# CB 2 Fermentation

A compost column models decomposition in nature. You can also model the process of decomposition by looking more closely at some of the specific ways in which matter is transformed during decomposition. A compost pile was created by combining organic matter (materials from living organisms) with micro-organisms and water. In this inquiry, you will investigate combinations of a living organism (yeast) organic molecules (sugar and/or flour) and water.

When you buy yeast in a grocery store, it is in a dormant state. To increase its metabolism and allow it to grow, you have to add water. What are the other requirements for yeast growth and reproduction? You will investigate this question and other requirements for yeast growth as you design and carry out this experiment.

*Materials*

- Yeast
- Sugar
- Flour
- Tap water in small beaker
- Zippered plastic bags
- Masking tape
- Warm water bath (35-45 degrees C.) in container large enough to contain bags
- Casio fx2 Graphing Calculator: Input and display of data
- Casio Data Collector EA-100 and $CO_2$ probe: $CO_2$ concentration readings
- Casio QV2800 Digital Camera: Visual images of changes in fermentation tube

*Procedure for Day Before Experiment*

1. This inquiry requires some advance preparation on the day before the experiment. You are going to combine yeast, water, sugar, and flour in various amounts in plastic bags. When yeast use energy from food, they give off carbon dioxide and ethyl alcohol.
2. Yeast cannot carry out life processes unless they are in a moist environment, so you must mix water with the yeast. Only 1/2 teaspoon of yeast per bag is needed.
3. Listen to the preparatory instructions given by your teacher.
4. Decide and record what you are going to test. The effect of the yeast? The sugar? The flour? The bags? The temperature of the water? Set up a series of bags in which you omit or include some of the ingredients. The ingredient which is different between the bags is the variable. State the variable which you will test and record it in your *BioCom Log*.
5. Decide what output variables you will look for. Some possibilities are the size or volume of carbon dioxide produced, changes in the cloudiness of the solution, carbon dioxide concentrations and other visual changes in the system.
1. Construct an hypothesis which will predict the outcome of testing your variable. Use an "If....., then....." statement. In developing your hypothesis, consider the following: a) the potential functions of each item, water, yeast, sugar, flour; b) the difference between sugar and flour.

*Procedure for Day of Experiment*

1. At the very beginning of the period, mix together the combinations of the ingredients you wish to test. Seal the bags and let sit for 30 minutes in warm water.
2. In your *Log*, make a data table like the one below. Identify the combinations of ingredients you will test. Use this table to record your results.

| Treatment # | Yeast (g) | Sugar (g) | Flour (g) | Water (ml) | Observations |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |

3. Observe each bag at intervals of 15, 20, 25 and 30 minutes.
4. Dispose of the contents of the bag, rinse out the bags, and clean up as indicated by your teacher.

*Explanations*

1. What patterns do you see in your results?
2. What generalizations can you make?
3. What are the inputs and outputs of this system?
4. How can we find out exactly what was given off?
5. What is a gas?
6. If you did this experiment again, how could you gather evidence to determine what was happening in the mystery bags. For example, what was produced, how much of it was produced, and what were its characteristics?
7. How does this experiment relate to your compost pile? What are the inputs and possible outputs of the compost pile? How would you describe the compost pile as a system?
8. What additional tests would you like to make?

*Applications*

1. A scientific model is often a simple facsimile of a real object, such as an atom, or a process, such as decomposition. They are used to help understand the nature of the original object. Have you ever made a model airplane? Describe the results of this inquiry as a model for the decomposition in your compost pile.
2. Describe an actual scientific model being used in your community.