Improved power by optimization of electrically wired glucose oxidase for biofuel cell

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Enzymatic electrodes can be applied to implantable biofuel cells as well as biosensors. The one of the key issues is to improve the power density in the development of biofuel cells and detection sensitivity in biosensors. Prof. Heller group developed miniature compartment-less biofuel cell system, in which glucose oxidase (GOx) was electrically wired to the gold electrode surface. This study aimed to evaluate factors associated with electrochemical performance of these GOx-wired electrodes thereby improving the power density in biofuel cell system. The GOx was wired by poly (1-vinylimidazole) complexed with Os (4, 4 -dimethyl-2, 2 -bipyridine)2Cl2. The electrolyte was 100 mM PBS buffer (pH 7.0) containing 30 mM of glucose. The cyclic voltametry (CV) value were measured using a potentiostat (CH Instruments, Austin, TX, model CHI 660d). It was found that concentrations of GOx and Os-complex mediator as well as the ratio of mediator to GOx critically influenced the generation of current density by enzyme electrode. The maximum current density was obtained from electrode loaded with 26 μg of GOx and 48 μg of mediator. The effect of glucose concentration was examined using this optimized electrode. Current was generated even in the presence of small amount (5 mM) of glucose, indicating high detection sensitivity for biosensor. Current density increased when glucose concentration increased. The maximum current (24 A) was obtained at 30 mM of glucose, indicating potential electrode for biofuel cells.