An Efficient Electrocatalyst based on Platinum Incorporated into N,S co-doped Porous Graphene for Oxygen Reduction Reaction in Microbial Fuel Cell

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In this work, an efficient electrocatalyst nanomaterial for application in fuel cells was introduced. The nanomaterial was prepared through platinum incorporation into the S,N co-doped porous graphene (PG) through pyrolysis method. The physico-chemical properties of the prepared samples were characterized using X-ray Diffraction (XRD), Raman spectroscopy, N₂ sorption-desorption, Transmission Electron Microscopy (TEM), Field Emission Scanning Electron Microscopy (FESEM) and X-ray Photoelectron Spectroscopy (XPS). The synthesized samples were further applied for oxygen reduction reaction (ORR) and evaluation in microbial fuel cell (MFC). The results revealed that impregnation of 10 wt.% Pt into the nitrogen and sulfur co-doped graphene structure (called G-STP-900-Pt 10) cause more improvement in catalytic activity compared to 20 wt.% Pt/C. Also, LSV measurements confirmed an improved onset potential (1.00 V) for G-STP-900-Pt 10 sample in comparison with 20 wt.% Pt/C (0.99 V vs. RHE). Furthermore, microbial fuel cell test showed higher cell potential and power density relative to Pt/C 20 wt.% too. Finally, for economic purpose, the optimal sample with lower Pt amount (10 wt.% Pt) was selected as a good candidate for ORR in MFCs.

Keywords: Oxygen reduction reaction, Microbial fuel cell, Porous graphene, Platinum, Nitrogen and sulfur co-doped graphene.

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