

# Persulfate-based advanced oxidation processes mediated by high-valent metal-oxo

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## Presenting Author' Biography



Dr. Mingce Long is a professor of Environmental Science and Engineering at Shanghai Jiao Tong University. He received his bachelor (1999) and master (2001) at Harbin Institute of Technology, and Ph.D. (2007) from Shanghai Jiao Tong University. He joined the same university in 2008, and was promoted to professor in 2018. His research interests are heterogeneous advanced oxidation processes including photocatalysis, Fenton-like catalysis and electrocatalysis. He has published more than 130 peer reviewed papers.

## Abstract

Persulfate-based advanced oxidation processes (AOPs) have attracted much attention, due to its ability to effectively remove recalcitrant organic compounds from water by avoiding the rigorous requirements of H<sub>2</sub>O<sub>2</sub>-based Fenton reactions. The development of efficient and stable catalysts to active persulfate to produce reactive species is the key. In the AOPs, catalysts with metallic active sites can generate non-radical reactive substances (High-valent metal-oxo, HVMO) with long lifespan and selective attack toward electron groups. However, it is still unclear how to regulate the generation and reaction of HVMO. Targeting to the difficulty in generating high-valent cobalt-oxo (Co<sup>IV</sup>=O), a strategy of enhancing electron delocalization in Co 3d-orbital through the asymmetric configuration of Co is developed by constructing Co sites with unique N<sub>1</sub>O<sub>2</sub> coordination on the surface of Mn<sub>3</sub>O<sub>4</sub>, thereby promoting electron delocalization and reducing the number of electrons on Co 3d-orbital, making it more thermodynamically favourable for generating Co<sup>IV</sup>=O in peroxymonosulfate (PMS) activation. CoN<sub>1</sub>O<sub>2</sub>/Mn<sub>3</sub>O<sub>4</sub> exhibits high intrinsic activity for PMS activation and sulfamethoxazole (SMX) degradation, and the Co<sup>IV</sup>=O species effectively oxidize the target contaminants via oxygen atom transfer to produce low-toxicity intermediates. Moreover, a similar strategy was developed to deal with the low activity of Mn<sup>IV</sup>=O generated in persulfate activation by traditional MnN<sub>4</sub> coordination structure, a new catalyst MnN<sub>5</sub> were formed on g-C<sub>3</sub>N<sub>4</sub> substrate through ammonium chloride mediated acetylacetone manganese pyrolysis method, achieving high selectivity in activating PMS to generate N<sub>5</sub>Mn<sup>IV</sup>=O with enhanced reactivity. These studies provide a deep understanding of the formation mechanism of HVMO at the molecular level, and helps guide the rational design of efficient environmental catalytic materials.

**Keywords:** Peroxymonosulfate; High-valent metal-oxo; reactivity; low-toxicity.

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## References

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