Detection of fats with dyes (Item No.: P7185900)

Curricular Relevance

Area of Expertise: Chemie

Education Level: Klasse 10-13

Topic: Organische Chemie

Subtopic: Lebensmittelchemie: Fette, Kohlenhydrate, Aminosäuren/Proteine, Vitamine, Gewürze

Experiment: Fettnachweis mit Farbstoffen

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	20 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

fats, tests for fats, dyes

Task and equipment

Information for teachers

Additional Information

The expression "What looks good, tastes good" can be used to enter into this topic. Lemonade is coloured with carotene, a pigment from carrots.
Paprika and curry powder give sauces a strong colour making them more relishing.

Notes on content and learning objectives

- Fats can be coloured intensively red with Sudan III solution.
- Paprika powder contains capsanthin, a pigment which dissolves preferentially in fats and colours them orange-red.
- Foods are coloured with fat-soluble dyes.
- Fat-soluble dyes can detect even small amounts of fat.

Notes on the method

In this experiment the students are introduced to food dyes. The sensitivity to light of the carotenoids can be demonstrated by allowing paprika powder to stand in sunlight.

Fundamentals and remarks

Detection with Sudan III and paprika powder dyes are not specific for fats, but in most cases they suffice. The natural pigment in paprika powder, capsanthin, is a carotenoid. Like other naturally occuring carotenoids, it is permitted for the colouration of many foods in teh EC area, and is frequently used for this.

Hints on going deeper

- This theme addresses the problem of food additives. A discussion on substances which have been given an E number is very informative.
- Examination of foods for dyes by means of thin layer chromatography, e.g. of jelly babies.
- Detection of fats in foods with Sudan III solution.
- Heating oil is coloured by the addition of dyes ao that it cannot be mistaken for other oils.

Hints on set-up and procedure

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Preparation:
Use as fresh paprika powder as possible, as the capsanthin content decreases with the length of storage.

Notes on the students experiments:
After shaking the test tubes, a few ml of water can be added to improve the separation of the phases.

Hazard and Precautionary statements

Ethanol:

H225:	Highly flammable liquid and vapour.
P210:	Keep away from heat/sparks/open flames/hot surfaces – No smoking.

Sudan III:

H315:	Causes skin irritation.
H319:	Causes serious eye irritation.
H335:	May cause respiratory irritation.
H341:	Suspected of causing genetic defects.
P261:	Avoid breathing dust/fume/gas/mist/vapours/spray.
P302 + P352:	IF ON SKIN: Wash with soap and water.
P305 + P351 + P338:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing.
P405:	Store locked up.

Hazards

- Sudan-III solution contains ethanol. Ethanol is highly inflammable. Extinguish all open flames. Close and remove all bottles when they have been used.

Waste disposal

Put the fatty phases in the container for comubstible organic substances. Pour the aqueous phases to drain.

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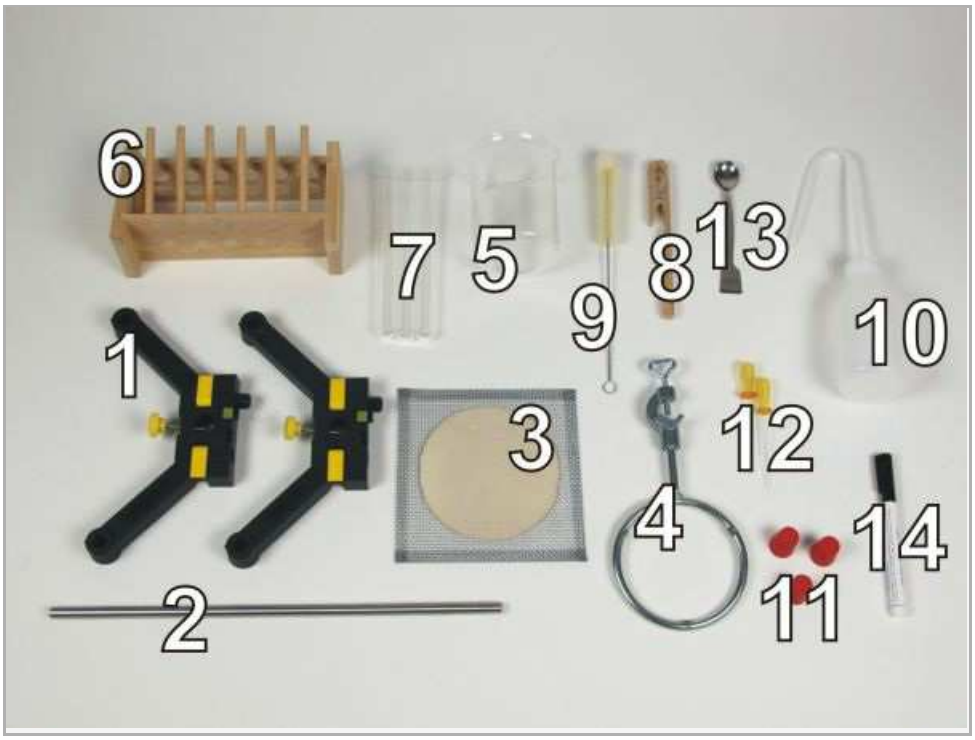
Task and equipment

Task

How can fats be detected with dyes?

Show the presence of fat with two dyes.

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	(3)
8	Test tube holder, up to d 22mm	38823-00	1
9	Test tube brush w. wool tip,d25mm	38762-00	1
10	Wash bottle, 250 ml, plastic	33930-00	1
11	Rubber stopper, d=22/17 mm, without hole	39255-00	3
12	Pipette with rubber bulb	64701-00	2
13	Spoon, special steel	33398-00	1
14	Labor pencil, waterproof	38711-00	1
	Butane burner f.cartridge 270+470	47536-00	1
	Butane catridge CV 300 Plus, 240 g	47538-01	1
	Water, distilled 5 l	31246-81	1
	Sudan-III solution,alcohol 250 ml	31861-25	1
	Boiling beads, 200 g	36937-20	1
Additional material			
	Coconut oil		
	Paprika powder		
	Vegetable oil (sunflower oil, olive oil,...)		

Set-up and procedure

Set-up

Hazards

- Sudan III solution contains ethanol. Ethanol is highly inflammable. Extinguish all open flames. Close and remove all bottles when they have been used.

Setup

Number three test tubes from 1 to 3 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.

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Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

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

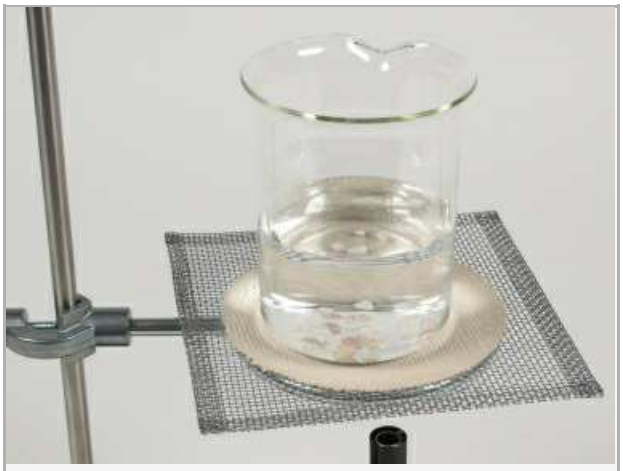

Fig. 7

Procedure

Pipette edible oil into the test tubes 1 and 3, to a height of 1 cm each of them. Add three spatula tips of coconut oil to test tube 2.

Fig. 8

Add three times the amount of distilled water to each test tube.

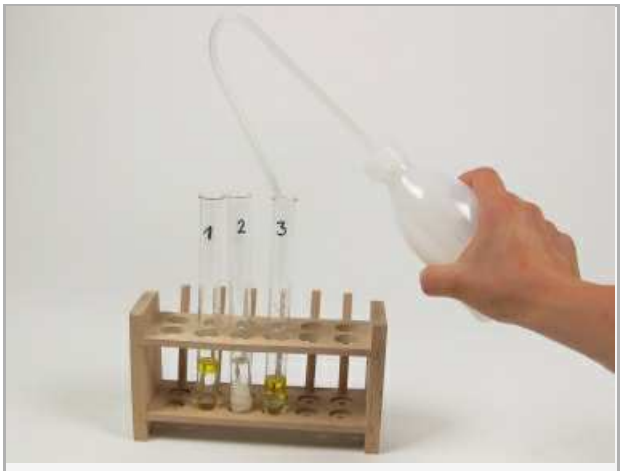

Fig. 9

Pipette 4 drops of Sudan III solution into the test tubes 1 and 2 (Fig. 10).
Add a spatula tip of paprika powder to test tube 3 (Fig. 11).

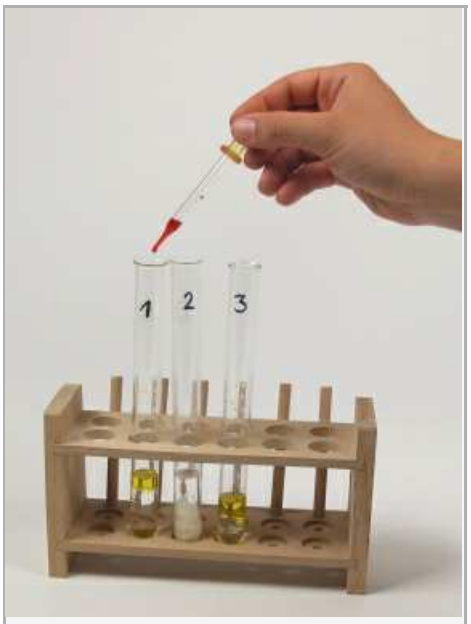

Fig. 10

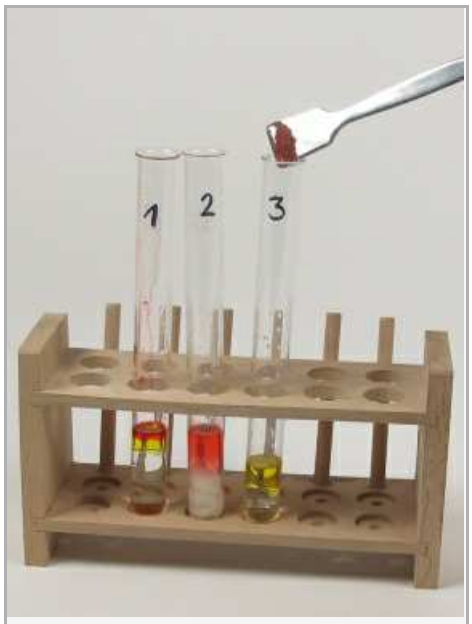

Fig. 11

Successively close the test tubes with a stopper and shake them vigorously. Place the test tubes in the beaker with hot water and leave them there for a few minutes.
Observe the colours of the various layers.

Waste disposal

Put the fatty phases in the container for combustible organic substances. Pour the aqueous phases to drain.

Report: Detection of fats with dyes

Result - Observations

Note your observations.

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Evaluation - Question 1

Draw conclusions from your observations.

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Evaluation - Question 2

Name foods which can be coloured with fat-soluble dyes.

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Evaluation - Question 3

Name other methods of detecting fats.

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Evaluation - Question 4

Complete the following statements.

1. Certain dyes are ..... in fat.
2. The specific ..... of Sudan III is a reliable indication of .....
3. Paprika also contains a pigment which dissolves in ..... giving an intensive ..... colouration.
4. ..... foods are to be coloured with specific .....