Abstract

The conversion of violaxanthin to zeaxanthin is essentially required for the pH-regulated dissipation of excess light energy in the antenna of photosystem II. Violaxanthin is bound to each of the antenna proteins of both photosystems. Former studies with recombinant Lhcb1 and different Lhca proteins implied that each antenna protein contributes specifically to violaxanthin conversion related to protein-specific affinities of the different violaxanthin binding sites. We investigated the violaxanthin de-epoxidation in the minor antenna proteins of photosystem II, Lhcb4-6. Recombinant proteins were reconstituted with different xanthophyll mixtures to study the conversion of violaxanthin at different xanthophyll binding sites in these proteins. Extent and kinetics of violaxanthin de-epoxidation were found to be dependent on the respective protein and – for each protein – also on the binding site of violaxanthin. In particular, violaxanthin bound to Lhcb4 was nearly inconvertible for de-epoxidation, while violaxanthin bound to Lhcb5 was fully convertible, but with slow kinetics. Lhcb6 exhibited heterogeneous violaxanthin conversion characteristics, which could be assigned to different populations of reconstituted Lhcb6 complexes with respect to violaxanthin binding sites. The results support the proposed different binding affinities of violaxanthin to the three putative violaxanthin binding sites (V1, N1 and L2) in antenna proteins. Under consideration of former studies with Lhcb1 and Lhca proteins, the data imply that violaxanthin bound to the V1 and N1 binding site of antenna proteins is easily accessible for de-epoxidation in all antenna proteins, while violaxanthin bound to L2 is either only slowly or not convertible to zeaxanthin, depending on the respective protein.