

MWP – Young Researcher Abstract 2025

Project title: Enzymatic Strategies for Lignin Valorization: A Biocatalytic Approach	
Author: Valentina Perna, Simone Tarp Sunding, Jane Wittrup Agger	
Affiliation: Technical University of Denmark (DTU)	E-mail: valper@dtu.dk
<p>Abstract (approx. 200 words): Fungi have developed oxidative enzymatic systems to break down lignin with the use of oxidative enzymes. Unspecific peroxygenases (UPOs) recently identified as co-expressed with laccases during early fungal lignin degradation. UPOs are heme-thiolate enzymes that use hydrogen peroxide for oxygenation reactions, displaying catalytic versatility by acting on fatty acids, aromatic hydrocarbons, and complex organic compounds.</p> <p>To examine their peroxygenase vs. peroxidase activity on phenolic and non-phenolic lignin dimers, we tested UPOs on guaiacylglycerol-β-guaiacyl ether (GBG) and veratrylglycerol-β-guaiacyl ether (VBG). The peroxygenase reaction yielded hydroxylated and demethylated products, while peroxidase activity primarily led to polymerization. GBG, a phenolic dimer, underwent dominant peroxidase-driven polymerization, whereas VBG was mainly modified through peroxygenase action. Peroxidase activity in VBG commenced only after hydroxylation occurred.</p> <p>Although UPOs' direct action on intact lignin remains unproven, they may help mitigate methoxy group toxicity, facilitating lignin-derived compound metabolism post-depolymerization. Harnessing UPOs for lignin valorization offers a sustainable route to upgrading lignin-rich byproducts into high-value bio-based chemicals. This approach supports a circular bioeconomy, reducing fossil dependence and unlocking new industrial value chains.</p>	
Key words: UPOs, Lignin model compounds, H ₂ O ₂	