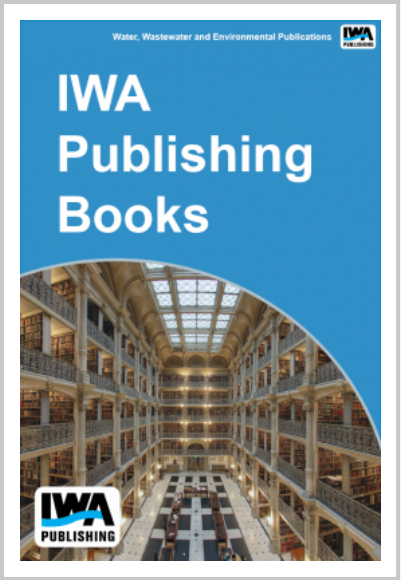
Online Monitoring of Wastewater Effluent Chlorination Using Oxidation Reduction Potential (ORP) vs. Residual Chlorine Measurement



Various control strategies are employed to ensure that a sufficient amount of chlorine has been applied to wastewater effluent in disinfection. In commonly used control strategies, such as Feed Back Control and Compound Loop Control, the combination of effluent flow rate, chlorine flow rate and chlorine residual are measured for dosing control with the chlorine residual used as a set point parameter. Recently Oxidation-Reduction Potential (ORP) has been employed as a control measurement and set point parameter for effluent chlorine dosing control as well. Theoretically, use of chlorine residual or ORP set point makes chlorine dosing possible to simultaneously respond to changes in effluent flow rate and in process, which cause variations in chlorine. This would potentially reduce chlorine feed requirements. Specific ORP or residual chlorine residual levels could be effectively monitored and maintained under changing effluent quality conditions. Immediate detection of chlorine feed malfunction could be achieved when analyzers are employed at the chlorine dosing point.

Despite these advantages, many wastewater treatment plants have chosen not to use signals from chlorine residual or ORP analyzers or results from manual grab chlorine residual testing for dosing control. Instead, chlorine residual or ORP information was only used to monitor the chlorine dosing strategy and to alert operations staff. Typical reasons include:

- Lack of confidence in on-line analyzers to provide an accurate and continuous output of ORP or chlorine residual readings.
- Insufficient staff to meet operations and maintenance requirements.
- Relative effectiveness of the current chlorine dose control system meeting regulatory requirements, typically involving flow-paced dose control with monitoring and control of chlorine mass feed.

An investigation of effectiveness of current residual chlorine and ORP measuring technologies in wastewater disinfection is imperative to address these concerns. This project examined the three key chlorination process monitoring methodologies: ORP sensors, membrane probe chlorine residual sensors, and chlorine residual automatic chemistry systems (colorimetric and amperometric). Side-by-side tests were conducted at multiple selected test sites. The differences, strengths and weaknesses of each methodology were identified. Bench scale laboratory experiments were performed to further compare the correlation of ORP and chlorine residual to microbial inactivation. Based on the findings, issues and optimization tips were examined for employing on-line chlorine residual or ORP analyzers in wastewater effluent chlorine dose control.

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