**A Key Enzyme for Biofuel Production: “Missing Link” between Oxidative Cellulose Degradation and Ethanol Fermentation by Microbes**

Cellulose is the most abundant renewable biopolymer on Earth, and the establishment of cellulosic biomass degradation systems has attracted significant attention. Cellulosic acid phosphorylase is a recently-discovered enzyme that can catalyze the decomposition of a major product of oxidative cellulose degradation and increase the efficiency of microbial bioethanol production. We have determined the crystal structure of cellulosic acid phosphorylase. The enzyme has a unique binding site for the gluconic acid moiety of the substrate. This study provides a molecular insight into the energetically efficient metabolic enzyme for oxidized sugars that may overcome the bottleneck of current biofuel production systems.

The development of cost-efficient systems for degrading and converting cellulosic biomass is a challenging but essential task for establishing a sustainable society. Therefore, microbial cellulases have attracted significant research attention for a long time. The recent discovery of lytic polysaccharide mono-oxygenase, which oxidatively cleaves glycosidic bonds of cellulose, has changed the paradigm of this research area [1]. Oxidative enzymes such as lytic polysaccharide mono-oxygenase and cellulose dehydrogenase synergistically act with orthodox hydrolytic enzymes such as oxygenase and cellobiose dehydrogenase synergistically to produce α-D-glucose 1-phosphate and D-glucose 1-phosphate) without consuming ATP.

CBAP produces the phosphorylated sugar (α-D-glucose 1-phosphate) of cellobionic acid by addition of inorganic phosphate) of cellobionic acid in the presence of oxygen. CBAP catalyzes phosphorylation (cleavage of the glycosidic bond by addition of inorganic phosphate) of cellobionic acid to produce α-D-glucose 1-phosphate and D-glucose 1-phosphate. Oxidative and dephosphorylative activities of CBAP can be investigated using cellobionic acid and gluconic acid.

Oxidation of cellobionic acid catalyzed by CBAP is a potential route for the effective generation of glucose and gluconic acid, which can be used for the production of bioethanol. The glucose and gluconic acid moieties of CBAP are recognized by the corresponding enzymes.

**REFERENCES**


**BEAMLINES**

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**Figure 1:** Schematic drawing of oxidative cellulose degradation system and the reaction of cellulosic acid phosphorylase.

**Figure 2:** Overall structure (left) and the active site (right) of cellulosic acid phosphorylase.