Respiration of Sugars by the Yeast *Saccharomyces cerevisiae*

**Introduction**

*Saccharomyces cerevisiae* can catabolize certain sugars for energy. Since this organism is a facultative anaerobe, it can use the sugars in the presence or absence of oxygen. This experiment is designed to determine if the yeast can catabolize a variety of sugars by carrying on aerobic respiration. Carbon dioxide gas sensor will be used to monitor the production of carbon dioxide as the yeast cells are added to four different sugars, namely, glucose, sucrose, fructose and lactose.

**Materials**

- Yeast suspension
- Sugar solutions (glucose, sucrose, fructose, lactose)
- Distilled water
- Respiration chamber
- Pipets
- Computer
- Logger Pro
- Water bath 37°C
- CO₂ sensor

**Procedure**

1. Your work station will have the test tubes containing 2 ml of glucose, sucrose, fructose, lactose and Distilled water.

2. Gently swirl the yeast suspension in the flask and add 2 ml of the yeast suspension to the glucose tube and place the tube in the 37°C water bath for 10 minutes.

10 minutes after glucose is placed in the water bath, add 2 ml of the yeast suspension to the sucrose tube. Place the sucrose tube in the water bath for 10 minutes. The tubes are placed in the water bath at 10 min. intervals. Incubation is staggered such that all the tubes are in the water bath only for 10 minutes.

3. After 10 minutes of incubation take the glucose tube out of the water bath. Pick up 1 ml of yeast suspension from deep inside the test tube using a pipet and add the sample to the respiration chamber.

4. Cap the chamber with the black rubber stopper that has the CO₂ probe. DO NOT twist the probe, but twist the stopper so the chamber is airtight.
5. Click on the collect option on the monitor. The computer will collect the data for 4 minutes.

6. After data collection, remove the stopper with the probe form the chamber and wash the chamber. Dry the chamber as much as possible with paper towels. DO NOT wash the sensor.

7. Move the mouse pointer where the values begin to increase. Hold down the left mouse button and drag the pointer to the end of the data and release. The area will be highlighted.

8. Click on analyze and the linear fit option. A floating box will appear. It will have slope of line $m$=number and that number is the rate of respiration. Record this number in your notebook. Close the floating box.

9. Click on the experiment menu and then click on store latest run to save the line graph.

10. Use a notebook or a few paper towels to fan air across the opening in the probe for one minute.

11. Repeat steps 4 through 10 for each of the other four test tubes.

12. Labeling each line graph:
   A. Click on insert and then text annotation.
   B. A box shows up. Type the name of the sugar in the box and click on white part of the graph to lock the box.
   C. Move the cursor near the box until a hand icon shows up and then click and drag the box near the line graph to be labeled.
   D. Line attached to the box can be dragged to the line graph to be labeled as well. Click done.

13. To make a bar graph:
   A. Click on page and then click on add page.
   B. New window shows up. In that new window click on new data set option. Click OK.
   C. Double click on X in the table on the left.
   D. Window shows up. Name the X axis “Sugars” in the new window that shows up.
   E. Double click on Y and label the Y axis “Rate of respiration” in the new window that shows up. You can type “RR” in the box for short name.
   F. Type the sugars and appropriate rate of respiration in the table on the left.
   G. Double click in the white area of the graph.
   H. A window shows up. Select bar graph option. In the same window on the top left click on axes option.
   J. In the new window type the top and bottom values for the y axis. Click on make all the values major ticks. Click on done. Bar graph shows up.

14. Take the computer to the printer in the back of the room. Get the printout of the line graph and the bar graph. Get a printout for each student in your group and also one for your instructor.

Questions:

1. Do yeast cells catabolize all the sugars used in this experiment? Explain.
2. Explain why some sugars were not catabolized by the yeast while others were.
3. Make a list of some locations where *Saccharomyces cerevisiae* grows in nature. Indicate the possible food sources at each of these locations.