Characterization of extracellular enzyme kinetics in two Mediterranean streams

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With 4 figures and 4 tables

Abstract: The extracellular enzyme kinetics were analyzed in the benthic biofilms at two second-order Mediterranean streams in each of the four seasons. The $V_{\text{max}}$ (maximal velocity), $K_m$ (apparent Michaelis constant) and $T_t$ (turnover time of substrate hydrolysis) were obtained for the $\beta$-glucosidase, $\beta$-xylosidase and phosphatase activities by the Michaelis-Menten approach. $V_{\text{max}}$ values were always higher for the cyanobacterial crust in La Solana (an open stream) – 33.8–130.8 for $\beta$-glucosidase, 27.9–114.9 for $\beta$-xylosidase, 75.1–240.5 for phosphatase – than for the sandy and epilithic biofilms in Riera Major (a forest stream) – 5.4–18.1 and 12.6–15.9 for $\beta$-glucosidase, 2.4–5.7 and 8.6–8.7 for $\beta$-xylosidase, 10.8–36.6 and 80.1–81.1 for phosphatase for sandy and epilithic biofilms, respectively. When normalized to biofilm biomass, the $V_{\text{max}}$ were still higher in La Solana. $K_m$ values were in the same range in the two streams. However, the turnover times were much lower in La Solana than in the epipsammic and epilithic biofilms of Riera Major. Such differences might be related to the different composition and structure in each biofilm as well as to the different environmental parameters (canopy, light, DOC content) in each stream. The rapid recycling of the organic matter in La Solana might be caused by the more labile substrates for the heterotrophs (organic compounds from primary producers), while the slower turnover time in Riera Major might be a result of it receiving an input of more recalcitrant material (litter fall from the riparian vegetation). The different nature of autochthonous biomass may also cause the differences in enzyme activities between both streams.

Introduction

Numerous extracellular enzymes hydrolyze high-molecular-weight molecules to low-molecular-weight molecules, allowing organic compounds to be available for microbial uptake (Burns 1983). The activity of microbial extracellular

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