CHARACTERIZATION OF MINNESOTA LUNAR SIMULANT FOR PLANT GROWTH

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Processing of lunar regolith into a plant growth medium is crucial in the development of a regenerative life support system for a lunar base. Plants, which are the core of such a system, produce food and oxygen for humans and, at the same time, consume carbon dioxide. Because of the scarcity of lunar regolith, simulants must be used to infer its properties and to develop procedures for weathering and chemical analyses. The Minnesota Lunar Simulant (MLS) has been identified to date as the best available simulant for lunar regolith. Results of the dissolution studies reveal that appropriately fertilized MLS can be a suitable medium for plant growth. The techniques used in conducting these studies can be extended to investigate the suitability of actual lunar regolith as a plant growth medium.

Dissolution experiments were conducted using the MLS to determine its nutritional and toxicity characteristics for plant growth and to develop weathering and chemical analysis techniques. Two weathering regimes, one with water and one with dilute organic acids simulating the root rhizosphere microenvironment, were investigated. Elemental concentrations were measured using inductively-coupled-plasma (ICP) emission spectrometry and ion chromatography (IC). The geochemical speciation model, MINTEQA2, was used to determine the major solution species and the minerals controlling them. Acidification was found to be a useful method for increasing cation concentrations to meaningful levels.

Initial results indicate that MLS weathers to give neutral to slightly basic solutions which contain acceptable amounts of the essential elements required for plant nutrition (i.e., potassium, calcium, magnesium, sulfur, zinc, sodium, silicon, manganese, copper, chlorine, boron, molybdenum, and cobalt). Elements that need to be supplemented include carbon, nitrogen, and perhaps phosphorus and iron. Trace metals in solution were present at nontoxic levels.

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