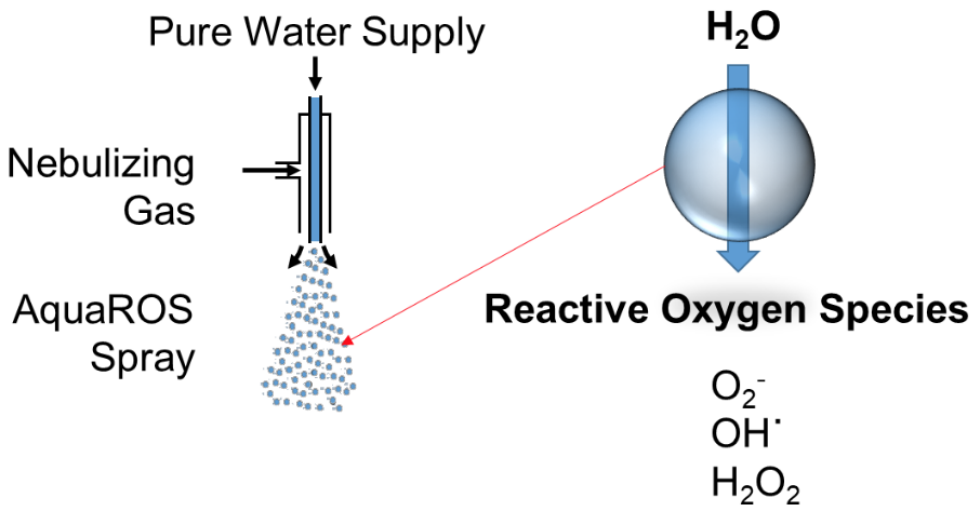
AquaROS: A Powerful New Disinfectant

Stanford University | Stanford, California

OVERVIEW

Researchers at Stanford have developed a new water-based disinfectant with the potential to destroy a wide variety of pathogens and significantly improve healthcare settings. AquaROS, a novel and broad-spectrum disinfectant, is based on the formation of micron-sized water droplets that cause the spontaneous generation of highly reactive oxidant species (ROS). Access to safe and effective disinfecting solutions like AquaROS is more critical than ever – in the U.S. approximately the same number of people die from healthcare-associated infections (HAIs) as from AIDS, breast cancer and auto accidents combined. Inexpensively produced by atomizing water, the new disinfectant has been shown to outperform other commercial methods at inactivating *Salmonella typhimurium* and *E. coli*. Based on these and other promising results, the researchers anticipate AquaROS can kill bacteria, fungi, mycobacteria and bacterial spores on critical surfaces such as medical instruments.



Schematic of the generation of AquaROS from pure water with no chemicals added and no electricity applied. (Zare Lab)

Ongoing Research

The researchers are currently working on evaluating AquaROS for the inactivation of viruses with the goal of determining its effectiveness against SARS-CoV-2. They are further exploring the optimization of the disinfection by studying the effects of environmental parameters (i.e., humidity, temperature) on the effectiveness of the spray in killing pathogens. They are also working on modifying the spray design to eliminate the need for a nebulizing gas.

Stage of Development

AquaROS has been shown to be **more efficient at destroying *Salmonella typhimurium* and *E. coli*** compared to standard 3% hydrogen peroxide, a widely used

HIGHLIGHTS

Inventors

Richard N Zare
Jae Kyoo Lee
Maria Theresa Dulay
Alison C Mody

Tags

Disinfectant
Reactive Oxygen Species
Hospital-Acquired Infection
Salmonella Enterica Subsp. Enterica
Escherichia Coli
Bacteria
Fungus
Mycobacterium
Endospore
Virus

Contact Information

Evan Elder
Senior Licensing Associate
evan.elder@stanford.edu
650-725-9558 (Mobile)

Resources

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commercial disinfectant. Preliminary results suggest that the droplets can eliminate bacteria by rupturing the cell membrane through oxidative stress and disruption by exposure to the droplets' magnetic field. The researchers' *QRB Discovery* paper [in press] describes the proof of principle of AquaROS for the disinfection of bacteria using two model bacteria, *E. coli* and *S. typhimurium*.

Applications

- Direct destruction and inhibition of viruses, bacteria, fungi, mycobacteria and bacterial spores on various surfaces
- Healthcare settings
- Food processing

Advantages

- Effective against a broad spectrum of pathogenic microorganisms
- Simple and easy to apply
- Requires only ordinary water
- Nontoxic and leaves no chemical residue
- Reactive species rapidly dissociate into oxygen and water upon contact with organic matter

Publications

- M. T. Dulay, J. K. Lee, A. C. Mody, R. Narasimhan, D. M. Monack, and R. N. Zare. Spraying Small Water Droplets Acts as a Bacteriocide, QRB Discovery (in press, 2020).
- J. K. Lee, K. L. Walker, H. S. Han, J. Kang, F. B. Prinz, R. M. Waymouth, H. G. Nam, and R. N. Zare Spontaneous Generation of Hydrogen Peroxide from Aqueous Microdroplets Proc. Nat. Acad. Sci (US) 116, 19294-19298 (2019).

Related Web Links

- Zare Lab

Keywords

Salmonella, pathogen inactivation, hospital sanitation, hospital hygiene, E. coli, disinfection, disinfectants, COVID-19: PPE, COVID-19, coronavirus, antivirus, antimicrobial, antibacterial, anti-infective, anti-fungal

Stanford Reference

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