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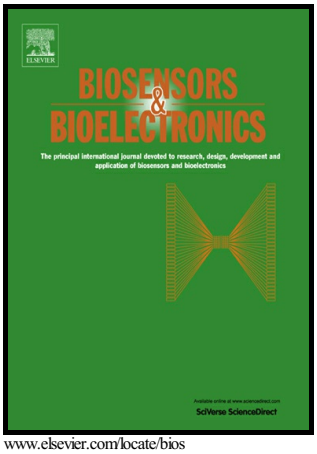

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Abstract:

The traditional microbial fuel cell (MFC) sensor with bioanode as sensing element delivers limited sensitivity to toxicity monitoring, restricted application to only anaerobic and organic rich water body, and increased potential fault warning to the combined shock of organic matter/toxicity. In this study, the biocathode for oxygen reduction reaction was employed for the first time as the sensing element in MFC sensor for toxicity monitoring. The results shown that the sensitivity of MFC sensor with biocathode sensing element (7.4 ± 2.0 - 67.5 ± 4.0 mA $\%^{-1}$ cm^{-2}) was much greater than that showed by bioanode sensing element (3.4 ± 1.5 - 5.5 ± 0.7 mA $\%^{-1}$ cm^{-2}). The biocathode sensing element achieved the lowest detection limit reported to date using MFC sensor for formaldehyde detection (0.0005%), while the bioanode was more applicable for higher concentration (>0.0025%). There was a quicker response of biocathode sensing element with the increase of conductivity and dissolved oxygen (DO). The biocathode sensing element made the MFC sensor directly applied to clean water body monitoring, e.g., drinking water and reclaimed water, without the amending of background organic matter, and it also decreased the warning failure when challenged by a combined shock of organic matter/toxicity.

Keywords:

Biosensor, biocathode, toxicity, sensitivity, signal interference, microbial fuel cell