Whatcom COMMUNITY COLLEGE

pH IN YEAST AND HOW IT AFFECTS THE GROWTH AND PROTEIN AMOUNT

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Biology 160: General Biology

Abstract

We used different levels of pH (5,7,9) in yeast over a 3-week period. Measured the growth of live and dead cells, and the amount of protein produced. We hypothesized that the more basic the pH the higher the protein and growth amounts. The data supported our hypothesis in protein and partially supported in growth. The importance of our topic was to gather data on how yeast and pH interact with each other to produce protein and how it grows.

Introduction

Our topic was how the different levels of pH (5,7,9) in yeast affect the growth and the amount of protein. We hypothesized that the more basic the pH the higher the protein and growth amounts. In the journal article Effects of high-medium pH on growth, metabolism and transport in Saccharomyces cerevisiae, it found that "Growth inhibition at high pH was also not due to significant lower amino acid transport by the cells or incorporation into proteins. The cell cycle stopped at pH 9.0, probably due to an arrest as a result of adjustments needed by the cells to contend with the changes under these conditions, and microarray experiments showed some relevant changes to this response."

Methods

Materials & Location

We followed the Bradford Assay protocol for the protein, and the Hemocytometer protocol for the growth. We did this each week in the lab at Whatcom Community College. Collected data each week starting 7/27 and ending 8/10.

Procedure

We used the Bradford Assay protocol for weeks 1–3 (using the same original yeast mix) and the Hemocytometer protocol for weeks 1–3 to count the live and dead cells each week using the same yeast mixture from week 1.

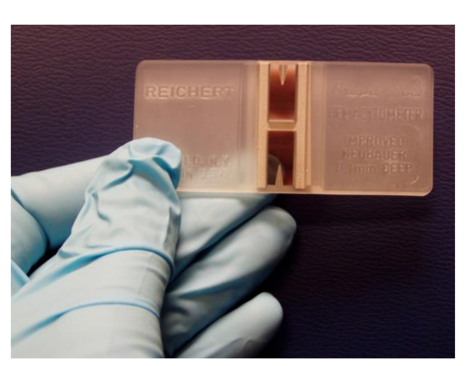

Figure 1. This is a picture of a Hemocytometer which was used each week to count the cell growth

Amount of Protein Produced and the Viability of live/dead cell growth

Weeks	Protein	Viability
1	PH 5: .663455 PH 7: .554786 PH 9: .506815	61.3%
2	PH 5: .186682 PH 7: .217031 PH 9: .498004	48.7%
3	PH 5: .12011 PH 7: .564576 PH 9: .731006	49.6%

Table 1. This table shows the 3 weeks we measured the amount of protein made at pH 5, 7, 9, and the viability of the live/dead cell growth

Number of Live Cell Growth

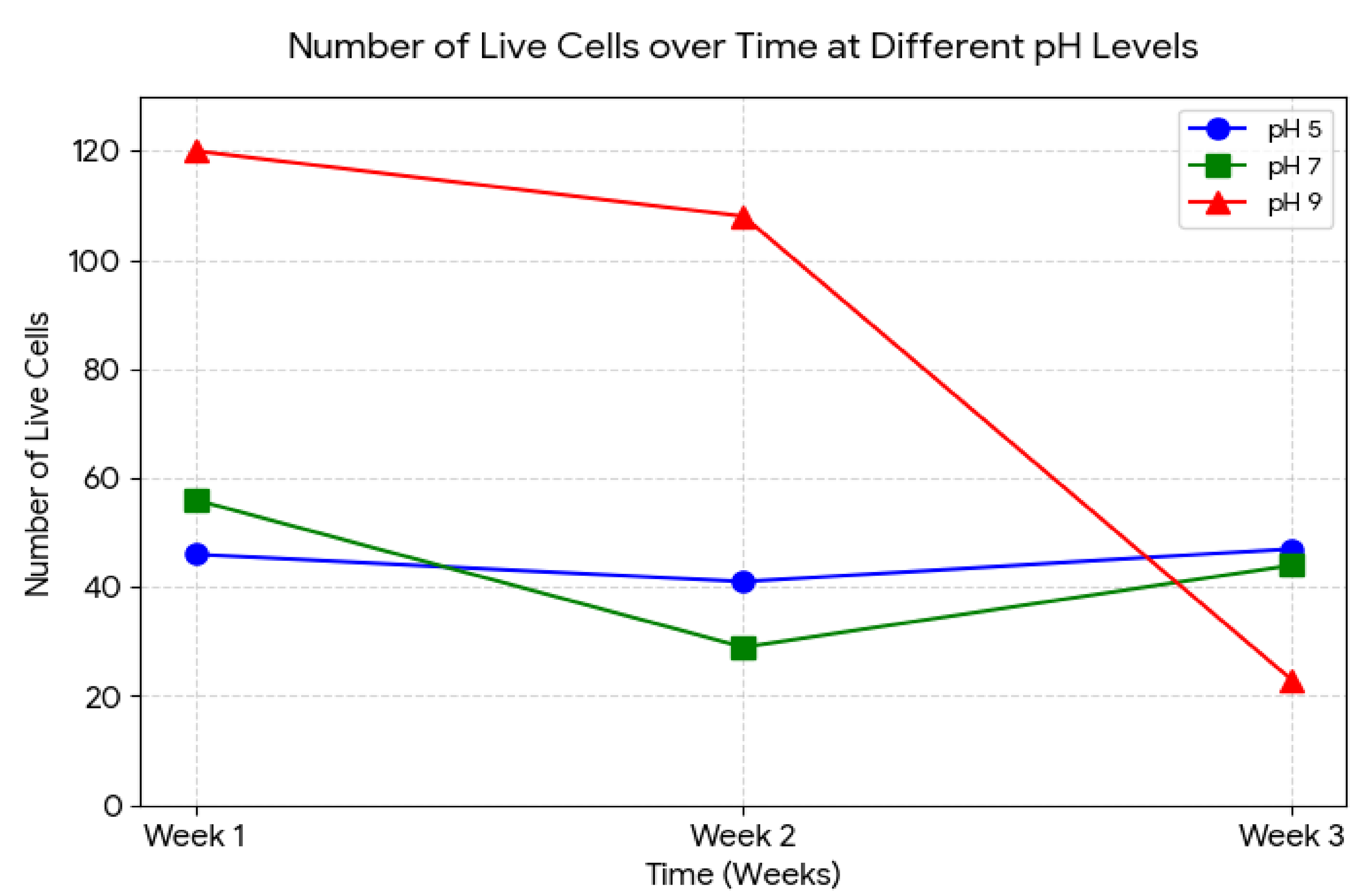

Figure 2. The line and dot graph shows the growth of live cells each week for pH 5, 7, and 9.

Discussion

The live cell count for pH for each week was 46, 41, and 47. pH 7 was 56, 29, and 44 with pH 9 at 120, 108 and 23. Our protein readings for each week were pH 5 .663455, .186682 and .12011, pH 7 .554786, .217031 and .564576, pH 9 .506815, .498004 and .731006. Our control group was 7 and our hypothesis was supported in protein and partially supported in growth. Our results showed consistent protein growth in all 3 weeks at pH 9, the most basic and showed mostly good live cell count growth at pH 9 except for week 3, but weeks 1 and 2 were supported.

Looking into our results, we found some similarities to other studies that had been constructed or looked further into the molecular level of what could be causing our results. One study found that, due to the basic pH, this was causing a breakdown of the cell. Making the cell go into defense mode producing more protein solubility to reduce the stress the cell was under (Serra-Cardona, Cana dell, Nariño). This allows us to further understand as to why the more basic the environment, the more protein was produced, because the cell, since the proteins are normally more acidic, was put into a stressful environment, causing it to go into survival mode and produce more protein due to its overall makeup change.

Our results showed that the more basic the pH, the better the protein growth in the yeast and the better the live cell growth each week, except for week 2 in the cell growth, in week 2, the best ratio of live/dead cells was at pH 5. The experiments done by Drummond and Triantafillou used similar methods to our experiment by using the blue dye, but their experiment was on a larger scale, they used 5mL of yeast with our experiment we used 1 mL and on week 3 we used 0.5 mL. Their results matched ours more but with more consistency since we had a different result in week 2. I believe the week 2 outcomes was very likely a human error, not a data error. In the future, I think it would behoove us to run the data at least two times to be sure we're collecting it correctly. The other studies and experiments we found do support our hypothesis. The more acidic the pH, the less growth and protein, the more basic the pH, the better the growth and protein, and the others were with bigger samples, which were fun to read about.

We were able to confirm our hypotheses and for future studies, we should use samples on a larger scale (like 5 mL as opposed to 1 mL or less, I believe that we will be able to see the growth more accurately. I also think we should experiment with different levels of pH to see if the hypothesis remains correct and/or where the hindrance begins and where the growth really flourishes.

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References/ Work Cited

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