Recycling Waste into Biochar: A Sustainable and Economic Wastewater Filter and Fertiliser for the Agricultural Industry

Nguyen, Minh Nga (School: Sydney Girls High School)

The agriculture industry contributes heavily to land, water and air pollution due to the poor management of agricultural waste products and wastewater. A potential method of addressing these problems is by recycling these wastes and turning them into biochar filters. However, research is severely lacking regarding biochar's insitu use treating real wastewater rather than batch influents, which fail to account for competitive absorption. There have been minimal models developed that outline biochar's practical application, and furthermore, exhausted biochar's suitability as fertilizer has not been evaluated. This project targeted these research gaps and the need for a comprehensive study into biochar's insitu use. A novel model in which biochar acts in the dual roles of a bioabsorbent and fertilizer was engineered, with the conditions that maximized biochar's effectiveness as a bioabsorbent being determined. The model formed recommends bamboo biochar's use under a 1-hour detention time and 36-hour running time. Running time is suggested to be increased to over to 72 hours if phosphate levels are concerning based on competitive absorption occurring, in which biochar's absorption sites are favorable to nitrogen-based compounds before phosphorous-based compounds. The exhausted biochar was a viable alternative to commercial fertilizer, with plants biochar fertilized growing at a similar level to plants commercial fertilized. This model's application can successfully remove a significant 45.6% of wastewater ammonium, phosphate, nitrate and nitrite, with effluent quality meeting Australian standards. This thus provides the agricultural industry an economic and sustainable way to reduce its environmental impact and pollution.

Awards Won: