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Improved performance of a paper-based glucose fuel cell by capillary induced flow

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Abstract

This work details the use of flow via capillary action in order to improve the power and current output from a paper-based enzymatic glucose / O_2 fuel cell. The fuel cell generates energy from glucose at typical physiological concentrations and conditions (5mM, pH 7.4). Additionally, the act of flowing increases the concentration of oxygen reaching the air-breathing cathode, thereby improving the overall fuel cell performance. In the fuel cell setup, screen-printed carbon electrodes coated with the relevant components constitute both the anode and cathode. These are mounted within a custom-made platform allowing for the anode and cathode to be overlaid with a paper channel acting as the electrolyte. In addition, reference/counter electrodes are mounted in parallel which allows for the individual interrogation of each component within the context of the final setup. The quasi-steady flow is generated by the capillary properties of the paper that constitutes the absorbent pad. This causes the solution of interest to be drawn from the reservoir, along the channel paper, to the electrode surface. The act of flow encourages mass