Student Guide

The Effects of Colloidal Silver on the Production of CO_2 in Saccharomyces cerevisiae

Materials

- 3, .5L plastic water bottles, labeled Robey Ag, 9V2hr Ag, and water
- 50mL each of colloidal silver generated from Robey, 9V battery, and distilled water
- 3 individual packets of Baker's Yeast OR the equivalent of 7g of yeast
- 3 tsp of table sugar
- 3, 30cm strands of twine or string
- 3, 12in. balloons
- 3 metric rulers
- 1 stopwatch
- 3 rubber bands
- 1, 9 x 13 aluminum pan
- 1 hot plate
- 1L beaker
- Protective goggles, apron, and hot glove

Image Source: http://www.animationfactory.com

Make a Prediction

What will happen when yeast is exposed to colloidal silver?

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Purpose

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Safety

Wear goggles and apron when performing this experiment.

Procedure

1. You will be assigned to a group of three. You and your partners will be responsible for collecting data on one yeast sample only.
2. After equipping yourself with the proper lab safety gear, report to your lab station.
3. Determine which bottle you will be responsible for gathering data on (water, Robey Ag, and 9V2hr Ag).

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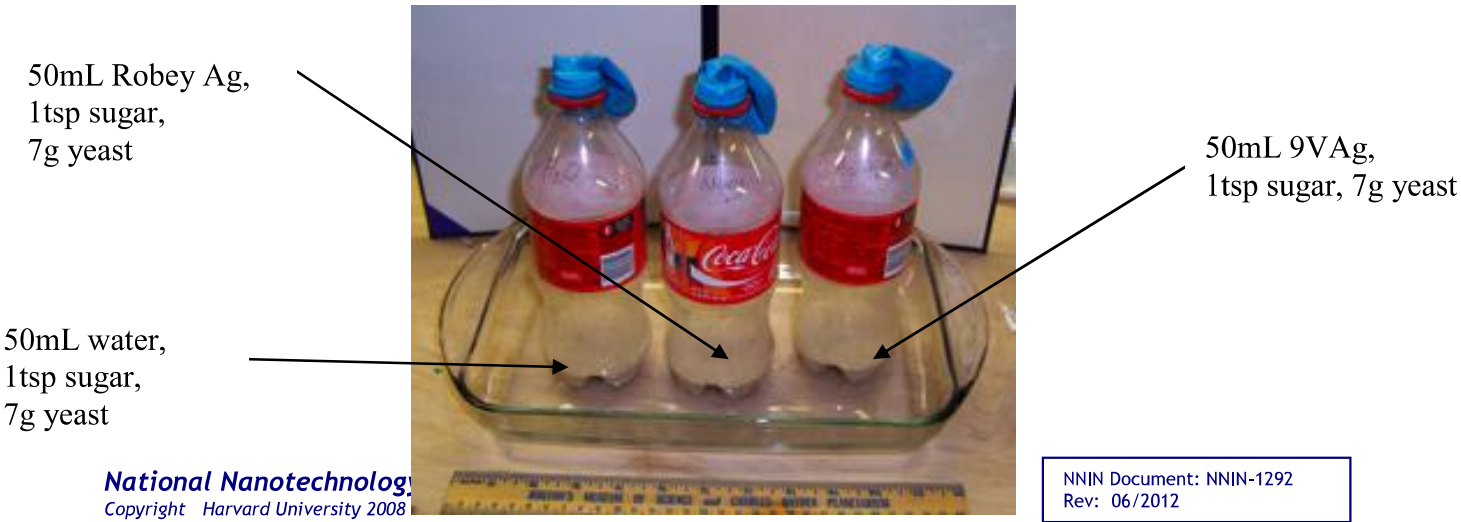
4. Heat 1L of tap water to about 100° C. You do not have to bring this sample to a boil.
5. While the water is heating, prepare your bottles. At the teacher's lab station, you will find samples of distilled water and colloidal silver that have been generated using two different methods. Retrieve 50mL of Robey Ag and add it to the bottle labeled "Robey Ag." Retrieve 50mL of 9V2hr Ag and add it the bottle labeled "9V2hr Ag." Finally, retrieve 50mL of distilled water and add it to the bottle labeled "water." These steps should take place at the teacher's lab station.
6. Return to your lab station and place 7g (the equivalent of 1 packet) of yeast into each bottle. Swirl gently to mix.
7. When the water on the hot plate has reached 100° C, place all 3 bottles into the aluminum pan and, with your hot glove on, pour a small amount of the 100° C water into the pan as well. Be careful not to add more water to the pan than there is in each bottle to prevent toppling.
8. When the yeast in the bottle has warmed, place 1 tsp of sugar into each of the bottles. **IMMEDIATELY** attach a balloon to each bottle and gently swirl the mixture.
9. Set your stopwatch for 5 minutes. Attach a rubber band to the neck of each bottle to prevent leakage of carbon dioxide. When the 5 minutes is up, use your twine/string to determine the circumference of the balloon at the widest point. Measure the length of the twine and record this value in the appropriate data table column.
10. Repeat step 9 for 15, 25, 35, and 45 minutes. Gather and record your data in the appropriate data table column for each trial. You may need to aliquot additional warm water to the aluminum pan as the experiment progresses.
11. When the experiment has come to its conclusion, turn off and unplug the HOT plate. Use your hot glove to place the hot beaker on the lab bench.
12. Discard the balloons in the general waste receptacle and pour yeast samples into the waste container designated by your teacher. Rinse your bottles at your lab station, and pour out the water from the aluminum pan down the sink.
13. Wipe down your station. Your station should now be clean and clear. The materials that should remain at your station include: aluminum pan, 3 plastic bottles, 3 rubber bands, hot plate, 1L beaker, 3 pieces of twine, and 3 metric rulers.
14. Return to your desk, and begin performing the calculations for determining Volume of Carbon Dioxide. First, you will need to use the equation for Circumference to determine a radius value. Once you have calculated your radius value, you can use the equation for Volume of a sphere to determine the approximate amount of CO_2 produced by your yeast sample.
15. Use Excel or similar spreadsheet program to graph your results.



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Data Tables

The Effects of Colloidal Silver on CO_2
Circumference

Circumference of Balloon (cm)	Time (minutes)					
	0	5	15	25	35	45
Water						
Robey Ag						
9V2hr Ag						

Making Calculations

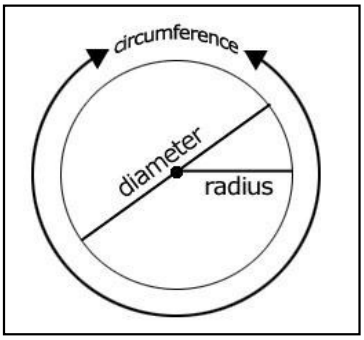

Image Source:
http://nasaexplores.nasa.gov/show_58_student_st.php?id=021221104647

In order to determine the radius of the balloon, you must solve the Circumference of a circle equation for *r*.

Equation for Circumference of a Circle

$$C = 2\pi r$$

The Effects of Colloidal Silver on CO_2
Radius

Radius of Balloon (cm)	Time (minutes)					
	0	5	15	25	35	45
Water						
Robey Ag						
9V2hr Ag						

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In order to determine the Volume of carbon dioxide produced in each balloon, you must solve the Volume of a Sphere equation for *V*.

Equation for Volume of a Sphere

$$V = \frac{4}{3}\pi r^3$$

The Effects of Colloidal Silver on CO_2 Volume

Volume of CO_2 (cm^3)	**Time (minutes)**					
	0	**5**	**15**	**25**	**35**	**45**
Water						
Robey Ag						
9V2hr Ag						

Interpreting Results

1. Did you observe what you predicted?

   _____

   If not, how did your observation differ from your prediction?

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   _____

   _____

2. Identify the control and the Independent and Dependent variables in this experiment.

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3. Why was it important to have a control group?

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4. Do your observations leave you with any more questions? What are they and describe how they can be addressed.

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Applying the Results

5. Construct an advertisement that promotes colloidal silver based on the results you obtained.

6. On a recent family visit to see your great-aunt Lucy, you notice that the cough she complained about on your last visit has not responded to the cough syrup and regimen of lozenges that she keeps in her housecoat pocket. She tells you that her friends at Bingo were telling her about a novel therapy called "liquid silver" which is supposed to treat most major ailments that are bacterial or viral in nature. She is considering giving the treatment a try. Based on the results of this investigation and what you know about colloidal silver, what would you tell your great-aunt who is considering using a similar product to help subdue her persistent cough? Be persuasive.

7. What are some additional variables that should be considered in the execution of this experiment? In other words, what are the limitations of this experiment? How could it be improved?

8. In 3 to 5 sentences, respond to the following statement: When a scientist has completed an experiment that supports his/her hypothesis, then his/her inquiry into this concept is complete.

Draw Conclusions

9. Example: Based on your results, can you say for certain that colloidal silver exhibits antimicrobial properties? Explain your answer.

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