

Introduction

Create a giant foaming reaction, and use science to wow your friends with this classic activity. With just a few ingredients you can make something that looks like foamy toothpaste being squeezed from a tube—but so big that it looks almost fit for an elephant!

Background

You might be familiar with hydrogen peroxide as an antiseptic used to clean cuts and scrapes, which it does by killing bacteria. But what is it? It is a liquid made from hydrogen atoms and oxygen atoms (its chemical formula is H₂O₂). It is available in different strengths, or concentrations. You usually find it in a 3 percent concentration (although higher concentrations are available, they are more dangerous and must be handled carefully). It also breaks down when exposed to light, which is why it usually comes in dark brown bottles.

When hydrogen peroxide breaks down, it turns into oxygen (O₂) and water (H₂O). Normally this breakdown happens very slowly. But you can make that reaction happen faster! How? By adding a catalyst. Yeast is an organism that contains a special chemical called catalase that can act as a catalyst to help break down hydrogen peroxide. Catalase is present in almost all living things that are exposed to oxygen, and it helps them break down naturally occurring hydrogen peroxide.

This means that if you mix yeast with hydrogen peroxide, the hydrogen peroxide will rapidly break down into water and oxygen gas. The oxygen gas forms bubbles. These bubbles would usually escape from the liquid and pop quickly. But adding a little dish soap provides additional surface tension, allowing the bubbles to get trapped and creating lots of foam. This foam looks like a giant squeeze of toothpaste—almost big enough for an elephant!

Materials

Empty plastic bottle
Dry yeast (found in the baking section of the grocery store)
Warm water
Liquid dish soap
3% hydrogen peroxide
Measuring cups
Measuring spoons
Safety glasses
Large tub or tray to catch the foam
Location for the activity that can tolerate spills (of hydrogen peroxide as well as possibly food coloring), such as a kitchen or bathroom—or an outdoor location
Liquid food coloring (optional)
Different-shaped bottles or glasses (optional)

Preparation

Put on your safety glasses to do this activity because hydrogen peroxide can irritate your eyes. (Note: although the product of this activity resembles toothpaste, it is not toothpaste, so do not attempt to use it!) Gather your materials in the location where you plan to do your activity. Place your plastic bottle on the tray or tub so that it is easy to clean up all the foam.

Procedure

Measure 1/2 cup of hydrogen peroxide, and carefully pour it into the bottle.

Add a big squirt of dish soap into the bottle, and swirl gently to mix.

If you want to make your foam a single color, add a few drops of food coloring directly into the hydrogen peroxide, and swirl the bottle gently to mix. If you want to give your foam stripes like some toothpastes, put the drops along the inside rim of the bottle's mouth. Let them drip down the inside of the bottle, but do not mix.

In a measuring cup mix together one tablespoon of yeast and three tablespoons of warm water. Stir for about 30 seconds.

Pour the yeast mixture into the bottle then quickly step back, and watch your reaction go! *What happens? How long does the reaction last?*

Extra: Try the activity without the dish soap. *What happens? How was the result different?*

Extra: Try the activity with different-shaped containers. What happens if you use a bottle with a narrower or wider neck—or a cylindrical drinking glass with no neck?

Observations and results

You probably saw lots of bubbles and foam in this activity. What makes the foam appear? When the hydrogen peroxide comes into contact with the yeast it starts breaking down into water and oxygen. Oxygen is a gas and therefore wants to escape the liquid. The dish soap that you added to your reaction, however, traps these gas bubbles, forming a foam. The reaction continues as long as there is some hydrogen peroxide and yeast left. Once one of them runs out it stops making new foam. If you tried the activity without dish soap, the reaction probably will still made bubbles—but not foam.

Cleanup

Wash the foam down the sink when you are done with the activity.