

The Polarized Light-induced Enzymatic Formation and Degradation of Biopolymers

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It has been reported [1] that moonlight stimulated decomposition of polysaccharides in plants. That phenomenon was interpreted [2] in terms of the activation of hydrolases with polarized light of the moon. Subsequent studies [3-7] showed that white, linearly polarized light decomposes starch, provided starch is crystalline. Definitely, no enzymes were involved in that process. Initially, side branches of amylopectin undergo scission followed by repolymerization of resulting short chains into linear amylose-like polysaccharide. Studies with polarized color light [8] showed that red light stimulated depolymerization whereas green light stimulated repolymerization.

Independently, focus on effect of the polarized light upon enzymatic reactions of polysaccharides resulted in interesting discoveries. Thus, white, linearly polarized light activated α -amylolysis of starch [9], hydrolysis of xylane with xylanase [10], hydrolysis of chitin with chitinase and chitosan with chitosanase [11], hydrolysis of cellulose with cellulase [12], and interestingly influenced production of cyclodextrins with cyclodextrin glycosyltransferase [13]. Effect of duration of illumination of cyclodextrin glucosyltransferase with polarized light had certain effect upon the yield and isomer ration of three isomeric cyclodextrins.

Application of the polarized light required 1-2 hour illumination of the enzymes in a small reaction vessel followed by admixture of so activated enzymes to a bioreactor. Further reaction did not require any illumination. These studies are under development.

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