Teacher's Guide

Fibres and Plastics

Part 2

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 (2/3)
Part 2

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 – 70-90 minutes (estimated, for a class of 40-45 students)

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

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

Learning objectives

Students will:

- Understand the properties of plastics.
- Compare Thermoplastic and Thermosetting plastic.
- Identify the uses and importance of plastic.

Learning outcomes

Students will be able to:

- Understand the dependence on plastic and its widespread usage.

Key Terms- Include Plastic and Cross-Linked Polymer

Thermoplastics	Thermosetting plastics	Linear Polymer

Materials Needed:

- Circle shaped paper cut outs for the opening activity.
- Printed worksheets for activity 'Uses of plastic' (printable version in appendix)
- Transparent plastic cup (optional), A pot/pan with plastic handle (optional), scotch tape for activity thermoplastic and thermosetting plastic

Section II – How are we going to learn?

1. Opening Session: Let's make a polymer! (Recap)
Time: 10 minutes

Materials required: Blank circles cut-outs – 12 to 15 per group (circles should be large enough to write one sentence on), sketch pens/colour pencils/crayons

Note to the teacher:

- The purpose of this activity is for students to revise facts about polymers that they previously learnt,
- This is a group activity (ask students to form groups of 3 or 4). In their groups, students will recall as many facts about polymers as they can and write down one fact on each circle.
- For example, students may write facts like-
  - Polymers can be natural, biopolymers or synthetic.
  - Biopolymers perform many important functions necessary for human survival.
  - Polymers are commonly seen as fibres, rubber or plastic.
- Encourage students to write about examples of polymers, uses of polymers, types of polymers, advantages and disadvantages of polymers etc.
- Allow students 5-7 minutes to do this.
- Next, they must colour code all their circles by drawing an outline. Each group may use up to 3 colours to do so. Students may use any colours they please.
- Ask the students to select a different color for the three types of polymers- biopolymers, natural and synthetic. (this system will help them clearly differntiate the traits of each of these polymers)
- Once the students have written down on their circles, ask them to arrange these circles into a polymer arrangement.
- Students are not allowed to open their textbook during the activity.
- The reference image (Figure 1) can be shared with students or even drawn on a paper/board and put up in the classroom. The group with the largest polymer (with the most number of correct facts) wins.

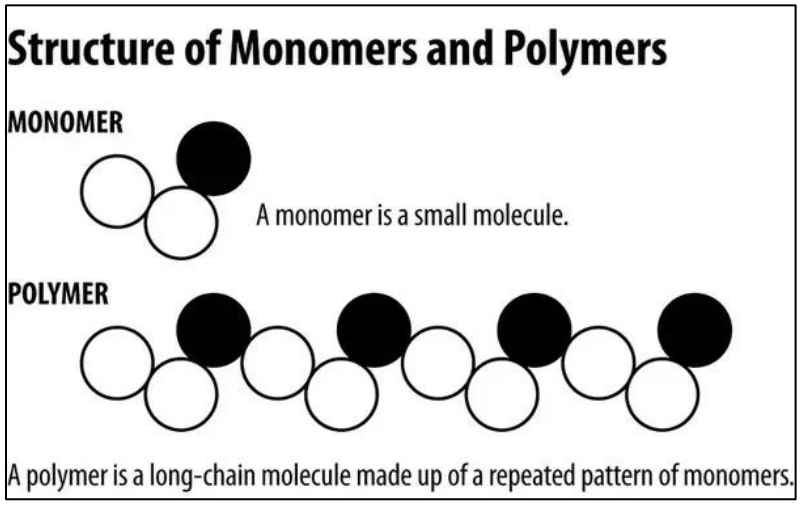

Figure 1- Source

Facilitation notes:

- In the last class we discussed about polymers. Who can remind the class about what polymers are?
- (After a few responses) We all now know that polymers are macro molecules that are formed when repeating monomers combine with each other.
- We learnt many more things about polymers. Let's see how many of those facts we can recall. How will we do this? We are going to create polymers!
- Each group has been given some blank circles. On each circle, you can write down one fact about a polymer. Once you have written down all the facts you can remember, you must arrange the circles or monomers in a repetitive pattern to form a polymer. The group with the largest polymer wins- but only if the facts are correct too!

Debrief:

- Ask a few students from each group to share
    a. How long was their polymer chain.
    b. One fact from their chain.

2. Activity: Properties and Use of Plastics
Time: 10 minutes.

Materials needed: Printed worksheet. One print for two students. (printable version in the appendix)

Note to the teacher:

The purpose of this activity is for students to deduce the properties of plastic by studying plastic products and their use.
In pairs, students should be given the worksheet below. (Printable version can be found in the appendix). In case printing isn't possible, ask the students to make the table in their notebook and write the names of plastic products instead of images.

Facilitation Notes:

- We have spoken about fibres and rubber previously. Let's now look at the most commonly used form of polymers- plastic!
- Plastic is used to make many products that we use every day. Plastic has many properties that make it extremely cheap and convenient to use for a variety of purposes. In pairs, look at the worksheet with images of plastic products. Looking at the products, can you think of what purpose they serve?

- Let's do the first one together- What is the first image?
- (After responses) Correct, it's a water bottle. So, in the purpose column, we can write- 'to carry water from place to place, to store water"
- What are the properties of plastic come in use for this product? Let's think of physical properties like size, shape, colour, weight etc.
- (Take a few responses) So, in the properties section, we can write- plastic can be moulded to irregular shapes, can be transparent, is safe to keep drinking water.

Product	Usage/purpose	Properties
 Plastic water bottle	To store and carry water	Plastic can be moulded into various shapes, it can hold liquids. It also does not let water seep through and is therefore suitable to carry water. (Because plastic is also lightweight, cheaper, and easier to transport, it used preferred over material like glass and steel for liquid storage)
 Plastic packaging	To keep fruits and vegetables fresh and safe from dust	It can be stretched, is lighweight and flexible.
  Car parts like bumper, interiors etc	To make car accessories	It is durable,can be moudled to form strong objects and a poor conductor of heat.
 	To provide shelter	It can be water resistant, is light and strong.

Tarpaulin		
 Builders hat	To provide protection	It can be moulded into hard material, is strong and extremely durable. It can also be used to mass produce cheap products.
 Medicine packaging	To keep medicines intact	It can be moulded into different shapes

Debrief:

- Discuss each product and what it tells us about the properties of plastic. Ask different pairs to share their answers.
- Ask students if they can think of products with similar properties that can replace plastic. For example, you may ask- Can you think of any other material that can be used for food packaging but has the same qualities as plastic? Also, ask students about other plastic products they use in their daily life.
- Finally, ask students if they think they are dependent on plastic materials for their day to day life?
- Students are likely to say yes. Emphasise on how across the globe plastic consumption has increased to alarming levels. It is cheap, water proof and durable. But this also leads to massive problems, which we will talk in detail in the next lesson plan.

3. Activity: Thermoplastic and Thermosetting plastic

Materials required:
Transparent plastic cup (optional), A pot/pan with plastic handle (optional), scotch tape

Facilitation Notes:

- Have you noticed the plastic handles on many kitchen items like pots and pans? Why do you think these plastic handles are put instead of just leaving the metal as it is?
- (Take responses) Correct! It's because the metal would probably get hot and burn your hand, but the plastic does not.
- Look at this plastic cup (the teacher to hold up the plastic cup). What do think will happen to it if it is heated?
- (Take responses) It melts, of course!
- But both the handles and the cup are made of plastic, then why are they so different?
- (Take responses) They are different because they have different properties and different molecular structure.
- Most transparent plastics will melt upon heating. They can then be remoulded. These are called thermoplastics. In thermoplastic polymers, molecules are arranged in a linear way or like a line. Look at the image on page 240 of your books and identify the molecular structure of thermoplastic polymers.
- You have all been given a small piece of scotch tape. Try tearing it along the length and breadth. Which is easier to do?
- (After students have tried the exercise, take a few responses) It is easier to tear along the length, the molecules in a tape are arranged in a linear way. This means that when torn length wise, the molecules slide over each other, enabling us to tear them with very less effort. (Refer to Figure 2 or draw the same on the board) This is what makes thermoplastics easy to mould. That's why we can mould them into many different shapes like bottles, pipes, window frames etc.

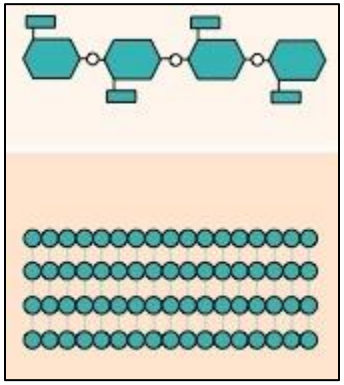

Figure 2: Source

- Thermosetting polymers are cross linked to one another and are therefore difficult to mould. They are hard and do not change their shape when heated. This is why handles of kitchen ware are made of thermosetting plastic.
- Now, look at the products listed on the board and explain which type of plastic they are made of.

Product	Type of plastic	Explanation
Water bottles		
Electric boards and switches		
Car interiors		

Polythene		
Shoe soles		

Solutions:

Product	Type of plastic	Explanation
Water bottles	Thermoplastic	They melt when heated and become hard again when cooled.
Electric boards and switches	Thermosetting plastic	They do not melt when heated. In addition, since it is a bad conductor of electricity, it does not let electric current pass through and is therefore safe to use in electrical appliances.
Car interiors	Thermosetting plastic	They do not melt under heat or we would have melted car interiors when parked under sunlight
Polythene	Thermoplastics	They melt when heated and can be moulded and reshaped in different sizes.

Conclusion:

- Plastic is perhaps the most commonly used man made product.
- From homes to industries, they are widely used for a variety of purposes. Since they are so widely used, it is also becoming increasingly difficult to replace plastic.
- We also studied the two types of plastic and the products they can be used to make.

Section III: Assessment

Time: 5 minutes

1. Match the properties of plastic to the products it is used in.

1. Plastic is used to make car accessories because	a) It's water and air resistent and does not let the contents get spoilt.
2. Plastic is used to make electrical tool handles	b) It can be moulded in many ways
3. Plastic is used to pack groceries and fruits because	c) It is lightweight yet strong

4. Plastic is used to make pipes because	d) It does not melt under heat and is an insulator

(Solution: c, d, a, b)

2. Write true or false
a) Thermosetting plastic melts under heat (False)
b) All plastic can be melted and remoulded (False)
c) Thermoplastics are usually transparent (True)
d) Polythenes do not melt when subjected to heat (False)

Homework:

1. Make a list of 10 plastic item you use in your house. What kind of plastic are they made of? Explain.

2. Imagine a world without plastics.
a) How would the world be different? Explain.
b) Can you think of a non-plastic replacement for each of the items you listed in previous question. (we will focus on this more when we talk about plastic pollution and how to reduce plastic consumption)

Section IV: Closure

Recap by the teacher
Time: 2 minutes

- We use plastics for many purposes in our everyday life, which makes them a very common form of polymers.
- Plastics are of 2 types mainly- thermosetting and thermoplastic.
- Thermoplastics can be melted and moulded as their molecules are not connected with each other. They can pass over each other as they are arranged in a linear manner.
- Thermosetting plastics are hard and do not melt when heated and can therefore not be remoulded.

Section VI: Additional resources

Resources for teachers:

1. Properties of Plastic
   The video shows the properties of thermosetting and thermo plastic.
   Link: Youtube

2. Reading: How plastic improves our lives
   This article explains the various applications of plastic
   Link: perfect plastic

Resources for students:

1. Video
   This video explains the difference between thermosetting plastics and thermoplastics
   Link: Types of plastic

Appendix

Product	Usage/purpose	Properties
 Plastic water bottle		
 Plastic packaging		
  Car parts like bumper, interiors etc		
 		

Tarpaulin		
 Builders hat		
 Medicine packaging		

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