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An FTIR study on the chlorophyll and apoprotein aggregation states in LHCII due to solvent effects

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Abstract content
   (Max 300 words)

Photosynthesis provides us with the most abundant and efficient light-harvesting systems found in nature. The photosynthetic process is very much dependent on the aggregation state of the chlorophylls and secondary conformational structure of the apoproteins in the light-harvesting systems. The aim of this study was to test possible buffer influence on these in the light-harvesting complex (LHCII) of Photosystem II (PSII).

LHCII was extracted from spinach leaves in a 20 mM Tricine buffer to stabilise the proteins, after which samples were diluted in 20 mM Tricine (pH 7.61) and 60 mM Tricine (pH 7.6) buffers respectively. Additionally, the 20 mM Tricine buffer was dialysed out of some of the LHCII stock samples directly into a 20 mM K₂HPO₄ / KH₂PO₄ buffer (pH 7.64) to prevent denaturing of the LHCII proteins. FTIR and absorbance spectra of samples were compared. Gaussian curve-fitting based on second order derivative resolution enhancement were performed on the Amide I region of all the FTIR spectra to reveal the overlapping component contributions of the chlorophylls and apoproteins in the light-harvesting complexes.

FTIR results from the light-harvesting complexes in the Tricine buffers indicated a downward shift by about 25 cm⁻¹ of the Amide I peak compared to the K₂HPO₄ / KH₂PO₄ buffer results. This leads to the assumption that the apoproteins have undergone a conformational shift from mostly α-helical to β-sheet structure. The curve-fitting method, however, predicted a smaller downward shift of between 3 and 7 cm⁻¹ of the apoproteins, indicating a slight unfolding of the apoproteins to a more unordered coil-structure, masked by the stronger Tricine peak around 1624 cm⁻¹ in the Amide I region. Results also indicated that the chlorophylls associated with these apoproteins assumed a less aggregated state, confirmed as a slight blue shift in the absorbance spectra. The results were more pronounced in the higher concentrate Tricine buffer.

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