Evidence brochure

clinell®

Drain Disinfectant

Proven protection against high risk and hard-to-kill-organisms


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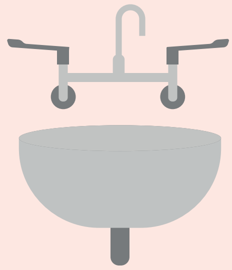
SACHET

Contents page

Contaminated wet and dry surfaces contribute to the transmission of pathogens associated with healthcare-associated infections (HAI)[1,2].

Contaminated sinks and drains are an important factor in the transmission of key Gram-negative bacteria, including *Pseudomonas aeruginosa* and carbapenemase-producing *Enterobacteriaceae* (CPE)[3,4].



Over half of Intensive Care Units (ICU) have a sink(s) **contaminated by multidrug resistant bacteria.***

In clinical settings, sinks meant for hand hygiene are used for waste disposal (including clinical fluid and drinks); **hand washing accounted for only 4% of uses in one study[6].**

Two thirds

of ICUs have a sink(s) that are contaminated with a CPE or an IRPA.*†

6 in 10

ICU sinks are inadequately disinfected or not disinfected at all.*

*Based on a multicentre study of 73 French ICUs wards covering 996 beds[5].
† Imipenem-resistant *Pseudomonas aeruginosa*

High-performance disinfection

Contamination plays an important role in the transmission of HAIs[1].

It is common for sinks and drains to be contaminated with antibiotic resistant bacteria[7].

Some of the most persistent outbreaks come from drains. In these ideal conditions, microorganisms form biofilms – protective structures rendering traditional disinfectants ineffective.

Clinell Drain Disinfectant is a high-performance disinfectant that provides proven protection against high-risk and hard-to-kill organisms.

More effective than traditional disinfectants

Getting to the source of the problem, Clinell Drain Disinfectant wipes out biofilms throughout the drainage system.

Simple to use oxidative technology

One sachet of Clinell Drain Disinfectant granules, combined with water, produces enough powerful oxidative agents including peracetic acid (see page 11) to break down biofilms and kill the microbes living within them.

Strong on microbes, gentle on drains

Despite generating strong oxidising agents, our formula maintains a near neutral pH. Regular use will prevent biofilm regrowth while conserving the integrity of the drain, preventing outbreaks before they happen.

High-risk & hard-to-kill organisms

Different microorganisms have different physiological structures and therefore exhibit differing tolerance to external factors such as chemical disinfection. Clinell Drain Disinfectant is proven to provide a high level of efficacy against otherwise hard-to-kill microbes including bacteria.

Tolerance to disinfectants	Organism example
Biofilms	Dry surface biofilm
Bacterial spores	*Bacillus subtilis* *Clostridioides difficile*
Mycobacteria	*Mycobacterium avium* *Mycobacterium terrae*
Small, non-enveloped viruses	Canine parvovirus Poliovirus
Fungal spores	*Aspergillus brasiliensis*
Gram-negative bacteria	*Acinetobacter baumannii* *Escherichia coli (E. coli)* *Klebsiella pneumoniae* (ESBL) *Pseudomonas aeruginosa*
Yeast	*Candida auris* *Candida albicans*
Large, non-enveloped viruses	Adenovirus Norovirus
Gram-positive bacteria	*Staphylococcus aureus* *Enterococcus faecalis* *Enterococcus hirae*
Enveloped Viruses	Vaccinia virus

Typical tolerance of microorganism types to disinfectants, adapted from McDonnell & Russell[8]

Wet surface biofilms

Sink and shower drains provide an ideal environment for microbes to form biofilms – cities of microbes living within a protective layer. Biofilms provide increased resistance to traditional disinfectants[9-11]; indicating why some outbreaks may seem impossible to resolve.

Even in the absence of outbreaks and known cases of infection, sinks have been found to be contaminated with microbes that have the potential for causing an outbreak[12]. Activities including hand hygiene supply bacteria that colonise the drainage system, and disposed fluids provide nutrients, thus supporting growth of biofilms[13].

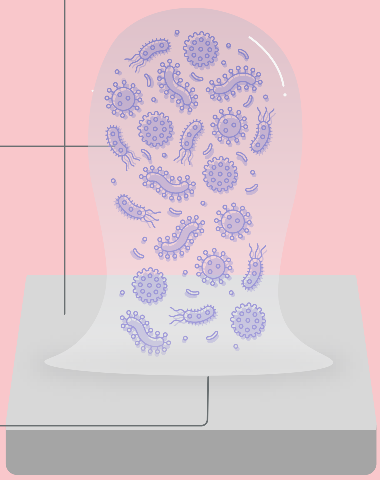
Biofilms form when free-floating microbes attach to a surface and change state. The secretion of Extracellular Polymeric Substances (EPS) creates a protective 'biofilm matrix' that traditional disinfectants, such as chlorine in concentrations commonly used in healthcare, can't penetrate.

Protected by the matrix, the microbes living within the protective layer are sheltered from external threats and are able to 'exchange genes' and transfer genetic material. This transfer of genetic material can occur between the dozens of pathogenic species that live within the biofilm. Resistance in one species can then transfer and can give rise to new antibiotic resistant bacteria[14,15].

Planktonic ("free-swimming") microbes attach to a surface to begin forming a biofilm.

The microbes produce a mix of Extracellular Polymeric Substances (EPS) – the "biofilm matrix" provides an added layer of microbial defence from disinfectants.

Inside the biofilm microorganisms are free to transfer antibiotic resistance genes.



Contaminating the clinical setting

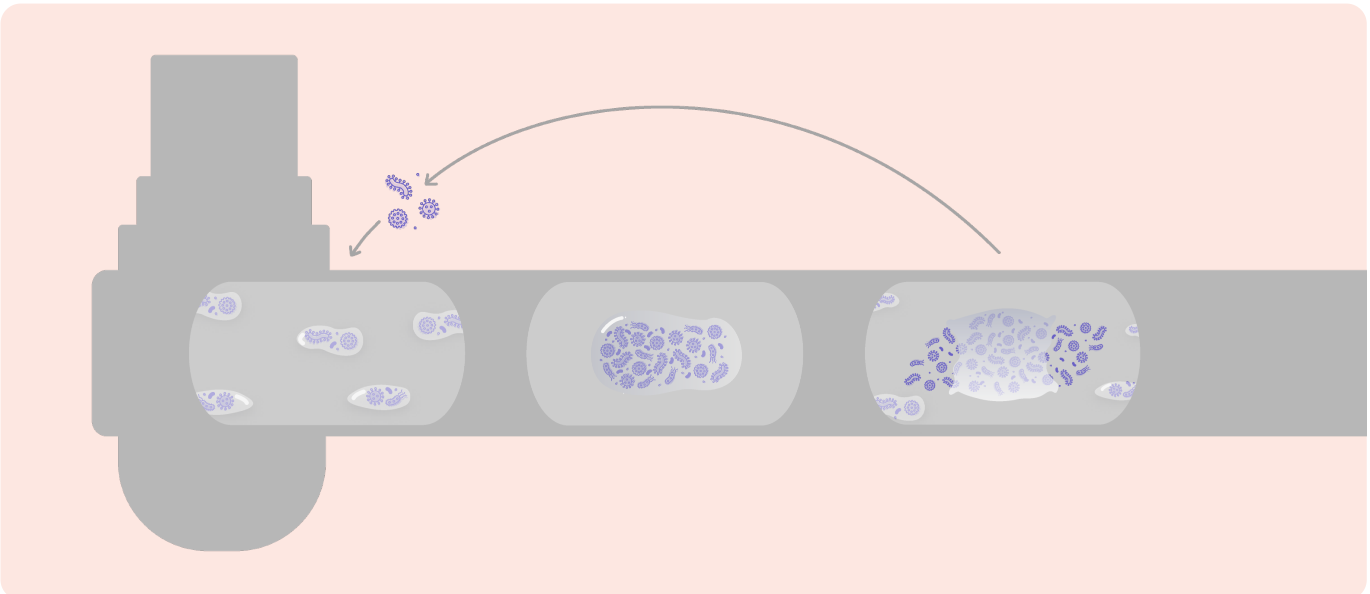
Once established, the wet surface biofilms continue to grow. When the area is treated with traditional disinfectants, the free-floating microbes outside of the biofilm are quickly killed. Microbiological samples taken will show the surface to be clean and disinfected. However, this is not the case. Inside the biofilm, the microbes survive and increase in numbers. Eventually, the biofilm will seed free-floating microbes back into the environment.

Laboratory experiments have shown that contamination in sinks and drains can potentially be transferred to the hands of healthcare workers and, subsequently, to patients[16,17]. These papers have been followed by clinical studies demonstrating exactly that occurrence[18-21].

Spread from the sink to the patient: In situ study using green fluorescent protein (GFP)-expressing *Escherichia coli* to model bacterial dispersion from hand-washing sink-trap reservoirs[17].

Kotay et al. ***Applied and Environmental Microbiology*****. 2017;83:e03327-16.**

A hand washing sink model was established in a lab setting. The dispersal of green fluorescent protein (GFP)-expressing *Escherichia coli* bacteria was measured under various conditions. A regular supply of nutrients (to model typical use of sinks in healthcare settings) resulted in the formation of biofilms. Once the *E. coli* biofilm had developed, the GFP-expressing *E. coli* was dispersed widely around the sink. This model illustrates how biofilm-related contamination in a sink drain can be spread in a clinical setting.



Wet surface biofilms and healthcare-associated infections

Research has established that biofilms existing within drainage systems are linked to outbreaks and the spread of contamination in healthcare settings.

Wastewater drains: epidemiology and interventions in 23 carbapenem-resistant organism outbreaks[22].

Carling PC. *Infection Control & Hospital Epidemiology*. 2018 39: 972-979.

This review of 23 outbreaks of carbapenem-resistant organisms summarises the recent evidence that contaminated drains and wastewater play a role in the continuation of these outbreaks.

Wastewater and drain-associated outbreaks were characterised by:
- Low density of new cases with long time periods between them
- Challenges with outbreak detection and definition
- Frequent colonisation of sinks and drains
- Apparent transfer of genetic material in drain biofilms
- Need for frequent drain disinfection in order to effectively tackle drain-related transmission

In summary, new genetic tools combined with new insights into the microbial ecology of biofilms provides evidence that contaminated drains and wastewater are an important factor in the transmission of carbapenem-resistant organisms in healthcare settings.

A prospective multicenter surveillance study to investigate the risk associated with contaminated sinks in the intensive care unit[5].

Valentin et al. *Clinical Microbiology and Infection*. (In Press) DOI: 0.1016/j.cmi.2021.02.018.

The study aimed to assess the incidence of sink contamination by multidrug-resistant (MDR) *Pseudomonas aeruginosa* and *Enterobacteriaceae*, risk factors for sink contamination and splashing, and their association with clinical infections in the intensive care setting. From the 73 ICUs participating in the study, 50.9% (606/1191) of all sinks were contaminated by MDR bacteria.

These included:
- 41.0% of sinks used only for handwashing
- 55.3% of those used for waste disposal
- 23.0% of sinks treated daily with chlorine
- 62.0% of those untreated

A total of 459 sinks showed visible splashes and 30.5% were close to the bed (<2 m) with no barrier around the sink making them susceptible to splashing. MDR-associated bloodstream infection incidence rates were also examined.

The authors concluded that there were frequent and multifactorial infectious risks associated with contaminated sinks in ICUs.

Current techniques aren’t working

Biofilms are hardy. Microbes living inside the biofilm can survive traditional disinfection, recover and seed microbes back into the environment.

Several different approaches have been taken to tackle contamination of sinks and drains in clinical settings. Changes in the structure of the clinical environment to reduce contact between staff/patients and sinks/drains, physical methods to remove biofilms and enhanced chemical disinfection[23-26].

Techniques employing traditional disinfectant eradicate free-floating microbes in drainage systems but despite diligent disinfection, outbreaks still occur.

Studies in the clinical environment show that improved management of sinks and drains results in significantly less transmission of CPE[23].

Intensive care unit wastewater interventions to prevent transmission of multispecies *Klebsiella pneumoniae carbapenemase*-producing organisms[23].

Mathers et al. *Clinical Infectious Diseases*. 2018;67:171-178.

The study evaluated the impact of introducing covers for hoppers (a toilet-like waste disposal unit) and sink trap heater/vibration devices to heat-sanitise the drain and dislodge the formation of biofilms in an ICU. Decreases for all CPE acquisitions (a 49% reduction; P = .003) and CPE-positive clinical cultures (a 71% reduction; P < .001) per admission in patients exposed to an intervention unit were observed.

This suggests that improved management of sinks and drains enhanced patient clinical outcomes.

Peracetic acid advantage

Peroxygen chemicals such as peracetic acid are good candidates for a drain disinfectant because they are not prone to break down by dirt or organic matter, are safe for staff to use and have rapid biocidal activity (including sporicidal activity)[24].

Peracetic acid has the noteworthy property of targeting both microbes in biofilms and the biofilm matrix itself – important in biofilm-rich environments such as sinks and drains[13]. Clinell Drain Disinfectant combines with water to generate peracetic acid. It provides an effective option to tackle contaminated sink and shower drains, reduce risk of transmission and maximise patient safety.

It's a trap! The development of a versatile drain biofilm model and its susceptibility to disinfection[27].

Ledwoch et al. *Journal of Hospital Infection*. 106(4): 757-764.

Researchers at Cardiff University developed a novel in-vitro biofilm model to address the need for a robust, reproduceable and simple testing methodology for disinfection efficacy against a complex drain biofilm.

The efficacy of sodium hypochlorite 1000 ppm (NaOCl), sodium dichloroisocyanurate 1000 ppm (NaDCC), non-ionic surfactant (NIS) and peracetic acid 4000 ppm (PAA) was explored, simulating normal sink usage conditions.

Bacterial viability and recovery following a series of 15-min treatments were measured in three distinct parts of the drain. The drain biofilm consisted of 119 mixed species of Gram-positive and -negative bacteria.

NaOCl produced a >4 log_{10} reduction in viability in the drain front section alone, NIS and NaDCC failed to control the biofilm in any drain sections.

Only the PAA formulation was able to significantly affect (>4 log_{10} reduction) the biofilm throughout the drain model and importantly, prevent biofilm regrowth for a minimum of four days.

A systematic evaluation of a peracetic-acid-based high performance disinfectant[28].

Humphreys et al. *Journal of Infect Prevention*. 2013;14:126-131.

This study evaluated the potential for peracetic-acid-based (PAA) disinfectants (such as Clinell Drain Disinfectant) to act as high performance disinfectants in healthcare settings.

When tested against bacteria and spores, PAA provided similar or improved performance than chlorine, especially when organic challenge was present or when tackling dried surface contamination.

These results suggest that PAA generating products provide an improved alternative to chlorine-based products.

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Use biocides safely. Always read the label and product information before use.

Drain Disinfectant order info	Product	Quantity	Product code
	Drain Disinfectant	24 sachets	CSDD24AUS

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