Online Proceedings

Poster Session 2

Commons West, Easel 10

1:00 PM to 2:30 PM

Synthesis of Graphene Oxide Quantum Dots from Biochar

Sydney Michelle Fry, Senior, Bioresource Science and Engr: Business
Mentor: Anthony Dichiara, Bioresource Science & Engineering
Mentor: Sheila Goodman

Quantum Dots (nanoparticles with semiconductor properties) are currently produced from potentially toxic materials, and are expensive to prepare. Developing a less toxic, more renewable quantum dot has the potential for utilization in biosensors and bioimaging without the high cost or environmental pollution associated with current metal-based quantum dots. Methods for developing graphene quantum dots are being investigated by utilizing a sustainable carbon source. Specifically, the use of hydrogen peroxide as an oxidant in a hydrothermal reaction is being optimized in terms of reaction time, temperature, carbon:oxidant ratio, and oxidant concentration. Carbon sourced from research being conducted on campus allows for reduced cost and waste treatment while providing an alternative to metal-based quantum dots. Further work on the subject will include incorporating the quantum dots into handsheets (paper samples) to test fluorescence, which ultimately will be used as optical and photoelectric sensing materials due to their high stability and distinct long-term fluorescent properties. Additionally, there is potential to explore other oxidants and carbon sources that have minimal environmental impact.

Poster Session 2

Commons West, Easel 9

1:00 PM to 2:30 PM

Synthesis of Reduced Graphene Oxide Aerogels for Detoxification of Biorefinery Effluents

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Mentor: Anthony Dichiara, Bioresource Science & Engineering
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The removal of contaminants from aqueous media is a challenge faced in many engineering systems. In particular, fermentation processes during biofuel production is hampered by a variety of toxic compounds present in hemicellulosic hydrolysates. Adsorption is an efficient and economic method of reduction in the amounts of phenolic compounds, acetic acid, aromatic compounds, furfural and hydroxymethylfurfural normally found in hemicellulosic hydrolysates. Activated carbon is currently the most widely used adsorbent. However, its poor reusability and its limited capacity to uptake larger molecules due to size exclusion effects necessitate the investigation into alternative materials. Carbon nanomaterials exhibit high specific surface area and open pore structure, making them very compelling for hydrolysate detoxification. To overcome the tendency of carbon nanomaterials to aggregate, which greatly reduces the number of sites available for adsorption, we developed mesoporous, nitrogen-doped, reduced graphene oxide aerogels with an open three-dimensional network. Graphene oxide was first prepared from renewable carbon sources and reduced by hydrothermal treatment to form hydrogels, which were then freeze-dried in tert-butanol to form aerogel sorbents. By adjusting the different synthesis parameters (i.e. temperature, pH, chemical dosages. . .), we were able to finely control the pore structure and chemical composition of the nitrogen-doped graphene aerogels, as measured by nitrogen physisorption and elemental analysis. Results revealed superior adsorption properties than activated carbon for the hydrolysate detoxification, which improved fermentation yields.