NT3100sc UV Sensor

Nitrate Measurement with Hach's NT3100sc UV Sensor

Background

One of the common goals at a wastewater treatment plant (WWTP) is the reduction of nitrogen, as it has negative effects on the water bodies it discharges into such as eutrophication, fish toxicity, and high oxygen consumption. To ensure that the nitrogen concentration in the WWTP discharge meets the regulated limits, the nitrification and denitrification processes require optimal control. Therefore, instrumentation needs to be placed in the relevant locations of the plant to measure the different forms of nitrogen to achieve a stable and cost-effective plant operation. Hach® offers a solution to measure nitrate (NO_3) with Hach's NT3100sc UV Nitrate Sensor for process control and monitoring.

Elimination of Nitrogen in Wastewater

Mainly organic nitrogen and ammonium nitrogen are present in the inlet of a WWTP. Through the ammonification process, organic nitrogen turns into ammonium. This process already starts in the sewage system and continues in the treatment plant. When nitrogen arrives in the inlet of the biological stage, it is largely transformed into ammonium. During nitrification, ammonium will be oxidized via nitrite to nitrate. That oxidation process requires oxygen. In denitrification, nitrate will be converted to nitrogen gas that can leave the system. Nitrite can be an intermediate product in this process. Denitrification can be done pre-aeration, post-aeration, simultaneous or intermittently. Sufficient amount of easily bio-degradable carbon, optimized internal recirculation and absence of dissolved oxygen should be maintained at all times for successful denitrification. Figure 1 illustrates the removal process during denitrification and nitrification.

A constant and systematic measurement of individual nitrogen parameters enables long-term stable performance of nitrogen removal to ensure total nitrogen compliance. Measurements can be conducted online and in the laboratory. Figure 2 (shown on next page) indicates the measuring points of nitrate to monitor and control the treatment processes in a WWTP.

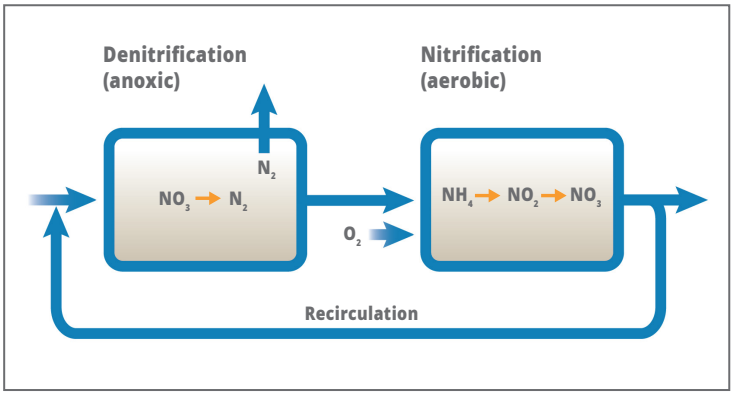

Figure 1: Basic schematic illustration of a nitrogen reduction in pre-aeration configuration

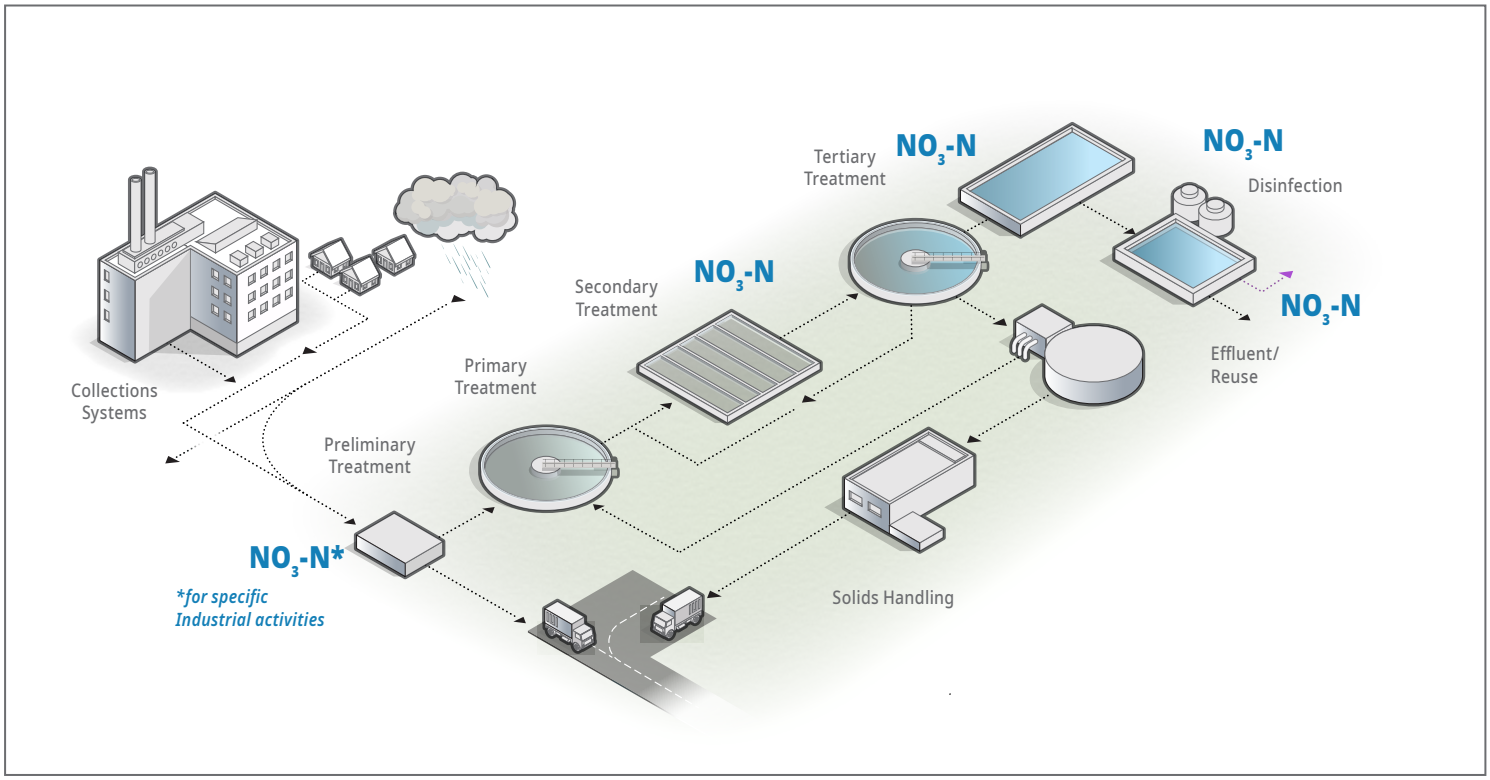

Figure 2: Recommended measurement points of nitrate in a WWTP

Online sensor

The NT3100sc online sensor is based on optical UV measurement methods that measures nitrate. The different path lengths (1 mm, 2 mm and 5 mm) allow the sensor to be applied not only in municipal wastewater but also in industrial wastewater, drinking water, and water reuse processes. Due to the integrated self-cleaning wiper, only minimal maintenance is required to prevent the optical system from being fouled by films and biological growth. Through turbidity compensation, the risk of measurement errors by interference is reduced to a minimum. The NT3100sc is compatible with Hach's SC controllers and Claros™ which supports facility operators and staff with data management and trouble-free operation. Real-time data empowers operators and staff to see process changes early, and to adjust appropriately to avoid upsets. With the simple handling and easy installation, the sensor is immediately ready for use.

Applications in Municipal Wastewater Treatment

The following table details suitable applications for nitrate measurements with the NT3100sc sensor.

Treatment Stage	Application	Measuring point	Purposes
Influent	Monitoring inlet	WWTP inlet	• Early indication of inlet concentrations allow for better reaction time; • Detection of industrial discharges
Secondary Treatment	Monitoring denitrification	Denitrification	• Optimization of the N-elimination process; • Control of internal recirculation; • Optimization of external carbon dosing
	Monitoring nitrification	Aeration tank	• Nitrate measurement to control aeration intensity to save aeration costs and optimize the process
	Monitoring of simultaneous nitrification and denitrification	Aeration tank	• Nitrate measurement to control aeration intensity and keep anoxic zones
	Monitoring of post-denitrification	Denitrification	• Control and optimization of external carbon dosing (ex.: methanol)
	Monitoring swing zones	Aeration tank	• Operation of swing zones / staging
	Monitoring swing zones	Aeration tank	• Operation of swing zones / staging
	Monitoring deammonification in main stream	Deammonification tank	• Outlet monitoring and prevention of nitrate development
Effluent	Monitoring of disinfection stage	Disinfection effluent	• Monitoring of outlet and limits
	Monitoring effluent	WWTP effluent	• Meeting compliance limits

World Headquarters: Loveland, Colorado USA | hach.com

United States **800-227-4224** fax: 970-669-2932 email: orders@hach.com
Outside United States **970-669-3050** fax: 970-461-3939 email: int@hach.com

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