

Targeted Age:

Elementary to High School

Activity Structure:

Group Activity (4 to 6 students)

Indiana Standards and Objectives:4.ESS.2, 5.ESS.3, 7.ESS.6, 7.ESS.7,
Env.2.11, Env.8.1**MATERIALS NEEDED**

- Calcium carbonate (antacid)
- Sodium bicarbonate (baking soda)
- Assorted liquid food colorings
- Assorted liquid flavorings
- Water
- Small plastic cups
- Sticks for stirring
- Plastic spoons for mixing
- Eye droppers
- Optional: hydrogen peroxide, fluoride, sugar, sweetener, diatomite

Introduction

In this lesson, students will identify common uses of aggregate materials to learn about the role of natural resources in providing raw materials for an industrial society. Students will combine ingredients to make toothpaste and produce an advertisement for their product.

Background Information

Aggregates are granular materials used in building and construction. In the aggregate industry, these materials are classified as crushed stone, sand, gravel, and slag. Many everyday products are made from aggregate. Concrete, asphalt, glass, household cleaners, makeup, medicine, paint, fertilizer, wallboard, and food additives are some of the common uses of aggregates in society.

Limestone is the primary rock mined for aggregate in Indiana. Formed from the mineral calcite (calcium carbonate), limestone is mined throughout Indiana and crushed into different sizes. Crushed stone is one of the most common and accessible natural resources in the state. It is used in the manufacture of cement, road base, food products, and agricultural lime (aglime).

Sand is a coarse- to fine-grained sediment. Deposited by glacial meltwater streams 2.6 million–12,000 years ago, sand is mined throughout northern and central Indiana. Coarse-grained sand is used for asphalt and concrete production, while finer-grained sand is used in making mortar, glass, or foundry sand.

The term “gravel” applies to a range of particle sizes rather than a specific rock or mineral type. Gravel is a collection of rock particles at least 0.08 inches in diameter, but can include boulders over 10 inches in diameter. In Indiana, gravel is loose rock that is often rounded by glacial meltwater streams. It is mined in northern and central Indiana, and can be used as fill stone or in the production of concrete and asphalt.

Slag is a man-made or synthetic aggregate made from recycled material from the steel-making process. It is a dark-colored rough-textured rock and is used for certain types of road construction. Slag is used as the surface material at the Indianapolis Motor Speedway because its angular, sharp texture creates excellent traction and skid resistance.

Remember– if it cannot be grown, it has to be mined! Approximately 28,603 pounds of aggregate is required for each Indiana resident per year. In total, each American will need 2.96 million pounds of minerals, metals, and fuels in their lifetime.

Vocabulary

Aggregate – granular materials used in building and construction; crushed stone, sand, gravel, and slag

Crushed Stone – construction aggregate, ranging from 1 inch to 0.01 inch in diameter

Gravel – a collection of rock particles, ranging from 0.08 inch to more than 10 inches in diameter

Limestone – a sedimentary rock composed primarily of calcite

Natural Resources – raw materials that occur in nature and can be used for economic gain; water, biomass, fossil fuels, and aggregate

Sand – a coarse- to fine-grained sediment, ranging from 0.002 inch to 0.08 inch in diameter

Slag – a man-made or synthetic aggregate made from recycled material from the steel-making process

Procedure

1. Discuss the uses of aggregates in students' everyday lives. Explain how crushed limestone is used as an abrasive in commercial toothpaste products.
2. Crush antacids (calcium carbonate) into a fine powder.
3. Divide students into groups of 4 to 6. Provide each group with a plastic cup containing 1/2 teaspoon of calcium carbonate (antacid) and 1/8 teaspoon sodium bicarbonate (baking soda).
4. Fill each group's cup with enough water to form a paste. Keep in mind that adding color and flavoring will make the paste more liquified.
5. Instruct groups to add liquid food colorings and flavorings to produce a marketable toothpaste. Groups may produce more than one toothpaste for trial, but only one recipe may be submitted for final judging.
6. Allow students to develop an advertising campaign for their winning toothpaste. Options include a slogan, jingle, rap, or song that will help sell the product.
7. Each group should present their product and its advertising campaign. A judge (the teacher, another staff member) will sample the toothpaste and decide a winner.
8. Award a prize for the best overall presentation of marketable toothpaste.



Figure 1: Crushed stone mine operation near Indianapolis.

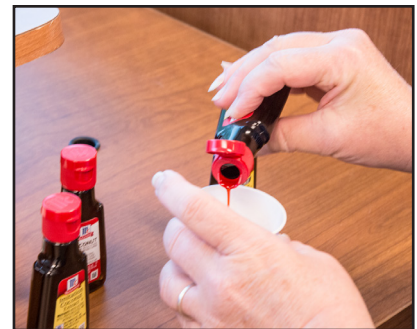


Figure 2: Adding liquid flavoring to calcium carbonate powder to create toothpaste.

Encourage students to investigate how they use aggregates in their everyday lives.



Name:

Class Period:

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Student Data Sheet

Create a marketable toothpaste and sell it to the class with an advertising campaign.

Toothpaste Name: _____

Basic Recipe:

1/2 tsp. calcium carbonate
1/4 tsp. sodium bicarbonate
Water, to form paste

Additional Ingredients (include measurements):

_____	_____
_____	_____
_____	_____
_____	_____

Advertising Slogan: _____

Advertising Description:

