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UV DISINFECTION · MONITORING · CONTROL

UV Treatment of Pool Water – Fact or Fiction?

By Graham Smith

UV- PURE & SIMPLE

The Role of UV Treatment

Ultraviolet (UV) radiation is being used increasingly to both **destroy harmful combined chlorine** (otherwise known as chloramines) and **act as an additional disinfectant barrier** to complement the role played by free chlorine in swimming pools.

Importantly, both UV and free chlorine have a role to play in the disinfection of pool water. While chlorine is very effective in destroying common water borne bacteria such as E. coli and various strains of faecal coliform, it is relatively ineffective against protozoan parasites such as Cryptosporidium and Giardia, which can readily contaminate a swimming pool via infected swimmers. These parasites are particularly pathogenic with those infected suffering symptoms including severe abdominal pain and diarrhea. In uncommon but extreme cases involving either the very young or very old, deaths have been reported from Cryptosporidiosis.

Having said this, **UV should only ever be seen as a secondary pool water disinfectant, with chlorine used as the primary disinfectant**. This is because chlorine has a very important property which UV lacks – the ability to provide a residual level of disinfectant in the pool water. This means, chlorine can remain in the pool water actively combating pathogens at the very moment they are introduced. UV on the other hand, can only disinfect the water as it passes through the UV chamber. Once the water has left the chamber, it is available to be re-infected by swimmers when the water returns to the pool. It is for this reason that most public and municipal swimming pools use UV systems more as a means to destroy harmful chloramines than as a disinfectant.

Destroying Harmful Chloramines

UV light has a very important property – it is very effective at breaking down many of the harmful compounds in pool water that are formed when the residual free chlorine in the pool reacts with the “impurities” of various sorts introduced into the pool water by swimmers. The most common of these harmful compounds are called chloramines.

Chloramines are formed by the reaction of the free chlorine with amine-based substances, most commonly urine. As could be expected, the higher the bather load, the more chloramines are formed and so it is the swim schools, public and municipal pools, hydrotherapy pools and hotel and resort pools that are most susceptible to the formation of chloramines. Furthermore, it is predominantly indoor pools which suffer the most for two reasons. Firstly, indoor pools lack the ventilation available to outdoor pools – no matter how effective the ventilation system in an indoor pool, it is never going to rival the ventilation capacity of an outdoor pool! Secondly, outdoor pools have a source of UV light available to them, free of charge for many hours most days of the week during summer – it’s called the sun!

FLUIDQUIP AUSTRALIA PTY LTD
12 Carl Court, Hallam, Vic, 3803, Australia
ph: 038795 7711 | fx: 038795 7722
fluidquip@fluidquip.com.au | www.fluidquip.com.au

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The Basics of UV

Having raised the issue of UV light and the sun, perhaps now is a good time to cover some of the basics about UV light and why it is so effective as both a disinfectant and a destroyer of chloramines.

UV light is a component of sunlight. It falls in the region between visible light and X-Rays in the electromagnetic spectrum between 100 nm and 400nm in wavelength (Figure 1). UV light in itself can be categorized even further into four separate regions

- Far UV (or "vacuum") 100nm – 200nm,
- UVC 200nm – 280nm,
- UVB 280nm – 315nm
- UVA 315nm – 400nm.

UVB and to an even greater extent, UVC are the most important UV regions for disinfection and dechloramination. These regions are however, significantly filtered out by the Earth's atmosphere so outdoor pools need to be exposed to the sun's rays for many hours a day to realise the same benefits achieved by only a few seconds exposure to UV light in a UV chamber.

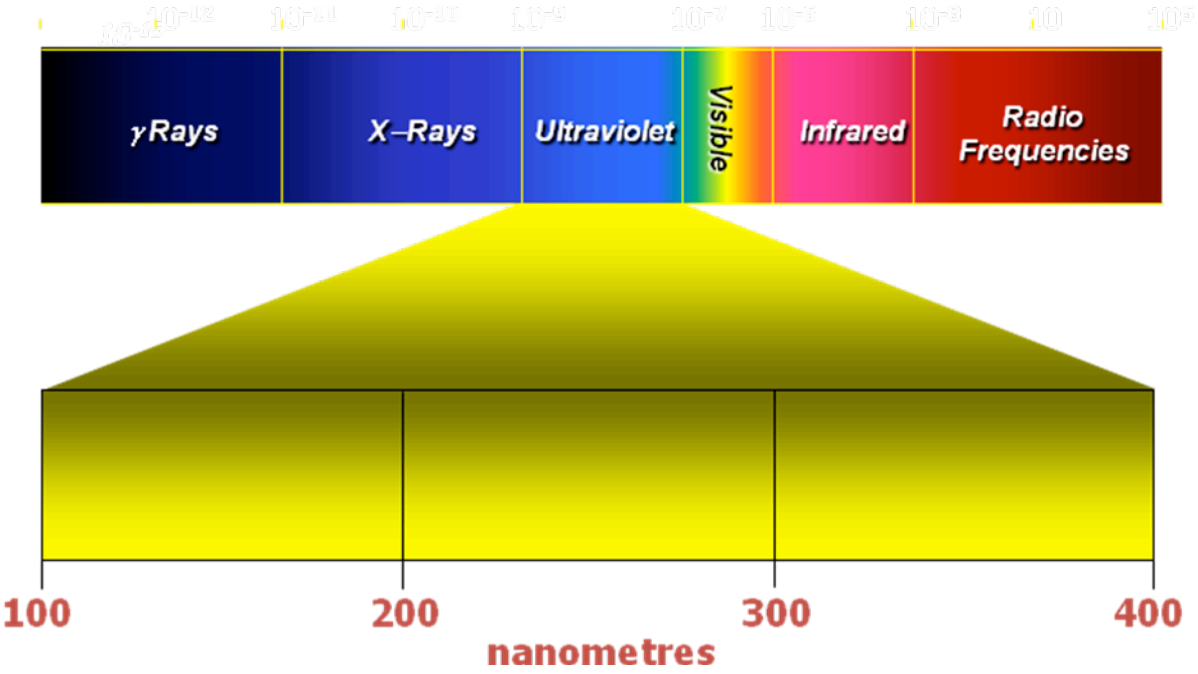

Figure 1 – Electromagnetic Spectrum (courtesy of Hanovia Limited)

Selecting a UV System

Speaking of UV chambers, the most effective are those which utilise so called "medium pressure" UV lamps. This is because these lamps selectively produce a broad spectrum of light in the most effective UVB and UVC regions of the spectrum. So called "low pressure" lamps produce only a single wavelength at 254nm which is relatively ineffective in destroying chloramines. Figure 2 shows an example of a UV systems and its most important components.

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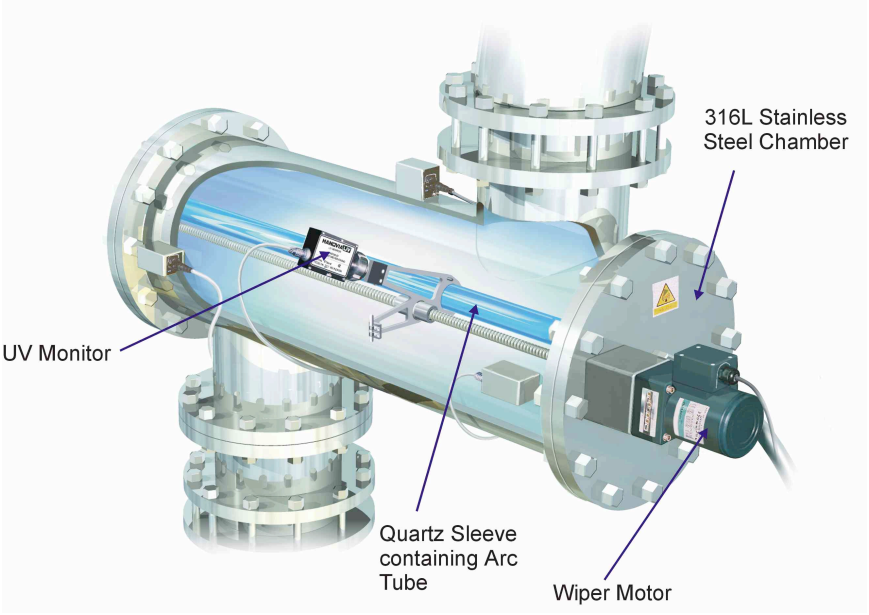

Figure 2 – Typical medium pressure UV chamber (courtesy of Hanovia Limited)

Forget Superchlorination and Increase Your Pool Availability

Those pools with combined chlorine levels stubbornly above two or even three milligrams per litre (otherwise known as "parts per million" or "ppm") can reduce this to a level well below one ppm in a matter of hours after a UV system is switched on. This then means the pool no longer has to rely on "Superchlorination" in order to bring down chloramines levels.

No longer having to Superchlorinate means chlorine usage is reduced and the pool is more available to swimmers. Some swim school owners have reported increases in patronage of up to 30% once "word gets around" that the pool water and the air inside the pool hall if virtually free of that "horrible chlorine smell" (of course it is the chloramines rather than the chlorine causing the smell!!) *and* the pool is more available for patronage because Superchlorination no longer interrupts opening times. Furthermore, pool owners find that their staff is much happier and healthier after being freed from the effects of inhaling chloramines.

It is also important to realise that chloramines are very corrosive. Removing chloramines from the pool atmosphere reduces corrosion of iron and steel structures within the pool, including ventilation ducts and roof supporting girders, thereby significantly reducing long term and ongoing maintenance costs.

Additionally, without Superchlorination dumping of water to lower TDS (Total Dissolved Solids) is less frequent, and for many pool operators this saving is another compelling reason for installing UV.

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A Cleaner, Safer Environment

UV is now a well-established method of water treatment for indoor pools. From hydrotherapy spas to the largest Olympic-sized competition pools, it is fast becoming the water treatment method of choice. With this acceptance comes a cleaner and safer environment for both indoor pool swimmers and those indoor pool staff who serve them.

Be Prepared for a Significant Investment

When considering UV treatment pools must be prepared for a significant investment - in the vicinity of $15,000 dollars for a top quality UV system alone. Often installation costs (depending on the layout of the plant room) may run to $10,000, so an investment of $25,000 or more can be expected. Secondly, annual electricity costs and yearly maintenance (including yearly UV lamp replacement) may run at approximately $5,000 per annum.

Key Points

1. Many indoor public and municipal swimming pools use UV treatment to destroy harmful chloramines.
2. UV treatment is a very effective secondary disinfectant.
3. No longer need to Superchlorinate, reducing chlorine usage and increasing pool availability.
4. Using UV to destroy chloramines leads to a cleaner, safer environment for bathers and staff.
5. Reduce corrosion of iron and steel structures brought about by the corrosive effect of chloramines.
6. Predominantly used in indoor pools with higher bather loads.
7. Medium pressure lamps are the most effective.
8. Budget for a significant financial investment.
9. UV treatment often results in increased pool patronage.

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The Author

Graham Smith (graham@fluidquip.com.au) is the National Sales Manager with Fluidquip Australia Pty Ltd

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