Paper 104

Application and Efficiency Enhancement of Green Catalysis in Industrial Wastewater Denitrification

Nitrogen pollution from industrial wastewater has become a critical environmental issue due to its adverse effects on aquatic ecosystems and human health. Excess nitrogen compounds, such as ammonia, nitrates, and nitrites, can lead to eutrophication, disrupting aquatic biodiversity and causing harmful algal blooms. Conventional nitrogen removal methods, including biological denitrification and chemical treatments, often suffer from high energy consumption, secondary pollution, and limited efficiency under varying wastewater conditions.

Green catalysis, as a sustainable and environmentally friendly approach, has gained increasing attention in the field of wastewater treatment. By utilizing advanced catalytic materials such as metal-organic frameworks (MOFs), biochar-supported catalysts, and photocatalysts, green catalysis enables efficient nitrogen removal with minimal environmental impact. These catalysts facilitate oxidation-reduction reactions, enhancing the degradation of nitrogenous pollutants into harmless nitrogen gas. Additionally, coupling green catalysis with advanced oxidation processes (AOPs) and electrochemical methods can further improve treatment efficiency while reducing operational costs.

This study explores the latest advancements in green catalysis for industrial wastewater denitrification, focusing on catalyst design, reaction mechanisms, and process optimization. By integrating nanotechnology, material science, and environmental engineering, this research aims to develop high-performance catalytic systems that enhance nitrogen removal efficiency while promoting sustainable wastewater management.