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Simultaneous selection of soil electroactive bacterial communities associated to anode and cathode in a two-chamber Microbial Fuel Cell

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Different bacteria have evolved strategies to transfer electrons over their cell surface to (or from) their extracellular environment. This electron transfer enables the use of these bacteria in bioelectrochemical systems (BES) such as Microbial Fuel Cells (MFCs). In MFC research the biological reactions at the cathode have long been a secondary point of interest. However, bacterial biocathodes in MFCs represent a potential advantage compared to traditional cathodes, for both their low costs and their low impact on the environment. The main challenge in biocathode set-up is represented by the selection of a bacterial community able to efficiently accept electrons from the electrode, starting from an environmental matrix.
In this work, a constant voltage was supplied on a two-chamber MFC filled up with soil over three weeks in order to simultaneously select an electron donor bacterial biomass on the anode and an electron acceptor biomass on the cathode, starting from the same soil. Next Generation Sequencing (NGS) analysis was performed to characterize the bacterial community of the initial soil, in the anode, in the cathode and in the control chamber not supplied with any voltage. Results highlighted that both the MFC conditions and the voltage supply affected the soil bacterial communities, providing a selection of different bacterial groups preferentially associated to the anode (Betaproteobacteria, Bacilli and Clostridia) and to the cathode (Actinobacteria and Alphaproteobacteria). These results confirmed that several electroactive bacteria are naturally present within a top soil and, moreover, different soil bacterial genera could provide different electrical properties.