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Nanostructured three-dimensional Reduced Graphene Oxide-Mn_3O_4 Architectures with High Conductivity and Bacteria Affinity for Highly Efficient Microbial Electrocatalysis

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Bioelectrochemical system (BES) exhibits great potential for the wastewater treatment, which can achieve the energy storage simultaneously. However, the application of BES is limited due to the interior structure and composition of electrode materials. Here, a hybrid nano-structure reduced graphene oxide-Mn_3O_4 (rGO@Mn_3O_4) electrode was obtained through one-step electrodeposition method, and utilized to enhance the performance of *Geobacter sulfurreducens* inoculated BES. The hierarchical rGO@Mn_3O_4 is equipped with open porous and higher surface roughness, which are favorable for the microbial colonization. And the electron transport from exoelectrogens to the electrode facilitated by the three-dimensional interconnecting conductive scaffold. Further, the rGO@Mn_3O_4 electrode realized the maximum current density in a three-electrode setup reached 0.0376 mA cm^{-2} with high loading, which is 3.03-fold higher than that of a bare rGO (0.0124 mA cm^{-2}). The great performance is attributed to the proper pore size distribution and the "rose"-like porous structure Mn_3O_4 particles coating on the surface of the rGO sheets network. This work reveals a synergistic effect in pore structure and surface chemistry design to promote bioelectrocatalysis in BESs.

Keywords: Graphene; Manganic oxide; Bioelectrochemical systems; Interface tailoring; Electron transfer; Microbial colonization

FULL TEXT