Hassle Free – Chemical Free – Cost Effective Chlorine Reduction in Water

When properly designed, ultraviolet (UV) light is an effective method for de-chlorinating water. There are abundant Technical Papers explaining the mechanisms and theory behind UV light chlorine and chloramines reduction. The only remaining question is: *"When is UV a practical method over conventional methods?"*

Conventional methods de-chlorinate water using granulated activated charcoal (GAC), sodium bisulfate, or sodium metabisulfite. These methods remove chlorine by either absorption or through chemical reactions, and both introduce drawbacks that must be managed. UV light de-chlorination method on the other hand has no drawbacks. It's a simple, single pass, no additive, no by-product producing process. And UV light has additional benefits, performing significant amounts of microbial disinfection and destruction of organic compounds. The conventional methods are unable to do likewise.

Removing Chlorine is Very Important

Chlorine is a capable disinfectant and plays an important role in ensuring the health and safety of water for consumption and for water recreation. However, there are many applications where chlorine is no longer necessary, and in reality the presence of chlorine is a great disadvantage.

Chlorine is corrosive, and damages a number of critical water filtering systems such as RO membranes and deionization resins. Chlorine greatly affects odor and taste of products manufactured for consumption, such as beverages. Chlorine can also affect the color of the product. The presence of chlorine in water for medical procedures (kidney dialysis) is unhealthy and potentially dangerous. These are just a few of the reasons why products and processes exist to remove chlorine from water.

Drawbacks of Traditional De-chlorination Methods

Historically, de-chlorination has been accomplished using granular activated carbon (GAC) or neutralizing chemicals such as sodium bisulfite/sodium metabisulfite. [1] Some of the problems with these traditional processes are:

- the need for frequent replacement/back-flushing when using GAC,
- potential for chlorine saturation, rendering the GAC ineffective,
- potential for creating high biological loads (with GAC), and microbial breakthrough,
- accelerated bio-film growth or scaling of the RO membrane,
- sodium sulfate production, creating an environment for sulfate reducing bacteria,
- documentation, handling, and storage requirements for sodium bisulfate/metabisulfite required by EPA and OSHA.

UV De-chlorination has No Drawbacks and Delivers Additional Benefits

Using UV for de-chlorination eliminates the problems of traditional methods. With UV de-chlorination there is no saturation point, no overdose consideration, and no production of harmful or problematic by-products. Also, UV does not affect odor, taste, or color or the pH of the water. In fact, the UV de-chlorination method enhances the end product quality and its process stability.

An important point for consideration is that the UV dose for de-chlorination is significantly higher than used for typical disinfection, anywhere from 10 to 20 times more. This higher dosage produces an extremely high level of microbial disinfection in the water. Additionally this dose will also reduce organic carbons such as Humic acid and pesticides and trace pharmaceuticals. None of these advantages exist using the traditional chlorine reduction methods.

What is the UV Dosage Bar?

The challenge which faces the designer of a UV de-chlorination system is determining the appropriate dose to achieve reduction of chlorine or chloramine. The rule-of-thumb is to provide 20 times the disinfection dose, or 600 mJ/cm^2 at the 254 nm UV light wavelength. This dosage will lower the chlorine concentration by a factor of 10.

However, in practice the UV dose required is affected by a number of parameters making it more difficult for the designer to optimize a solution. These other factors include:

- the UV transmittance (UVT) of the water (high concentrations of chlorine will actually lower the UVT)
- the presence or lack of other chemicals, particularly organics, in the water.

Recent studies have shown that the addition of a relatively small amount of organic chemicals in the water can increase the destruction of free chlorine in water by nearly a factor of 100 for a given UV dose [2].

A UV Water Treatment System that Meets the Challenge

When is UV a practical method for de-chlorination over traditional methods?

The answer is determined by a mix of analytical modeling, a bit of subjective analysis and technology bias. Today UV is not widely used as a primary de-chlorination process, but it is growing in acceptance. As the successes and benefits of UV become more widely known, there will be more adoption.

Ultraviolet Sciences Inc. (UVSI) is growing this adoption. UVSI products are the most compact, most energy efficient, highest performing UV water treatment systems for commercial and industrial applications. The patented, highly UV reflective design is key in generating the UV dose necessary for chlorine reduction. Competing systems are significantly larger and use much more energy to deliver an equivalent UV dose, making them less practical. UVSI innovative products lower this barrier, making UV chlorine reduction cost effective and practical.

UVSI has made UV light a superior alternative to traditional de-chlorination methods. For information on how UV light can help you with your de-chlorination process please contact UVSI at: info@uvsciences.com, or visit us on the web: www.uvsciences.com

[1] Shipe, Bradley, "The use of UV in dechlorination applications," Water Technology Online, vol. 25, no. 8, August 2002.

[2] Feng, Y., Smith, D. W., and Bolton, J. R., "Photolysis of aqueous free chlorine species (HOCl and OCl^-) with 254 nm ultraviolet light," J. Environ. Eng. Sci., vol. 6 (2007), pp. 277-284.