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# Novel Electrode Based on Ruthenium Oxide and Polyaniline Anode for Improved Performance of Microbial Fuel Cells

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**ABSTRACT:** Microbial fuel cells (MFCs) are a promising technology capable of directly converting into electricity from the abundant biomass on the earth. This work described the synergistic effect of ruthenium oxide (RuO2) nanoparticles and/or polyaniline (PANI) on carbon paper (CP) based anode for better bacterial attachment and enhance electron conductivity. The obtained macroporous structure RuO2 and PANI was characterized by scanning electron microscopy (SEM) and X- ray diffraction (XRD). Cyclic voltammetry (CV) results demonstrated that the CP coated with RuO2 and/or PANI has a larger active area than plain CP electrodes. To test microbial electricity generation, the CP, CP/RuO2, CP/PANI and CP/RuO2/PANI electrodes were used as anodes in the MFC system with the same projected geometric surface area of 9 cm2 were poised at 0.2 V. Inoculum from activated sludge sample inoculated into MFCs with glucose as the sole electron donor. Electrochemical impedance spectra (EIS) results provided evidence that there was a substantial improvement in electron transfer between the microbes and the anode as well as electrical conductivity. The differences in electricity generation and power density from these four electrodes were confirmed by polarization and power density curves. The power output of a single chamber microbial fuel cell (MFC) constructed from the carbon paper anode and mixed bacterial culture increases drastically with the CP/ RuO2/PANI modification. The power density and OCP were experimentally measured as 923 ± 5 mV and 1123 ± 20 mW/m2, respectively, which were approximately 15 times greater than the plain carbon paper based MFCs. More bacteria were observed to adhere attached on the CP/ RuO2/PANI anode than on the other anode during the working of the MFC. This strategy provides an easy scale-up, simple and controllable method for the preparation of high-performance and moderate-cost MFC anodes. 

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