

‘Alternative’ Systems

A review of what is available

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Dr. Lowry has published in trade journals and gives numerous lectures on pool and spa chemistry. He presently is a member of the national Spa and Pool Institute (NSPI) Chemical Treatment and Process Committee and has, for the past several years, given talks on spa chemistry at the annual NSPI fall convention.

While Dr. Lowry has written previous articles on different ‘alternative’ systems, this article summarizes a fuller aspect of the different systems which claim to be replacements or supplements to standard chlorine /bromine treatment of pool water.

An “alternative” system or device which treats and/or sanitizes pool water supplements or complements the use of the only two accepted pool/spa sanitizers in Canada, namely chlorine or bromine. To understand how these systems work, however, we must first define some of the terms used in this article.

Sterilization: 100% destruction of all bacteria on the object being sterilized This process has no use in recreational water. One cannot sterilize a pool or -spa. There is simply too much activity - bathers entering and leaving, air volume changes, large spaces, etc. One does not sterilize anything in a pool/spa environment.

Disinfection: 100% destruction of all disease-causing bacteria (pathogens) on the object being disinfected. As with sterilization, one cannot obtain complete destruction in the pool environment. Although improper, the terms "disinfection" and "disinfectant" have persisted and are commonly used.

Sanitation: The destruction of microorganisms to levels (usually by 99% or more) deemed safe by public health standards. This is the proper term to be used. with pool / spa water. One sanitizes pool / spa water with a 'sanitizer'.

Oxidation: Simply stated, oxidation is the combination of an element with oxygen. Burning coal (carbon) to produce carbon dioxide is oxidation. This usually means destruction of the substance being oxidized. Oxidation can occur without flames when chlorine oxidizes the organics from bathers in pool water. The substance is oxidized, destroyed or 'burned out'. Oxidizing does not necessarily mean sanitation. Nor does sanitation necessarily mean oxidation. For example, potassium monopersulfate, a non-chlorine oxidizer commonly used in the pool is an oxidizer but an ineffective sanitizer. Whereas polyhexamethylene biguanide (PHMB) which is sold as ‘Baquacil ‘ or ‘Soft Swim’ (not registered as yet in Canada) is a sanitizer but not an oxidizer.

Chlorine the Bad

The key reason for the demand for ‘alternative’ systems is the public’s perception of the “evils” of chlorine, namely, environmental damage. Rachel Carson’s book, “Silent Spring” depicted

the hidden environmental evils of DDT. It is chlorinated hydrocarbons like DDT, a trichlorinated hydrocarbon, which have caused all the bad publicity. This, plus the horrors of poisonous gas attacks using elemental chlorine, have given the public the feeling that chlorine is “evil” and must be eradicated from our society.

Chlorine the Good

In the battle for potable water, the discovery of chlorine has been a boon for mankind. Our high standard of living would be decimated without the security of sanitized water due to the presence of a chlorine residual, which does not create environmentally damaging chlorinated hydrocarbons but “hypochlorous acid” (free available chlorine, FAC). While able to chlorinate hydrocarbons, the worst by-products are small quantities of trihalomethanes (THM’s). Mainly composed of chloroform, these gaseous by-products are easily reduced by the UV rays of the sun and cause no environmental damage to the ozone layer. While considered a carcinogen, the quantities produced are minuscule and the World Health Organization reports no known cases of cancer from chlorinated drinking water.

Diseases such as typhus and cholera have been eradicated since the filtration and chlorination of potable water. And when you consider the numerous deaths experienced in overcrowded troop camps due to contamination of drinkable water as late as the American Civil War, the negatives of chlorine use pale in comparison to the benefits.

What Makes Chlorine Unique?

Chlorine (bromine is similar and for brevity will not be further mentioned) has a list of properties that make it an ideal sanitizer for pools/spas. Lets look at these properties.

Sanitizer: Free available chlorine (FAC) (hypochlorous acid) is a sanitizer. It enters through the bacterial cell wall and kills the organism by destroying the sulfur groups on the cell’s enzymes, causing the cell’s metabolism to stop, resulting in the cells death.

Fast Kill Times: Not only does FAC kill bacteria – it does it very quickly. The Association of Analytical chemists uses a kill time of 30 seconds at 0.6 PPM FAC to completely destroy a given concentration of bacteria as a standard for a swimming pool disinfectant.

Stable Residual: FAC is stable enough in solution to allow a residual to exist in every portion of pool water. Such FAC residuals “stand guard” against the presence of bacteria which will be quickly destroyed.

Oxidizing Agent: While not the most vaunted property of chlorine, its ability to oxidize is the key to its usefulness as a sanitizer. It has been estimated that over 90% of the FAC residual is used to oxidize organics introduced into the pool by bathers. If the purpose of FAC was only to kill bacteria, much lower levels of chlorine could be allowed. It is the oxidative properties of chlorine, which make it the workhorse of cleansing pool/spa water.

The Pool Placebo Effect?

Some ‘alternative’ systems are marginally effective, some none at all, and yet they continue to sell. One look at the ‘pool placebo effect’ explains why. Do you remember chlorophyll toothpaste – the rave in the 1950’s? What did it do? Nothing! Yet most toothpaste manufacturers added it to their product. Where is it now?

The publics desire for a chlorine substitute is motivated by the belief that its beneficial properties are quite marginal...like the copper band worn around your wrist to ward off the evils of rheumatism. A lack of monitoring, judging results on short-term application only, and

being part of the purchase decision, all help improve the image of certain products, which is not warranted. More information on this subject can be found in a previous article of this publication.¹

“Save 90% of your Chlorine Costs!”

Many ‘alternative’ systems attempt to justify their purchase by touting a savings of “90% chlorine”. Pool owners are even told to cut back on the pool chlorine level to prove this savings. Wrong! Cutting back on the level of pool chlorine to save money is like using a credit card to conserve cash...its works fine until the bill appears and the true cost becomes known. The same goes for reducing chlorine levels. The water may look fine for a while (how long depends on bather load) but when the filter cycle shortens and the water becomes turbid, a good chlorine shock will be required...some great savings!

The true test for chlorine savings is not by reducing FAC levels but by maintaining your standard levels to see if the alternative system being tested will maintain these levels with a 90% reduction of chlorine usage!

Alternative Sanitizers – Some Examples

Chlorine Generators: These devices contain electrical cells which generate chlorine from a bank of salt added to the pool water. After being depleted, the FAC reverts back to salt to be reused. **This device is really not an ‘alternative’ system, as FAC is produced and reacts the same as adding chlorine from a purchased bucket.**

Ionizers: These are usually copper and or silver electrodes which introduce soluble copper and silver ions to the pool when an electric current is passed through the unit. Copper is used for algae control and silver for bacteria control. While once touted as “chlorine-free” systems, they are now mainly sold as devices to be used with low levels of chlorine. These ‘heavy metal’ devices (so-named because of the high density of elemental metals) are sold in the pool industry as ‘alternative’ sanitizers.

They have several shortcomings, however. First, in Canada, silver is not allowed as a sanitizer and is not even allowed to be listed in any accompanying literature. Second, although copper is an extremely effective algaecide, it has the propensity to precipitate and discolour pool surfaces with a tenacious grey to black stain. Finally, these devices are not oxidizers, so 90% of the workload of chlorine is not fulfilled.

Magnets: Using magnets as water conditioners, mainly for pH and scale control, is dismissed as a scam by some industrial water treatment associations and in a previous article by the writer.² Aggressive marketing and threats of legal action often silence the opponents of magnetic devices. These devices are also sold as a way to increase gas mileage when attached to the gas tank and as a way to increase blood circulation when attached to the body by adhesive tape.... interesting.

Oxygen generators: These devices pass current between two electrodes resulting in the electrolysis of water creating two volumes of hydrogen at the cathode and one volume of oxygen at the anode. The word “nascent” oxygen is often used to give them a scientific flair. The sanitation properties of oxygen are flaunted. This weakly soluble oxygen has little – if any

¹ Lowry, R. Neil, “Devices Part 11”: 1991 Canadian Show Issue, Pool & Spa Marketing

² Lowry, R. Neil, “Magnets”, December 1995, Pool & Spa Marketing

– ability to kill bacteria or oxidize organics and the failure of such systems was once the topic on the TV show ‘Hard Copy’.

Ozone Generators: These create O_3 by passing air through either Corona Discharge (CD) or Ultraviolet (UV) Radiation. Ozone – an extremely powerful oxidizing agent – is so unstable that it must be generated at the point of entry into the pool. Due to its activity and low solubility, it does not leave a required residual in pool water and must be used with chlorine. It is not a stand-alone system. Allowing ozone to accumulate in enclosed areas can also compromise the health of the individual.

UV Devices: It is known that bacteria are killed when subjected to certain wave lengths of ultraviolet light. You may have seen surgical instruments sterilized under UV light. Having UV irradiate water passing through a transparent pipe in the return line may kill the bacteria in the pipe, but it has no effect on sanitizing the remaining water in the pool. UV leaves no residual and no ability to oxidize. Trojan Technologies of London, Ontario, which sells UV generators, dismisses the use of UV technology for use in pools.

Oxidative Catalysts: These devices use a cartridge attached to the return line which contains metallic copper and finely divided elemental silver. There are no electrical components. The copper and silver dissolve by erosion or corrosion. Finely divided silver is known to be an oxidative catalyst in the synthesis of certain hydrocarbons. These devices claim that they can control algae and can assist chlorine in killing bacteria. This device is incompatible with bromine sanitizers. It has no ability to oxidize. While little staining occurs with copper, it is often difficult to measure any copper residual in the water. Some critics of this device say it is a form of homeopathy, a branch of medicine, which dilutes the drug to a point where it cannot be detected and yet claims medicinal results. Claims for silver efficacy are not allowed in Canada.

Conclusion

A list of the above ‘alternative’ systems is compiled on the spreadsheet shown on page 18. Examine it carefully and learn the beneficial and negatives of each system. Hopefully, this will assist the reader in their choice of an ‘alternative’ sanitizer.

Summary of Alternative Sanitizers						
Name	Description	Sanitizer	Residual	Fast kill	Oxidizer	Algaecide
Chlorine Generators	Chlorine generation from salt	Yes	Yes	Yes	Yes	Yes
Ionizers	Copper/silver Ion generation	No	CU Only	No	No	Yes
Magnets	Permanent Magnets	No	No	No	No	No
NOGS	Nascent Oxygen Generators	No	No	No	No	No
Ozone Generators	Produce Ozone	Yes	No	Yes	Yes	Yes
UV Devices	Ultraviolet Disinfection	Yes	No	Yes	No	Unknown
Vision Unit	Oxidative Catalysts	No	CU Only	No	No	Dissolved CU