# SIMPLE EDUCATIONAL MODEL OF MICROBIAL FUEL CELL

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Microbial electrogenesis is considered to be one of the alternative methods of energy obtaining in bioenergetics. This process is well studied in scientific communities, but it is limited in educational field. Commercial devices, called microbial fuel cells (MFCs), were created to raise attention to this topic. However, it is essential to create a simple educational model of the microbial fuel cell for the widespread popularization of this technology.

The aim of this work was to create several examples of microbial fuel cells for educational purposes. We propose to combine microbial electrogenesis approach with the demonstration of such crucial microbiological processes as alcoholic fermentation, lactic acid fermentation, and microbial diversity of lake mud.

Each MFC model consists of two chambers made of plastic pumps – cathode (aerobic) and anode (anaerobic), with immersed electrodes (nails) and cooper wires fixed on them inside. Sets of chambers were connected by electron-permeable bridge. All cathodic chambers were filled with 140 ml of boiled water, previously cooled to room temperature. Contents of anodic chambers are the following:

- Alcoholic fermentation: 140 ml of boiled water, 5 tsp. of sugar and 1 tsp. of dried yeast;
- Lactic acid fermentation: 140 ml of yogurt with 1.6% of fat without fillers and sugar;
- Lake mud microbial consortium: 140 ml of mud taken from the local lake.

Electron-permeable bridge was filled with agar gel (10% of agar and 10% of sodium chloride in water). To create anaerobic conditions, anodes must be sealed with electrical tape before connecting them with cathodes. The value of the voltage on each MFC was measured every 35 minutes using a multimeter. Results were different for each model. In the first, the voltage initially decreased due to aerobic chamber leakage, but after refilling, the voltage increased due to active electrogenesis. In the second, the voltage decreased at the beginning, but as yogurt warmed, its value started to increase. In the third, voltage decreased due to the adaptation of consortium to new conditions, but under light exposure, bacteria started to divide, increasing voltage.

Three ideas for educational MFCs were proposed. Positive results of their application were obtained. Several advantages of these models can be identified as the low cost of materials needed for their construction and the serial connection of all chambers may produce more voltage.