# Novel banana peel/graphene oxide derived biosorbent for water purification

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**Abstract**

More than 100 million tons of banana peels are produced annually, and about 40 million banana peels (40% of total weight) remain greatly unused. Hence, exploring banana peels' ability to clean contaminated water would bring an additional value to the current "waste" product. One of the most common aspects of water pollution currently is heavy metal contamination, which is particularly dangerous for humans due to its high toxicity. Banana peels contain a high concentration of carbohydrates, the two most abundant being cellulose and starch, which has multiple hydroxyl and carboxyl functional groups. Banana peels are an easily available and cost-effective adsorbent that can adsorb different kinds of heavy metal ions. This research primarily focuses on improving the current efficiency of this technique through the development of a banana peel/graphene oxide hybrid adsorbent. The cross-linking graphene oxide possess numerous hydroxyl, carbonyl, carboxyl, and epoxide functional groups that can be used to induce chemical reactions with banana peel carbohydrates, providing the graphene oxide with additional functional groups. This modification can potentially increase the adsorption capacity of banana peel derived adsorbents. It is evident through FTIR analysis that banana peel powder and graphene oxide have many functional groups of similar types. Thus, reactions can readily occur to combine the two substances. The TGA analysis of both compounds, however, indicates different patterns of thermal decomposition. Further thermal analysis is required for the hybrid adsorbent. After the development and characterization of this hybrid adsorbent, the next step is to complete a water purification analysis. In the future, banana peel/graphene oxide derived adsorbent may serve as a sustainable and efficient solution for water purification.

Key words:
banana peel, banana, graphene oxide, biosorbent, water purification, adsorbent

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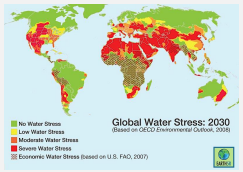
## Introduction

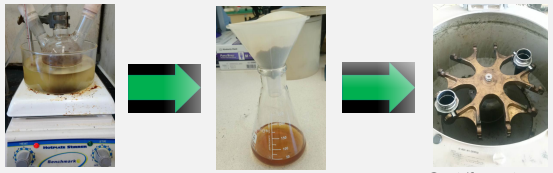
- According to UNO, 2.1 billion people have no access to clean water.
- Conventional approaches are very expensive.
- More efficient and low-cost water treatment technology is needed.
- More than 200 million tons of banana peels are produced annually.[1]
- Banana peel/Graphene oxide based biosorbent is a promising candidate for water purification.




## Methodology

**Pre-treatment of banana peel**


**Carbohydrate extraction[2]**




## Results

**Structural Analysis**

**Figure 1:** FTIR of banana peel powder

| Bands ($cm^{-1}$) | Assignments |
|---|---|
| **3279** | O-H stretching |
| **2916 and 2849** | C-H stretching of alkane |
| **1728** | C-O stretching of carboxylic acids |
| **1592** | C–C bond of diene |
| **950–1600** | Attributed to ester, polysaccharide or protein |
| **885** | N-H deformation of amine |

**Table 1:** FTIR absorption bands of banana peel powder

**Thermogravimetric Analysis (TGA)**

**Figure 2:** TGA analysis of banana peel powder

## Conclusions


**Expected Outcomes:**

- Low cost adsorbent
- Sustainable and renewable
- Single integrated technology
- Environment friendly

**Future Work:**

- Development of hybrid adsorbent.
- Characterization of the adsorbent.
- Water purification analysis of the adsorbent.

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