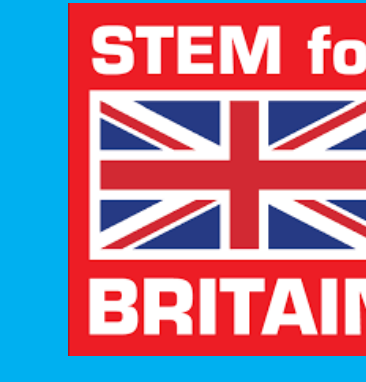


# Persistent Pollutant Removal in Water using Novel Sunlight-Activated Semiconductor Materials: A New Horizon for Sustainable Water Treatment

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## 1. Introduction-Why PS?

- ✓ **PROBLEM:** Unsafe water causes ~1.4 million deaths each year worldwide (WHO, 2018), highlighting the need for safer, sustainable, and eco-friendly treatment solutions
- ✓ **CHALLENGE:** Persistent pollutants in unsafe water are not effectively removed by traditional wastewater treatment plants (WWTP)
- ✓ **SOLUTION:** Photocatalytic Systems (PS) provide sustainable abatement approaches that can effectively remove pollutants

## 2. Photocatalytic Systems(PS) Synthesis

**Codoped Catalyst (NaCuCN)**

Dicyanamide  $\xrightarrow{550\text{ }^\circ\text{C}}$  Graphitic Carbon Nitride  $\xrightarrow{\text{NaCl, CuSO}_4}$  Cu/Na doped catalyst (NaCuCN)

**HCMP**

1,4 diethynylbenzene monomer  $\xrightarrow{\text{CuI/Pd}}$  HCMP (Homocoupled Conjugated Microporous Polymer)  $\xrightarrow{\text{Methanol}}$  Reactor

## 3. PS Structural Characteristics

- ✓ Electron microscopy shows fused particles, enabling a robust structure for environmental remediation
- ✓ Electron microscopy depicts a clustered layer structure for efficient water treatment
- ✓ NaCuCN spectrum confirms a well-connected chemical network, enabling efficient pollutant removal
- ✓ FTIR studies confirms stable carbon ring structures, indicating chemical stability and environmental relevance of the photocatalyst

## 4. PS Performance

- ✓ NaCuCN strongly absorbs visible light (400–650 nm), effectively activating electrons and enabling light-driven reactions
- ✓ HCMP shows strong visible-light absorption, enabling efficient use of light energy for photocatalytic activity
- ✓ The NaCuCN system achieved 82% pollutant removal within 120 minutes under visible light
- ✓ HCMP/Methanol system achieved 72% pollutant removal within 120 minutes under visible light

## 5. PS Comparison

HCMP	Codoped Catalyst (NaCuCN)
Large surface area	Low-cost catalyst
Metal-free	Inorganic material
Organic photocatalyst	Externally assisted H <sub>2</sub> O <sub>2</sub>
Sun-light activated	
Green oxidant (H <sub>2</sub> O <sub>2</sub> ) generation	
Sustainable environmental remediation	

- ✓ HCMP represents a sustainable, metal-free sunlight-driven solution for environmental problems
- ✓ Eco-friendly, low-cost graphitic carbon nitride enhanced with earth-abundant sodium and copper for improved sunlight-driven water purification

## 6. Conclusion

- ✓ The NaCuCN system is a purpose-designed, eco-friendly material that uses sunlight and a small amount of green oxidant (H<sub>2</sub>O<sub>2</sub>) to clean water more effectively, rapidly breaking down harmful pollutants
- ✓ A sustainable metal-free HCMP system that generates pollutant-breaking species through its interconnected structure
- ✓ Both systems represent green strategies for sunlight-driven aqueous environmental remediation