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Research on Odorous Gas Emission Monitoring and Control

Technologies in Wastewater Treatment Plants

With the continuous advancement of urbanization, wastewater treatment plants (WWTPs) have become essential environmental infrastructure in cities. However, odor emissions from WWTPs have attracted increasing public attention due to their impact on surrounding air quality, potential health risks, and social conflicts, posing challenges to the sustainable operation of these facilities.

The odor emissions from WWTPs are complex, primarily consisting of hydrogen sulfide (H_2S), ammonia (NH_3), volatile organic compounds (VOCs), and other malodorous substances. These gases originate from various processes such as anaerobic decomposition of sewage, sludge treatment, and aeration tanks, exhibiting uneven spatiotemporal distribution and dynamic variability. Accurate monitoring of odor components and concentrations is fundamental for developing effective control strategies.

Currently, odor monitoring technologies include gas chromatography, Fourier-transform infrared spectroscopy (FTIR), and electronic noses, each with advantages and limitations. Control methods range from biofilters, activated carbon adsorption, chemical scrubbing to advanced oxidation processes such as ozonation. Selecting suitable techniques tailored to plant-specific conditions remains a key challenge. Achieving real-time, efficient odor emission monitoring alongside precise and cost-effective control measures is a focus of current research.

This study aims to systematically analyze the composition and emission characteristics of odorous gases from WWTPs, develop a real-time online monitoring platform based on multi-sensor data fusion, and innovate targeted control technologies. Emphasis will be placed on the synergistic treatment effects of biofilters combined with advanced adsorption materials. Laboratory simulations and field tests will be conducted to evaluate performance and applicability, facilitating integrated optimization of odor control technologies and ensuring environmental safety and social harmony around wastewater treatment facilities.