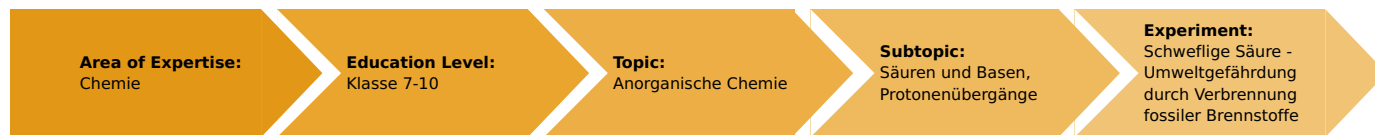


Sulphurous acid - environmental hazards due to the combustion of fossil fuels

(Item No.: P7158000)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

sulphurous acid, material property, environmental hazards

Task and equipment

Information for teachers

Learning objectives

- Because of the fact that they are based on vegetable or animal proteins, fossil fuels contain sulphur.
- When these substances are burnt, sulphur dioxide is formed which contributes essentially to the formation of the "acid rain".

Notes on set-up and preparation

Preparations

Commercially available fuel oil or diesel fuel contain only little sulphur. It is thus recommended to use the oil samples offered by the oil industry. Some of these oils have a high sulphur content.

Remarks on the students' experiments

Make sure that in the two parts of the experiments the substances are not heated too vigorously in order to reduce the formation of harmful gases. The oil should be only slightly heated. If it does not burn, continue heating until the burning point is reached.



Hazard and Precautionary statements

Sulphurous acid:

H332:	Harmful if inhaled.
H315:	Causes skin irritation.
H319:	Causes serious eye irritation.
H335:	May cause respiratory irritation.
P261:	Avoid breathing vapours.
P280:	Wear eye protection.
P305 + P351 + P338:	IF IN EYES: Rinse continuously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Crude oil:

H226:	Flammable liquid and vapour.
P260:	Do not breath vapour.
P262:	Do not get in eyes, on skin or on clothing.
P301 + P310:	IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P331:	Do NOT induce vomiting.
P403:	Store in a well-ventilated place.

Hazards

- When sulphurous acid and crude oil are heated, harmful substances are formed. The experiment must thus be carried out under the fume hood!
- Petroleum can splash during the combustion. Put on protective glasses!

Notes

The way crude oil was formed is not completely known. However, due to the fact that it contains enzymes, optically active substances and haemin degradation products its biogenic origin can be assumed as certain. When dead plankton (digesting sludge) decomposes under anaerobic conditions, hydrocarbons are formed which can be considered as a crude oil mother substance.

Remarks on the method

This topic is very appropriate for discussing the possibility of saving energy which has a strong reducing effect on the output of pollutants. Draw the students' attention to the fact commercially available catalysts cannot reduce the "acid rain" caused by sulphur dioxide since they only lead to the formation of even more aggressive sulphur trioxide.

Waste disposal

- Put the residual sulphurous acid into a special reservoir marked correspondingly or in the collecting tank for acids and alkalis.
- Burn the residual fuel oil or treat it as an inflammable organic substance.

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Task and equipment

Task

What additional substances contribute to the "acid rain"? (2)

Burn some petroleum and study the resulting combustion products.



Equipment



Position No.	Material	Order No.	Quantity
1	Protecting glasses, clear glass	39316-00	1
2	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
3	Test tube, 18x188 mm, 10 pcs	37658-03	(1)
4	Graduated cylinder, 10 ml, plastic	36636-00	1
5	Test tube holder, up to d 22mm	38823-00	1
6	Crucible tongs,200mm,stainl.steel	33600-00	1
7	Porcelain dish, 75ml, d = 80 mm	32516-00	1
8	Potass.iodide/starch paper,1 book	30202-00	1
9	Ring with boss head, i. d. = 10 cm	37701-01	1
10	Wire gauze with ceramic, 160 x 160 mm	33287-01	1
11	Support base, variable	02001-00	1
12	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
	Butane burner f.cartridge 270+470	47536-00	1
	Butane cartridge CV 300 Plus, 240 g	47538-01	1
	Wood splints, package of 100	39126-10	(1)
	Crude oil (petroleum),synthetic, 500 ml	31808-50	1
	Sulphurous acid,5-6%,g.r. 1000 ml	31832-70	1

Set-up and procedure

Set-up

Hazards

- When sulphurous acid and crude oil are heated, harmful substances are formed. The experiment must thus be carried out under the fume hood!
- Petroleum can splash during the combustion. Put on protective glasses!



Set-up

Set up the support system according to Fig. 1 - Fig. 3 and place the wire gauze square onto the support ring (Fig. 4).



Fig. 1



Fig. 2

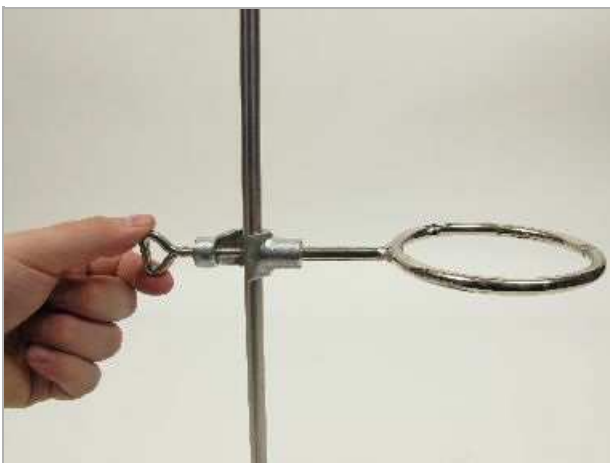


Fig. 3

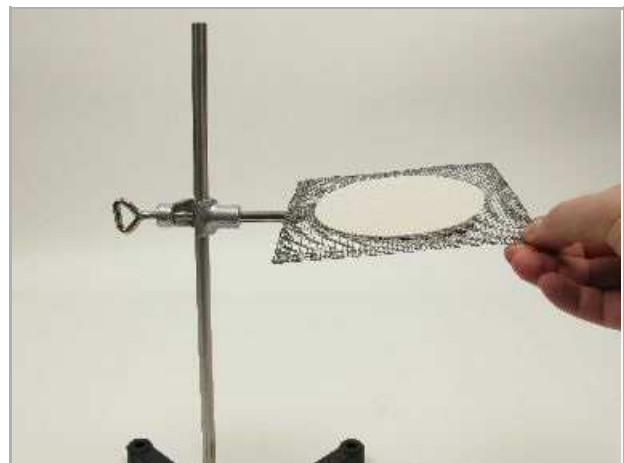


Fig. 4

Place the evaporating dish onto the wire gauze square and fill it with about 2 ml of crude oil (Fig. 5).



Fig. 5

Procedure

Fill the test tube one quarter full with sulphurous acid (Fig. 6), heat it (Fig. 7) and use the crucible tongs to hold a strip of humidified potassium-starch paper over the test tube orifice when the first traces of vapour can be seen (Fig. 8).



Fig. 6

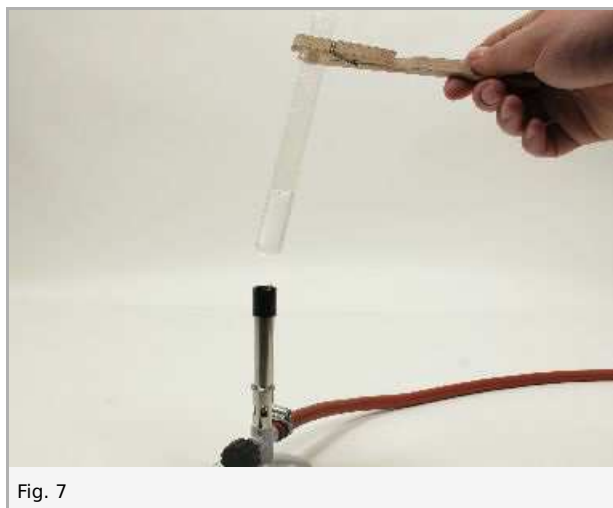


Fig. 7

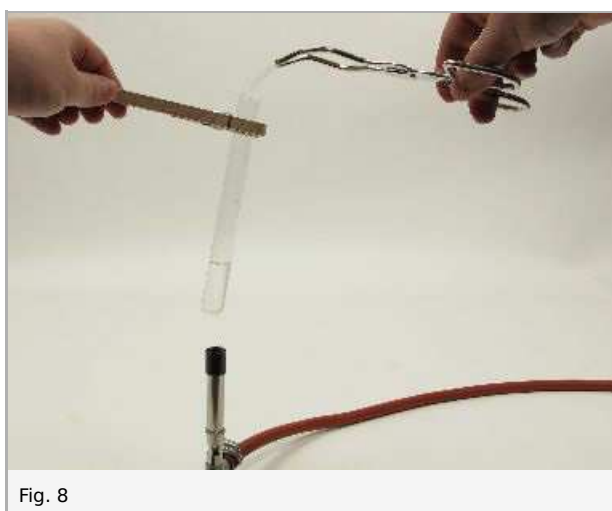


Fig. 8

Slightly heat the crude oil in the evaporating dish (Fig. 9). Ignite it by means of a burning wood splint (Fig. 10) and hold another strip of humidified potassium-starch paper sufficiently high over the rising gases (Fig. 11).



Fig. 9

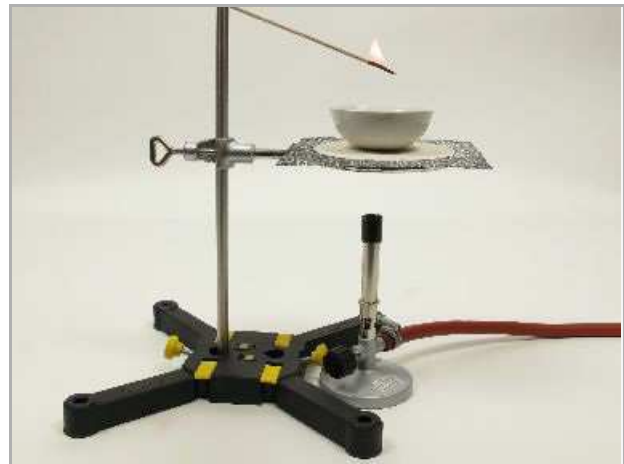


Fig. 10



Fig. 11

Waste disposal

- Fill the residual sulphurous acid into the collecting tank for acids and alkalis.
- Burn the residual crude oil or put it into the collecting reservoir for inflammable organic substances.

Report: Sulphurous acid - environmental hazards due to the combustion of fossil fuels

Result - Observations

Write down your observations on

- the sulphurous acid.
- the burning oil.

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Evaluation - Question 1

What substances are formed when sulphurous acid is heated and what is the function of the potassium-iodide starch paper in this content?

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Evaluation - Question 2

Draw the conclusions from your observations made during the combustion of the oil.

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Evaluation - Question 3

How is oil formed? Use the answer to this question to explain the formation of the substance produced during the combustion of oil.

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Evaluation - Question 4

Explain where crude oil and similar substances are burnt. What protective measures can be taken for the environment?

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