



Curiosity Guide #204

Digestive System

Accompanies Curious Crew, Season 2, Episode 4 (#204)

Making Enteric-Coated Tablets

STEM Challenge

Description

Develop a coating for a "medicine" that will not cause stomach pain.

Materials per Group

- Flour, 60 ml or one-fourth cup
- Corn starch, 30 ml or one-eighth cup
- Sugar, 60 ml or one-fourth cup
- Vegetable oil, 30 ml or one-eighth cup
- Paper plate
- 4 Plastic bowls, 1 for each ingredient
- Plastic cup
- Clear diet soda, 1 cup
- Plastic spoon
- Skittles
- White board and marker
- Safety glasses

Materials for Control

- Plastic cup
- 1 cup clear diet soda
- Skittles
- Stopwatch

Procedure #1: Making an Enteric-Coated Tablet

- 1) Did you know that biomedical engineers develop systems, therapies, and devices to improve the biological conditions for people? These could include making artificial limbs, joints, or organs.
- 2) We know that certain medicines can cause stomach discomfort when taken. Today you will conduct a bioengineering challenge to design enteric-coated tablets that won't dissolve in the acid environment of the stomach.
- 3) Your challenge is to develop a recipe for a coating that will slow down a Skittle from dissolving in liquid that simulates the liquid in our stomachs.
- 4) Here are some attributes of the ingredients you have available for your recipes.
 - Oil bonds substances together and slows down dissolving.
 - Flour, cornstarch, and sugar help thicken a mixture.
 - In proper quantities, sugar will also reduce solubility of a tablet and slow down the dissolving process.
- 5) In your team, decide how many spoonful of each ingredient you want to blend for your tablet coating.
- 6) Record your recipe on the white board. Make your recipe on the paper plate.
- 7) If you change your recipe, make sure to change the white board, too.
- 8) Apply your mixture to a Skittle. Think about the size of your coated Skittle. Will it be easy to swallow? How large will the packaging need to be for this product?

Procedure #2: Testing the Product

- 1) All groups will perform the test at the same time.
- 2) Pour the clear diet soda into a cup. One person needs to pour an extra cup of diet soda for the control.

- 3) The person in charge of the control cup gives the signal for teams to drop their coated Skittles into the cups of soda. Drop an uncoated Skittle into the control cup.
- 4) Start the stopwatch.
- 5) After several minutes, stir the cups to simulate the stomach churning.
- 6) After 10 minutes, remove the tablets. How did your coating perform compared to the control Skittle, which had no coating?
- 7) Compare results between groups.
- 8) Alter your original recipe and try again!
- 9) Other things to try: Alter your recipe to make a smaller coated Skittle. Graph the time each of your recipes takes to dissolve.

My Results

Explanation

Do you think you might like to become a biomedical engineer?

Biomedical engineers work to solve problems similar to this investigation, and many more. The sensitive nature of the human stomach and the need to consume certain medicines give biomedical engineers strong reasons to experiment with different enteric-coating recipes. Enteric coatings withstand the acidic environment in the stomach and delay digestion of the medicine until it reaches the small intestine.

As a student "biomedical engineer," you need to be alert in looking for relationships between ingredients that performed best in your trials. Once you find a basic formula that works, you will also need to think about the size of the tablet when coated and the time it takes for the tablet to dissolve.

Biomedical engineers consider other factors when developing enteric coatings. These include protecting the medicine from temperature swings and exposure to light and humidity, providing a pleasing taste, making the pills easy to swallow, having a time-release impact, and making the pills large enough for a marketing logo.

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