

INTRODUCTION

The purpose of this experiment is to discover the effect of temperature upon the rising of bread dough. The process of dough rising is based on yeast. Yeast is a type of fungus which breaks sugar down into smaller components.

The type of yeast used for these tests is *Saccharomyces Cerevisiae*, which was domesticated for wine, beer and bread production thousands of years ago. *Saccharomyces Cerevisiae* is commonly referred to as baker's yeast or brewer's yeast for this reason.

Yeasts used for leavening bread can be either caught from the environment or produced commercially. In the environment, yeast can easily be found in fruits and berries (such as apples, peaches, and grapes), as well as in plant exudates (such as sap).

When mixed with bread dough, the yeast converts sugar molecules into carbon dioxide (CO₂), alcohol and water. The CO₂ expands in the dough to produce gaseous bubbles. These bubbles cause the bread to rise - the more CO₂ present, the faster the bread will rise. If temperature is related to the amount of CO₂ produced by yeast, then higher temperatures will result in increased production of CO₂.

MATERIALS

1 Erlenmeyer Flask
1 One-hole Rubber Stopper
1 Striker
1 600ml Glass Beaker
1 Glass Beaker of any size (to contain flask)
1 Thermometer
Yeast Solution
Petroleum Jelly
Ice and/or snow
Glass Tubing
Hot Plate
Table for the recording of data
Access to tap water and natural gas will also be necessary.

PROCEDURE

1. Using a bunsen burner, position the glass tubing so that it will reach from the inside of the Erlenmeyer flask to the bottom of the glass beaker, leaving enough room for gas to escape while in the beaker.
2. Add 75ml of yeast solution to the flask.
3. Add 500ml of water to the beaker.
4. Place the rubber stopper in the flask and apply petroleum jelly around the hole of the stopper to stop gas from escaping. Insert the glass tubing so that it will receive gas from the flask and carry it underneath the water in the beaker, and place the beaker and flask on a lab counter.
5. Observe the beaker for ten minutes and count the number of bubbles escaping into the water. Record this information and the current room temperature in a data table.
6. Find the average number of bubbles per minute and record this in the data table.
7. Remove the glass tubing from the apparatus.
8. Repeat steps 2-7 at a temperature of 83 °C, placing the flask in a hot water bath prepared by using a hot plate and waiting for five minutes to allow the yeast to reach the appropriate temperature before inserting the glass tubing.
9. Repeat steps 2-7 at a temperature of °C, placing the flask in a container full of ice or a cold water and waiting for five minutes to allow the yeast to reach the appropriate temperature before inserting the glass tubing.

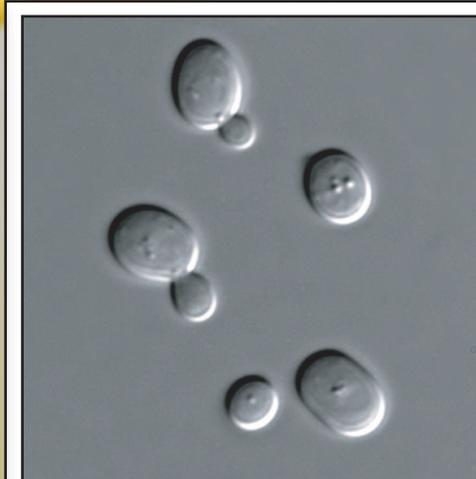
CONCLUSIONS

Average data collected shows an average of 0 carbon dioxide bubbles per minute at 0 degrees Celsius, an average of 11.5 bubbles per minute at 19 degrees Celsius, and an average of 76.8 bubbles per minute at 83°C.

The test at 83°C showed a near-constant decline in the amount of bubbles as time passed. This occurred because the sugar fueling the yeast is depleted, so the yeast has less fuel to produce carbon dioxide. The test at 0 degrees Celsius showed no production of carbon dioxide, presumably because the low temperatures killed the yeast. The room temperature test (19 °C) showed a fairly even level of carbon dioxide production, but not enough to be useful in the making of leavened bread.

We incurred two experimental errors in the first testing at 0 degrees Celsius. By beginning the testing immediately following the insertion of the yeast solution into the cold water bath, the warm air molecules in the flask were not given an opportunity to cool before being attached to the rest of the apparatus. This caused a vacuum to form in the glass tubing, pulling water up the tubing rather than pushing the gas out. Attempting to remedy the situation, we moved the flask into a slightly warmer area, skewing the results by raising the temperature enough to allow carbon dioxide production. Applying this knowledge to the second test eliminated these anomalies.

This experiment shows that carbon dioxide production from yeast increases with increased temperature, as the number of carbon dioxide bubbles increased as the temperature rose. However, yeast consumes sugar much faster at higher temperatures, causing dramatic growth for a short amount of time which quickly drops to very low levels. Because the rising of bread dough is dependent on the amount of carbon dioxide produced, increased temperatures will result in bread rising further than it would at room temperatures.



Saccharomyces Cerevisiae (Yeast), a type of fungus which breaks sugar down into smaller components.



Yeast can be found in fruits and berries. The 'bloom' (dusty covering) on these grapes is yeast.