

“Martians and Moon Bugs:” Progress Report on Extracting DNA from Lunar and Martian Regolith



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2. Research Question

How many microliters of *E. coli* broth needs to be added to soil samples in order to maximize nanograms per microliter of DNA extracted?

1. Introduction

- Soil microbiology is vital to optimizing agriculture in lunar and martian settlements
 - Increasing crop yield
 - Decreasing crop spoilage
 - Limiting food born disease.
- DNA extraction is vital to analyzing microbiomes
 - Counting Nitrogen fixing bacteria
 - Assessing Mycorrhizal associations
- Previous DNA Extractions of lunar regolith have resulted in minimal nanograms of DNA per microliter. (Vencer et. al, 2025)
 - < 3.4 nanograms/microliter DNA needed for PCR and gel electrophoresis

3. Methodology

1. Sterilize soil with autoclave
2. aliquot 250mg of sterile soil into six tubes
3. inoculate 15 mL of 12.6 g/500 mL LB broth with *e.coli* and let incubate for 48 hours.
4. add 300 microliters of broth to two 250mg soil samples. Repeat with 600 and 900 microliters
5. Extract using Quick-DNA Fecal/Soil Miniprep kit (Zymo) and FastDNA SPIN Kit for Soil (MP biomedical) DNA extraction kits.
6. Quantify nanograms of DNA per microliter using DNA Fluoremeter

4. Results

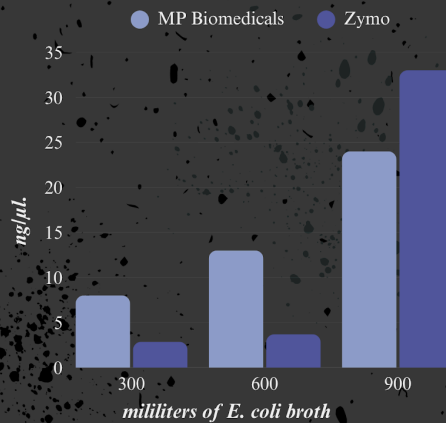


Fig. 1: Results of DNA extractions with comparable kits FastDNA SPIN Kit for Soil (MP Biomedicals) and Quick-DNA Fecal/Soil Miniprep kit (Zymo)

7. References

1. Vencer, E. et. al, (2025) *The Role of Cyanobacteria in Enhancing Radish Growth in Simulated Extraterrestrial Soils*, University of Colorado, Boulder

5. Discussion

- 900 microliters of *e.coli* broth provided the most DNA ng/μL.
- Zymo extractions stagnated with 300 and 600 μL of *E.coli*.

Limitations

- Distribution of cells per μL.
- Lack of Qiagen kit.
- Application of data is limited - more research is needed

6. Future Research

How can researchers maximize the nanograms of DNA extracted from Lunar and Martian regolith using commercially available kits?

Kit Used	No modifications	Increased cell lysis	Additional phosphate buffers
FastDNA ^{SPIN} Kit for Soil (MP Biomedicals)	Three 250 mg samples	Three 250 mg samples	Three 250 mg samples
Quick-DNA Fecal/Soil Microbe Miniprep Kit (Zymo)	Three 250 mg samples	Three 250 mg samples	Three 250 mg samples
QNeasy PowerSoil Pro Kits for Soil DNA Extraction (Qiagen)	Three 250 mg samples	Three 250 mg samples	Three 250 mg samples

Fig. 2: Proposed result matrix for future DNA extractions of *E. coli* from Highland, Lowland, and Martian regolith.