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PROSPECTIVE FOR MICROBIAL FUEL ELEMENTS APPLICATION IN BIOLOGICAL LIFE SUPPORT SYSTEMS

Abstract

The long terms of the planned space missions require creation of mostly closed life support systems (LSS) for crews in spacecraft with cyclic regeneration of substances in an artificial ecosystem, because food reserves will significantly exceed the mass and volume of LSS with a closed cycle of biogenic elements (regenerative LSS). Future planetary bases also need similar LSS. Organic waste will inevitably accumulate during operation of inhabited containment facilities. To include biogenic elements contained in organic waste in the subsequent stages of the cycle, it is necessary to transform their form of mineral compounds, because they can be absorbed by plants in hydroponic greenhouses. One of the ways to mineralize organic waste is their biodegradation by microorganisms. Microbial fuel cells (MFC) - devices for generating electric current using microorganisms - have been widely used in recent years in research devoted to searching for alternative energy sources from renewable organic raw materials. In addition to the source of electricity, MFC can be used as bioreactors for biodegradation and mineralization of organic waste, because it affects redox reactions and metabolism of microorganisms. MFC increase the rate of organic substrates biodegradation and biological removal of nitrogen, phosphorus and sulfur. In order to provide technological support for the biodegradation of liquid organic waste, the design of the MFC cell was developed, which allows one to obtain a difference in electrical potentials that occurs under certain conditions as a result of the vital activity of an association of microorganisms and to remove the resulting biogas. In MFC of this type, it is possible to carry out anaerobic fermentation of solid organic waste (vegetable waste). Research has been carried out on biological nitrogen removal in the course of biodegradation of vegetable waste, as well as from activated sludge from sewage and river sludge.