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DEPENDENCE OF BIOELECTRICITY PRODUCTION FROM ELECTROTECHNOLOGICAL PARAMETERS OF PLANT-MICROBIAL ELECTRO-BIOSYSTEMS

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The principle of operation of plant-microbial electro-biosystems is based on the collection of bioelectric energy generated by electro-active microorganisms localized in the rhizosphere of plants using electrodes [1, 2]. Plants form photosynthetants in excess and some of these products not required for metabolism are excreted by the root system in the substrate [3-5]. Organic root excretants and carbon dioxide, as well as plant precipitation and the substrate compounds themselves serve as sources of nutrition for rhizosphere microorganisms [6, 7]. Microbial conversion is accompanied by the donation of electrons to the electrodes and the generation of bioelectricity [1, 3, 8].

Plant-microbial electro-biosystem can be considered as a hybrid bioelectrochemical device, because both electrotechnological and biological components, such as electrode material, their interelectrode distance and location, load, type and stage of plant development are important for the functioning of electro-biosystems [5, 9-11]. In electro-biosystems based only on microorganisms, it has been shown that reducing the distance between the electrodes in the electro-biosystem can increase its power [9, 12-14]. By changing the species of plants in the same electro-biosystems based on the same anodes and cathodes, their different efficiency was demonstrated [15-17]. Taking into account the importance and little-studied role of interelectrode distance in the functioning of plant-microbial electro-biosystems, we set ourselves the task to investigate the influence of the distance between the anode and cathode on the bioelectric potential and current of electro-biosystems from *Lemna minor* in the laboratory conditions.

To conduct the research, electro-biosystems with *L. minor* plants obtained from contaminated ditches, natural substrate and electrodes [18], which were placed in the substrate around the duckweed roots at different distances from 1 to 10 cm were constructed.

The growth of bioelectric parameters with a decrease in the interelectrode distance was demonstrated both when using short-term connected resistors of 500 Ohms, 1 kOhm, and without the use of load. Electro-biosystems of plate configuration with an interelectrode distance of 1 cm were characterized by 0.203 V higher values of bioelectric potential than electro-biosystems with a 10 cm interelectrode distance with a short-term connection of a 500 Ohm resistor (Fig. 1).

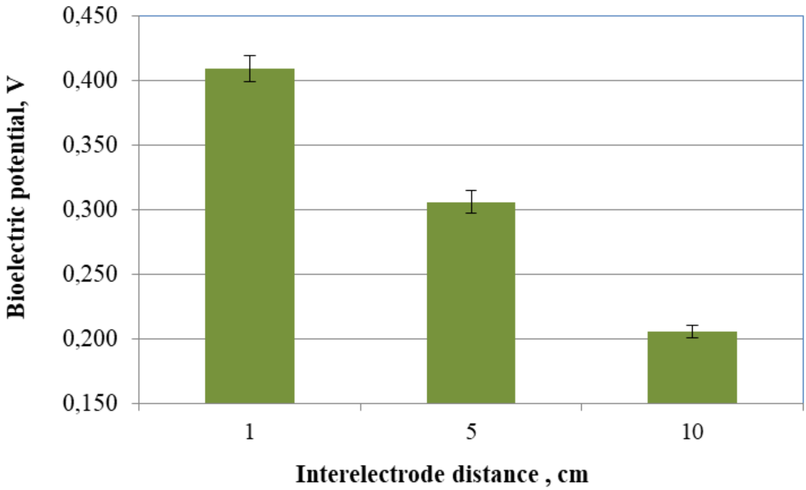

Fig. 1 Influence of interelectrode distance on bioelectric potential of electro-biosystem with *L. minor* at short-term loading of 500 Ohm (x ± SE, n = 7)

Similar trends were observed with short-term connection of 1 kOhm resistors and without load. Obviously, reducing the distance between the electrodes reduces the internal resistance, leads to faster electron and proton transfer to the electrodes and prevents the influence of competing microorganisms of electrons and protons. The identified effect has important value for modeling efficient plant-microbial electro-biosystems.

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