Catalysts For Aqueous Contaminant Reduction

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FULL DESCRIPTION

Background

In the US, the health reference level for chlorate (ClO$_3^-$) is set at 0.21 milligrams per liter (mg/L) and the minimum reporting level at 0.02 mg/L. Although ClO$_3^-$ contamination challenge for water systems has been recognized, research efforts for ClO$_3^-$ reduction are limited. Platinum group metal (PGM) catalyzed hydrogenation provides a clean degradation route. However, most reported ClO$_3^-$ reduction catalysts exhibit maximum activity in acidic conditions or require higher dosage (10 - 80X) of the catalyst.

Technology

Prof. Jinyong Liu and his research team have developed a novel catalyst through the use of rational chemistry and simple engineering approach. The developed ruthenium (Ru) on palladium-carbon supports (Pd/C) makes it possible to treat ClO$_3^-$ contamination under various water conditions. The facile method yields catalysts that demonstrat robustness and unprecedented performance.

Profiles and turnover factor (TOF$_0$) for 1 millimolar (mM) ClO$_3^-$ reduction by three different catalysts.
pH dependence of the Ru-Pd/C, Ru/C. First-order rate constants are normalized by the loading of PGM.

ADVANTAGES

▶ Facile catalyst preparation - a highly active catalyst is prepared in 20 minutes using 1 atmosphere H₂ at 20 deg. C - without any heating.
▶ Unprecedented catalyst performance - the catalysts show a substantially higher activity of reduction at both neutral and acidic pH.
▶ Higher robustness - the catalyst allows complete reduction of ClO₃⁻ even in the presence of sulphate (SO₄²⁻) and chloride (Cl⁻).
▶ The ruthenium and palladium exhibit bimetallic synergy.
▶ Reduced cost of catalyst.

SUGGESTED USES

Water treatment applications such as:

▶ Drinking water
▶ Waste-water runoffs from agriculture and dairy
▶ Waste-water treatment in industrial processes
▶ Water treatments that use various electrochemical processes

RELATED MATERIALS

▶ Preparation and Synergy of Supported Ru₀ and Pd₀ for Rapid Chlorate Reduction at pH 7

INVENTOR INFORMATION

▶ Please read recent press coverage of Prof. Jinyong Liu’s research.
▶ Please visit Prof. Jinyong Liu’s group website to learn more about their research.
▶ Please review all inventions by Prof. Jinyong Liu and his team at UCR