RESPIRATION OF SUGARS BY YEAST

Yeast are able to metabolize some food, but not others. In order for an organism to make use of a potential source of food, it must be capable of transporting the food into its cells. It must also have the proper enzymes capable of breaking the food's chemical bonds in a useful way. Sugars are vital to all living organisms. Yeast are capable of using some, but not all sugars as a food source. Yeast can metabolize sugar in two ways, aerobically, with aid of oxygen, or anaerobically , without oxygen.

In this lab, you will try to determine whether yeast are capable of metabolizing a variety of sugars. When yeast respire aerobically, oxygen gas is consumed and carbon dioxide is produced. You will use a CO_2 Gas Sensor to monitor the production of carbon dioxide as yeast respire using different sugars. The four sugars that will be tested are glucose (blood sugar), sucrose (table sugar), fructose (fruit sugar), and lactose (milk sugar).

Procedure

1. Prepare a water bath for the yeast. A water bath is simply a large beaker of water at a certain temperature. This ensures that the yeast will remain at a constant and controlled temperature. To prepare the water bath, obtain some warm and cool water. Combine the warm and cool water into the 500-600ml beaker until it reaches 38-40^{o}C. The beaker should be filled with about 300ml water. Leave the thermometer in the water bath during the course of the experiment to monitor the temperatue of the water bath.

2. Obtain five test tubes and label them G, S, F, L, and W.

3. Obtain the four sugar solutions (5% conc.): glucose, sucrose, fructose, and lactose.
   a. Place 2ml of the glucose solution test tube G.
   b. Place 2ml of the sucrose solution in test tube S.
   c. Place 2ml of the fructose solution in test tube F.
   d. Place 2ml of the lactose solution in test tube L.
   e. Place 2ml of distilled water in test tube W.

4. Obtain the yeast suspension (1 pk. dried yeast in 100ml distilled water). Gently swirl the yeast suspension to mix the yeast that settles to the bottom. Put 2ml of yeast into each of the five test tubes. Gently swirl each test tube to mix the yeast into the solution.

5. Set the five test tubes into the water bath.

6. Incubate the test tubes for 10 minutes in the water bath. Keep the temperature of the water bath constant.

7. Prepare the computer for data collection by opening the file in the Experiment 12A folder of Biology with Computers. The vertical axis has carbon dioxide concentration scaled from 0 to 5000ppm. The horizontal scale has time scaled from 0 to 4 minutes. The data rate is set to 4samples/minute.

8. When the incubation is finished, place 1ml of the solution in test tube G into the 250ml respiration chamber.

9. Quickly place the shaft of the CO_2 Gas Sensor in the opening of the respiration chamber. Gently twist the stopper on the shaft of the CO_2 Gas Sensor into the chamber opening.

10. Begin measuring carbon dioxide concentration by clicking <Collect>. Data will be collected for 4 minutes.

11. When data collection has finished, remove the CO_2 Gas Sensor from the respiration chamber. Fill the respiration chamber with water and then empty it. Make sure that all yeast have been removed. Thoroughly dry the inside of the chamber with a paper towel.

12. Determine the rate of respiration:
    a. Move the mouse pointer to the point where the data values begin to increase. Hold down the mouse button. Drag the pointer to the end of the data and release the mouse button.
    b. Click on the Regression button to perform a linear regression. A floating box will appear with the formula for a best fit line.
    c. Record the slope of the line, m, as rate of respiration (ppm/min).
    d. Close the linear regression floating box.
    e. Share your data with the class by recording the sugar type and respiration rate on the board.

13.Use a notebook or notepad to fan air across the openings in the probe shaft of the CO_2 Gas Sensor for 1 minute.

14. Repeat steps 8-13 for the other four test tubes.

15. Submit a print out of one of the sugars tested and prepare a histogram of class averages for each solution with rate values plotted on the y-axis and the sugar type on the x-axis.

Questions

1. Considering the results of this experiment, do yeast equally utilize all sugars. Explain.

2. Hypothesize why some sugars were not metabolized while other sugars were.

3. Why do you need to incubate the yeast before you start collecting data?

4. Yeast live in many different environments. Why is the human body an ideal place?