COMPARING THE STABILITY OF NON-PROTEINOGENIC AMINO ACIDS TO PROTEINOGENIC AMINO ACIDS WHEN IRRADIATED AND IN PERCHLORATE SPIKED MARS REGOLITH. L.A. Rowe[1] K. Davidson[1], C. Smith[1,2], C. Kovarik[1], J. Peller[1,3]. [1]Valparaiso University, Department of Chemistry, 1710 Chapel Drive, Valparaiso, IN, USA, 46383, laura.rowe@valpo.edu, [2] Ivy Tech Community College, 3100 Ivy Tech Drive, Valparaiso, IN 46383, [3]University of Notre Dame, Notre Dame Radiation Laboratory, 102 Radiation Research Building, Notre Dame, IN, 46556.

Introduction: All known living organisms on Earth utilize the same 20 (22) proteinogenic amino acids to build their proteins via translation. However, a multitude of non-proteinogenic amino acids have been found both in meteors and in the products of origin of life experiments. [1-3]. Moreover, different local concentrations of building block molecules combined with the different environmental pressures of Mars may have resulted in a different repertoire of available amino acids if life were to have evolved. The purpose of this work is to explore whether or not non-proteinogenic amino acids exhibit equitable or enhanced stability as compared to proteinogenic amino acids when exposed to environmental conditions mimicking conditions found in space or on Mars, with equitable or enhanced non-proteinogenic amino acid stability suggesting the possibility of life selecting an alternative amino acid lexicon during extraterrestrial evolution.

UV and Gamma Irradiation: As a first step in this study the three aromatic proteinogenic amino acids (Tyr, Trp, Phe) and 20 non-proteinogenic aromatic amino acids were exposed to different doses of gamma radiation and different wavelengths of UV light while in a dilute aqueous solution. The amount of intact (non-degraded) amino acid present in the samples before and after irradiation was determined by integration of UHPLC-MS peaks. Results showed that many of the non-proteinogenic amino acids tested were just as stable as their proteinogenic counterparts under these conditions, and certain fluorinated amino acids had enhanced stability [4]

Perchlorate Spiked Regolith Analysis: Currently, we are studying the stability of proteinogenic and non-proteinogenic amino acids when they are exposed to 0.5% sodium, magnesium, or calcium perchlorate dissolved in deionized water or deionized water adjusted to a pH of 8.3, and the stability of these amino acids in Mars MMS regolith simulant mixed with perchlorate and water [5]. The extent of degradation of the amino acids is quantified by integrating UHPLC-MS peaks and comparing to appropriate control solutions. Future work will look at the stability of peptides and proteins under these conditions, as well utilizing a carbon dioxide saturated atmosphere during stability studies to more accurately mimic Martian surface conditions.

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