Designing activated biochars: Impacts of porosity and particle size on adsorption

Zoe A. Pollard, Athar Roshandelpoor, Pirooz Vakili, , Jillian L. Goldfarb

The U.S. tart cherry industry faces wide-ranging challenges including increased competition from imports, uncertainties over the impacts of climate change, and abundant sources of waste cherry pits. To meet human food and fiber needs in an environmentally and economically sustainable way, we must improve the efficiency of water and nutrient use while converting vast quantities of agricultural and food waste to renewable bioproducts. In this work we explore the processing conditions and application of waste cherry pits to biochars produced in a fixed bed reactor under slow pyrolysis conditions. Through sustainable waste to byproduct valorization these biochars can be implemented as soil amendments which reduce nutrient run-off causing eutrophication of lakes. In addition, the biochars are activated chemically and physically for removal of heavy metals from water using point-of-use activated carbon filters. Macrostructure and microstructure have been shown to greatly affect the bulk material properties and effectiveness of activated biochars. Here we investigate the effects of particle size distribution, porosity, packing, and activation conditions that result in activated carbons with high adsorptivity and selectivity. By developing this waste-to-byproduct conversion pathway we alleviate economic issues associated with cherry pit waste handling and create value-added products that can be used locally including soil amendments to reduce nutrient run-off and activated carbons to remove heavy metals from drinking water.