

Are Enzymes the Future of Plastic Recycling?



Name

Class

Teaching Sequence

Work through this resource material in the following sequence:

10 minutes

Tune In: The properties of plastic

20 minutes

Find Out: What are enzymes?

25 minutes

Take Action: Enzymes: Heroes of recycling!

5 minutes

Reflection

Tune In: The properties of plastic

Step 1

Show your students the images of the various plastic items on the [attached visual explainer](#). If you have access to a variety of different plastic items, you may like to display these to your class instead, allowing them to see and touch them to better inform their observations. These could include plastic drink bottles, hard packaging, soft packaging, coffee lids, takeaway cups, cling wrap, bags, eyeglasses, combs, toys, wires and cables, cosmetic bottles and packaging, yoghurt containers, bottle tops, microwave meal trays, etc

As your students observe the plastic items, ask them

What properties make plastic useful?

- Long-lasting
- Strong
- Can be made into different shapes, sizes, thicknesses, and colours

What properties of plastic make it harmful?

- Long-lasting means it doesn't break down and is harmful to the environment when we dispose of it
- Made out of non-renewable resources - fossil fuels

Step 2

Watch the following video with your students, which gives a brief history of plastic, including why it was originally made, how it is made and the different types of plastic that exist.



[A brief history of plastic - Ted-Ed](https://www.youtube.com/watch?v=9GMbRG9CZJw) (youtube.com/watch?v=9GMbRG9CZJw)

After watching the video, ask your students:

- What types of plastic did they hear about that they didn't know before?
- What are some advantages and disadvantages of using plastic?

What are some ways we can make less of an impact on the environment using plastic?

- Reduce, reuse, recycle, using biodegradable plastics (plastics that are able to break down in the environment)

What are some methods of recycling plastics?

- Students may know that recycling plastics is an option but not be entirely sure how this process actually works. Essentially plastics are taken, cleaned, sorted, shredded into small pieces, melted and formed into little pellets again, which can be used to make more materials. Most times, any new products made from recycled material will need to be mixed with virgin (new) plastic to ensure they are suitable for use. This means we are still using fossil fuels and still contributing to landfill, even when we use recycled plastics.

Find Out: How do we recycle plastic?

Step 1

Show your students the next slides on the [attached visual explainer](#), which are designed to help explain how plastic is currently recycled - or, more commonly, downcycled.



If you have Lego class sets, this step could be completed as an activity. Give students walls made out of Lego and ask them to build as many creative things as they can without taking apart the walls, assessing how many things they can make, their strength and durability. They can then break down the Lego into its individual bricks and undergo the same process to see how this changes the building process.

Step 2

Explain to your students that we can look to nature for ways to help us work out methods of breaking down plastics so that they don't stick around for hundreds of years in our environment. In fact, we can look into the way our own body works!

If students are able to eat plain crackers, give everyone a cracker, and make sure everyone has water on hand. First, ask them to chew their cracker quickly and swallow. Ask them to describe what they notice about the taste.

- Most likely, it just tastes like a plain, savoury cracker!

Once students have finished their crackers and washed them down with some water, give everyone a cracker again. This time ask your students to chew it for as long as they can and let the cracker sit on their tongue. Encourage them to think about what flavours they taste the longer they chew. Ask them to describe if the taste was any different.

- This time, the cracker should taste sweeter.

Explain to your students that crackers contain starch which is a carbohydrate. Other foods that contain carbohydrates include bread, rice, potatoes and pasta. Our bodies break carbohydrates down into sugars, which we can then turn into energy. This process starts in our mouth. We have a special chemical in our saliva that breaks down the carbohydrates we eat into sugars. That's why the longer we let them sit in our mouth and mangle, the more sugar will be made, and the sweeter things will taste.

These chemicals are called enzymes. We have them in our mouth and saliva, but we also have lots of other types of enzymes in our bodies that do all types of different jobs.



If you want to explore the concept of enzymes with your students in more detail, you could run this experiment - [How do Enzymes Work?](#) Using jelly and fresh pineapple to witness enzymes in action!

Step 3

Ask your students if they can see any links between plastic needing to be broken down into its building blocks and how enzymes work.

Take Action: Enzymes: Heroes of Recycling!

Step 1

Watch the following video with your students, which shows how Samsara Eco is using enzymes to tackle the plastic recycling problem!



<https://vimeo.com/883828661>

Who is SAM? - Samsara Eco (<https://vimeo.com/883828661>)

As you watch, ask your students to note the three positives of the Enzyme recycling process.

- Remove existing plastic pollution
- Create new plastic from waste instead of non-renewable fossil fuels
- Repeat the process infinitely

Step 2

Divide your students into small groups to complete a research task. Each group will research a different end-of-use process for plastic. Allocate each group to one of the processes below

- Plastic waste goes to landfill
- Plastic waste is thrown out and ends up in the environment
- Plastic waste is recycled using the current method
- Plastic waste is recycled using enzymes - the Samsara Eco method!
- Plastic waste is recycled in another alternative, exciting way (this could be a great option for students requiring extension)
 - Students could look into mealworms, wax worms, and microbes

In their groups, students should use the internet to research the answers to the following questions.

- How is plastic made?
- How does making plastic affect the environment?
- What happens when plastic goes through your process?
- What impacts does your process have on the environment?
- How does this affect the amount of plastic being made new?

Some useful resources for your students

- Plastics 101 - [National Geographic](#)
- Plastic particles and soil - [UN Environment Programme](#)
- Enzymes for plastic recycling - [Samsara Eco website](#)
- Plastic pollution crisis - [IUCN](#)

Step 3

Once students have collated all of their information, bring the class back together to share their research with the class. Discuss all of the options by prompting them with the following questions:

- Which methods are most positive for the environment? Why?
- Why do you think the enzyme method is not the standard method for all plastic recycling?
- What do you think needs to happen to ensure we recycle all plastic in the most positive ways possible?

Reflection

Reflect on this lesson with your students by using the [Headlines Visible Thinking Routine](#)

Ask your students to answer the following:

- Write a headline that captures the most important information that you've learnt today that you want the world to know.
- How is your headline different from what you would have said yesterday?

These lessons have been created in partnership with

Sam For Change & Planet Ark

