



Eliminating Bacteria In Pool And Spa Plumbing

by Ronald L. Barnes & D. Kevin Caskey

According to a study by Prozone Pool Products of Huntsville, Alabama and The University of Alabama in Huntsville, Advanced Oxidation Processes (AOP) used in treating water with ozone are said to be highly effective in eliminating bacteria in pools, spas and hot tubs.

As the understanding of recreational water maintenance continues to grow, it is important to keep aquatic facility operators informed and educated on the latest technologies such as the utilization of AOP.

In this article, the ability of AOP to eliminate organisms that are linked to recreational water illnesses such as Legionnaires' Disease, Hot Tub Lung and Hot Tub Rash, will be described.

Health Hazards Associated With Pools, Spas

Harmful bacteria such as *E. coli*, *Legionella pneumophila*, *Pseudomonas aeruginosa*, *Mycobacterium avium*, *Streptococcus* and *Salmonella* are known to exist within the plumbing and water of pools, spas, and hot tubs. These organisms cause a variety of illnesses in humans such as: infection of the skin, eyes, ears, hair follicles, intestines and urinary tract.

Illnesses of a more severe nature include Pontiac Fever, Legionnaires' Disease, and 'Hot Tub Lung' (Hypersensitivity pneumonitis in clinical terms.) This spectrum of illnesses can be acquired from breathing, contacting or swallowing recreational water contaminated by bacteria.

Legionella, which causes Legionnaires' Disease and Pontiac Fever, not only infects individuals in water, but can be

transmitted to individuals in close proximity. This occurs when bacteria becomes airborne by way of aerosol mists produced in spas and hot tubs. The bacteria behind 'Hot Tub Lung' is spread the same manner.

Advanced Oxidation Processors And Water Sanitation

Advanced Oxidation Processors produce 'ozonites' which are produced from ozone after it has undergone a series of chemical reactions.

These ozonites rapidly eliminate unwanted bacteria and organic matter (oil, sweat, dead skin cells) that are introduced into the water by bathers. Additionally, some types of bacteria already exist at various levels in municipal water sources.

AOP can eliminate bacteria from the plumbing and water in a pool, spa, or hot tub. This is related to a time element, as bacteria require a certain period of time before becoming irreversibly attached to a surface.

The second variable relates to available nutrition within a body of water. By quickly oxidizing organic matter, ozone dramatically reduces the food supply necessary for bacteria to grow.

Test Setup And Methodology

A test found that an AOP was able to quickly treat water in three spas.

*For this test, all three tubs were purposely contaminated with *E. coli*. Advanced Oxidation Processes were created with an 'Advanced Oxidation Hybrid Generator' for all three experimental tubs.

Tub No.1 had a 284 L (75 gal.) capacity and 10 adjustable jets. The plumbing was set up with a bypass configuration that allowed for a small amount of water containing ozonites to be drawn into the air line allowing for dispersal into the main body of water via the jets. This was in addition to ozonites already present in the main water line.

Tub No. 2 had a 378.5 L (100 gal.) capacity and six adjustable jets. Ozonites were simply drawn into the water line by the suction side of the pump.

Left: Advanced Oxidation Processes (AOP) used in treating water with ozone are said to be highly effective in eliminating bacteria in pools, spas and hot tubs.



Readers should be reminded that there are no Pest Control Products (PCP) approvals for ozone or ozone-producing devices registered with Health Canada, Pest Management Regulatory Agency (PMRA). It is illegal in Canada to make sanitizing claims about any product or device that is not PCP registered. Health Canada, PMRA therefore requires a PCP registration for any products and/or devices which make fungicidal, sanitizing or disinfecting claims. Currently in Canada, ozone (any form) may be used as a supplemental oxidizer only in swimming pool and spa waters and must be used in conjunction with an approved and registered sanitizer (ie: chlorine/bromine), per Health Code. Pool & Spa Marketing does not promote the use of any "unregistered" product, as a sanitizer.

Comments On Test Results

This test demonstrates the effectiveness of Advanced Oxidation Processes in terms of quickly eliminating a large amount of E. coli in a spa filled to capacity.

These results are a strong indicator of how Advanced Oxidation Processes are an extremely useful tool in the proper maintenance of heavily used recreational water.

Rapid elimination of bacteria serves to knock out its ability to form the microcolonies. Given the certainty of bacterial introduction into all types of recreational water, it is imperative that rapid elimination of bacteria takes place. **PSM**

** The test was conducted by Prozone and The University of Alabama in Huntsville. Copyright, 2006 Prozone Water Products, Inc. Trademarks and Registered Trademarks are property of Prozone Water Products, Inc.*

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Tub No.3 was a blower tub with a 378.5 L (100 gal.) 100 gallon capacity. Ozonites were injected into the water line just past the blower.

Each tub was filled to capacity and 40 ml portions of E. coli concentrated at 1.9 million cells/200 ml were added. This amounted to 370,000 bacterial cells.

An additional trial was done on Tub No. 2 in which the bacteria was twice as concentrated. Upon dissemination of bacteria into the spa, the Advanced Oxidation Processor was turned on and water samples were taken over a 20-minute period.

These samples were processed using standard microbiological lab techniques.

Results Of AOP Testing

Tub No. 1 demonstrated the elimination of bacteria in less than nine minutes and a two log reduction of bacteria was seen in six and a half minutes.

Tub No. 2 demonstrated a complete elimination in less than six minutes with a two log reduction in five and a half minutes. This same log reduction rate was seen when the concentration of bacteria was doubled in this tub.

Tub No. 3 demonstrated a complete elimination of bacteria in less than nine minutes with a log reduction rate of three in eight minutes.

Bacteria Found In Recreational Water

1. E .coli
2. Legionella pnemophila
3. Pseudomonas aeruginosa
4. Mycobacterium
5. Streptococcus
6. Salmonella

Illnesses Associated With Recreational Water

1. Legionnaires' Disease
2. Pontiac Fever
3. 'Hot Tub Lung'
4. Folliculitis (Inflammation of Hair Follicles)
5. Otitis Media (Ear Infection)
6. Urinary Tract Infections

Terminology

1. Advance Oxidation Processes (AOP): Pathway by which molecular ozone chemically converts to powerful oxidizers and sanitizers.
2. Advance Oxidation Processors™: Devices that accomplish AOP.
3. Ozonites™: Oxidizers produced by Advanced Oxidation Processors
4. Organic Matter: Substances such as oil sweat and dead skin cells that serve as 'food' for bacteria. They are introduced into recreational and bathing water by the user(s).

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