

Student's Card 2

Phosphorous Recovery from Wastewaters

Module 2

Objective: Creation of the Reactor

Introduction

Reactors play an important role to remove and recover nutrients (i.e. ammonia and phosphorus) from the wastewaters. The wastewaters release into the environment without treatment can produce high levels of phosphorus in the effluents and therefore be a cause of pollution.

There are various technologies for recovering phosphorus one of this is the precipitation of phosphorus from aqueous solutions by producing struvite ($\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$) The struvite can be use as fertilizers in agriculture.

Objective: Make a reactor for the extraction of struvite from wastewaters and evaluate its functioning. The purpose of this training is to promote the acquisition of different skills: (i) teamwork; (ii) troubleshooting; and (iii) practical activity

Necessities



List of tools

- Sturdy cutter or blade for iron saw
- Hot glue
- Wrench
- Screwdriver
- A powerful hairdryer or an industrial heat gun
- Drill with cup tips.

List of Equipments

- 1 PVC tube for raw sewage with a 140 mm diameter and 200mm 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

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- 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

Lab Procedure

Part I (For assembly please use the picture in Figure1)

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

Part II

Wear gloves and protective glasses

1. mount the reactor on a support;
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 wastewater;
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;
7. leave the filtrate dry at room temperature.

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Students are encouraged to complete the part with description of the devices used to assemble the reactor.

HIGHER PART

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CENTRAL PART

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.....

.....

FUNNEL

.....

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TAP

.....

.....

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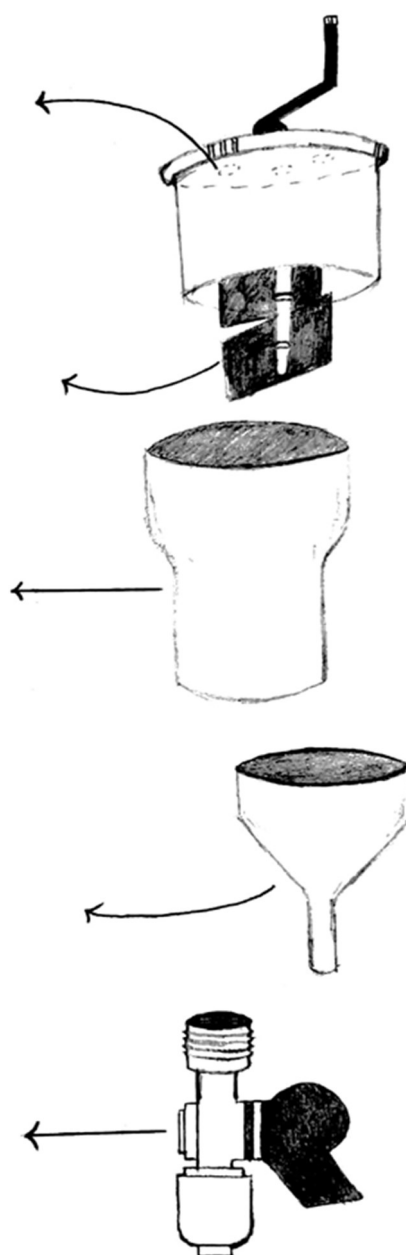


Figure 1. Reactor assembly scheme

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Additional Safety Notes

Caution: risk of burns when using the hair dryer.

Caution when using the jigsaw

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.



Questions

- 1) Why did we use a valve to block the direct passage of the solution through the filter?
- 2) What is the advantage of building the reactor like the one proposed to obtain struvite?