Optimal Yeast Strain and Temperature When Calculating the Rate of Fermentation

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Abstract

The purpose of this experiment is to find out which strain of yeast performs best at different temperatures in order to reach the maximum rate of fermentation. We hypothesized that the instant yeast would yield the highest fermentation rate at the highest temperature of the 3 tested, in the shortest amount of time. After our multiple trials, we found that our hypothesis was supported, dependent on the temperature the yeast was exposed to. We feel that knowing this information is important because it allows us to choose the proper yeast strains for future applications in everyday uses, like baking!

Introduction

Yeast is a single-cell organism that needs food, warmth, and moisture to thrive. It converts food into carbon dioxide and alcohol. We thought it would be interesting and potentially useful to find out what temperature yeast thrives in best, when fed sucrose. We also took a look at three different types of yeast. While we were planning the project, we looked up the optimal temperatures for yeast growth/fermentation. Yeast sleeps in cold water, dies in hot water, and thrives in warm water. According the company Bobs Redmill, the optimal temperatures for active yeast is 40-46 Celsius, 49-54 for instant, and yeast dies when in water hotter than 60 degrees celsius [1]. We based our three testing temperatures off of that: 40, 50, and 60 degrees Celsius. We chose active, instant, and champagne yeast to test because they are the most common in the average household, so they could present results useable in everyday life.

Methods

Materials:

- Beakers
- Fermentation Tubes
- Pipettes
- Test Tubes
- 20% Sucrose Solution
- Champagne Yeast
- Active Dry Yeast
- Instant Yeast
- Water Baths
- Scoopula
- Distilled H2O

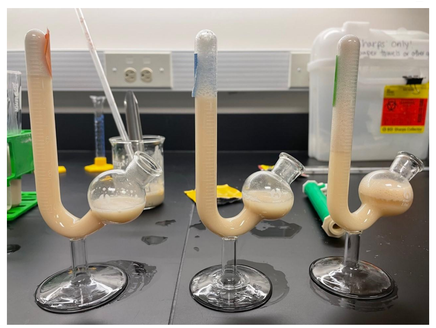
Location

Whatcom Community College, Room 110

Procedure

Before beginning our experiment, we set 3 different water baths to different temperatures (40°C, 50°C, and 60°C). We then measured 10 mL of our 20% sucrose solution and placed them inside of our water baths to heat them to the appropriate temperature. While the sucrose solution was heating, we mixed and measured 50 mL of distilled H2O and 1 packet of yeast. We did this 3 times with each of our strains of yeast (instant, active dry, and champagne). After the sucrose solution was heated to the appropriate temperature, we mixed 10 mL of the sucrose solution with 10 mL of the yeast solution and immediately transferred it to marked fermentation tubes. Once we transferred the yeast and sucrose solution to the tubes, we made sure that there were no air bubbles trapped at the top of the tubes. The tubes were immediately placed into the water baths and a timer was started to time the rate of fermentation. We pulled the fermentation tubes once the CO2 released reached a halfway point in at least one tube. At that point we stopped the timer, recorded the time, documented the fermentation tubes and began the process again to replicate our trials 3 times.

Photo of 1 of the trial fermentation experiments



Averages of CO2 Released at Temperatures Tested

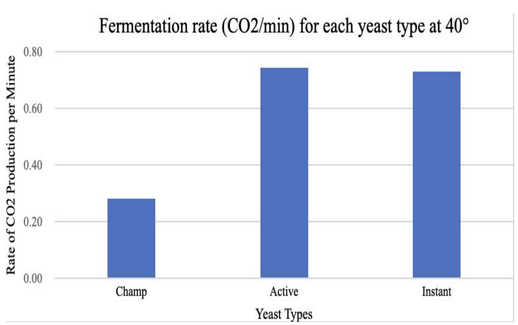


Table 1. Fermentation Rate at 40° C of the 3 different yeast strains

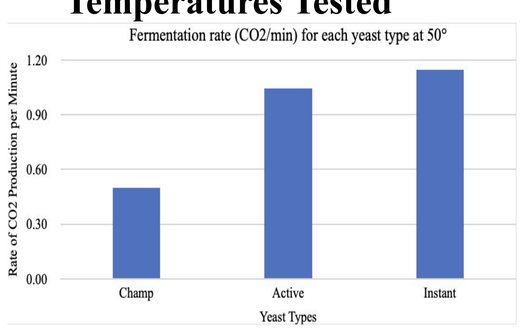


Table 2. Fermentation Rate at 50° C of the 3 different yeast strains

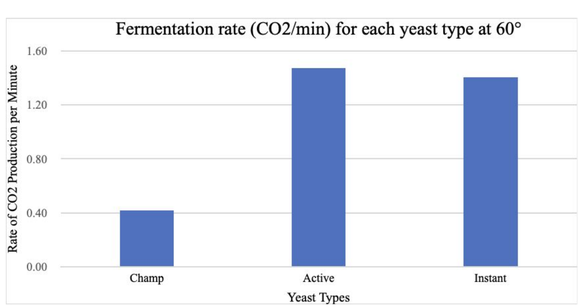


Table 3. Fermentation Rate at 60° C of the 3 different yeast strains

Discussion

According to Sergi Maicas, yeast fermentation is essential in the making of bread and different yeast strains will determine the quality of the bread as well as the final appearance of the dough, volume, texture, and taste. We experimented with three different yeast strains in three different temperatures to observe which strand will yield the most optimal results in those given temperatures. It was interesting to see that at a lower temperature – 40 degrees Celsius, there was not a major difference between all of them. However, when we left them in higher temperatures, they had significantly higher fermentation rate. Our hypothesis was somewhat supported within a certain range of temperatures. Surprisingly, the active strain had the highest fermentation rate at the highest temperature, 60 degrees Celsius; meanwhile, the instant strand gave out the most optimal result at 50 degrees Celsius. Nevertheless, both instant and active strand fermented at a faster rate in range of 50 – 60 degrees Celsius.We wanted to find out which strain of yeast would produce the most CO2 at the fastest rate in the most ideal temperature to determine which strain would yield the best result. We experimented with three different strains of yeast, active, instant, champagne within the best range of temperatures (from 40 – 60 degrees Celsius) which we believe that facilitated the most growth for the yeast cells. After the replicated 3 trials and the recorded average charts, we concluded that at 60 degrees Celsius, active strain would yield the best result; meanwhile, at 50 degrees Celsius, the instant strain would give the best result in fermentation rate. Interestingly, at 40 degrees Celsius, there was not much of a difference between the active and instant strain. Additionally, champagne yeast would work best at 50 degrees Celsius and came in last in fermentation rate. One of the obstacles that we encountered during the experiment was time limitation in replicating more trials, as well as conducting data.

If we were to conduct the experiment again, we thought it would be helpful to have more time, perhaps another week. It could help work out the kinks of our procedures. Also, find a different third type of baker's yeast, instead of using champagne yeast. In addition, another experiment that could take our research one step further would be to actually use the fermented yeast in bread baking to see if there was a measurable difference between strains in the rise and fluffiness of the bread produced.

Acknowledgements

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References/ Work Cited

[1] *What temperature kills yeast* (2018) *Bob's Red Mill Blog*. Available at: https://www.bobsredmill.com/blog/baking-101/what-temperature-kills-yeast/ (Accessed: November 29, 2022).

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