CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38679

Project Title

The Effect of Colored Light on the Respiratory Patterns in Saccharomyces cerevisiae

Abstract

Objectives/Goals

The objective of this experiment was to explore the effects of various colored lights on the carbon dioxide production in yeast during the fermentation process.

Methods/Materials

To perform the experiment, a homemade apparatus was built. This apparatus included a large bucket of water, in which an inverted graduated cylinder filled with water was placed. A vinyl tube was pushed all the way up the cylinder until it peaked above the water. This tube ran down through the cylinder and out of the water bucket, and connected to a glass flask which contained the metabolizing yeast. When the yeast respired, the gas produced would go through the tube and displace the water in the graduated cylinder. The yeast mixture included dry active yeast, granulated sugar, and water at about 38 degrees Celsius. The CO2 levels were measured in 4 minute intervals for a total of 20 minutes per trial. 5 trials per colored light/control.

Results

The results showed that white light actually enhanced the CO2 production in the yeast, producing a mean of 49.2 mL of CO2, while green and blue light slightly inhibited it (41.7 and 43.4 mL, respectively). The control experiment (no light), yielded the same results as the red light trials, about 45 mL CO2. The carbon dioxide production however, did not oscillate, but this may have been because of the short amount of time in which the experiment was conducted.

Conclusions/Discussion

White light had the best effect on the metabolism of the yeast. This is most likely because white light emulates sunlight, which is what the organism is naturally exposed to. Red light, unlike hypothesized, did not enhance the CO2 production in the yeast. However, blue and green light inhibited its metabolism. The oscillations were expected to reveal the circadian rhythms of the yeast, however, due to the short span of the experiment, this phenomenon was not observed. Applications of this data include light therapy, which could possibly revert to LED lights instead of lasers to treat various medical conditions, as LED light has proven to stimulate the cytochrome c oxidase enzyme (the primary photoreceptor) in the mitochondria of organisms, thus achieving the same effects as expensive lasers.

Summary Statement

LED light stimulates the cytochrome c oxidase enzyme in the mitochrondria of organisms, thus enhancing metabolic efficiency.

Help Received

My father helped me in designing my apparatus.

Preliminary