Novel Graphene Oxide Based Photocatalyst Glass Coating for Organic Removal Under Solar Light

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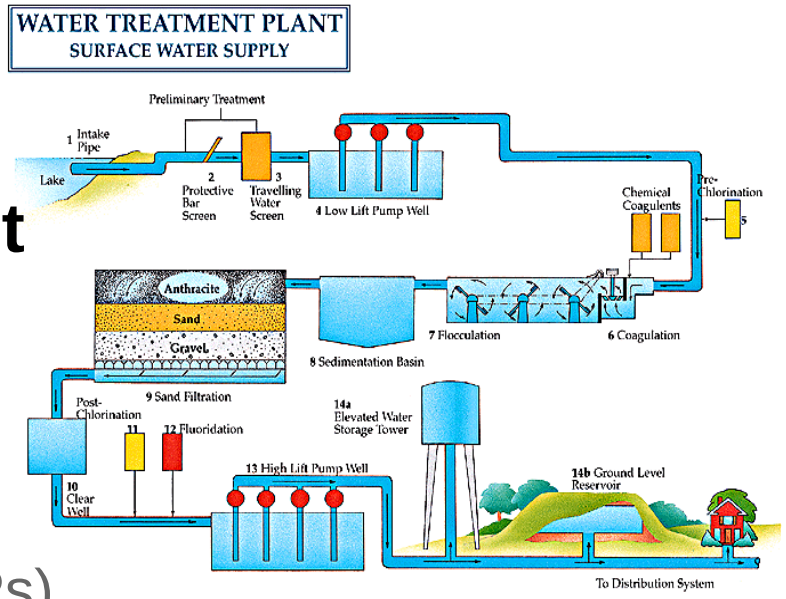
Introduction

- **Water pollutants:**
  - Inorganic wastewater
  - Emerging organic contaminants (EOCs)
  - Microorganism

- **Conventional water treatment plants：**
  - Inadequate
  - Harmful disinfection byproducts (DBPs)



Introduction

- Emerging treatment technology:

  Semiconductor-mediated heterogeneous photocatalysis

- Advantages:
  - non-hazardous and economical semiconductors
  - Shorter reaction time
  - Complete mineralisation of the contaminants into harmless substances

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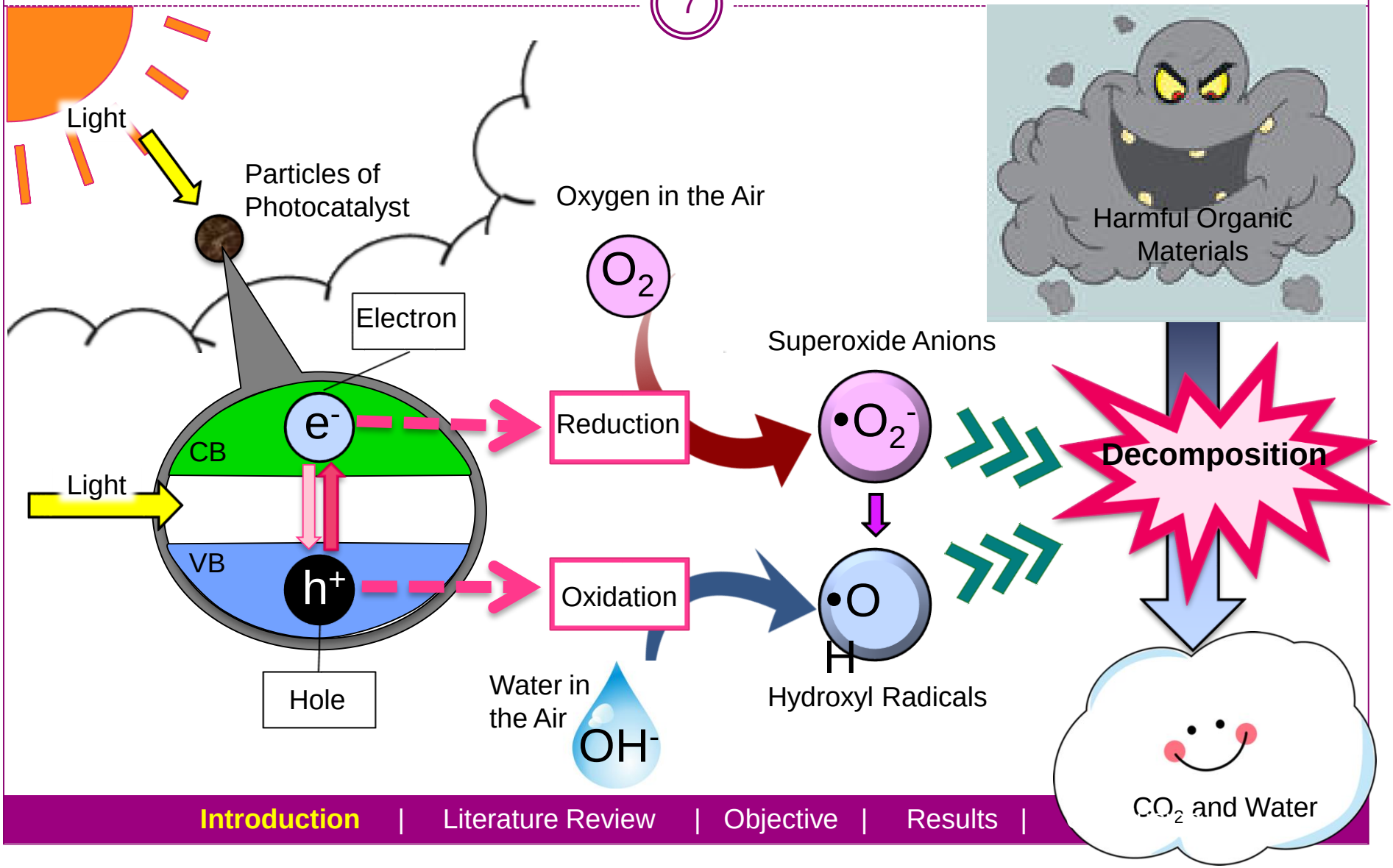
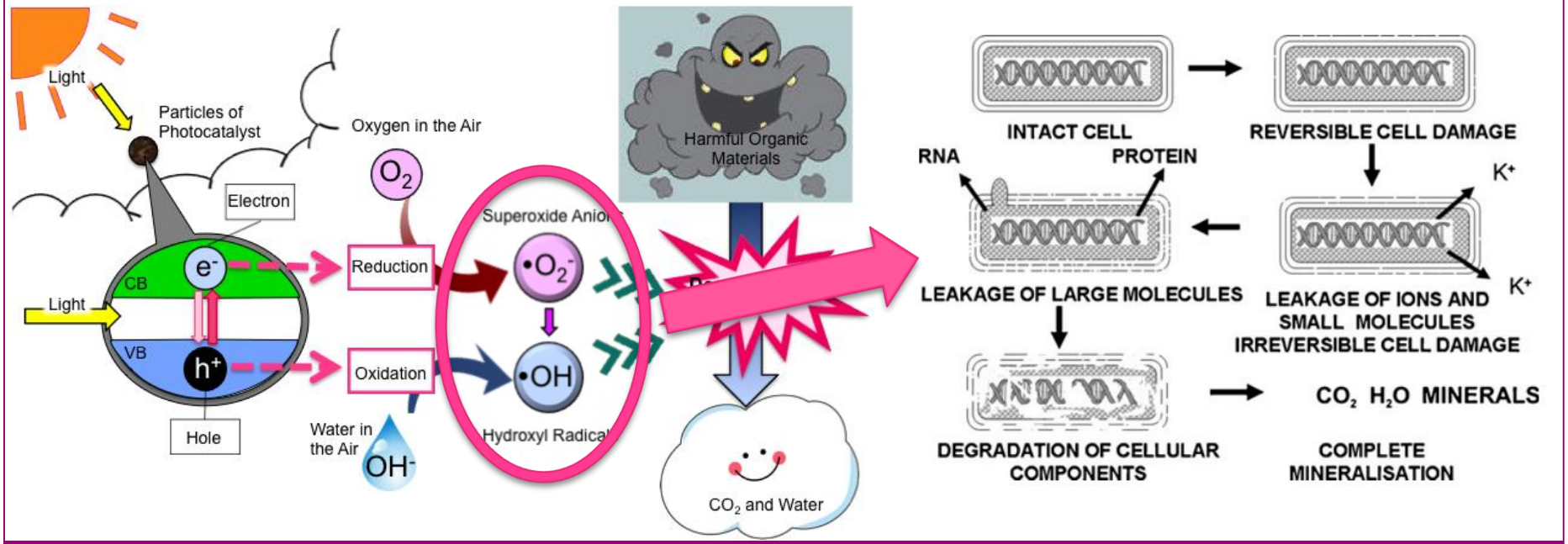
Semiconductor-mediated heterogeneous photocatalysis



Solar Photo-disinfection

- With the aid of the **reactive oxygen species (ROS)**, **microorganisms** such as bacteria and viruses could be effectively **destroyed**.



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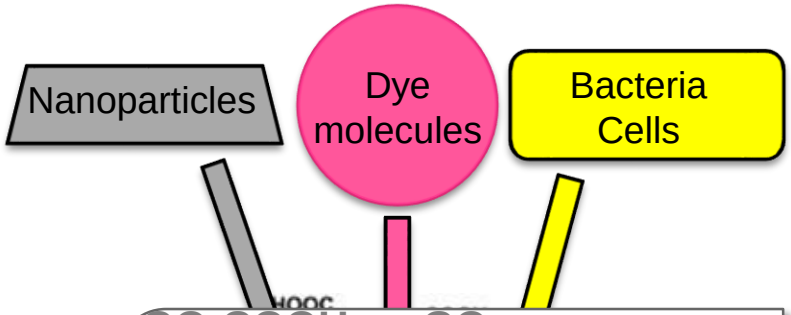
Carboxylic acid functionalised Graphene Oxide (GO-COOH) Sheets



- Advantages:
  - Excellent photocatalytic conductivity
  - Large surface area (2600 m^2/g)
  - Carboxyl functional groups
    - Effective support for inorganic **nanoparticles**
    - Strong binding ability with the **dye molecules** via π-π interactions
    - **Bacteria cells** can be assembled and adsorbed on the GO-COOH sheets
- Disadvantages:
  - Aggregation as suspensions in solution

GO-COOH vs GO:
Further carboxylation: enhanced hydrophilicity and more carboxyl groups as anchoring sites to strongly bind contaminants to the surface of GO-COOH

Copper Sulfide (CuS) as Semiconductor

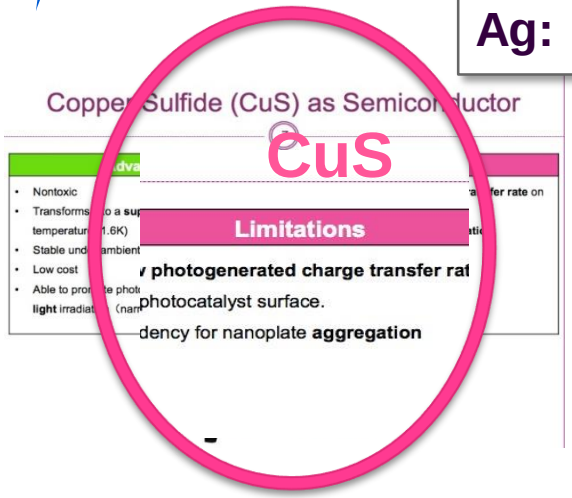
Advantages	Limitations
• Nontoxic • Stable under ambient conditions • Low cost • Promote photocatalysis under **visible light irradiation** (narrow band gad 2.1eV)	• **Low photogenerated charge transfer rate** on the photocatalyst surface. • Tendency for **nanoparticles aggregation** • **Disinfection ability** not so strong

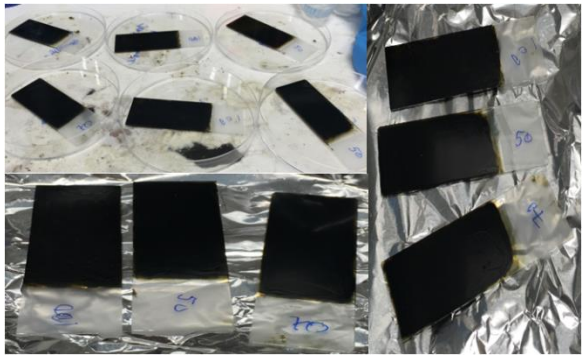
Considerations for CuS-based nanocomposite

Glass coating increases the ability in recovery, recycling and isolating these nanoparticles

Novel copper sulfide-based nanocomposites (GO-COOH-CuS-Ag) for water remediation: Synergistic effect

GO: Suitable support and enhanced photocatalytic ability
Ag: Enhanced disinfection ability





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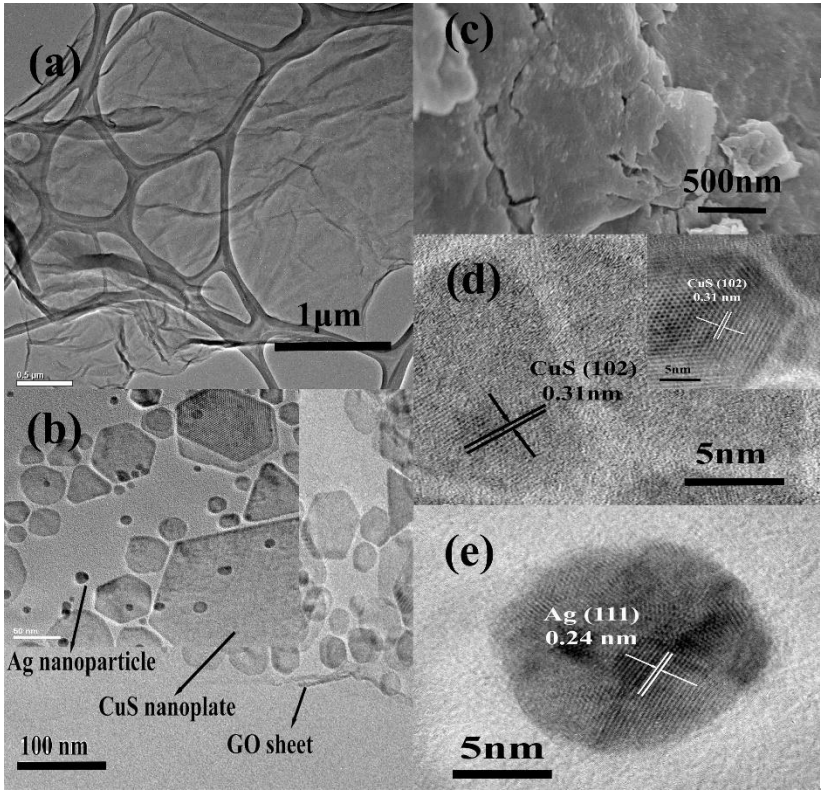
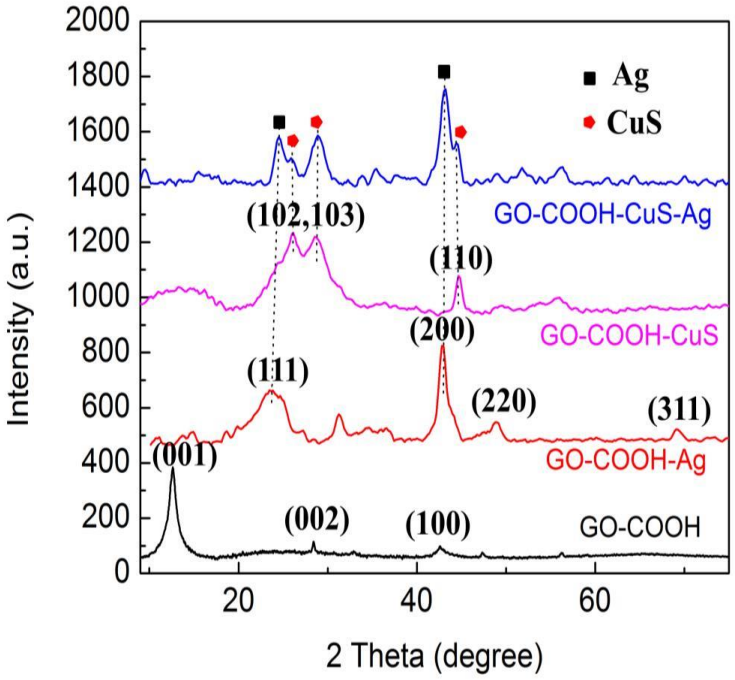
Morphological and Structural Analysis

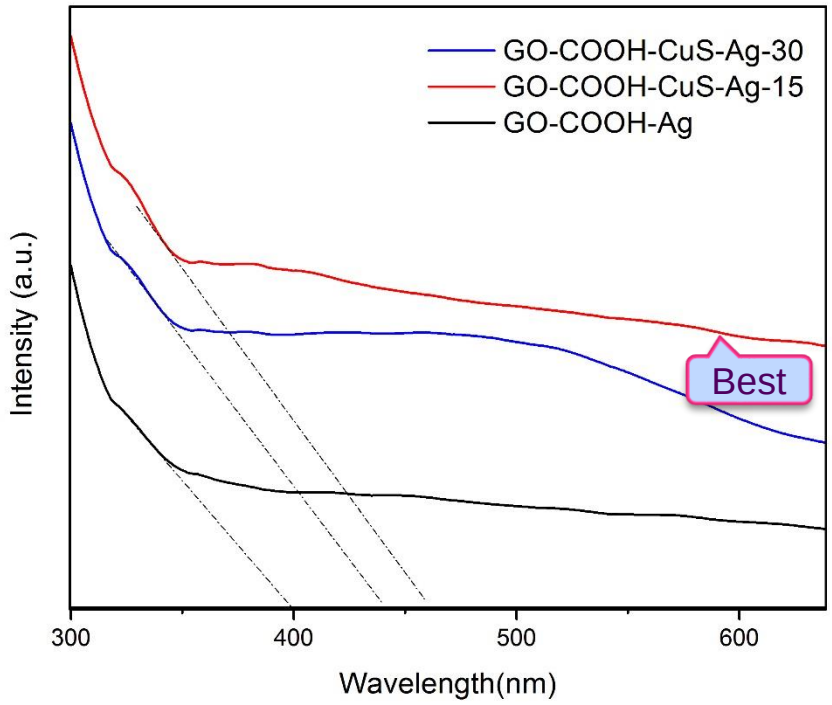


- TEM and FESEM images



- XRD patterns

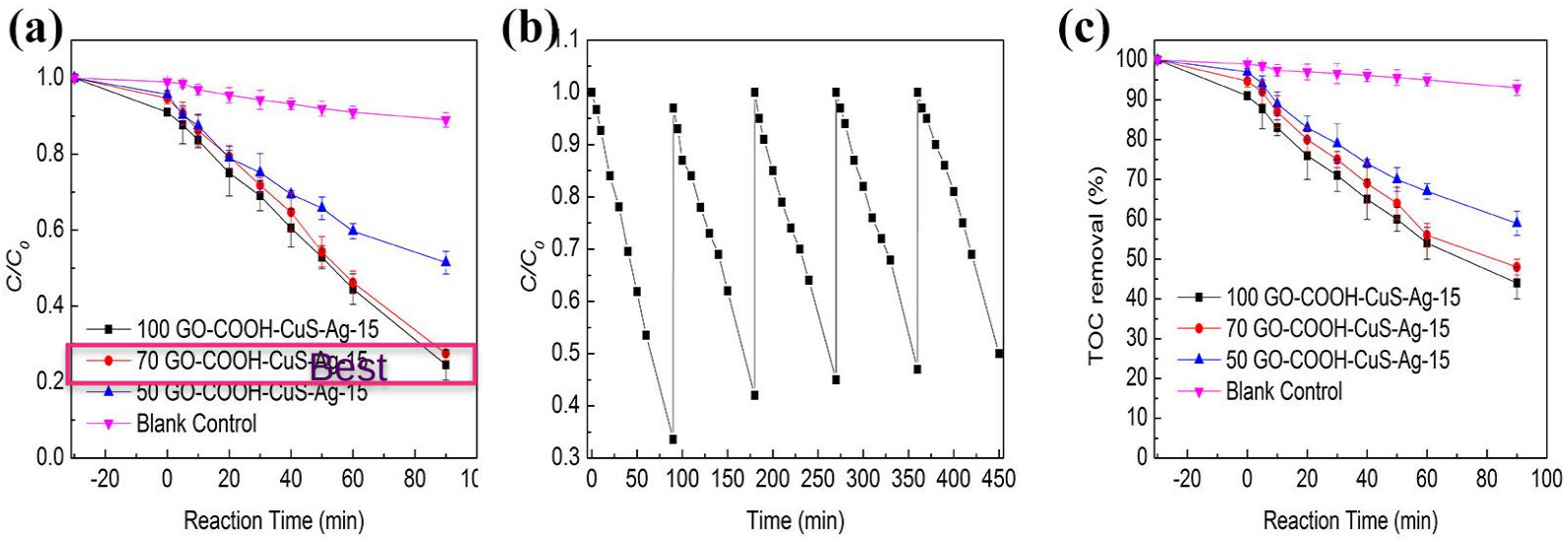
Optical Properties



Enhanced Absorbance

- (a) UV-vis diffuse reflectance spectra (DRS)

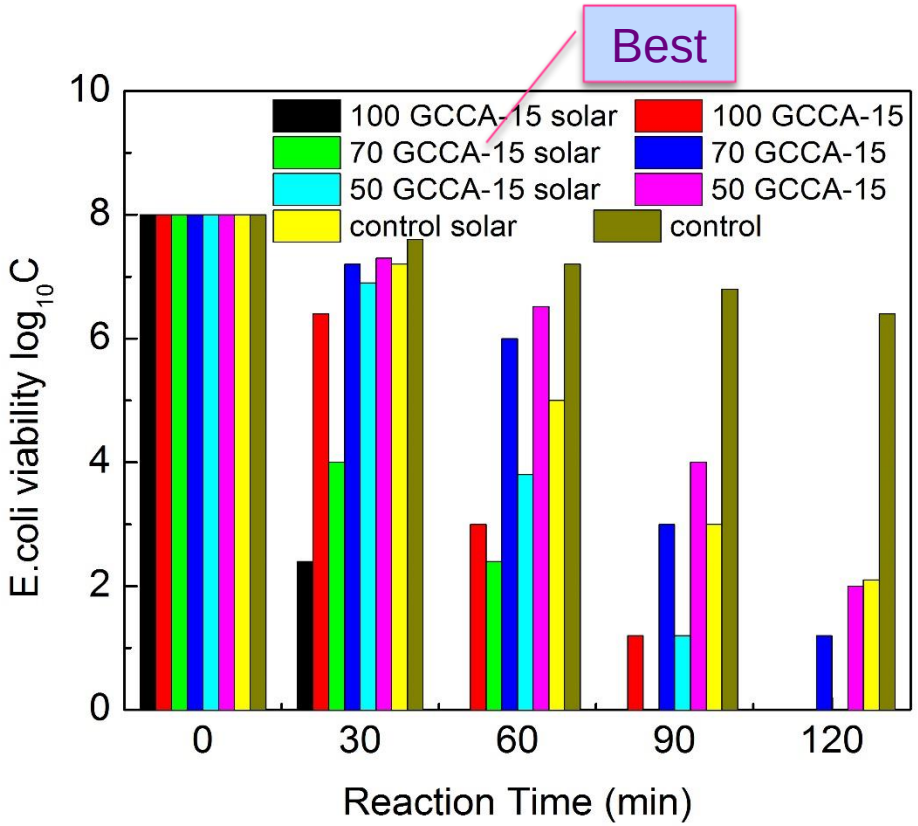
Photocatalytic Degradation of MB



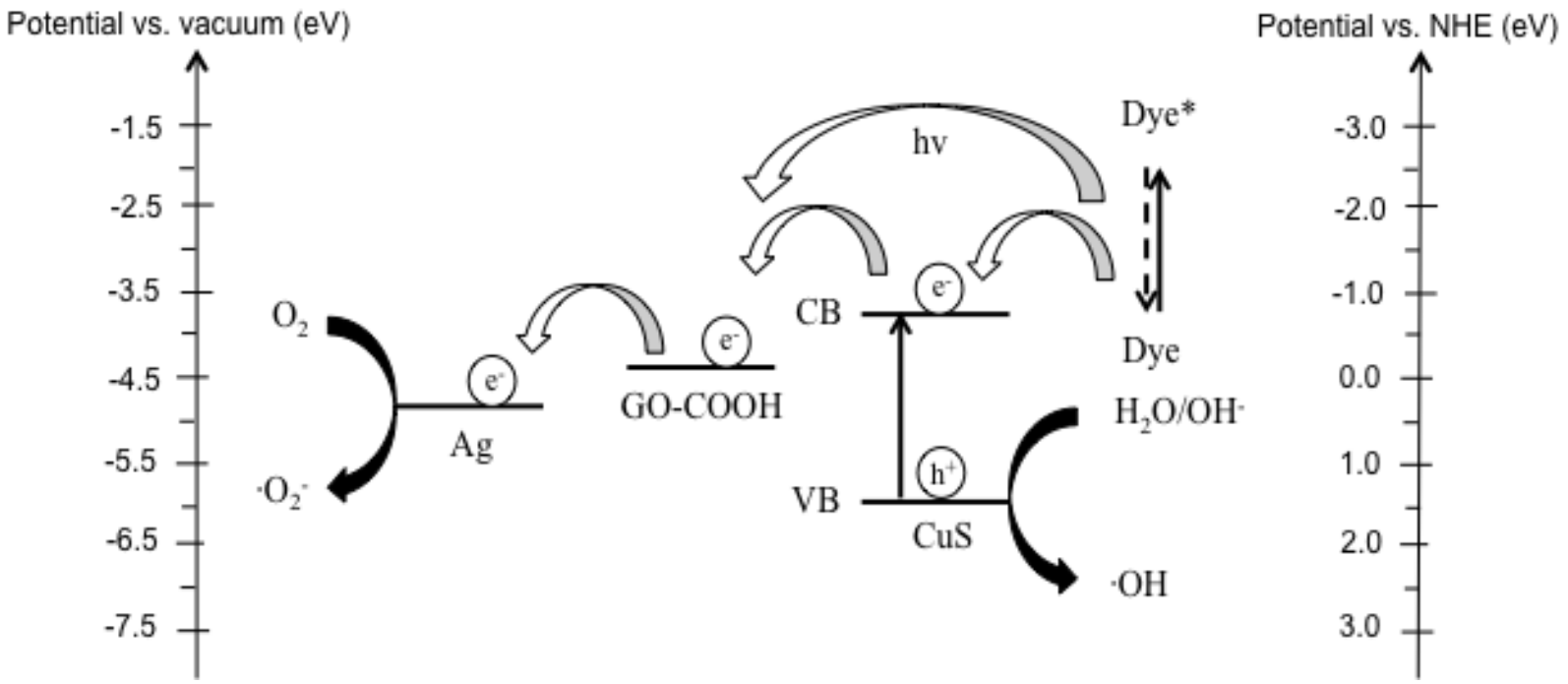
- (a) Photocatalytic performance for MB (40 ppm)

Comparison of Antibacterial capabilities

- Antibacterial activities of GO-COOH-CuS-Ag for *E. coli*



Photocatalytic Mechanism



- Schematic illustration of proposed electron transfer mechanism of GO-COOH-CuS-Ag nanocomposites.

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Conclusions

1. High performance potential in photodegradation and photo-disinfection processes of GO-COOH-CuS-Ag glass coatings
2. Advantage of simplifying the recovery and reuse in comparison to powdered forms.
3. Reducing problems including the agglomeration of powdered particles that may cause blockages.

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Question and Answer