Adsorption of Nitrophenols (NPhs) Using N-Doped Carbonaceous Material

Bhattacharyya, Anusha (School: Little Rock Central High School)

Nitrophenols (Nphs), a chemical used for synthesizing in pesticides, insecticides, herbicides and other industries, is a major source of water pollution. Due to population growth, the usage of these products are increasing exponentially and along with it water pollution related to NPhs. U.S. Environmental Protection Agency (EPA) reported 4.9 billion pounds of pesticide usage/year in the USA alone. Agro products used for farming, undergo hydrolysis and biodegradation to produce NPhs which are directly discharged into waste water and natural water resources. NPhs and their derivatives are highly toxic, mutagenic and bio-refractory pollutants and has been classified as a priority pollutant by EPA. Current adsorbents used for NPhs remediation are expensive, inefficient, and unsustainable. The goal of this project was to find a suitable adsorbent using naturally abundant environmentally benign material to remove NPhs from water in an efficient, inexpensive and sustainable way. To achieve this, nitrogen doped carbonaceous material containing titanium dioxide (N-C-TiO2) was synthesized by the pyrolysis of microcrystalline cellulose (MCC), dopamine and TiO2 at 500 °C. NPh adsorption on the N-C-TiO2 adsorbent surface was then studied by varying the pH, initial concentration of NPh, and adsorbent dose. After 4 hour of sonication 80% 4-NPh adsorption was achieved using N-C-TiO2 at pH 3.0. 4-NP adsorption best fitted to the Langmuir isotherm plot with R2 value of 0.9981 and absorption capacity of this adsorbent is 52.91 mg·g-1. In addition, adsorbent reusability was studied successfully for five cycles. N-C-TiO2, with absorption capacity of 52.91 mg·g-1 and being real cheap, proved to be a real good solution comparing to the current alternatives.

Awards Won:
Third Award of $1,000
Arizona State University: Arizona State University Intel ISEF Scholarship