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THE FIRST BIONIC NUTRIENT-GENERATOR SYSTEM; A CO2 CONVERSION SYSTEM FOR LONG-DURATION SPACE MISSIONS AND SUSTAINABILITY ON EARTH

Abstract

- Dr. Tara Karimi - Eng. Samantha Albright - Eng. Khalifa Alfalasi - Eng. Mohammad Almuhairi The purpose of this research project is to utilize an existing component on earth, which considered as a polluting component, and same time this component can be a resource that can be utilize on other planet such as Mars. This project will have its impact in different sectors such as energy industry, food science and deep space exploration. First stage of this abroad topic will focus on food science and convert CO2 into useful energy source component for a human body, such as glucose. This conversion process can be implemented and used in areas facing difficulties in food resources. Example of this case is to apply this conversion in the ISS to have an existing food source for the crew, and this will be our first approach toward utilizing CO2. One of the major challenges of a Mars mission is the production of human life-support supplies including a nutritious source of food. Currently, almost all supplies are supported from the earth. Dependence on earth is a risk for long-duration space missions. Therefore, development of innovative solutions for in-situ resource utilization (ISRU) is critical to provide a self-regenerative food system for long-duration space missions. One such ISRU solution is inspired by nature and applies advanced methods of electrochemistry and synthetic biology, resulting in an innovative process to produce critical nutrients. CO2, water, and light energy are used as the main feedstocks. CO2 is an ideal feedstock for ISRU since astronauts breathe out 1kg/day/person of CO2, and 96The research project will aim on designing the first Bionic Nutrient-generator system which has the capacity for the continuous production of critical nutrients in an automated process. The Bionic Nutrient-generator system simulates photosynthesis in plants by utilizing CO2 and solar energy to produce carbohydrates (starting from glucose). Glucose plays a central role in providing energy for almost all bio-manufacturing processes. The physicochemical system will produce glucose and its intermediates from CO2. Specific catalysts will be applied for the selective production of each carbohydrate. In addition to glucose, this approach can be used for bio manufacturing of other critical biomolecules including amino acids, vitamins, probiotics and other critical pharmaceutics for deep space exploration and settlement applications.