



# MAKING BIOPLASTICS

## **Overview**

Students will make biodegradable plastic from cornstarch. They will learn about the vocabulary associated with making bioplastics and learn about environmental issues associated with bioplastics.

## **Objectives**

1. Identify five nonfood uses for Kansas crops.
2. Differentiate between renewable and nonrenewable resources.
3. Create plastic or another product similar to commercial products produced with biodegradable ingredients from Kansas crops.

## **Background Information**

Petroleum is the fuel source for many products that make our society mobile. Additionally, petroleum and its derivatives are found in plastics, paint, building materials, cloth, and are used to produce electricity. The world's petroleum reserves are rapidly decreasing so researchers are developing replacements for petroleum products. Chemists say there is nothing currently made from petroleum (non-biodegradable) that cannot be produced from biodegradable plant materials.

Most plastics use materials that come from petroleum. New biodegradable plastic products such as garbage bags, car parts and packing peanuts are being made from plant starches that are most commonly derived from grain sorghum and corn. Plastic bottles are stronger and lighter when made from 15 percent cornstarch.

Starch is a major component in the production of biodegradable plastics. Plastic bags made from a starch base will biodegrade 10 - 20 times faster than plastic bags made from petroleum products. Another biodegradable product that has been developed is loose fill packaging material with a plant starch base. This product replaces the Styrofoam™ packing peanuts that are used to fill empty spaces in boxes. This packing material decomposes upon contact with water whereas the petroleum-based Styrofoam™ can take up to 20 years to decompose in a landfill.

Biodegradable plastics provide more benefits besides reducing the need for petroleum-based raw materials. They are not expensive and can be composted to be used as a carbon rich soil supplement.

**Suggested  
Grade Level:**  
3rd-6th

**Time:**  
45 minutes

**Subjects:**  
Science  
Language Arts

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## Worksheet 1: Vocabulary

Directions: Read the following paragraphs and locate the **bold** words in the word search below.

There are many nonfood uses for Kansas crops. The **starches** or stored carbohydrates from Kansas crops are used to make new **biodegradable** plastic products such as garbage bags, car parts and packing peanuts. **Ethanol**, cornstarch, paper, windshield washer fluid and printing ink are more products made from Kansas crops instead of other **raw materials**. Plant starches and oils can be found in adhesives, batteries, detergents, crayons, matches, plywood, antibiotics and chewing gum.

Crops are **renewable** resources. We can use all of this year's crop and we'll be able to plant another crop next year and use it. We will never run out of crops because we can always grow more.

**Nonrenewable** resources — such as water, soil and petroleum — cannot be produced again. Once we use them, they are gone. One benefit of using Kansas crops instead of **petroleum** to produce plastic products is that we will never run out. Another benefit is that plastics made from Kansas crops are biodegradable.

Soil is an important part of the biodegradation process. Soil contains living organisms that **decompose** organic materials into nutrients. Kansas crops are organic materials that can enrich the soil.

### Word Bank

Starches  
Biodegradable  
Ethanol  
Raw materials  
Renewable  
Nonrenewable  
Petroleum  
Decompose



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## Vocabulary

**Biodegradable:** (Of a substance or object) capable of being decomposed by bacteria or other living organisms.

**By-Product:** An incidental or secondary product made in the manufacture or synthesis of something else.

**Decompose:** Make or become rotten; decay or cause to decay.

**Ethanol:** Systematic chemical name for ethyl alcohol.

**Landfill:** A place to dispose of refuse and other waste material by burying it and covering it over with soil, especially as a method of filling in or extending usable land.

**Nonrenewable:** (Of a natural resource or source of energy) existing in finite quantity; not capable of being replenished.

**Petroleum:** A liquid mixture of hydrocarbons that is present in certain rock strata and can be extracted and refined to produce fuels including gasoline, kerosene, and diesel oil; oil.

**Process:** A series of actions or steps taken in order to achieve a particular end.

**Raw Material:** The basic material from which a product is made.

**Renewable:** (Of a natural resource or source of energy) not depleted when used.

**Starch:** An odorless tasteless white substance occurring widely in plant tissue and obtained chiefly from cereal grains and potatoes. It is a polysaccharide that functions as a carbohydrate store and is an important constituent of the human diet.

**Value-Added:** The amount by which the value of an article is increased at each stage of its production, exclusive of initial costs.

**Waste:** Use or expend carelessly, extravagantly, or to no purpose.

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## Lesson 1: Homemade Plastic

### Materials

- 2 tablespoons cornstarch
- 2 tablespoons water
- 4-5 drops corn or other vegetable oil
- 2-3 drops food coloring, optional
- Resealable plastic bag
- Use of microwave oven

### Procedures

1. Place cornstarch in resealable plastic bag.
2. Add water and vegetable oil.
3. For additional effect you may add food coloring.
4. Zip the bag closed and knead the bag for several minutes to mix.
5. Unzip a small opening in the top (to vent) and place in a microwave oven on high for 30-40 seconds.
6. Remove the bag and open as soon as it is cool to the touch.
7. Roll into a ball, and enjoy.

## Lesson 2: Making Goop

### Materials

- 1 1/2 cups cornstarch
- 2 cups baking soda (1 lb. box)
- 1 1/4 cups water
- 2-3 drops food coloring, optional
- Mixing bowl

### Procedures

1. Mix ingredients well in mixing bowl. Do not cook!

### Note

This recipe results in a material that acts like a solid if it is stirred quickly, and like a liquid if stirred slowly. The ratio of water to starch is critical. If there is too much water, the starch will always flow easily, but if there is not enough water, the mixture will never flow easily.

# MAKING BIOPLASTICS

## What I Know About Food Crop Products

Name: \_\_\_\_\_

1. Name five nonfood uses for Kansas crops.

\_\_\_\_\_

\_\_\_\_\_

2. What is the difference between renewable and nonrenewable resources?

\_\_\_\_\_

\_\_\_\_\_

3. Kansas crops are (mark all that apply):

biodegradable  
nonrenewable  
renewable

petroleum  
filling up landfills  
raw materials

4. Why is soil so important in the biodegradation process?

\_\_\_\_\_

\_\_\_\_\_

5. Name two benefits of using Kansas crops instead of petroleum to produce plastic products.

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