

POSTER PRESENTATION

PHOSPHORUS RETENTION IN STREAMS: APPLICATION OF AN IN SITU ENRICHMENT SYSTEM (ISES) TO ASSESS THE CONTRIBUTION OF BENTHIC BIOFILMS

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Factors that influence the assimilation and subsequent downstream transport of nutrients in streams are not completely understood. Stream biofilms (benthic bacteria, fungi, and algae suspended in mucilaginous matrix) appear to play an important role in phosphorus (P) assimilation and retention; however, few measurements have been reported in the literature and even fewer experiments have been run to quantify their role. We evaluated P uptake rates of benthic biofilms along a stream productivity gradient in the mid-Atlantic region (Plateau and Piedmont provinces in Pennsylvania). We did 5 experiments using an in situ enrichment system, ISES (after Gibeau and Miller 1989) in each province. ISES used polystyrene vials filled with agar and spiked with increasing concentrations of KH_2PO_4 to deliver 5 relevant P loading treatments (0 to 2.0 g P/m²/d) that spanned the range of P point sources reported in the literature, while nitrogen (N) was added as a blocked factor (5 levels of P, 2 levels of N, 6 replicates, n=60). The vials were capped with porous porcelain disks that acted as a colonizing substratum. Experiments were incubated in each stream for 14-17 days, after which replicate biofilms were removed, and their P-uptakes rates were measured using short-term radiotracer ($\text{H}_3^{33}\text{PO}_4$) experiments in the laboratory. As anticipated, P uptake by the biofilms declined with increasing P loads in all experiments; the decline was described using a hyperbolic decay function. Moreover, P storage (as biologically bound polyphosphate) into the biofilm matrix increased with P loading, indicating that the decline in P uptake was related to increased P-storage in the biofilm. These data suggest that biofilms exposed to low P loads, were starved, and therefore exhibited the greatest uptake rates for P. Similarly, biofilms growing in streams that were less productive (lower conductivity and benthic chlorophyll levels) showed higher uptake rates compared to those in high productivity streams. We conclude many streams in the mid-Atlantic region appear to be close to P-saturation (high internal pools) and have comparatively lower capacity to remove new P from the water. If P inputs exceed biofilm uptake capacity (inducing saturation), we predict downstream reaches to experience greater in stream transport of nutrients to terminal coastal ecosystems like the Chesapeake Bay.