



Teacher's Guide

Fibres and Plastics

Part 3

Based on the Kerala State Board Curriculum for
Standard VIII



JANAAGRAHA CENTRE FOR CITIZENSHIP & DEMOCRACY

Janaagraha's initiative to improve citizen engagement in India's democracy through their civic learning program

Developed in collaboration with Young Leaders for Active Citizenship (YLAC)

Fibres and Plastics | Teacher's Guide (3/3)

Part 3

Class VIII

Board – Kerala State Board

Subject – Science

Textbook – Basic Science Part-II, for Class VIII (Kerala State Board)

Chapter 17 – Plastics and Fibres

Number of parts – 03

Length – 80-95 minutes (estimated, for a class of 40-45 students)

Note: Teachers may divide the lesson plan into as many periods as they see fit

Section I – What are we going to learn and why is it important?

Learning objectives

Students will:

- Understand how and why plastics cause pollution.
- Identify practices and strategies to reduce the pollution caused.

Learning outcomes

Students will be able to:

Understand the importance of the 4 R's (**refuse, reduce, reuse and recycle**) in managing waste and practicing it in their daily lives.

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Key Terms Please includes: Pollution from plastic, Recycle, Reduce, Reuse and Reduce

Biodegradable	Landfill
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Materials Needed

Section II – How are we going to learn?

1. Opening Session: Hook/Introduction

Time: 5 minutes

Facilitation notes:

- In your history lessons you must have read about different ages or periods in history. Many of these periods were named after the material most used during that period. For example, the time when humans most used stone to make tools and objects was called the stone age. Once iron was discovered, stone was replaced by iron to make tools and other useful items. What would this time in history be called? What material are most tools and objects made of today? Start by thinking about the first thing you use in the morning, what's that made of? From when you woke up in the morning to now, what are the different things you've used and what are they made of? Make a list and share it with your partner. You have 3 minutes to do this!
- (After the end of 3 minutes) Now look at the list given by your partner and identify what most things are made of.
- (take 3-5 responses) Plastic, of course! In the last few classes we have discussed the properties and widespread use of plastic. So many of the things we use in our daily life are made of plastic.
- Tooth brushes, food packets, shampoo bottles, handles, buckets, mugs, cups, glasses- life without plastic made utilities is near unimaginable.

2. Activity: The cost of plastic products

Time: 10 minutes.

Materials needed: A toothbrush (packed), print outs of the flashcards (1 set per group of 5 students)

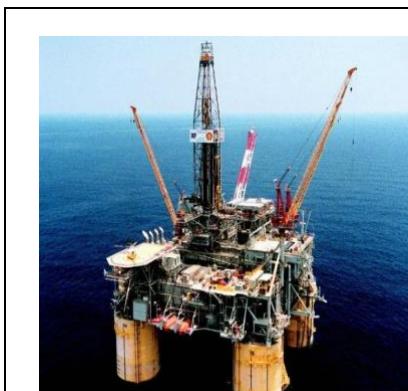
Note to the teacher:

- The purpose of this activity is for students to understand that plastic products do not decompose quickly and cause both land and air pollution.
- In groups, students will trace the life cycle of a plastic toothbrush to realise that discarded toothbrushes often end up in a landfill for hundreds of years.

- In order to trace the life cycle of a toothbrush, students will be given several flash cards with information related to a toothbrush. They must arrange the cards in an order starting from production to disposal. (Printable version can be found in the Appendix. In case printing isn't possible, you may write out the events on different flash cards yourself)
- For this activity, divide the class into groups of 5.
- Once students have done this, you should lead a discussion around what happens to the plastic once it reaches the landfill. This should lead to the explanation that plastic can take hundreds of years to decompose as it isn't biodegradable.

Facilitation Notes:

- In this 'Age of Plastics' the first piece of plastic we use every day is probably the toothbrush, assuming we all brush our teeth in the morning.
- How is a toothbrush made? Once we throw it where does it go? Let's look at the life of a plastic toothbrush to find out what happens to all those plastic products that we throw away after use.
- In your groups, you will all be given some flash cards. Each card has an event in the life of a toothbrush written on it. You must arrange the cards in the correct order. You have 5 minutes to do this.
- (At the end of five minutes) Time is up! Let's discuss the correct order. (Take responses from different groups to establish the correct order of events)
- Flash cards in the correct order:



Polypropylene makes the plastic part of a toothbrush. The bristles



After extraction, petroleum is sent to refineries where it is refined



The polypropylene pellets are heated and poured into



They are then packed in plastic packaging and are ready to be

<p>are made of nylon. They are both made from oil and petroleum which is extracted from the Earth.</p>	<p>into small plastic pellets. These pellets are then packed and transported to manufacturers.</p>	<p>toothbrush moulds once they melt. Bristles are added to the brush so they can be attached as the plastic cools and hardens.</p>	<p>transported to stores.</p>
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 <p><u>At stores, these toothbrushes are purchased by many people. As per dental recommendation, a toothbrush is used for 3-5 months and then discarded.</u></p>	 <p><u>After a consumer no longer wishes to use the same toothbrush, it is thrown into a dustbin.</u></p>	 <p><u>The garbage from dustbins is then taken to a large dumping ground where it is collected along with a lot of other waste.</u></p>	 <p><u>All this waste is eventually transported and dumped into a landfill.</u></p>
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- Now that we have learnt that the used toothbrush finally reaches the landfill, what happens to it there? How long does it stay there? (Take a few responses from students)
- Let me help you understand what happens. Think of what would happen to a fruit or vegetable peel that is thrown on the ground. (Take a few responses) It would begin to decompose. This means that substances start breaking down into more simple organic matter.
- Would this happen to plastics as well? Why or why not? (Take responses)
- Well, plastics are non-biodegradable. This means that the bacteria or tiny organisms that break down or decompose matter. Therefore, plastic never really breaks down and goes back into the soil but breaks up into tiny pieces of plastic that may continue to exist for many years, far beyond our lifespans.

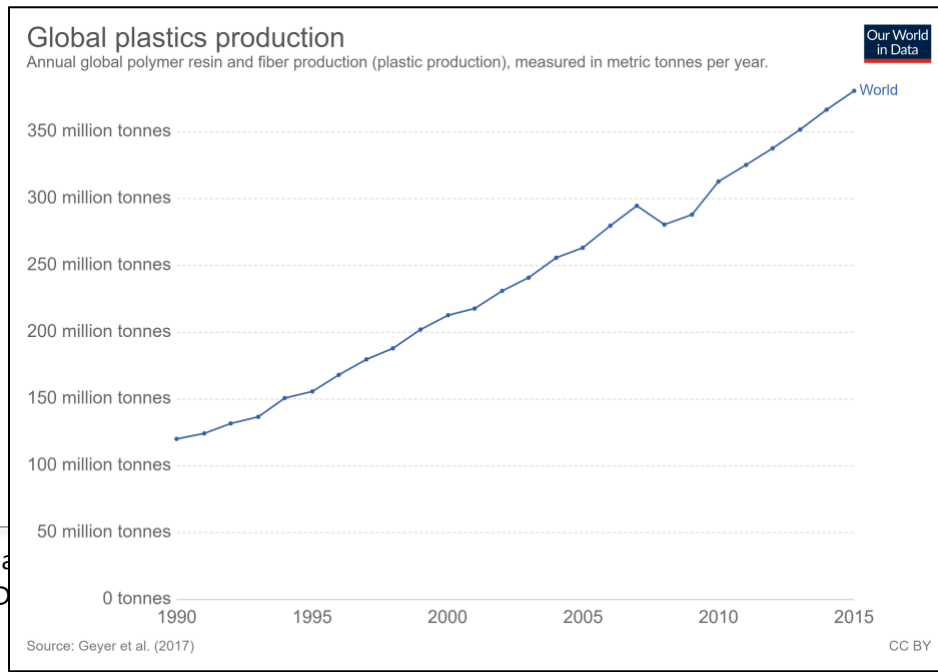
3. Activity: Plastics and Pollution

Materials required:

Newspaper article, Global Plastic production statistics (Printable version in the Appendix). The article can be copied onto the board or chart paper if printouts are not possible.

Facilitation Notes:

- We understand that a plastic once produced will not biodegrade. Imagine- the toothbrushes that our great great grandparents used are still on this Earth!
- But we have all these dumping grounds and landfills. So, what's the problem? Why can't we let the plastic just remain in the landfill? Let's look at these two images and then answer the questions that follow.



Let's look at these two images and then answer the questions that follow.

How Long Does Plastic Take to Break Down?

The Estimated Decomposition Rate of Plastics in Our Oceans

Item	Material	Decomposition Rate	Notes
Soda Bottle	Polyethylene terephthalate (PET)	450-1,000 years	Up to 56 million tons of PET are produced each year. Recycling PET can reduce its environmental impact by 61.7%
Plastic Grocery Bag	High-Density Polyethylene (HDPE)	10-100 years	Plastics don't biodegrade; they are broken down into tiny pieces that float in the ocean. They may photodegrade in sunlight after five centuries.
Detergent Bottle	High-Density Polyethylene (HDPE)	500-1,000 years	Typically, thicker HDPE plastics break apart into pieces smaller than a paper clip, floating to the top of the ocean.
Drinking Straws	Polypropylene (PP)	100-500 years	If placed end to end, the amount of straws used in the U.S. in a single day could circle the globe two and a half times.
Toothbrushes	Polyamide (PA)	500+ years	Toothbrushes are typically made of hard plastics and nylon.
Yogurt cups	Polypropylene (PP)	100-500 years	In 2016, a celebratory Yoplait cup for the 1976 Olympics washed up on shore, reminding us all how plastic is here to stay.

- a) What was the global production of plastic in 2015?
- b) Where do you think this plastic goes once it is not in use anymore?
- c) My household consumes about 1 plastic bottle of detergent in a month and 5 bottles of Pepsi. All of these are dumped in a landfill near a river.
 - (i) How long do you think these items will take to decompose?
 - (ii) Is my household waste polluting the environment? How?

Solutions:

- a) Over 350 million tonnes.
 - b) It is probably dumped in landfills. It could also be burnt or dumped in waterbodies.
 - c) (i) Bottle of detergent- 500 to 1000 years, Bottles of Pepsi- 2250 to 5000 years.
 - (ii) Yes because it will not decompose for many years. Large heaps of garbage will develop that will dirty the area and attract disease spreading organisms. It may fall into the river where marine life may eat it and get poisoned.
- Now, carefully read the sentences starters on the board, think about them and try to complete the sentences with your partner.
 - a) When it rains over a landfill, many toxic elements from plastic waste dissolve... (into the water that seeps into ground water. This ground water becomes polluted before it reaches our homes for consumption.)

b) Waste of all kinds dumped together is exposed to heat and air. Some of this waste begins to decompose, often releasing strong gases that cause fires and..... (melts plastics that often contain toxic chemicals. The toxic chemicals pollute the air we breathe and threaten the life of those living in the area)

c) Landfills are filling up very quickly and turning into mountains of garbage. This creates an unhygienic situation because..... (The area is dirty and attracts mosquitoes and other disease-causing insects. It also releases a bad odour that may be harmful to inhale)

- Now let's hold on to these thoughts and understand another bit of information.

4. Discussion: Plastic disposal in my state!

Time: 10 minutes

Material Required:

Prints of the article- one for two students (Printable version can be found in the Appendix). The article can be copied on to the board or chart paper if printing is not possible.

Note to the teacher:

- The purpose of this activity is for students to understand the plastic consumption and disposal patterns in the state of Kerala.
- Students will read an article about the same and answer questions that follow.

Kerala produces 480 tonnes of plastic waste a day!

Via Onmanorama July 03, 2018 20:13 IST

Kerala produces 480 tonnes of plastic waste per day as the administration fails to enforce a ban on plastic material below 50 microns. On an average, a family in the state produces 60 grams of plastic waste per day, the Kerala Suchitwa Mission has estimated.

The state government has spent more than Rs 2.5 crore over the past two years on awareness campaigns, yet the plastic waste problem shows no sign of abating.

The local self-government department issued an order banning plastic items below 50 microns in 2016. Yet a majority of the local bodies took no action to ban the sale of such plastic items. The manufacture of such plastic is also not banned yet. The local bodies seldom try to adhere to 2016 guidelines to issue licences to such manufacturing units.

The Thiruvananthapuram municipal corporation produces 26 tonnes of plastic waste per day, while Kochi and Kozhikode produce 16 tonnes each. Kollam is the next biggest offender with eight tonnes. Thrissur produces seven tonnes and Kannur four tonnes.

An ambitious project to recycle plastic waste by using them to make roads has not helped, the administration admitted in response to a query

Facilitation Notes:

- In pairs, you will read an article about plastic waste in Kerala.
- Based on your reading, answer the questions below in pairs. Don't forget to discuss the answer with your partner before you write it down in your notebooks. You will have 10 minutes to do this.

A) Why do you think the Kerala government has issued a ban on plastic material below 50 microns? Read the paragraph titled 'Plastic and Micron' on page 242 of your books before you answer the questions.

B) Has the ban been effective? Why or why not?

C) Has the government found a way to use this plastic waste?

Solutions:

A) Since plastic with less than 40 micron thickness is easily breakable and may be discarded, it may lie in garbage heaps for many years to come. It may not easily be picked up for recycling and may even be eaten by animals leading to poisoning.

B) The ban has not been effective because there is no check on the manufacture or sale of such plastic.

C) Yes, the government has planned to make roads using this plastic waste.

Debrief:

- Once the students have answered the question, discuss the solutions with the class. Encourage students to add the points they have missed out, to their respective answers.
- Also mention how states across India are making efforts to reduce plastic use. Maharashtra has banned single use plastics in the year 2018. Most states are beginning to encourage the use of paper products whenever possible.
- Countries around the world are waking up to this problem. Canada, for instance, has pledged to ban all single use plastic by the year 2020.

5. Activity: Plastic free product design (poster making)

Time: 20 minutesNote to the teacher:

In groups, students will design a product to replace an existing plastic product. Each group will be assigned a plastic product to design an alternate. They must choose the most eco friendly and practical materials to design their product. Students will not actually create the product in class, but only explain its design and advantages through a poster. The following guidelines can be put up on the board or a chart for groups to follow when designing the product. Each group will then be given an opportunity to present their product to the class.

Products to be assigned: Plastic Straw, Plastic cutlery (spoons and forks), polythene shopping bags, Plastic toothbrush, plastic bottles, plastic cups

Guidelines:

Each poster **MUST** contain the following:

1. A list of material used to make your product. Try and use as many eco friendly materials as possible.
2. Product packaging details- Explain how the product will be packaged in an eco friendly manner.
3. 3-5 reasons why people should use this product instead of its plastic version.
4. Whether your product can be re-used and/or re-cycled.
5. A catchy name for your product.

Facilitation Notes:

- Let's try to understand how we can reduce the amount of plastic waste we generate in our homes. Which plastic products do we most commonly use? (Take responses)
- Do you think we can replace these with non-plastic, eco-friendly products? Which ones? (take responses)
- Excellent! Since you have such great ideas, let's put them to the test. Each group will be assigned a plastic product. Together, you must come up with an eco-friendly alternative to that product and make a poster to explain the design.
- The guidelines to follow are listed on the board. Let's quickly discuss them. (Ask a few students to read and explain each point)
- Great! Let's now get to work. You have 15 minutes to design the poster. After 15 minutes, each group will come and present their product to the class. You will have 1 minute to explain your product.
- Along with the product, everyone will come up with names of 5 plastic products that they can reduce the use of.

Debrief:

- After each presentation, allow 2 students to give feedback to the group.
- Feel free to give feedback yourself where necessary.
- Encourage students to develop a sample product and bring it to class.
- Ask students to think about whether it is possible to develop the product for the entire class.

6. Concluding activity: The 4 Rs of reduction

Time: 10 minutes

Now having studied in detail about the damages of plastic, let's make an action plan for making our classroom a plastic free zone! (divide the class into 4 groups and give them the following task:)

Facilitation Notes:

- In your groups you each represent one 'R' of waste reduction.
 - Group 1: Reduce
 - Group 2: Recycle
 - Group 3: Re-use
 - Group 4: Replace/Refuse
- Take the next 5 minutes and think of at least 5 plastic material or items that fit into each of these categories. After you are done, we will discuss these with the large group.
- (after five minutes, ask students to share in the large group. A few examples are mentioned as under)

Reduce	Recycle	Re-use	Replace/ Refuse with what ?
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<ul style="list-style-type: none"> • Food packed in plastics like chips and chocolates. • Plastic mineral water bottles. • Disposable plastic cups. • Straws. 	<ul style="list-style-type: none"> • Plastic bottles. • Plastic jars. • Plastic pots. 	<ul style="list-style-type: none"> • Plastic containers. • Plastic bottles. • Plastic cutlery. • Plastic bags. 	<ul style="list-style-type: none"> • Plastic bags. (with paper/ cloth bags) • Plastic plates, trays etc. (with paper/ glass crockers) • Plastic bottles. (with glass/ metal bottles) • Plastic packing materials. (with various options like paper, jute etc)
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Section III: Assessment

Time: 10 minutes

- Mention 5 things that you use in your homes that are made of plastic and can easily be replaced.
- What is thermo plastic and thermo setting plastic.
- Mention three uses of plastic that make it easier and more feasible to use over other material.

Section IV: Closure

Recap by the teacher

Time: 2 minutes

- Plastic waste can be very dangerous as it can pollute the land, water and air.
- Burning plastic in open areas causes air pollution.
- Toxins from plastic can seep into groundwater and affect the quality of water that reaches us. Plastic waste can also be dumped in waterbodies and cause harm to marine life.
- Plastic waste isn't biodegradable and will therefore be around thousands of years after us. This could create mountains of plastic waste!
- Link between Active Citizenship---not using plastic..using eco friendly materials needs to come in te conclusion..

Recap by students

Time: 5 minutes

Ask students to pick 1 topic from the following topics and share a learning from the same.

- a) Air/land pollution by plastics (they can mention points about how burning plastic released poisonous gases in the air or how plastic being non-biodegradable survives for hundreds of years and pollutes the environment in the form of waste)
- b) Water pollution by plastics (plants and animals in the aquatic system are faced with the alarming threat of plastic pollution. Besides surviving for hundreds of years, animals often end up swallowing plastic leading to assured deaths. Plastic breaks down into smaller pieces and is easily absorbed into the food sources for sea creatures)
- c) Alternates for plastic (while sure shot ways of replacing plastic are still being discovered, there are alternatives that we can adopt in our everyday lives:
 - Do not buy plastic bottles. Carry your own water.
 - Re-use plastic containers.
 - Carry a paper or cloth bag to the market. Do not buy/ ask for plastic bags.
 - Segregate plastic waste from other kitchen waste while throwing.

Ask each student to share their most valuable learning from the lesson.

Section V: Homework**Homework:**

1. Imagine that you are the owner of a Travel Agency. You wish to promote 'Plastic Free Tourism in Kerala'. Make a brochure that explains how tourism can be made plastic free. Use the guidelines to understand how to design the brochure:

Guidelines:

- a) My brochure has an interesting cover with the name of the company and a catchy slogan.
- d) My brochure explains how plastic waste can cause land, water and air pollution.
- e) My brochure explains how people can reduce plastic-based pollution by following the 4 Rs- Reduce, Re-use Refuse and Recycle.

2. For one week- collect all your household plastic waste separately and answer the questions that follow:

- a) How much does this waste weigh?
- b) What products have been discarded?
- c) Are there any eco friendly alternatives to these products? List them.
- d) Take 2 small containers and fill them with mud from a park. Make the surface moist by sprinkling some water. Bury a piece of plastic in one and some vegetable/fruit waste in another. See the condition of the buried material after a month and record your observations.

Section VI: Field Visit(s) to a beach or public space with plastic litter.

Ideal visit time: 1-2 hours

- Students should conduct a clean up activity.
- Students should be given separate waste collection bags for plastic and non-plastic waste.
- Ask students to make a list of the items collected.
- From the list, students should identify products that can and cannot be recycled.
- Ask students to write their findings on a chart paper and display the same in the class.

Section VII: Additional resources

Resources for students:

1. Trash me
This incredible video shows a social experiment done by Rob Greenfield. For thirty days he wore all the trash he produced.
Link: [Youtube](#)
2. Article: Civic Body launches its grievance redressal cell
This article talks about how Patna Municipal Corporation has launched a grievance redressal cell to ensure timely response to citizen complaints.
Link: [Time of India](#)

Resources for teachers:

1. Article: A crisis in highly urbanised Kerala
This article explains the waste management crisis plaguing Kerala.

Link: [The Hindu](#)

Resources for students:





1. Video: What really happens to the plastic you throw away?

The video explains how plastic lands up in landfills and at the bottom of the ocean, creating large garbage dumps under water.

Link: [Ted-Ed](#)

Appendix

The following are printable versions of the flash cards for the activity – The cost of plastic products

			
<p>Polypropylene makes the plastic part of a toothbrush. The bristles are made of nylon. They are both made from oil and petroleum which is extracted from the Earth.</p>	<p>After extraction, petroleum is sent to refineries where it is refined into small plastic pellets. These pellets are then packed and transported to manufacturers.</p>	<p>The polypropylene pellets are heated and poured into toothbrush moulds once they melt. Bristles are added to the brush so they can be attached as the plastic cools and hardens.</p>	<p>They are then packed in plastic packaging and are ready to be transported to stores.</p>



At stores, these toothbrushes are purchased by many people. As per dental recommendation, a toothbrush is used for 3-5 months and then discarded.



After a consumer no longer wishes to use the same toothbrush, it is thrown into a dustbin.



The garbage from dustbins is then taken to a large dumping ground where it is collected along with a lot of other waste.



All this waste is eventually transported and dumped into a landfill.

Printable version of the article for the discussion on Plastics and Pollution

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An ambitious project to recycle plastic waste by using them to make roads has not helped, the administration admitted in response to a query under the Right to Information Act. The government ordered to use plastics for 10 per cent of the roads built by local bodies in 2016-17. The target was doubled to 20 per cent a year later. The Clean Kerala Company was entrusted to powder plastic and hand over the material for the public works department and local bodies.

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