DEVELOPMENT OF ALGAL FUEL CELLS FOR DECOLOURISATION OF AZO DYES

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ABSTRACT

Microbial Fuel Cells (MFCs) are regarded as a promising approach for the biological treatment of dye-containing waste water and have advanced in the recent years. This study investigated the potential of photosynthetic biocathodes as a more economically feasible alternative to its more energy intensive abiotic cathode counterparts that rely on energy intensive external mechanical aeration. In this study, three different sets of MFC were investigated. The first two MFC sets were fully biotic, dual chamber, H-type Photosynthetic Microbial Fuel Cells (PMFC). The microalga *Chlorella vulgaris* was employed in the cathode chamber of the PMFC and was investigated under static and agitated conditions. The third MFC set employed Platinum as a catalyst with mechanical aeration. The anodic chamber was kept constant in the three sets, with *Shewanella onedensis* MR-1 inoculated into synthetic waste water containing 350 mgL^{-1} Acid orange 7 (AO7).

Decolourisation of AO7 was achieved with efficiency of (>50%) after 5 days of operation. The highest value of dye removal efficiency was 87%, achieved by PMFC with static *C.vulgaris* culture. This was followed by 72.4 % and 53% for the PMFC with agitated *C.vulgaris* culture and abiotic cathode MFC respectively. Polarisation testing data revealed an average maximum power density of 2.4 mWm^{-2} of electrode surface area for the PMFC reactor with biocathode under shake conditions. This was the highest value achieved among the three sets, followed by 1.53 mWm^{-2} for the other set PMFC reactor set with biocathode's under static conditions, then 1.114 mWm^{-2} for the MFC with abiotic cathode.

This study highlights the ability of algae-based biocathode to sustain the cathodic oxidation reduction reaction similar to abiotic cathodes using platinum solely as a catalyst to be effective in providing a less energy intensive process by eliminating mechanical aeration.

Keywords: Biocathodes; bioremediation; azodye degradation; photosynthetic microbes

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