Quantifying Microgravity Effects on Headspace Limited Ethanol Genesis by Saccharomyces Pastorianus

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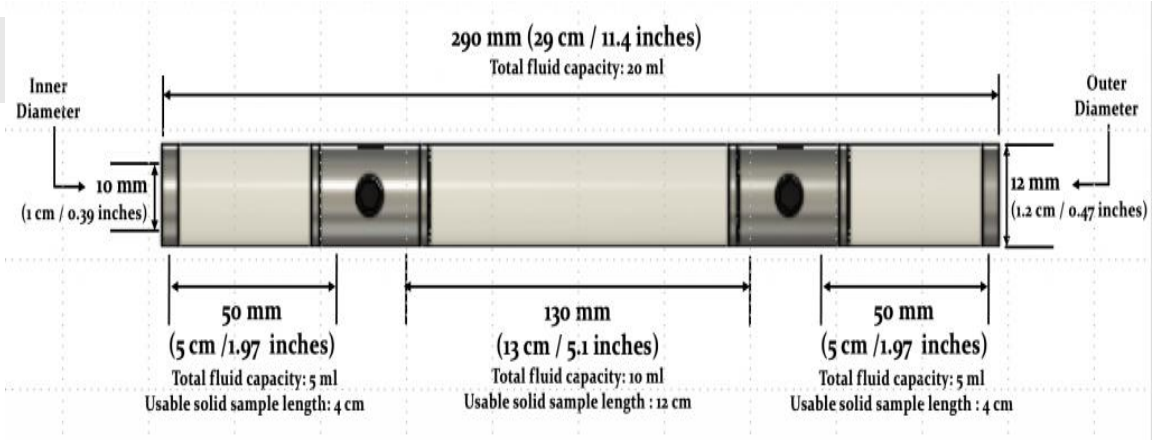
Background

Fermentation performance depends not only on yeast metabolism, but also on physical properties such as convection, sedimentation, and the dynamics of CO_2.In microgravity, these processes vanish, and properties such as viscosity and surface tension take over. This experiment uses a sealed, isolated environment with Saccharomyces pastorianus on maltose to test how microgravity changes the process of fermentation.

Research Question:
How does the absence of gravity affect Saccharomyces pastorianus' ability to undergo anaerobic fermentation using maltose as a fuel source?

Significance

Yeast is a very common resource for producing items such as bread and alcohol. Learning the effects that gravity has on yeast's ability to ferment and survive in microgravity has many applications pertaining to humanity's ability to survive in space, and the future precautions that must be made.



Methods

The tube will be separated into three chambers by two valves.

Chamber One

- A speck of yeast, serially diluted to a ratio of 1:100, three times total.
- Sterile water is added to bring the total volume of the chamber to 12.7mL.

Chamber Two

- 5.483 mg of Maltose is weighed out.
- Add enough sterile water to bring solution to 12.72mL total volume.
- Take out any impurities that might affect the sensitive yeast by purifying the solution with a filtered syringe.

Chamber Three

- Contains 1.82 mL of 16% methanol free formaldehyde, to settle the yeast.

Operational Timeline and Triggers

On the day the payload would arrive on the ISS, **A=0**, the experiment begins. Valve 1, separating the yeast compartment (Chamber 1) and the maltose (Chamber 2) is opened and the fermentation process can begin. The compartment is expected to reach a pressure of 1.5-1.6 PSIG by the time the next interaction window**, A+2**. During this next interaction window, Valve 2 is opened, allowing the flow of the formaldehyde. This will kill the yeast, securing the ethanol produced and stopping further production. This is to stop the yeast from exceeding the 2 PSIG pressure restriction.

References

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