FTIR difference spectroscopy for the Study of Electron Transfer Cofactors in Photosystem I

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In natural photosynthetic systems, ultra-efficient solar energy capture and conversion results from a set of uniquely organized protein-bound pigments. The pigment-protein interactions bestow some unique properties on the pigments resulting in this efficiency. The structural organization of these protein bound pigments were studied using Fourier transform infrared difference spectroscopy (FTIR DS). Solar energy capture results in the transfer of electrons via the pigments across a biological membrane. These light-induced electron transfer (ET) processes were studied using time-resolved step scan FTIR DS. Here we focused on ET in photosystem I (PSI) photosynthetic reaction centers from several strains. In all cases there is a high degree of similarity in the FTIR DS collected for the different samples, underscoring the robustness of this time resolved FTIR technique and confirming minimal experimental variability in these spectra. The similarity in the time-resolved FTIR DS suggests a highly conserved structural environment for both the A_0 and A_1 cofactors bound in the protein binding sites across the different strains.

Of particular interest here is the study of P700 in PSI samples from *Chroococcidiopsis thermalis* (*CT*) cells that have been grown under white light (WL) and far-red light (FRL). P700 in PSI from cells grown under FRL are similar to that found in most other strains. Unintuitively, P700 in PSI samples from cells grown under WL differ considerably from that obtained from other strains. The origin of these differences is established from the FTIR DS and indicates a new paradigm for P700 in in these WL PSI samples.