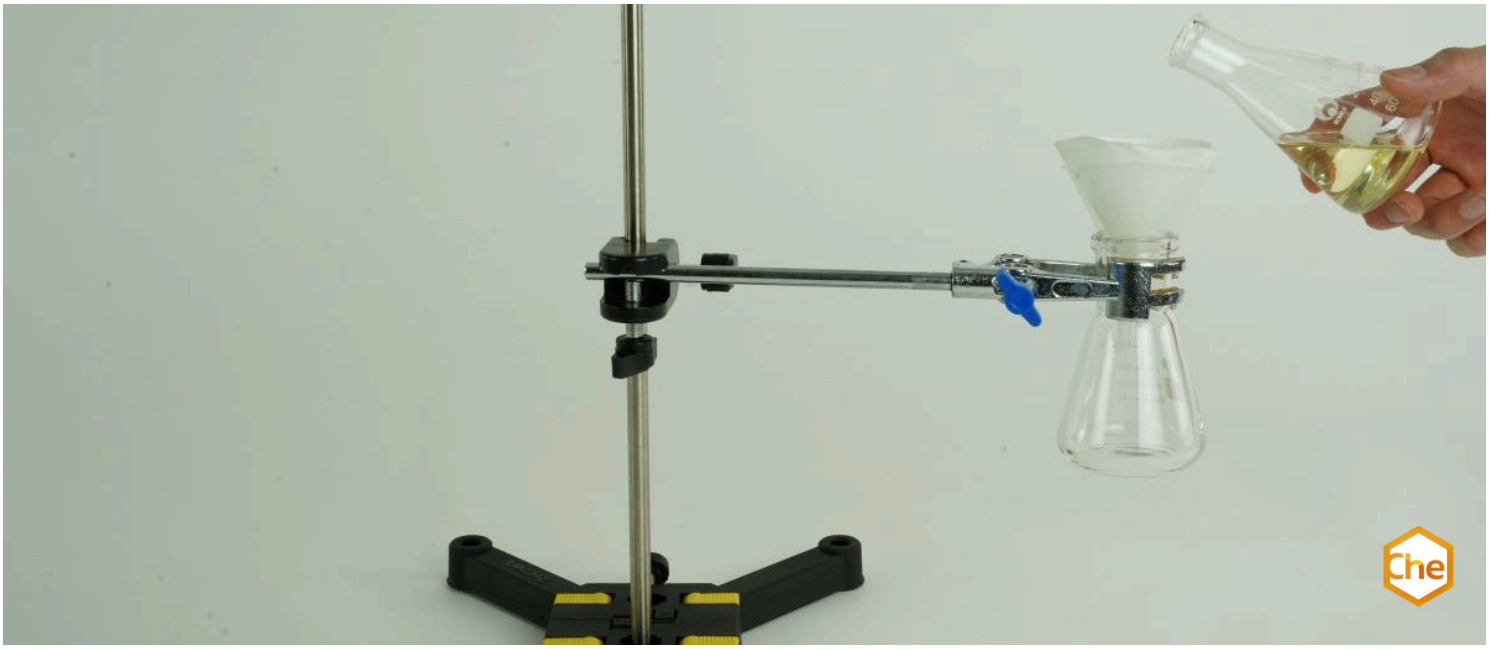
Removal of paraffins by extraction



Chemistry | Industrial Chemistry | Petrochemistry

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/638b6882abe2e70003a7e575

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Teacher information

Application

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The experimental setup

Some petrochemical products are lubricating oils. Unpurified lubricating oil also contains higher-boiling alkanes, for example long-chain paraffins, which precipitate at low temperatures and thus reduce the lubricating effect. These paraffins can be removed from the lubricating oil by extraction with an oil-dissolving solvent or precipitation.

In this experiment, students deparaffinise lubricating oil using the solvent acetone.

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Other teacher information (1/5)

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Prior knowledge

Students should already have a good basic knowledge of hydrocarbons, their groups and nomenclature. Furthermore, students should be familiar with working safely with chemicals.

Principle

Long-chain paraffins can be precipitated and removed from lubricating oil by extraction with an oil-dissolving solvent.

Other teacher information (2/5)

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Learning objective

The students learn that uncleaned lubricating oil also consists of long-chain paraffin, which greatly reduces the lubricating effect in the cold. These paraffins can be removed from the lubricating oil by extraction with an oil-dissolving solvent and precipitation.

Tasks

De-wax lubricating oil by extraction. Write down and draw conclusions from your observations.

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Other teacher information (3/5)

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Notes on set-up and procedure

Preparations

The lubricating oil fraction required for the experiment must be produced from petroleum by vacuum distillation. The lubricating oil available from mineral oil companies is already deparaffinised, but paraffinic lubricating oil can also be obtained there.

Notes on the student experiments

If sufficient paraffin has already precipitated after the first cooling, a second filtration can be omitted. As a rule, however, a larger part of the paraffin is dissolved again by heating during filtration, so that repeated cooling and filtration is sometimes necessary.

Other teacher information (4/5)

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Notes on set-up and procedure

Better than acetone, chlorinated hydrocarbons can also be used as oil-dissolving substances. However, the method described here is hardly used any more because of the danger of halogenated hydrocarbons and for reasons of cost, since paraffins can be removed more cheaply and more specifically with urea. This method is shown in the next experiment.

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Other teacher information (5/5)

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Methodological remarks

This experiment and experiment P7171500 can also be carried out in groups by exchanging the experimental results. A rethinking process is necessary here, as it is not the solid that is extracted but the liquid that dissolves the solid.

Disposal

- Collect lubricating oil in an appropriately marked container.
- Put the contents of the test tubes into the collection container for combustible organic substances.
- If necessary, heat the paraffin again in a water bath for easier disposal.

Safety instructions

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The general instructions for safe experimentation in science lessons apply to this experiment.

For H and P phrases, please refer to the safety data sheet of the respective chemical.

Dangers

- Acetone is highly flammable. Extinguish all open flames!
- Acetone attacks the skin! Wash off splashes immediately!
- Put on protective goggles!

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Student information

Motivation

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Lubricating oil

When machines work, many surfaces come into contact with each other and the friction between them causes wear. However, this friction can be significantly reduced if lubricating oil is used, which forms a sliding film on the surfaces so that the machine can work better. It is not without reason that there is the saying: "It runs like clockwork!".

However, there are components in the lubricating oil that reduce the lubricating effect at certain temperatures. These can be removed from the lubricating oil using suitable processes.

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Tasks

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The experimental setup

1. De-wax lubricating oil by extraction.
2. Note down and draw conclusions from your observations.

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Equipment

Position	Material	Item No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
3	Boss head	02043-00	1
4	Spoon, special steel	33398-00	1
5	Dish, plastic, 150x150x65 mm	33928-00	1
6	Funnel, diameter = 50 mm, plastic (PP)	36890-00	1
7	Beaker, 150ml, low-form	46060-00	1
8	Beaker, Borosilicate, low form, 250 ml	46054-00	1
9	Erlenmeyer flask, stopper bed, 100 mlSB 19	MAU-EK17082002	1
10	Graduated cylinder, 50 ml, plastic	36628-01	1
11	Test tube, 180x18 mm,100pcs	37658-10	1
12	Test tube brush w. wool tip,d20mm	38762-00	1
13	Test tube rack for 12 tubes, holes d= 22 mm, wood	37686-10	1
14	Universal clamp	37715-01	1
15	Lab thermometer,-10..+150C	38058-00	1
16	Rubber stopper, d=22/17 mm, without hole	39255-00	1
17	Protecting glasses, clear glass	39316-00	1
18	Glass rod, boro 3.3, l=200mm, d=6mm	40485-04	1
19	Acetone, extra pure, 1000 ml	30004-70	1
20	Sodium chloride 1000 g	30155-70	1
21	Circular filter,d 90 mm,100 pcs	32977-03	1

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Additional equipment

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Additionally required

Ice
Hot water
Lubricating oil (paraffinic)

Set-up (1/2)

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1. Set up the stand according to Fig. 1 to 4.

Figure 1

Figure 2

Figure 3

Figure 4

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Set-up (2/2)

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2. Clamp the funnel in the universal clamp (Fig. 5). Put a folded filter paper into the funnel, moisten it with some acetone (Fig. 6).

3. Fill the tub about halfway with pieces of ice and add table salt while stirring until the temperature drops below -10 °C (Fig. 7 and 8).

Figure 5

Figure 6

Figure 7

Figure 8

Procedure (1/3)

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Figure 9

Figure 10

1. Add 20 ml of lubricating oil to the Erlenmeyer flask (Fig. 9) and 25 ml of acetone.

2. Close the Erlenmeyer flask with the rubber stopper and shake the mixture vigorously (Fig. 10).

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Procedure (2/3)

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Figure 11

Figure 12

3. Place the opened Erlenmeyer flask in the tub filled with the cold mixture for about 5 min (Fig. 11).

4. Then filter the cooled mixture into the second conical flask (Fig. 12).

5. Place the filtrate again in the refrigeration mixture and filter again through the same filter after cooling.

Procedure (3/3)

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Figure 11

Figure 12

6. Fill the beaker two-thirds full with hot water.

7. Scrape the residue from the filter paper (Fig. 13), put it into a test tube and place it in the hot water (Fig. 14 and 15).

8. After about 3 min, allow the test tube to cool in the test tube rack.

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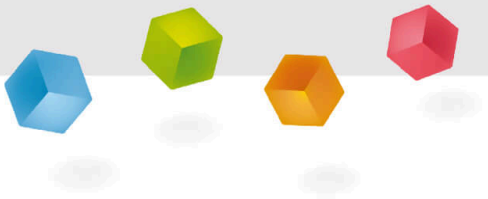

Report

Task 1

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Write down your observations.

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Task 2

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Which of these substances was extracted from the lubricating oil in this experiment?

- Water
- Long chain paraffins
- Acetone
- Sunflower oil

Task 3

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The process exploits the solubility of paraffin in acetone to extract it from the rest of the lubricating oil.

○ True ○ False

Check

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Task 4

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Why does distillate-derived lubricating oil need to be dewaxed before bottling to be effective in all seasons?

- ○ Paraffin becomes solid at low temperatures and would thus considerably reduce the lubricating effect of the lubricating oil during cold seasons.
- ○ At cold temperatures, the oxidation process of the paraffin is accelerated and the lubricating oil would become rancid.
- ○ At low temperatures, the paraffin evaporates and the protective lubricating oil sliding film would disappear on cold days.

Check

Slide	Score / Total
Slide 21: Extraction of the substance	0/1
Slide 22: Physical property	0/1
Slide 23: Everyday reference	0/1

Total 0 / 3

Solutions Repeat Export text

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