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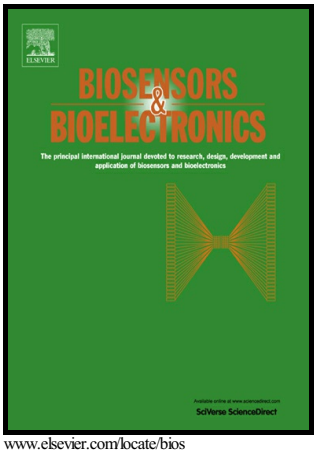

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1. Abstract

The measurement of pH is important throughout many biological systems, but there are limited available technologies to enable its periodical monitoring in the complex, small volume, media often used in cell culture experiments across a range of disciplines. Herein, pad printed electrodes are developed and characterised through modification with: a commercially available fullerene multiwall carbon nanotube composite applied in Nafion, casting of hydrophobic ubiquinone as a pH probe to provide the electrochemical signal, and coated in Polyethylene glycol to reduce fouling and potentially enhance biocompatibility, which together are proven to enable the determination of pH in cell culture media containing serum. The ubiquinone oxidation peak position (E_{pa}) provided an indirect marker of pH across the applicable range of pH 6 – 9 (R^2=0.9985, n=15) in complete DMEM. The electrochemical behaviour of these sensors was also proven to be robust; retaining their ability to measure pH in cell culture media supplemented with serum up to 20% (v/v) [encompassing the range commonly employed in cell culture], cycled >100 times in 10% serum containing media and maintain >60% functionality after 5 day incubation in a 10% serum containing medium. Overall, this proof of concept research highlights the potential applicability of this, or similar, electrochemical approaches to enable to detection or monitoring of pH in complex cell culture media.

Keywords:

Carbon; cyclic voltammetry; Ubiquinone; carbon nanotubes; cell culture; pH