RESULTS OF THE STUDIES OF THE ORGANIC WASTE BIOTRANSFORMATION PROCESSES ON SATELLITES "BION-M" №1 AND "PHOTON-M" №4

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The problem of utilization of organic waste in confined habitats

- The long terms of interplanetary expeditions and the operation of planetary bases require the creation of the most closed biological life support systems (BLSS).
- Recycling of organic waste is necessary in closed BLSS .
- The disposal of waste beyond the limits, for example the lunar or Martian base, is unacceptable due to the presence of planetary quarantine.
- Warehousing and storage of waste is unsafe in the sanitary-epidemiological aspect.
- Already, a significant proportion of waste accounted for the waste of personal hygiene.

Bioreactor developed by BioTechSis, Ltd. for fermentation in space flight conditions

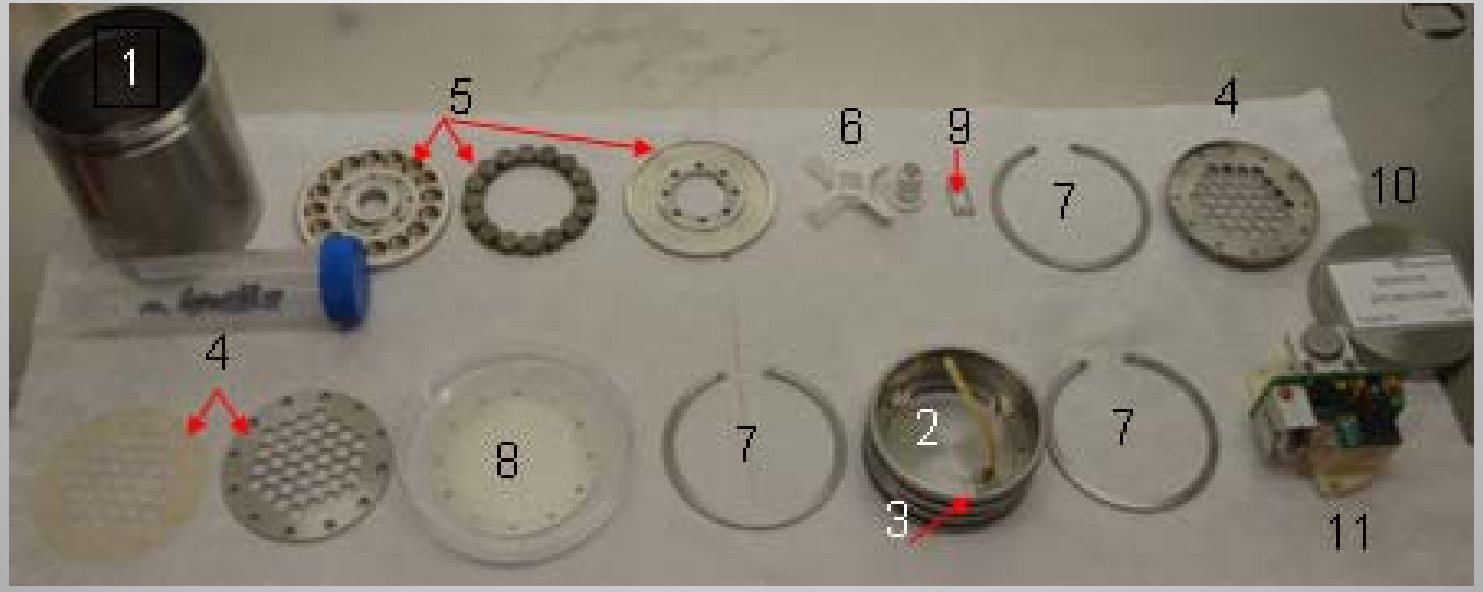


Fig. 1. The bioreactor of the BTS. 084.011.000, Plant No. 03, production of BioTechSis. 1. Bioreactor capacity, 2. Bioreactor lid-piston, 3. Pressure relief connector, 4. Membrane support (metal frame and silicone gasket), 5. Magnetic stirrer (base, metal frame and magnet), 6. Magnetic stirring blade and axis , 7. Shut-off ring, 8. Polymer gas permeable membrane, 9. Stirrer lock, 10 Top cover, 11. Built-in pressure and temperature sensor.

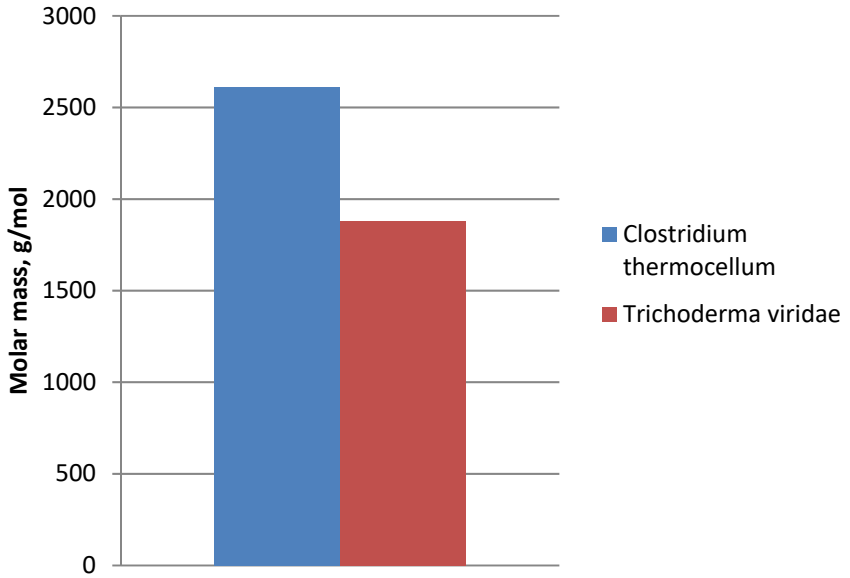
Analysis of cellulolytic activity after cultivation of Community No. 5 for 14 days at a temperature of 55 ° C and 14 days at a temperature of 25 ° C under conditions of orbital flight (Experiment) or on Earth (control, and repeated seeding of the culture), substrate - gauze.

Probe	Decomposition of cellulose, %
1. Fragmenter with Bion M (experiment)	5,3
2. Fragmenter with Bion M, having reinoculated after the flight	32,9
3. Fragmenter control on Earth	29,9
4. Fragmenter control on Earth, having inoculated	50,3
5. Fragmenter control in glass	62,2
6. Fragmenter control in the glass, reinoculated.	28,5

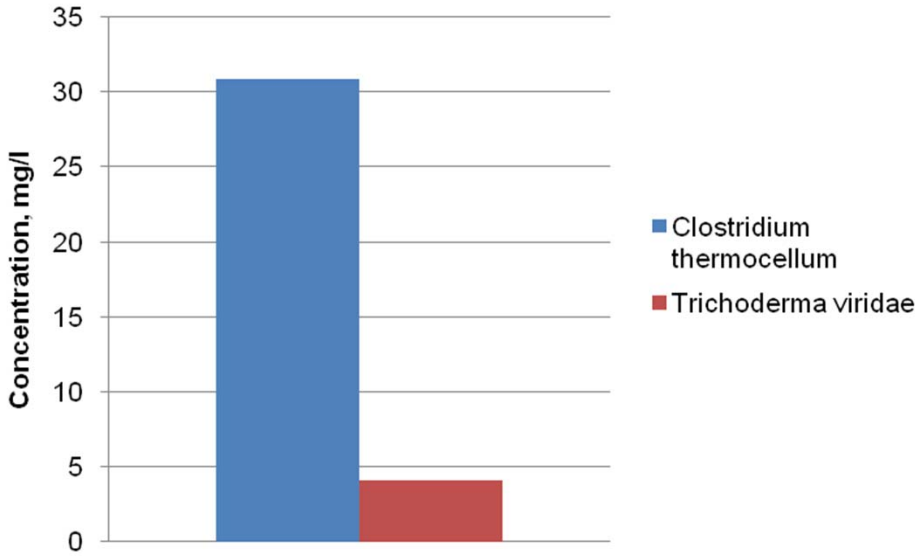
Analysis of the content of volatile fatty acids in samples after cultivation of Community No. 5 for 14 days at a temperature of 55 ° C and 14 days at a temperature of 25 ° C, under conditions of orbital flight (Experiment) or on Earth (control, and repeated seeding), substrate - gauze fabric.

Probe	Acetate	Propionate	Butyrate	Valeriat	Capronate
1. Fragmenter with Bion M (experience)	3.714	0.177	1.334	-	-
2. Fragmenter with Bion M, having reinoculated after the flight	46.716	0.283	17.184	0.102	0.156
3. Fragmenter control on Earth	31.861	0.882	25.494	0.106	0.030
4. Fragmenter control on Earth, having inoculated	47.127	1.293	14.233	0.036	-
5. Fragmenter control in glass	12.959	0.468	5.733	0.019	-
6. Fragmenter control in the glass, reinoculated.	40.703	0.717	22.265	0.067	0.019

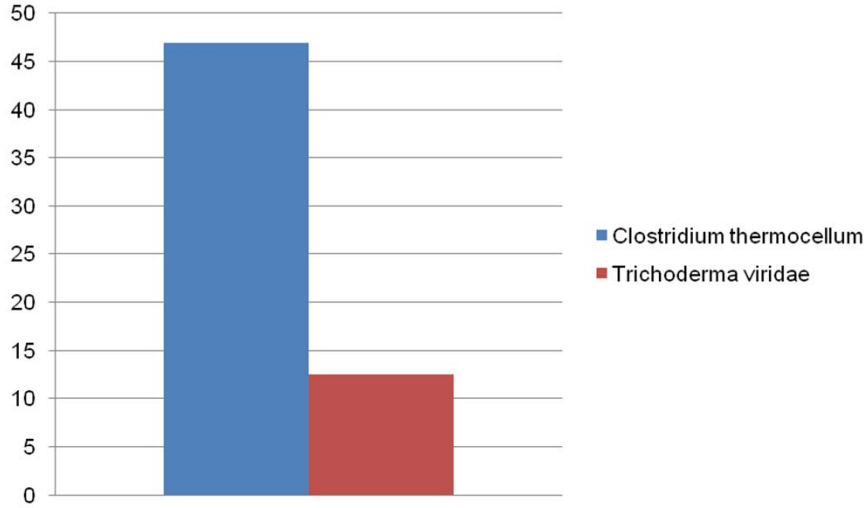
The total molar mass of volatile organic compounds before and after post-treatment using culture Trichoderma viridae in space flight condition



The total concentration of volatile organic compounds before and after post-treatment by Trichoderma viridae culture in space flight conditions



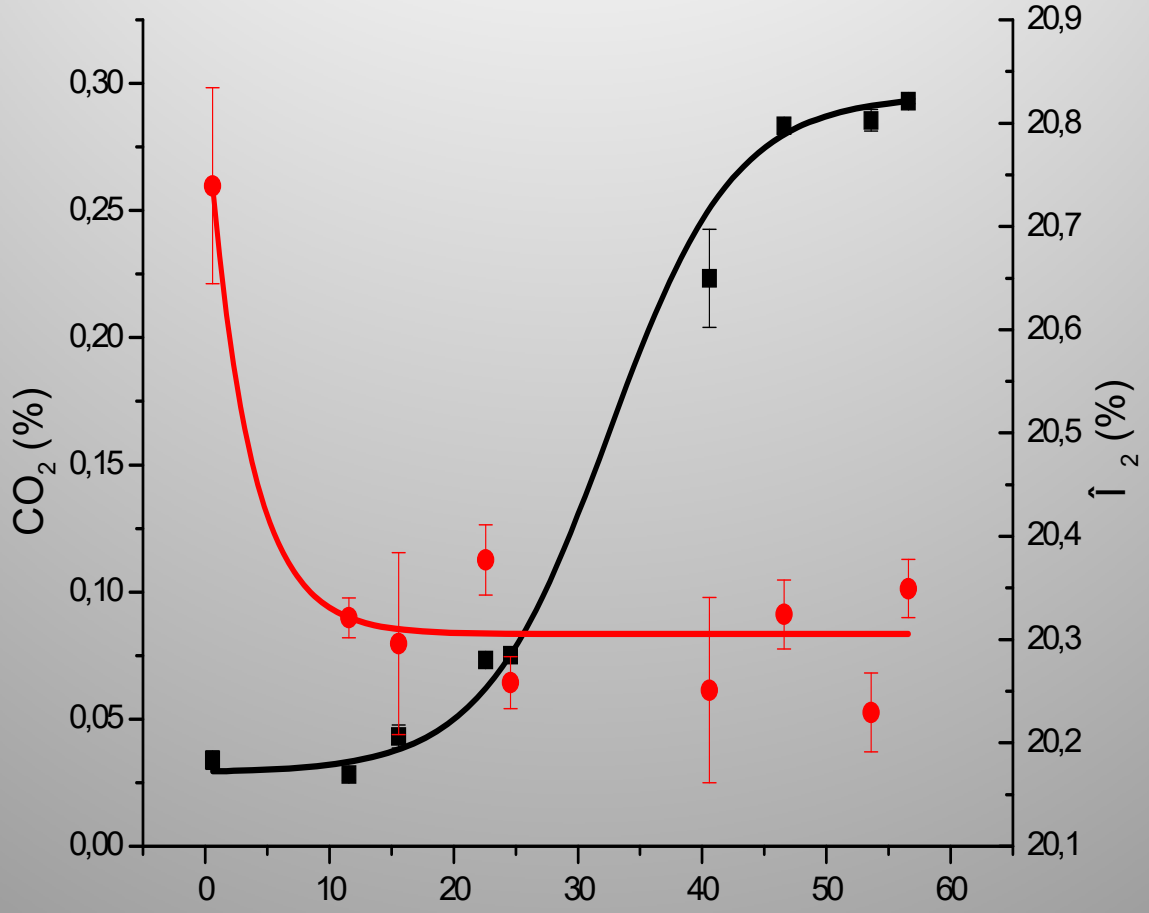
Comparative value of the contamination coefficient of liquid media, formed before and after post-treatment byTrichoderma viridae culture in space flight conditions

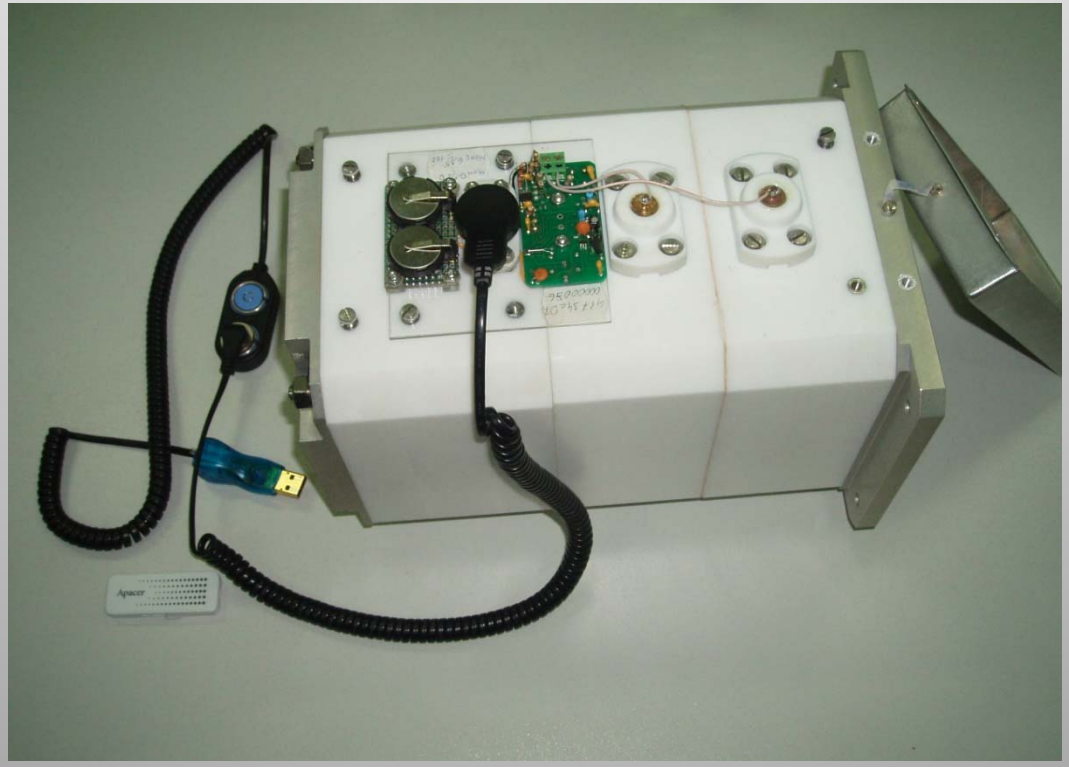


Functions of MFC containing activated sludge in the composition of the BLSS

- fermentation of organic substances
- removal of heavy metal ions
- removal of nitrogen oxides formed during the decomposition of proteins
- power generation

Changes in concentration of oxygen and carbon dioxide while long-term function of MFC

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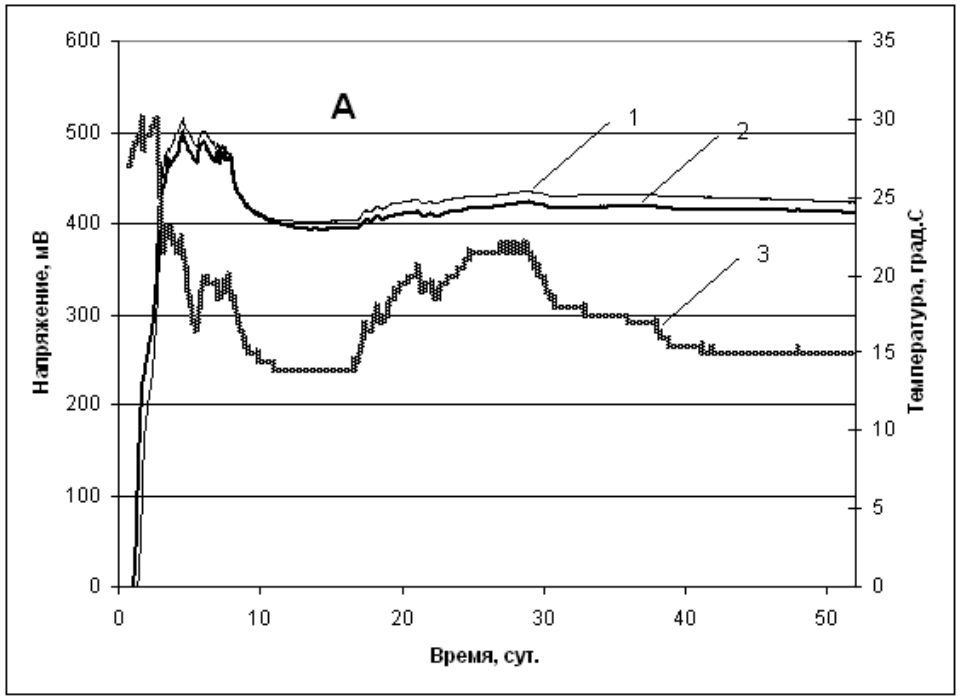
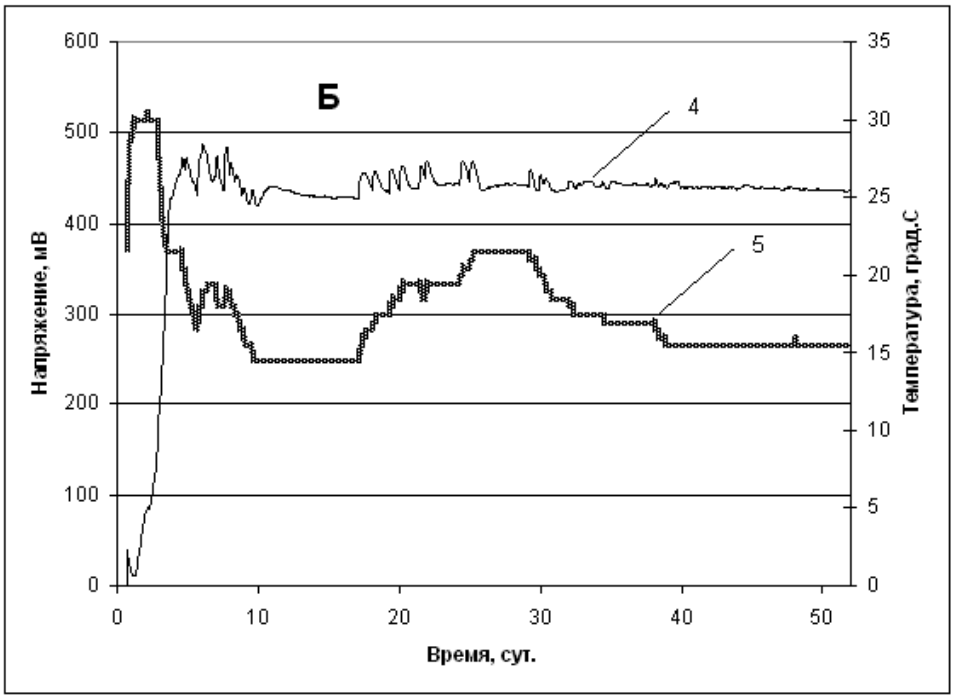
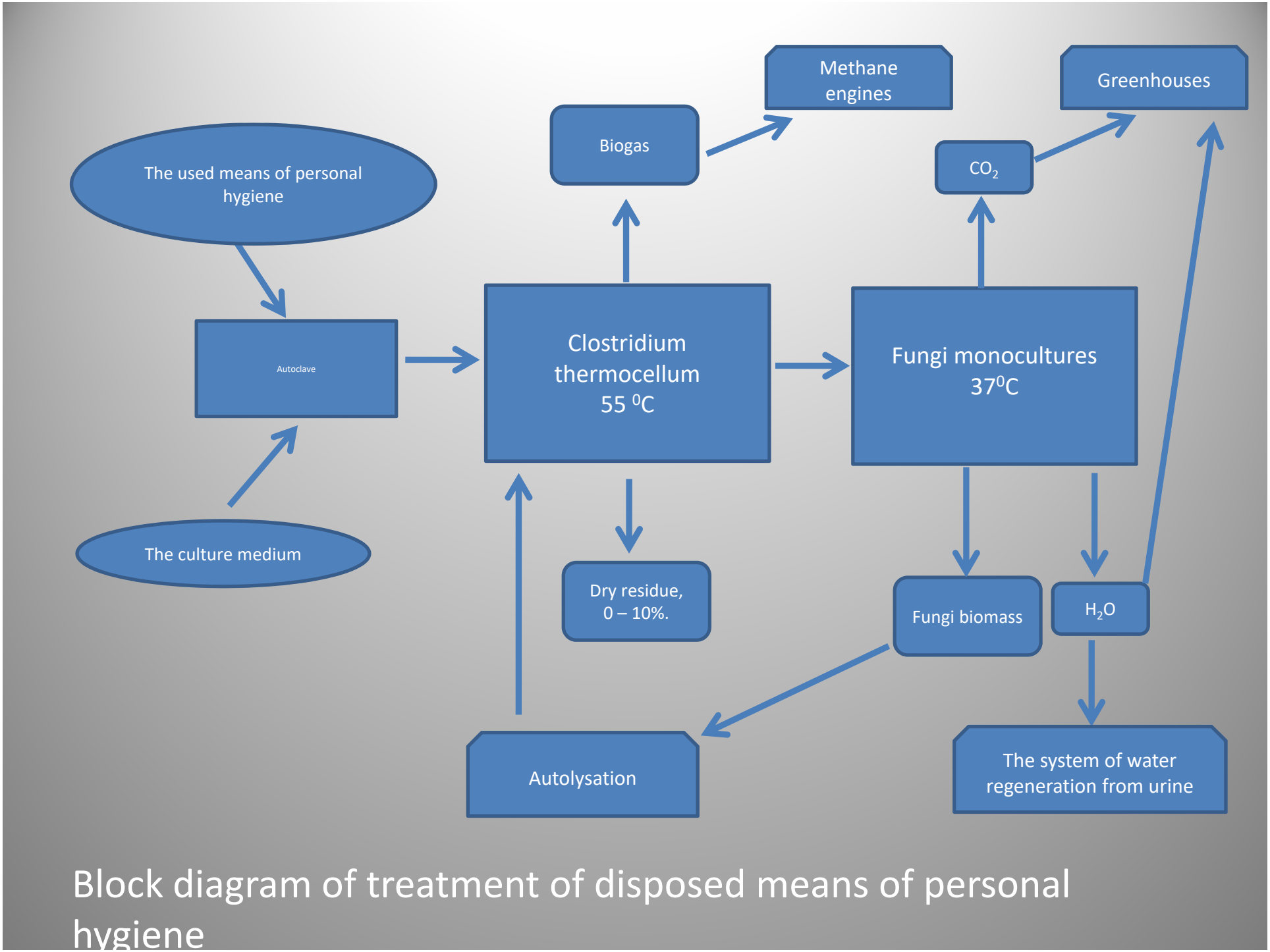
Electrical characteristics of MFC in spaceflight (A) and ground control (B)

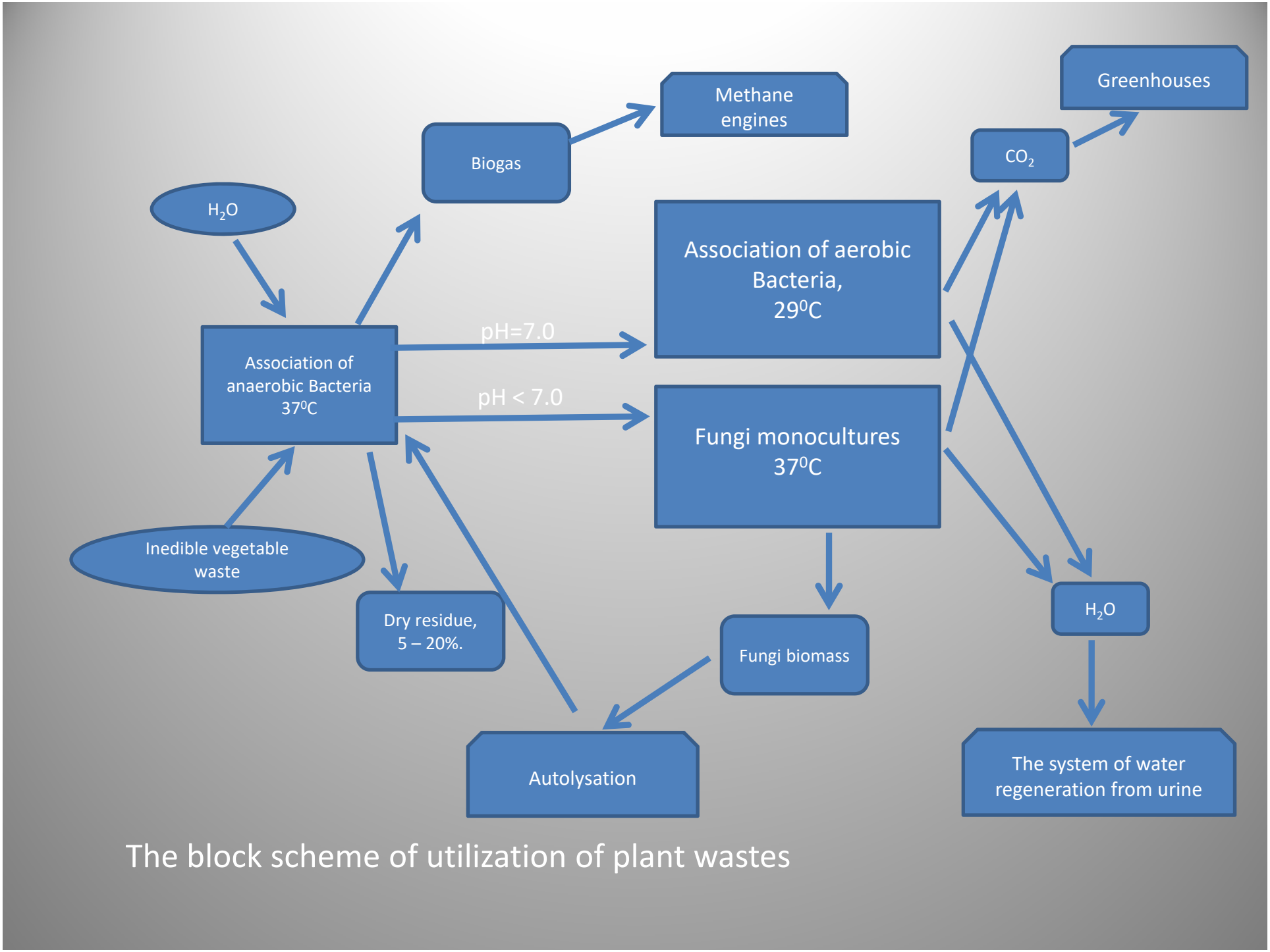
Horizontal scale – time (days)
Vertical – voltage (mV)







Block diagram of treatment of disposed means of personal hygiene



The block scheme of utilization of plant wastes