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Abstract

Harmful Algal Blooms (HABs) are a devastating ecological and economic consequence of the abundance of nutrient-rich agricultural runoff entering aquatic ecosystems (Baker et al. 2014). Bioavailable phosphorus from synthetic fertilizers is one of the major nutrients contributing to this global issue. Previous studies indicated that dissolved phosphorus can be removed from an aqueous environment when passed through a composite mixture of granular steel wool particles and activated carbon (Erickson, Gulliver, and Weiss, 2007). In this project, we conducted experiments using higher quality concentration measurements to determine what grades of steel wool (SW-0000, SW-000, SW-00) and types of activated carbon (granulated - GAC, powdered - PAC, extruded - EAC) and in what combinations are most effective at removing phosphorus. Additionally, the production of iron-oxide byproducts was monitored as a characteristic of filter longevity. The feasibility of scaling up the proportions of materials was also assessed to determine the safety, health, and environmental regulations of filter implementation as well as to produce an economic analysis and design matrix. It was determined that a combination of GAC and SW-0000, would be the best choice of filter media due to its ability to uptake phosphorus, cost, and ability to trap carbon dust. From the experimental and existing data, a prototype filtration device was designed and analyzed regarding the materials needed, longevity, regulation, cost, and potential future implementation in the Maumee River and the Cuyahoga River.