



TeachEngineering

Recycle Home Toilet Water



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Nitrogen & Water Cycle: Real World Connection

The nitrogen and water cycles are natural phenomena.

The key for successful recycling of organic waste and water is to replicate the efficiency at which nature does it so that it benefits all of us.

We must also remember to treat our water supply as a precious limited resource. This whole planet is going through a major water crisis. We need to think about innovative ways in which we consume our water.



Nitrogen and water on Earth.

Homemade Wastewater Treatment

Flushing the toilets is one of the most wasteful actions that we take, which wastes the most water in our homes.

Today, 35.8% of the world's population still lacks access to any proper sanitation facilities.

Most of the waste-water that flush toilets create - more than 80% worldwide - ends up going directly back into the environment into untreated open sewers.

First of all, let's take a look at how wastewater treatment plants work.

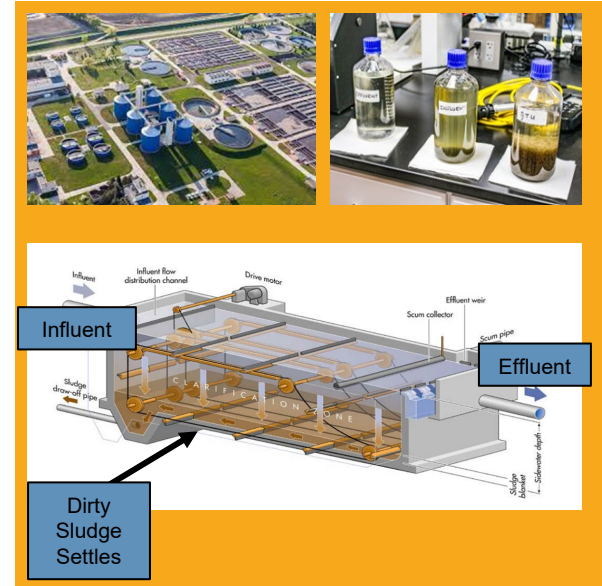


How could we recycle toilet water to be used more than once for toilet use?

Wastewater Treatment Plant

How Do Wastewater Treatment Plants Work?

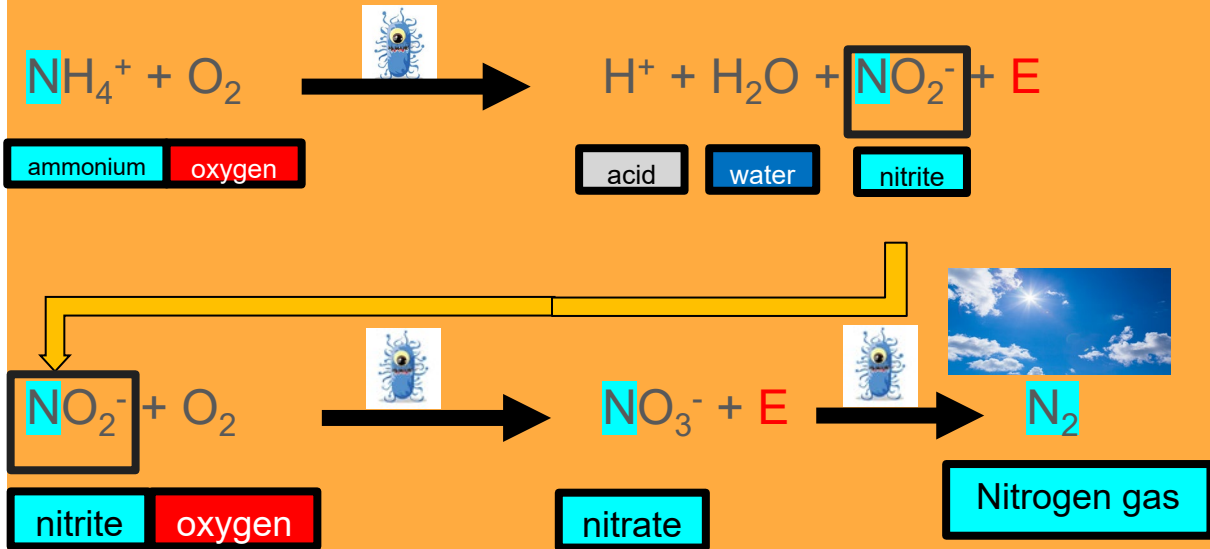
<https://youtu.be/FvPakzqM3h8>



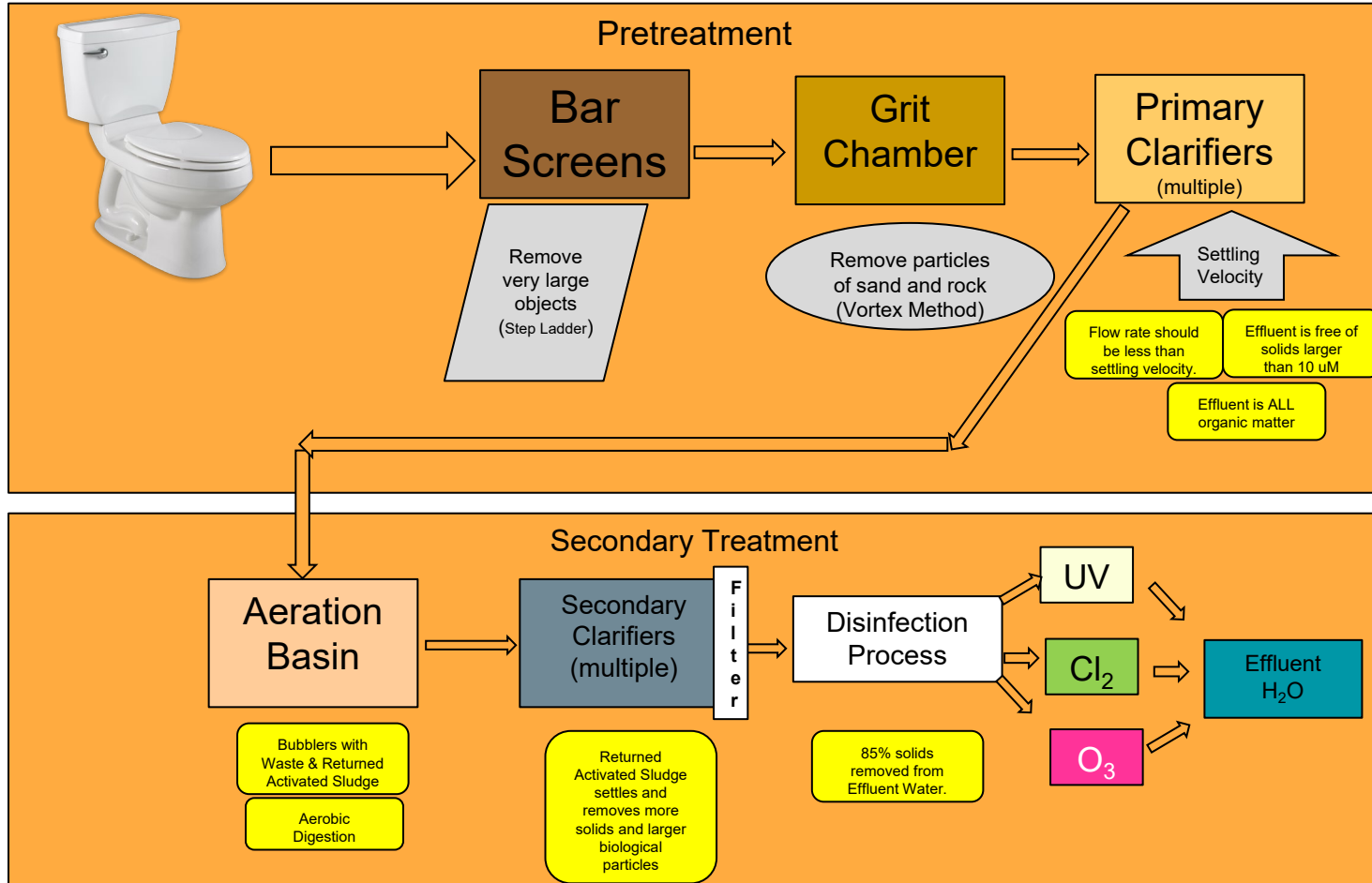
Clarifier is one of the steps in treating wastewater.

Nitrogen Removal Basics Using Hungry Bacteria

<https://youtu.be/BosHU4ARR9w>



Civil Engineering Our Wastewater



Activity Embedded (Formative) Assessment

Discussion: wastewater treatment plants must monitor the bacterial sludge content, oxygen, nitrogen, acidity (pH) and the solids content. Adjustments must be made depending on the situations caused by environmental factors. Steps are in place to make those adjustments.



Monitoring Waste Water

Activity Embedded (Formative) Assessment

Process Question

Place the following processes for treating wastewater in the correct order:

Secondary Clarifier

Bar Screens

Aeration Basin

Grit Chamber

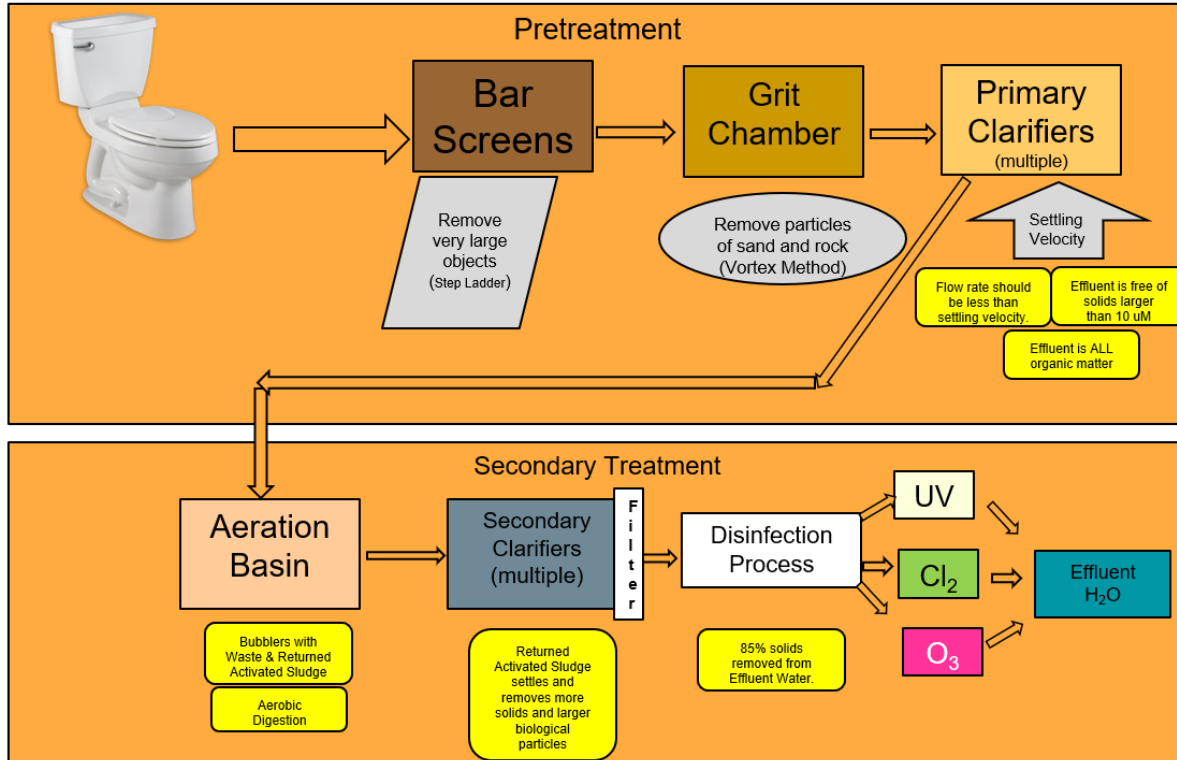
Disinfection

Primary Clarifier



There are various processes that are used to treat sewer water.

Civil Engineering Our Wastewater



There are various processes that are used to treat sewer water.

Sketching

Please sketch and design your home wastewater treatment device.

Students are to form groups of three. Each group will sketch and design the device setup. Each group will clearly write their device's water- cleaning process. It should cover all phases of treating blackwater.



Sketching a model that demonstrates recycling of wastewater.

Data Table

What parameters would you test throughout the process of your wastewater and include in your data table?

Each student group will create a data table that will show relevant data that would be necessary to demonstrate device efficiency.



Setting up your data table.

Engineering

Each student group will construct their home wastewater treatment model using the materials at their station.

Construction: Each group will engineer their design by building their device using the materials at their station.

***If you need more materials, you may ask the teacher for more supplies.**



Engineering a model that demonstrates recycling of wastewater.

Peer Review & Rubric Scale

Peer Review: Groups, please exchange your papers. One person stays behind and will explain their group's design to the other two members of the other group.

Rubric Scale: Using a rubric scale, rate the other group's design and model. This will be constructive criticism.

Does this group explain why their design shows the best way to recycle wastewater? Why or why not?



Offering and receiving constructive criticism.

Class Discussion

What worked and what problems were found, room for improvement, and important takeaways?

You have already learned about water recycling in a treatment plant and in nature. What do you see and how do both processes compare and contrast at the atomic and nanoscale?

How does the chemistry of the nitrogen and water cycle relate to the engineering design of your home blackwater recycling model.



How can engineering improve upon this invention?

Citations

- The Conversation. The world needs more toilets – but not ones that flush. March 21, 2017. theconversation.com/the-world-needs-more-toilets-but-not-the-ones-that-flush-74007.