# Photo-electrochemical communication between cyanobacteria and osmium redox polymer modified electrodes

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Most of the energy for all forms of life in the world originates from the sun, the ultimate energy source. Photosynthesis is the process by which green plants, algae and some bacteria convert sunlight into chemical energy with a quantum yield of about 100% [1]. Cyanobacteria, also called blue green algae, account for 20-30% of the primary photosynthetic activity on earth. The electrogenic conduit of cyanobacteria might be exploited to develop light sensitive devices that can convert solar energy into electricity [2]. Recently *Rhodobacter capsulatus*, the metabolically versatile purple bacteria, was shown to communicate with osmium redox polymer modified graphite electrodes [3].

In this communication photo-electrochemical studies have been conducted between *Leptolyngbya* sp. CYN82, a cyanobacterial species (collected from the Cawthron Institute Culture Collection of Microalgae CICCM) and electrodes modified with flexible $Os^{+2/+3}$ functionalities. The photosynthetic component in the cyanobacterial cells was excited with visible light and then the subsequent electron transfer from these cells onto the electrode surface has been documented by cyclic voltammetry and chronoamperometric measurements. A noticeable photocurrent was observed with the cyanobacteria embedded in the osmium polymer matrix in the presence of light under anoxic conditions.

[1] S. Berry, B. Rumberg, Kinetic modeling of the photosynthetic electron transport chain, Bioelectrochemistry, 53 (2001) 35-53.

[2] J.M. Pisciotta, Y. Zou, I.V. Baskakov, Light-dependent electrogenic activity of cyanobacteria, PLoS ONE, 5 (2010).

[3] K. Hasan, S.A. Patil, K. Górecki, D. Leech, C. Hägerhäll, L. Gorton, Electrochemical communication between heterotrophically grown *Rhodobacter capsulatus* with electrodes mediated by an osmium redox polymer, Bioelectrochemistry, (2013) in press, doi:10.1016/j.bioelechem.2012.05.004