SPACE LIFE SCIENCES SYMPOSIUM (A1)
Interactive Presentations (IP)

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EVALUATION OF TOXICITY OF NUTRIENT SOLUTIONS FOR PLANTS BASED ON MINERALIZED ORGANIC WASTES FOR THE BTLSS

Abstract

The higher-plant greenhouse in biotechnical life support systems (BTLSS) is the major component of the environment, and, hence, the physiological state of the plants must be maintained within a normal range. One of the main issues here is preparation of a nutrient solution based on mineralized organic wastes produced within the system that would not inhibit the growth and development of these plants. Researchers of the Institute of Biophysics (Krasnoyarsk, Russia) have developed a way to mineralize organic wastes in hydrogen peroxide by using an alternating current electric field, which has been found to be generally suitable and to yield environmentally safe products: a mineralized solution and gas. The solution, however, exerted an inhibitory effect on the first three generations of the plants in the plant conveyor, which was later reduced – probably due to biofiltration of the solutions by the microflora developing in the irrigation tanks. In order to achieve stable operation of the BTLSS and preclude repeated inhibition of plant growth, measures should be taken to remove this adverse factor. A possible major reason for this inhibitory effect could be certain toxic compounds. Therefore, mineralized solutions were autoclaved to see whether these compounds could be destroyed. Preliminary experiments with microalgae showed that the probability of crop germination increased significantly (over 90%) in the nutrient medium based on the autoclaved mineral solution while the crops grown in the non-autoclaved medium died in more than 50% cases. This study describes results of the experiment in growing even-aged wheat stands on nutrient solutions based on autoclaved and non-autoclaved mineralized human wastes. The authors discuss the origin of the toxic compounds and propose an experimental method of bioluminescent rapid test of mineralized solutions to check their suitability for preparing nutrient solutions for higher plants.