

1st Place Winner
Safety and Recycling
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Preparation and Testing on
Biodegradable Plastics

Grade Level(s): Grades K-8

Subject(s): Biodegradable plastics, properties of plastics and biodegradable plastics, fair test, and scientific inquiry

OBJECTIVE:

At the end of the lesson, students will be able to:

1. Be aware of the existence of biodegradable plastics
2. Prepare their own biodegradable plastics
3. Design method(s) to compare biodegradable plastics and plastics available in the market
4. Evaluate the advantages and disadvantages of biodegradable plastics

PURPOSE:

The purpose of this lesson is for students to prepare a type of biodegradable plastic. Then, they are required to design method(s) to compare its properties with some common plastics that are readily available in the market. They advance to identifying variables in an experiment and fair test; avoid changing more than one variable at a time for fair comparison. As a result of their testing, they can evaluate the advantages and disadvantages of the biodegradable plastics they made.

OVERVIEW:

The teacher shows news about the plan for taxation on plastic bags. (People in Hong Kong will need to pay for plastic bags used in order to cut down use.) The problem is that people over use the non-biodegradable plastics. Synthesis of biodegradable plastics may be another solution.

Then, the teacher will introduce a method to prepare biodegradable plastics in school or even in the home. Students follow the method to prepare biodegradable plastics. After the plastics have been made, students are

required to design method(s) to compare the properties between biodegradable plastics and plastics available in the market. Students need to submit proposals for testing and modifications that can be made afterwards. If they cannot figure out their methods, the teacher will guide them in the right direction to help solve their problem.

Finally, the teacher will discuss the results and the advantages and disadvantages of biodegradable plastics.

MATERIALS NEEDED:

Reorganize the class into groups of four students. Most likely, each group will need the following to make biodegradable plastics:

- Glycerol, agar, glucose, starch, and [gelatin]
- 1 x 250 cm³ beaker
- 1 x 100 cm³ measuring cylinder
- Electronic balance
- Stir bar, Stir & hot plate

Any apparatus or chemicals upon request in testing properties of biodegradable plastics.

ACTIVITIES:

1. In front of the class, prepare the materials listed above.
2. Set (5 minutes): Discuss the news of the arrangement of taxation on plastic bags. Discuss whether students will agree with the setup of taxation on plastic bags or not, and discuss other alternatives to reduce the use of plastic bags. Introduce that making biodegradable plastics is one possible method to reduce the use of plastic bags.
3. Brief introduction (5 minutes): Introduce the procedure on making biodegradable plastics: prepare standard 1% glycerol solution (w/w), weighing the other solid ingredients and then heat with stirring until all solid(s) dissolve in the solution (refer to the student handout attached and remind students to be aware of the hot plate).
4. Experiment (25 minutes): Allow students to follow the procedure to prepare the homogenous biodegradable plastics solution. When the solution reduces to about 20 cm³, the solution should be poured into a container. Wait for it to dry. While waiting for the solution to evaporate, show some already made samples and answer questions on how to test biodegradable plastics.

5. Writing proposals and waiting for dryness of biodegradable plastics (2 weeks): Each group of students should submit a proposal on how to test the properties of biodegradable plastics. The teacher should approve the proposal and arrange chemicals and apparatus for them.
6. Experiment (60 minutes): Gather the whole class with their biodegradable plastics and have them perform their own designed experiment. They should record the results and make any modifications on the procedures as necessary. At the end, the students should summarize their findings.
7. Conclusion (30 minutes): Each group will present their results and discuss the properties of biodegradable plastics produced.
(Advantages: can be decomposed naturally, high elasticity, burn with less sooty flame; Disadvantages: lower in strength and some may be broken easily.)

MODIFICATIONS OR EXTENSIONS:

1. Prepare some articles on the chemistry of this type of biodegradable plastic and discuss with students.
2. Students can compare properties of this biodegradable plastic and other biodegradable plastics available in the market.