Chlorine Dioxide -
within Hospitals and Healthcare

Chlorine dioxide is being heralded as the "ideal anti-microbial agent" of the next decade, with a potential that is far reaching - *"the gentle giant of available biocides"*

Chlorine dioxide has been commonly used in large scale applications, such as the purification of municipal water supplies throughout many parts of the world. Improved mechanisms for the safe, simple and cost effective delivery of chlorine dioxide have enabled its use in a wide rage of application areas.

Public awareness of invasive pathogens such as Legionella, MRSA, SARS has reached an all time high because of recent high profile outbreaks. There is t an urgent need to modify treatment regimes and implement a biocidal treatment that is fast acting, non-toxic, non-irritating and meets with regulatory standards. Chlorine dioxide offers all of these with a range of pathogen destruction unsurpassed by traditional biocides and their inherent side effects.

Chlorine dioxide's chemistry is radically different from that of Chlorine. The addition of two oxygen atoms creates a totally different chemical with very different properties.

Catalytic [1] Chlorine dioxide has to be the most exciting development to emerge since it was first discovered by Sir Humphrey Davy back in 1811. It allows Chlorine dioxide to be delivered in precise and controlled quantities at "point of use", without the need for cumbersome and potentially hazardous generation techniques. Combine this with the production of an "ultra-pure" solution containing >98.5% effective Chlorine dioxide with zero residual chlorite and this is the product for the Healthcare sector.

Advanced digital dosing technology offers precise delivery, enabling continuous treatment of water - *"the very starting point for patient care"* - eradicating harmful biofilms and pathogen nutrient sources that build up within pipework and systems. Hospital pipework is not dissimilar to a maze, deadlegs may exist. There is serious threat within deadlegs due to the prevalence of biofilm and the "safe haven" for pathogens. These biofilms become extremely invasive, aided by the warm [2] environment and left unchecked will continue to multiply.

A flow related Chlorine dioxide dosing system means that the water is dosed as it's used, so there is continuous protection without the requirement for periodic shut-downs.

Biofilm Control in Water Systems

A Biofilm is a layer of micro-organisms contained in a matrix (slime layer) that forms on surfaces in contact with water. Incorporation of pathogens in biofilm can protect the pathogens from concentrations of biocides that would otherwise kill or inhibit those organisms freely suspended in water. Biofilm provides a safe haven for organisms where they can reproduce to levels where contamination of water passing through becomes inevitable.

It has been proven beyond doubt that Chlorine dioxide removes biofilm from water systems and prevents it from forming when dosed at a continuous low level. The proof of biofilm removal can always be seen when a Chlorine dioxide treatment programme is started. Initially, the TVC level rises dramatically, but after a period of time come down to levels not previously seen. This is caused by biofilm "burn out".

Once the system is clear of biofilm, the TVC's remain at a consistently low level providing low level dosing is maintained.

[1] = Catalytic Chlorine Dioxide generation technologies—patent pending

[2] = Studies show that organisms favour temperatures between 20 to 45ºC for growth, with optimum growth achieved at 35ºC. The Legionella group contains approximately 40 separate species and the species can be further sub-divided into serogroups. Legionella pneumophilia has at least 16 serogroups of which serogroup 1 is the most significant and is predominantly associated with UK outbreaks of Legionnaires' disease.

Legionella is an organism that has found particular ecological niche in engineered water systems.

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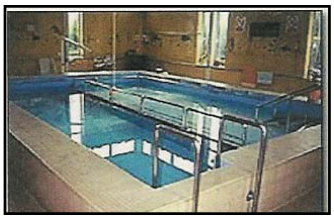
Hydrotherapy Pools

Chlorine dioxide can fulfil a diversity of applications, wherever there is a need for pathogen control Chlorine dioxide has a leading role.



Hydrotherapy pools are maintained at higher temperatures which provide the ideal conditions for bacteria to thrive and with almost 5% of the population having a disability, the hydrotherapy pool has become an essential part of rehabilitation and convalescence for such persons.

In the present day climate the daily loadings placed on pool water are exceptionally high. It is vital that the pool water hygiene conditions are maintained at the highest standard to ensure all patients and staff entering the water are protected from pathogens.

Chlorine dioxide technology has been successfully adapted to meet the high demands of the Hydrotherapy Pool System environment.

Dental Unit Water Lines

Dental unit waterline biofilm has been recognised for more than 3 decades as having the potential for contamination, giving risk of infection to patients and staff. This risk is exacerbated due to the increased numbers of immunocompromised patients. There is also increased awareness of the potential occupational hazard in dental practice resulting from the possibility of pathogenic bacteria present in aerosol mist generated by the hand tools.

Typical examples of waterborne bacterial human pathogens found in DUWL samples are Pseudomonas aeruginosa, E coli, and Legionella species.

Studies have shown that Chlorine dioxide will eliminate such pathogens and the biofilm that will proliferate within the water lines. The main purpose of Chlorine dioxide is to improve the water quality entering the patient's mouth and surrounding atmosphere by reducing the bio-burden and the eliminating the biofilm within the system. Chlorine dioxide is well established within the oral hygiene sector being an active ingredient in mouthwash, toothpaste and used for more specialist treatments.

It is general these days for domestic tap water, which must be assumed to be of potable quality, to be used in DUWL's. The problems occur because of the use of very small pipework (0.5mm in many cases). Biofilm builds up, as is normal in any unprotected water system. However, as the surface area of biofilm to water volume ratio is far higher, it leads to greater levels of contamination. Combine this with the warm environments associated with Dental units and the perfect combination for biofilm growth is established.

"Winning Ways"

In December 2003, the Chief Medical Officer issued a document entitled "Working together to reduce Healthcare associated infection in England".

The aim of this document is to attempt to redress the rapid increase in *"Hospital acquired infections".*

The document focuses on specific action areas. Within Action Area 3 -

"Reducing Reservoirs of Infection"

the following statements can be found: -

- Cleaning and disinfecting programmes and protocols for environmental surfaces in patient care areas will be defined and carefully monitored to ensure high standards of cleanliness are achieved.
- Contamination of the water supply in hospitals with bacteria such as Legionella will be avoided by appropriate building design and maintenance, by cleaning water storage tanks, maintaining consistently high temperature in hot-water supplies, keeping cold-water systems cold and minimising water storage
- Attention will be given to the prevention of airborne infection by the use of ventilation in specialist areas and correct engineering and mechanical services.

Extracts from Department of Health document 34152 which can be viewed at www.doh.gov.uk/cmo

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