Iron-Modified Biochar Recovers Phosphorus From Wastewater as Fertilizer Through Column Filters and Flow Reactors (Year 2)

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Controlling water pollution by phosphorus (P)-laden wastewater and satisfying the high demand for P fertilizer are two global challenges scientists and policymakers face. This project aims to study the economic viability of implementing previously designed novel iron-modified biochars as sorbents to recover P from wastewater and reuse it as fertilizer. Economic analysis was based on a comparison between the production costs of IB in granular (GIB) and powdered (PIB) forms and the benefits of 1) P removal from wastewater, 2) P recovery as fertilizer, 3) soil amendment, and 4) greenhouse gas (GHG) reduction abilities. All terms are expressed on values realized using 1 metric ton (t) of IB. Overall estimated production costs of GIB and PIB were found to be $1747 and $1763/t, respectively. Meanwhile, the soil amendment and GHG reduction values of pristine biochar were found to be $2580/t. The average value of P removal in different treatment alternatives was about $100/kg of P removed, and the recovered P has an estimated value of $41/kg. Year 1 results found the adsorption capacity of IB to be around 3.1 g/kg, so full utilization of one ton of such biochar for P treatment can add $310 in P removal and $127 in P reuse as fertilizer. Therefore, the overall value of IB reaches $3017/t, over 70% higher than the production cost of GIB/PIB. This indicates the application of iron-modified biochar to recover P from wastewater is economically feasible.

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