Compost in a bottle

Overview

This activity demonstrates the decomposition process and the breakdown of organic matter into compost. This activity is suitable for F - Year 6, and can be modified for different ages.

Learning intentions

Students gain an understanding of:

- What is compost?
- How does composting work?
- Organic / Inorganic decomposition
- Aerobic / Anaerobic composting
- ADAM principles
- Why composting is important and the issues of organic waste in landfill.

Students practice experimental design, develop observation and recording skills, and are encouraged to think critically about natural processes.

Suggested Australian Curriculum links

This activity is relevant to Science Inquiry Skills across all primary year levels of the Australian Curriculum, including:

- Different materials can be combined, including by mixing, for a particular purpose (ACSSU031).
- Everyday materials can be physically changed in a variety of ways (ACSSU018).
- Science involves asking questions about, and describing changes in, objects and events (ACSHE021, ACSHE034).
- People use science in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035).
- Living things can be grouped on the basis of observable features and can be distinguished from non living things (ACSSU044).
- Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062).
- The sustainable management of waste from production and consumption (ACHGK025).

Discussion

Ask: What is decomposition/ breaking down?

Decomposition is the process by which a material is broken down into simpler parts.

Composting is a great example of decomposition.

Ask: What is compost?

Compost is the breakdown of organic matter by bacteria and other organisms into humus. Composting is nature's way of recycling.

Ask: What happens in a compost and how does it work?

Prompting questions: What are the main ingredients of compost?

Compost is made up of:

- Organic material (food scraps, garden material, and low-grade paper like tissues and paper towel)
- Water
- Air
- Bacteria and fungi

Prompting questions: What happens to this material? What breaks it down? What can we see in compost? What can't we see?

Microorganisms like bacteria and fungi feed on the organic matter. As they feed and multiply, they release heat. This heat helps break down the organic material, **decomposing** it. Oxygen (**air**) and moisture (**water**) also help the microorganisms to grow.

Macroinvertebrates like centipedes, mites, spiders, slaters, and earthworms all help the decomposition process, and are important to make your compost work effectively!

Ask: What does ADAM stand for?

A: Aliveness **D**: Diversity **A**: Air **M**: Moisture

Ask: Has anyone heard of the word 'aerobic'? (This may be familiar in relation to exercise)

Aerobic compost means with air and usually does not smell

Anaerobic means without air and can smell (rotten egg smell).

Discussion continued

Ask: Why is composting important?

- About half* of the waste* we throw away is organic material.
- This material is valuable once composted - creating a nutrient rich product which acts as natural fertiliser.
- Composting means you don't have to buy synthetic fertilisers, which can save you and your school money!
- Compost reduces soil evaporation, saving water.
- By aerobically breaking down organic material, composting prevents the release of methane gas (which is released in anaerobic conditions like landfills).

*half *refers to the weight of organic material, but by volume organic material it is usually about one third. Discuss the difference between weight and volume and why compostable material might be a higher percentage by weight than volume of bin materials.*

* waste *is a word often used to describe something we no longer have any use for and may not value. Most materials do have value, and are better referred to as resources - not waste!*

Ask: Has anyone heard about methane being an issue?

Methane is a greenhouse gas which is 25 x more effective at heating the atmosphere than carbon dioxide.

EPA (2017), Overview of Greenhouse gas emissions, viewed 25th August 2017, <www.epa.gov/ghgemissions/overview-greenhouse-gases)

Composting organic material prevents the production of methane in landfills and helps to reduce atmospheric warming.

Ask: There are two categories of organic material for composting. Do you know what they are? Why is it important to have both?

Brown - Carbon rich material (dry leaves, paper and newspaper).

Green - Nitrogen rich material (grass clippings, food scraps).

By volume, the ratio is usually about 1 part Brown : 2 parts Green material.

Microorganisms need 30 parts carbon for every 1 part nitrogen they consume. Too much nitrogen means the excess turns to ammonia anaerobically and creates the undesirable smell). Too much carbon may slow decomposition.

Experiment

Materials

- 1.25 - 2 litre clear plastic PET bottle (1 per student, pair or small group)
- scissors
- bucket of soil per class
- bucket of leaves per class
- small container of fruit and veg scraps (maybe leftovers from snacks or lunch)
- fertiliser (optional - may speed up process)
- spray bottle/bucket of water
- felt tip/ permanent markers (preferably coloured)
- Tape (masking)
- *Optional* - inorganic materials (bread clips, small bits of plastic bag, chewing gum) to test for decomposition rates.

Procedure:

- Cut the top of the PET bottle (around the neck) leaving a small section connected to form a flip top lid.
- Layer the ingredients in the order of: leaves/twigs, soil, food scraps, soil (scatter through non-organic items if using).
- Spray each layer with a squirt of water (just enough to moisten).
- Flip the top of the PET back down and tape.
- Label the layers using felt tips (and mark the top of the compost), and student/s name/s.
- Place in a sunny spot and leave for 4 to 6 weeks.
- Once a week, mark the new height of the compost and observe changes in the volume and the rate of decomposition. Record changes in a compost journal.

Optional:

- Treat half the experiments as anaerobic and the other half as aerobic (leave bottle lid off) to see if one breaks down more rapidly.
- Compare different light conditions - place some bottles on a windowsill, and others in a dark cupboard and observe differences.

Conclusion

After the experiment is finished:

Discuss what happened to the food scraps, leaves, soil and optional non-organic material? Did the volume decrease or increase? Did you see any mould or fungus in your bottle?

Research and draw a picture of the natural decomposition cycle.

Discuss which items can go into a compost system. If using inorganic material, discuss the impact this material has if it becomes litter. Does it break down? Where would it end up?

Extension activities

- Start your own school compost!
- Design a poster outlining what can and can't go into a compost system.
- Organise a tour of a commercial composting facility to see where the contents of your household 'green bin' go and how they are broken down.

Post Experiment

After the experiment is finished, empty the contents of the bottles into a compost system or organics bin (removing any inorganic material if used), and place the bottles in a recycling bin if not reusing. They may need to be dusted out with a hand broom if excess soil remains.

Additional Resources

- Jeffries Recycled Organics Screening System (R.O.S.S.) video (4 min 36)
- City of West Torrens – organics bin life cycle (Peats Composting Facility) video (5 min 20)
- Cool Australia A look at our organic waste activity
- WA Waste Authority School Compost Activity Guide
- How compost is made animated video (WRAP, UK, 6 min 30)