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UV Spectroscopy Studies On Photosystem (PS) II of Freshwater Algae: Under Phosphate Stress

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Extended Abstract

In this paper, the phosphate stress response on the photosystem II of freshwater algae is analyzed under laboratory conditions. Algal colonies absorption and PS II UV peak (~680 nm) are used as a metric for evaluation of the phosphate stress response. The significance of phosphate in algal growth media will be reasoned and discussed in this paper. The potential undesirable boom of algal colonies will be highlighted due to the excess phosphate concentration in the colonies. This work is a preliminary assessment of the required phosphate concentration in growth media when algae are confined in micro-environments like micro photosynthetic power cells.

Phosphate composition constitutes one of the major building blocks of the cell; comprising in the nucleic acid, phospholipids and complex carbohydrates. The phosphate uptake and intracellular regulation are chiefly governed by the availability of the phosphate concentration in their local environment (growth media). Excess availability of the phosphate in the growth media will result in algal boom, a common occurrence in lakes after heavy storms carrying phosphate rock sediments. This excess concentration of phosphate is stored as a vacuole in the cytoplasm (intracellular matrix). These stored phosphates are used during the phosphate-deprived condition to sustain growth. The inorganic phosphate ion (uptake) undergoes *photophosphorylation*, the conversion of ADP to ATP. This conversion by *photophosphorylation* is essential in the photosynthesis electron chain which governs the electron flow in the chloroplast. Photosynthesis is a light-initiated process where the chlorophyll, comprising a light sensitive photosystem, is excited by light photons. The excited energy is comprised in their photosystem (PS) I and II. In this work, the phosphate concentration in the growth media of freshwater algae, Chlamydomonas *reinhardtii*, is varied in the steps of $\pm 10\%$ from the nominal established value for optimum growth. The variation in the algal colony size and number of algal cells/ml are measured via UV absorption. The characteristics peak of PS-II system at ~680nm is monitored over this range for any shift. Variation in the growth and wavelength shift will be reported. This work is essential in understanding the biofilm formation during the operation of micro-photosynthetic power cell (*μ-PSC*). A μ-PSC is a biofuel cell which contain suspended algae (algae dispersed in growth media) in microfluidic environment for electrical output. This paper will also cover the fundamental overview on the *photophosphorylation* and electron transport in *μ-PSC*. The significance of this work with respect to *μ-PSC* will be highlighted.