The Impact of Sugar Concentration on Fermentation and Consumption

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Abstract

Through fermentation and spectrophotometry, we studied the impact of sugar concentration on yeast. We hypothesized that a higher sugar concentration doesn't necessarily correlate to a higher rate of fermentation or sugar consumption. The purpose of this experiment was to learn how sugar consumption impacts fermentation rate and the ideal sugar concentration for yeast consumption. Our hypothesis was proven correct as fermentation rate and sugar consumption stalled despite the higher concentrations.

Introduction

The fermentation of yeast is a process used all over the world and in industries such as the food and beverage industries. In this process, the yeast consumes glucose in order to make energy in the form of ATP. One of the ways fermentation could be affected is the amount of sugar available to the yeast (Timmermans, 2022).

In this experiment we wanted to know how does the sugar concentration influence the fermentation rate and rate of sugar consumption. Due to previous fermentation experiments conducted, we thought that as the sugar concentration got higher, then both the fermentation rate and the sugar consumption rate would stay the same.

Methods

Materials & location

The materials used in this experiment included a yeast maltose solutions, sucrose, distilled water, Benedict's reactant, cuvettes, micro pipettes and pipette tips, microcentrifuge tubes. Equipment included a pcr machine, and spectrophotometer. The location was lab room 110 and we collected data every week on Monday.

Procedure

Different concentrations of maltose solution were prepared with yeast, each placed in fermentation tubes and in the thermal incubator where results remained consistent for 3 weeks. We checked and recorded how maltose concentration affects yeast fermentation and rate of sugar consumption.

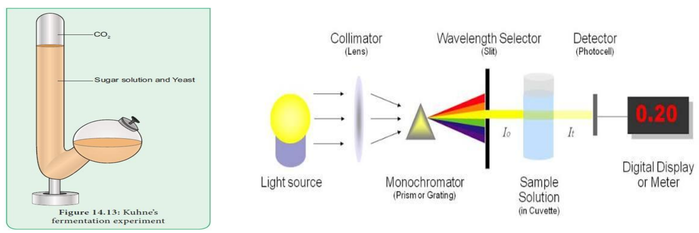


Figure 1. materials we used during our procedure that helped us determine how sugar concentration affects fermentation and rate of sugar consumption

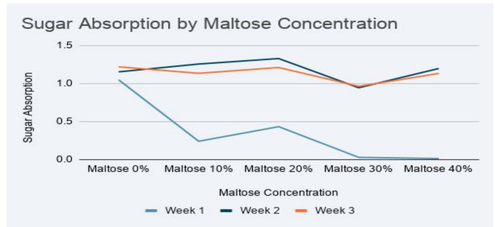
Data

sugar concentration			
Maltose	week 1	week 2	week 3
0%	1.04	1.15	1.216
10%	0.237	1.253	1.131
20%	0.429	1.325	1.207
30%	0.015	0.941	0.96
40%	0.009	1.194	1.129

Fermentation			
Maltose	week 1	week 2	week 3
0%	0	0	0
10%	0	0	0
20%	0	0	0
30%	0	0	0
40%	7.6mL	0	0

figure 1. sugar concentration and fermentation results over the course of 3 weeks

Fermentation Rate and Sugar Absorption



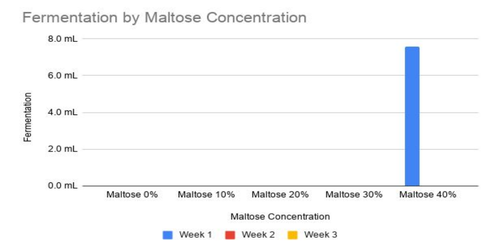


Figure 2. Sugar absorption per sugar concentrate sample over the course of 3 week experiment. Fermentation rate per sugar concentrate sample over 3 week experiment.

Discussion

According to the collected data, every concentration sample did not have a linear relationship with fermentation rate or sugar absorption. Fermentation was in fact effectively zero among all samples, except for 40% maltose. 40% M had the highest fermentation rate collected on the initial day of the experiment, but for all following days of data collection had zero fermentation like all other concentration samples. Sugar absorption among all concentration samples were in a near identical range during every data collection.

The teams conclusion was that fermentation had stalled in all concentration samples after the maximum amount of maltose had been consumed by the yeast. This resulted in no fermentation data for samples 0%, 10%, 20%, and 30%. The 40% sample had recorded fermentation in the first day of data collection, but all following collections yielded no fermentation.

Our findings have indicated that higher concentrations of maltose don't directly affect fermentation rate or the rate yeast will absorb sugar content. The metabolic rate in maltose samples are relatively constant under similar conditions to the experiment. We would recommend this experiment to be repeated but with different yeast and sugar types, to understand if this a shared characteristic among all yeasts and sugars, or if different sugar and yeast types execute metabolic processes at different rates.

Acknowledgements

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