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Geomorphologic influences on bank sediments phosphorus chemistry

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Abstract:

Stream sediments play a fundamental role controlling dissolve reactive P (DRP) concentration in stream water. As sediment-water interactions are directly affected by channel geomorphology and sediment chemical composition, we compared differences in P chemistry between bank sediments at Upper West Emma Creek (UWEC) watershed near McPherson Kansas. Stream banks with mean height of 53 cm (BTI) and 107 cm (BTII) were sampled along the bank profile at three different heights and analyzed for equilibrium P concentration at zero net P sorption (EPCo), maximum adsorption capacity (Pmax), P release rate (Pï¡), moisture, anion exchange extractable P (AEP) and oxalate extractable Alox, Feox, and Pox. Samples that were taken at the water level (ho), at both bank types, exhibited the highest moisture content as well as the highest Pmax ($p<0.05$). Pmax for BTI sediments was higher than Pmax for BTII sediments at ho, h1 and h2 heights ($p<0.01$). Desorption kinetics experiments reflected that sediments located at the top of the bank had the highest values for AEP and they were able to release about twice as much P than sediments closer to the surface water. Similarly, EPCo and Pw were higher at top bank samples when compared with water level samples ($p<0.05$). However, Pox, Alox and Feox were not affected by bank type nor bank height. Thus, as sediments chemical composition remains constant, it has been shown that gravimetric moisture content may be influencing P sorption and desorption parameters along the bank profile. Additional research should be done to establish whether or not continuously sediment-water interaction is affecting P chemical behavior of samples taken at the water level. Finally, this research results indicate that bank features play an important role buffering P in stream systems; however, during bank erosion events they may be a substantial source of P.

Impact Statement:

The proposed experimental work is aimed at determining effects of stream geomorphology on chemical and physical characteristics of bank sediments with respect to phosphorus adsorption and desorption chemistry. This has been accomplished by collecting bank samples from Upper West Emma Creek (UWEC) Watershed, near McPherson, KS. Activities such as identification of bank types, bank height measurements and sample collection were conducted in the field. In addition, field samples were analyzed for adsorption and desorption chemical parameters at the soil fertility laboratory located at the plant science complex at KSU. Teaching activities have become an important part of this project. Graduate students as well as undergraduate collaborators have had the opportunity to improve their research skills. We learned from research results that bank sediments play an important role in buffering phosphorus contamination in UWEC watershed. Additionally, questions about how water content is affecting sediments chemical properties have arisen. Finally, this project has given us a better understanding about sediment water interaction at the watershed scale level.

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