



Ozone In Spa Applications

The key element in a three step approach

by Deborah Kon

Owning a spa comes with a responsibility to keep the water clean and properly maintained and choosing ozone as part of a three-step system in spa water treatment is an important step toward achieving clean and safe water.

The only appropriate disinfectants for spa water are either chlorine or bromine, which are the only chemicals that have been approved as stand-alone disinfectants. These chemicals have the ability to kill viruses and bacteria very quickly and also provide residual protection, making sure that viruses and bacteria are being killed at all times.

If chlorine is used in a spa without any other water sanitation system, it has been estimated that 85 per cent of chlorine is used up for oxidation, 2.5 per cent of chlorine is used for disinfection, 2.5 per cent is used for a residual, and 10 per cent of the chlorine is destroyed by the hot water temperature.

If bromine is used in a spa without any other water sanitation system, approximately 80 per cent of bromine is used up for oxidation, 7.5 per cent is used up for disinfection, 2.5 per cent is used for a residual, and 10 per cent of bromine is destroyed by the hot water temperature.

Spa Water Oxidation – Why Use Ozone?

The high temperature of hot tub water causes it to evaporate, allowing bather waste and other organics that were dissolved in the water to remain in the spa and accumulate. High water temperature also causes more bather waste to be released into the water as bathers sweat. This waste builds up quickly in the spa's small volume of water. A good oxidizer is needed to break down the heavy organic load in the water. Leaving these compounds in the spa water will encourage the growth of potentially harmful bacteria.

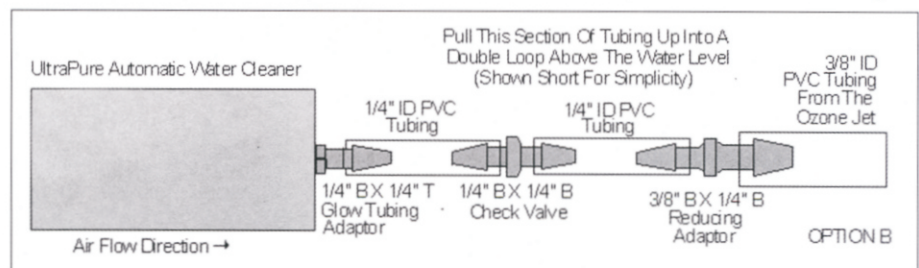
While useful as a disinfectant and a residual, using chlorine as an oxidizer is not the best option. Chlorine is an extremely good disinfectant and can function as an acceptable residual in the water, however, it does not perform as well when used as an oxidizer. At spa concentrations, chlorine has the tendency to combine with organic compounds. Chlorine will combine with non-living bather waste such as body oils, cosmetics, antiperspirants and lotions, leading to the formation of new chlorinated organic compounds that cannot be broken down. These chlorinated organic compounds form scum lines, clog filters, and result in the formation of soft scale.

Chlorine will also combine with urine and other nitrogen-containing compounds from sweat. When chlorine combines with these compounds, new compounds called chloramines are formed. Chloramines are not effective disinfectants, causing skin and eye irritations as well as a strong and pungent "chlorine" odour around a spa. Many people mistakenly assume that if this strong odour is present, the spa is safe to enter. In reality, they are smelling chloramines which are not disinfecting the water. The presence of chloramines also indicates that chlorine has been depleted and there may not be a sufficient chlorine residual remaining in the water. As the chloramines and chlorinated organic compounds are formed, more and more chlorine is needed to establish a sufficient free chlorine residual in the water. This is known as superchlorination. If 85 per cent of chlorine is used for oxidation only, this would produce a large amount of chlorinated organic compounds and chloramines in the water. Using chlorine to oxidize non-living bather waste is obviously not the most efficient use of chlorine.

Bromine will also combine with organic and nitrogen-containing compounds. The difference between chlorine and bromine is that combined bromine or bromamines are good disinfectants and cause little irritation and smell. However, using bromine to oxidize non-living bather waste is not the most efficient use of bromine since 80 per cent of it is used up for oxidation alone. In addition, bromine is very slow at breaking down non-living bather waste, therefore, it cannot be used as an oxidizer.

A more efficient water treatment for a spa is to use chlorine or bromine for disinfection and residual, and a separate and more effective oxidizer such as ozone to break down non-living bather waste. This is the basis of a three step approach to treating spa water.

Ozone is the strongest oxidizer commercially available for spa water treatment. Because ozone is a more powerful oxidizer than chlorine and bromine, it reacts with non-living



Ozone must be produced on-site using an ozone generator – such as an ultraviolet (UV) type. In ultraviolet ozone generators, ozone is produced by passing ambient air over an ultraviolet lamp, which does not require any feed gas air preparation systems.

bather waste more quickly. Ozone, however, does not combine with these compounds, as it is strong enough to cause the compounds to break apart instead. The oxidized compounds (“broken parts”) are more water soluble, and some can also gas-off into the surrounding air, preventing the formation of chlorinated organic compounds. Ozone also reacts with nitrogen containing compounds from sweat and urine. As these compounds are broken apart, they cannot form unpleasant and irritating chloramines in the water. This in turn reduces eye and skin irritations experienced by bathers. The use of ozone also helps to prevent the formation of scum lines, clogging of filters, and the formation of soft scale, all caused by chlorinated organics. Similarly, if ozone and bromine are used together in a spa, the formation of brominated organic compounds that can also form scum lines, clog filters, and form soft-scale, are greatly reduced.

When used in conjunction with ozone in spa water, chlorine or bromine function as the primary disinfectants and provide the safety residual. Ozone acts as the primary oxidizer, where it is very effective in removing or altering non-living bather waste. Since ozone is very reactive, it must be produced on site using an ozone generator. This means that ozone is continually being introduced into the water. This allows for continual oxidation and prevents the build-up of non-living bather waste in the water. The continual breakdown of non-living bather waste reduces the amount of available nutrients that bacteria require to grow. The reduced formation of chlorinated and brominated organic compounds lower the cost of running the spa and minimize water maintenance since specialty chemicals such as shock treatments, scumline cleaners, filter degreasers, clarifiers, etc, are rarely needed. The use of ozone increases the efficiency of chlorine and bromine

as their workload is reduced and they are allowed to tackle viruses and bacteria, rather than acting as oxidizers in the water. Since chlorine and bromine are no longer needed for oxidation, the quantities of chlorine and bromine required for proper disinfection and residual can be significantly reduced.

Common Ways Of Making Ozone

Ozone must be produced on site using an ozone generator. There are two types of ozone generators, ultraviolet (UV), and corona discharge (CD) types. In ultraviolet ozone generators, ozone is produced by passing ambient air over an ultraviolet lamp. This method does not require any feed gas air preparation systems. Well suited for use in spas, UV systems produce sufficient ozone to function as an effective oxidizer in a spa and are economical to use.

With corona discharge (CD) ozone generation, ozone is produced with a high voltage electrical discharge. CD ozone generators are better suited for water treatment applications that are much larger than spas.

The use of chlorine or bromine with ozone ensures that all three water sanitation requirements (disinfection, oxidation and residual) are met and the challenges associated with hot water temperature and low water volume are also easily dealt with. Ozone is the best oxidizer commercially available for spa water. With proper water maintenance, including the use of ozone, spa owners can truly enjoy relaxing in a safe and healthy environment. **PSM**

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