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Tech ID: 32110 / UC Case 2020-216-0

BACKGROUND

OTHER INFORMATION

KEYWORDS

Chlorate reduction, wastewater treatment, water

treatment, chlor-alkali process, molybdenum,

palladium, hydrogenation catalysts

CATEGORIZED AS

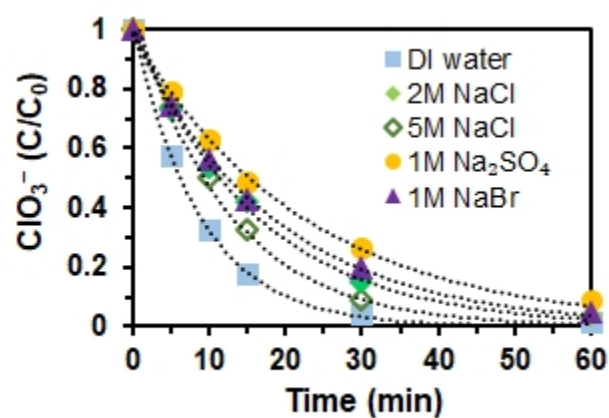
- ▶ **Environment**
 - ▶ Other
 - ▶ Remediation
- ▶ **Materials & Chemicals**
 - ▶ Other

RELATED CASES

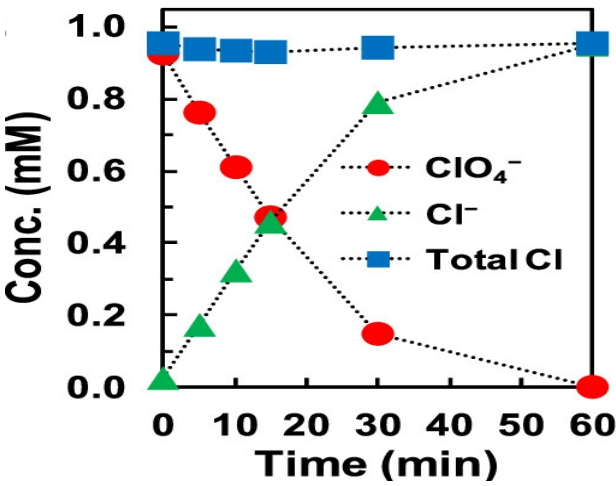
2020-216-0

BRIEF DESCRIPTION

Inspired by biological systems, Prof. Jinyong Liu's lab at UCR has developed a novel heterogeneous, bimetallic catalyst $\text{MoO}_x\text{-Pd/C}$. The catalyst contains earth-abundant molybdenum (Mo) and the carbon support of Pd/C has a high capacity to accommodate MoO_x species. The incorporation of a Mo^{VI} yields a highly active and robust catalyst. The porous carbon mimics the enzyme protein pocket (of microbes) to accommodate the oxygen atom transfer metal site. The representative figures shown below demonstrate the high activity and robustness of the catalyst for both chlorate and perchlorate reduction.



The effect of concentrated salts on the reduction of 1 mM ClO_3^- by the $\text{MoO}_x\text{-Pd/C}$ catalyst at a loading of 0.2 g/L. The reactions were conducted at 25 °C and under 1 atm H_2 .



Chlorine balance for ClO₄⁻ reduction

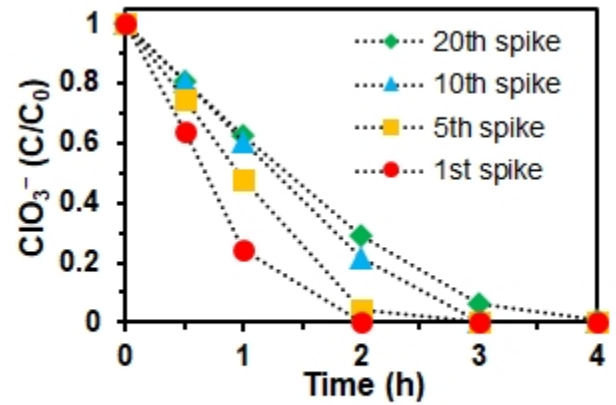


Fig. 3 shows the profiles of the reduction of 0.18M ClO₃⁻ spikes in a multiple-spike reaction series. The decrease of activity was only caused by the gradual build-up of concentrated Cl⁻ (see details in the publication).

ADVANTAGES

- ▶ 55-fold more active than palladium on carbon (Pd/C). Under 1 atm H₂ and room temperature, the (MoO_x–Pd/C).
- ▶ Enables rapid and complete reduction of ClO₃⁻ in a wide concentration range (e.g., 1 μM to 1 M) and ClO₄⁻ concentration ranges from 10μM to 0.1 M.
- ▶ Exhibits strong resistance to concentrate salts such as chloride, sulfate, and bromide at 1 to 5 M.
- ▶ In a batch reactor setup, the catalyst was reused for twenty cycles of 0.18 M ClO₃⁻ reduction and no activity loss was observed.

APPLICATION

The high activity, outstanding stability, and strong resistance to common salts make the MoO_x–Pd/C suitable for removing ClO₃⁻ and ClO₄⁻ and other oxyanions in the brine and in the chlor-alkali process and other scenarios such as water purification, wastewater treatment, and waste brine valorization.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,819,835	11/21/2023	2020-216

RELATED MATERIALS

- ▶ [A Bioinspired Molybdenum Catalyst for Aqueous Perchlorate Reduction](#)
- ▶ [Catalytic Reduction of Aqueous Chlorate With MoO_x Immobilized on Pd/C](#)

RELATED TECHNOLOGIES

Please review all [water treatment technologies](#) at UCR.