

Graphene Oxide-Chitosan Nanocomposites for Water Purification

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Outlines

- Introduction
- Materials
 - ❖ Graphene oxide
 - ❖ Chitosan
- Methods
- Results
- Future Work



Introduction

- Clean Water Crisis
 - ❖ Water is life: Clean and plentiful water provides the foundation for prosperous communities
 - ❖ Water pollutions: chemical (gasoline, oil, heavy metals, organic dyes); biological (virus and bacterium);



4,500 CHILDREN WILL DIE TODAY FROM WATER-RELATED DISEASES.



Introduction

- **Water Pollution Diseases:**
 - ❖ Dirty water is the world's biggest health risk, and continues to threaten both quality of life and public health
 - ❖ Cholera, Dysentery
 - ❖ More than **1 billion people** worldwide lack safe drinking water and died from water pollution diseases



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Introduction

- **Water Purification**
 - ❖ It is the process of removing the various types of contaminants from water, making the water suitable for human consumption and use.
 - ❖ **Method:** Physical (e.g., **Adsorption**), Biological, Chemical
 - ❖ **Benefits of Adsorption:** ease of operation and comparably low cost.



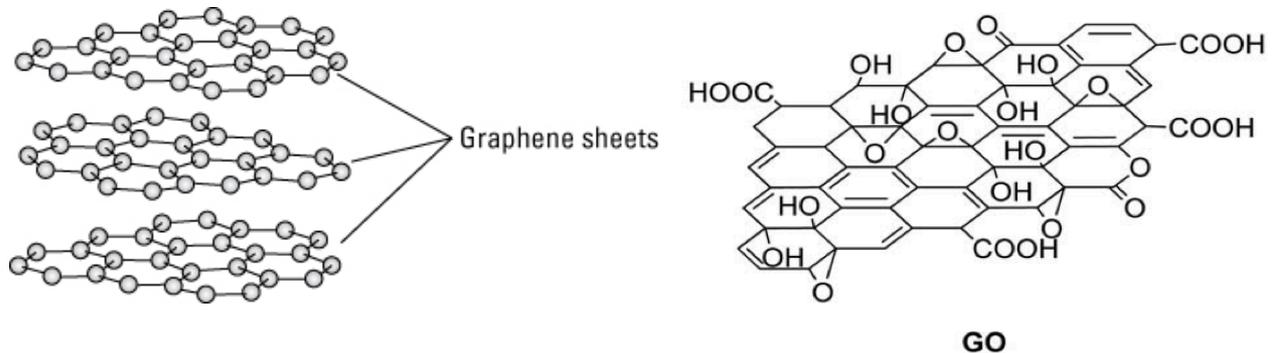
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Graphene oxide

- **Graphene:** an ultra-thin carbon material with high mechanical strength, excellent conductivity, and high surface area
- **Graphene oxide:** Functionalized graphene



Graphene oxide

- **Advantage:**

- ❖ High surface area
- ❖ Functional groups allowing for additional chemical modification

- **Drawbacks:**

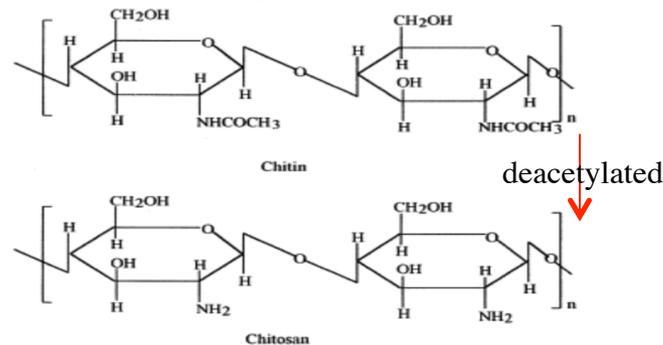
- ❖ Secondary pollution

1. Graphene oxide has potential **toxicity**
2. Tiny materials **are difficult to be collected** completely after usage.



Chitosan

- **Chitosan:** Natural polysaccharide derived from Chitin which is the secondary abundant natural polysaccharide
- **Applications:** Chitosan (CS) has been applied for many fields including adsorptions of metal ions and oil.



Chitosan

- **Advantages:**

The second most abundant natural polymer after cellulose in the world

- ❖ **Cheap** and **plentiful**

- ❖ **Biocompatibility** and **biodegradable**

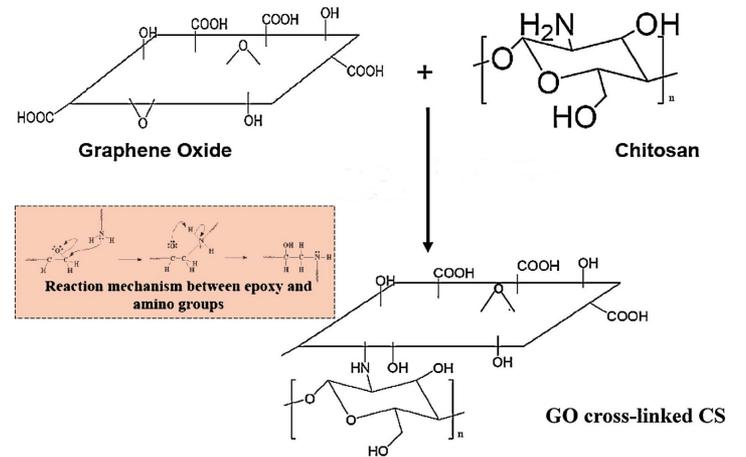
- **Drawbacks:**

- ❖ **Low mechanical properties**, which restrict its use in a wide-range application.



Graphene Oxide-Chitosan

- GO sheets and CS chains can be well self-assembled together as GO-CS nanocomposites (hydrogel).
- GO-CS Microspheres

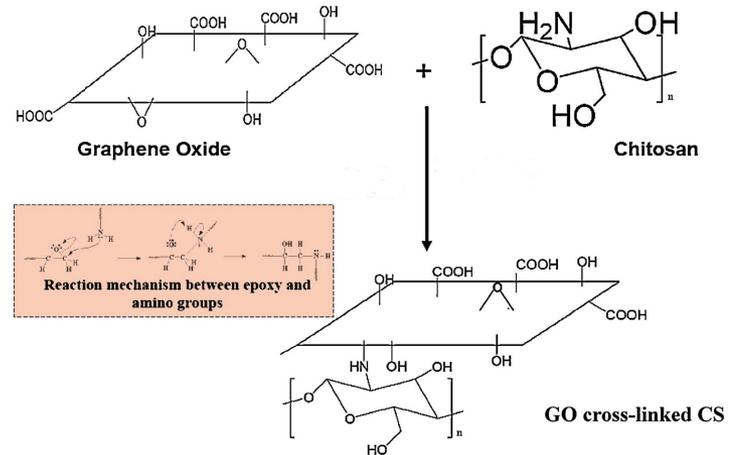


Shao et al., 2013



Graphene Oxide-Chitosan

- Advantage of GO-CS Microspheres
 - ❖ Easy collected after using
 - ❖ Enhanced tensile strength

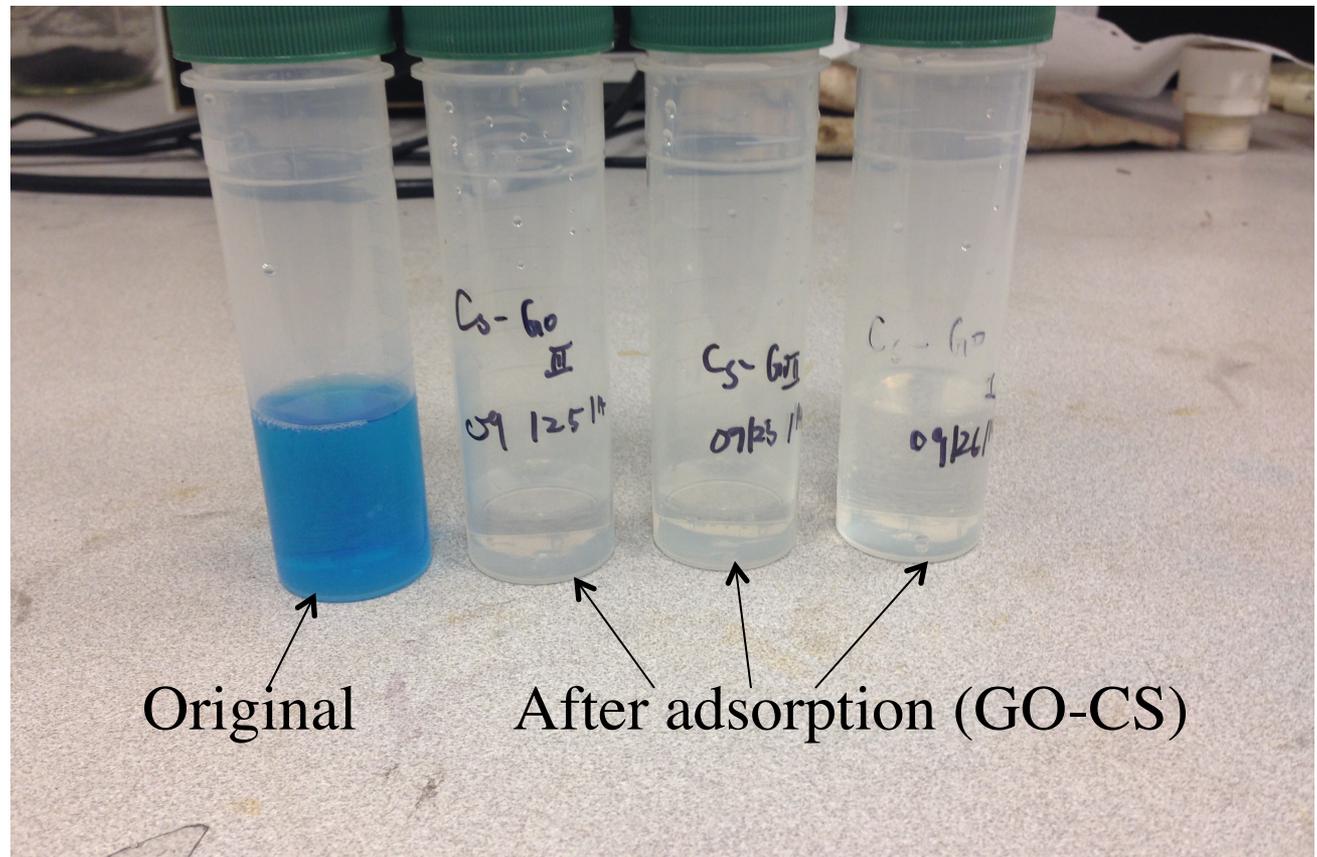


Shao et al., 2013



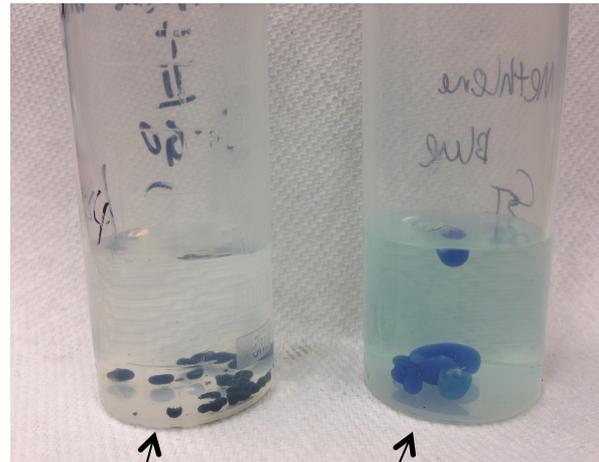
Results

- Part 1: Adsorption of Methylene Blue



Results

- Only CS VS. GO-CS

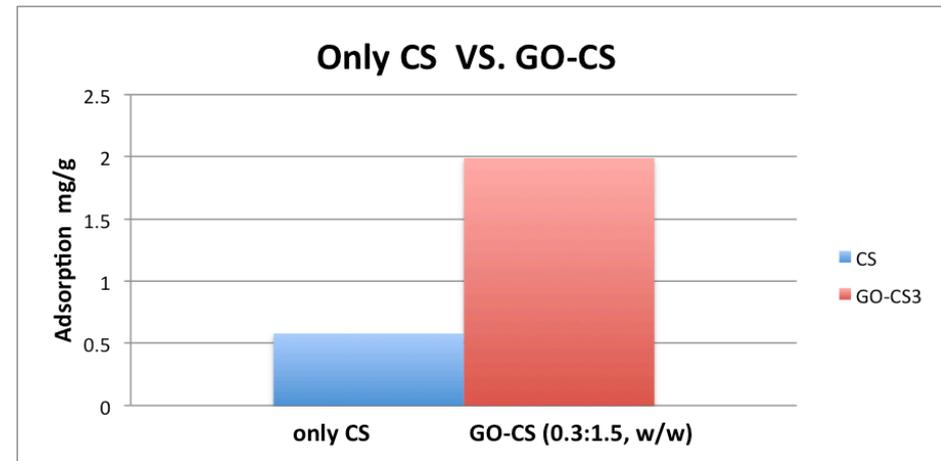


GO-CS

CS

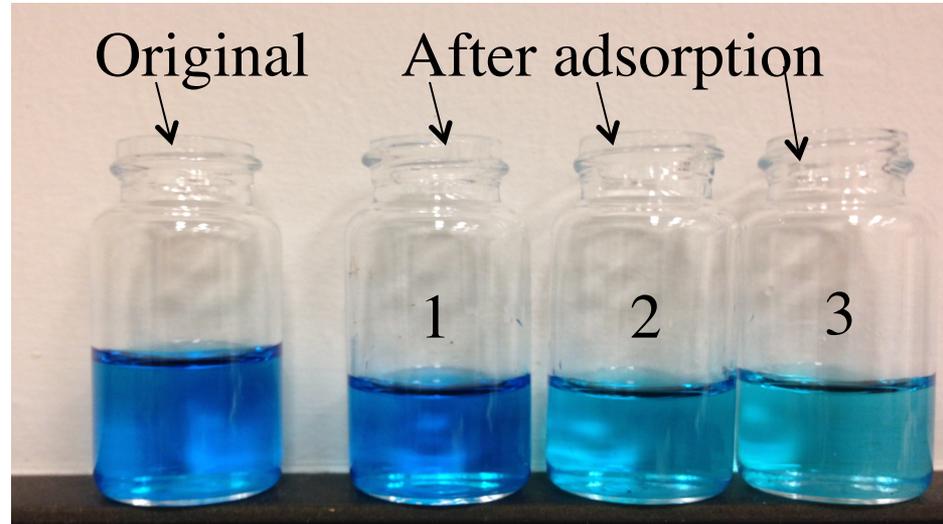
Finding:

Addition of GO can significantly improve the adsorption of Methylene Blue



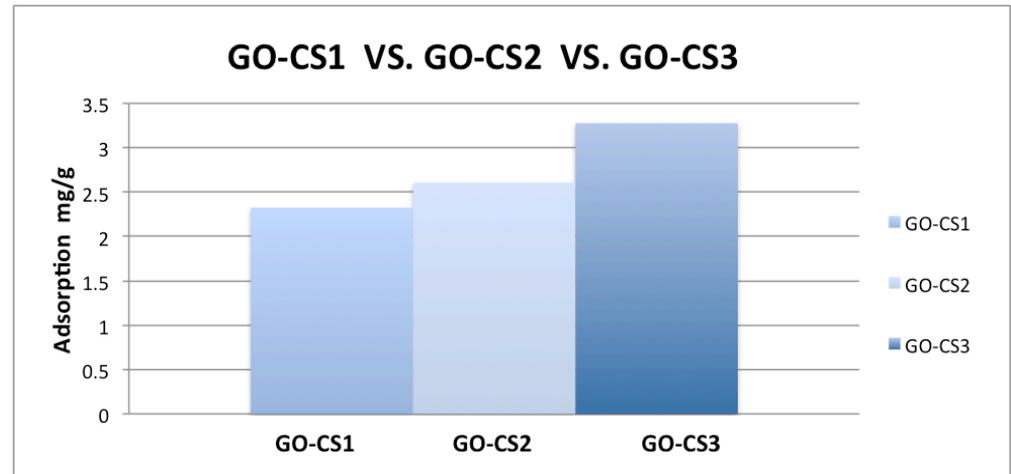
Results

- GO-CS1 VS. GO-CS2 VS. GO-CS3



Finding:
Increasing the content of GO leads to higher adsorption capacity to MB

Weight ratio:
GO-CS1 (0.1:1.5)
GO-CS2 (0.2:1.5)
GO-CS3 (0.3:1.5)



Future work

- Heavy metals
- Oil
- Bacteria

