

For Teachers

Reactor for Struvite recovery from wastewaters

Module 2

Objective: Creation of the Reactor

Build a basic reactor for the extraction of struvite from synthetic wastewaters and evaluate its functioning. The used materials should be available at a DIY store. The aim of this trial is to demonstrate the P recovery as struvite extracted from synthetic wastewaters by using very common materials. This experience will make pupils aware of the P recycling from wastewaters to reduce the exploitation of natural resources.

Necessities

List of materials/tools

- Sturdy cutter or blade for iron saw
- Hot glue
- Hot glue
- Screwdriver
- A powerful hairdryer or an industrial heat gun
- Hot glue
- 1 PVC tube for raw sewage with a 140 mm diameter and 200 mm of height
- 1 connection with screw cap PVC tubes with 140 mm of diameter properly drilled with a central drill of 15 mm diameter and one lateral of 25 mm of diameter
- 1 plastic funnel
- 1 PVC tap for irrigation systems
- 1 rubber tubes
- 1 threaded rod with 8 mm of diameter
- 4 dice for threaded rod
- 4 dice for clamps
- 2 clamps for threaded rod
- 2 washers with 13 mm of diameter
- 1 screw-fitting joints
- 1 drilled bolt with semisphere
- 2 plastic wings



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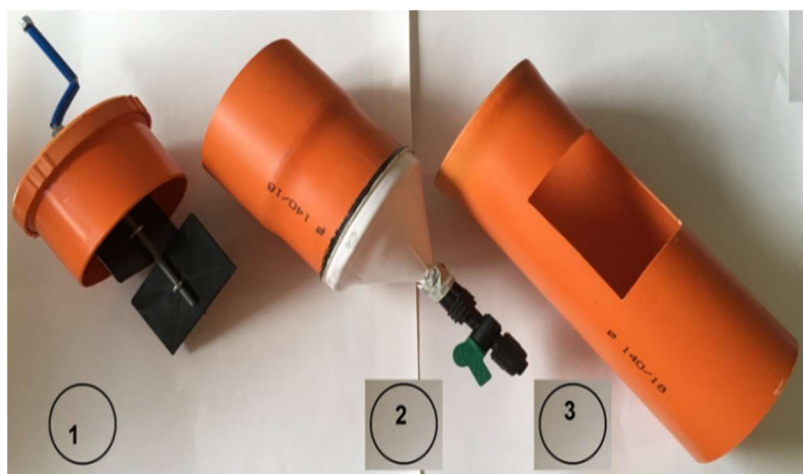
Procedure

Part I

Wear gloves and protective glasses

1. With an hairdryer heat the funnel in such a manner that it joins the PVC tube and later secure it with hot glue.
2. Heat the PVC tap in such a way to make it stick to the lower part of the funnel and fix it with hot glue.
3. Bend the threaded rod in such a manner to obtain a handle and insert on the higher part a rubber tube. (Heat the tube if necessary).
4. Put the drilled bolt with semisphere on the lid of the connection and tighten from the bottom of the connection joint.
5. Stick the connection joint on the lid, insert the washers and tighten the dice.

Fix the two spatulas at the not folded threaded rod part using the clamps



- | |
|---|
| 1) Higher part
2) Central part plus funnel
3) Support |
|---|

The image shows the reactor after assembling.

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Figure 1. The reactor is ready to simulate the extraction of struvite from synthetic wastewaters on small-scale (see part II).

Part II

Wear gloves and protective glasses

1. mount the reactor on a support (Figure 1);
2. place under it a flask provided with a funnel with filter;
3. pour in the reactor the synthetic wastewater, after having added possibly 1/2 drops of NaOH 0.5 M until pH = 8;
4. add the magnesium sulphate to the synthetic wastewaters (see Module 1, struvite extraction); turn the handle for about an hour in order to promote the struvite precipitation;
5. wait some hours in order to complete the precipitation;
6. open the tap slowly and filter the solution with the filter paper in order to catch up the precipitate; leave the filtrate dry at room temperature

Additional Safety Notes

Caution: risk of burns when using the hair dryer.

Caution when using the jigsaw

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Additional Notes

The materials are easily available from DIY stores, or warehouses for professional plumbing. Most of the material may be found at home. The total price of the materials used is € 20.

Conclusions

All details on how to assembly all parts of the reactor are explained in the video.

Video Tutorial

A video tutorial of this activity can be found at the following YouTube link:

<https://youtu.be/wP7UR47mmTo>



Questions

- 1) **Why did we use a valve to block the direct passage of the solution through the filter?**

A:The struvite precipitation takes several hours, so the solution has to be left in the reactor to complete the reaction.

- 2) **What is the advantage of building the reactor like the one proposed to obtain struvite?**

A:The goal of the experiment was to build a simple teaching reactor with easily available material to demonstrate the P recovery from wastewaters-