HARVESTING SUNLIGHT ENERGY: A BIOPHYSICS APPROACH

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The most efficient light harvesting and energy transfer systems are found in nature as part of the photosynthesis process. It has been shown that organised connective light harvesting complexes are required for long range energy transfer [1]. By extracting these system fragments and maximising their organisational structure, similar artificial systems for energy sources and transfer system can potentially be developed.

Photosynthetic light harvesting (LHCII) materials were extracted from spinach leaves using the Krupa et al. [2] method. Samples consisted of different concentrations of LHCII added to either a 20 mM Tricine (pH 7.6-7.8) buffer solution or a 0.02 mg / ml Pheroid™ artificial vesicle (a combination of fatty acids and nitrous oxide) aqueous solution.

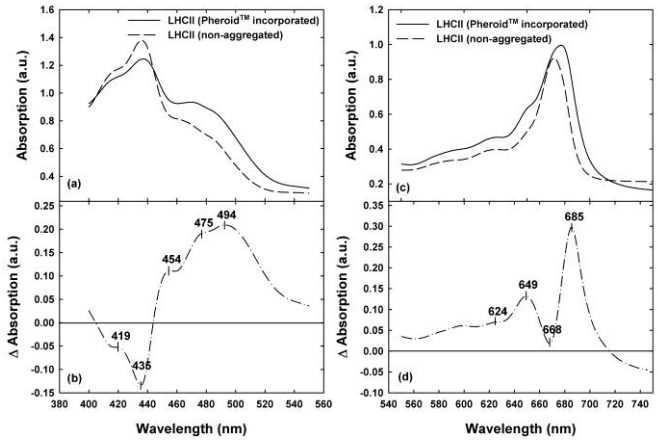

Figure 1: Absorption spectra at 293 K of 1.74 mg / ml LHCII in the (a) Soret and (c) Qy regions. Solid line: LHCII incorporated into Pheroid™. Dashed line: Non-aggregated LHCII in Tricine buffer.
Calculated incorporated-minus-non-aggregated absorption difference spectra (dot-dash line) for the (b) Soret and (d) Qy regions.

Difference spectra between the incorporated LHCII into Pheroid™ vesicles and non-aggregated LHCII in the Tricine buffer were calculated (Fig 1). Difference spectra in the Soret region (Fig 1a,b) show a decrease in the transition amplitudes at 419 nm and 435 nm (Chl a), as well as a broad band appearing around 494 nm, indicating protein aggregation of the incorporated material [3].

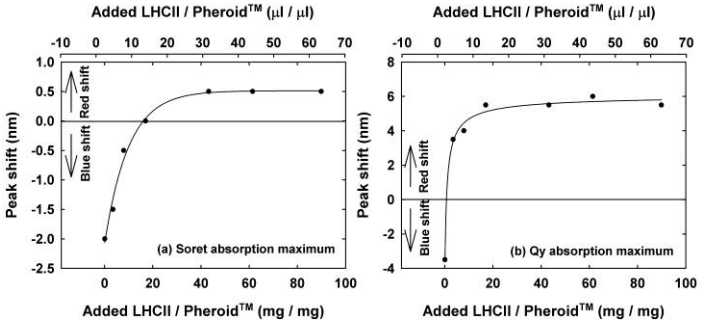

Figure 2: Peak shifts in the Soret and Qy absorption maxima of LHCII after incorporation into Pheroid™ vesicles.

The Qy transitions of chlorophyll in the red (Qy) region appears to red-shift by 3.5 – 5.5 nm (Figs 1c,d and 2); indicating a possible change in organisation of the light harvesting system after incorporation into the Pheroid™.

References

[1] Barzda V, Garab G, Gulbinas V and Valkunas L 1996 Evidence for long-range excitation energy migration in macroaggregates of the chlorophyll a/b light-harvesting antenna complexes *BBA - Bioenergetics* **1273** 231

[2] Krupa Z, Hunter N P A, Williams J P, Maissan E and James D R 1987 Development at cold hardening temperatures the structure and composition of purified rye LHCI *Plant Physiol.* **84** 19

[3] Haferkamp S, Haase W, Pascal A A, van Amerongen H and Kirchhoff H 2010 Efficient light-harvesting by Photosystem II requires an optimized protein packing density in grana thylakoids *J. Biol. Chem.* **285** 17020