Unveiling the Impact of Sugar on Yeast Cell Population

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Biology 160: General Biology

Abstract

The collection of data drawn from this experiment allowed us to measure the effects seven types of sugar have on yeast production. Data was collected by counting yeast cell fermentation under a microscope and averaging the amounts of cells counted. This type of research is important to the medical commit, so better diagnoses can be made. We found that most sugars do increase cell growth through the process of glycolysis.

Introduction

Captivated by the world of yeast in our biology class, my partners and I were intrigued by this organism's ability to ferment in various conditions. Inspired by this curiosity, we delved into existing research to learn more about yeast cell growth. An article on the effects of different sugars on yeast fermentation (Powalski, 2008), and a study on the effect of sugar type on ethanol production (Armstrong et al., 2018), added depth to our understanding and inspired our own research project.

Building upon these studies, we honed our research to focus on the effects of seven distinct types of sugars: monk fruit, coconut, glucose, sucrose, maltose, fructose, and lactose. We formulated our research question: In what ways do various sugar types affect yeast cell population? Once we established our question, we hypothesized that yeast would exhibit varying cell counts when exposed to diverse types of sugars, with some sugars promoting growth, while others might inhibit or produce a neutral effect on the fermentation of yeast.

Methods

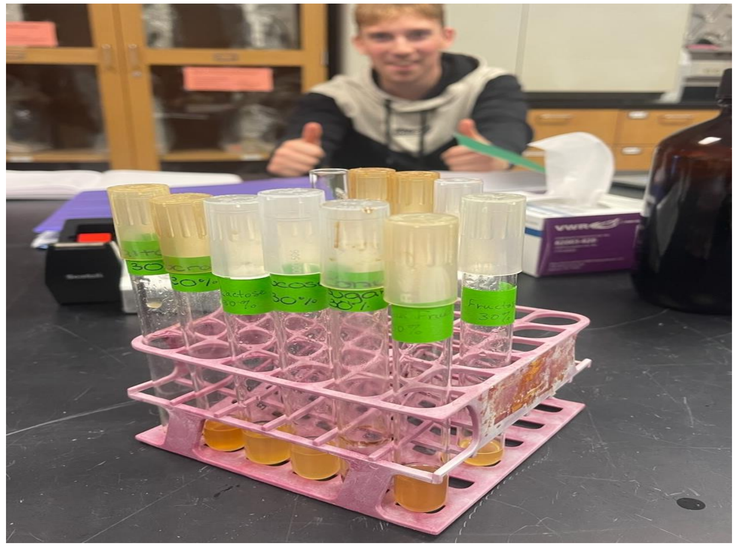
Materials & Location

For this experiment we organized a plan to test yeast cell production, collect data, and gather the supplies needed for the experimental process. Seven types of sugar were used, each at a 30% dilution in water and HAO yeast was utilized because it would be easier for cell counting. The materials were provided for the experiment in the biology lab and the experiment was carried out in the lab. As data was collected, on week two we noticed a drop in the cell population that in later weeks showed increase in the number of cells. As the process and testing continued, the experiment was proving the hypothesis to be accurate.

Procedure

To start our experiment, we combined 2.5mL of our various sugar solutions with 1mL of yeast in 7 separate test tubes, allowing fermentation in an incubator for three weeks. Performing weekly cell counts, we utilized hemocytometer slides, pipettes, a microscope, a tally counter, and methylene blue. We added one drop of methylene blue and one drop of yeast sugar solutions to a hemocytometer slides, took two separate cell counts for each mixture, and averaged them. After three weeks, we were able to examine the impact of sugar on yeast cell counts during fermentation.

Yeast Fermentation Process



Picture 1. The picture above displays test tubes filled with different sugar solutions in yeast during their fermenting process.

Yeast Cell Population Data

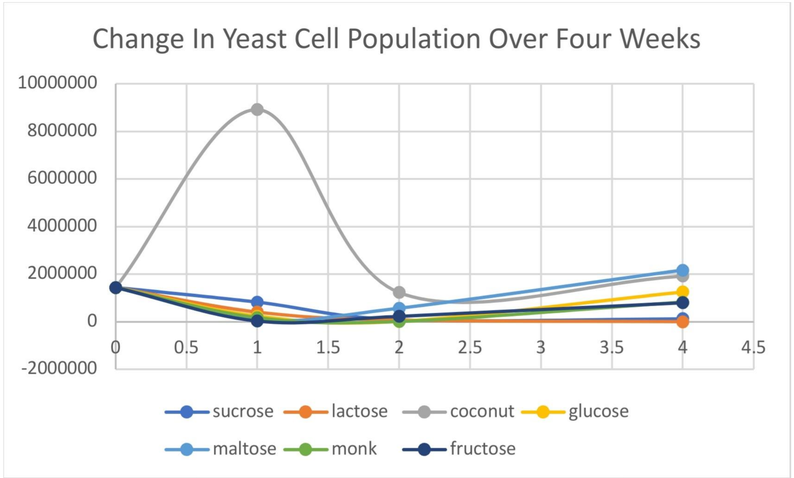


Figure 2. The data provided in the graph above, illustrates the average cell count per sugar solution over a four-week period. The conclusion of the data shows that maltose had the most significant growth compared to the other solutions.

Discussion

Data was collected over the last four weeks to quantify and observe the growth rate of yeast cells fed with several different types of sugar mediums. Our hypothesis predicted that each type of sugar solution would either cause an increase, decrease, or constant rate of cell growth. The results from this study failed to reject the hypothesis. There were a few similarities between mediums, and only two, maltose and coconut sugar, had remarkable growth. The average amount of yeast cells at the baseline was 144 cells. The sugars used were sucrose, lactose, coconut sugar, glucose, maltose, monk fruit sugar, and fructose. They were at 30% dilution with water for the experiment. Results indicated that sucrose and lactose decreased in cell production, while coconut sugar, glucose, maltose, monk fruit sugar, and fructose all increased in population. The population of yeast cells grown in the maltose solution had the most significant difference in growth and increased by 3,000% from week zero to week four. These findings appear logical, due to maltose's regular use in commercial alcohol fermentation, as it has a fast rate. The data we recorded is important in determining which kinds of sugars affect cell production because, this information is used to understand glycolysis in our bodies which can help or hinder medical conditions, such as diabetes and cancer. Our findings of sugar's effect on cell population is on a small scale and would need to be replicated several times to gain the most accurate information, however this gives us a good understanding of how to conduct future experiments to find the most precise data.

Acknowledgements

We would like to express our gratitude to Lauren Maniatis, our biology teacher, for her support, expertise, and encouragement throughout this research project.

References/ Work Cited

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