

Role of light in the enzymatic breakdown of plant biomass

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Light stimulates the breakdown of plant material and other biomass in nature.
Credit: Gisle Bjørneby / NMBU

It is well known that light stimulates the breakdown of plant material and other biomass in nature, but it has not been clear exactly how. Recently, researchers at NMBU have uncovered possible explanations. Their latest findings have just been published in *Nature Communications*.

In their new paper, the researchers describe how light activates [lignin](#), which is an important component of almost all [plant material](#). This activation of lignin leads to the production of the substance hydrogen peroxide, which many enzymes need to be able to break down the various components in such plant materials. So, lignin acts as a kind of "solar panel," which generates what the enzymes need to break down biomass.

One of the types of enzymes that need hydrogen peroxide are so-called "lytic polysaccharide monooxygenases," or LPMOs, which were discovered at NMBU and are now used worldwide to break down and valorize difficult-to-degrade plant materials that would otherwise have been lost.

This new study shows that it is, among other things, the amount of light that determines how much [hydrogen peroxide](#) is available to the LPMOs, which in turn controls how quickly the biomass is broken down.

Complicated questions

It is not easy to study lignin and the processes that sunlight sets in

motion. To get to the bottom of this, many different researchers have contributed.

"We have had a fruitful collaboration with chemists at KBM and SINTEF and, not least, with NMR experts at NTNU, to find out what actually happens to the lignin when it is exposed to light. This collaboration, and especially the NMR studies carried out by Finn Aachmann and his team at NTNU, has made it possible to understand what is actually happening," says project leader Vincent Eijsink.

"It is fascinating that light can make lignin start [enzyme](#) reactions," says Svein Horn, who leads the Bioprocess Technology and Biorefining (BioRef) group at KBM and one of the authors of the article.

"With this new understanding we have to consider how light affects the enzymes we use to break down biomass when we develop biorefining processes at NMBU," he adds.

"This work not only increases our understanding of how [biomass](#) is degraded in nature, but also points at new opportunities for the valorization of lignin," says Eirik Kommedal, the article's first author.

More information: Eirik G. Kommedal et al, Visible light-exposed lignin facilitates cellulose solubilization by lytic polysaccharide monooxygenases, *Nature Communications* (2023). [DOI: 10.1038/s41467-023-36660-4](https://doi.org/10.1038/s41467-023-36660-4)

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