

ASPHALT COOKIES

- Asphalt is made of a variety of materials, and so are the cookies (nuts, coconut, oats)
- The ingredients are measured
- Asphalt is a liquid at 300F, same as our chocolate mixture
- A drum mixer is used for asphalt – we mix by hand
- As the mixture is being stirred, it starts to cool and becomes stiffer and sticks together
- We will roll our cookies – in the field a paver spreads and rolls the asphalt



- Just like asphalt, the cookies will harden as they cool

Chocolate Asphalt

A unique and fun hands-on activity parallels the procedures used to produce asphalt pavement while introducing students to basic engineering principles.

Drained by potholes? Frustrated by miles of road construction? Students who attended the University of Nevada Reno's Women in Science Day gained a new appreciation for road construction through a unique engineering presentation.

Joanna Ambroz came up with the idea and explains, "I was trying to think of a creative youth outreach activity that would interest students without scaring them away from engineering. I wanted to develop a hands-on activity related to my field of interest - civil engineering with an emphasis in pavement and materials. Asphalt cookies were the perfect solution."

Asphalt cookies are chocolate no-bake cookies. The process of making these cookies parallels the procedures used to produce asphalt pavements. Asphalt is a black sticky substance used in road construction to hold rocks together. When heated asphalt liquefies; as it cools, it hardens and becomes solid. A mixture of asphalt and rocks makes good roadway material after it hardens. The similarities between making cookies and preparing pavement include using a hot liquid added to a variety of dry ingredients and mixed together, which when cooled hardens and gains strength.

While the first group of students was hesitant about trying to make their asphalt cookies, their success attracted many others to try making their own cookies. The presentation was a big hit with students and other presenters alike. Be sure to bring plenty of materials.

Asphalt cookies

By Joanna Ambroz, SWE

Objectives:

- Introduce the civil engineering area of paving and materials to fourth through seventh grade students.
- Create a hands-on activity for groups of five to 10 students that last approximately 15 minutes.
- Explain the physical properties of asphalt and discuss road construction techniques
- Use an easy-to-prepare cookie recipe as an analog for making asphalt
- Illustrate how engineering affects our daily lives, but often goes unnoticed

Basic Supplies:

- Large container to prepare the chocolate "asphalt" liquid binder on the stove before the presentation
- Crockpot or other heating unit to keep the liquid warm
- Large spoon for stirring
- Steep sided bowls, one per student
- Sturdy stirring spoons, one per student
- 16 oz. sealed cans to use as rollers, one per student
- 1/4 cup measuring cups
- 1/8 cup measuring cups
- tablespoon measure
- extension cord

- wax paper, cut into squares
- water and paper towels for cleaning up

Construction materials:

- chopped walnuts
- flaked or shredded coconut
- old fashioned and quick oats

Asphalt recipe:

Prepare in advance. In a large container combine the following ingredients:

- 1/3 cup cocoa powder
- 1/2 cup milk
- 1/4 pound butter (1/4 pound = 1 stick)
- 2 cups sugar

Heat, stirring frequently until mixture boils for two (2) minutes. Pour into crockpot with temperature at highest setting. A single batch yields approximately two (2) cups or 8 portions. Double or triple as needed.

Presentation outline:

A large poster with photos of an asphalt plant (drum mixer type), laboratory mixing and compacting equipment, a paver / screed and a compaction roller helps to illustrate the field processes.

Different textured rocks and samples of loose and or compacted pavement samples or photos of actual construction materials also help to illustrate the concepts.

Bowls, spoons, and measuring cups should be set up prior to the presentation and can be reused for each group of students.

1. A variety of materials is used in the preparation of paving materials. Discuss the different sizes and textures of the rocks used.
2. Engineers select and calculate the correct quantities of each rock size needed to produce a strong asphalt pavement. Calculated percentages of the different sizes of rocks are combined to determine the appropriate blend of rock materials. The mixture of rocks and asphalt binder are then compacted and put through a series of tests which smash, stretch, and freeze the pavement to determine the best blend of rocks to use in a certain climate.
3. Explain that different measuring techniques are used in the field than in the laboratory. In the field engineers use huge quantities of each rock size and weigh them on scales as large as a garage. In the lab, much smaller quantities of each material are needed and ordinary measuring utensils are used.
4. Discuss the properties of the edible construction materials to be used in the demonstration and compare with original materials. Encourage each student to measure the recommended quantities of all construction materials (ingredients) into their mixing bowl: 1/8 cup old fashioned oats - 1/8 cup quick oats - 1 tablespoon walnuts - 1 tablespoon coconut.
5. Point out that the drum mixer at the asphalt plant tumbles all the ingredients until they are will coated with the asphalt binder. The tumbler works like a clothes dryer. Mixing the ingredients in the bowls is a similar process.
6. Show the liquid form of the chocolate asphalt in the crockpot to the students and explain that when asphalt is heated to 300 F, it is also a liquid.

7. Measure and pour 1/4 cup chocolate asphalt into the materials mixture. Students should stir the combination until all of the particles are well coated. Notice that as the mixture cools while it is being stirred, it becomes stiffer and starts to stick together. Asphalt behaves in the same manner.
8. When the materials are thoroughly mixed, each student should pour and mound the mixture on to a square of wax paper. Cover with a second piece of wax paper.
9. In the field, the pavement is spread with the paver and then rolled into a thin mat with a roller. The roller is very heavy and smashes all of the air out of the pavement which helps to make the asphalt very strong. Each student should now use a can to roll their cookie out to a 1/4" to 1/3" thick cookie.
10. When the cookies are flat, show the students that they can still identify the different materials they put in their cookies. The oatmeal, walnuts and coconut are visible through the wax paper.
11. Have each student feel the heat coming off the top of the cookie. Immediately after pavement is rolled out it is still very hot. Just like the asphalt, the cookies will harden as they cool.
12. Congratulations! You made it through the demonstration and the students may take their asphalt cookies with them. When the cookies have cooled, they can be peeled off the wax paper and eaten.

<http://www.engr.uconn.edu/~edpweb/myo/workshops/ChocolateAsphalt.htm>