



Analysis of Extraction Techniques Employed to Detect the Chemical Composition of Biomarkers in Simulated Martian Soil

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INTRODUCTION

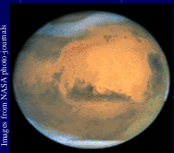
In order for us to propose solid evidence of present or past life on Mars it is important that efficient methods of detecting the chemical evidence present in Martian soil be found.

Objectives

- Successful methods for testing the biomarkers under dreadful conditions or "degradation" of Martian atmosphere with the assumption that life possibly existed millions of years ago.

Searching for more techniques may allow us to

- build on more sensitive methods of exposure.
- Prepare future explorations for identification of signs of life.
- Give proposals about the evolutionary development of the surface of Mars over time.



Mars simulant soil which is produced by the JSC Jet Propulsion Lab is used to represent the soil on the surface of Mars.

METHODS

- Mars simulant soil was used in all of the samples that were deliberated into glass test tubes.
- There were experimental samples containing E. coli bacteria and control samples containing only buffer.(Tris HCl)

➤ The samples were divided into "earth" (having been exposed to oxygen and water) and "mars" (exposed to nitrogen and moisture depleted) samples.

- Mars samples were placed in a sealed desiccator where oxygen was vacuumed out and nitrogen was pumped in, in order to produce a Mars atmosphere.

➤ Both Earth and Mars soil was baked in a 150°C oven to induce an "accelerated aging" process.

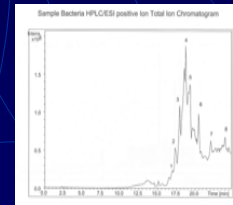
- Earth samples were processed by 2 filtrations after having been baked at least 2 weeks. The liquid samples as a result of filtration from the Mars simulant Earth samples were eluted with methanol and run on High Performance Liquid Chromatography (HPLC) for analysis.



This procedure was used in continuation of the previous technique that was used and it was found to be fairly competent but not necessarily superlative.

RESULTS

- One control sample and one experimental sample of simulant soil containing E. coli were run on the mass spectrometer just to test the amount of contaminants that may have been present in comparison to the previous soil that was used for research in the lab.

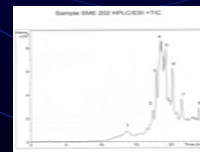
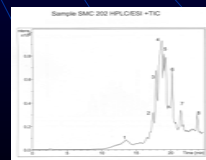


- These graphs clearly show that the soil is relatively "clean" and free of contaminants encountered as a result of previous research. The peaks at the end represent the compounds present in the buffer and the bacteria induced soil, respectively.



- The tables and graphs results of the HPLC so far show that the soil is comparatively clean and few in contaminants unfortunately nothing new has shown up in the data that can give confirmation that there may be any life.

- This graphs show very little change in the amount of compounds in the soil even after it was allowed to "age" in the 150° C oven for 2 weeks.



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CONCLUSION

- There are a lot of compounds present in the soil sample which make them hard to analyze. More ways would have to be devised to elute the compounds and further breakdown the biomarkers. The samples containing the bacteria were anticipated to have a noticeable difference from the controls with an increased number of peaks. As of yet there is no recognizable difference in the chromatograms of the experimental vs. the control in this particular research.

FUTURE GOALS that would enhance this project would be:

- a more trustworthy purification of contaminants from the soil,
- a more efficient extraction procedure,
- the addition of more bacteria to the soil sample



Though this "microbe" is significant evidence, it is imperative that we be aware that this does not establish the fact of extra-terrestrial life.

