



Plant Power



Challenge:

Can you find which plants have an enzyme called catalase that breaks hydrogen peroxide into water and oxygen.

General Description:

Visitors work with 3% hydrogen peroxide and several different fruits and vegetables to determine which ones have the catalase enzyme.

Objectives:

To introduce the concept of a catalyst and the idea of enzymes as catalysts in living systems. To show chemical reactions as evidenced by the production of a gas and to demonstrate some simple properties of enzymes. To draw inferences from their observations.

Materials:

For 5 stations (1 child per station)

- 5 24 well plates
- 5 dropping bottles with 3% hydrogen peroxide
- A variety of cut up fruits and vegetables
- Choose 4 of these:
sweet potato, kiwi fruit, carrot, red pepper, mushroom, watermelon, pineapple, turnip
- Choose two of these:
apples, grapes, zucchini
- A food processor or grater
- Plastic plates or 3 ounce cups to hold fruits and vegetables (5 or more)
- A wash bottle of tap water or a bucket of water for rinsing well plates.
- Paper towels for spills
- A safe container to dump solutions into and seal (waste container)



Activity Preparation:

(approx. 20 min. with food processor or 1 hour without)

1. **Pour about 15 ml of 3% hydrogen peroxide into dropping bottles.**

2. **All fruit and vegetables should be cut just before using.**

Cut into very small pieces any 4 of the following:

sweet potato, kiwi fruit, carrot, red pepper, mushroom, watermelon, pineapple, or turnip.

These are relatively high in catalase enzymes.

3. Take some of each type of fruit or vegetable that you cut up, place in a strainer, and **cook** for a few seconds in boiling water (hold the strainer in the water).

Or place the container in the microwave for 30 seconds each.

4. **Cut into very small pieces any 2 of the following:**

apples, grapes, or zucchini.

These are relatively low in catalase enzymes

5. **Each station should have:**

- 1 24-well plate placed on a paper towel
- 1 dropping bottle with hydrogen peroxide
- Access to the dishes of fruits and vegetables.



Directions:

Have visitors do the following:

1. Participant **must** wear a pair of safety goggles before beginning!
2. Put some (10-20 drops) of hydrogen peroxide in each of five wells in the first and second row of the well plate.
3. Put a different piece of fresh fruit or vegetable in each well in the first row. Watch what happens.
4. Put a piece of cooked fruit or vegetable in the wells in the second row. Watch what happens and compare with uncooked fruit or vegetables in the first row.
5. Participants can try as many fruits and vegetables as they wish.

Clean Up (approx. 15 min):

- Rinse well plates and shake dry over a paper towel.
- Wipe up spills with paper towels.
- Discard fruits and vegetables in the trash.
- The unused hydrogen peroxide can be stored and saved for next time.
- Clean goggles with window cleaner and white paper towels.
- Disinfect in goggle cabinet for full 15 minutes.

Safety Issues:

Participant must wear a pair of safety goggles before beginning!

Goggles must be sterilized before use.

3% Hydrogen peroxide can go down the drain and is not very toxic.

Clean up any spills immediately, and wash thoroughly if a visitor gets it on their skin.

If solutions get in eyes, flush immediately with clean water.



Tips For Doing the Activity:

- Explain that the challenge is to find out which fruits or vegetables have a chemical called an enzyme that breaks up hydrogen peroxide into water and a gas, oxygen.
- Have the visitors try several types of fruits and vegetables and look for bubbles forming.
- Ask visitors what they see happening in each well.
- After the visitors have tried the raw fruits and vegetables, ask what they think will happen if cooked fruits and vegetables are put in hydrogen peroxide.
- Now give the visitors the cooked fruits and vegetables so they can see if they made a good prediction.
- Compare the fresh fruit wells with those that have cooked fruits and vegetables.
- Visitors should discover that cooking inactivates enzymes and some fruits have almost no catalase enzyme.
- Explain that cooking changes the enzyme so that it can no longer react with the hydrogen peroxide. Make the comparison with cooked and uncooked egg white.

Background Information:

Basic explanation for young children:

All living things have chemicals called enzymes that help the animal or plants grow and prosper.

Enzymes make things happen. A common enzyme found in most animals and some plants makes hydrogen peroxide break apart into water and oxygen.

More in depth explanation for older children:

Almost all living things contain an enzyme made of protein called catalase that is designed to break apart peroxides. Peroxides are very reactive and can cause unwanted reactions in living systems. Enzymes are present to break them down rapidly when they form. Enzymes are complex proteins that act as catalysts to speed up reactions. Since enzymes are complex proteins, they are denatured and destroyed by heat. Hence, cooked vegetables and fruits have no enzymatic activity.

Credits and Disclaimer



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Acknowledgments: These activities were developed by the Sciencenter with a grant from the Camille and Henry Dreyfus Foundation, Inc.

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Challenge:

Can you find which plants have an enzyme called catalase that breaks hydrogen peroxide into water and oxygen.

Vegetable or Fruit						
Uncooked						
Cooked						