Yeast Population Dynamics Lab Procedure

Testing Temperature

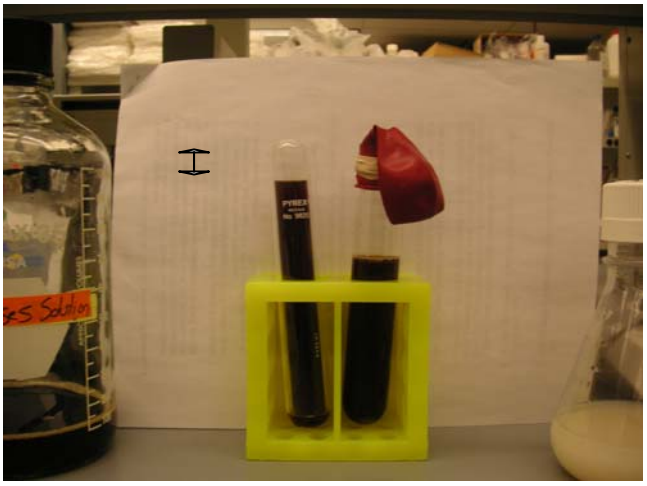
1. Prepare 25% molasses solution – in a 500ml container dilute 125ml of molasses with tap water until you get a total solution volume of 500ml. I recommend you refrigerate solution after mixing.
    - % solution = $\frac{\text{volume of solute (molasses)}}{\text{Total volume of solution}} \times 100$

2. Prepare yeast solution – dilute 1 gram of baker's yeast into 100ml of warm tap water. Solution can be used immediately or one hour later.
    - Note: brand of baker's yeast does not matter, even if ascorbic acid is listed amongst the ingredients.

3. Add 25-28ml of molasses solution to two small, clean test tubes (18mm x 150mm) each.

4. Add 1ml of yeast suspension to the molasses solution. Make sure yeast is suspended in solution and not settled on the bottom of the container. Thoroughly mix yeast and molasses solutions together.

5. Invert large test tube (25mm x 150mm) and place over small test tube. Flip test tubes so that the large one is now right side up with the small test tube inside. Most of the solution will stay inside small test tube.
    - If smaller test tubes are unavailable a balloon can be used instead. Make yeast and molasses solution in large test tube. Place opening of balloon over opening of test tube and hold in place with a rubber band.



6. Take initial reading by measuring (in centimeters) the height of the bubble inside the small test tube. (see photo)
    - If using a balloon an initial reading is unnecessary.
7. Place one set of test tubes on a counter at room temperature and another in an incubator set at 30 degrees Celsius.

8. Record the height of the bubble (in centimeters) every 24 hours for five to six days. Encourage students to keep organized notes and to make a graph charting the size of the bubbles. The height of the bubbles will need to be converted into a unit of volume (milliliters). Remember to subtract the initial volume of the cylinder or balloon from final volume of carbon dioxide. (see step 6)

Calculations

1. For Test Tubes:
   Volume of cylinder = 3.14 x r^2 x H
   r = radius of cylinder
   H = height of bubble

   Ex. Radius of small test tube = 9mm = .9 cm
   r^2 = .9cm x .9cm = .81cm^2
   Initial height of bubble = 2.5cm
   Volume of cylinder = 3.14 x .81cm^2 x 2.5cm = 6.4cm^3
   1cm^3 = 1ml
   Initial volume of cylinder = 6.4ml

2. For Balloon Circumference:
   Volume of balloon = (4/3) x 3.14 x r^3
   Radius of balloon = Circumference / (3.14 x 2)

   Ex. Radius = 11cm / 6.28 = 1.75cm
   R^3 = 5.36cm^3
   Volume of balloon = (4/3) x 3.14 x 5.36cm^3 = 22.44cm^3
   1cm^3 = 1ml
   Volume of CO_2 in balloon = 22.44ml