The 40th Congress of the Japanese Society of Infection Prevention and Control Sweet Seminar 4(SS4)
Date: Saturday, July 12, 2025 Time: 14:10–15:50
Venue: Pacifico Yokohama North, 3F, Room G302 (Room 10)

Utilization of IONLESS™ (Hypochlorous Water) in Infection Control Within Hospital Rooms



Chairperson

Kei Kasahara, M.D., Ph.D.
Professor, Department of Infections Diseases of Nara Medical University

In this seminar, we welcomed distinguished speakers from Japan, China, and Taiwan to discuss the clinical application of IONLESS™ (hypochlorous water). The product has overcome the longstanding challenge of storage stability, and recent findings have demonstrated its safety and effectiveness in spatial spraying and environmental disinfection in occupied settings.
A broad range of insights was shared—from fundamental research to practical strategies for managing multidrug-resistant organisms in clinical environments. The session proved highly meaningful, raising expectations for IONLESS™ (hypochlorous water) as a new approach to infection control in hospital rooms and other healthcare settings.



Hypochlorous Acid Water: Research and Clinical Applications in China

Haiqun Ban, M.D., Ph.D.
Professor, Infection Control Department, Renji Hospital affiliated to Shanghai Jiao Tong University, School of Medicine, China

History of Hypochlorous Acid Water in China

In China, acidic electrolyzed water was introduced more than 30 years ago, prompting a large number of basic and applied research. In 2011, a draft of national standard for devices that generate acidic electrolyzed water was released.

Subsequently, Professor Li Xinwu, a colleague, advanced the research and practical applications of hypochlorous acid. As a result, hypochlorous acid water produced by both electrolysis and chemical synthesis was introduced in China. Research continued to progress, and the COVID-19 pandemic led to a substantial increase in demand.

Bactericidal Activity of Hypochlorous Acid Water and the Influence of Organic Matter

Hypochlorous acid is a naturally occurring chemical molecule, and the U.S. Food and Drug Administration (FDA) classifies hypochlorous acid (HOCl) as one form of free chlorine with strong antimicrobial activity against a broad spectrum of microorganisms.*[1] Its germicidal effect is reported to be 50 to 100 times greater than that of hypochlorite ions (in vitro).*[2]

In our laboratory studies, hypochlorous acid water at 40–100 mg/L achieved an F value of ⩾4 (equivalent to the bactericidal effect of heating at 121°C for 4 minutes) after one minute of exposure, effectively inactivating vegetative cell and fungi such as Candida albicans.

For poliovirus (enterovirus), when the organic load in the test system consisted of 0.3% bovine serum albumin (BSA), the same conditions yielded an F value of ⩾4. However, when BSA was increased to 3%, the F value occasionally fell below 4.

Similarly, for Bacillus subtilis spores, exposure to an available chlorine concentration of 101–118 mg/L for 5 minutes achieved an F value of ⩾5 (equivalent to heating at 121°C for 5 minutes) under 0.3% BSA conditions. In contrast, even 30 minutes of exposure resulted in an F value of only 3.74 when BSA was increased to 3%.*[3]

These findings indicate that the bactericidal efficacy of hypochlorous acid water may vary depending on the amount of organic matter present in the test environment.

Bactericidal Mechanism of Hypochlorous Acid Water

The bactericidal activity of hypochlorous acid water is primarily attributed to the ability of hypochlorous acid molecules to penetrate the cell membrane and simultaneously act on multiple intracellular and extracellular targets, including the cell wall, cell membrane, mitochondria, nucleic acids, and proteins.*[4] In contrast, hypochlorite ions are unable to pass through the cell membrane and act mainly on the cell wall.

For this reason, Chinese national standards require that at least 85% of the available chlorine content must be present in the form of hypochlorous acid molecules for the product to be recognized as hypochlorous acid water.

Hypochlorous acid water acts rapidly and is effective against a broad spectrum of microorganisms.*[3] However, certain precautions are necessary. As shown in the earlier experiments, its antimicrobial effect can be influenced by the presence of organic matter, making storage duration and post opening stability important considerations.

To ensure effective and broader utilization of hypochlorous acid water, users must consider the target microorganisms, method of application, and intended use environment.

Bactericidal Effect of Hypochlorous Acid Water in Dental Clinics

Although hypochlorous acid water can be used as a disinfectant in food related settings, one of its most promising applications is in the medical field (Figure 1). A multicenter study conducted in dental clinics reported high rates of blood contamination, particularly in rinse sinks (87%) and on handpiece handles (48%).*[5]

In our laboratory research, hypochlorous acid water with an available chlorine concentration of 44.5 mg/L achieved a 100% bactericidal rate against isolates recovered from rinse sinks and handpiece handles after 10 minutes of exposure.

Furthermore, when surgical instruments were disinfected with concentrations of 50–70 mg/L for 30 and 60 seconds, the bactericidal rates were 98.75% and 96.77% at Hospital A, and 98.73% and 98.50% at Hospital B, respectively.*[6]

In addition, an assessment of microbial contamination in 144 samples taken from the dental unit waterlines of a clinic established 10 years earlier revealed a median contaminant level of 200 CFU/mL, with the highest contamination observed in water for handpieces (1,415 CFU/mL).*[7] Due to concerns regarding infection risk, the water supply lines were reconstructed using a mildly acidic hypochlorous acid water generator. During the 1st week after renovation, the microbial count increased, likely due to biofilm that had accumulated over the past 10 years being flushed out by the hypochlorous acid water.

Subsequently, microbial contamination was controlled after 1 to 2 weeks of disinfection with a mean available chlorine concentration of 44.5 ± 2.07 mg/L, and microbial contamination continued to be controlled even at lower concentrations of 15.47 ± 5.72 mg/L (with microbial counts remaining at zero).*[7] Environmental metagenomic sequencing (mNGS) of water samples also demonstrated a marked reduction in microorganisms after disinfection, whereas numerous bacteria and pathogens were detected prior to treatment.*[7]

Stability of Hypochlorous Acid Water

The stability of hypochlorous acid water requires careful attention. IONLESS™ (hypochlorous water), which is produced by electrolysis and has recently been imported into China, demonstrated favorable stability: under storage at 40°C for 180 days, the reduction in available chlorine concentration was 9.78%, and the projected shelf life was 36 months.*[8] We anticipate broader adoption of hypochlorous acid water in China and globally.

*Based on Chinese stability testing standards (the corresponding period in Japan is 15 months).

*1 the US FDA. Analysis and Evaluation of Preventive Control Measures for the Control and Reduction/ Elimination of Microbial Hazards, Chapter 5 (https://cdn.who.int/media/docs/default-source/essential-medicines/ 2021-eml-expert-committee/applications-for-addition-of-new-medicines/a.18_hypochlorous-acid.pdf?sfvrsn=35222172_4)

*2 Ministry of Health, Labour and Welfare (Japan). Materials on the similarities between hypochlorous acid water and sodium hypochlorite. 2009 Aug. Accessed 2025 Dec 8. Available from:https://www.mhlw.go.jp/shingi/2009/08/dl/s0819-8k.pdf)

*3 Duan H et al. Chin J Infect Control, 2021, 20(3), 261-264

*4 Yan P et al. processes, 2021, 9 (12), 2240 (Accessed 2025 Dec 8, https://doi.org/10.3390/pr9122240)

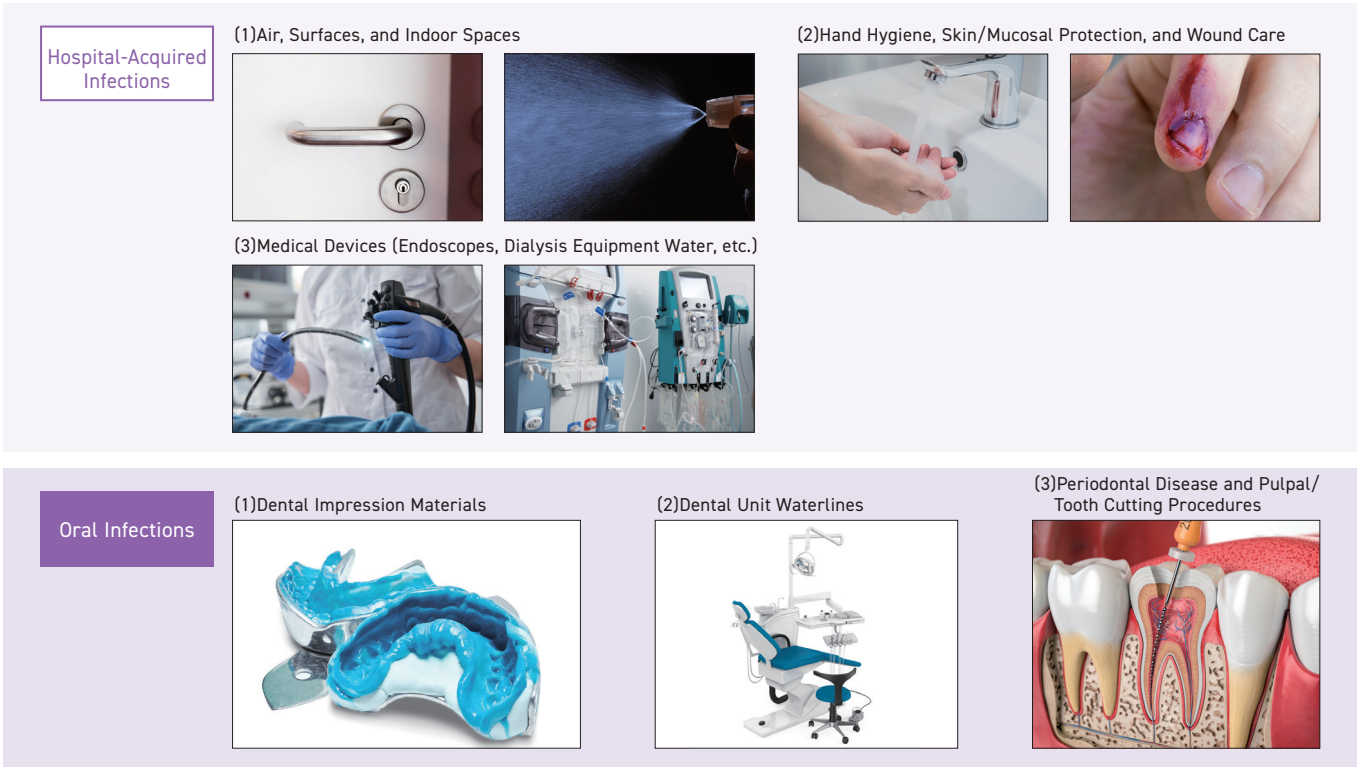
*5 Ding J et al. J Hosp Infect, 2025, 161, 44-51

*6 Li Xinwu, et al. Chinese Nursing Management (Zhongguo Huli Guanli).(4), 5-8

*7 CHINESE JOURNAL OF DISINFECTION, 2025

*8 National Online Registration Information Service Platform for Disinfection Products (China). CLFine™Hypochlorous Acid Disinfectant," Report No.: SHA01-24041163-JC-01

Figure1 Application of Hypochlorous Acid Water in Healthcare Settings in China





Evaluation Report on the Use of IONLESS™ (Hypochlorous Water) in Occupied Settings of Medical and Welfare Facilities

Mikio Takahashi
Assistant, Department of General Medicine, Iwate Medical University School of Medicine
Deputy Director, Infection Control Department and Medical Safety Management Department, Iwate Medical University Maru Medical Center

Rationale for Initiating Research

The catalyst for beginning clinical research on IOLESS™ (hypochlorous water) was the COVID 19 pandemic and the need to control clusters in many medical institutions and elderly care facilities. IONLESS™ (hypochlorous water) is classified as slightly acidic hypochlorous acid water, with a pH of 5.0–6.5 (slightly acidic) and an available chlorine concentration of 10–80 ppm. It contains few impurities and is a disinfectant that meets both drinking-water and tap-water quality standards.

Safety of IONLESS™ (hypochlorous water)

A study reported in Japan that, in a 1 m^3 space, after spraying SARS CoV 2 and influenza virus into the air and subsequently spraying IONLESS™ (hypochlorous water), higher bactericidal activity was observed at available chlorine concentrations of 3 ppm and 30 ppm, with the higher concentration showing greater effectiveness. *1

When considering whether IONLESS™ (hypochlorous water) could be used for aerosol infection control in hospital rooms occupied by inpatients or facility residents, university's ethics committee review board requested that safety at mucosal exposure sites be assessed first.

This study was conducted with approval from the Iwate Medical University Ethics Review Board. In the experiment, IONLESS™ (hypochlorous water) or tap water (control group) was sprayed into the room air for 12 hours per day over 30 days.

38 patients were included; the mean age was 84.1 years. Most participants (89.5%) were classified as independence level C2, meaning they were fully bedridden and unable to turn over without assistance. The history of smoking was absent in 57.9% of participants.

Major past medical histories included cerebral infarction (13 cases), hypertension (9 cases), and dementia (7 cases). Major current conditions were congestive heart failure (13 cases), chronic respiratory failure (9 cases), and COVID 19 (7 cases).

As a result, no adverse events were observed in either group regarding itchy/red eyes, sore throat, runny nose, cough, stress from odors, or stress from the noise of the sprayer. (The criteria for judgment are based on the Common Terminology Standards v5.0, JCOG version.)

Infection-Control Effect of IONLESS™ (hypochlorous water)

We also examined infection control performance in situations where viruses enter the room from outside while IONLESS™ (hypochlorous water) is being sprayed. In a four bed room, a circulator was placed at the entrance to ensure uniform concentration throughout the space, and 2 IONLESS™ sprayers were operated in cycles of 15 minutes of spraying followed by 30 minutes of rest. This maintained an airborne available chlorine concentration of 0.03 ppm during spraying, and ⩾0.01 ppm during non spraying intervals for 12 hours per day. A similar setup was used for the control group using tap water, where the airborne available chlorine concentration remained at ⩽0.01 ppm.

The IONLESS™ group included 52 patients, and the tap water group also 52 patients (total 104). The mean age was 82.9 years. The predominant independence level was C2 (67.3%), indicating patients who remain bedridden and cannot turn over without assistance. The history of smoking was absent in 64.4% of participants. Major past medical histories included cerebral infarction (32 cases), hypertension (26), and diabetes (15). Major current conditions included congestive heart failure (20 cases), chronic respiratory failure (8), and aspiration pneumonia (7).

During the 60 days observation period, three patients in the IONLESS™ (hypochlorous water) group became positive around the same time. It was later found that a staff member responsible for these patients had developed symptoms several days earlier and subsequently tested positive for SARS CoV 2. The remaining patients in the same room remained negative. In the tap water group, no positive cases were observed.

During the same period, according to surveillance data from the Iwate Prefecture Infectious Disease Information Center, the average weekly number of COVID 19 and influenza positive patients per medical institution in the prefecture was 7.12. This suggests that both the IONLESS™ group and the tap water group may have experienced some infection control benefit. Additionally, two other study periods were conducted (with total patient counts of 42 and 256, respectively), and no positive cases were observed in either group during those periods. These findings suggest that humidification itself may contribute to infection control effects.

Humidification Effect of IONLESS™ (Hypochlorous Water)

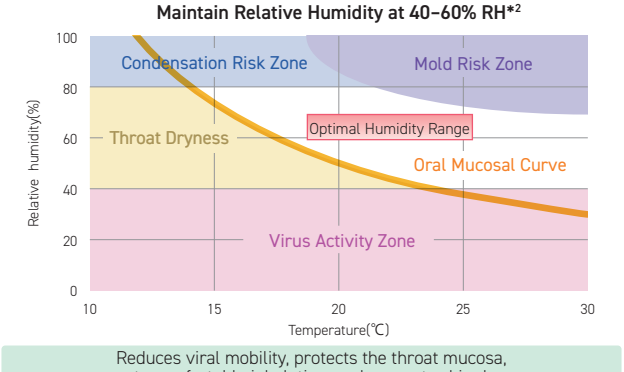
Humidification facilitates smooth ciliary movement in the respiratory mucosal layer, allowing viruses and bacteria to be expelled from the body.*2

In contrast, under dry conditions, ciliary function deteriorates, impairing clearance and increasing the risk of respiratory infections. *2

The ideal humidity level for preventing aerosol transmission of respiratory viruses indoors is generally considered to be 40–60% relative humidity (RH). *2

At Oushuku Onsen Hospital, one of the cooperating institutions, room

Figure2 Relative Humidity Considered Optimal for Infection Control



Reduces viral mobility, protects the throat mucosa, supports comfortable inhalation, and prevents skin dryness.

Created based on Miura Toyohiko, Journal of Occupational Health, 1978, 54(4), 165 177.

humidity has been maintained at around 60% and temperature at 20–25°C since the introduction of IONLESS™ (hypochlorous water) spraying. Because excessive humidification can cause condensation in winter and mold growth in summer, these values are considered an appropriate moisture environment for infection control purposes (Figure 2).

The presence of bacteria and mold inside humidifiers has long been a problem, and as a result, humidifiers are not commonly used in medical institutions. In humidifiers filled with tap water, bacterial growth was observed beginning on the 3rd day even when the water was replaced daily.*3

In contrast, with IONLESS™ (hypochlorous water) at 40 ppm, no bacterial proliferation was observed for 11 days without replacing the water, and when the water was replaced, suppression of bacterial growth continued for nearly 2 weeks (Figure 3). *3

These findings suggest that the use of IONLESS™ (hypochlorous water) can reduce the labor required for humidifier cleaning.

Summary

The spraying of IONLESS™ (hypochlorous water) is expected to provide two benefits for infection control: enhancement of the body's defense mechanisms through improved ciliary activity resulting from humidification, and reduction of airborne viral concentrations through its sanitizing effect. These combined effects may help prevent clusters that are difficult for healthcare staff to control. Moving forward, we aim to increase the number of clinical cases and further verify its effectiveness.

Figure3 Suppression of Bacterial Growth in Humidifiers Using Ionless™ (Hypochlorous Water)

Microbial control effects of 40 ppm hypochlorous acid water in a humidified environment

Test Sample	Day1	Day2	Day3	Day4	Day5	Day6	Day7	Day8	Day9	Day10	Day11
Tap water (No replacement)		Bacterial Growth	Bacterial Growth	Bacterial Growth							
Tap water (With replacement)			Bacterial Growth	Bacterial Growth							
40ppm Hypochlorous Acid Water (No replacement)											Tank Cleaned
40ppm Hypochlorous Acid Water (With replacement)											

[Method] Test samples were placed inside an ultrasonic humidifier (Ururi S, Nitori Co., Ltd.) and sprayed. The contents were cultured daily, and bacterial growth was observed over time.

Nipro Pharmaceutical Research Center Data

*1 Imoto Y et al. Food Environ Virol, 2025, 17(1), 9
*2 Moriyama M et al. Annu Rev Virol, 2020, 7(1), 83-101
*3 Nipro Basic Research Laboratory Data



"Assessment of Environmental Bacteria in a Pediatric Ward Playroom" Evaluation of Changes in Environmental Bacteria through Atomization of IONLESS™ (Hypochlorous Water)

Kiyohito Okumiya, M.D., Ph.D.
Assistant Professor, The Department of Pediatrics and Child Health Kurume University School of Medicine

Importance of Infection Control in Pediatric Wards

Our hospital's pediatric ward has 56 beds and primarily admits patients with hematologic and oncologic diseases. In FY2023, positive blood culture results included environmental organisms such as Bacillus species and Gordonia species, which are widely distributed in soil and water, as well as environmental bacteria and resident flora of the skin and oral cavity such as Pseudomonas aeruginosa and Staphylococcus species. Notably, even bacteria that are usually considered contaminants—such as Streptococcus mitis/oralis—can cause persistent bacteremia and become true pathogens in immunocompromised patients.

Among fevers in immunocompromised patients, Febrile Neutropenia (FN) is particularly important. During chemotherapy or after hematopoietic stem cell transplantation—when immune suppression is pronounced—patients who develop fever with neutrophil counts below 500/μL are at high risk of progressing to sepsis.*[1] Although 80–90% of children with acute lymphoblastic leukemia*[2] can now be cured, FN remains a major cause of severe complications and mortality. Therefore, we considered that reducing environmental bacteria may help reduce the incidence of FN.

In the pediatric ward, patients are allowed to play in the playroom when they are not in the neutropenic phase. However, because many patients' chemotherapy has long term indwelling central venous lines, with multiple connector points for administration of various medications, dragging the line while playing in the playroom may allow bacteria to adhere to the connectors. Although disinfection is performed before drug administration, bacteria with strong adhesion properties—such as Bacillus species—may remain even after disinfection and could potentially contaminate medications during administration.

The playroom is used by hospitalized children and their parents and relatives. Cleaning is performed once daily by the nursing assistants using a potassium peroxymonosulfate (wipe type) disinfectant on tables and floors. However, wiping individual toys is not performed due to the high labor burden.

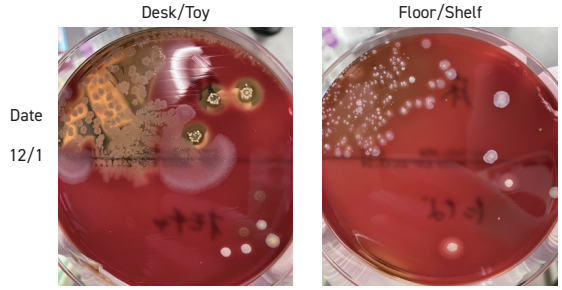
Background and outcomes leading to the use of IONLESS™ (hypochlorous water) spraying

According to the comparative table of disinfectants presented by the World Health Organization (WHO) *[3], alcohol is ineffective against spores and fungi, and hypochlorite cannot inactivate prions. In contrast, hypochlorous acid water is effective against these microorganisms and is also considered harmless in terms of safety. Alcohol, hypochlorite, and hydrogen peroxide should not be applied to the skin, eyes, or mucous membranes, whereas hypochlorous acid water is classified as non irritating. Based on these characteristics, we decided to implement spatial spraying of IONLESS™ (hypochlorous water).

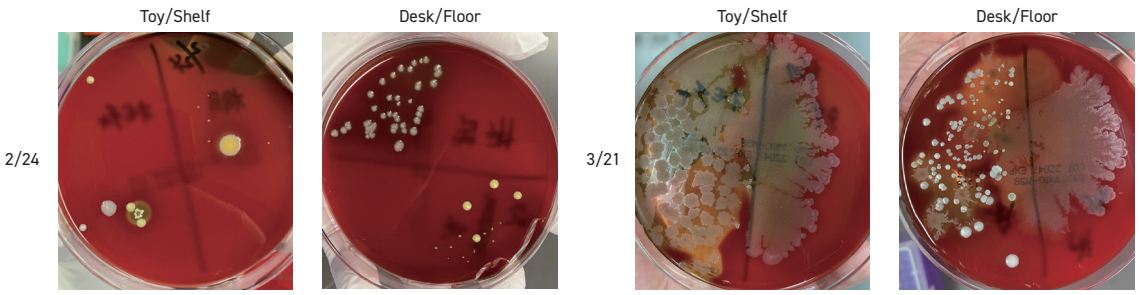
The advantages of this approach include the elimination of manual wiping, its low corrosiveness toward metals used in medical instruments and devices*[4], and its safety when inhaled. *[5] In a 90 day inhalation study in monkeys exposed to 1,000 ppm hypochlorous acid water for one hour per day, no abnormalities were observed in clinical assessments such as body weight, food intake, respiratory examination, blood and urine tests, nor in lung biopsy findings.

Although hypochlorous acid water is considered harmless, we considered the aversion of patients and staff toward visible disinfectant spraying. Therefore, spraying was performed at night for 12 hours, and the study was conducted in three phases, each lasting six months. In phase 1, environmental cultures were obtained the morning after one night of spraying; in phase 2, the morning after two consecutive nights; and in phase 3, the morning after 3 consecutive nights.

Figure4 Quantity and Species of Bacteria Before Starting the Study



Date				
12/1	Desk	*Bacillus subtilis*	Floor	*Staphylococcus epidermidis*
		Trichosporon japonicum		
	Toy	*Micrococcus luteus*	Shelf	*Staphylococcus capitis*
		Streptococcus mitis oralis		*Staphylococcus hominis*
2/24	Toy	*Staphylococcus warneri*	Desk	*Roseomonas mucosa*
		Kocuria rhizophila		
	Shelf	*Staphylococcus aureus*	Floor	*Kocuria rhizophila*
3/21	Toy	*Bacillus subtilis*	Desk	*Staphylococcus warneri*
	Shelf	-	Floor	*Bacillus subtilis*



Our case was conducted with the approval of the Kurume University Institutional Review Board (IRB).

Samples were collected from desks, shelves, floors, and toys (in storage) within a 2 meter radius of the sprayer. A moistened cotton swab was used to wipe a 2 cm square area, which was then inoculated onto blood agar plates. Colony counts were evaluated on the following day and the day after. MALDI TOF MS was used for bacterial identification, and 16S rRNA analysis was performed when identification was not possible.

Prior to this study, environmental cultures were performed periodically over approximately 6 months, detecting environmental bacteria such as Bacillus spp. and Staphylococcus spp., including from desks that had been thoroughly wiped (Figure 4). Because sample collection timing depended on my availability, it was not standardized. Notably, even on March 21, 2024—immediately after the nursing assistant completed wiping—bacteria were still detected on the desk.

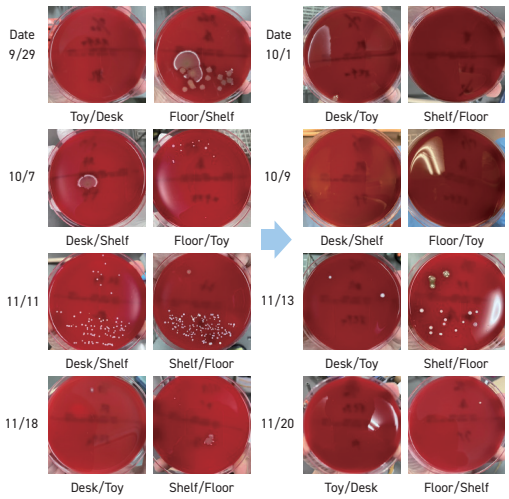
In phase 1, following one night of spraying, no clear reduction in colony counts was observed. In phase 2, after 2 consecutive nights of spraying, the bacterial load decreased (Figure 5). In phase 3, after 3 consecutive nights, only 1 colony was detected on the floor (Figure 6). When spraying was performed for 3 consecutive nights from Monday to Wednesday, bacteria decreased on Thursday, increased again by Monday of the following week, but remained lower than pre spraying levels. These findings suggest that regular spraying of IONLESS™ (hypochlorous water) may reduce environmental bacteria.

The bacteria detected in the playroom included environmental species such as Bacillus, Kocuria, Roseomonas, and Pantoea; oral associated Micrococcus; skin commensals Streptococcus, Staphylococcus, and Corynebacterium; and fungi such as Trichosporon. After spraying or wiping, the bacteria that continued to be detected included Bacillus subtilis, Micrococcus luteus, Roseomonas mucosa, and Pantoea eucrina.

Figure5 Bacterial Load Before and After Two Nights of IONLESS® (Hypochlorous Acid Water) Spraying

	Date	Bacteria Load
	9/29	
Shelf		15
Desk		0
Floor		0
Toy		0
	10/7	
Shelf		1
Desk		0
Floor		11
Toy		0
	11/11	
Shelf		1
Desk		81
Floor		140
Toy		9
	11/18	
Shelf		2
Desk		1
Floor		1
Toy		1

	Date	Bacteria Load
	10/1	
		0
		0
		0
		1
	10/9	
		0
		0
		0
		0
	11/13	
		3
		2
		14
		0
	11/20	
		0
		0
		1
		0



Bacteria Load: Colony counts

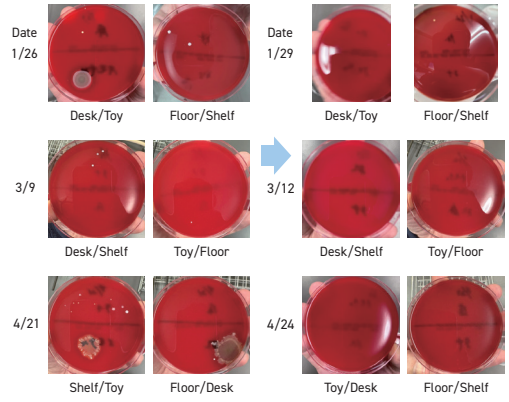
Our case was conducted with the approval of the Kurume University Institutional Review Board (IRB).

Figure6 Bacterial Load Before and After Three Nights of Spraying IONLESS® (Hypochlorous Water) at 40 ppm

	Date	Bacteria Load
	1/26	
Shelf		2
Desk		0
Floor		2
Toy		2
	3/9	
Shelf		3
Desk		2
Floor		0
Toy		0
	4/21	
Shelf		10
Desk		2
Floor		0
Toy		1

	Date	Bacteria Load
	1/29	
		0
		0
		1
		0
	3/12	
		0
		0
		0
		0
	4/24	
		0
		0
		0
		0

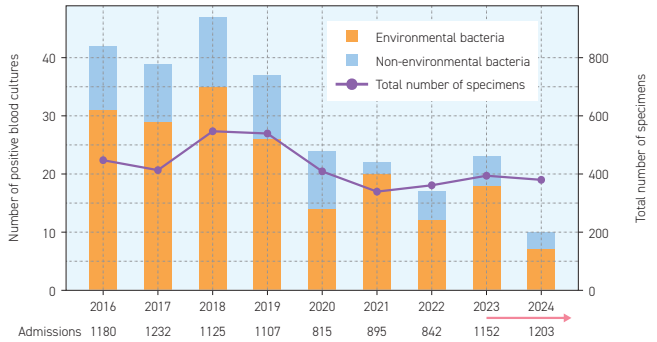
Hardly detected



Bacteria Load: Colony counts

Our case was conducted with the approval of the Kurume University Institutional Review Board (IRB)

Figure7 Trends in the Number of Positive Blood Cultures Among Pediatric Inpatients



If the same bacterium was detected multiple times from a single patient, it was counted only once.

Our case was conducted with the approval of the Kurume University Institutional Review Board (IRB).

Trends in the Number of Positive Blood Cultures in the Pediatric Ward

The previous study was conducted between 2023 and 2025, and Figure 7 shows the trend in the number of positive blood cultures among pediatric inpatients at our hospital. The orange bars represent environmental bacteria or normal flora of the oral cavity and skin, while the blue bars represent common pathogenic bacteria such as Streptococcus pneumoniae and Escherichia coli.

The total number of specimens has remained nearly unchanged since 2016, and the number of admissions, which declined in 2020 due to the COVID 19 pandemic, had returned to pre pandemic levels by 2023. However, after the introduction of IONLESS™ (hypochlorous water) spraying in 2023, the number of positive blood cultures decreased compared with levels seen before 2019.

Although this trend alone is not sufficient to definitively conclude that IONLESS™ (hypochlorous water) spraying was effective as an infection control measure, it suggests that the possibility cannot be ruled out.

Conclusion

Spraying IONLESS™ (hypochlorous water) made it possible to reduce bacterial counts in the playroom without requiring additional manual labor. As a future perspective, we aim to investigate whether the bacterial strains detected in blood cultures match those previously identified and stored from the playroom environment. If blood culture–positive strains are found to be identical to those collected from the playroom, it would suggest that the playroom may have been a source of infection.

Furthermore, we plan to examine whether spraying in patient rooms similarly reduces environmental bacteria and whether the incidence of bacteremia decreases as a result.

*1 Japanese Society of Clinical Oncology, Pediatric Oncology Subcommittee (Ed.). Guidelines for the Management of Febrile Neutropenia (FN), 3rd revised edition, 2024, Nanzando.

*2 Japanese Society of Medical Oncology. Cancer Chemotherapy Guidelines: Acute Lymphoblastic Leukemia (ALL) in Children.
Accessed December 8, 2025.http://www.jsco-cpg.jp/childhood-leukemia/guideline/

*3 Application for Inclusion in the 2021 WHO Essential Medicines List. Hypochlorous Acid(HOCl) for disinfection, antisepsis, and wound care in Core Categories 15.1, 15.2, and 13, Submitted 24 November 2020 Rev 2-16 Dec 2020, p37

*4 Hiroshi Sato et al.
Journal of Blood Purification Technology, 2021, 29(1), 51–56.
[Conflict of Interest] The author is an employee of Nipro Corporation.

*5 Mediford Co., Ltd.
13-Week Inhalation Toxicity Study of Hypochlorous Acid Water in Monkeys(Test No.: B220569).



Atomized IONLESS™ (hypochlorous water) is effective to reduce multi-drug resistant organisms in a hospital

Chun-Kai Huang, M.D., Ph.D.
Professor, Department of Infection Control, E-Da Hospital, Kaohsiung, Taiwan, and I-Shou University, Taiwan

Disinfection Methods within the Hospital

Our hospital is a medical center in southern Taiwan with 1,249 beds. In the hospital environment, cleaning and disinfection are critically important; however, existing disinfection methods are not perfect and have several disadvantages.

For example, bleach containing chlorine can be toxic to the respiratory system depending on its concentration, requiring adequate ventilation, and wiping is necessary to ensure reliable effectiveness. Alcohol is flammable and carries the risk of fire accidents, and it cannot inactivate non enveloped viruses. Ultraviolet (UV) light can damage the eyes and skin, and its effective range is limited.

Amid these challenges, hypochlorous acid water has emerged as a potential alternative disinfection option. It has been extensively studied over many years, and numerous research papers have been published. In 2023*[1] and 2024*[2], reports were published demonstrating the excellent indoor disinfection performance of low ion hypochlorous acid water (IONLESS™).

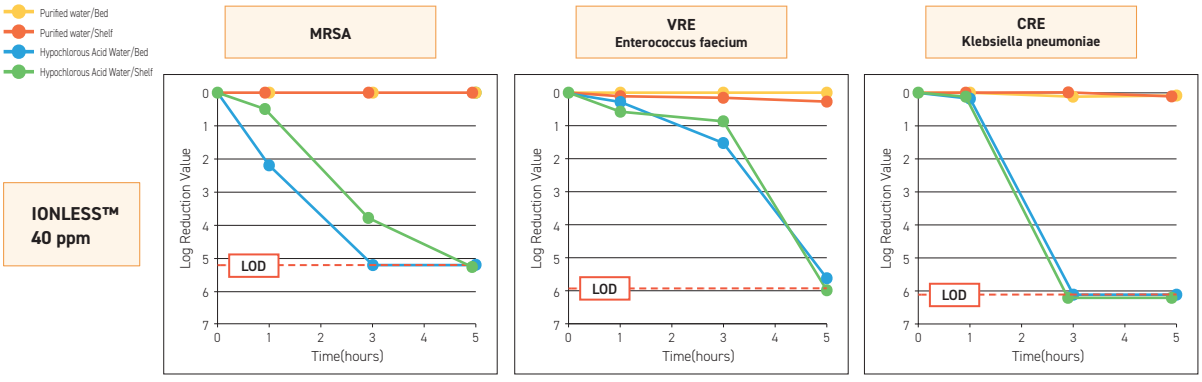
Sanitization Effect of IONLESS™ (Hypochlorous Water) on Multidrug-Resistant Bacteria

Our hospital conducted a study focusing on 3 types of multidrug resistant bacteria. Two of them were Gram positive bacteria—methicillin resistant Staphylococcus aureus (MRSA) and Vancomycin Resistant Enterococci (VRE). The third was a Gram negative organism, Carbapenem Resistant Enterobacterales (CRE), specifically Klebsiella pneumoniae. These 3 isolates are commonly encountered in hospitals, and all strains used in the experiments were clinical isolates obtained in our facility, meaning they were actual pathogenic organisms.

Because Gram positive bacteria are resistant to desiccation, disinfection testing for 3 species was performed under dry conditions, whereas testing for Gram negative bacteria was conducted under non dry conditions.

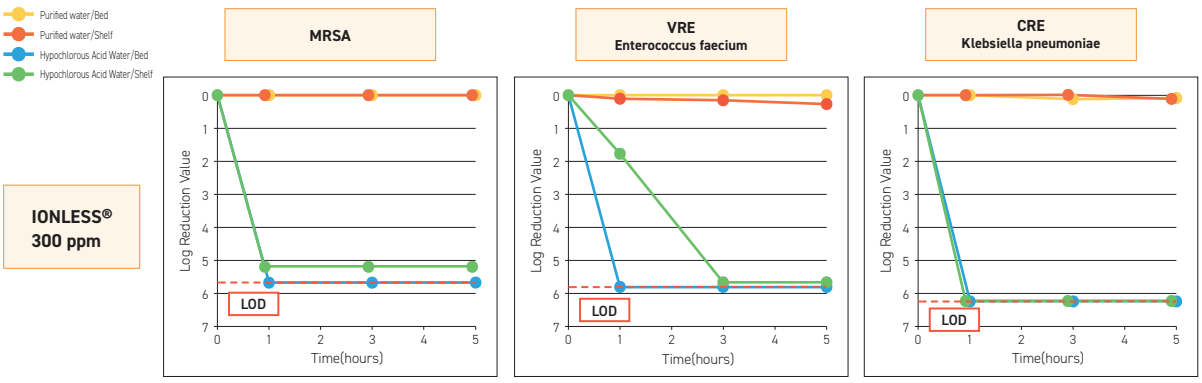
Two concentrations of IONLESS™ (hypochlorous water) — 40 ppm and 300 ppm — were used for the experiments, with purified water serving as the control group. In an unoccupied patient room of approximately 93 m³ with the air conditioner running, bacterial samples were placed in 2 locations: at the foot of the bed and on the shelf where the television is placed. An ultrasonic sprayer was operated for 5 hours.

Figure8 Results of Spraying IONLESS™ (Hypochlorous Water) at 40 ppm



LOD：Limit of Detection (n=1)

Figure9 Results of Spraying IONLESS™ (Hypochlorous Water) at 300 ppm



LOD：Limit of Detection (n=1)

The results are shown in Figures 8 and 9. With spraying of purified water, no change was observed in the bacterial counts on either the bed or the shelf. However, with spraying of IONLESS™ (hypochlorous water) at 40 ppm, CRE on both the bed and the shelf, and MRSA on the bed, reached the limit of detection within 3 hours.

With 300 ppm spraying, all samples reached the limit of detection within 1 hour except for the VRE shelf sample, which also reached the limit of detection after 3 hours.

A limitation of this study is that it did not evaluate the safety of IONLESS™ (hypochlorous water) and its effect on viral inactivation.

Promise of IONLESS™ (Hypochlorous Water)

There are 3 key points for controlling MultiDrug Resistant Organisms (MDROs):

(1) adherence to hand disinfection;

(2) rigorous implementation of disinfection methods; and

(3) contact isolation of infected patients together with disinfection measures.

Our experiment indicated that spraying IONLESS™ (hypochlorous water) is a promising approach for item (2).

Furthermore, there are 4 important factors for an effective disinfection method.

First, whether the disinfectant can reach the target areas—IONLESS™ (hypochlorous water) showed a disinfection effect even at the foot of the bed.

Second, the effective concentration of hypochlorous acid water—higher concentrations appeared to produce faster disinfection.

Third, the required disinfection time—spraying IONLESS™ (hypochlorous water) at 40 ppm for 5 hours—reduced 3 MDROs to the limit of detection.

Fourth, the bacterial species for which disinfection is effective—although VRE required more time, for common hospital MDROs, extending the spraying duration and/or selecting a higher concentration was considered likely to achieve effectiveness.

Future Perspectives

In CT and MRI examination rooms, imaging is not withheld even for patients infected with influenza or COVID 19. Emergency departments also routinely receive patients with infectious diseases. In the waiting areas of infectious disease and internal medicine clinics, many patients present with respiratory symptoms, and causative pathogens vary, including Mycoplasma and Legionella species. As healthcare providers, we must protect patients from infections caused by all possible pathogens.

Although the present study was conducted on a small scale within patient rooms, we hope to incorporate IONLESS™ (hypochlorous water) as one of the options for environmental disinfection within hospital settings.

*1 Fukuzaki S. J Microorg Control, 2023, 28(4), 165-175
*2 Miura M et al. J Infect Chemother, 2024, 30(2), 123-128
[Conflicts of Interest] This study was supported by Nipro Corporation. In addition, three of the authors of this paper are employees of Nipro Corporation.

NIPRO
CLFine™
IONLESS™ Hypochlorous Water
Airborne bacteria removal and reduction of airborne viruses through indoor sprayin
Removal of surface attached bacteria and reduction of surface attached viruses
On doorknobs, handrails, walls, windows, and other frequently touched surfaces
Contact for Materials Request NIPRO CORPORATION

NIPRO
NIPRO CORPORATION
3-26, Senriokashinmachi, Settsu, Osaka, 566-8510, Japan

Edited in March 2026(PI)[Approval No. 2603023255]