Effect of Environmental Factors on Growth Kinetics of Biocontrol Agent *Bacillus thuringiensis* Bacterium using 2L and 5L A+ Sartorius Stedim Biostat® Fermentation Systems

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Introduction

- *Bacillus thuringiensis* (Bt) is a Garm-positive bacteria that resides in soils and makes proteins that are toxic to most insects when ingested.
- It is not toxic to humans since we cannot activate them.
- It consists of a spore and a protein crystal within the spore which gives it its toxicity.
- It is commonly used as an insecticide.
- We tested for the optimal growth rates for three variables: temperature, RPM speed, and aeration.

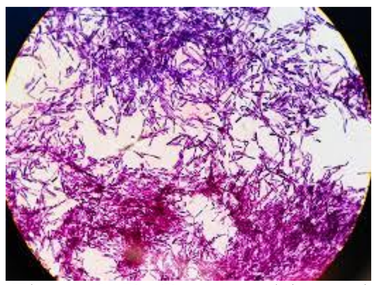


Figure 1: Bt Gram-positive stain (2).

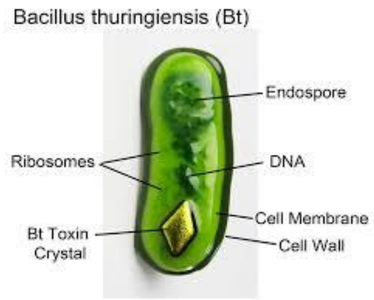
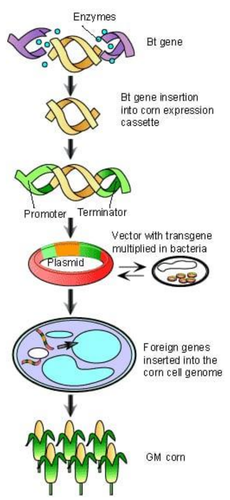


Figure 2: Bt image showing protein crystal (3).

Importance of *B. thuringiensis*

- Bt has been used as an insecticide since the 1920s and is common in organic farming.
- It is the source of the genes used to genetically modify crops so they can defend against insects.



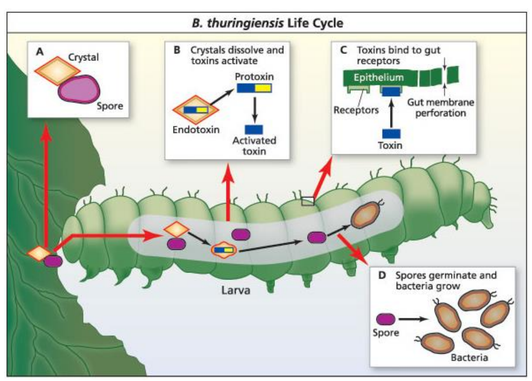
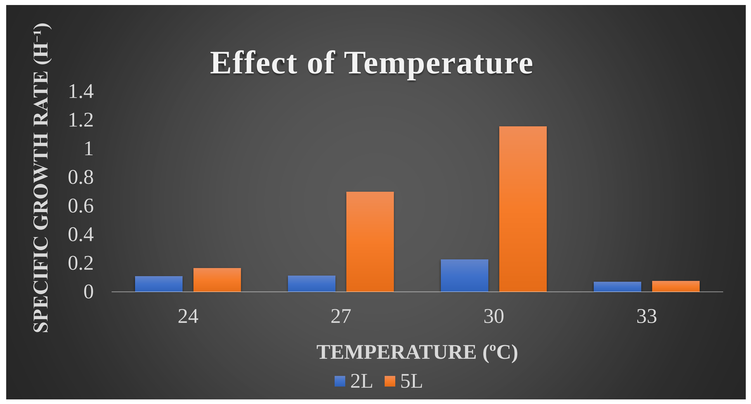
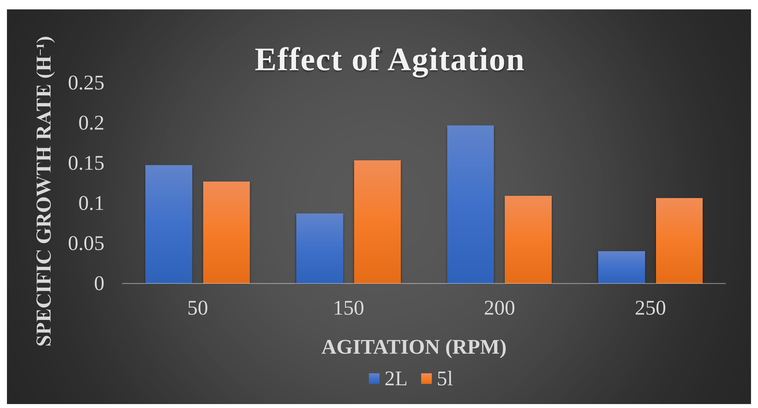


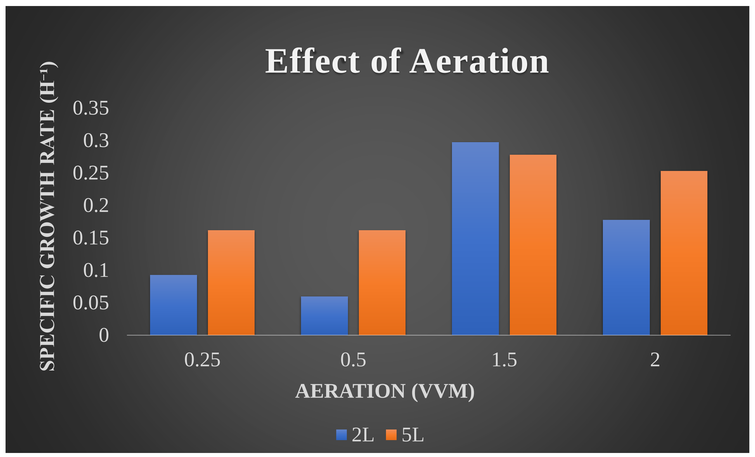
Figure 4: Bt Life Cycle (4).

Figure 3:Process and role of Bt in GMO crops (4).

Results







- The 2 L bioreactor had optimal conditions at 50 RPM, 30º C, and 1.5 VVM
- 2 L bioreactors highest SGR was 0.2974 h^{-1} with the lowest doubling time being 1.0122 h^{-1}.
- The 5 L bioreactor had optimal conditions at 150 RPM, 27º C, and 1.5 VVM.
- 5 L bioreactors highest SGR was 1.1557 h^{-1} with the lowest doubling time being 0.2605 h^{-1}.

Materials and Methods

Step 1: Bioreactor Preparation using nutrient broth.
Step 2: Transfer *Bacillus thuringiensis* culture into bioreactor.
Step 3: After 24 hours, record and analyze *Bacillus thuringiensis* growth

Figure 5: Bioreactor full set up

Figure 6: Bt culture media after being on the shaker for 24 hours.

Conclusion

With knowing the specific growth rates of Bt, we are able to research greater aspects involving the bacteria. Future applications involve protein isolation of Bt, and exposure of this protein to test tolerance of toxin on insects. This would allow us to see how much Bt is needed in pesticides without it being harmful to other organisms.

References

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