MOVE INTO SAFETY

Effective Technologies for Disinfection

— *Role of surfaces in the spread of HAI* —

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- **It is widely recognized that the surfaces of medical devices represent an important source of pathogens and therefore play an important role in the spread of hospital infections.**

- **Epidemiological studies have shown that, following the discharge of an infected or colonized patient, the risk of acquisition of the same pathogen by the next occupant of the room increases.**

- **Disinfection of surfaces therefore represents a fundamental procedure for the prevention of infections and to break the infection transmission chain!**

- ***However, in most cases surface disinfection is only carried out manually with lots of limitations…***

Issues with manual disinfection

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Ordinary manual cleaning and disinfection have important limitations

- Process affected by human errors (rush, operator's accuracy and motivation affect a lot the outcomes).
- Impossibility to establish if all surfaces have been uniformly treated (complex geometry, cables, etc.).
- Impossibility of verifying if contact time has been correctly respected.
- Process not replicable and many variables to control.
- Often products are diluted down before the use with the possibility of making a mistake in the effective concentration.

— H_2O_2 –based automated disinfection systems —

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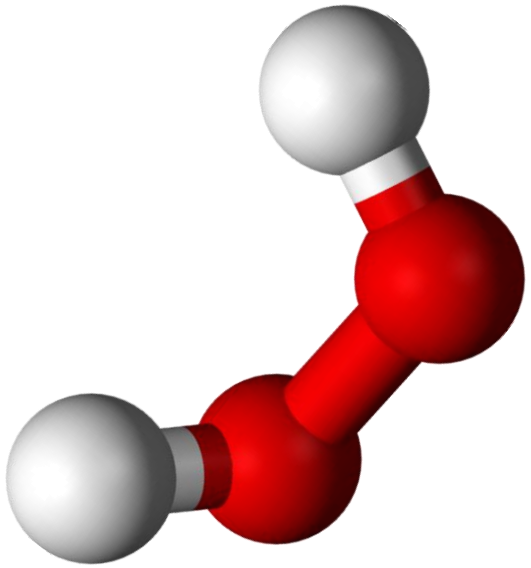
To overcome the numerous limitations of manual disinfection procedures, several automated disinfection systems based on the nebulization of hydrogen peroxide solutions were born in the last years.



At the right concentration broad spectrum of activity

Fully biodegradable

At concentration <8% it is not toxic nor corrosive and shows extensive compatibility with materials

Anyway, Hydrogen peroxide alone often is not enough…

— *Issued with H_2O_2 –based automated disinfection systems* —

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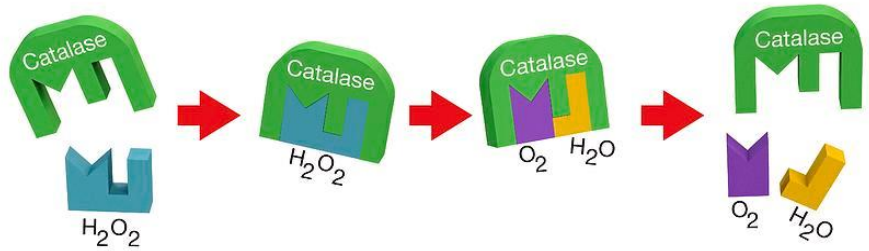
The use of a solution based on simple H_2O_2 can present important limitations, due to the fact that most pathogens are catalase producers. Therefore, they are able to defend themselves from low concentrations and low doses of disinfectant solution.



Alcuni produttori di catalasi

- *Staphylococcus aureus*
- *Acinetobacter baumannii*
- *Klebsiella pneumoniae*
- *Escherichia coli*
- *Candida albicans*
- *Enterobacter species*
- *Mycobacterium tuberculosis*
- Molti altri

Other factors (e.g. surfaces that are not perfectly clean, not perfectly dry) can emphasize these limits and make the disinfection process ineffective against these pathogens!

It is essential to use innovative solutions where the peroxide is supported by other components to be more active on catalase-producing pathogens !!

Scientific literature

- *Ali, S., Muzslay, M., Bruce, M., Jeanes, A., Moore, G., & Wilson, A. P. R. (2016).* ***Efficacy of two hydrogen peroxide vapour aerial decontamination systems for enhanced disinfection of methicillin re-sistant Staphylococcus aureus, Klebsiella pneumoniae and Clostridium difficile in single isolation rooms.*** *Journal of Hospital Infection, 93(1), 70-77.*
- *Andersen, B. M., Syversen, G., Thoresen, H., Rasch, M., Hochlin, K., Seljordslia, B., Berg, E. (2010).* ***Failure of dry mist of hydrogen peroxide 5% to kill Mycobacterium tuberculosis****. Journal of Hospital Infection, 76(1), 80-83.*
- *Fu, T. Y., Gent, P., & Kumar, V. (2012).* ***Efficacy, efficiency and safety aspects of hydrogen peroxide va-pour and aerosolized hydrogen peroxide room disinfection systems.*** *Journal of Hospital Infection, 80(3), 199-205.*
- *Haque, M., Sartelli, M., McKimm, J., & Bakar, M. A. (2018).* ***Health care-associated infections–an overview****. Infection and drug resistance, 2321-2333.*
- *Kramer, A., Schwebke, I., & Kampf, G. (2006).* ***How long do nosocomial pathogens persist on inanimate surfaces? A systematic review****. BMC infectious diseases, 6(1), 1-8.*
- *Otter, J. A., & French, G. L. (2009).* ***Survival of nosocomial bacteria and spores on surfaces and inactivation by hydrogen peroxide vapor****. Journal of clinical microbiology, 47(1), 205-207*
- *Pottage, T., Macken, S., Walker, J. T., & Bennett, A. M. (2012).* ***Methicillin-resistant Staphylococcus au-reus is more resistant to vaporized hydrogen peroxide than commercial Geobacillus stearothermophilus biological indicators****. Journal of Hospital Infection, 80(1), 41-45.*
- *Suleyman, G., Alangaden, G., & Bardossy, A. C. (2018).* ***The role of environmental contamination in the transmission of nosocomial pathogens and healthcare-associated infections****. Current in-fectious disease reports, 20, 1-11.*
- *Szabó, S., Feier, B., Capatina, D., Tertis, M., Cristea, C., & Popa, A. (2022).* ***An overview of healthcare associated infections and their detection methods caused by pathogen bacteria in Ro-mania and Europe****. Journal of clinical medicine, 11(11), 3204.*

— *The 99T disinfection System* —

The 99T disinfection system is based on the innovative HyperDRYMist® Technology which relies on the synergistic action of the two components of the system:

Propriety formula containing a patented non-toxic formulation containing low level hydrogen peroxide with carefully selected co-formulants, **boosting its biocidal activity** and **overall stability** making it effective against **spores, fungi, viruses, bacteria and mycobacteria**.

- Efficacy
- Compatibility
- Safe

The **portable micro-nebulizer** converts the solution into an **ultra-fine dry mist (droplets less 1 µm)** , resulting in **complete and homogenous coverage** providing excellent material **compatibility**, **safely**.

- Ease of Use
- Efficiency
- Compatibility
- Safe

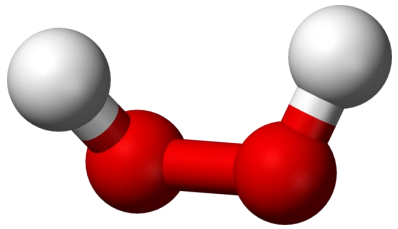
— *The 99S proprietary formula* —

What makes 99S solution so special as compared to other hydrogen peroxide solutions?

In 99S solution, selected co-formulants added at very low concentration act synergistically with hydrogen peroxide to:

- **Increase the overall effectiveness of the solution**
- **Stabilize hydrogen peroxide**
- **Boost hydrogen peroxide action against the pathogens, in particular against catalase-producing microorganisms.**

SELECTED CO-FORMULANTS (<0.2%)



Catalase producing pathogens:

- *Staphylococcus aureus*
- *Acinetobacter baumannii*
- *Klebsiella pneumoniae*
- *Escherichia coli*
- *Candida albicans*
- *Bacillus subtilis*
- *Aspergillus*
- *Mycobacterium tuberculosis*
- Many other microorganisms

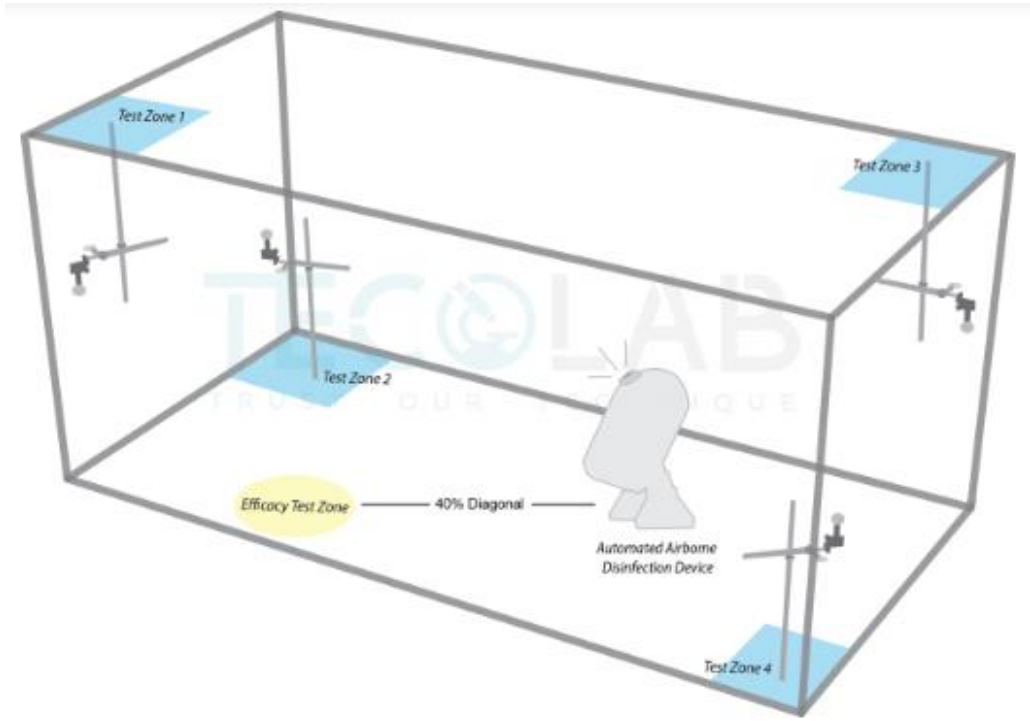
— *Much more effective than simple H_2O_2* —

EN 17272 Distribution test Airborne surface disinfection test

99S solution at 6,6% H_2O_2 and Silver cations + less than 0,2% patented formula *VS* H_2O_2 and Silver cations alone

The EN 17272 distribution test is the most challenging efficacy test for airborne surface disinfection systems, as it requires to achieve >5 Log reduction against *S. aureus* in 8 points located in all sides of the room.

The EN 17272 Distribution test was conducted exactly under the same conditions to prove that 99T solutions are far more effective than H_2O_2 only based solutions.



— *Much more effective than simple H_2O_2* —

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EN 17272 Distribution test Airborne surface disinfection test

Log Reduction	
99S	**H_2O_2 6.6% (+$AgNO^3$)**
D1: >6.27	D1: >6.45
D2: >6.27	D2: <1.73
D3: >6.27	D3: <3.88
D4: >6.27	D4: >6.45
D5: >6.27	D5: <1.91
D6: >6.27	D6: <0.90
D7: >6.27	D7: >5.74
D8: >6.27	D8: <3.80

Clinically Proven

HyperDryMist® is trusted by healthcare facilities across the globe that seek an automated disinfection solution proven to be clinically effective in the prevention and reduction of hospital acquired infections (HCAIs).

More than 20 studies, articles and posters have been published confirming the eectiveness of HyperDryMist Technology.

AJIC American Journal of Infection Control

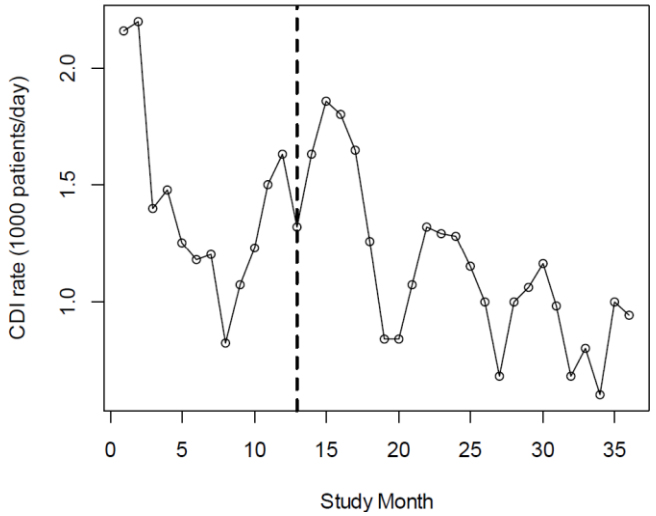
ECCMID

ICPIC

ICPIC 2017

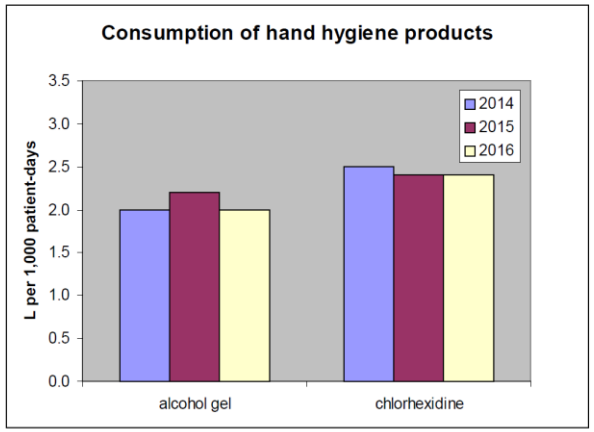
4th International Conference on Prevention & Infection Control

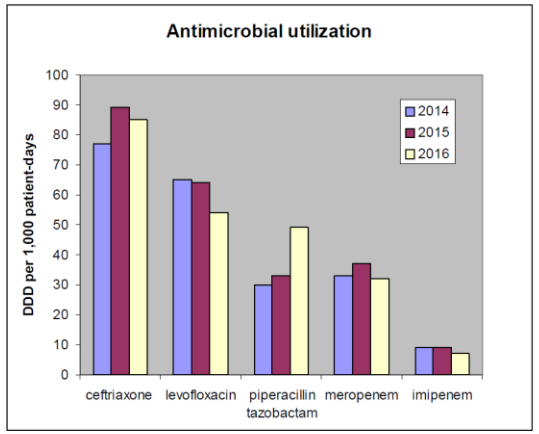
20 June to 23 June 2017 Geneva Switzerland

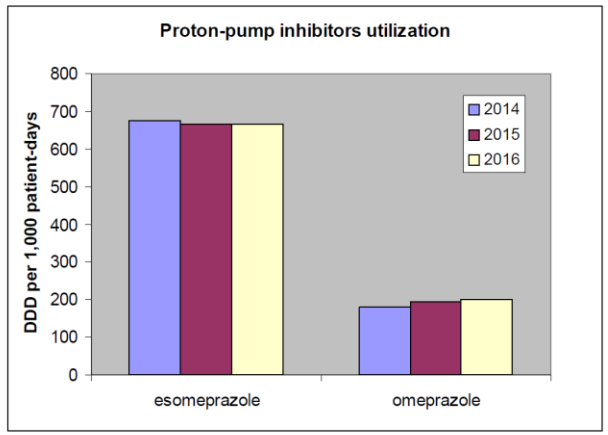


	2014	2015	2016
CDI rates per 1,000 patient-days	1.73	1.32	0.93

	2014	2015	2016
Age (years), Med	79.5	79.8	79
Gender, female %	53	61	57
Length of stay (days), Med	11	10	11







— *Filling the gap between autamated and manual disinfection* —

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Performance

HyperDRYMist® system

Automated high level disinfection system for high risk environments. Disinfection cycle requires absence of people and a minimum of 30 minutes of contact time.

99J Spray

It does not require any mechanical action such as the use of a wipe or the rinsing step, reducing the risk of cross contamination

Wipes, manual triggers and aerosol sprays with LPG

Most commonly used disinfectants on the market, that have several limitations in terms of efficacy, efficiency and safety.

— *Areas of application for the 99J Spray* —

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Disinfection of contaminated hospital bathrooms (vs *Clostridium difficile*)

- **Bathrooms play an important role in transmission of nosocomial pathogens: infections can occur through primary exposure to bioaerosols generated by rinsing or secondary exposure through contact with contaminated surfaces (1,6), which can remain contaminated for long time, up to 24 rinses [1,4].**

- ***C. difficile* is the most common pathogen that can be found in hospital bathrooms, leading to very severe disease especially in immunosuppressed individuals [5].**

- **Other most commonly found pathogens that can persist for long time in dry surfaces are *Aeromonas sp., Bacillus sp., Campylobacter sp., Escherichia sp., Klebsiella sp., Pseudomonas sp., Salmonella sp., Serratia sp., Shigella sp.,* and *Staphylococcus sp.* [2,6] .**

- **Effective cleaning and disinfection procedures with the right products on targeted microorganisms can effectively reduce the risk of infection in hospital bathrooms [1,2,3].**

- ***Scientific literature shows that the use of sponges and wipes to clean surfaces can contribute to the spread of enteric pathogens from the bathroom to other surfaces* [3].**

— *Scientific literature* —

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1. Aithinne KAN, Cooper CW, Lynch RA, Johnson DL. **Toilet plume aerosol generation rate and environmental contamination following bowl water inoculation with Clostridium dicile spores**. Am J Infect Control. 2019 May;47(5):515-520.

2. Abney SE, Bright KR, McKinney J, Ijaz MK, Gerba CP. **Toilet hygiene-review and research needs**. J Appl Microbiol. 2021 Dec;131(6):2705-2714.

3. E.L. Best, J.A.T. Sandoe, M.H. Wilcox. **Potential for aerosolization of Clostridium dicile after ushing toilets: the role of toilet lids in reducing environmental contamination risk**. Journal of Hospital Infection, Volume 80, Issue 1, 2012, Pages 1-5, ISSN 0195-6701.

4. Johnson DL, Lynch RA, Villanella SM, Jones JF, Fang H, Mead KR, Hirst DVL. **Persistence of Bowl Water Contamination during Sequential Flushes of Contaminated Toilets**. J Environ Health. 2017 Oct;80(3):34-49.

5. Binion DG. **Strategies for management of Clostridium dicile infection in immunosuppressed patients**. Gastroenterol Hepatol (N Y). 2011 Nov;7(11):750-2.

6. Lai ACK, Tan TF, Li WS, Ip DKM. **Emission strength of airborne pathogens during toilet ushing**. Indoor Air. 2018 Jan;28(1):73-79.

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3-Steps procedure in case of high infectious risk (vs *Clostridium difficile)*

All the disinfection processes, including the 99J must be conducted after an accurate surface cleaning, to remove any dirt and organic residue. However, since the use of 99J spray does not require a mechanical action and a direct contact of the user with the contaminated surfaces, it can be a valid tool also before cleaning, in order to reduce the infectious risk and the risk of accidental cross contamination.

If you have any questions, please don't hesitate to contact.