ABE 304 Bioprocess Engineering Laboratory

Executive Summary and Presentations

Executive Summary

- 1 page
- Concise summary of important information
- Intended for specific readers who want to know, but lack
  - Time
  - Patience
  - Energy to slog through a long, detailed report

Executive Summary

- The executive summary must be:
  - **Brief**: The executive summary is generally not longer than one page.
  - **Crisp**: Words and sentences must be relevant to the subject. Be succinct, focused, and organized.
  - **Readable**: The executive summary should be organized and formatted so that the reader can quickly extract the essential information.

Executive Summary

- Suggested organization
  - Introduction and Objectives
  - Procedure and Results
  - Conclusions and Recommendations

Examples

- #1
  - What is good?
  - What could be improved?

Effect of Temperature on Production and Xanthan Gum

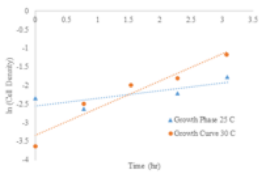
Introduction & Objectives

Fermentation is a microbial process that produces chemical compounds used in the production of fuels, pharmaceuticals, and food products such as xanthan gum. *Xanthamonas campestris*, which produces xanthan gum, is sensitive to temperature, pH, and nutrients available for growth. *X. campestris* utilizes glucose in fermentation media as a carbon and energy source to create xanthan gum. The effect of temperature on xanthan gum production was studied by fermenting at temperatures of 25 °C and 30 °C.

Procedure & Results

The production of xanthan gum and cell densities from three different cultures of *X. campestris* were analyzed. The three cultures differed in their inoculation times. To measure the cell density, the cells were incubated and agitated. The optical density was measured using a spectrophotometer. To measure the xanthan gum production, sulfuric acid was added to the *X. campestris* and the absorbances of the solutions were measured using a spectrophotometer. The results showed that the amount of bacteria and xanthan gum produced were altered by the temperature and the inoculation time.

- *X. campestris* cell density increased over time at temperatures of 25 °C and 30 °C (Figure 1).
- *X. campestris* growth was higher at 30 °C and grew more quickly than at 25 °C (Figure 1).
- The kinetic growth curve showed the *X. campestris* lag phase was longer at 25 °C than at 30 °C, indicating that *X. campestris* preferred to grow at 30 °C compared to 25 °C (Figure 1).
- Xanthan gum production from *X. campestris* increased as fermentation time increased (Figure 2).
- A greater amount of xanthan gum was produced at 25 °C than at 30 °C (Figure 2).



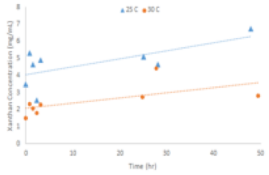


Figure 1: Kinetic Growth Curves

Figure 2: Xanthan Production

Conclusions & Recommendations

Time and temperature provided variance in xanthan gum production. As time progressed, xanthan gum concentration increased as the bacteria consumed glucose to create the xanthan gum. At a temperature of 30 °C, the bacteria grew more quickly and produced xanthan more efficiently. At 25 °C, the bacteria produced a greater quantity of xanthan than at 30 °C. The following are experimental recommendations:

1. To optimize the creation of xanthan gum, utilize a temperature of 25 °C.
2. To optimize the growth of *X. campestris*, use a temperature of 30 °C.
3. A temperature of 25 °C will result in a larger volume production of xanthan gum at a lower operating cost.

Examples

- #2
  - What is good?
  - What could be improved?

Introduction and Objectives

Biological engineers use fermentation in order to produce a variety of products. *Xanthamonas campestris* was used to ferment glucose into xanthan gum in a batch process in order to gain first hand insight on the importance of optimization. Temperature greatly affects the rate xanthan fermentation where increasing the temperature, increases the rate of fermentation (Shu & Yang, 1990). Temperature was varied during the fermentation process, and samples were taken to prove the correlation between temperature and xanthan gum yield.

Procedure and Results

Prior to the experiment, phases three and two were inoculated at 48 and 24 hours, respectively, and phase one was inoculated at time zero in order to be able to take samples from all sections of the growth curve. The temperature was varied at 25°C and 30°C. Samples from each phase and temperature were taken every 45 minutes, and tested for cell density, glucose concentration, and xanthan concentration. Xanthan concentration was determined by making a calibration curve from a stock solution and measuring absorbance. Cell density was measured by centrifuging a sample, re-suspending the pellet, and then measuring optical density. Glucose concentrations were found by adding GOPOD to the supernatant, incubating it, and then reading absorbance at 510 nm. Relative cell density at 30°C leveled off around 0.45 and around 0.40 for 25°C. The xanthan concentration for 25°C was found to be much higher than the 30°C culture. Values obtained for glucose concentrations were all around 0.35 mg/mL, and not changing with time.

Conclusions and Recommendations

The relative cell density increased as a function of time until plateauing for both temperatures, thus matching the expectation from the growth curve. The relative cell density of the 30°C cultures was higher than the 25°C, which was also expected. Glucose assays did not produce plots with logical trends. Glucose was supposed to decrease steadily over time, but it did not. The warmer temperature was expected to produce xanthan gum faster, but it did not. Assay errors are likely the reason for the results. Recommendations for future experiments include determining the ideal dilution factor for assays and to make sure the spectrophotometer values make sense. Both of these additional steps would help alleviate potential sources of error during the course of the experiment.

Executive Summary

- Each group should pick one of the labs performed in class and write an executive summary.
  - Preferred to choose report that you did the least well on to show improvement.
  - Use the feedback from your graded lab reports to help write your executive summary.

- Due Wednesday May 2 at NOON