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Applications of Nanoscale Polypyrrole Proton Exchange Membrane in Microbial Fuel Cells

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Using simulated syrup wastewater and lake silt as substrates, a microbial fuel cell power generation system was set up, the effect of nanoscale polypyrrole proton exchange membrane on the performance of microbial fuel cells was studied. Firstly, using the Nafion membrane MFC and nanoscale TiO_2/SiO_2 proton membrane MFC as comparisons; secondly, by using the methods of surface polymerization and internal polymerization, $FeCl_3$ and H_2O_2 were used as initiators, polypyrrole proton exchange membrane and nanoscale polypyrrole proton exchange membrane were prepared, and the performances of several kinds of microbial fuel cells with different membrane were tested and compared. The result shows that, the performance of MFC with nanoscale polypyrrole proton exchange membrane is the best. When internal polymerized nanoscale polypyrrole proton exchange membrane prepared by using the $FeCl_3$ as initiator was used as the separator of MFC, the steady output voltage is 17.3 mV, COD removal is 25.24 %, and the water uptake of the membrane is 64.37 %; when surface polymerized nanoscale polypyrrole proton exchange membrane was used as the separator of MFC, the state voltage is 14.4 mV, COD removal is 36.55 %, and the water uptake of the membrane is 54.18%. And when H_2O_2 was used as initiator, the steady voltage of MFC with internal polymerized nanoscale polypyrrole proton exchange membrane is 9.2 mV, COD removal is 19.39 %, and the water uptake of the membrane is 41.59 %; the steady voltage of MFC with surface polymerized nanoscale polypyrrole proton exchange membrane is 8.4 mV, COD removal is 29.38 %, and the water uptake of the membrane is 32.39 %. The nanoscale polypyrrole proton exchange membrane improved the performance of MFC evidently.

Keywords: microbial fuel cell; proton exchange membrane; surface polymerization; internal polymerization

FULL TEXT