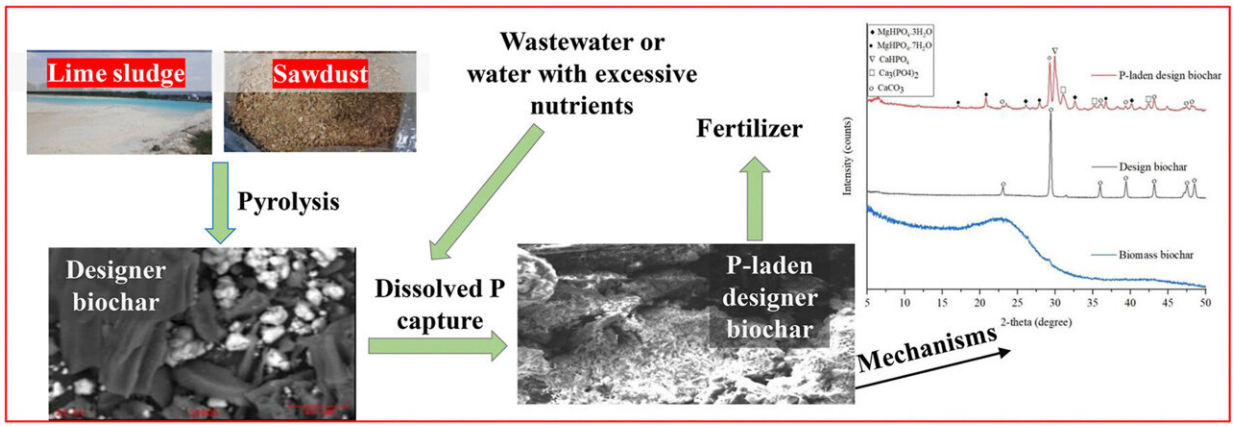
Scientists tackle farm nutrient pollution with sustainable, affordable designer biochar pellets

November 4 2024, by Lauren Quinn



Graphical abstract. Credit: *Chemosphere* (2021). DOI: 10.1016/j.chemosphere.2021.129717

What if farmers could not only prevent excess phosphorus from polluting downstream waterways, but also recycle that nutrient as a slow-release fertilizer, all without spending a lot of money? In a first-of-its-kind field study, University of Illinois Urbana-Champaign researchers show it's possible and economical.

"Phosphorus removal structures have been developed to capture dissolved phosphorus from tile drainage systems, but current phosphorus

sorption materials are either inefficient or they are industrial waste products that aren't easy to dispose of. This motivated us to develop an eco-friendly and acceptable material to remove phosphorus from tile drainage systems," said study author Hongxu Zhou, who completed the study as a doctoral student in the Department of Agricultural and Biological Engineering (ABE), part of the College of Agricultural, Consumer and Environmental Sciences and The Grainger College of Engineering at U. of I.

Zhou and his co-authors used sawdust and lime sludge, byproducts from milling and drinking water treatment plants, respectively. They mixed the two ingredients, formed the mixture into pellets, and slow-burned them under low-oxygen conditions to create a "designer" biochar with significantly higher phosphorus-binding capacity compared to lime sludge or biochar alone.

Importantly, once these pellets bind all the phosphorus they can hold, they can be spread onto fields where the captured nutrient is slowly released over time. The findings are published in the journal *Chemosphere*.

Leveraging designer biochar's many sustainable properties, the team tested pellets in working field conditions for the first time, monitoring phosphorus removal in Fulton County, Illinois, fields for two years. Like the majority of Midwestern corn and soybean fields, the experimental fields were fitted with subsurface drainage pipes.

This drainage water flowed through phosphorus removal structures filled with designer biochar pellets of two different sizes. The team tested 2–3 centimeter biochar pellets during the first year of the experiment, then replaced them with 1 cm pellets for the second year.

More information: Simin Yang et al, Capture and recover dissolved

phosphorous from aqueous solutions by a designer biochar: Mechanism and performance insights, *Chemosphere* (2021). DOI: 10.1016/j.chemosphere.2021.129717