The applications of green sorption media for stormwater treatment and nutrient removal benefit surface and ground water bodies by reducing non-point source pollution from stormwater runoff. To enhance nitrogen and phosphorus removal, a sequential study was performed to develop an improved green sorption media in this study by including the iron filings into the previous biosorption activated media (BAM). The iron-filings-based green environmental media (IFGEM) are thus composed of sand, tire crumb, clay and ground iron filings in which clay and iron particles are supposed to have salient interactions that cannot be present in BAM. However, the optimal ratio between clay and iron-filings remains unknown. The innovative media recipe was determined from a suite of sequential clay and iron filing contents variations by fixed-bed column testing seven IFGEM recipes with varied clay and iron filing aggregates. The optimal IFGEM recipe (IFGEM\(\text{r}^3\)) was initially determined from the nutrient removal efficiency at three influent conditions obtained from spiked distilled water with three levels of phosphate (0.3, 0.5, 0.7 mg/L) and nitrate (0.9, 1.3, 1.7 mg/L) concentrations designed to mimic in-situ stormwater conditions. The nutrient removal and recovery potential with respect to varying physical and chemical properties of IFGEM were further investigated by response surface method (RSM). Response surface method was later employed to identify the optimal or intelligent IFGEM recipe from simulated nutrient removal results based on the seven IFGEM recipes. The RSM encompassed the modeling of the response surface of three responses (total nitrogen, total phosphorus, and ammonia removal) in relation to clay and iron filing contents. Lastly, to validate the efficacy of the real-world applications, a fixed-bed column study was performed to explore the biological and physicochemical characteristics of IFGEM\(\text{r}^3\) for nutrient removal in stormwater treatment. The nutrient removals and interactions of microbial population dynamics were analyzed for natural soil, BAM, and two IFGEMs (IFGEM\(\text{r}^1\) and IFGEM\(\text{r}^3\)) simultaneously for final validation of this bioengineering technology. Results indicate that IFGEM has a great potential to achieve the essential removal of nutrients for stormwater runoff.

Major: Environmental Engineering

Educational Career:
Bachelor's of Environmental Engineering, BS, 2017, University of Central Florida

Committee in Charge:
Ni-Bin Chang, Chair, CECE
Kelly Kibler, Dept. of Civil, Environmental, and Construction Engineering
Andrew Randall, Dept. of Civil, Environmental, and Construction Engineering
Martin Wanielista, Dept. of Civil, Environmental, and Construction Engineering

Approved for distribution by Ni-Bin Chang, Committee Chair, on June 9, 2019.

The public is welcome to attend.