Prediction of the pH range of the PsbS-dependent photoprotective response in chloroplasts of *Lobosphaera incisa*

Ptushenko Vasily V.[1,2*]

[1] *Belozersky Institute of Physico-Chemical Biology, Lomonosov Moscow State University, 119992 Moscow, Russia*

[2] *Emanuel Institute of Biochemical Physics, Russian Academy of Sciences, 119334 Moscow, Russia*

** E-mail: ptush@belozersky.msu.ru*

Plants need to balance between light harvesting used for photosynthesis and photoprotection in excess of light. One of the key mechanisms used by oxygenic phototrophs for rapid balancing is non-photochemical quenching (NPQ) of excited chlorophyll molecules. In land plants, PsbS protein located in the photosynthetic membrane plays crucial role in NPQ. Excessive light energy leads to acidification of the intrathylakoid space (lumen) and hence to protonation of some PsbS lumen-exposed acidic groups. In turn, this causes PsbS transition to the NPQ-inducing state. Although the mechanism of PsbS-dependent NPQ is still unknown, the amino acid residues serving as pH indicators are known for some model objects (Arabidopsis, spinach [1,2]).

For algae (except Charophyta), participation of PsbS in photoprotection has not yet been directly shown, although the PsbS gene has been found in the genome of green algae. Only a few years ago, PsbS protein was detected in the model alga *Chlamydomonas reinhardtii*, as well as high-light-induced differential expression of PsbS gene [3,4]. The latter indirectly indicates PsbS participation in the photoprotection. In this work, the amino acid sequence of PsbS from green alga *Lobosphaera incisa* was determined, and the three-dimensional structure was predicted. Using the methods of molecular dynamics and continuum electrostatics, pK values for lumen-exposed amino acid residues were calculated. It was shown that PsbS-dependent NPQ in *L.incisa* could be induced at lower values of the transmembrane ΔpH than in higher plants, which may indicate a more effective PsbS-dependent photoprotection in green alga.

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