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Development of Novel Adsorptive Media for Water Pollution Control

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DEVELOPMENT OF NOVEL ADSORPTIVE MEDIA FOR WATER POLLUTION CONTROL

A Proposal for the Research and Creative Experience for Undergraduates
(RCEU) Program, Summer 2018

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Project Summary:

Water is one of the most important resources for life. Surface water and groundwater are two major water sources that sustain human needs. These sources can be polluted by both point-sources (e.g. discharge pipe from treatment plant) and nonpoint-sources (e.g. rainfall-runoff, agriculture runoff). In particular, nonpoint source pollution, the largest source of water quality degradation in U.S., may represent greater challenges due to the diffuse, stochastic, and variable loadings. Stormwater management has been traditionally focused on mitigation of peak flow. However, the built environments also represent an interface where various pollutants such as nutrients, heavy metals, organics, and pathogens can be mobilized and transported by rainfall-runoff, and eventually contribute to the degradation of receiving water bodies. Furthermore, rapid development of industrialization, population growth, environment deterioration, and climate change have increased the water demand and shortage of clean water sources becomes an issue worldwide in recent years. As a result, utilization of non-traditional water resources such as treated wastewater and stormwater may represent a sustainable solution in the long run for communities with severe water stress. Therefore, cost-effective reduction of pollution associated with stormwater runoff and treated wastewater becomes even more imperative to protect public health. The overarching goal of this project is to develop and test novel low-cost multifunctional adsorptive media for water pollution control. Here we propose to develop novel low-cost multifunctional adsorptive media to remove various contaminants from contaminated water. We will utilize and functionalize the emerging low-cost carbon materials through facile and scalable hydrothermal procedures and further evaluate its adsorption capacities of multiple pollutants including nutrients, heavy metals, organics, and pathogens. The student will actively involve in media preparation, characterization, laboratory reactor design and fabrication, and adsorption tests to evaluate the media performance.

Student Prerequisites:

Students should have good background in General Chemistry, knowledge of water/wastewater treatment is advantageous but not required. Typically students with a major in

Civil and Environmental Engineering, Chemical and Materials Engineering, Chemistry should be able to carry out the research work. Previous research/lab experience is a clear benefit.

Student Duties:

Under the PI's supervision, the student is expected to understand the general challenges related to water we are facing now, common treatment and pollution control technologies especially adsorption processes. The student duties include: literature review to gain necessary background information supporting this research; development of media synthesis protocol; media preparation in the lab; media evaluation through a series of laboratory experiments; data analysis and reporting. The student will learn how to review scientific papers, understand the water quality challenges, gain hands-on experience of standard water chemistry analysis as well as advanced instrument such as ion chromatography, spectrophotometer, HPLC, and obtain training on a set of techniques of materials synthesis and adsorption tests.

Mentor Supervision and Interaction:

The undergraduate student will work closely with the faculty advisor and other students in the research group. A graduate student will help get the RCEU student started. The student is encouraged to see the faculty advisor for advice and suggestions whenever needed. One-to-one meeting with the advisor will be set up on a weekly basis, reviewing the progress, discussing any problems encountered, and developing future work plan. Group meetings will also be held bi-weekly, where the students will make oral presentations to the whole group on their research work. In addition to the weekly progress report (oral or written), the student is expected to involve in manuscripts preparation together with other group members for publication. Upon mutual satisfaction, the student may continue working in the PI's research group as a student specialist after summer 2018.