

Some possibilities of a closure degree increase and matter turnover intensification in the bioregenerative life support system BIOS-3

A.A. Tikhomirov (1), S.A. Ushakova (1), V.V. Velichko (1), À.G. Degermendzhy (1), Ch. Lasseur (2), B. Lamaze (2)

(1) Institute of Biophysics Siberian Branch of Russian Academy of Science, Russia, (2) ESA ESTEC, 2200 AG Noordwijk, The Netherlands, (tikhom@ibp.ru / Phone: +7-3912-494317)

The problems of scientific-technical substantiation of perspective joint IBP-ESA works on imitation of functioning of stationary bioregenerative life support systems (BLSS) on Moon and/or Mars are discussed. With this purpose the possibilities of matter turnover intensification and closure degree increase which can be achieved after modernization of the BIOS-3 (BLSS designed and constructed at Institute of Biophysics, Siberian Branch of Russian Academy of Sciences (IBP SB RAS) , Russia) are considered. These works are performed in the frame of INTAS IA project under the joint SB RAS-ESA financial support. Specifically, at the expense of intensity increase of photosynthetic active radiation from 150 to 250 Wt/m² the productivity of photosynthesizing unit on oxygen and biomass is supposed to increase on 50% on average. The given substantiation is based upon analysis of carried out preliminary experiments in a laboratory environment and in the BIOS-3 facility and also on series of experiments carried out at present time. The results of technical reconstruction of lighting and thermoregulation systems demonstrating practical possibility of these plans implementation are produced. On the grounds of mass exchange processes intensification the problems of a crew supply with vegetarian food and oxygen under a smaller photosynthesizing unit size are considered. Some possibilities of the humans' wastes utilization under combination of physicochemical and biological methods and necessary technical decisions allowing closure increase of matter turnover are analyzed. Experience and technologies developed in the frame of "MELISSA" program for their further use in joint ESA-IBP SB RAS experiments in the modernized BIOS-3 on imitation of BLSS work with the specified closure degree of matter turnover in conformity with the Moon and/or Mars conditions are estimated.