Science Societies

Designer Biochar Enhances Excess Nutrient Removal

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Designer biochar (left) and gypsum pretreated biomass (right). Photo by Wei Zheng.

Agricultural runoff and sewage effluent both release excess nutrients into watersheds if treated improperly, jeopardizing water quality and triggering harmful algal blooms. Numerous phosphorus sorption materials (PSMs) have been used to remove phosphorus from nutrient‐containing water. Once used, PSMs are usually landfilled because many are industry by‐products and may release toxic chemicals. Flue gas desulfurization (FGD) gypsum, a by‐product of coal‐fired power plants, is an environmentally friendly PSM that is calcium (Ca) based. However, Ca‐based gypsum is less efficient at adsorbing dissolved phosphorus compared with iron‐ or aluminum‐based PSMs.

Researchers at the University of Illinois at Urbana‐Champaign engineered a novel designer biochar by pyrolyzing sawdust pretreated with FGD gypsum. They discovered that the phosphorus sorption capacity of the designer biochar was about ten times higher than that of gypsum. They also revealed the mechanism of sorption enhancement of the gypsum‐incorporated biochar and further confirmed that the designer biochar is an excellent PSM to capture dissolved phosphorus.

In addition to its phosphorus‐removing abilities, the nutrient‐captured biochar can be used as a slow‐release fertilizer. This practice could be a win‐win strategy to protect water quality and reintroduce lost nutrients for land application.

Adapted from Katuwal, S., Circenis, S., Zhao, L., & Zheng, W. (2023). Enhancing dissolved inorganic phosphorous capture by gypsum‐incorporated biochar: Synergic performance and mechanisms. Journal of Environmental Quality, 52, 949–959. https://doi.org/10.1002/jeq2.20505