HORIBA, Ltd.

International Sales Office
P&E Team

Kinta SEKIGUCHI

Ammonia Nitrogen (NH_4-N) Meter
HC-200NH

Date: October 2017

Outline

- Aeration control in Wastewater Treatment Plant
- Ammonia Nitrogen Meter
  - Overview
  - Features
  - Filed test (Stability and reliability)
- Applications
  - Waste water treatment
  - Drinking water treatment
- Summary

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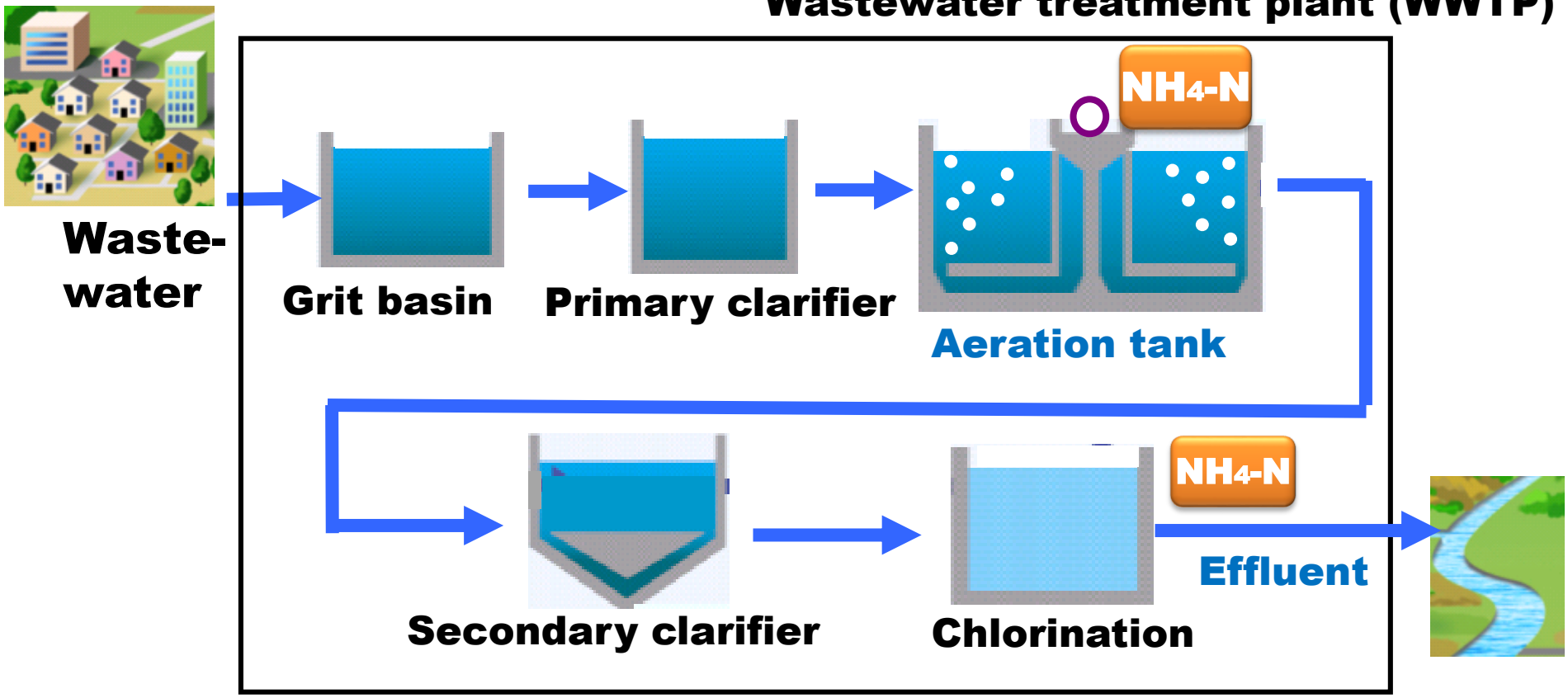
Wastewater treatment plant & NH_4-N

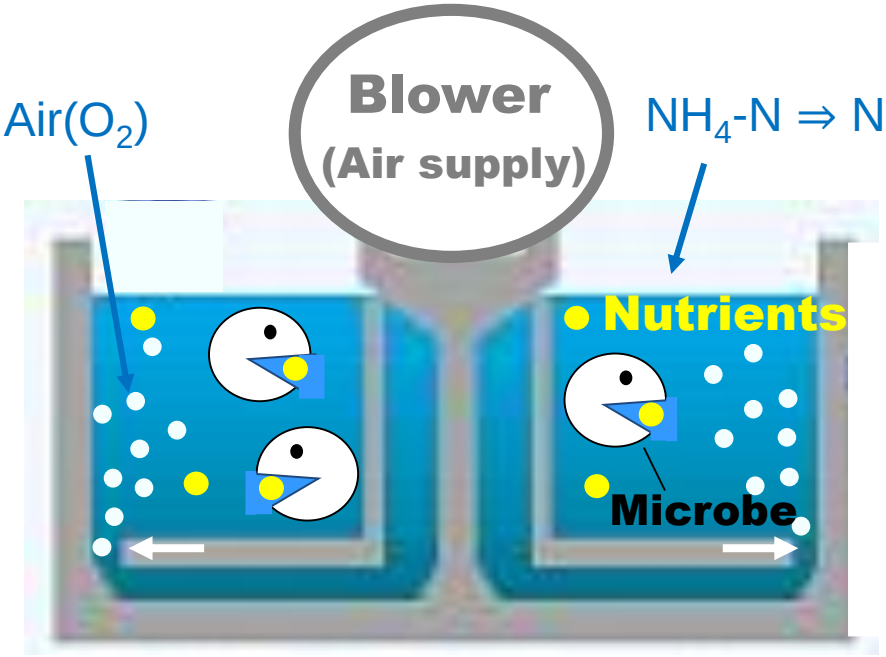


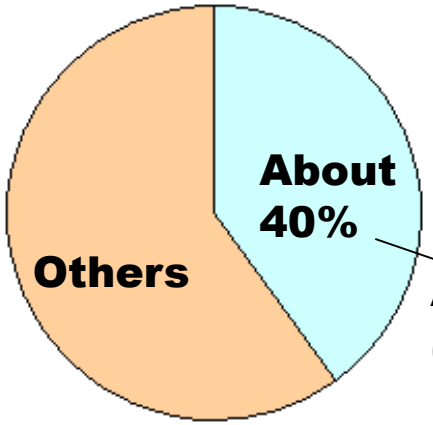
Application 1 : Monitoring at aeration tank for aeration control.
(Treatment process control)

Application 2 : Monitoring of effluent for water quality check.
(Regulatory requirement)

Biological treatment in aeration tank

Aeration tank: Removes nutrients(NH_4-N) by microbes





Rate of energy consumption in WWTP

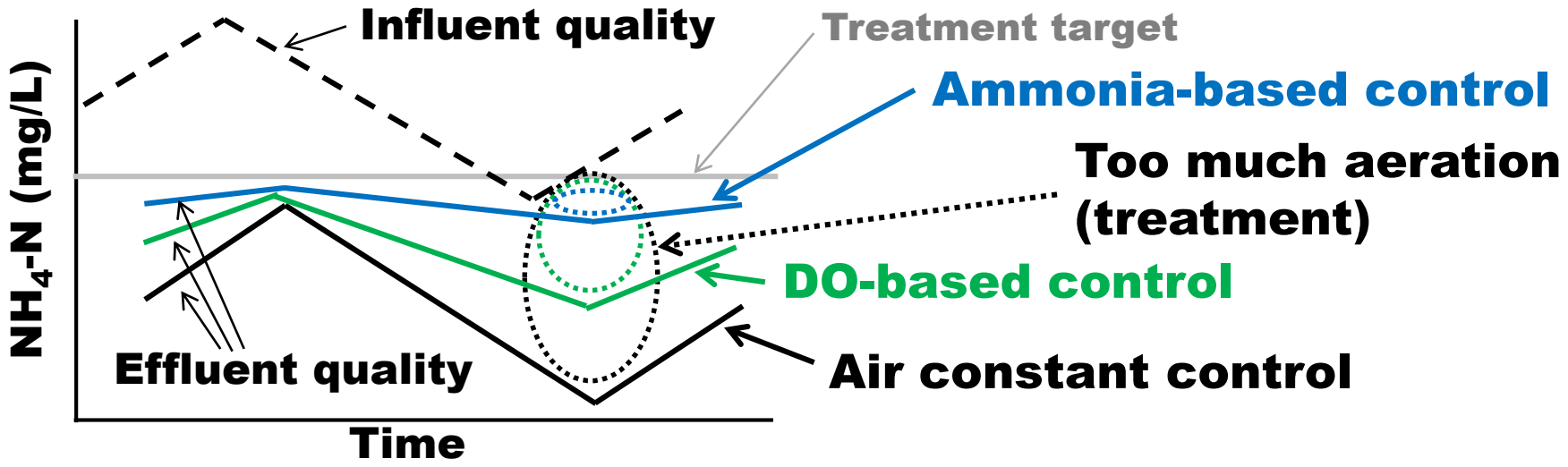
(Rough estimate based on customer inquiry survey by HORIBA)

- **Microbes removes nutrients.**
- **Air is supplied to activate microbes.**
- **Huge energy is consumed for the aeration.**

Ammonia-based aeration control is expected to minimize energy consumption

Aeration control

Image of aeration control (based on customer hearing survey)



DO-based control : DO is indirect indicator of nutrient. Hence aeration with margin is necessary. Too much air when influent is cleaner.

Ammonia-based control : NH_4-N is direct indicator of nutrient. Hence the margin(extra air) can be minimized.

In Japan, some municipals have been researching that ***10 to 30% reduction*** of energy consumption would be possible. (Result of HORIBA's hearing survey)

e.g. Electric bill of blowers in 100,000m^3/day plant is 1.1MUSD/year.

(Condition: 0.5kWh/1m^3/day, 0.15USD/kWh, 40% of energy is consumed by blower)

⇒ ***In case of 30% energy reduction, 0.3MUSD/year can be saved.***

Market information

Market situation

- Some municipals in Japan try to reduce energy consumption of blower by NH_4-N monitoring.
- Some water treatment companies have been doing demonstration test of energy saving in WWTP by aeration control with NH_4-N and DO. (Government support project)

Requirement from users

- **Sensor life** (More than 6 months is desirable)
- **Stability and reliability** of the measurement (Especially low range)
- **Easy maintenance** (All user maintenance is desirable)
- Quick support and enough explanation when trouble

(*Information from customer hearing survey by HORIBA)

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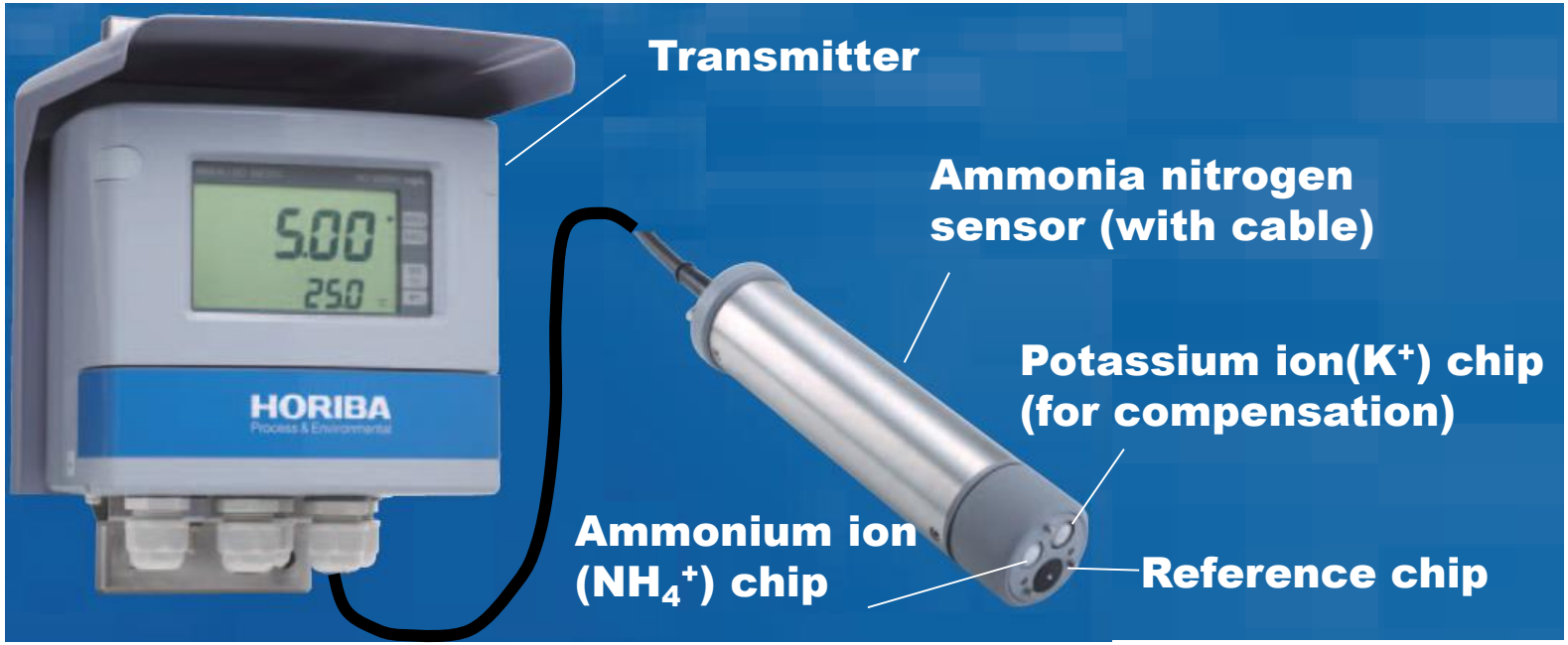
NH_4-N Measurement method

Method	Strength	Weakness
ISE (Ion-selective electrode)	●Does not need reagent ●Direct immersion possible	●Difficult to measure low range sample stably ●Influenced by interference factor, potassium ion and so on (Potassium compensation possible)
Gas sensitive electrode	●Less influenced by interference factor	●Need reagent ●Sampling necessary
Colorimetric	●Less influenced by interference factor	●Need reagent ●Sampling necessary

ISE is widely used and suitable for real time monitoring of aeration.

Product components

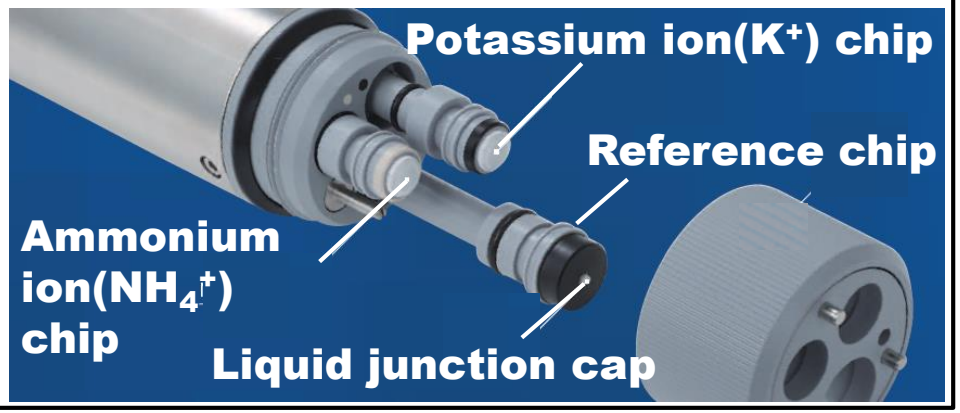
Product (HC-200NH)



Option

- Holder
- Cleaner

Consumables

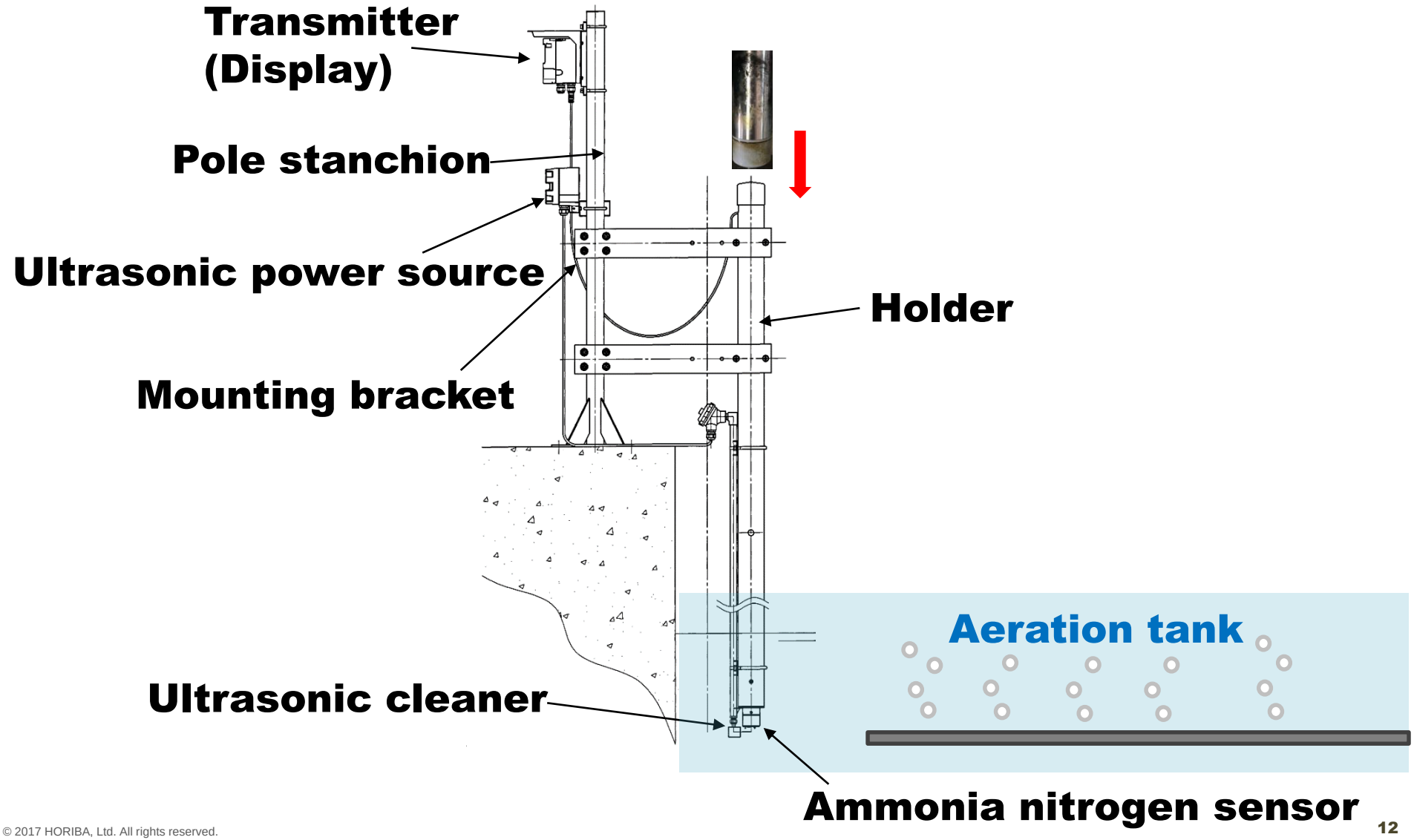


Parts	Model
Transmitter	HC-200NH
Ammonia nitrogen sensor	AM-2000
Ammonium ion chip	7691
Potassium ion chip	7692
Reference chip	7211

Specifications

Principal	**Ion-selective electrode(ISE) method**
Range	**NH_4-N : 0 to 1000 mg/L** **Temperature : 0 to 40 ℃**
Resolution	**NH_4-N :** **0.01 mg/L : 0.00 to 10.00 mg/L** **0.1 mg/L : 0.0 to 100.0 mg/L** **01 mg/L : 0 to 1000 mg/L** **Temperature: 0.1 ℃**
Accuracy (Repeatability)	**±3%±1digit, ±0.2 mg/L±1digit whichever is greater (Standard solution)**

Installation example



Features

	Customer needs	HORIBA HC-200NH Features
Measu-rement	Sensor long life (Resistance to fouling)	**Feature 1** Protection film on ion selective membrane.
		Feature 2 Anti-fouling by ultrasonic cleaning Unique Tech.
	Stability and reliability of the measurement	**Feature 3** Optimized internal solution to the low-concentration sample Patent applied
Mainte-nance	Easy maintenance	**Feature 4** Tool-free sensor chip replacement Unique Tech.
	Risk reduction of sudden sensor error	**Feature 5** Sensor deterioration diagnosis function Patent applied Unique Tech.

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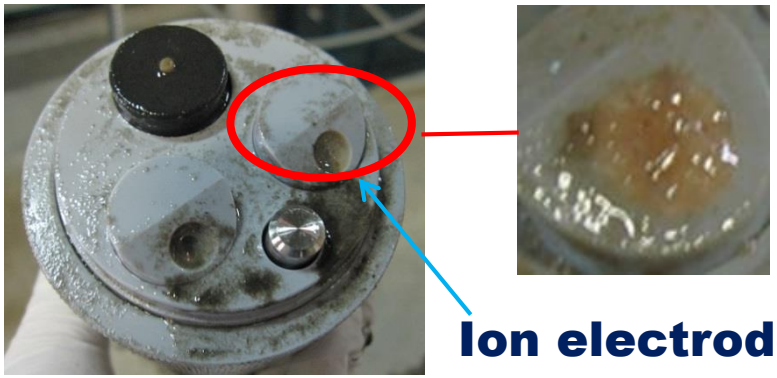
Protection film against microbes

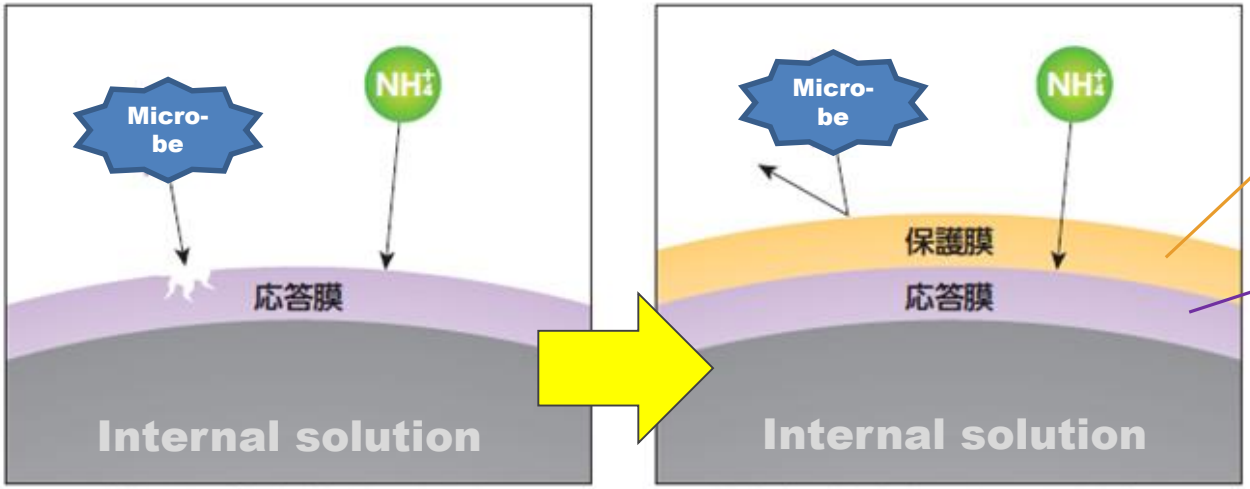
Fouling in aeration tank



Biofilm due to microbes

- Influence on measurement
- Deterioration because microbes decompose membrane components (plasticizer)

Sensor feature



The protection film(PTFE) prevents membrane from microbes attack.

Feature 2

Anti-fouling by ultrasonic cleaning

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Unique Tech.

Ultrasonic cleaning

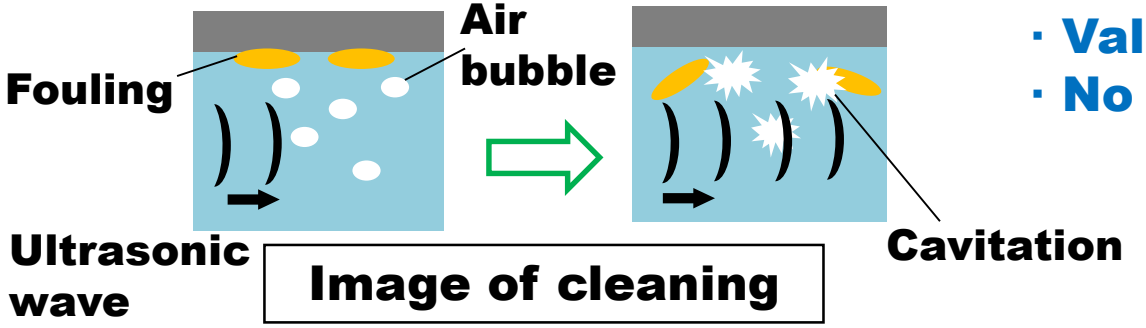
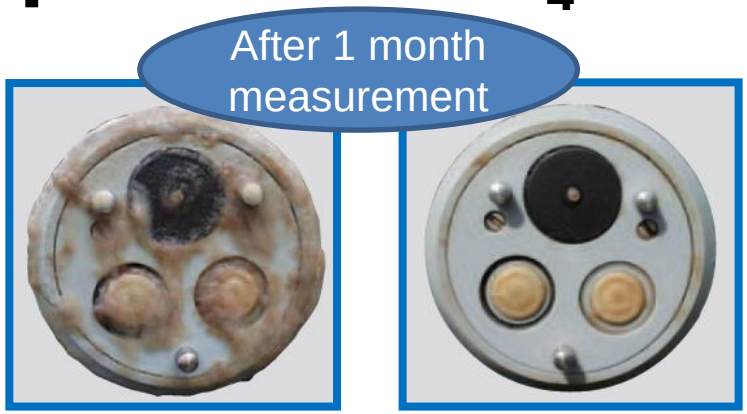


Image of cleaning

Anti-fouling by cavitation

- Valid to microbial fouling
- No need air nor water supply

Application to NH_4-N meter



Without cleaning With ultrasonic cleaning

Optimized oscillation way and positioning enable simultaneous measurement and cleaning.

Feature 3

Stable at low concentration sample

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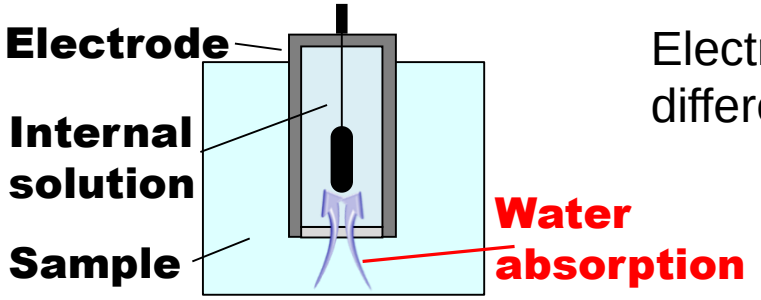
Patent applied

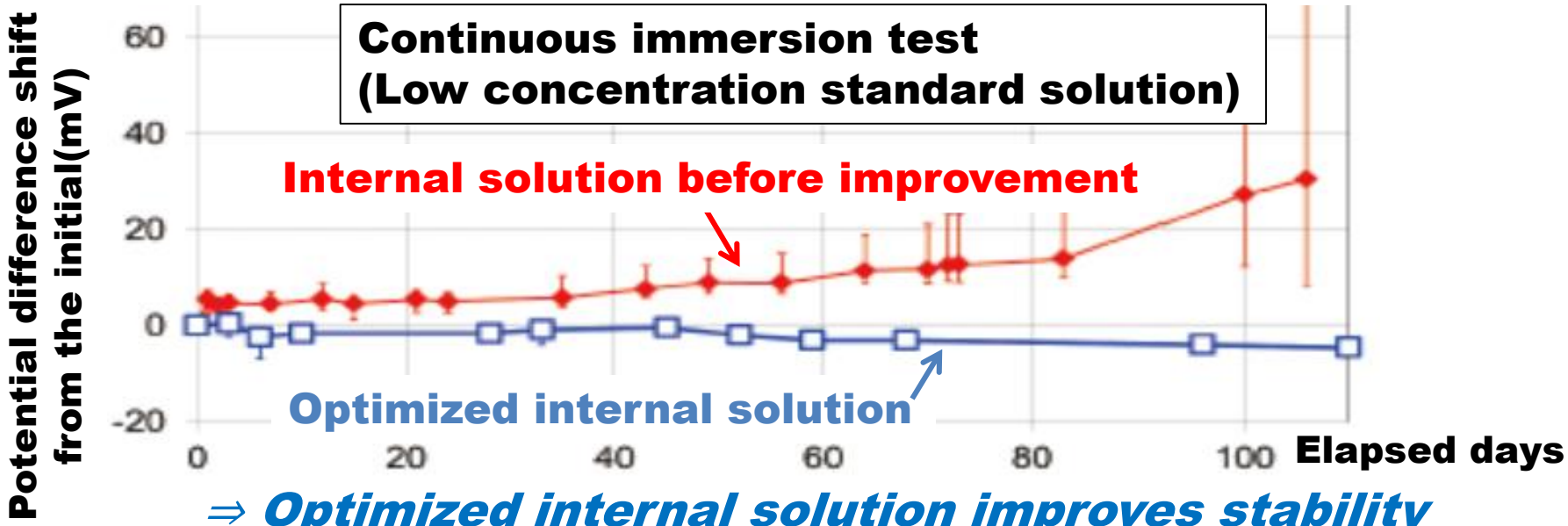
Bad influence by sample water absorption



Electrode absorbs sample water due to salt concentration difference between sample and internal solution.
(Low) (High)

⇒ *Measurement error and sensor damage*

Optimized internal solution to low-concentration sample



⇒ *Optimized internal solution improves stability at low concentration sample*

Feature 4
Tool-free sensor chip replacement

HORIBA Process & Environmental

Unique Tech.

Ammonium ion(NH_4^+)chip (7691)

Turn the sensor cap by hand

Potassium Ion(K^+) chip (7692)

Reference Chip(7211)

Sensor cap

Each electrode（NH_4^+, K^+, Ref） can be replaced without tools. (No need for manufacturer maintenance)

Feature 5

Sensor deterioration diagnosis function

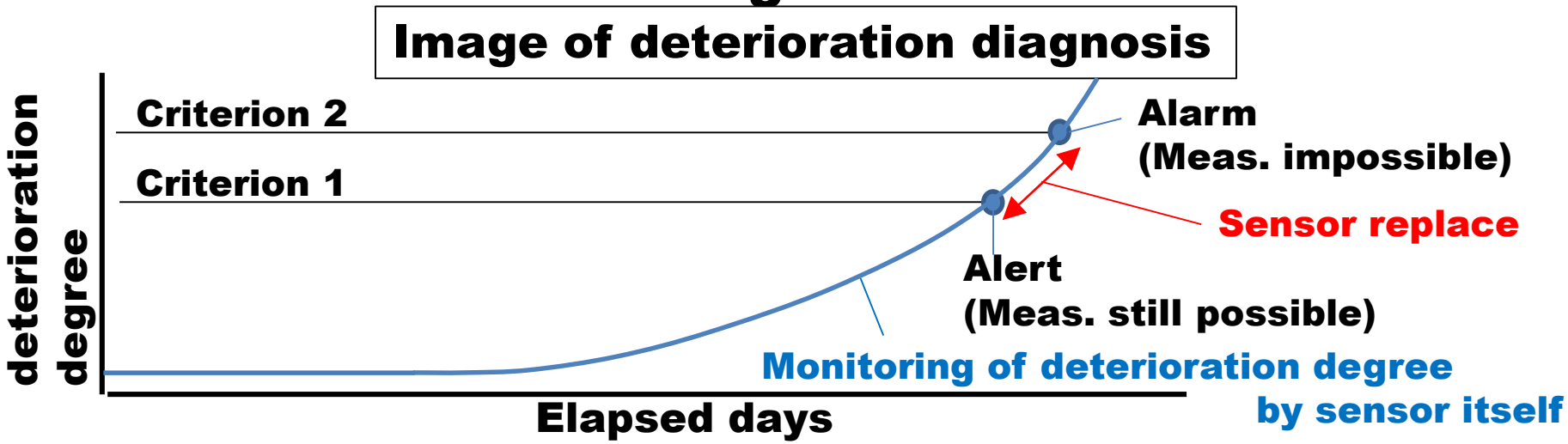
Patent applied

Unique Tech.

■Deterioration progress due to fouling

Risk of sudden sensor error

■Sensor deterioration diagnosis



⇒Deterioration diagnosis decreases the risk of sudden sensor error

Field test example

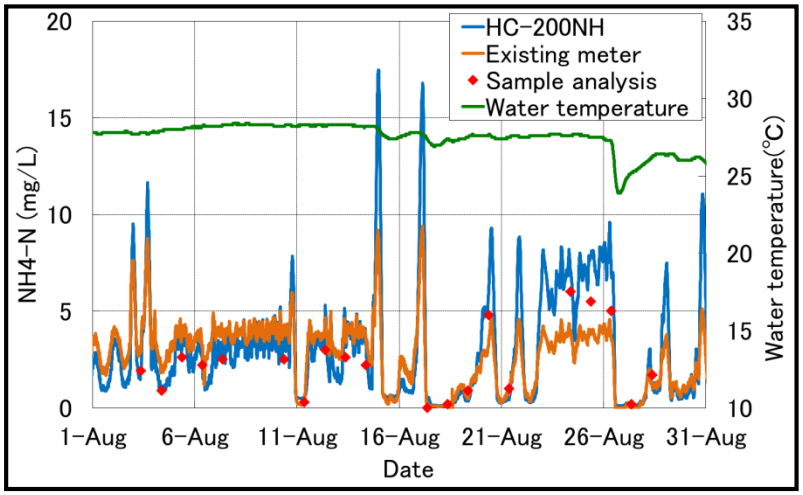
Cooperation

Joint research with Bureau of Sewerage, Tokyo Metropolitan Government

Test condition

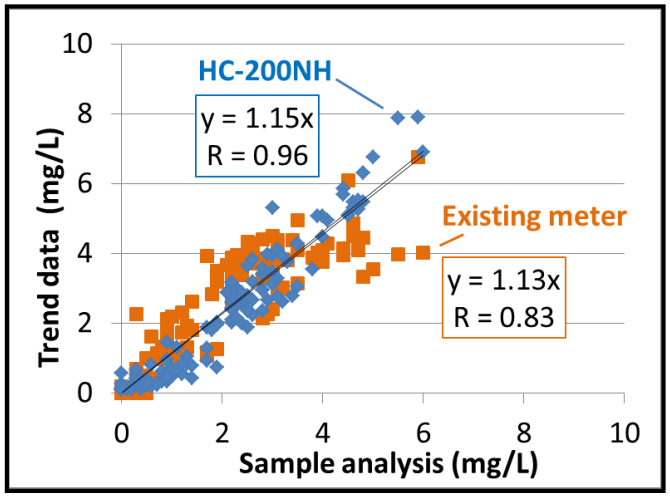
Place: At an aeration tank in a wastewater treatment plant in Tokyo
Period: May to November 2015 (6 months)
Sensor life target: More than 6 months
Reliability target: Correlation with manual analysis R>0.9
Maintenance period: Once a month (Cleaning, calibration)

Trend data example



Measurement followed sample analysis for 6 month. (Sensor life target is achieved)

Correlation with sample analysis



Result : R=0.96(target : R>0.9) (Reliability target is achieved)

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Wastewater treatment

Sewage and factory waste water

Semi-con fab. (Test installation)

Tokyo Metropolitan Government (Joint research)

Wastewater treatment R&D center

北京排水集团
BEIJING DRAINAGE GROUP CO.,LTD

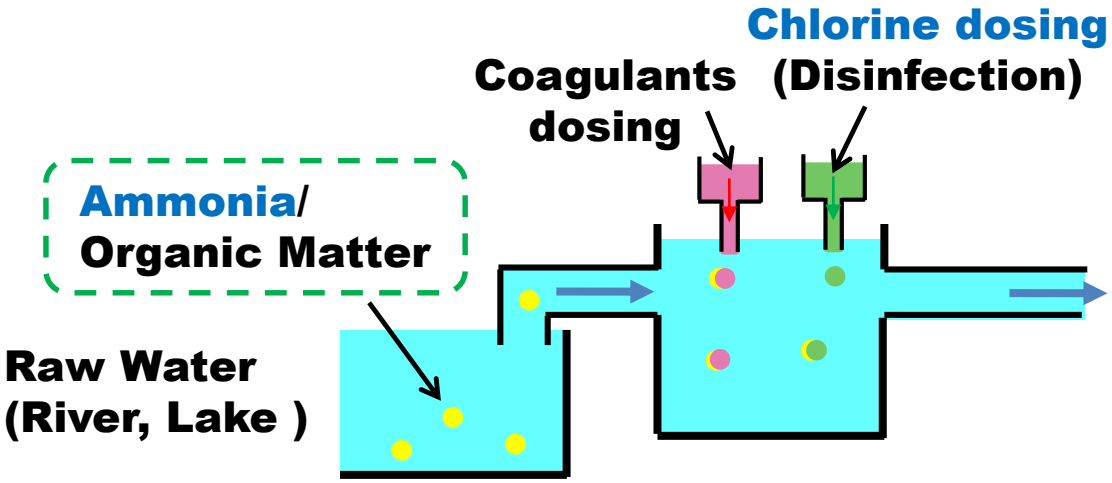
Wastewater treatment plant

More and more facilities trying ammonia-based aeration control, especially in big city.

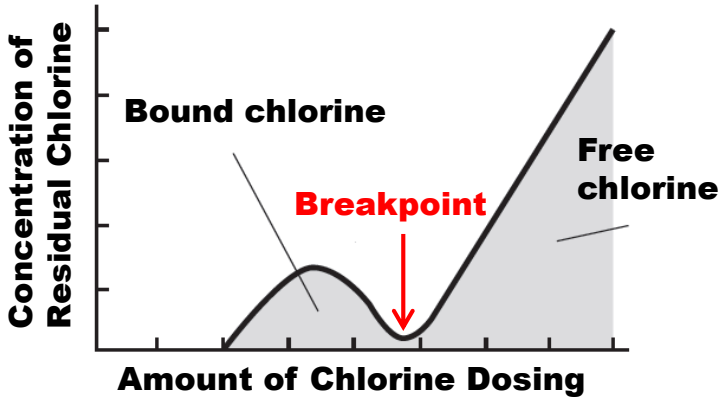
Drinking water treatment(Intake Water)

- Control of chlorine dose in drinking water treatment plant

Image of Chlorine dosing process



"Breakpoint chlorination"



Chlorine needs to be dosed about 10 times of Ammonia

⇒ ***Ammonia monitoring in raw water helps the control of chlorine dose.***

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Summary

- **Huge electric power consumption for blower in biological aeration tank in WWTP is one of issues to be improved. Municipals and water treatment companies in Japan are working on it.**
- **In order to save energy for blower, blower control by NH_4-N is effective.**
- **Long sensor life, stability(in low range), reliability and easy maintenance are required for Ammonia Nitrogen Meter.**
- **There are several applications such as waste water treatment process and drinking water treatment process.**

HORIBA wishes HC-200NH(Ammonia Nitrogen Meter) helps energy saving and effective treatment

Thank you very much for your attention.

Thank you

Omoshiro-okashiku
Joy and Fun

眞峰

감사합니다

Cảm ơn

ありがとうございました

Dziękuję

धन्यवाद

Grazie

Merci

谢谢

நன்ற

ขอบคุณครับ

Obrigado

Σας ευχαριστούμε

شُكْرا

Tack ska ni ha

Большое спасибо

Danke

Gracias