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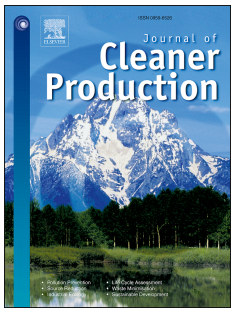

Chemically activated graphite enhanced oxygen reduction and power output in catalyst-free microbial fuel cells

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Chemically activated graphite enhanced oxygen reduction and power output in catalyst-free microbial fuel cells

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Abstract: In search of a cost effective cathode material for microbial fuel cells (MFCs), graphite was chemically treated with H_3PO_4, HNO_3, $ZnCl_2$, urea or melamine, and the effect of chemical activations on the oxygen reduction reaction (ORR) was examined. The performance of MFCs with activated graphite as the catalyst-free cathodes was then compared to those with untreated graphite. Results suggested that H_3PO_4 and HNO_3 activations could improved ORR, showing the highest ORR activity in graphite treated with 14.62 M H_3PO_4 for 12 h at 30-50 ºC. MFCs with H_3PO_4 and HNO_3 activated graphite cathodes generated maximum power densities (7.9 W/m^3 and 6.5 W/m^3, respectively) 2.4 and 1.8 times higher than that of the untreated control. The chemical activation process involves just a simple immersion step, and it does not require heating, electrochemical process or expensive chemicals. Therefore, it is a highly cost-effective approach to improve the performance of MFCs. We recommend an *in-situ* modification of graphite cathodes in scale-up MFCs with either H_3PO_4 or HNO_3 to optimize MFCs' various industrial applications.

Keywords: Activation, Cathode, Graphite, Microbial fuel cell, Oxygen reduction reaction