

Abstract

This experiment concentrated on discerning how the concentration of yeast impacted its fermentation. It was a topic of interest because fermentation is unique to yeast and bacteria, as it is their form of metabolism, and, therefore, the results should represent the efficiency of their enzymes. Before this experiment, we hypothesized that an increase in yeast concentration would positively affect its rate of fermentation. Following the experiment, the final results favored our hypothesis; a higher concentration of yeast increased the fermentation rate.

Introduction

Yeast is a versatile microorganism used during the production of certain foods because of its unique fermentation ability. During fermentation, yeast metabolizes sugar into energy and releases carbon dioxide (Maicas, 2020).

This knowledge prompted our research question: how does the concentration of yeast affect its fermentation rate? When approaching this experiment we discerned that our independent variable was the amount of yeast, and the dependent variable was the fermentation rate. Based on prior understanding, we then hypothesized that a higher yeast concentration would result in a faster fermentation rate.

Methods

Materials & Location

This experiment took place in a biology lab at Whatcom Community College. The materials used per trial were as follows: 6 fermentation tubes, six test tubes (a stand in which to hold them), 6 125 mL beakers, 7 10 mL pipettes, 1 100 mL flask, a scale, a total of 9 (5g) yeast packets, 300mL of distilled water, and 60 mL of 20% sucrose solution.

Procedure

Acquire materials; pour 50 mL of distilled water into each beaker; weigh out the yeast in grams and put each quantity into the designated beaker; using a pipette, deposit 10 mL of each yeast solution into separate test tubes; using a pipette, put 10 mL of sucrose solution in a test tube and turn it upside down (fingers capping the top) to mix(x6); pour each solution into separate fermentation tubes halfway, turn upside down, and pour the rest; place in incubator to ferment and begin timer. When complete, measure the volume of CO₂ produced in mL, record, and calculate fermentation rate.

Grams of Yeast and The Solution's rate of Fermentation



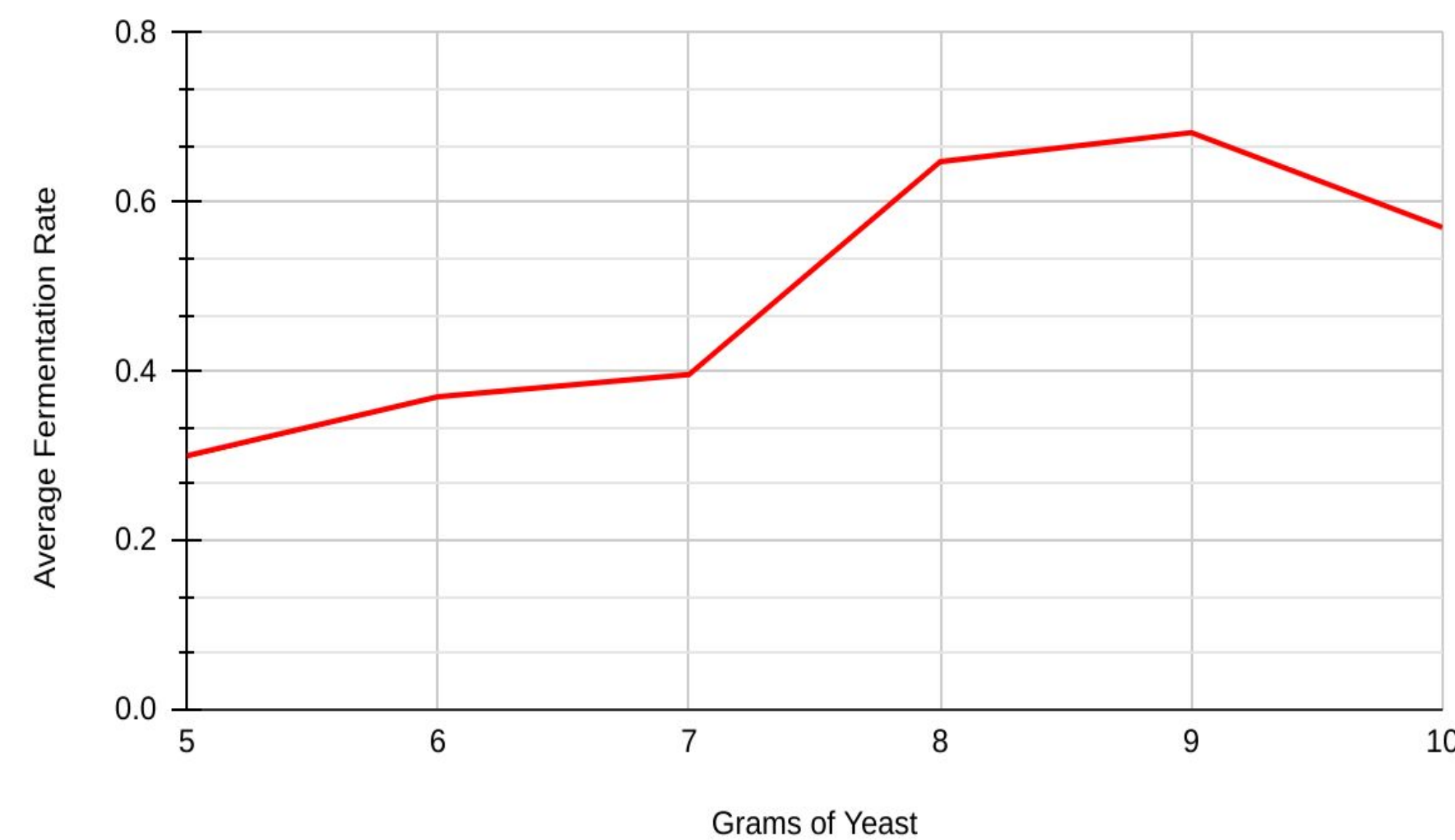
Figure 1: Trial 4 after fermenting supports the hypothesis because of the resulting fermentation rates.

| Yeast (g) | Average Fermentation Rate (mL/min) |
|-----------|------------------------------------|
| 5 | 18.4% |
| 6 | 27.8% |
| 7 | 32.2% |
| 8 | 46.2% |
| 9 | 51.6% |
| 10 | 36.6% |

Table 1. The fermentation rates of different concentrations of yeast in grams

Grams of Yeast and The Average Fermentation Rate Per Gram

Average Fermentation Rate vs. Grams of Yeast



Graph 1: This graph shows the average rate of fermentation of each different amount of yeast within the experi. As you can see, the fermentation rate goes up when the grams go up, but only slightly. The highest average fermentation rate for grams of yeast is at 0.682 mL CO₂/min with 9 grams of yeast.

Discussion

During this experiment, it was found that with the increase in grams (1 gram increase intervals) of yeast, the fermentation rate also increased. We found that, with 1 gram intervals starting at 5 grams, that the highest fermentation rate within these intervals was that of 9 grams of yeast. With the highest duration being only 18 minutes and 5 seconds, the fermentation process took less time with higher amounts of yeast.

Since we discovered that the fermentation rate is higher when the grams of yeast is higher, this supports our hypothesis. We thought that an increase in yeast concentration would positively affect its fermentation rate. With this being said, there are many importances to having a faster, higher fermentation of yeast with things like beer and bread. Since the releasing of carbon dioxide is faster when the yeast concentration is higher, this is important for the making of good quality bread and beer. The shortcomings of our experiment is the small amounts of yeast we could study. The other shortcoming is the timing we had due to having to do multiple trials at a time.

Although this concept is important for making certain foods and drinks, we weren't able to do a larger study due to the fact that we were only doing it in a science lab. This is important to know because now it is known that the higher the concentration of yeast, the higher and faster the fermentation rate.

Acknowledgements

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References/ Work Cited

- Maicas, Sergi. "The Role of Yeast in Fermentation Processes." *Microorganisms*, 2020. National Library of Medicine, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7466055/#:~:text=During%20fermentati on%2C%20yeast%20cells%20convert,influence%20beer%20flavor%20%5B9%5D.> Accessed 17 March 2023.