



Phosphorus Removal in Woodchip Bioreactors

Intro

Woodchip bioreactors are very effective at reducing Nitrate-Nitrogen concentrations in tile drainage water, but they have also shown signs of reducing Dissolve Reactive Phosphorus (DRP). DRP plays a significant role in nutrient loading of water from ag landscapes since it's hard to remove and small amounts can cause eutrophication (excess algae). There has been limited studies on how and why the woodchips are reducing/absorbing this phosphorus, so the University of Illinois set up to crack the code.

This study looks at 7 different species of woodchips with various amounts of natural, Phosphorus-absorbing metals to determine if and how we could potentially design better bioreactors capable of treating both Phosphorus and Nitrogen found on agricultural landscapes.

Site & Testing

All testing was done on a small scale in a laboratory where researchers compared 7 different species of wood: cypress, white oak, hickory, poplar, cedar, maple, and woodchips taken from an in-field bioreactor of unknown source (70/30 ratio hardwood/softwood). These samples originated from plywood lumber, fallen branches, or commercially available woodchips.

Small vials were filled with woodchips and water (either clean, deionized water with known amounts of P, or river water representing typical ag runoff) then shaken for up to 72 hours. Phosphorous concentrations were taken throughout the 72 hours to determine if there was treatment over time for any given woodchip-water combination.

Results

Woodchips from the bioreactor and the shredded poplar lumber woodchips reduced Dissolved Reactive Phosphorus the most; over 80% reduction achieved. However, the metal content (the likely factor in P removal) of these woodchips were considerably different, so it's still a bit of a mystery of how all of these factors (metal concentrations, water pH, woodchip shape/surface area, presence of fungus, temperature, etc.) play into DRP removal. Almost all of the other woodchips had inconclusive results.

Takeaway

The results didn't lead us to a silver bullet for a dual-purpose bioreactor woodchip blend capable of treating nitrates and Phosphorus. But it did show that DRP reduction is quite possible and can be an added benefit of this edge-of-field practice. And since these bioreactors are used primarily to treat nitrates, a standard nitrate-eating woodchip blend seems to be our best bet for the time being.

-Trey Allis

Application Engineer – Prinsco

Citation:

Sanchez Bustamante-Bailon, A.P., Margenot, A., Cooke, R.A.C. *et al.* Phosphorus removal in denitrifying woodchip bioreactors varies by wood type and water chemistry. *Environ Sci Pollut Res* (2021).

<https://doi.org/10.1007/s11356-021-15835-w>