

Soybean Science

Science and Technology

Materials

1/4 cup frozen soybeans
Electric coffee bean grinder
Eyedropper
Microscope and glass slide with cover
Glass container: measuring cup or pie plate
Hot water (boiling temperature is best)
Absorbent brown paper or paper towels

Overview

Soybeans are an important source of oil, and soybean oil is used in hundreds of products used by people everyday. Soybean oil is widely used in cooking oil, biodiesel fuel, crayons and printing ink. In this lesson, students will extract oil from soybeans.

Objectives

1. Students will extract oil from soybeans.
2. Students will list uses of soybean oil.

Background Information

Even though soybeans have been a major food crop in China for over 5,000 years, they were not grown in the United States until the 1800s. They were grown in the U.S. for animal forage until a scientist named George Washington Carver began studying them in 1904. He found many ways to use soybeans that had never been discovered before that time. Today, soybeans are a valuable crop in the U.S. because they possess oil and protein that can be used in many different 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 1.1 billion bushels in 2005. Exports to China have more than doubled since 2004, from over 197 million bushels to over 432 million 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 here in the U.S. and around the world.

Soybean oil is used in hundreds of products used everyday. From foods to ink, from paints to plastics, soybeans are an important ingredient in many common items. Soybeans are often called "magic beans" because they can be made into so many products. Some of the products that

Grade Level: 6-12

Time: 30 minutes +
overnight

Standards:
Science and Technology
History

*For Kansas standards, visit
www.ksde.org*



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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, biodiesel fuel, crayons, and printing ink. Cooking oil made from soybeans is low in saturated fats and is used to help reduce fat and lower cholesterol levels in the diets of many. 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 do not 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.

Preparation

Soybeans should be frozen prior to the lesson. Ask a soybean farmer or a farmers' COOP for some untreated (no chemicals including insecticides) soybeans.

Instructional Format

1. Share background information with students.
2. Students will follow procedures to do the activity. Lab safety rules should be taught and explained as students proceed through the lesson.
3. Upon completing the lesson, students will discuss the activity.

Procedures

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

Students should be able to touch and see 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



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the microscope or felt and 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.

Conclusion Questions (Assessment)

Soybeans are an important source of what two things?

Oil and protein

Soybeans are ingredients in what products?

Cooking oil, printing ink, diesel fuel, etc.

Who did the first soybean research in the United States?

George Washington Carver in 1904

Resources

To receive a free book – Soybeans an A-Z Book – from the Awesome Agriculture Series, contact Kansas Soybean Commission, 2930 S.W. Wanamaker Drive, Topeka, KS 66614-4116 or www.kansassoybeans.org.

Kansas Foundation for Agriculture in the Classroom (2010). Soybean growth stages pictures. <http://www.ksagclassroom.org>.

Kansas Soybean Commission and Kansas Soybean Association (2010). <http://www.kansassoybeans.org>

Want More? Extensions

Look for soybeans on product labels at home and bring the products to school to add to a display. Or just add the names of products found to an on-going discovery list kept on a bulletin board.

