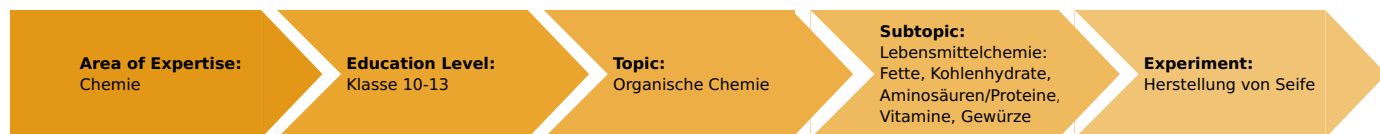


Production of soap (Item No.: P7185500)

Curricular Relevance



Difficulty



Intermediate

Preparation Time



10 Minutes

Execution Time



20 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

material property of soaps, preparation of soap

Task and equipment

Information for teachers

Additional Information

The production of soap dates back to antiquity. Animal or vegetable fats were boiled down with wood ashes.

Notes on content and learning objectives

- Soaps can be produced from long chain alkane acids of fats by adding lye.
- Soap must therefore consist of alkali salts of fatty acids.

Notes on the method

Working in groups is particularly motivating here, as the same product is formed from various starting materials, and this product differs greatly in its properties phenomenologically from the educt. The various experimental procedures can be introduced to the working groups and the equality of the results used for a fruitful discussion.

Fundamentals and remarks

The "saponification" of fats carried out here corresponds to the classical procedure for manufacturing soap, which can also be achieved with plant ashes (potash) according to the old recipe.

Hints on going deeper

- Variation in the alkali used results in the production of very different soaps.
- The possibility is given here to introduce physical characteristics.
- The cleaning action can be discussed in connection with the theme "personal hygiene".

Notes on set-up and procedure

Preparation:

Prepare concentrated caustic soda and 25 % caustic soda (34 g NaOH to 100 ml water) ready for use. Keep the eyewash bottle readily available.

Margarine or hardened vegetable fat are particularly suitable as fat.

Notes on the students experiment:

Both stearic acid and fat should only be heated so much that they just start to melt. At higher temperatures, the caustic soda

tends to spurt out more strongly.



Hazard and Precautionary statements

Ethanol:

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

Sodium hydroxide

- 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.
P309 + P310: IF exposed or you feel unwell: Call a POISON CENTER or doctor/physician.
P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing.

Hazards

- Sodium hydroxide is extremely caustic. Wear protective gloves!
- Spitting can occur when caustic soda is added to the melted substance. Wear protective glasses!
- Alcohol is highly inflammable. Before handling it, extinguish all open flames.

Waste disposal

Pour the contents of the test tubes into the beaker and filter. Pour the filtrate into the container for organic liquids. Put soap and remains of fat into the normal waste container.

Production of soap (Item No.: P7185500)

Task and equipment

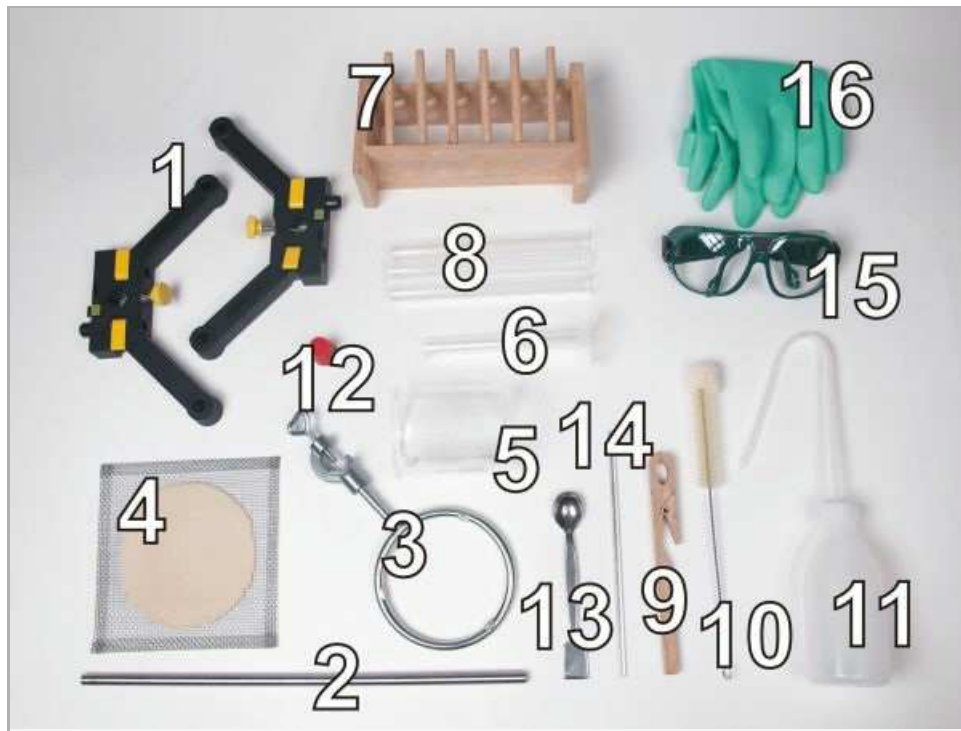
Task

How can soap be produced from fat?

Prepare soap from stearic acid or from fat.



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, 250 ml	36013-00	1
6	Graduated cylinder, 10 ml, plastic	36636-00	1
7	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
8	Test tube, 180x18 mm, 100pcs	37658-10	(3)
9	Test tube holder, up to d 22mm	38823-00	1
10	Test tube brush w. wool tip, d25mm	38762-00	1
11	Wash bottle, 250 ml, plastic	33930-00	1
12	Rubber stopper, d=22/17 mm, without hole	39255-00	1
13	Spoon, special steel	33398-00	1
14	Glass rod, boro 3.3, l=200mm, d=6mm	40485-04	1
15	Protecting glasses, clear glass	39316-00	1
16	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
	Sodium hydroxide, flakes, 1000 g	30157-70	1
	Stearic acid 250 g	30228-25	1
	Denaturated alcohol (spirit for burning), 1000 ml	31150-70	1
	Water, distilled 5 l	31246-81	1
Additional material			
	Fat		

Set-up and procedure

Set-up

Hazards

- Sodium hydroxide is extremely caustic. Wear protective gloves!
- Splitting can occur when caustic soda is added to the melted substance. Wear protective glasses!
- Alcohol is highly inflammable. Before handling it, extinguish all open flames!



Setup

Assemble the stand as shown in figures 1 to 5. 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. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

Put 3 spoonfuls of fat in a 250 ml glass beaker and place the beaker on the wire gauze.



Fig. 6



Fig. 7

Procedure

Conversion of fat with caustic soda

Carefully heat the beaker with a small flame, so that the fat just starts to melt. Add to it 10 ml of raw alcohol and 5 ml of distilled water. Add 10 ml of 25 % caustic soda to the mixture a little at a time and heat for a further 10 minutes, while stirring with a glass rod.

During this time, replace water lost as steam by careful addition of distilled water. Allow the beaker to cool.



Fig. 8

Conversion of stearic acid with caustic soda

Put a spoonful of stearic acid in a test tube and add 3 ml of raw alcohol and 5 ml of distilled water to it. Briefly heat the mixture, then add 3 ml of concentrated caustic soda. Heat the mixture cautiously under gentle shaking for about 3 minutes, without allowing it to boil. Allow the test tube to cool a little, then place it in the test tube rack.



Action of the reaction products of the conversion of stearic acid on water

Pour about 1 ml of that part of the mixture just prepared which separates up to the top into a second test tube. Add distilled water to a height of approx. 5 cm, stopper the test tube and shake it vigorously.

Action of the reaction products of the conversion of fat on water

Use the spoon to remove a little of the substance which is settling down in the beaker and put it in a further test tube. Add distilled water as for the second test tube, and again stopper the test tube and shake it vigorously.

Waste disposal

Pour the contents of the test tubes into the beaker and filter. Pour the filtrate into the container for organic liquids. Put soap and remains of fat into the normal waste container.

Report: Production of soap

Result - Observations

Note your observations in the following succession:

- a) Conversion of fat with caustic soda.
- b) Conversion of stearic acid with caustic soda.
- c) Action of the reaction products on water.

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Evaluation - Question 1

Draw conclusions from your observations.

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Evaluation - Question 2

Fats are glycerol esters of long chain alkane acids. Which reaction must have taken place in the first part of the experiment?

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Evaluation - Question 3

Which conclusions must be drawn on the composition of soaps from the parts of the experiment?

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Evaluation - Question 4

Complete the following statements.

1. Fat and stearic acid form an with and
2. Caustic soda stearic acid and fat under the formation of
3. Fats are, caustic soda splits these into and the of the fatty acid.
4. The sodium salt of a fatty acid is The reaction is called
5. In, are formed from alcohols and acids. converts esters into and the of the acid.

Evaluation - Question 5

Which soaps are formed when sodium hydroxide and when potassium hydroxide are used?

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Evaluation - Question 6

Which pH do soaps have?

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