Oxygen evolution in chimeric spinach photosystem II with cyanobacteria manganese stabilising protein

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Photosystem II (PSII) is the first multiprotein complex in the photosynthetic electron transfer chain and catalyses the light-driven oxidation of water and reduction of plastoquinone. The PSII protein contains a sub domain termed oxygen evolving complex (OEC), where water is split during photosynthesis, and oxygen released as a by product. The OEC is made up of loop regions of the core membrane spanning subunits, a cluster of Mn_4Ca ions which are the site of water oxidation, and three extrinsic proteins which are bound electrostatically to the core proteins. Of these extrinsic proteins, only the 33kDa manganese stabilising protein (MSP) is common to higher plants, algae and cyanobacteria. The MSP is essential for stabilising Mn binding and provides optimal O_2 evolution. However the MSP does not appear to provide any ligands to any of these ions and its function was proposed to facilitate O_2 production by forming a channel which controls entry of the substrate water to the active site or release of the O_2 and proton products (De Las Rivas & Barber, 2004; Ferreira *et al.*, 2004; Wydrzynski *et al.*, 1996).

In this presentation we have created chimeric PSII complexes by removing all three extrinsic proteins from the PSII complex of spinach, and replacing the native MSP with recombinant MSP from the thermophilic cyanobacterium *Thermosynechococcus elongatus.* The recombinant protein is either fused with thioredoxin or truncated by 39 amino acids at the C-terminus resulting in a deletion of the conserved water channel residues. Here we present the O_2 evolution and tyrosine radical decay kinetics of these chimeric proteins. The results show the importance of these conserved residues to catalytic function and suggest that substrate accessibility is important for this enzyme.

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