Viability of Yeast Cells in Various Salt Solutions

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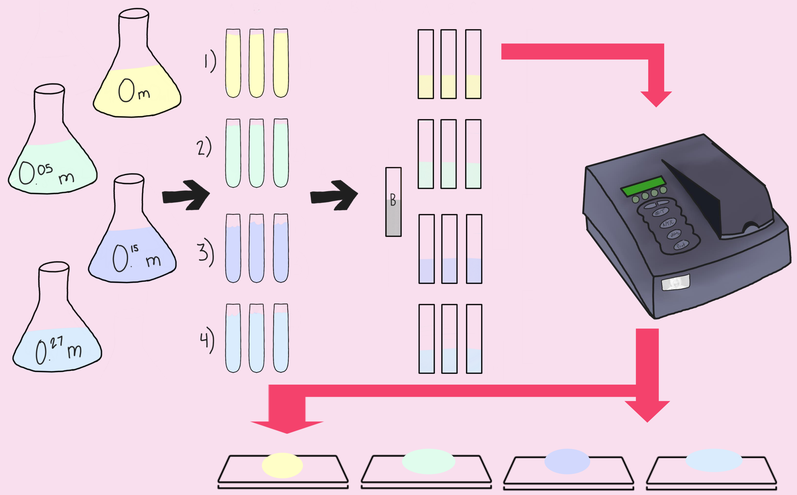
Hypothesis: When S. cerevisiae is grown in a solution with salt there will be a notable change in its cell viability and/or growth rate

Introduction

Saccharomyces cerevisiae is an ideal model organism for extrapolating results to eukaryotic cells due to its' rapid reproduction time and its cost effectiveness. Salt in know to inhibit yeast growth and can lead to cell lysis. Our experiment aims to see the halotolerance of *S. cerevisiae* in molarity solutions UP To 0.27M. The experiment uses a yeast viability assay, and mass spectrometer to determine the cell viability and optical density (growth rate).

Methods

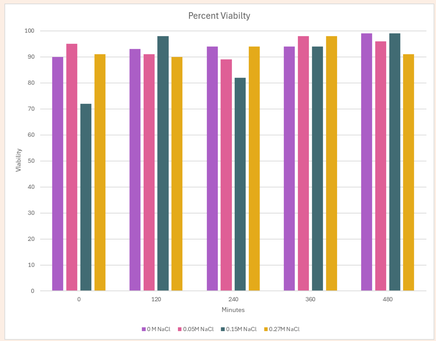


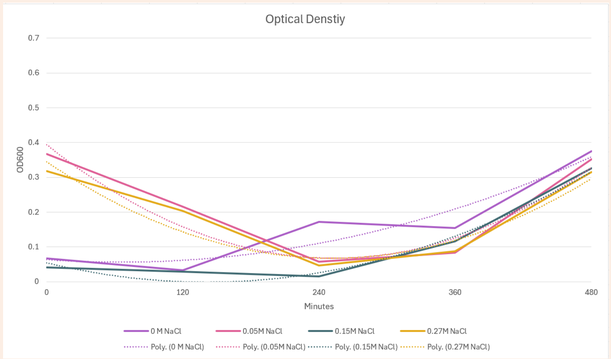
1) Using de-iodized NaCl and distilled water, create 3 salt solutions. Gather and label 12 sterile test tubes, fill each with 14mL of YEPD growth media. Add 300 µL of HBO yeast cells from an overnight to each tube.
2) Gather/label 13 cuvettes the same as the test tubes, label one as "B" for blank. Using micropipette, add 1000 µL of sterile YEPD. Fill each cuvette with 1000 µL of their corresponding solution.
3) Set spectrometer to 600nm; blank using "B", read and record each cuvette.
4) Place a drop of methylene blue on a microscope slide, put 10 µL of solution from each cuvette onto their own slide, mix with tip of pipette, let rest for 1 min & add cover slip.
5) Using microscope count 100 yeast cells, keeping track of how many are dead and alive. Record.
6) Repeat steps 4-8 every two hours for a total of 8 hours. Record all data.

Results

Yeast cell viability in 3 saline solutions and a control with no salt concentration. Yeast assay was performed with methylene blue every two hours and consistent results were viewed amongst all 4 groups. Group 2 (0.05M NaCl) had a particular dip in our last reading but still had a high optical density reading, despite this group 2 is still in agreement with the rest of the data as the readings were still around the 80% viability mark and should be regarded as an odd outlier.

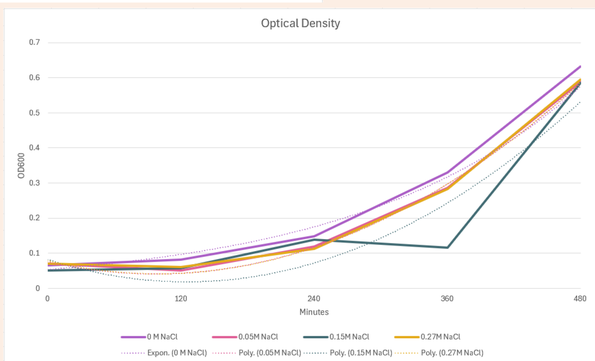
Yeast cell viability in 3 saline solutions and a control with no salt concentration. Yeast assay was performed with methylene blue every 2 hours, we viewed consistent cell growth rates throughout the 4 groups. There were two outliers within group 3 (0.15M NaCl), this can be seen alongside the optical density readings where group 3 had slightly lower readings. Our first methylene blue assessment at hour 0 was contaminated and impacted cell viability but once it was switched with a new methylene blue the viability counts stabilized.





Growth trends of *S. cerevisiae* in varying saline solutions over the course of 8 hours. During trial 1 data collection there were some unusually high optical density readings but as the samples reached the 4-hour mark, they evened out and we continued to see exponential growth for the last two readings.

Growth trends of *S. cerevisiae* in varying saline solutions over the course of 8 hours. During trial 2 we viewed a much more consistent result trend amongst all of our solutions and all of our collected data follows a consistent linear optical density readings.



Conclusion

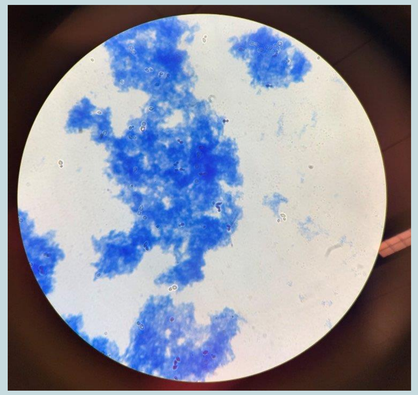


Image of Trial 2, 4c (0.27M NaCl)

Observe the dead (blue) & live cells (opaque)

Image by Kaya Miller, 2/23/24

Trials 1 and 2 optical densities both exhibited a rough exponential curve, especially from the 360 time point onwards. Despite trial 1 having a scattered start it ended reasonably uniform and notably at about half of trails 2's values. It's likely that this discrepancy is an error on the scientist's part. The cell viability counts of both trials were high at 80% or above, with 2 notable dips at trial 1, 0.05 M, time 480 and trial 2, 0.15 M, time 0, Both of which were brought down by a single outlying count from which the average was derived. Out of the 16 T-tests preformed (using Vasserstats) only 3 had a p-value less than 0.05, and of those the only ones in agreement across trials were series 3 (0.15 M) optical densities; both with a p-value of 0.02 for the final time. Overall, from the data collected, it does not seem that NaCl up to 0.27 M impacts cell growth or viability, But more trials are advisable. This data implies that there is a safe range for *S. cerevisiae* to be growth in, a principle that can be extrapolated to eukaryotic cells for applications like baking, pickling, and human salt consumption recommendations.

References

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