

# Effects of Vitamins on the Yeast Fermentation Process



## Introduction

- Yeast is a single-cell, plant-like organism that is part of the fungus family. The most commonly used yeast is called *saccharomyces cerevisiae*.
- The fermentation process happens when the enzymes in yeast start to break down the sugars into glucose. Then the glucose is processed by the yeast to produce carbon dioxide and alcohol.
- The fermentation process is used for baking, alcohol beverage fermentation and the production of biofuels.
- Vitamins are nutrients for yeast. They are important for enzyme structure and function.
- Vitamin B<sub>1</sub> (thiamine) is used as a co-enzyme in the alcoholic fermentation.
- Vitamin C (ascorbic acid) is also used for bread baking and it helps strengthen the gluten network.

## Purpose

Test two water-soluble vitamins (Vitamin B<sub>1</sub> and Vitamin C) to better understand their effect on the fermentation of yeast and determine which one speeds up the process.

## Hypothesis

Vitamin C and Vitamin B<sub>1</sub> will both speed up the yeast fermentation process.

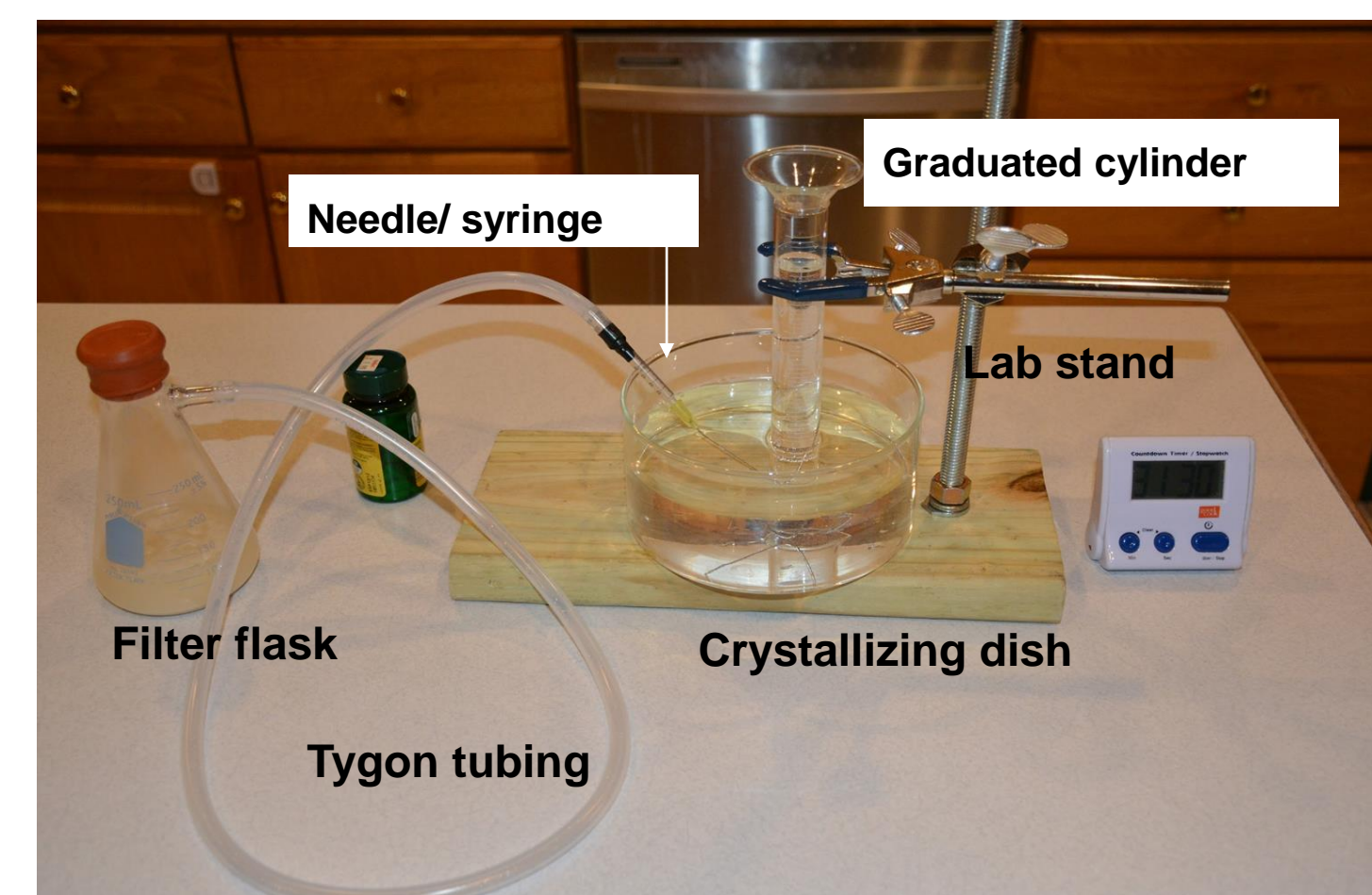
## Materials



## Procedure

### a) Measure the amount of CO<sub>2</sub> produced in yeast/sugar/water formulations with/without vitamins

1. Build the experimental setup.



2. Weigh vitamins, grind them into powder and pour them into a flask.
3. Weigh the distilled water into the flask and swirl the solution until the powder is dissolved.
4. Weigh the sugar into the flask and swirl until dissolved.
5. Weigh the yeast then add it to the flask.
6. Cap the flask with the rubber stopper and attach the tygon tube to the arm.
7. Start the timer and swirl the solution.
8. Record the time and the amount of CO<sub>2</sub> produced.
9. Repeat 3 times.

### b) Effect of pH before/after neutralization of vitamin C

1. Dissolve vitamin C in water.
2. Add the baking soda little by little and test until the pH is 7 using a pH strip.
3. Follow the procedures for yeast/sugar/water formulations to measure the amount of CO<sub>2</sub> produced.

### c) Fermentation of doughs with/without vitamins

1. Weigh the flour and pour 1/3 into the electric mixer.
2. Weigh vitamins, sugar, yeast and water into a bowl and mix until everything is dissolved.
3. Add the solution to the flour and mix on medium for 2 minutes. Add 1/3 flour, then mix on high for 2 minutes.
4. Then change the beater for a hook, add the last 1/3 flour and mix on medium for 10 minutes.
5. Put 100g of dough in each of the 3 glasses and position a ruler by the glasses. Use camera to take pictures every minute.



6. Bake the dough in the oven at 400 °F for 30 minutes in a muffin pan and compare how the bread looks with and without vitamins.

## Data

Figure 1. Test runs for control formulation

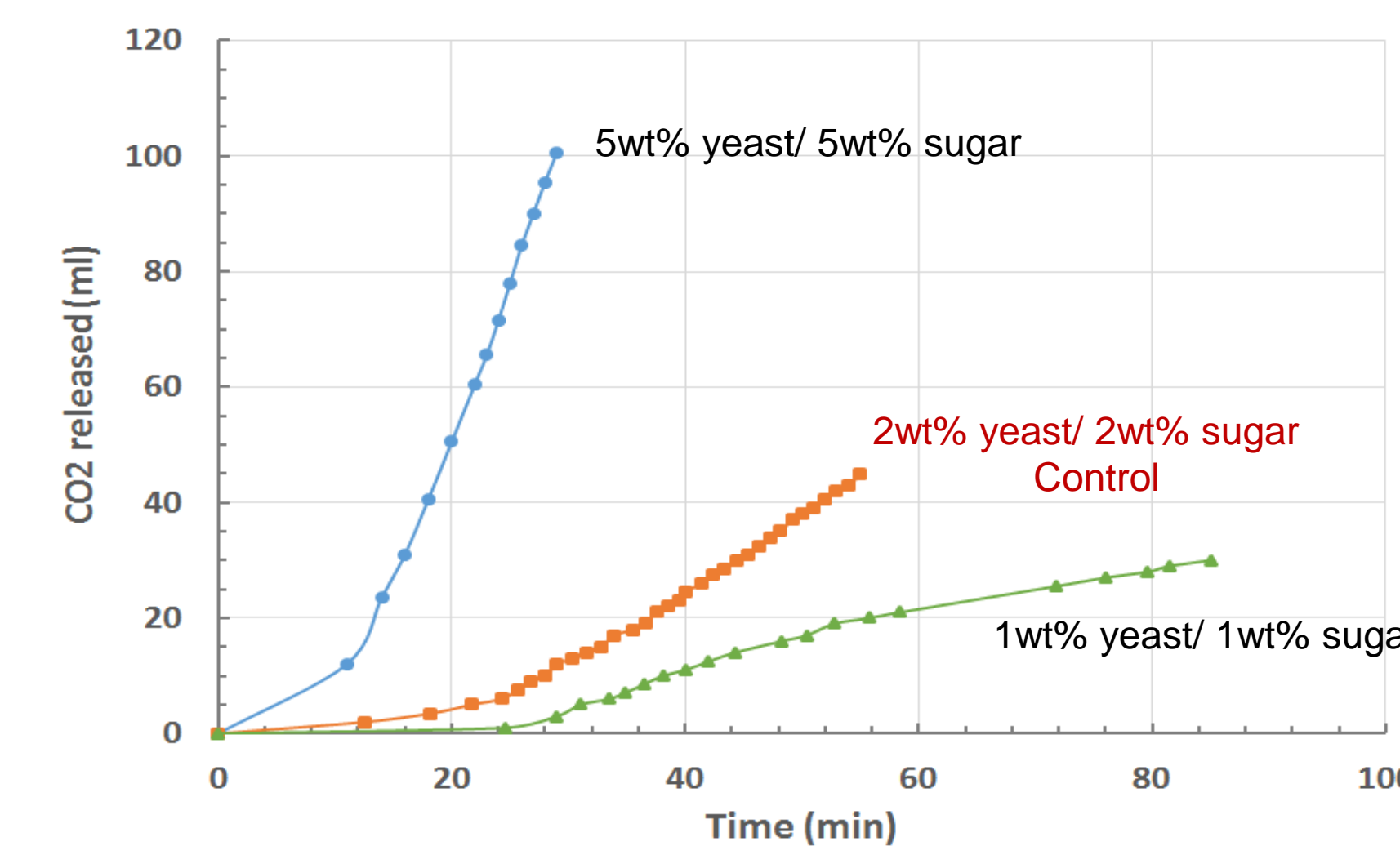


Table 1. Formulations

Ingredients	Yeast/Sugar/Water			Doughs		
	Control	Vitamin C	Vitamin B1	Control	Vitamin C	Vitamin B1
Yeast (wt%)	2	2	2	2	2	2
Sugar (wt%)	2	2	2	2	2	2
Water (wt%)	96	95.8	95.8	35	34.8	34.8
Vitamin C (wt%)	0	0.2	0	0	0.2	0
Vitamin B1 (wt%)	0	0	0.2	0	0	0.2
Bread flour (wt%)	0	0	0	61	61	61

Figure 2. Fermentation of formulations with/without vitamins

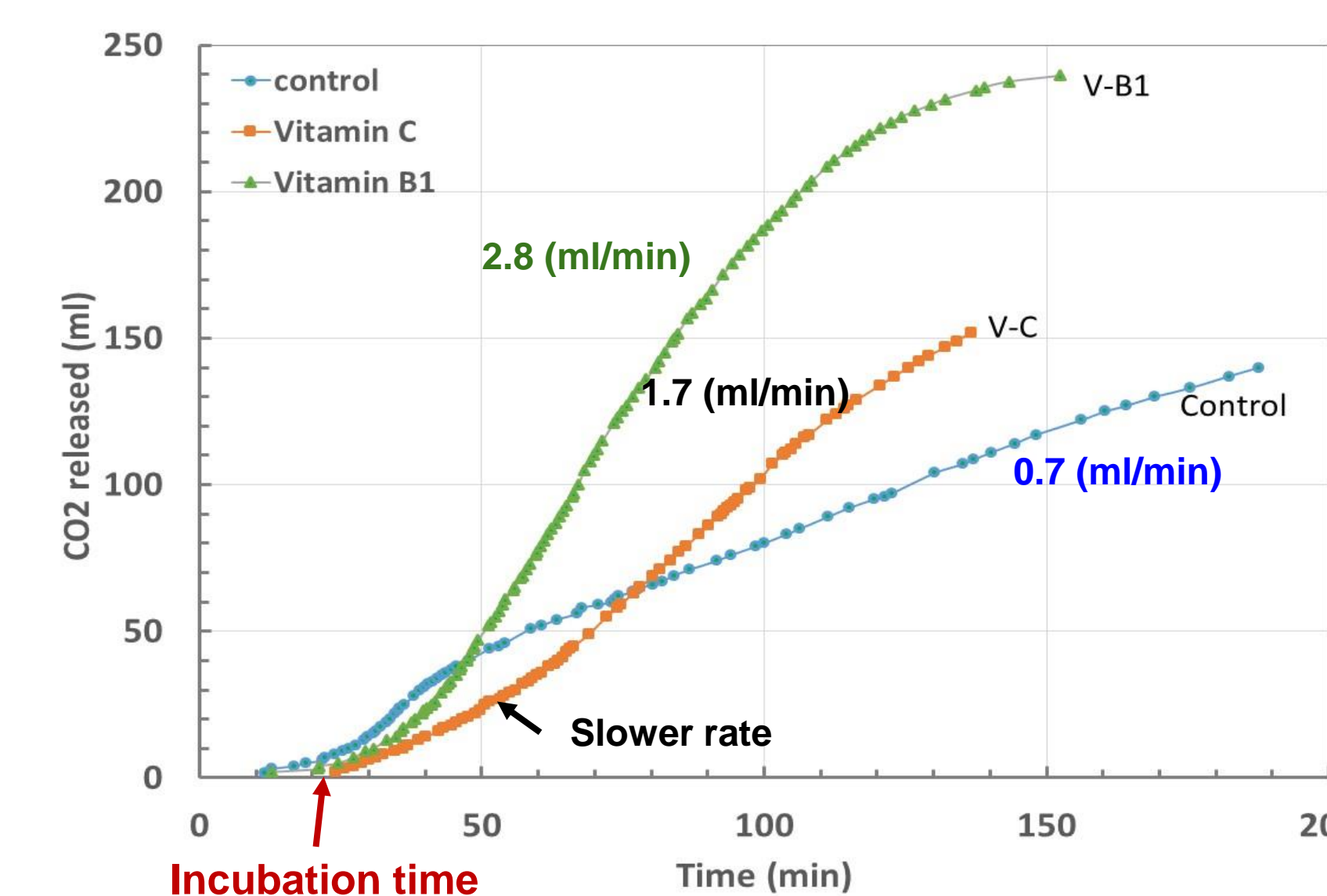


Figure 3. pH effects on yeast fermentation process

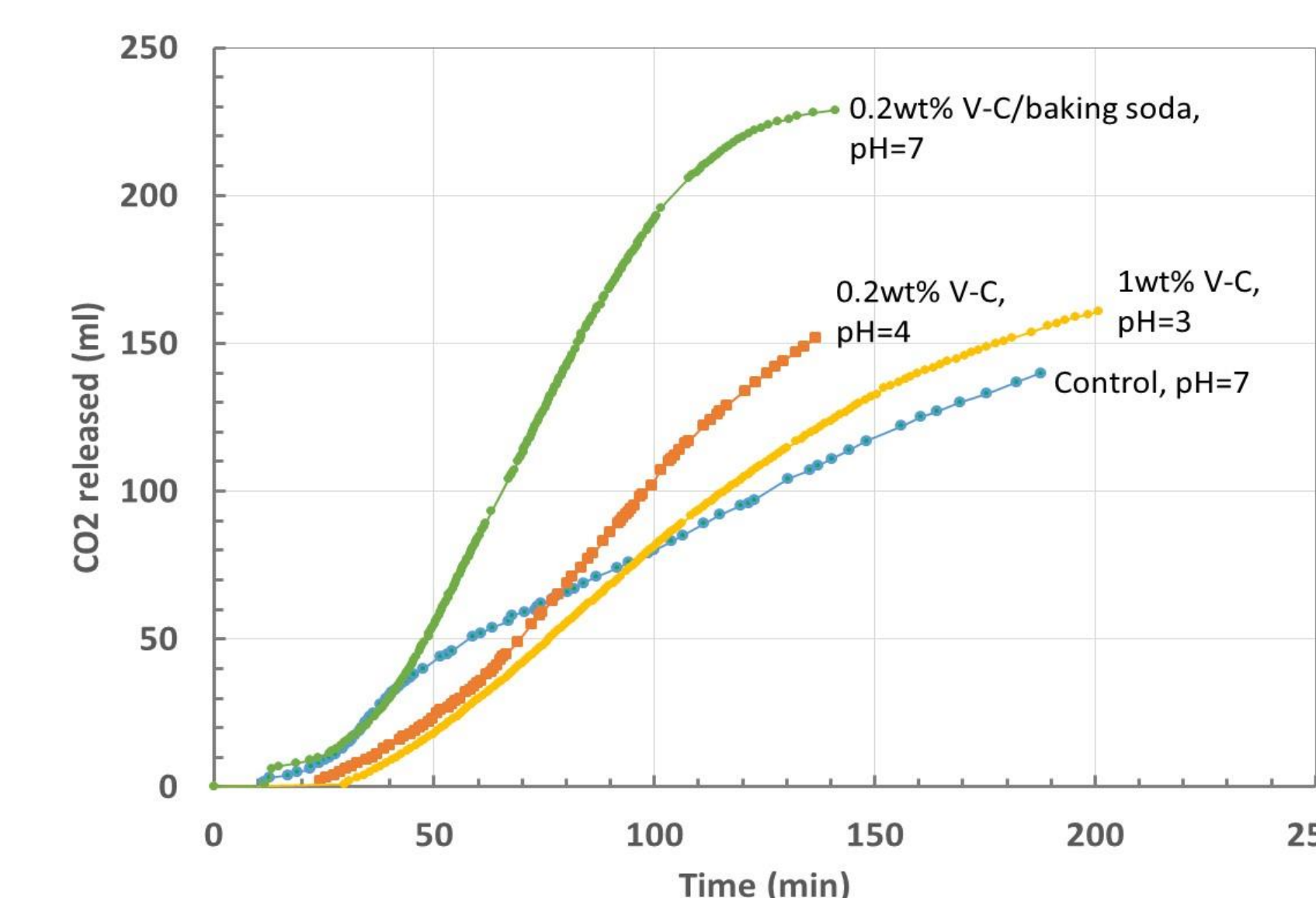


Figure 4. Fermentation of doughs with/without vitamins

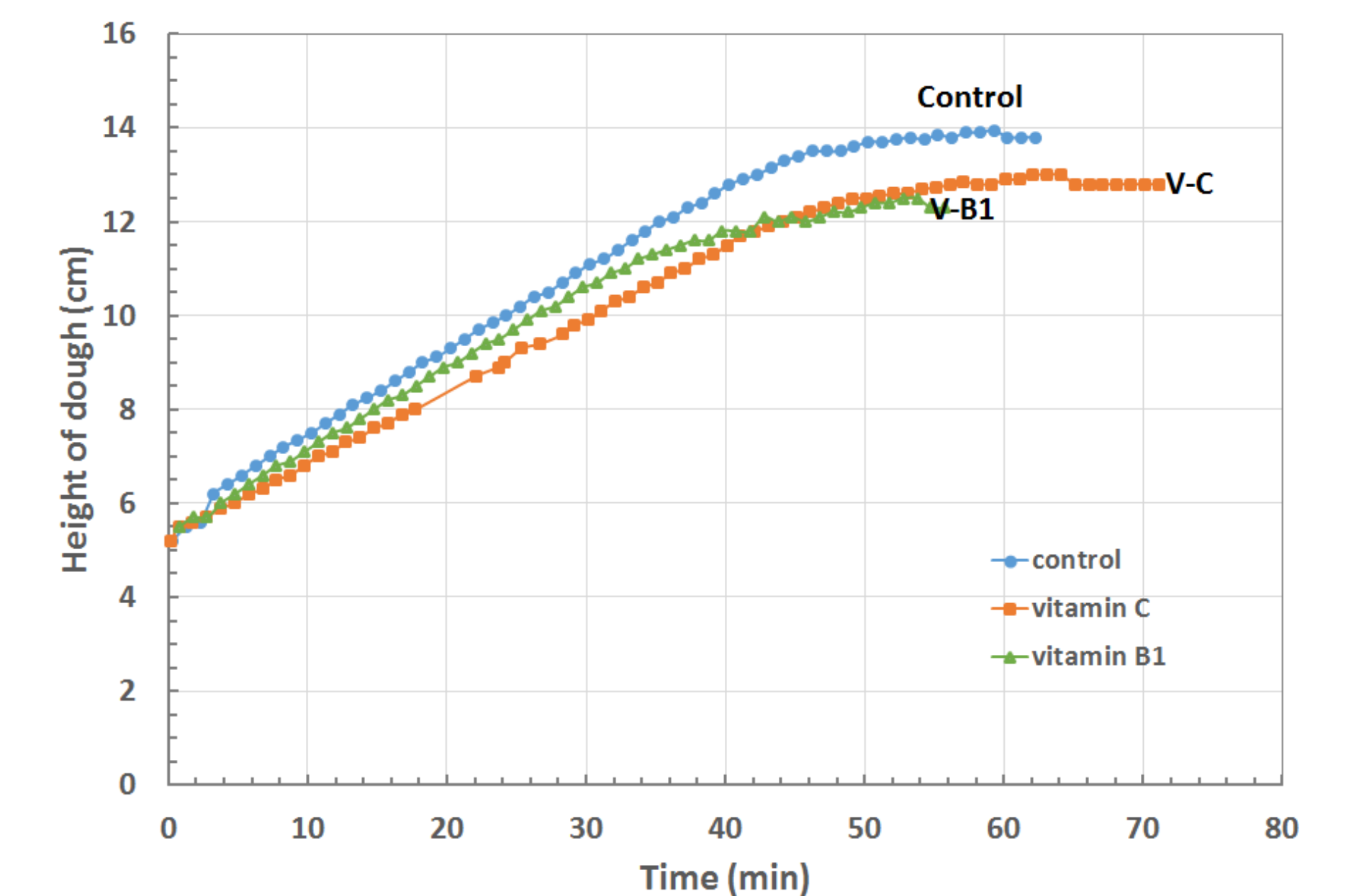
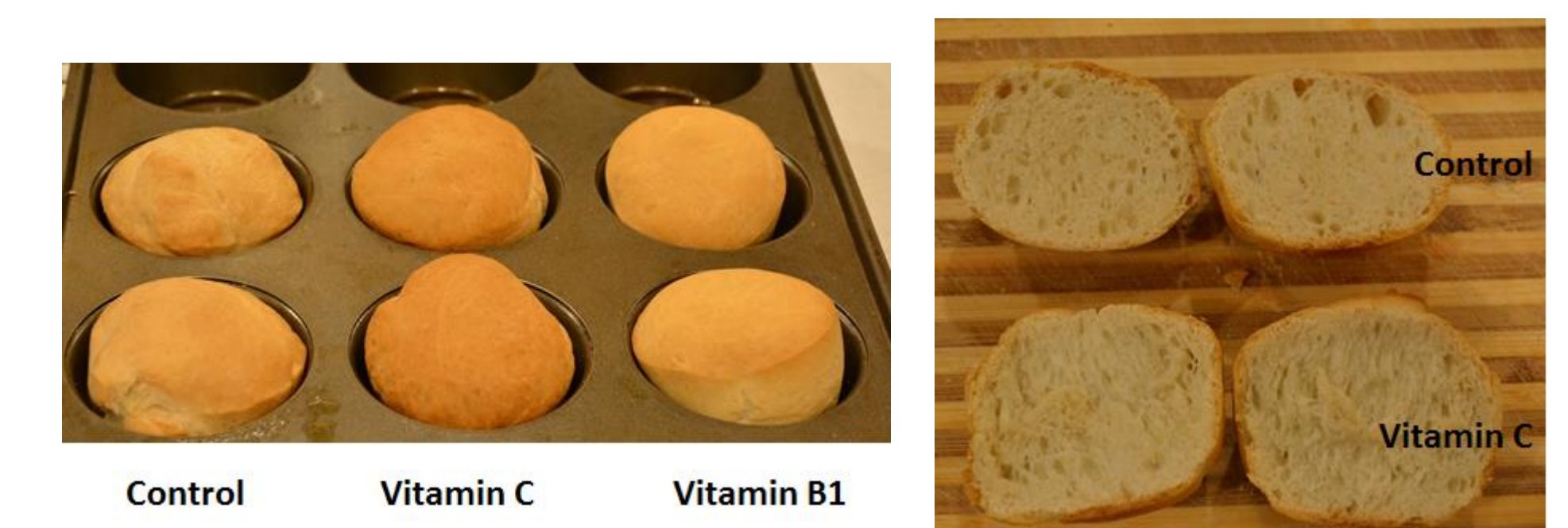


Figure 5. Doughs with/without vitamins after baking



Grow higher

Soft texture

## Results

The hypothesis (Vitamin B<sub>1</sub> and Vitamin C can speed up the fermentation of yeast) was supported.

## Conclusion

- 2wt% of yeast and 2wt% of sugar were selected as the control formulation.
- At the very beginning, the incubation time of the yeast/sugar/water formulations with Vitamins B<sub>1</sub> or Vitamin C was slightly longer than the control formulation and the fermentation rate of Vitamin C was slower. However, the formulations with Vitamins B<sub>1</sub> or Vitamin C both had faster fermentation rates at a later stage.
- pH had a significant effect on the yeast fermentation process. Lower pH slowed down the fermentation rate. Neutralization to pH7 greatly sped it up.
- The dough formulations with vitamins had a slightly slower growth rate than the control. The bread with vitamins grew higher and had a better texture than the control.