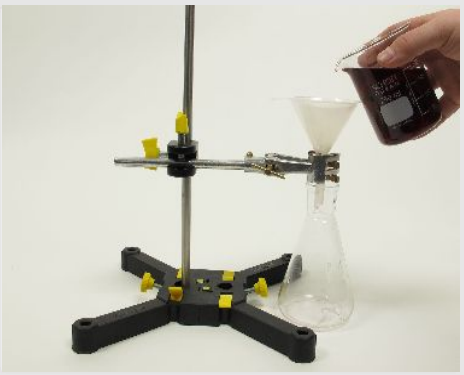
- Moisten the finished folded funnel with methylated spirits and filter the contents of the mortar into the Erlenmeyer flask.
- Refill the solution from the Erlenmeyer flasks in the marked test tubes.

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Procedure (6/6)

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red cabbage juice indicator

- Cut the red cabbage into pieces as well and proceed with the petals as described above.
- Filter the contents of the mortar into a clean Erlenmeyer flask.
- Keep the marked test tubes in a dark room (refrigerator) until the next hour.

Disposal

- Allow solvent residues to evaporate in the fume cupboard.

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Report

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Monitoring

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Enter the colour of the dyes produced into the table!

Ausgangssubstanz	Farbe des Farbstoffes
Rote Beete	
Rotkohl	
Blütenblätter	

Write down your observations!

Task 1

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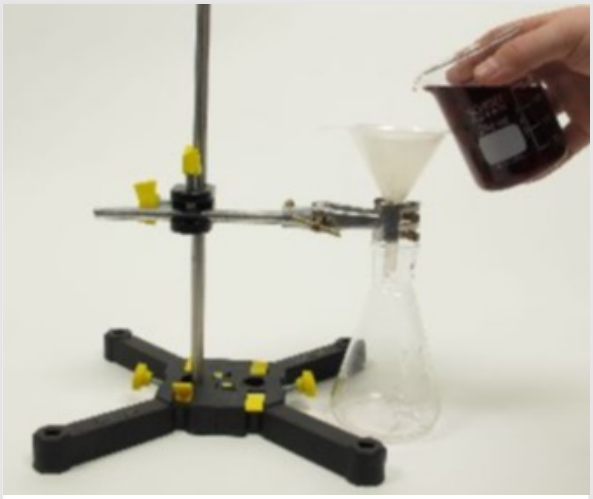

Separation of the red cabbage juice

Which separation process was used to produce the dyes?

- ○ Centrifuging
- ○ Extraction process
- ○ Decanting

Check

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Task 2

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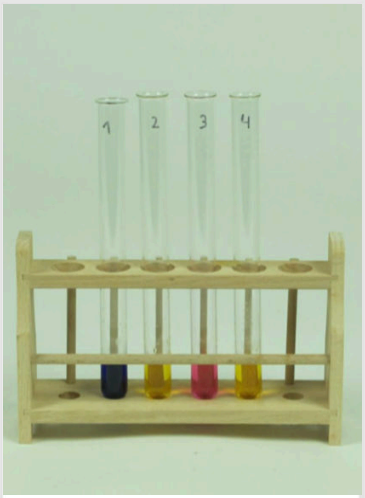

different indicators

Complete the cloze text with the appropriate terms!

The specific properties of the dyes were used in the production of the dyes. Their good solubility in [ ] (flower/red cabbage dye), or their solubility in [ ] (beetroot) in relation to the other [ ] of the plants enable the [ ] of the dyes.

Check

Slide	Score / Total
Slide 21: Separation methods	0/1
Slide 22: Preparation of the dyes	0/4

Total amount 0 / 5

Solutions Repeat Exporting text

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