Factors Affecting the Rising of Bread Dough - Temperature

Objective

To study the effect of temperature on the rising of bread dough.

Principles*

Yeast is a single-cell microbe that has important roles in bread-making: leavening and gluten development. When combined with flour and water to make bread dough, enzymes in the yeast break down starch of flour into sugar. The yeast uses sugar as their food and gives off the byproducts carbon dioxide and alcohol, i.e. alcoholic fermentation:

$$\underset{\text{(glucose)}}{C_6H_{12}O_6} \xrightarrow[\text{fermentation}]{\text{yeast}} \underset{\text{(alcohol)}}{2\ C_2H_5OH} + \underset{\text{(carbon dioxide)}}{2\ CO_2}$$

The released carbon dioxide bubbles are held in the dough's gluten network. Each time the yeast gives off another puff of carbon dioxide, the gas expands the gluten network and causes the bread dough to rise. The rising of the bread dough, therefore, depends on the growth and activity of the yeast. Factors that favour yeast growth and its activity should help facilitate the rising of the bread dough.

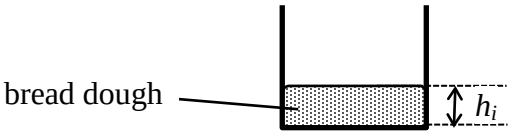
Part I – Experimental Work

Apparatus and Materials

Apparatus		Materials	
transparent glass cup / 250 ml beaker*	× 4	bread flour	80 g
chopstick / glass rod*	× 4	instant yeast	4 tsp
weighing scale	× 1	¼ tsp sugar	× 4
measuring spoons	× 1 set	distilled water	90 ml
round-headed knife	× 1	cold distilled water ❖	30 ml
measuring cylinder#	× 1	*(❖ kept in the refrigerator for at least 30 minutes)*	
thermometer	× 1		
ruler	× 1		

Procedure

1. Label the transparent glass cups (beakers) as A, B, C, and D.
2. Measure and record the temperatures of the distilled water and the cold distilled water.
3. Add **20 g bread flour, ¼ tsp sugar** and **1 tsp instant yeast** into **<u>each</u>** cup. Mix well with the stirrer (glass rod).
4. Add **30 ml distilled water** (6 tsp water) into cup A. Stir the content to make a wet dough. Press the dough to fill up any airspaces at the bottom of the cup and level the dough at the top. Measure and record the initial height of the dough (h_i).



5. Measure the **room temperature** with a thermometer. Leave cup A at **room temperature** for 25 minutes.
6. Repeat step 4 by adding **30 ml <u>cold</u> distilled water** into cup B. Put cup B into the refrigerator. Measure the temperature inside the refrigerator and leave it there for 25 minutes.
7. Repeat step 4 by adding **30 ml distilled water** into cup C. Put cup C in a **warm/slightly hot** environment (e.g. a steamer kept at a temperature of ***40–65℃***). Measure the temperature of this environment and leave it there for 25 minutes.
8. Repeat step 4 by adding **30 ml distilled water** into cup D. Put cup D in a **very hot** environment (e.g. a steamer kept at a temperature ***above 80℃***). Measure the temperature of this environment and leave it there for 25 minutes.
9. Measure the temperature of the environment in which each cup is placed every 5 minutes. Record the range of fermentation temperature for each cup.
10. After allowing 25 minutes for fermentation, measure and record the final height of the dough (h_f) in each cup. Note and record the texture of the dough in each cup.

    [Hint: You may indicate the "size of bubbles observed in the dough" using "+" signs. The greater the number of "+" signs (maximum being 5), the larger is the size of bubbles observed in the dough.]

Results

Cup (Beaker)	Temperature of distilled water (°C)	Fermentation temperature (°C)	Height of the dough		Rise of dough (cm)	Appearance
			h_i (cm)	h_f (cm)		
A						
B						
C						
D						

Part II - Report Writing

Discussion

1. Based on the results of this experiment, state and explain which temperature(s) favour(s) yeast fermentation.

2. Based on the results of this experiment, state and explain which temperature(s) inhibit(s) yeast fermentation.

3. Discuss the applications of your findings in bread making.

4. Suggest one further investigation that can shed light on yeast fermentation in bread making.

Conclusion