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Light-dependent photocurrent generation: novel electrochemical communication between biofilm and electrode by ferrocene cored Poly(amidoamine) dendrimers

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Abstract

In this study, ferrocene (Fc) cored polyamidoamine (PAMAM) dendrimer generations were used as a mediator to produce photo-current by providing electrochemical communication between photosynthetic microorganisms and electrode. Photosynthetic microorganisms (PM) (algae and cyanobacteria mixture) were attached to the graphite electrode surface and photocurrent generation was demonstrated. A photocurrent density of 0.033 μA cm^{-2} was obtained by direct electron transfer of PM to the electrode without using any mediator. FcPAMAM structures with different redox potentials successfully interconnected the electrode and PM, resulting in a photocurrent density of 1.18 μA cm^{-2}. Two different water-soluble mediators, *p*-benzoquinone and hexacyanoferrate (III), were used to accelerate photo-current through the reaction center and the photocurrent density was raised to 11.89 μA cm^{-2}. Superoxide dismutase (SoD) and catalase (Cat) enzymes have been successfully used to remove reactive organic species (ROS) from the reaction center and further increase in photocurrent density was reached up to 20.04 μA cm^{-2}.

Keywords: *Photosynthesis, Bioelectricity, Algae, Cyanobacteria, Electron transfer, Ferrocene*