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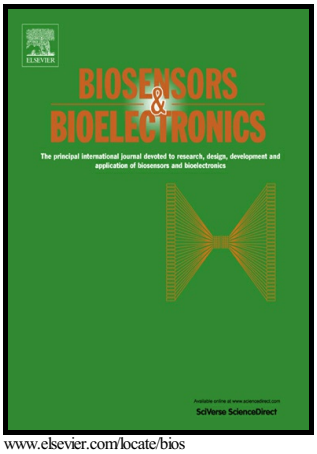

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Enzymatic Glucose/Oxygen Biofuel Cells: Use of Oxygen-Rich Cathodes for Operation under Severe Oxygen-Deficit Conditions

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Abstract

A glucose/oxygen biofuel cell (BFC) that can operate continuously under oxygen-free conditions is described. The oxygen-deficit limitations of metabolite/oxygen enzymatic BFCs have been addressed by using an oxygen-rich cathode binder material, polychlorotrifluoroethylene (PCTFE), which provides an internal oxygen supply for the BFC reduction reaction. This oxygen-rich cathode component mitigates the potential power loss in oxygen-free medium or during external oxygen fluctuations through internal supply of oxygen, while the bioanode employs glucose oxidase-mediated reactions. The internal oxygen supply leads to a prolonged energy-harvesting in oxygen-free solutions, *e.g.*, maintaining over 90% and 70% of its initial power during 10- and 24-hour operations, respectively, in the absence of oxygen. The new strategy holds considerable promise for energy-harvesting and self-powered biosensing applications in oxygen-deficient conditions.

Keywords: biofuel cells; glucose; glucose oxidase; oxygen independence; polychlorotrifluoroethylene; cathode

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