# NANYANG SINGAPORE

### On-site Production of Key Chemicals for Climate-neutral Water Treatment

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#### Traditional Method:



Transportation ❖Transportation Cost is incurred ❖Necessity to be transported in ifferent forms with more specialized handling requirements n Cost is inc

Storage Cost is incurred Necessity to comply with regulations and laws

Storage

End-users Demand Areas Our Solution:

**Electrochemical** on-site, on-demand production

H,O and O, 28 raw materials



**Abstract:** 

Electrochemistry offers a climate-friendly alternative for producing water treatment agents such as hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) and ozone (O<sub>3</sub>), which are normally made through energy-intensive methods. By generating these reactive substances electrochemically from water and oxygen, this approach avoids the need for transport and storage while reducing environmental impact. The challenge lies in improving efficiency and selectivity, which this project addresses by developing low-cost catalysts, optimizing electrolyzer parameters, and scaling up to an industrially relevant cell design. The ultimate goal is to integrate this technology into water treatment systems for sustainable, on-site production of key chemicals for climate-neutral water treatment.

### **Novelty**

- ✓ Low-cost carbon catalyst for H₂O₂ electrochemical production from O₂
- ✓ Structurally-engineered **Pb-based catalyst** to boost Ozone production
- ✓ Scaled-up electrolyzer prototype with reaction surface area > 40cm²

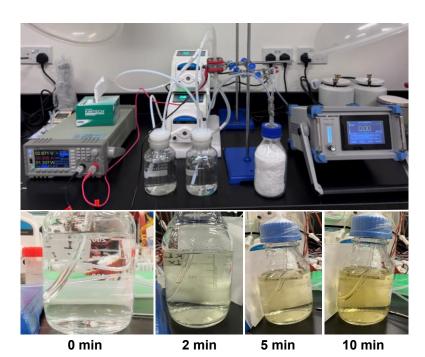


Fig 2. Pictures of ozone generator setup. The resulting ozone oxidizes I into  $I_2$  in the ozone absorber solution, resulting in the yellow coloration overtime.

#### 1000 Density (µA/cm²) 500 selectivity (%) -1500 -3000 0.4 0.5 0.6 0.7 100 NiCP: CMK3 (%)

Fig 1. Linear scanning voltammetry graph and its corresponding H<sub>2</sub>O<sub>2</sub> selectivity plot of the carbon-based catalyst developed for this project. The catalyst shows superior activity and >90%

## H<sub>2</sub>O<sub>2</sub> and Ozone for Water Treatment

#### **Advantages:**

- Strong oxidizing agents effectively removes contaminants, organic matter, and microorganisms.
- Environmentally friendly breaks down into water (H2O) and oxygen (O<sub>2</sub>), leaving no harmful residues.

## **Electrochemical production method**

#### **Advantages:**

- Avoids transport and storage of reactive chemicals.
- Uses only water and oxygen as inputs, reducing carbon footprint.
- Allows direct integration to water treatment systems for continuous operation.
- Reduced supply chain dependence on centralized plants.

### **Intellectual Property:**

An Approach Of Hydrogen Peroxide Production In A Three-Chamber Reactor (NTU-Ref 2025-146)

#### **Publication**

Phase shuttling-enhanced electrochemical ozone production. EES Catalysis. 1, 301-311 (2023)