

IAA/IAF SPACE LIFE SCIENCES SYMPOSIUM (A1)
Life Support, habitats and EVA Systems (6)

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PHYSICAL MODEL OF THE CLOSED ECOSYSTEM**Abstract**

The atmosphere is the most important component of the environment in closed life support systems (CLSS), and the mass exchange between this component and the living components of the system – the crew, higher plants, microflora, etc. – occurs continuously. An unsuitable composition of the air may considerably impair vital functions of the living components or even cause their death, which is inadmissible if the system includes humans. Therefore, it is imperative to develop the approaches enabling the monitoring and adjustment of the air composition in the CLSS. Several-month-long experiments conducted in BIOS-3 (Russia) and Lunar Palace 1 (China) showed the possibility of establishing a balanced gaseous environment in a closed system with humans and higher plants. However, as the processes of organic waste treatment are improved, additional measures may need to be taken to process accompanying gases and to purify the atmosphere. Researchers of the Institute of Biophysics (Krasnoyarsk, Russia) have designed a physical model of the CLSS (without humans) to simulate the interaction between the plant compartment and different original approaches to organic waste processing. These approaches include the use of the soil-like substrate for biological oxidation of organic waste and the physicochemical method of mineralization of human wastes. In addition to supplying mineral nutrients to plants, the use of these methods would alter the air composition, and it would have to be adjusted depending on the approach used to process wastes. This study describes the methods of physicochemical processing, capturing, and after-treatment of the resultant gases and the entire atmosphere of the system.