This project was undertaken with the financial support of the Government of Canada
Ce projet a été réalisé avec l'appui financier du gouvernement du Canada

Wastewater Treatment Plant Design:

Name: _____
Date: _____

Estimated Completion Time: ~15 minutes

Introduction

Workshop Reminder:
In the Biofuel Production & Water Effects workshop, we explored the effects of waste water in the ground from farm land and from biofuel production feedstocks. Today, we will use our knowledge and experience from the workshop to discuss different methods of treating water runoff before it even reaches the ground. Understanding water treatment will help us mitigate water runoff and contamination of our groundwater.

Lesson Information:
Before water reaches the ground it is usually treated to avoid contaminating groundwater. Most large scale biofuel production plants or facilities will do this to ensure that the water they are discharging into the environment is safe.

Scenario:
Imagine you are an engineer that is tasked to build a water treatment plant for bioethanol production. Your goal is to compare the different types of water treatment methods and select the ones that are most applicable to make your own water treatment plant.

Task

Using the water treatment options on the next page, design and draw out a water treatment plant. Some of the provided water treatment methods are best suited for certain parts of a plant. Remember we need to remove large solids first and from these remove smaller and smaller contaminants. From the water treatment plant you

created add the points together of the components to determine how clean your water is.

Points	5	10	15
Water class	Black Water	Grey Water	Clean Water

Water Treatment Method	Description	Pros	Cons	Points
Distillation	- These are generally large towers made of metal - This method boils the water to remove pathogens or bacteria from the water - Heating is usually done by burners or burning material like wood or coal	- If properly boiled, pathogens and bacteria are removed sufficiently	- Energy intensive - Does not remove large solid material	5
Filtration	- Filters come in a wide range of sizes to best suit what they are trying to remove - These filters can remove solid particles such as rocks or soil	- Removes solid particles from wastewater	- Needs to be cleaned consistently - Clogs very easily	3
Adsorption	- Adsorption is usually used with activated carbon - Activated carbon can remove chemicals, bacteria, and pathogens from water	- Removes 99.99% of bacteria and pathogens from water	-Costly to replenish the activated carbon	4
Algae Pond	- This type of treatment uses algae to consume the contaminants within them. - A paddle is used in these ponds to increase algae growth and thus increasing the amount of contaminants they can remove from the water.	- Large amount of contaminant removal - Can produce biofuel or biogas	- Treatment of wastewater takes a long time	4
Chlorination	- This type of treatment is used to get rid of parasites, bacteria, and viruses within the water by using chlorine.	- Cost effective way of removing parasites, bacteria, and viruses	- Does not remove large solids from wastewater	3
Anaerobic Digestion	- In this treatment process, bacteria is used to break down organic matter within wastewater with no oxygen required for the bacteria.	- Large amount of water that can be treated - Produces	- For high cost to build and maintain	5

	- This treatment process also produces biogas that can be used for heating or cooking.	biogas		

In the space provided on the next page draw out your water treatment plant to treat the wastewater coming from the bioethanol plant. Once drawn out add together what points each component is and determine how clean your water is.

Bioethanol Wastewater

1. Does your wastewater treatment plant remove large solids and contaminants? Explain why it does or doesn't.
   Answer:

2. What else can we use the treated water for?
   Answer:

Worksheet Debrief

Summary:
In this worksheet, we've explored water treatment through designing your own water

treatment process, while recognizing its relation to Biofuel Production & Water Effects workshop. By designing your own water treatment process, you have demonstrated how water treatment can be utilised to treat water to be used for everyday use. Remember, understanding and exploring these concepts not only enhances your scientific knowledge, but also prepares you for a future in chemical engineering or water treatment processes.