Photoinactivation and Protection of Glycolate Oxidase *in vitro* and in Leaves

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Glycolate oxidase that was partially purified from pea leaves was inactivated *in vitro* by blue light in the presence of FMN. Inactivation was greatly retarded in the absence of O_2. Under aerobic conditions H_2O_2 was formed. The presence of catalase, GSH or dithiothreitol protected glycolate oxidase against photoinactivation. Less efficient protection was provided by ascorbate, histidine, tryptophan or EDTA. The presence of superoxide dismutase or of hydroxyl radical scavengers had no, or only minor, effects. Glutathione suppressed H_2O_2 accumulation and was oxidized in the presence of glycolate oxidase in blue light. Glycolate oxidase was also inactivated in the presence of a superoxide-generating system or by H_2O_2 in darkness. In intact leaves photoinactivation of glycolate oxidase was not observed. However, when catalase was inactivated by the application of 3-amino-1,2,4-triazole or depleted by prolonged exposure to cycloheximide a strong photoinactivation of glycolate oxidase was also seen in leaves. *In vivo* blue and red light were similarly effective. Furthermore, glycolate oxidase was photoinactivated in leaves when the endogenous GSH was depleted by the application of buthionine sulfoximine. Both catalase and antioxidants, in particular GSH, appear to be essential for the protection of glycolate oxidase in the peroxisomes *in vivo*.