Evaluating the Efficacy of Sterilization Techniques on Martian and Lunar Regolith Simulants

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Background

- Martian and lunar regolith simulants are used to understand the future of terrestrial life on other celestial bodies.
- The regolith simulants consist of material that is terrestrially sourced and therefore is susceptible to contamination by microorganisms that don't exist on the surfaces of Mars and the Moon.
- **We hypothesize that the regolith simulants are not sterile fresh out of the bag**
- There is a lack of knowledge regarding sterility of the simulants.
- These microorganisms could affect research conducted using the regolith simulants. This could especially impact plant growth studies either through the presence of pathogens or plant growth promoting microorganisms.
- **How do we determine if the simulants are sterile?**

Figure 1: Surface Sterilization. Bags and surfaces were wiped with ethanol to ensure sterile working conditions.

Procedure

- Fresh regolith simulant samples were collected and cultured on various agars to determine microbial count.
- Repeat using autoclaved regolith simulant to determine the efficacy of this sterilization method
- The three different growth mediums used in the procedure are Nutrient Agar, Sabouraud Dextrose (SD) Agar and Glycerol Yeast Extract (GYE) Agar.

Agar types used in the procedure:

Nutrient Agar	SD Agar	GYE Agar
General purpose, bacteria	Fungi, dermatophytes	Spore forming bacteria, Actinomycetes

Results

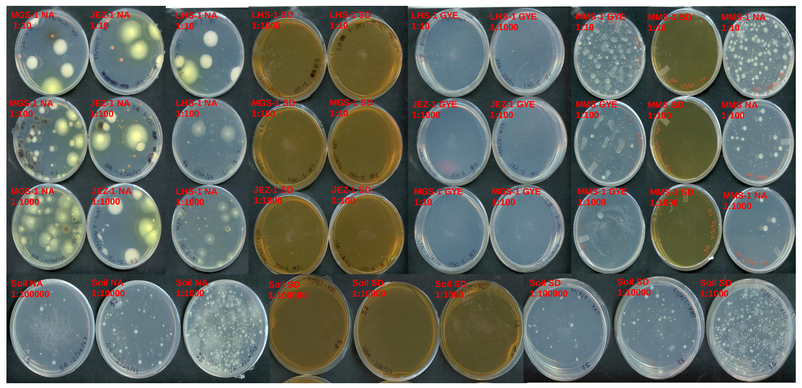


Figure 4: Cultivations from fresh regolith samples, with soil for control.

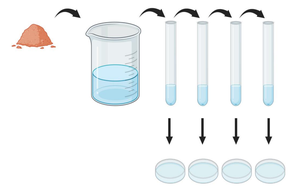


Figure 2: Fresh regolith simulant diluted and cultured on the different growth mediums.

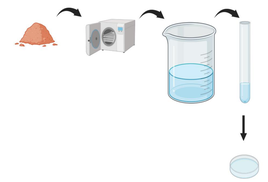


Figure 3: Autoclaved regolith simulant cultured on the different growth mediums.

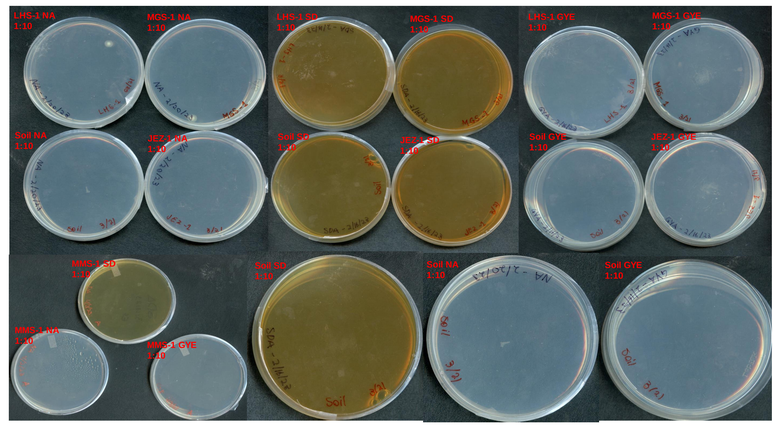
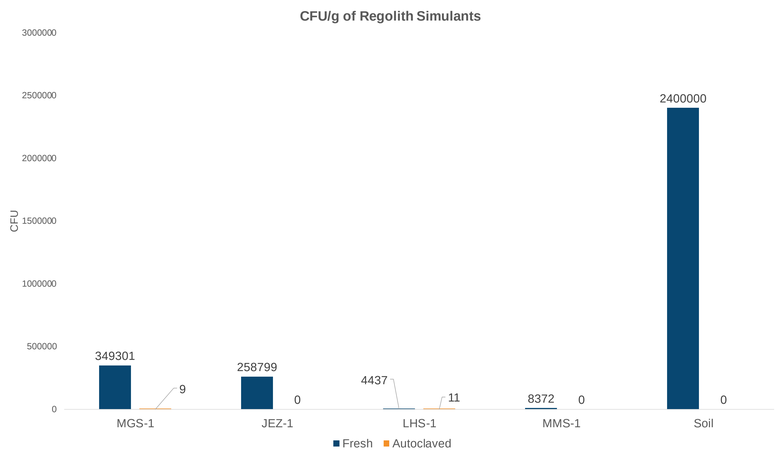
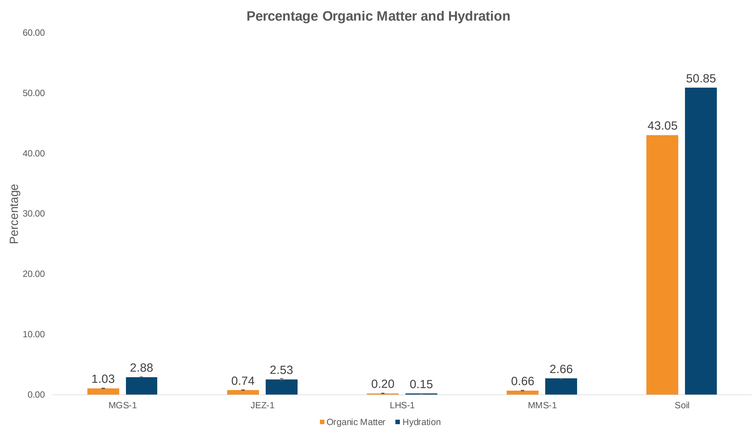


Figure 5: Cultivations from autoclaved regolith samples.





Conclusion

- Regolith simulants are not sterile and could be a reservoir of plant growth promoting bacteria or pathogens.
- However, these populations are not as significant as expected.
- We recommend that regolith simulants must be sterilized before using it for biological research.

Future Directions

- Grow plants in regolith after Loss on Ignition to see how well they grow with the organic matter removed.
- Perform experiment using other sterilization techniques to determine most efficient sterilization method.

References

- Leboffe, M. J., & Pierce, B. E. (2015). *Microbiology: Laboratory theory and application* (4th ed., pp 641-642)..