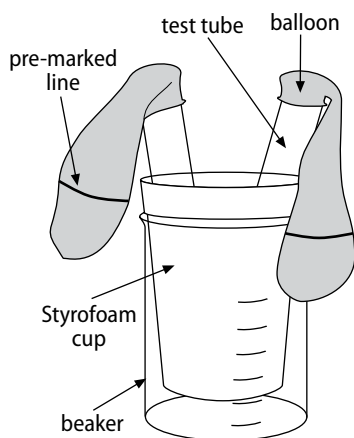


Effects of Chlorine on Germs

Test Substances...

Use the following test substances:

- chlorine bleach
- table salt (NaCl)
- antibacterial hand sanitizer
- liquid soap
- baking soda



Sample data table

Test Substance	Balloon Circumference (cm) After 30 Minutes
control	
chlorine bleach	
table salt	
hand sanitizer	
liquid soap	
baking soda	

To be safe for swimmers, swimming pools must be disinfected. Chlorine is a typical disinfectant used in pools. In this activity, you'll observe the effects of chlorine on yeast growth, which simulates the bacterial activity that can occur in pools.

Stuff You'll Use: ▶large Styrofoam® cup ▶warm water ▶250- to 400-mL beaker ▶150-mm test tubes with stoppers ▶wax pencil or labels and permanent marker ▶1.25-mL (1/4-teaspoon) and 15-mL (1-tablespoon) measuring spoons ▶sugar ▶rapid-rise active dry yeast ▶test substances (See box at left.) ▶9-inch-diameter round balloons ▶measuring tape or string and ruler

What to Do:

! *This activity works best if done in groups. Each group should have its own setup and test substance. At minimum, test substances should include chlorine bleach and table salt (NaCl). If people with latex allergies are present, use latex-free balloons or do not do this activity.*

- 1 Prepare a water bath by filling the Styrofoam cup halfway with warm water. Place the cup into the empty beaker to prevent the cup from tipping.
 - 2 Inflate two balloons about halfway. Use a marker or wax pencil to draw a line around each balloon at its widest point. Deflate, reinflate, and deflate the balloons several times to stretch the latex.
 - 3 Label one test tube "control" and the other one with the name of your test substance. Add 15 mL (1 tablespoon) warm water, 1.25 mL (¼ teaspoon) sugar, and 1.25 mL (¼ teaspoon) yeast to each test tube. Stopper the test tubes and shake for about 20 seconds to mix the contents. Remove the stoppers and place the test tubes in the water bath.
 - 4 Add 2.5 mL (½ teaspoon) of the test substance to the appropriate test tube, replace the stopper, and shake for about 20 seconds. Remove the stopper and place the test tube back into the water bath.
 - 5 Add a small puff of air to each balloon (just enough to get the wrinkles out). Secure a balloon over the opening of each test tube. Use a measuring tape or a piece of string and ruler to measure the circumference of each balloon at the premarked line. *Compare the relative size and quantity of bubbles in the test tubes.* Return the test tubes to the water bath.
- !** *Yeast can vary in activity due to age and other factors. You may want to proportionally increase the amount of yeast and sugar in step 3 if bubbling in the control sample seems minimal.*
- 6 Observe the test tubes and balloons, noting the bubbling action. After 30 minutes, measure the circumference of each balloon. Fill out the appropriate information in the data table.
 - 7 Share your results with other groups. Discuss your observations, noting any differences between groups who used different test substances.

Did your test substance affect the growth of yeast? Which test substances had the most significant effect on the growth of the yeast?



How It Works:

Active dry yeast is a very small fungus in the dormant stage. In this activity, yeast simulates the bacteria and algae that can grow in swimming pools.

Yeast cells produce carbon dioxide (CO_2) gas when they metabolize sugar. The test tube containing the chlorine bleach should show less CO_2 production than the control, because the chlorine has killed some of the yeast.

When chlorine is added to water in a swimming pool, a reaction occurs splitting it into hypochlorous acid (HOCl) and hypochlorite ions (OCl^-). Both components are strong oxidizing agents that kill microbes by attacking the cell walls and destroying key enzymes in the cells needed for metabolism.

More Fun?

Learn more about the science behind disinfectants. Terrific Science Press (www.terrificscience.org/sciencestore) offers the following books that include activities involving chlorine, water purification, germs, and personal hygiene:

- ▶▶ [*Hands Up: Hand Washing Presentation Guide*](#)
- ▶▶ [*Lather Up! Hand Washing Activity Handbook*](#)
- ▶▶ [*Wet Your Whistle! Drinking Water Activity Handbook*](#)
- ▶▶ [*What's that Smell: The Science Behind Adolescent Odors*](#)

