Parameter estimation for models of ligninolytic and cellulolytic enzyme kinetics


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Funding: LDRD Program of ORNL

Objective

• Provide well-documented enzymatic parameters for application in enzyme-driven soil organic carbon (SOC) decomposition models by compiling a database of kinetic parameters for typical ligninases and cellulases through a literature search and data synthesis.

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• The maximum specific enzyme activity ($V_{\text{max}}$) was log-normal distributed, with no significant difference in $V_{\text{max}}$ exhibited between enzymes originating from bacteria or fungi.
• Ligninases had higher activation energy ($E_a$) and lower optimum pH ($pH_{\text{opt}}$). An increase or decrease of 1.1–1.7 pH units from $pH_{\text{opt}}$ would reduce $V_{\text{max}}$ by 50%.
• $V_{\text{max}}$ from lab measurements with purified enzymes were 1–2 orders of magnitude higher than those under field conditions.

Significance

• The developed kinetic parameters add to our understanding of key ligninolytic and cellulolytic enzyme kinetics essential for modeling the decomposition of plant litter and soil organic matter.