

From Corn to Plastic

Grade Level: 4-6

Approximate Length of Activity: 30-40 Minutes

Objectives

Teacher

1. Teach the definition of a renewable resource.
2. Help students recognize substitution possibilities of a renewable resource for a nonrenewable resource.
3. Explain how corn can be helpful in eliminating unnecessary waste in our landfills.
4. Help students follow the procedures for creating a biodegradable plastic product.

Students

1. Understand the environmental reason for using corn as a source for the production of plastics.
2. Follow the step-by-step procedures in making plastics from corn.
3. Observe and record data from an experiment.

Michigan Content Standards: (Science) S.I.P.E.1: S.IP.04.11; S.IP.04.12; S.IP.04.13; S.IP.04.14; S.IP.04.15; **S.I.A.E.1:** S.IA.04.12; S.IA.04.13; **S.RS.E.1:** S.RS.04.11; S.RS.04.16; S.RS.04.17; S.RS.04.18; S.RS.04.19; **S.I.P.M.1:** S.IP.05.11; S.IP.05.12; S.IP.05.13; S.IP.06.11; S.IP.06.12; S.IP.06.13; **S.RS.M.1:** S.RS.05.15; S.RS.05.16; S.RS.05.17; S.RS.05.19; S.RS.06.14; S.RS.06.15; S.RS.06.16; S.RS.06.17; S.RS.06.18; S.RS.06.19

Introduction

Illinois and Iowa are the two major corn-producing states in the United States. U.S. farmers use more land to grow corn, which provides more food for people than any other crop. Approximately 4,000 of the products in a supermarket contain corn or a by-product of corn.

Corn is one of nature's most amazing energy-storing devices. A corn seed weighs about one-hundredth of an ounce, yet can produce a corn plant that will grow seven to ten feet tall. Corn plants produce between 600 and 1,000 seeds like the one from which it grew. Seeds are known as corn kernels. On an ear of corn, kernels are in rows with as few as eight or as many as 36 rows. The number of rows is always even. Some kernels will become corn seeds that can be planted to grow corn for the next year. Since we can plant new corn every year, it is a renewable resource.

The corn seed (kernel) is composed of four main parts: the pericarp, the endosperm, the germ, and the tip cap. Each part has a role to play in producing a new corn plant. The pericarp is a hard, outer coat that protects the seed both before and after planting. It prevents bacteria and fungi from entering and destroying the seed. The endosperm makes up about four-fifths of the kernels weight. It provides food and energy for the young plant. The germ is the living part of the corn kernel. The germ contains genetic information, vitamins, and minerals that the seed needs to grow. The tip cap is where the kernel was attached to the cob.

In autumn, combines harvest the corn. Combines are machines that pick, shuck and shell ears of corn right in the field. After the corn is shucked, it is unloaded from the bin on the combine into



a truck or a wagon with an unloading auger. When the trucks and wagons are full of corn, they transport the corn to a grain elevator or unload it into a storage bin. A grain elevator is a cylinder-like structure made out of poured concrete and steel. When a truck or wagon with grain arrives at the elevator, the wagon is weighed. The clerk at the elevator office subtracts the weight of the wagon or truck from the total weight to determine the weight of the corn. The clerk uses a sample to measure the moisture content and weight of the corn. Next, the trucks and wagons go to the elevator storage area where the corn is dumped into a pit. The corn is drawn into the elevators by way of augers in a pipe system.

Over the past several years, many new products have been developed from corn. They include:

Cornstarch Packaging Material - Packaging peanuts are made with more than 95 percent cornstarch. They are used to fill in boxes to protect the contents. The cornstarch packing peanuts are lightweight, shock absorbing, totally biodegradable, do not attract rodents and contain no oil. The packing peanuts are made from a renewable resource (corn) and are reusable.

Golf Tees - Tees are made from cornstarch with biodegradable additives and small amounts of inorganic minerals. Golfers use the tees to hold their golf ball up off the ground. Golf tees made from corn are lightweight, paint free, stronger, reusable and totally biodegradable. They can replace the use of wooden tees, which helps our environment since trees can take as much as 30 years to grow while corn grows each year. Golf tees made from cornstarch decompose in water, carbon dioxide, and biomass, so golf courses are littered less than with traditional wooden or plastic tees.

Ethanol - Ethanol is a high performance fuel made from corn that is safe for our environment. It burns cleaner and pollutes less than petroleum fuels. Since ethanol is made from a renewable resource (corn), it can be replenished. Using ethanol saves nonrenewable petroleum and reduces our dependence on oil from other countries.

Plastics - Most plastics are made from oil products, a nonrenewable resource. Plastics do not break down or biodegrade. Because of this, plastics last for thousands of years and take up a great deal of room in landfills. Landfills are filling up and experts believe the landfills in the United States will reach maximum capacity in the next 20 years. A solution to this problem is plastics made from corn products such as cornstarch. Plastics made from corn will break down. Unlike oil, corn is a renewable resource. Plastics from corn will help to reduce space needed for landfills.

Materials Needed

- "Making Biodegradable Plastic" worksheet
- 2 cups cornstarch
- ¼ cup corn oil
- 2 cups water (approximately)
- 30 plastic resealable bags
- 2 packages food coloring (4 bottles/packages)
- Tablespoon medicine droppers
- Microwave

Activity Outline

1. Begin with a discussion about plastics. Have students name things they can think of that are made of plastics.
2. Explain how plastics do not biodegrade and are taking up space in landfills.
3. Discuss with students how researchers have discovered how to make a biodegradable plastic from corn.
4. Using their worksheet, have each student make their own biodegradable plastic.
5. Place a tablespoon of cornstarch in a plastic resealable bag.
 - Add two drops of corn oil to the cornstarch.
 - Add one and one-half tablespoons of water to the corn oil and cornstarch.
 - Add two drops of your favorite food coloring to the mixture. Seal the bag and knead well to form a consistency.
6. Have students complete the questions on their worksheet.

Discussion Questions

1. Why is it necessary to find other forms of materials instead of depending on oil?
2. What could you make out of plastic if you let it harden?
3. Discuss additional methods or products.

Related Activities

1. Expose your biodegradable plastic to sunlight and air. Compare daily observations to traditional plastic.
2. Bury plastic and biodegradable plastic in the soil. Observe each week and record results.
3. Free samples of "eco foam," a biodegradable packing material, can be obtained from: National Corn Growers Association, 1000 Executive Parkway, Suite 105, St. Louis, MO 63141-6397.
4. The lesson "Food and Fiber Products" located in the science section of this curriculum guide.
5. The lesson "Corn: An A-mazing Plant" located in the social studies section of curriculum guide.

Making Biodegradable Plastic

Follow the recipe to make your own biodegradable plastic from corn and answer the questions below.

Directions

1. Place a tablespoon of cornstarch in a resealable plastic bag.
2. Add two drops of corn oil to the cornstarch.
3. Add one and one-half tablespoons of water to the corn oil and cornstarch.
4. Add two drops of food coloring to the mixture.
5. Seal the bag and knead well to a uniform consistency.

Discussion Questions

1. What do you notice about your biodegradable plastic?

2. Is your biodegradable plastic the same as other students? How is it different?

3. What could you make with the biodegradable plastic if you let it harden? (Remember it will eventually dissolve)

Heat the plastic in a microwave for 20-25 seconds on high power.

1. What happens to your plastic now?

2. Form your plastic into a ball and describe what it will do.

3. Name three things that could be made from corn plastic in the future.