



SOYBEAN SCIENCE

Overview

Soybeans are an important source of oil and is used in hundreds of products we use everyday. Soybean oil is widely used in cooking oil, bio-diesel fuel, crayons and printing ink. In this lesson, students will learn how to extract oil from soybeans.

Objective

1. Students will learn how to extract oil from soybeans.

Background Information

Even though soybeans have been a major food crop in China for over 5000 years, they were not grown in the United States until the 1800's. They were grown for animal forage until a scientist, George Washington Carver, began studying them in 1904. He found many new ways to use soybeans. Today, soybeans are a valuable crop in our country because they possess oil and protein that can be used in a variety of products.

Soybeans are one of the top five crops grown in Kansas. Total U.S. soybean exports have almost doubled since 1984, from nearly 598 million bushels to over 1.9 billion bushels in 2016. Exports to China have more than doubled in the since 2004, from over 197 million bushels to over 1 billion bushels. A bushel of soybeans weighs about 60 pounds. Each bushel can be turned into 11 pounds of oil and 48 pounds of protein-rich meal to be sold around the world.

Soybeans are often called magic beans because they can be made into so many products. From foods to ink, from paints to plastics, soybeans are an important ingredient in our lives. Some of the products that include soybean oil or soybean protein are: cereal, chocolate, hot dogs, candy, baby food, flour, soup, ice cream, cookies, soap, shampoo, fabric softener, cosmetics, pet food and vitamins.

Soybean oil is widely used in cooking oil, bio-diesel fuel, crayons and printing ink. Cooking oil made from soybeans is low in saturated fat and is used to help reduce fat and lower cholesterol in our diets. Diesel fuel made from soybean oil is biodegradable, sulfur-free, does not produce explosive vapors and emits a much lower amount of pollutants. "Prang Fun-Pro" crayons are made from soybean oil and provide brighter and smoother colors that don't flake. Printing ink used by newspapers and other commercial printers are often made with varying amounts of soybean oil. Soy ink is used because it prints more paper per pound and offers better color reproduction.

**Suggested
Grade Level:**
4th

Time:
30 minutes + overnight

Subjects:
Science

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Materials

- 1/4 cup frozen soybeans
- Electric coffee grinder
- Pyrex glass

Preparation

You can do this lesson plan two different ways. You can ask a local soybean farmer or co-op for untreated soybeans or go to your grocery store and buy soybean meal or soy flour. If you use whole soybeans, they should be frozen prior to this lesson. If you use soybean meal, skip step one below.

Procedures

1. Measure $\frac{1}{4}$ cup of frozen soybeans and place in an electric coffee grinder. Pulverize and grind to a fine powder.
2. Place the finely ground soybeans into a Pyrex glass container and carefully cover with boiling water. Use enough water that the mixture can separate into layers. Stir the mixture for approximately one minute and then let it sit.
3. Ask students what the mixture looks like. Also, ask students if the mixture has an odor.
4. Let the mixture sit – preferable overnight; at least until later in the day.
5. Ask students if the appearance of the mixture changed (i.e. any layers that can be seen).
6. Using an eyedropper, carefully extract a sample from the top layer of the mixture. Place a drop of the sample onto a slide with cover and place under a microscope. Beads of oil should be observable as students take turns looking through the microscope. You may need to draw on the board what they should look for.
7. Have a student barely touch the top layer of the mixture in the Pyrex glass container with their finger. Have them rub their finger on the palm of their other hand. Have this student describe what it feels like. Have another student touch the top layer with their finger and then rub in on a piece of absorbent brown paper/paper towel. Have this student describe what it looks like.

Your students should be able to see and touch the results of crushing, stirring and soaking soybeans. The result is that oil is released from the soybeans and collects on top of the mixture because it is less dense than the other substances in the mixture. This oil is what the students saw under the microscope of felt or saw when they touched the top layer of the mixture. The soybean meal should settle to the bottom of the jar, while the middle layer is a solution of water and protein. The commercial process of extracting oil from soybeans is much more complex and involves a chemical solution.

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Conclusion Questions

1. Soybeans are an important source of what two things?

Oil and protein

2. Name five products that include soybeans as an ingredient?

Cooking oil, printing ink, diesel fuel or any other items from the background information

3. Who did the first soybean research in the U.S.?

George Washington Carver, 1904