Do Animals Give Off CO_2?

Introduction

Demonstrate that animals produce carbon dioxide as part of respiration.

Concepts

- Cellular respiration
- Energy

Background

All organisms harvest energy from the chemical bonds of organic molecules in cellular respiration. In oxidative, or aerobic, respiration all six of the energy rich C—H bonds of a glucose molecule are broken. The carbon atoms of the glucose are ultimately combined with oxygen atoms and released as CO_2 gas.

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy (ATP and heat)}$$

Bromthymol blue can be used as an indicator for the presence of carbon dioxide. Bromthymol blue is blue in a solution of a pH greater than 7.6, green between 7.6 and 6.0, and yellow at a pH of 6.0. Bromthymol blue will turn yellow in the presence of CO_2 because CO_2 forms a weak acid when it is dissolved in an aqueous (water) solution. In this demonstration an aquatic animal is used to show that animals give off CO_2.

Materials

Bromthymol blue, 0.04%

Snails, 2 or more depending on size of jar

Glass jars with lids, 2, small

Water, enough to fill both jars (use aged or dechlorinated water)

Safety Precautions

This demonstration is not considered hazardous, but always follow appropriate laboratory safety rules.

Preparation

Fill each jar with water. Add bromthymol blue to the water in each jar. Mix the bromthymol blue and water.

Snails should be treated with care and not stressed during this demonstration.

Procedure

1. Fill both jars with aged tap water. Add enough bromthymol blue to give the jar a definite blue color. If the bromthymol blue is yellow, add a few drops of sodium hydroxide to turn the indicator blue.
2. Put the snails (or fish) into one of the jars and seal the lid.
3. Seal the other jar which contains only bromthymol blue water. This jar served as the control sample.
4. In 24 hours, check the color of the indicator in the two jars.

Disposal

Bromthymol blue may be disposed of down the drain with an excess of water according to Flinn Suggested Disposal Method #26b. Snails should be returned to an aquarium tank.

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Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Evidence, models, and explanation
Constancy, change, and measurement
Content Standards: Grades 5–8
Content Standard A: Science as Inquiry
Content Standard C: Life Science, structure and function in living systems, regulation and behavior
Content Standards: Grades 9–12
Content Standard A: Science as Inquiry
Content Standard C: Life Science, matter, energy, and organization in living systems, behavior of organisms

Tips

- Small freshwater fish may be used instead of snails.
- Instead of using a snail, use a straw to gently blow bubbles into the bromthymol blue solution. Be careful not to drink the solution.
- Explain that the carbon dioxide produced during respiration enters the organism as food.
- Extend the activity to explore the production of oxygen by photosynthesis by removing the snail and adding an aquatic plant, such as elodea or duckweed, to the jar. Place the jar in sunlight and observe the next day.

Reference

This activity was adapted from *A Demo A Day—A Year of Biological Demonstrations*, Bilash, Borislaw, Shields, Martin; Flinn Scientific: Batavia, IL (2001), pg 90.

Materials for *Do Animals Give Off CO_2?* are available from Flinn Scientific, Inc.

Catalog No.	Description
B0046	Bromthymol Blue, 5 g
LM1106	Pond Snails, pkg of 12
AB1128	Containers, Sample, 4 oz.

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.