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STUDY OF PLANT GROWTH UNDER THE EFFECTS OF PERCHLORATE AND ITS RADIOLYSIS PRODUCTS ON MARTIAN REGOLITH

Abstract

The main goal of the PRatian research is to understand the germination of plants under the effects of perchlorate and its radiolysis products on Martian soil. Perchlorate (ClO4-) is a salt found within the Martian soil. This chemical compound may be harmful because it is potentially toxic to humans if ingested or inhaled (i.e. it interferes with human's ability to absorb iodine); however, presence of perchlorate on Martian soil shows several advantages for future exploration on the Red Planet. For example, at high temperatures, perchlorate is a powerful oxidant suitable for rocket propulsion and it can be utilized as an onsite fuel resource for sample return missions and in the eventual human exploration of Mars. During September 2016, an Analog Mars simulation will take place in Rzepiennik Biskupi, Poland, to develop the understanding of the environment and the systems and operations required to future Martian human exploration. The PRatian experiment consists in four chambers, equipped with temperature and humidity sensors, root modules, draining system and camera, for each station of Earth/Mars regolith combinations: (1) Mars regolith simulant + below average (0.75%) solution of Calcium Perchlorate and demineralized water, (2) Mars regolith simulant + solution of 0.75% Calcium Perchlorate and demineralized water, (3) Mars regolith simulant + above average (0.75%) solution of Calcium Perchlorate and demineralized water (4) Earth regolith simulant + solution of 0.75% Calcium Perchlorate and demineralized water. The plants chosen for this experiment are garden cress (Lepidium sativum) and kidney beans (Phaseolus vulgaris) due to their fast germination rate, small size and important nutritional value as a possible source of food for humans living conditions on Mars. Part of the research and development work addressed in this paper is the main design, integration, and software description that performs data sampling and collection tasks. During the two weeks experiment, further step towards understanding human interaction with the Martian environment will be accomplished and thus, another step closer towards sending humans to Mars.
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