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CAROAT®

The Superchlorination Alternative

CAROAT® – The Super-chlorination Alternative

What is Superchlorination

In order to disinfect pool or spa water, a sanitizer is required to kill pathogenic bacteria and viruses within seconds of application. Although alternative methods are gaining in popularity and acceptance, there are several reasons why chlorine is by far the number 1 sanitizer used in pools and spas:

- it's time-tested
- it's quick and efficient
- it disinfects pool and spa water by killing nearly every microorganism that can cause a disease

As contaminants build up in the pool water, they combine with chlorine based sanitizers in the water to form undesired and noxious "combined chlorine" types of compounds. Two of these unwanted types of compounds are halogen amines and trihalomethanes (THM).

Chloramines and Trihalomethanes– Hazardous Side Effect of Chlorine Treatment

Chloramines

These chemicals have the typical chlorine odor of pools and cause irritation of eyes and skin. In addition, they have a tendency to turn crystal clear pool water cloudy and hazy. Chloramines are formed by the reaction of chlorine and amines according to the following formulas (considering ammonia as an example for the amine species):

$HClO + NH_3 \rightarrow H_2O + NH_2Cl$ Monochloramine

$HClO + NH_2Cl \rightarrow H_2O + NHCl_2$ Dichloramine

The chemical oxidization potential of chloramines is lower than the original hypochlorite and therefore its effectiveness as a sanitizer is minimized. When contaminant levels continue to increase in the water, the halogen sanitizer is significantly reduced in efficiency. This can lead to poor water quality and other issues associated with algae.

Trihalomethanes (THMs)

These are compounds such as chloroform (CHCl3) and related species. They are formed, for example, by the reaction of chlorine and the acetyl group which are present in the pool waters' contaminants. THMs are volatile chemicals, which are proven to be present in the breathing zone of the swimmer and are easily inhaled. Chloroform is classified as a suspected human carcinogen and may cause birth defects. The allowed limit of chloroform in drinking water is extremely low in almost every country around the world.

Shock Treatment of Chlorine Sanitized Pools

Superchlorination or "shocking" is an industry standard used to eliminate the collective byproducts which are formed by the sanitizer. In this process, the chlorine concentration is raised to about ten times the normal level in order to reach what is known as the "breakpoint". At this point, the chloramines are broken down according to the following equation:

$3\,HClO + 2\,NH_3 \rightarrow N_2 + 3\,HCl + 3\,H_2O$

Superchlorination Has Several Significant Disadvantages

Formation of Chloramines and THMs

Chlorine will combine with the organic contaminants, which are continuously introduced into the water, to form chloramines and THMs also after the breakpoint has been reached. Realistically, the pool water can never be completely free of chloramines and THMs.

Difficulties to Reach the Breakpoint

The proper amount of chlorine needed to reach the breakpoint is not easy to find. The effective chloramine level in the pool increases by the addition of chlorine. If the breakpoint is not reached only the concentrations of the undesirable substances are increased.

Significant Downtimes and Dechlorination

High chlorine levels in the pool can cause significant downtime before the water returns to normal levels and is safe to reenter. In worst case, it may even be required to dechlorinate the water.

Bleaching of Pool & Spa Surfaces

High chlorine levels in the pool can damage and fade pool surfaces and vinyl liners.

PHYSICAL PROPERTIES OF CAROAT®			
Parameter	**Unit**		**Comment [1]**
Active Oxygen Content	%	> 4.5 / 4.7	S/T
Moisture	%	< 0.3	S
Bulk Density	g/cm³	1.10	T
Particle Size Distribution		> 0.8 mm: 0-2% > 0.1 mm < 0.8 mm: 90-100% < 0.1 mm: 0-10%	T
Solubility in water (20 °C)	g/l	260	approx.

[1] S = technically specified; T = typical value

Why use CAROAT®

CAROAT® is the solution of choice to solve the problems which are caused by super-chlorination. CAROAT® is a potassium monopersulfate triple salt with the composition $2\,KHSO_5 \cdot KHSO_4 \cdot K_2SO_4$.
CAROAT® is the only stable and safe carrier of the desired active compound $KHSO_5$, which is characterized by the following:

- odorless
- fast dissolving
- a powerful oxidizer (high oxidation potential)
- oxygen-based, doesn't contain chlorine
- unaffected by UV degradation
- compatible with sanitizers based on chlorine, bromine and other non-halogen based alternatives

CAROAT® is a non-chlorine oxidizer used for shock treatment applications. It has all the positive functionality of a chlorine oxidizer while avoiding the negative side effects.

Advantages of Using CAROAT®

No Chloramines or Chlorine Odors

CAROAT® is oxygen-based. It contains no chlorine and therefore does not result in chloramine formation or chlorine odor. Actually the opposite! CAROAT® accelerates the degradation of chloramine produced by the chlorine sanitizer.

No Unhealthy THMs

The high oxidation potential of CAROAT® is based on oxygen, not on chlorine. Therefore, hazardous THMs such as chloroform, can't be formed by CAROAT®.

Increases Efficiency of the Sanitizer

CAROAT® helps the already present chlorine to remain in its free state so that it can do its job of killing bacteria and viruses. There is no need to increase the chlorine level!

Sparkling Clear Water

CAROAT® significantly improves water clarity by producing sparkling clean and crystal clear water. CAROAT® is aggressive in eliminating swimmer waste and other contaminants. In addition, it won't damage the vinyl liners of your pool and does not bleach the surfaces – no more fading!

Same Day Shock and Swim

Pool use can be resumed after a short waiting period. No significant downtime, which can be especially troublesome in commercial pools!

Can Be Used Day and Night

CAROAT® is unaffected by UV degradation and therefore can be used day or night.

Harmless, non-toxic

CAROAT® is approved and widely used to treat drinking water around the world.

CAROAT® as a "Preventative Shock Agent"

CAROAT® used on a regular basis can be your "preventative shock agent".
CAROAT® will give:

- better water quality
- longer periods of uninterrupted swim time
- a more manageable maintenance schedule

Using CAROAT® as Part of a Sanitizer as a Comprehensive System

CAROAT® does not replace sanitizers since the sanitizer is designed to kill a broad spectrum of bacteria and viruses. However, CAROAT® works well with all commonly used sanitizers, such as chlorine, bromine and other non-halogenated alternatives.

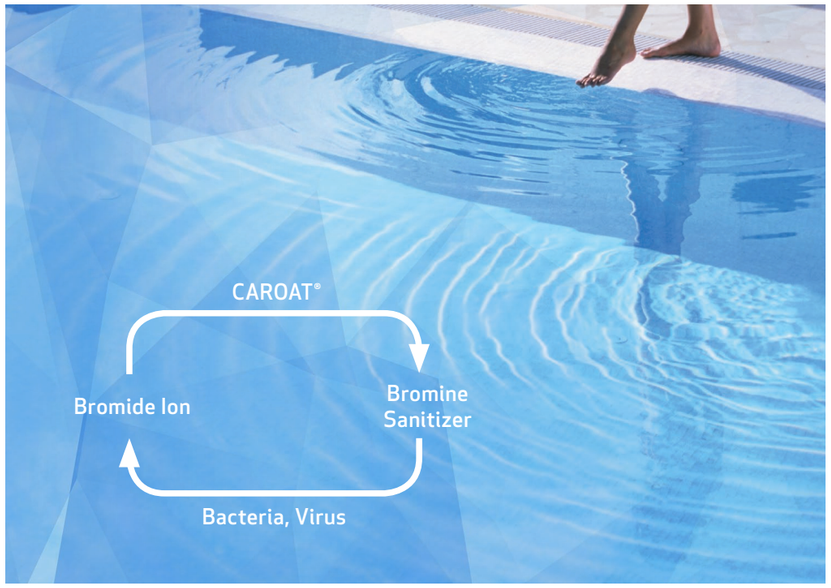
CAROAT® with Chlorine Sanitizers

Combines the proven sanitizing capabilities of chlorine with the superior oxidizing power of CAROAT®. This eliminates the drawbacks associated with chlorine shocking.
The advantages are:

- effective with ALL forms of chlorine
- safe and easy to use
- easier to transport than liquid chlorine bleach (1 pound per 1 gallon / 1 kilo per 8.3 liters)
- produces sparkling clear water

CAROAT® with Bromine Sanitizers

This is an excellent non-chlorine system. CAROAT® not only acts as an oxidator of all contaminants. It's also a regenerator of the active bromine sanitizer from the inert bromide ion according to the formula below.
When compared to chlorine system, less bromide sanitizer is consumed overall.



CAROAT® is effective with ALL forms of bromine
CAROAT® is safe and easy to use.

How to use CAROAT®

Dose and Frequency

Recommendations for pool treatment:

- 1.5 pounds per 10,000 gallons / 18 grams per 1,000 liters
- use weekly for preventative pool care
- use as shock treatment after heavy use, rain and wind storms
- more frequent and higher doses may be useful in commercial pool applications

Recommendations for spa treatment:

- 1-2 ounces per 250 gallons / 15 – 30 grams per 500 liters
- oxidize with non-chlorine shock after each use

Due to its acidic nature, regular use will also lower the pH and the total alkalinity of the water. Soda ash and/or Sodium Bicarbonate should be added to maintain acceptable pH levels.

Water Testing

- No interference will be detected when using OTO test kits
- Minimal interference with free chlorine readings on DPD#1 tests
- DPD#3 reacts with the potassium in the total chlorine test which gives a false high combined chlorine reading, but there are test kits available to eliminate monopersulfate interference.
- There is no interference with free chlorine readings. When using test strips, the service professional should be aware that potassium can react with total chlorine and bromine tests.

Transition Plan – to Stop Superchlorination and Switch to Using CAROAT®

1. Stop chlorine shocking. Check water balance and sanitizer level.
2. Add CAROAT® for 5-8 weeks according to the following plan.
   Dose:
   Initial dose 1.5 – 2.0 pounds per 10,000 gallons / 18 grams per 1,000 liters
   Regular dose 1.5 pounds per 10,000 gallons / 18 grams per 1,000 liters

FREQUENCY	
Pool Use	**Frequency**
low (more than 1,500 gallons / 5,700 liters per bather)	1x per week
medium (500 – 1,500 gallons / 1,900 – 5,700 liters per bather)	2x per week
heavy (less than 500 gallons / 1,900 liters per bather)	3x per week

3. Monitor cloudiness, free available chlorine (FAC) residuals, combined available chlorine (CAC) residuals, combined chlorine odor, chlorine use and pH
4. Assess performance

- has chlorine consumption decreased?
- are chlorine residuals easier to treat?
- has water clarity improved?
- have objectionable odors (caused by combined chlorine compounds) been reduced?
- does the water look and feel better?
- are bathers more comfortable (fewer complaints about burning eyes, odors, irritations)?
- have overall treatment and maintenance costs been affected?

CAROAT® – even when used on a regular basis as part of a comprehensive water treatment program – is not a cure for all water problems.
Naturally there are other considerations:

- Circulation – pumps and filters should be properly sized for adequate flow and pumping rates
- Water balance – pH, alkalinity or calcium hardness levels
- Condition of the filter elements and media needs to be maintained properly to assure maximum effectiveness
- Regular vacuuming to prevent the buildup of particles that make the water cloudy

However, routine shocking with CAROAT® will yield a sufficient concentration of free sanitizer in the pool water. This minimizes issues that might occur from different chlorine or bromine compounds.

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