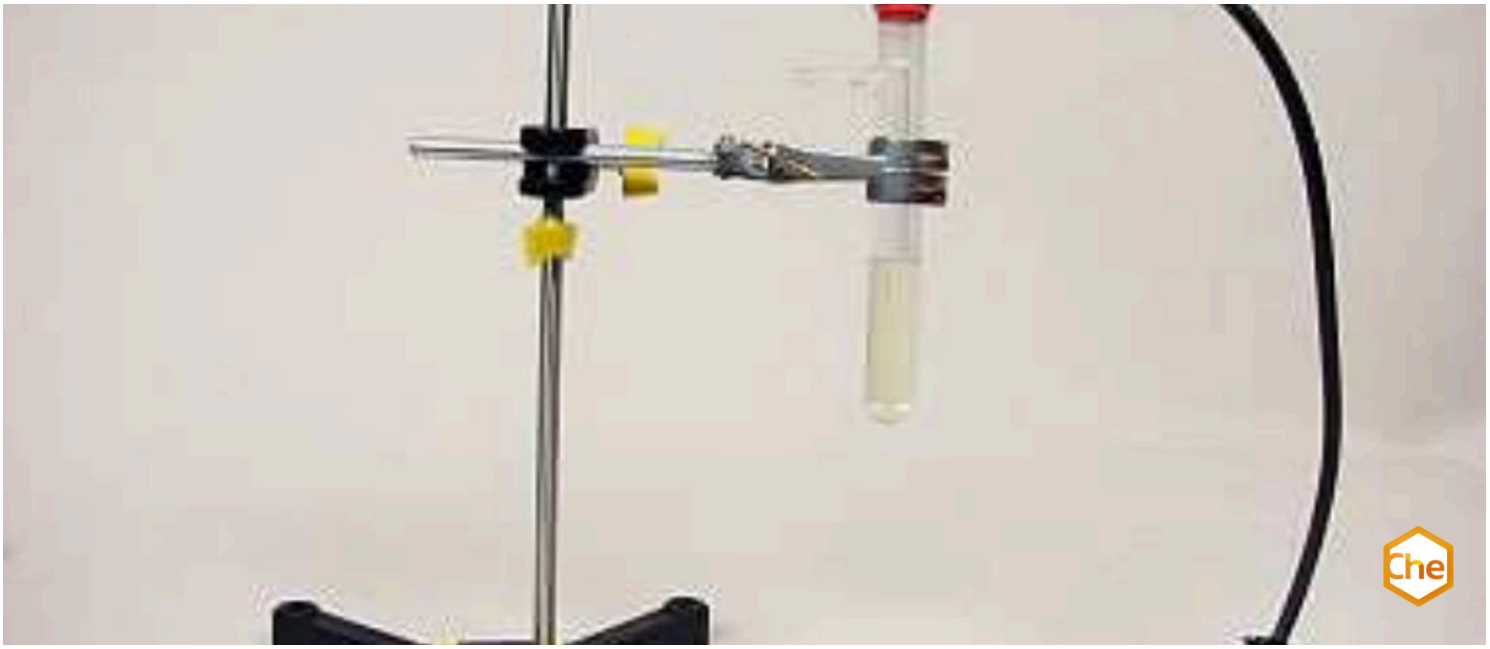
Mode of operation of an aeration tank (sewage treatment plant)



In this student experiment, this principle is modelled. A stream of air is passed through a solution containing iron salts. It can be observed that the water-soluble iron sulphate is converted into an insoluble form (oxidised) by the oxygen flowing through the air and can then be removed from the water (by filtration).

Chemistry > Industrial Chemistry > Exhaust gas cleaning, environmental protection

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/633b4f52bdf6080003a94317

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Teacher information

Application

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Experimental setup

In this experiment, the students observe the effect of a continuous flow of air through a solution containing iron salts.

In the process, they find that oxidisable substances are oxidised and separated by the supply of air.

This experiment is intended to illustrate the principle and functioning of the aeration basin in a sewage treatment plant.

The mechanical plant components upstream of the aeration basins (sand separation/pre-sedimentation basin) should already be known before the use of this experiment, so that the experiment is installed in the water treatment process at the technically specified stage.

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Other teacher information (1/2)

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Prior knowledge

Students are familiar with the chemical processes of oxidation and reduction.

They have been taught about the different steps of a water treatment plant.

Principle

The students experiment independently on the experimental set-up and, with the help of a continuous air flow through dirty water containing iron salts, cause iron compounds to precipitate, which become visible as precipitation.

Other teacher information (2/2)

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Learning objective

One treatment stage in the sewage treatment plants is aeration in the aeration basins

Here, oxidisable substances are oxidised by air supply and separated as sludge

Tasks

- Students create continuous aeration of a ferrous sulphate solution with a rubber blower for about 10min
- They observe the failure of the compounds formed by oxidation and note down their observations

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Safety instructions

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Make rubber-glass joints slippery with glycerine. Do not use force!

Wear protective goggles!

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

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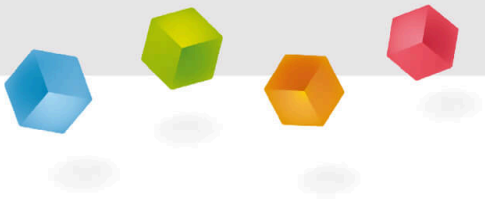

Student information

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Motivation

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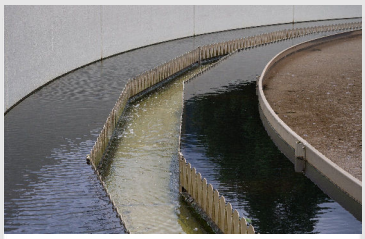
Sewage treatment plant



Waste water

Each of us uses an average of 127 litres of water in everyday life, most of which ends up in a sewage plant or water treatment plant. Large amounts of water are also polluted in industry, which then has to be treated before it can be returned to lakes and rivers.

But how exactly do you clean even industrial wastewater so well that it can be reused as drinking water?

In this experiment, we want to recreate the principle of one part of the water treatment system, the aeration tank, in an experiment and thus understand how it works.

Tasks

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What is not part of water treatment?

- Skidding basin.
- Primary clarifier
- Aeration tank

Why is wastewater aerated in sewage treatment plants?

- Using a rubber blower, pass a continuous stream of air through a test tube containing ferrous sulphate solution for about 10 minutes.
- Observe the test tube and make a note of 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	Test tube,180x20 mm,side arm,PN19	MAU-17080301	1
5	Graduated cylinder, 10 ml, plastic	36636-00	1
6	Glass tubes,right-angled	MAU-10030701	1
7	Universal clamp	37715-01	1
8	Test tube brush w. wool tip,d20mm	38762-00	1
9	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	1
10	Rubber bulb, double	39287-00	1
11	Protecting glasses, clear glass	39316-00	1
12	Iron-II sulphate 500 g	30072-50	1
13	Glycerol, 250 ml	30084-25	1

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Set-up (1/2)

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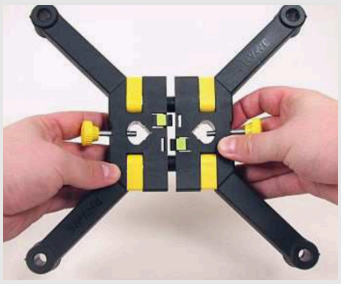
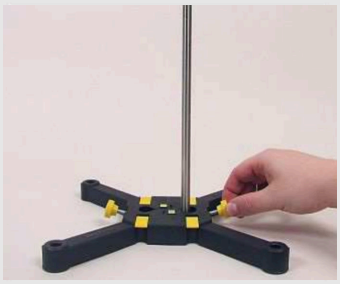
Put the two halves of the support base together as shown in the illustration above left,

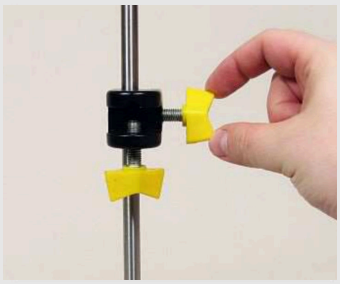
Position a support rod in the support base as shown in the picture above right,

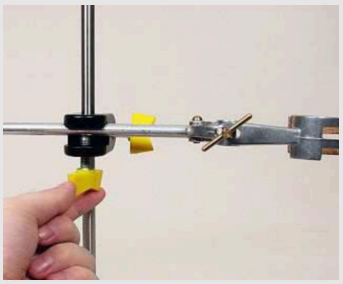
Attach a sleeve to the support rod (picture below left).

Hold a universal clamp in this sleeve (illustration below right).









Set-up (2/2)

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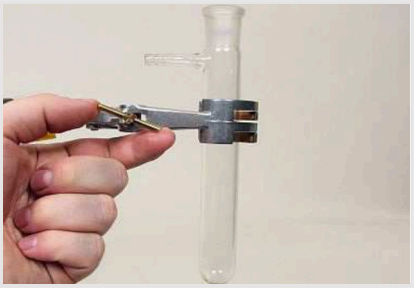
Take a test tube with a nozzle (see picture on the right).

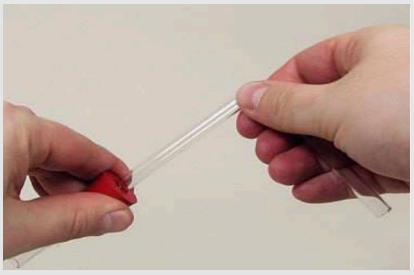
Clamp the test tube with the nozzle vertically into the clamp as shown in the figure above.

Take an angle tube as shown in the illustration on the right.

Make the angle tube slippery with a drop of glycerine.

Insert the long leg of the angle tube into the rubber plug by turning it and without using force (illustration below).





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Procedure (1/2)

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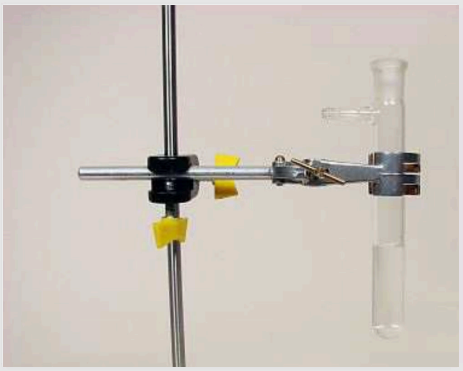
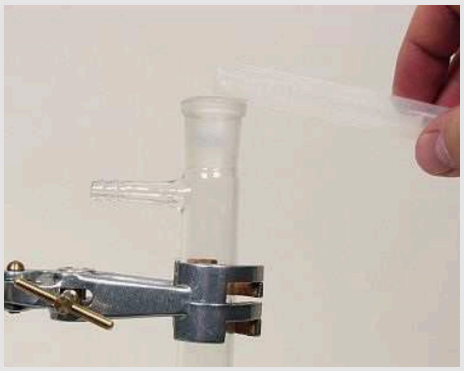
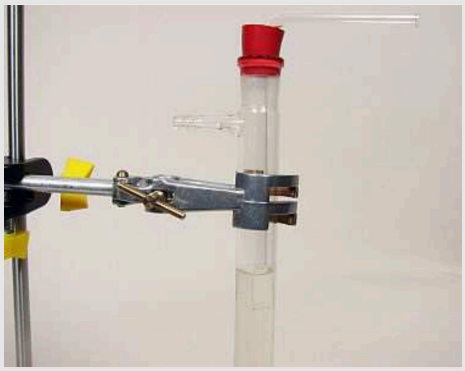
Fill the test tube one third full with water (fig. left) and add 2 ml iron(II) sulphate solution (fig. centre). Close the test tube with the rubber stopper (fig. right). Carefully move the angle tube until the long leg almost touches the bottom.







Procedure (2/2)

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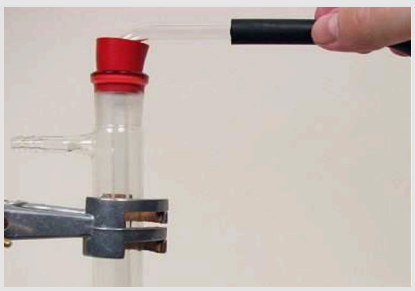
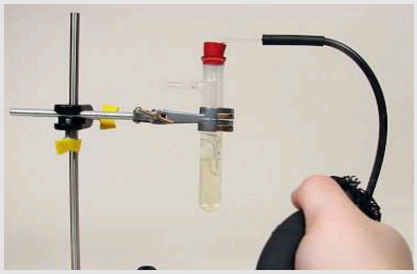
Connect the rubber blower to the other end of the angle tube (top illustration) and pump air evenly through the solution for about 10 minutes as shown in the illustrations below.

Disposal

- Filter off the precipitate and add to the heavy metal waste.
- Place the filtrate in the collection container for acids and alkalis.





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Report

Task 1

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Over time, aeration of the liquid causes a ...

- solid precipitation.
- gas.

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Task 2

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Summarise what you have learned in this experiment.

In this experiment, you learned about the functioning of the _____ of a water treatment plant.
In this process, _____ toxins are oxidised by the _____ from the supplied air and then _____ as sludge.
But since this method cannot eliminate every _____, further steps in water treatment are necessary.

separated
oxidisable
oxygen
contamination
aeration tank

Check

Slide	Score / Total
Slide 8: Water treatment	0/1
Slide 15: Ventilation	0/3
Slide 16: Summary of the experiment	0/5
Total	**0 / 9**

Solutions Repeat

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