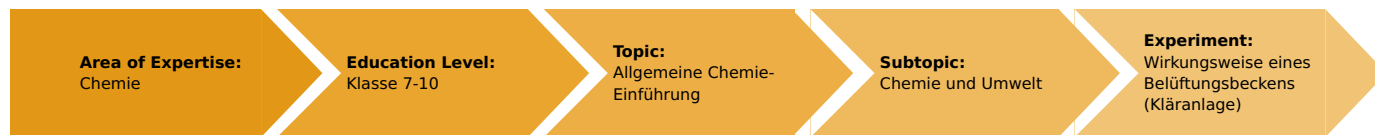


Mode of operation of an aeration tank (sewage treatment plant) (Item No.: P7155000)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



10 Minutes

Recommended Group Size



2 Students

Additional Requirements:

Experiment Variations:

Keywords:

Aeration tank, sewage treatment plant

Task and equipment

Information for teachers

Learning objectives

- One of the cleansing steps in sewage treatment plants is the aeration in aeration tanks.
- In these tanks oxidisable substances are oxidised by supplying air and deposited as sludge.

Notes on set-up and procedure Hinweise zu Aufbau Durchführung

Preparation

The approximately 20% iron(II) sulphate solution must be freshly prepared: To do this, dissolve 57.5 g of the heptahydrate in 100 g of water. (5,5 g $\text{FeSO}_4 \cdot 7 \text{H}_2\text{O}$ in 100 g)

Remarks on the students' experiments

The current of air must be passed through the solution slowly and continuously. The experiment can be terminated when a clearly visible precipitate has formed.



Hazard and Precautionary statements

Iron(II) sulphate:

H302: Harmful if swallowed.

H315: Causes skin irritation.

H319: Causes serious eye irritation.

P302 + P352: IF ON SKIN: Wash with plenty of soap and water.

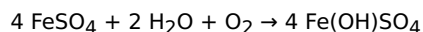
P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Hazards

- Lubricate rubber-glass connections with glycerol. Do not use force!
- Wear protective glasses!

Note

Depending on the initial pH of the sewage, oxihydrates and other poorly soluble iron(III) compounds, in particular basic iron(III) sulphate, are formed:



Remarks on the method

Completing the Exercises 3 to 5 requires the use of a text book or another reference work. In this context, we refer you to "Foundations of the Chemical Industry" which is exceptionally well suited to introduce the topic "water and water purification". The mechanical parts of the plant (sand catcher/presettling tank), which are upstream from the aeration tank, should already have been introduced before the implementation of this experiment. Thus, this experiment is integrated in the course of water purification at the technically correct location.

Waste disposal

- Filter the precipitate and put it into the container for heavy metal wastes.
- The filtrate contains even larger quantities of iron sulphate which can be precipitated as hydroxide or sulphate and disposed of as heavy metal waste.
- Any solution which, subsequent to a long standing period, contains very little iron sulphate can be put into the collection container for acids and alkalis.

Mode of operation of an aeration tank (sewage treatment plant) (Item No.: P7155000)

Task and equipment

Task

Why is sewage aerated in sewage treatment plants?

Pass an air current through a solution containing an iron salt.



Equipment



Position No.	Material	Order No.	Quantity
1	Boss head	02043-00	1
2	Universal clamp	37715-00	1
3	Protecting glasses, clear glass	39316-00	1
4	Support base, variable	02001-00	1
5	Test tube brush w. wool tip,d25mm	38762-00	1
6	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
7	Graduated cylinder, 10 ml, plastic	36636-00	1
8	Rubber bulb, double	39287-00	1
9	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	1
10	Test tube,180x20 mm,side arm,PN19	36330-00	1
11	Glass tubes,right-angled, 10	36701-59	(1)
Additional material			
	Iron-II sulphate 500 g	30072-50	
	Glycerol, 250 ml	30084-25	
	Water		

Set-up and procedure

Set-up

Hazards

- Lubricate rubber-glass connections with glycerol. Do not use force!
- Wear protective glasses!



Set-up

Set up the support stand with the universal clamp according to Fig. 1 - Fig. 4. Attach the test tube with the side arm to it using the clamp (Fig. 5).

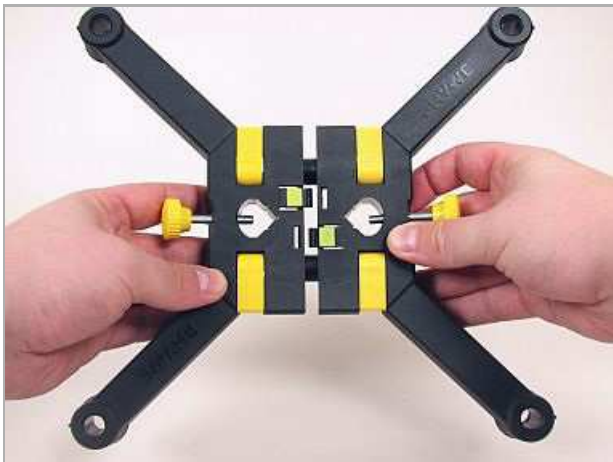


Fig. 1

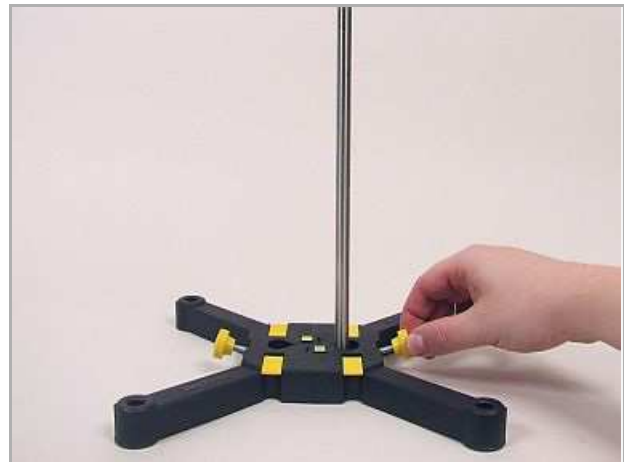


Fig. 2

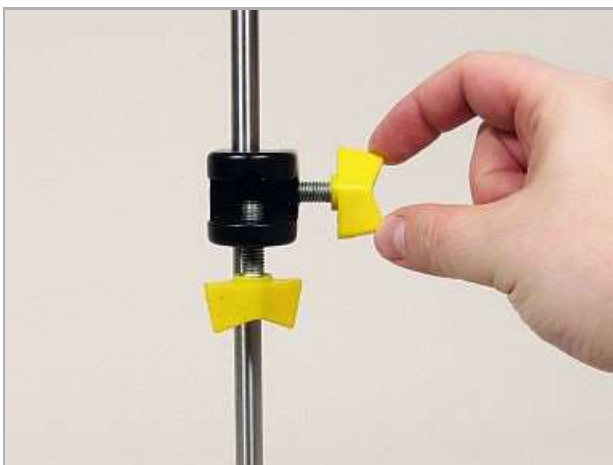


Fig. 3

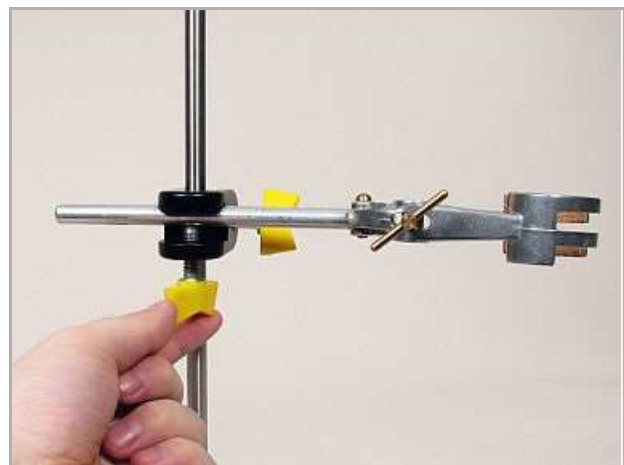


Fig. 4



Fig. 5

Lubricate the right-angled glass tube with a drop of glycerol and insert its long leg into the rubber stopper by twisting it without force (Fig. 6).

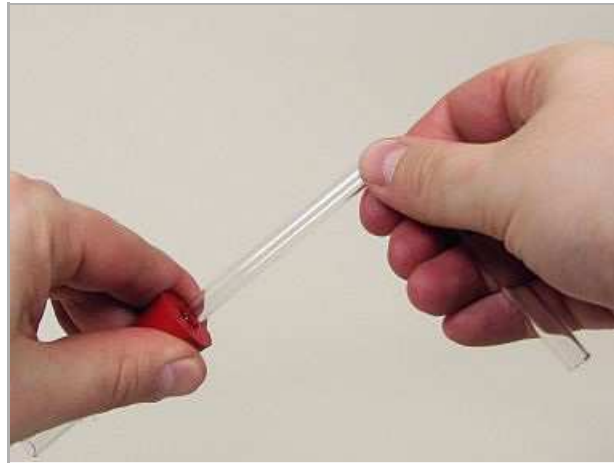


Fig. 6

Procedure

Procedure

Fill the test tube one-third full with water (Fig. 7); add 2 ml of iron(II) sulphate solution (Fig. 8).

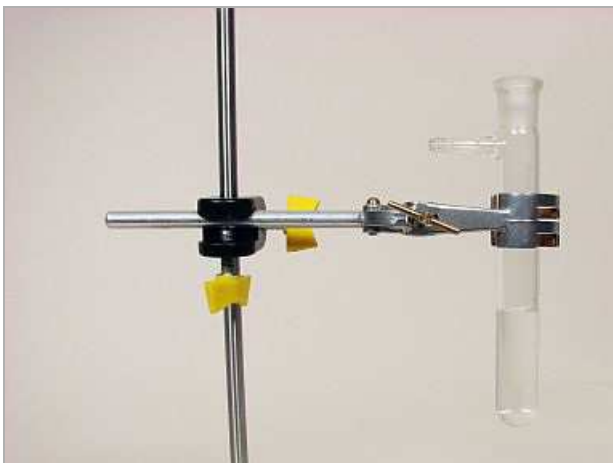


Fig. 7

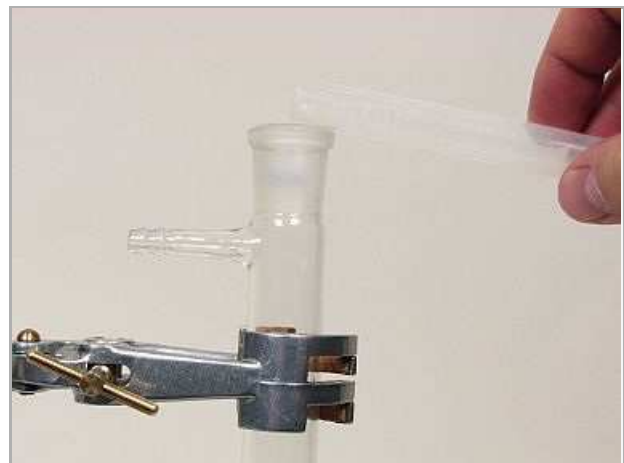


Fig. 8

Seal the test tube with the rubber stopper (Fig. 9). Move the right-angled glass tube cautiously downwards until the tip of its long leg nearly touches the bottom of the test tube.

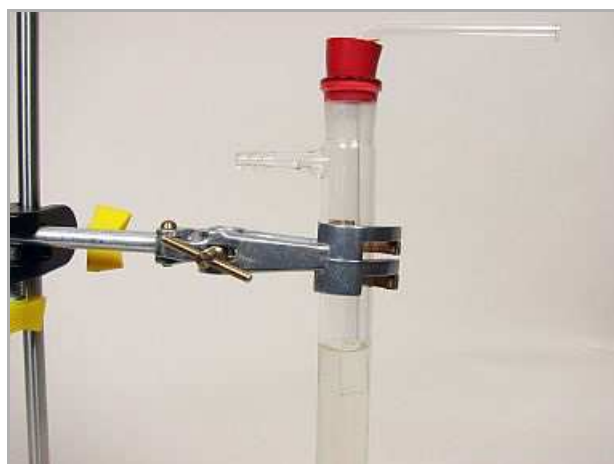


Fig. 9

Connect the rubber bulb to the other end of the right-angled tube (Fig. 10) and pump air uniformly through the solution for approximately 10 minutes (Fig. 11).

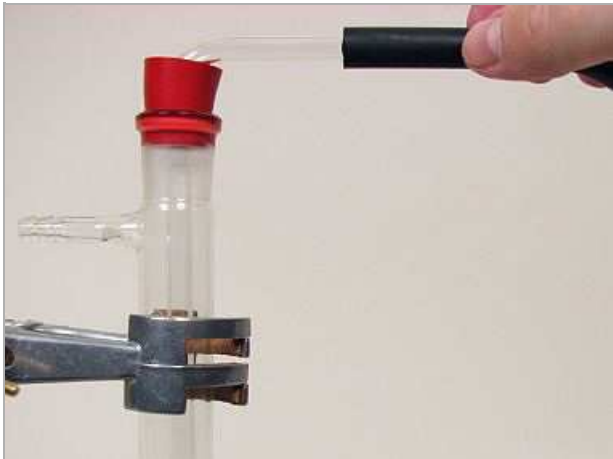


Fig. 10

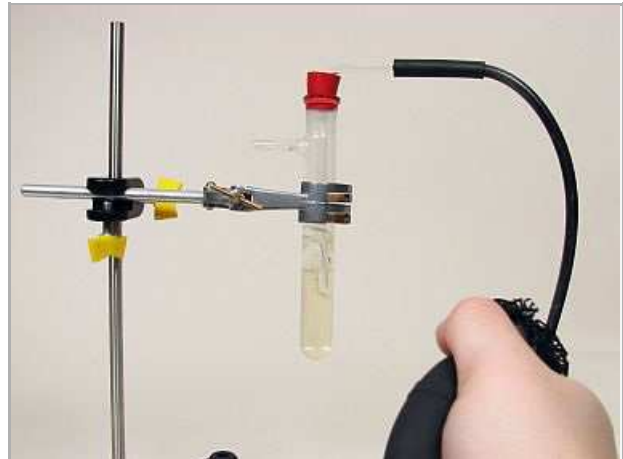


Fig. 11

Waste disposal

- Filter out the precipitate and put it into the container for heavy metal wastes.
- Pour the filtrate into the collection container for acids and alkalis.

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

Result - Observations

Note your observations.

.....

.....

.....

.....

Evaluation - Question 1

Draw conclusions based on your observations.

.....

.....

.....

.....

Evaluation - Question 2

How can the substance produced by aeration be removed?

.....

.....

.....

.....

Evaluation - Question 3

Based on your conclusions, answer the question in the experiment's title. Which substances are removed from sewage in this manner?

.....

.....

.....

.....

Evaluation - Question 4

Is aeration alone sufficient to remove organic pollutants?

.....

.....

.....

.....

Evaluation - Question 5

Which type of installation appropriately follows the aeration facilities in sewage treatment plants?

.....

.....

.....

.....