CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
S0418

Project Title
The Effect of FeS on Yeast Metabolism

Abstract

Objectives/Goals
The objective of this experiment is to see whether sulfide ions can be oxidized fast enough by S. Pombe and brewer's yeast sulfide oxidizing proteins, or if their rate of oxidation is too slow and the cytochrome c oxidase lipoprotein complex in the mitochondria and inhibited by the ions and the aerobic metabolism pathway of the yeast is shut down and it is forced into aerobic respiration.

Methods/Materials
I used 18 food solutions for each yeast sample: 10 for brewer's yeast and 8 for S. Pombe yeast. 2 samples of each brewer's yeast and S. Pombe sets were simple control, only having yeast and food. 2 of each set contained FeS, which ionizes in water to form HS^-. 2 of only the brewer's yeast set contained FeS and vinegar, which was used to makes the sulfide ions form faster. 2 of each set contained Na(2)SO(4), because it is a reducer of oxygen in the water. This was used because FeS is also a reducer of O(2) and Na(2)SO(4) was used as a control for this. 2 of each set also had NaHSO(3), and this was also used to the same purpose. The density of the water was measured every 12 hours to see if alcohol was being produced. The yeast was also aerated at this time. The experiment took 22 days.

Results
The brewer's yeast exposed to FeS showed the most dramatic decrease in water density. The control brewer's yeast went down slightly in density. The rest of the controls in the brewer's yeast set showed no change in water density. The S. Pombe set showed little change.

Conclusions/Discussion
The experiment showed that at least the brewer's yeast, were forced to switch to the anaerobic pathway because of the exposure to sulfide ions, inhibiting the production of ATP by means of the electron transport chain. The S. Pombe yeast didn't grow fast enough in order to see a change. The Na(2)SO(4) and NaHSO(3) stopped the yeast growth. The vinegar and FeS did the same. The controls went down in density slightly because the sugar in the water was still being converted to water and CO(2), which caused the density to go down slightly. This means that yeast sulfide oxidizing proteins can't handle the HS^- because the rate of oxidation for these proteins was too slow. This means that sulfide ions will have an effect on human mitochondria and won't simply be snuffed out by the defense system against these ions. That means that using H(2)S to induce suspended animation may be a possibility.

Summary Statement
My project is used to see whether yeast can handle a saturation of sulfide ions using the same sulfide ions oxidizing proteins which are found in the human genome or if their metabolism will be forced into the anaerobic pathway.

Help Received
I did part of my experiment under the supervision of a lab technician at the Placentia Linda Laboratory.