Water-Based Disinfectants: A Safer Alternative for MCS Patients and Healthcare Workers

For individuals with Multiple Chemical Sensitivity (MCS) and healthcare workers (HCWs) frequently exposed to harsh chemicals, the use of water-based disinfectants in hospital settings offers significant benefits. These alternatives can provide effective sanitization while reducing the risk of adverse reactions and long-term health effects associated with traditional chemical disinfectants.

Advantages for MCS Patients

Patients with MCS often experience severe reactions to common chemical agents used in hospitals. Water-based disinfectants, such as electrolyzed water, ozonated water, and reactive oxygen species (ROS) water, can significantly improve the hospital experience for these individuals:

1. **Reduced Symptoms:** Water-based disinfectants are less likely to trigger MCS symptoms like headaches, nausea, and respiratory issues, allowing patients to focus on recovery rather than managing chemical sensitivities.
2. **Improved Air Quality:** Unlike traditional disinfectants that release volatile organic compounds (VOCs), water-based options do not contribute to poor indoor air quality, benefiting all patients but especially those with MCS.
3. **Decreased Stress:** Knowing that safer disinfection methods are being used can reduce anxiety for MCS patients, potentially improving overall treatment outcomes.
4. **Broader Access to Care**: With water-based disinfectants, MCS patients may be able to access medical facilities and treatments that were previously challenging due to chemical sensitivities.

Benefits for Healthcare Workers

HCWs are routinely exposed to harsh chemicals during disinfection procedures. Water-based alternatives offer several advantages:

1. **Reduced Occupational Health Risks:** Long-term exposure to chemical disinfectants has been linked to respiratory issues and skin irritation. Water-based options minimize these risks.
2. **Improved Compliance**: The non-irritating nature of water-based disinfectants may lead to better adherence to sanitization protocols among HCWs.
3. **Versatility**: Many water-based disinfectants, like electrolyzed water, can be used on various surfaces and equipment, simplifying cleaning procedures.
4. **Cost-Effectiveness:** Some water-based systems, such as on-site electrolyzed water generators, can reduce long-term costs associated with purchasing and storing traditional chemical disinfectants.

Efficacy and Safety

Water-based disinfectants have demonstrated impressive efficacy against a wide range of pathogens:

1. **Broad-Spectrum Activity:** Ozonated water and electrolyzed water have shown effectiveness against bacteria, viruses, and fungi, rivaling or surpassing traditional chemical disinfectants.
2. **Rapid Action:** Many water-based disinfectants work quickly, with some formulations achieving significant pathogen reduction in minutes.
3. **No Harmful Residues:** Unlike some chemical disinfectants, water-based options do not leave toxic residues on surfaces, enhancing overall safety for patients and staff.
4. **Environmental Friendliness:** Water-based disinfectants break down into non-toxic components, reducing environmental impact and aligning with sustainability goals.

Practical Considerations

Implementing water-based disinfectants in healthcare settings requires some considerations:

1. **Training:** Staff may need education on proper use and application of new disinfection systems.
2. **Initial Investment:** Some water-based disinfection systems may require upfront costs for equipment, though long-term savings are often realized.
3. **Compatibility:** Ensure that water-based disinfectants are compatible with existing surfaces and equipment in the healthcare facility.
4. **Regulatory Compliance:** Verify that chosen water-based disinfectants meet relevant health and safety regulations.

Conclusion

The adoption of water-based disinfectants in healthcare settings offers substantial benefits for both MCS patients and HCWs. These alternatives provide effective sanitization while significantly reducing the risks associated with chemical exposure. As healthcare facilities strive to create safer, more inclusive environments, water-based disinfection technologies represent a promising solution that addresses the needs of sensitive individuals without compromising on cleanliness and infection control. By embracing these innovative approaches, hospitals can enhance patient care, protect staff health, and contribute to a more sustainable healthcare system.

Characteristics of Water-based Disinfectants

Ozonated water, reactive oxygen species (ROS) water, and electrolyzed water (hypochlorous acid) are different types of disinfectant solutions with distinct mechanisms of action. Their mechanisms involve oxidation of microbial components, but the specific oxidizing species differ. They are generally considered safe, effective, non-toxic and environmentally friendly.

Ozonated Water

- Produced by dissolving ozone gas (O3) into water.
- Ozone is a powerful oxidizing agent that can inactivate microbes by oxidizing their cell components like proteins and lipids.
- Ozonated water has shown antimicrobial activity against various bacteria, viruses, and fungi.
- United States Food and Drug Administration (USFDA) has declared ozonated water as a "Generally Recognized as Safe (GRAS)" product under 21CFR173.
- Is routinely used to disinfect bottled water to extend shelf life
- Has a relatively short half-life due to the instability of ozone.
- Has been shown to be an effective hospital disinfectant[1]
- Has been shown to be more effective than alcohol-based hand rub in disinfecting hands[2]
- Also known as ozonized water

Reactive Oxygen Species (ROS) Water

- Produced by energizing a catalyst in the presence of water.
- Generates reactive oxygen species like superoxide radical (O2-), singlet oxygen (O), hydrogen peroxide (H2O2), hydroxyl radical (OH) and ozone (O3).
- Damages microbial cells by oxidizing lipids, proteins, and nucleic acids.
- Has shown potential for disinfecting surfaces and equipment in healthcare settings.[3,4]
- Studies indicate that ROS can penetrate and disrupt biofilms[5]
- Also known as Plasma Activated Water (PAW)

Electrolyzed Water (Hypochlorous Acid)

- Produced by electrolyzing a salt (NaCl) water solution.
- A strong oxidizing agent that can disrupt cell membranes and inactivate enzymes in microbes.
- Antimicrobial activity is primarily due to the high oxidation-reduction potential and available chlorine content.
- Shown to have many applications in healthcare including environmental disinfection.[6]
- United States Food and Drug Administration (USFDA) has declared electrolyzed water as a "Generally Recognized as Safe (GRAS)" product under 21CFR173.
- Slightly acidic electrolyzed water (SAEW) is optimized for environmental disinfection[7]
- Studies indicate that HOCl can penetrate and disrupt biofilms[8]
- Also known as super-oxidized water.

Further reading:

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de Oliveira, C.R., de Oliveira Carvalho, M.C., Schmitz, G.V. et al. Ozonated water in disinfection of hospital instrument table. Res. Biomed. Eng. 39, 329–334 (2023). https://doi.org/10.1007/s42600-023-00272-0

2 - Ozonized water as an alternative to alcohol-based hand disinfection - PubMed (nih.gov)
Breidablik HJ, Lysebo DE, Johannessen L, Skare Å, Andersen JR, Kleiven OT. Ozonized water as an alternative to alcohol-based hand disinfection. J Hosp Infect. 2019 Aug;102(4):419-424. doi: 10.1016/j.jhin.2019.01.026. Epub 2019 Feb 5. PMID: 30731184.

3 - A residue-free approach to water disinfection using catalytic in situ generation of reactive oxygen species | Nature Catalysis
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4 - Man-made reactive oxygen species as green disinfectants - ScienceDirect
Chengjun Li, Huan Zhong, Guorui Liu, Di Liu, Mengjie Wu, Su Shiung Lam, Christian Sonne, Man-made reactive oxygen species as green disinfectants, Eco-Environment & Health, Volume 2, Issue 4, 2023, Pages 243-245, ISSN 2772-9850, https://doi.org/10.1016/j.eehl.2023.05.001

5 - Interactions of plasma-activated water with biofilms: inactivation, dispersal effects and mechanisms of action | npj Biofilms and Microbiomes (nature.com)
Mai-Prochnow, A., Zhou, R., Zhang, T. et al. Interactions of plasma-activated water with biofilms: inactivation, dispersal effects and mechanisms of action. npj Biofilms Microbiomes 7, 11 (2021). https://doi.org/10.1038/s41522-020-00180-6

6 - Microorganisms | Free Full-Text | New Clinical Applications of Electrolyzed Water: A Review (mdpi.com)
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7 - Electrolyzed water as a disinfectant: A systematic review of factors affecting the production and efficiency of hypochlorous acid - ScienceDirect
Rita E. Ampiaw, Muhammad Yaqub, Wontae Lee, Electrolyzed water as a disinfectant: A systematic review of factors affecting the production and efficiency of hypochlorous acid, Journal of Water Process Engineering, Volume 43, 2021, 102228, ISSN 2214-7144, https://doi.org/10.1016/j.jwpe.2021.102228

8 - Slightly acidic electrolyzed water disrupts biofilms and effectively disinfects Pseudomonas aeruginosa - ScienceDirect

Takashi Okanda, Ryo Takahashi, Tomoko Ehara, Kiyofumi Ohkusu, Nobuhiko Furuya, Tetsuya Matsumoto, Slightly acidic electrolyzed water disrupts biofilms and effectively disinfects Pseudomonas aeruginosa, Journal of Infection and Chemotherapy, Volume 25, Issue 6, 2019, Pages 452-457, ISSN 1341-321X, https://doi.org/10.1016/j.jiac.2019.01.014