



Substrate-dependent temperature sensitivity of soil organic matter decomposition

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Activity of extracellular enzymes responsible for decomposition of organics is substrate dependent. Quantity of the substrate is the main limiting factor for enzymatic or microbial heterotrophic activity in soils. Different mechanisms of enzymes response to temperature suggested for low and high substrate availability were never proved for real soil conditions. We compared the temperature responses of enzymes-catalyzed reactions in soils. Basing on Michaelis-Menten kinetics we determined the enzymes affinity to substrate (K_m) and mineralization potential of heterotrophic microorganisms (V_{max}) 1) for three hydrolytic enzymes: β -1,4-glucosidase, N-acetyl- β -D-glucosaminidase and phosphatase by the application of fluorogenically labeled substrates and 2) for mineralization of ^{14}C -labeled glucose by substrate-dependent respiratory response.

Here we show that the amount of available substrate is responsible for temperature sensitivity of hydrolysis of polymers in soil, whereas monomers oxidation to CO_2 does not depend on substrate amount and is mainly temperature governed. We also found that substrate affinity of enzymes (which is usually decreases with the temperature) differently responded to warming for the process of depolymerisation versus monomers oxidation. We suggest the mechanism to temperature acclimation based on different temperature sensitivity of enzymes kinetics for hydrolysis of polymers and for monomers oxidation.