Is chlorine in deep water?

The lido renaissance has put the spotlight on pool disinfectants. *John Boler* reports on chlorine's fight to stay on top

The long, hot summer has persuaded many more city dwellers than usual to seek relief from global warming by taking a dip in their local pools and spas. But behind the scenes, a war is being waged against the chlorine disinfectants traditionally used to keep these pools free of bacterial and viral contamination.

Chlorine faces two enemies. The first combatants are armed with chemical alternatives to chlorine. The second are fighting for natural pools that do not require chemicals at all; they depend on water movement and plants to keep the water clean. But it remains to be seen whether either can win the battle to take chlorine's crown.

Chlorine was first used to disinfect water in the late 19th century to control the spread of water-borne diseases, such as typhoid, cholera, dysentery and gastroenteritis. Chlorine has a residual effect, a major advantage over other disinfectants, such as ozone, ultraviolet light and ultrafiltration, which have only a temporary effect. In addition to purifying water, chlorine helps remove tastes and odours, controls the growth of slime and algae, and helps to remove unwanted nitrogen compounds.

Global warming and the fight against obesity has encouraged a dramatic increase in the use of outdoor pools or lidos. And lifestyle factors, such as increased leisure time and a desire to keep up with the Joneses, has seen many more people installing a domestic hot tub or swimming pool. All of this has increased the attention on pool air and water quality.

Recreational water is, therefore, a growing market for speciality chemical manufacturers and formulators in Europe. The UK market alone is worth £120–150m/year ($228–284m/year)[1]. Topaz Consulting, in its recent report[2] for the Spa Business Association, found that spas in the UK experienced year-on-year growth of 26, 28 and 30% between 2003 and 2005.

The trend for demonising chemicals, however, means that disinfectants such as chlorine, have come under attack. Environmental groups have taken to 'chlorine bashing', and governments have responded by clamping down on the owners of public spas, hot tubs and whirlpools.

Last month, the Canadian government issued more stringent guidelines on the upkeep of pools. And in the US, the health department in California instructed swimming pool owners to reduce levels of disinfection by-products 'because there *might* be a risk' to pregnant women and their unborn children.

Chlorine: health risk low

In many cases, there is no evidence to support claims that chlorine, used properly, is hazardous to health. One of the most common accusations is that chlorine in swimming pools is a factor in the increase in the incidence of asthma.

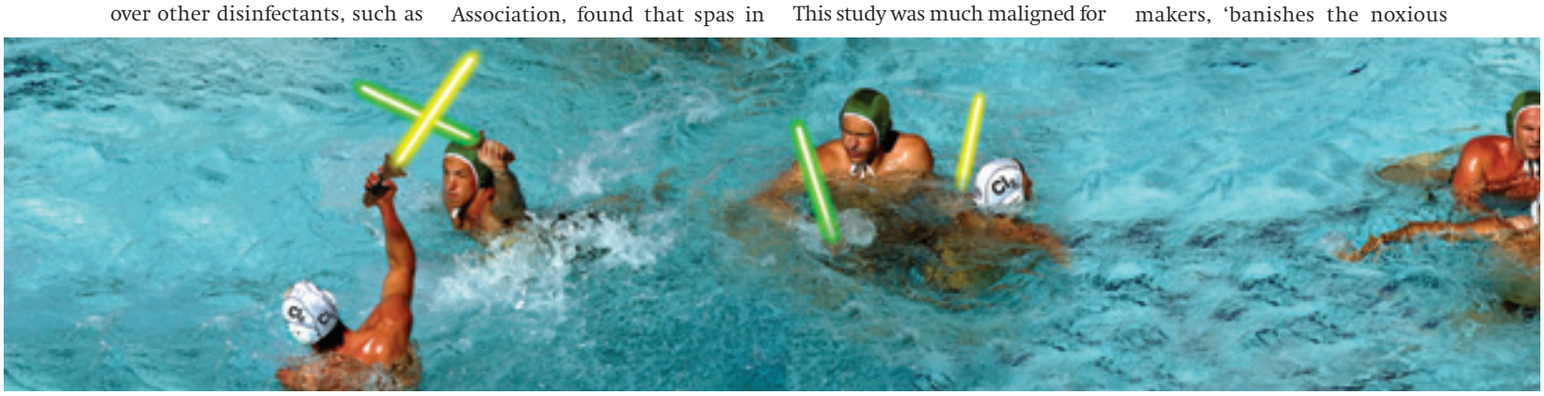
A 2003 Belgian study suggested a link between asthma and the by-products of chlorination in indoor pools, such as chloramines. This study was much maligned for faults in its methodology. And a later study conducted on behalf of the Dutch government concluded that air quality rather than water quality provides the link with asthma and wheezing symptoms. The solution, they say, is improved ventilation. In addition, the dosing system should ensure a minimum amount of free chlorine in the water, and change with the number of bathers.

There are, however, genuine concerns about eye irritation caused by chlorine. But, as the World Health Organisation (WHO) points out, there is also a risk of contracting eye infections, such as conjunctivitis, from exposure to adenovirus in unchlorinated swimming pools or water, for which chlorination is inadequate. In spite of what many swimmers assume, the major cause of irritation is too little free chlorine, rather than too much[3], and incorrect water pH (see table, p13).

What instead?

So chlorine isn't perfect; but are the alternatives any better?

One alternative being aggressively marketed is *PristineBlue* (PB), a copper sulphate (or blue vitriol) product, which, according to its makers, 'banishes the noxious



odours, aggravated eyes and skin, damage to hair, costumes, and even pool liners and equipment associated with traditional water treatment'. But what is not clear is whether PB can be relied upon as a stand-alone sanitiser and whether it controls viruses.

PB is approved as an algaecide in the US, and is used in more than 600 000 private US pools. It is marketed in Europe by Pristine Pools Limited (PPL) and was launched in the UK and France earlier this year.

One reason for the uncertainty over its value as a stand-alone sanitiser is the apparent inconsistencies between information issued by PPL to pool users in Europe and that given by Earth Science Laboratories (ESL), when marketing it as Earthtec to US drinking water suppliers. PPL promotes PB as a 'chlorine-free alternative'. But ESL says that Earthtec, which shares PB's EPA registration number — 64962 — 'enhances the efficiency of chlorine'.

Misleading metals

The Pool Water Treatment Advisory Group (PWTAG), a UK based organisation dedicated to raising standards in swimming pool water treatment, says that wrongly promoting copper/silver alone is common. And that this poses 'a real infection risk to bathers'. PWTAG chairman Howard Gosling says that product claims are 'often based on misleading data, such as the use of copper/silver to keep drinking water "healthy" in water systems, neglecting to mention that people are not swimming in that type of system, and that they introduce bather pollution.' He also says that there is 'no good evidence' that used together, copper and silver give more than marginal benefit.

Pools needed to be 'dosed with a chlorine residual disinfectant as well', he says.

Doubts about the suitability of PB as a bactericide were further reinforced when in June, the New York State pesticide database[4] said PB/Earthtec could be used in hot tubs, spas, swimming pools and potable water but only as an algaecide.

The Canadian government has also concluded[5] that copper sulphate does not 'control microorganisms such as bacteria and viruses or eliminate the need for sanitisers such as chlorine or bromine based pool products'.

The other alternative to chlorine is to use a natural pool. They avoid all non-biological controls of debris algae, bacteria, viruses and other contaminants. Since their development in 1983 they have been successfully marketed in Italy, Belgium, the Netherlands and France and thousands have been built.

Now their Austrian inventors are testing the water in the UK, where the first pool was completed in 2001. Brochures promise 'fresh, clean and clear water . . . blending seamlessly with your environment'. With what may seem reckless pride, agents offer 'guaranteed perfect water conditions 365 days of the year'. The sale includes 'a complete range of swimming pool supplies' — excluding chemicals, of course.

However, the efficiency of these natural pools depends largely on how well they are designed. The website Clear Water Revival[6] says that a well designed pool can maintain itself through most of the year. It should be treated like a pond in all but the most formal designs, with most work to be done preparing for winter. The water needs to circulate continuously for the plants' roots to cleanse the pool[7]. But aquatic plants do not remove all contaminants from the water, and pools constructed of dirt, concrete or rubber liners don't necessarily keep bacteria at bay. But it is agreed that the probability of contracting a serious disease from a natural swimming pool is low.

The effect of the pH of chlorinated pools on skin/eyes

pH	Effect
> 8.0	Eye irritation Skin irritation
7.8 7.6 7.2	Most ideal for eye comfort and disinfection
< 7.0	Eye irritation Skin irritation Corrodes pipes

Source: Centers for Disease Control and Prevention, Atlanta, Georgia

'The probability of contracting a serious disease from a natural pool is low'

Chlorine resistance

There are a few organisms that are resistant to chlorine. *Cryptosporidium*, which is found in human faeces, is one of them. In the US last year, *cryptosporidium* is reported to have affected at least 1800 people and caused the closure of an entire amusement park. And *cryptosporidium* is likely to be present in public pools, given that small children do what they do. *Giardia* cysts, associated with severe gastroenteritis, are also resistant to chlorine.

In both cases, ozone is the best disinfectant. But ozone is not a residual disinfectant, and it is not adequate on its own. Ultraviolet (UV) light is also effective against *cryptosporidium* and *giardia*, but like ozone, UV has no residual effect and, according to the WHO, has to be combined with chlorine. This highlights the importance of differentiating between water treatment, immediate measures to prepare water, such as oxidation by 'shock' treatment with chlorine or ozone, and disinfection, a steady process requiring a residual biocide.

So while the jury is still out on the swimming pond approach, all the other approaches to keeping bathing water clean seem to require chlorine as an integral component of the system or for back-up or preparatory treatment.

Perhaps the promoters of these alternatives would gain more credibility by admitting this up front. Maybe it is time to abandon sophistry, be open about the limitations, as well as the benefits of these products and avoid the temptation to score points off chlorine, a chemical we will all depend on as long as water-borne disease is a threat to health.

References

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