Development and use of immobilized biomimetic ligands for oxidative degradation of contaminants

UNSW Water Research Centre, School of Civil and Environmental Engineering

Biomimetic ligands for oxidative degradation

Biomimetic ligands for oxidative degradation take inspiration from natural biological enzyme motifs to generate ligands that are both oxidatively robust and capable of stabilizing highly oxidizing high-valent metal species. The oxidizing form can be catalytically generated from the resting state in many ways and employed to degrade a broad variety of contaminants.

Competitive advantage

- Oxidation of non-biodegradable and toxic organics such as aromatics, pesticides, and volatile organic compounds;
- Selective oxidant, which is strong enough to achieve full mineralization to CO2;
- Versatile activation of high-valent oxidant by either electrochemical methods or by addition of a chemical oxidant;
- Ligand is stable to high-valent oxidation state allowing complex to be reused catalytically many times;
- Oxidizing capacity of high-valent state effective over broad pH window, from strongly acidic to alkaline pH.

Recent research projects

- Demonstration of electrochemical activation of the [Fe^{IV}(O)(tpena)]^+ oxidant, and characterization of its reactivity as a function of pH towards a wide variety of substrates;
- Demonstration and mechanistic study of formation of [Fe^{IV}(O)(tpena)]^+ and HO^· oxidants during H₂O₂ activation;
- Demonstration of HClO activation of [Fe^{IV}(O)(tpena)]^+ oxidant.

Successful applications

- Degradation of dye contaminants using all activation methods
- Demonstration of complete mineralisation by all activation methods by oxidation of formic acid to CO₂

More information

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