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STUDY OF MICROBIAL DECOMPOSITION OF DISPOSED PERSONAL HYGIENIC MEANS AND PLANT WASTES IN THE INTERESTS OF LIFE SUPPORT OF LUNAR BASES AND INTERPLANETARY MISSIONS KORSHUNOV D.V., ILYIN V.K. INSTITUTE FOR BIOMEDICAL PROBLEMS, MOSCOW, RUSSIA

Abstract

Long periods of interplanetary space expeditions and the operation of planetary bases require creation of maximally closed life support systems for crews with cyclic regeneration of substances in an artificial ecosystem. Among the wastes that are formed in the conditions of a manned space flight already now, an essential part form personal hygiene wipes. Uneaten parts of plants form greenhouses waste. Disposed personal hygiene products and greenhouse waste will occupy significant volumes, which increase the system mass. In addition, the waste contains contaminants and microbes, which are dangerous. Microbial decomposition of above types of waste was tested. Fermentation was carried out in two consecutive stages. On the first gauze and vegetable waste (potato peel, cabbage stalk, carrot peel) were hydrolyzed with anaerobic cellulolytic microorganisms. Clostridium thermocellum F1 strain was used to degrade gauze tissue. Associations of mesophilic microorganisms were used to decompose plant wastes. In the second stage, the liquid media obtained as a result of first stage, was purified by aerobic microorganisms: fungi and bacteria. The purification efficiency was evaluated by chromatography-mass spectrometry. Preliminary studies have shown that as a result of cleaning both concentration and mass of volatile organic compounds contained in products of gauze and vegetable wastes decomposition decreased significantly, in some cases by several hundred times. Analysis of cultural solutions obtained as a result of plant residues biodegradation revealed a number of important biogenic elements in them: potassium, calcium and nitrogen. These data allow us to consider cultural solutions as a potential source of elements of mineral nutrition of greenhouse plants. An experiment on aerobic aftertreatment of gauze tissue biodegradation products obtained was also conducted in of orbital flight on the Bion-M No. 1satellite. The cultivation of the strain Trichoderma viridae on a satellite was carried out in bioreactor for 14 days at 37C. The strain of Trichoderma viridae showed stable growth under conditions identical to those of pre-flight cultivation. Analysis of gas phase composition by chromatography-mass spectrometry revealed total concentration of volatile organic compounds in the products of biodegradation of gauze to decreased about 7 times by after purification in space flight conditions. The total amount of volatile organic substances also decreased 3 times. Despite the limited oxygen resource associated with the lack of aeration system in the bioreactor, the Trichoderma viridae strain demonstrated the ability to produce an aerobic aftertreatment of the substrate obtained after anaerobic biodegradation of gauze tissue under orbital flight conditions.