Effect of anodes decoration with metal and metal oxides nanoparticles on pharmaceutically active compounds removal and microbial communities in microbial fuel cells

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Abstract: Anode modification with MnO_2, Pd and Fe_3O_4 nanoparticles was evaluated for pharmaceutically active compounds (PhACs) removal and power generation in microbial fuel cells (MFCs). The MFCs with Pd, MnO_2 and Fe_3O_4 anodes achieved a maximum power density of 824, 782 and 728 mW m^{-2}, respectively, which were higher than that with carbon black (CB) modified anode (680 mW m^{-2}) and nonwoven cloth (NW) anode (309 mW m^{-2}). The removal percentages of carbamazepine and diclofenac in MFCs with MnO_2, Pd and Fe_3O_4 anodes were more than 80% and 50%, respectively, while ibuprofen and iohexol showed limited biodegradation. Moreover, anode modification with MnO_2, Pd and Fe_3O_4 could reduce the total anode internal resistances and thus result in the enhanced power generation of MFCs. The study for the first time reported anode modification with MnO_2, Pd and Fe_3O_4 nanoparticles to enhance the PhACs removal and power production, which may help to understand the role of metal and metal oxides nanoparticles in the degradation of PhACs and power generation in a bioelectrochemical system.

Keyword: microbial fuel cell; pharmaceutically active compounds; anode modification; community structures