Challenges of Life Support/Medical Support for Human Missions (8)
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USE OF METHANE IN CLOSED-LOOP LIFE SUPPORT SYSTEMS.

Abstract

The paper discusses the use of methane generated in the process of oxygen recovery from carbon dioxide released by humans during hydrogenation in the Sabatier reaction in the course of oxygen recovery in a regenerative life support system for crews on a space mission. It demonstrates that the generated methane can be used for both pyrolysis and production of food protein. The use of pyrolysis is enabled by new technologies, which make it possible to lower the temperature of the process down to 500-700 deg.C and obtain readily removable carbon. It makes the case for the use of existing methods of fodder protein production from methane based on methanotrophic commercial-grade bacteria in food protein production after some additional purification, and also provides a calculation basis and recommendations for the design of methanotrophic (methane oxidizing) fermentation units and food protein production from major specialists in methanotrophic production technologies. It shows that it is feasible to operate onboard a spacecraft simultaneously both systems: for methane decomposition and biological methane oxidization with food protein production, because the amount of additional oxygen required for food protein production is less than 10Development of a system for food protein production from methane will enable its use as one of the systems for providing food on the Moon and planets, as well as a backup system in space missions to the Moon and planets. This could be facilitated by mining water directly on the Moon and planets, and obtaining from it the additional oxygen required for methanotrophic biosynthesis. In addition to this, since the Martian atmosphere is 95% carbon dioxide, there is a potential for using hydrogen extracted from water available on Mars to obtain in Sabatier reaction large amounts of methane, apart from the fact that Mars has a certain amount of naturally occurring methane. All these factors allow using methane for food protein production on the Moon and planets.