Western Engineering Outreach

Compost Bioreactor

Grades 3-5

Meet Today's ENG HERO!

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To learn more about Dr. Nakhla visit:
https://www.eng.uwo.ca/civil/faculty/nakhla_g/index.html

Learning Goal:

- Students will learn about environmental engineering, what biodegradable and environmentally friendly means, and what composting is.
- Curriculum Connections: Grade 3 - Soils in the Environment; Grade 5 - Conservation of Energy and Resources

Materials Needed:

- 2 L plastic bottle (e.g. pop bottle)
- 3 cups of soil
    - Garden soil works best because potting soil does not have all of the organisms and bacteria that help with decomposition
- ¾ cup water
- 1 sheet of paper, torn into small pieces (can also use recycled paper or newspaper)
- 1 leaf of lettuce, torn into small pieces
- 1 apple, cut into small pieces

- Small piece of plastic food containers (e.g. cut piece from a yogurt cup)
- Gardening gloves (to work with the soil)
- 2 spoons or popsicle sticks (for moving dirt aside)
- Scissors
- Measuring cups, sizes: 1 cup, ½ cup, ¼ cup
- Masking tape
- Marker or pen
- Rags, paper towel, broom, etc. for clean up
- Paper or notebook
- Pencil




Engineering and Science Connections:

Environmental Engineering

Environmental engineers use engineering and science to solve environmental problems. Environmental engineers can work in all sorts of places. The focus of their work can include (but is not limited to) restoring habitats, cleaning up spills, creating new technologies to clean up pollution, or improving water quality.

What does environmentally friendly mean?

Environmentally friendly or eco-friendly means that something is not harmful to the earth or environment. This can refer to items, like cleaning products that are non-toxic and are made from sustainable ingredients that do not deplete the environment, or it can refer to processes, like production plants that conserve resources and/or energy while making a product.

Some easy ways for you to be more environmentally friendly or aware at home can be things like making sure to turn the lights off when you leave a room or not leaving the water running when you are brushing your teeth.

What does biodegradable mean?

The dictionary states that biodegradable means that an object or substance is capable of being decomposed by bacteria or other living organisms.

That means that if an item is biodegradable it can be broken down by bacteria (or other small organisms in nature) that can turn it into something that is natural. Biodegradable items are considered to be environmentally friendly because they are turned back into something that is found in nature.

COMPOST BIOREACTOR

Biodegradable items are typically made from plants, animals, or minerals and can be easily broken down into natural elements that do not harm the environment. Examples of biodegradable items could be food waste, sewage, and paper products. Examples of non-biodegradable items could be plastic bottles, and Styrofoam packaging.

Can you think of any other examples? What items do you use in your home that are biodegradable?

Composting
The activity today is all about composting!

Composting is a way to break down food, yard, and animal wastes into new soil/fertilizer. That new soil or fertilizer can be used in gardens to nourish plants by providing them the nutrients they need to help them grow.

A significant portion of the waste created by humans and sent to landfills is food waste. Composting is awesome because it prevents certain types of waste from going to a landfill. By composting it, you are able to create new soil/fertilizer that can be used instead of sending that waste to accumulate in a landfill.

Some engineers are specialists in optimizing the composting process. They would create innovative processes so that the waste breaks down more quickly and efficiently.

After this activity, you may be inspired to compost at home. Work with an adult to see if you can implement it at your home! However, composting may not be possible for you depending on where you live and whether or not you have a garden that could use fertilizer. Even if you cannot compost at your home, in the near future you can participate in the green bin program.

The City of London is planning to implement a green bin program in the future. This program is curbside pick-up for organic waste, which includes things like food waste, eggshells, coffee grounds, vegetables peels, and more! The program is expected to be implemented in London by 2022 with the goal of reducing the amount of waste from the city that is sent to landfills. More information about the progress of the city's green bin program is available at this link: https://globalnews.ca/news/6520327/green-bin-program-comittee-endorsement-london-councillors/

Today's activity is a to make your own model landfill to learn how composting works. Engineers often use models to see how their ideas will work and test them out before building a full-scale solution.

Video Recommendation:

What is composting? (for kids) https://www.youtube.com/watch?v=MQN26JLs7xU
Composting 101: How Composting Works? https://www.youtube.com/watch?v=1-LyHBJydGk

Activity:

This activity will take place over five days, taking about 2 hours total. You will be creating a model landfill. You will use 4 different pieces of waste and observe how each one changes over time (whether it begins to break down or not). The 4 pieces of waste will be a small piece of apple, a torn piece of lettuce, a torn piece of paper, and a small piece of plastic.

DAY 1

1. Cut the 2 L plastic bottle in half.
2. Place the top portion of the bottle upside down in the cut off bottom half of the bottle. This will act as the stand that keeps the model upright.

3. Put on gardening gloves. If you are doing this inside, you may also want to put out some newspaper to make clean up easier.
4. Place 2-3 cups of soil inside the upside down half bottle. Leave the lid on the upside down half bottle so that the soil doesn't fall through into the stand.

5. With your finger, draw an X in the soil to outline 4 separate, equal-sized areas. Each area is going to have a different type of waste placed in it.
6. In each space, place 1 of the pieces of waste. In one spot, place a small piece of apple; in another spot, place a small piece of torn lettuce; in another spot, place a small piece of torn paper; and in the final spot, place a small piece of plastic.

7. Record on a piece of paper where each piece of waste is located in the bottle. You can also label your bottle with a marker or even create little flags stuck into the soil with the type of waste written on it (with a

toothpick, a small piece of paper, and tape). It is important to keep a good record of where each is located as you observe it over the next 4 days.
8. Sprinkle the remaining soil on top of each piece of waste.
9. Sprinkle ¾ cup of water over the model. For your model landfill, this simulates rain fall.
10. Place your model in a place where it will get sunlight and won't be disturbed.
11. Make some predictions on your paper about what you expect to happen to each type of waste over the next 4 days.

DAY 2

1. Observe your model, but do not disturb it.
2. Record your observations on your sheet of paper. Does anything appear to have changed yet?

DAY 3

1. Put on your gloves.
2. Use a spoon or popsicle stick to gently scrape back the top layer of dirt.
3. Observe the model and record your observations on your paper. Some questions to think about are: What do you notice about each type of waste in your landfill? Have any items started to biodegrade? How do you know?
4. Gently move the top layer of dirt back over the waste using the spoon or popsicle stick.
5. Sprinkle ¾ cup of water over the model.
6. Leave the model in a place that will get sunlight and won't be disturbed.

DAY 4

1. Observe your model, but do not disturb it.
2. Record your observations on your sheet of paper. Does anything appear to have changed yet?

DAY 5

1. Put on your gloves.
2. Use a spoon or popsicle stick to gently scrape back the top layer of dirt.
3. Observe the model and record your observations on your paper. Ask yourself: What has changed and what has not changed? Which pieces of waste began to biodegrade, and which items remain unchanged? Does this line up with your predictions from Day 1?

What Did You Learn?

- What does biodegradable mean?
- What is composting and why is it important?
- What can you do at home to save resources and energy or be more environmentally friendly?

Future Learning

- Try collecting your food waste to compost at home.
- See if your school has a composting program.
- Determine what items or products in your life can be replaced by more environmentally friendly options.

Share your creations!

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

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Thanks for discovering with us!