

The Continuous Dosing of Huwa-San DW to Domestic Water Systems in the United Kingdom

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Summary

Huwa-San DW TR50 a 50% hydrogen peroxide stabilised using low level colloidal silver has been used to control legionella in Domestic Water systems in the United Kingdom since 2002. Initially it was used as a one off disinfectant in situations where chlorine (bleach) had not been successful. Huwa-San DW TR50 has also been used as a continuous dose chemical to control legionella and other water microorganisms in domestic water systems. This report shows that a continuous dose strategy has been entirely successful. Providing the system is thoroughly disinfected with a minimum level of 200 ppm Huwa-San DW TR50 for 24 hours an average dose level of around 15 -20 ppm will eliminate legionella and other bacteria from a domestic water system.

This paper shows that this applies to different sizes of systems – large using 150 tonnes of water per day to smaller systems using around 15 tonnes of water per day. It applies to waters which are very hard (430ppm CaCO₃) to very soft (8ppm CaCO₃). It also applies to waters which have been pre chlorinated and to waters which have not. The report points out that it is essential to have a good dosing and control system to ensure that the correct level of product is dosed at all times.

Huwa-San DW TR50 is a modern solution to micro-organisms in water systems, dosed at a level of 15-20ppm the product offers an excellent solution to Legionella and bacteriological control.

Introduction

The number of people, who contract Legionnaires Disease, like UK crime statistics, is greatly under reported in the United Kingdom. The HPA (Health Protection Agency) believe that the true figure could be between 8,000 and 10,000. The disease is therefore significant and arises mainly from the use of showers and spa baths in commercial or domestic situations.

The disease is no respecter of building types and has been associated with hospitals, hotels, care home, office blocks and condominiums. It is also no respecter of water system age. Biofilm will develop in any water system within a few days of commissioning the water system. Over the years these biofilms can become very obdurate and very difficult to remove. Certain old buildings like some hospitals and certain hotels may also have very complex pipework configuration which contains a number of dead legs and areas of water stasis.

The Reason for Disinfection of Domestic Water Systems

The water supply to most of the domestic water systems in the United Kingdom comes from the public water supply. While this water is chlorinated there will be residual bacteria present in the supply which enters a building. E.C. Regulations allow up to 100 cfu/ml in the potable water supply. This supply can also contain pathogens like *pseudomas* and *legionella*. These bacteria will be in very small numbers and would not pose any threat. Unless allowed to multiply within the water system. Part from bacteria the water supply can also contain low levels of protozoa including *Amoeba Acanthus*

In large commercial and industrial premises the incoming supply will generally feed a cold water storage tank (C.W.S.T.) which can supply all the cold water outlets (WC's taps and showers) . The stored water generally also supplies the calorifier which delivers the domestic hot water (DHW) to the premises.

The low levels of bacteria present in the water supply allows biofilm to develop in well-designed systems which have compliant cold water storage tanks and calorifiers supplying DHW at optimum temperature (60 °C or greater). In systems where there is corrosion, contamination or bacterial ingress the potential for biofilm formation increases. In old water systems the biofilms can become very obdurate and almost impossible to remove.

Legionella breeds readily in these biofilms protected by the polysaccharide layer and out of the water flow. When a well-developed biofilm forms on the internal surfaces of a water system it will be grazed by large micro-organisms – protozoa. These creatures will devour the bacteria present in the biofilm including colonies of legionella. The legionella ingested by protozoa will then deactivate the digestive system of the larger organism and turn it into a host where it can incubate and breed safely. Eventually the legionella breeds to the extent that the protozoa cannot contain the numbers of bacteria. The protozoa then burst releasing thousands of legionella into the water. The legionella species which produced in this manner is Legionella pneumophila sero group 1. It is therefore obvious that the lethal form of legionella is associated with system biofilm and amoeba. It is also apparent that a good disinfectant needs to achieve three things if it is to eradicate legionella from a domestic water system. Independent tests show that Huwa-San DW TR50 is a fast legionella bactericide¹, an effective amoebicide², and that is very efficient at removing and treating biofilm. ³

Our experience of using Huwa-San DW TR50 as continuous dose sanitizer in around 100 different buildings is that following an initial disinfection a Huwa-San DW TR50 dose of between 15ppm and 20ppm will ensure that legionella is eradicated from the system. In some instances it may take a few weeks or months before this position is reached as a system clean-up has to take place and biofilm is slowly removed from the system. (See photographs in Appendix 1).

Huwa-San DW TR50 has been introduced into a number of different water systems

The majority of the buildings which we have treated are supplied with mains water or by spring water – Turnberry Hotel or from a borehole. Helledon Hospital is a Mental Hospital in Norwich England. It is supplied by borehole water which is contaminated with iron bacteria. The water from

the borehole is treated with Huwa-San DW TR50 immediately after it exits the borehole and prior to its storage in a large CWST.

In other situations Huwa-San DW TR50 has had to deal with other microorganisms like e coli. It is the only disinfectant which proved capable of removing pseudomonas A from a water system in Glasgow Royal infirmary. This system had previously been treated by a number of other chemical (Chlorine – Chlorine Dioxide) agents without success.

Dosing Systems

Huwa-San DW TR50 is introduced into the various water systems using a variety of different dosing techniques. The advantage of these systems compared with other continuous dose treatments e.g. chlorine Dioxide or Copper silver ion is that the Huwa-San DW TR50 dose systems are generally fairly low cost but can still deliver accurate quantities of Huwa-San DW TR50. There is only one problem in dosing Huwa-San and that is that small oxygen bubbles can cause the pump to lose prime, and stop further pumping. A conventional dosing pump therefore has to be fitted with a degas head which removes the oxygen bubbles and allows the pump to function even after a long period of no water flow and no chemical dose. (Some early continuous dosing systems failed because of this – We now install a continuous dose system with a dosing tank, bund , intelligent dosing pump fitted with a degas head and contact water meter for less than £1200(around C\$2,000)

The dosing pump which is currently used is an intelligent pump which can take a pulse from contact water meter and deliver either a number of impulses per pulse or an impulse per number of water meter pulses. This is the system(CD) which is used most often when the chemical is being injected into a pressure line.. Generally the pump can be set to give the desired Huwa-San concentration which can be simply checked using test strips.

In a number of sites where there is a large cold water storage tank peristaltic pumps are used and these can be controlled in a timer which allows the pump to run for the required time to maintain an average level of chemical in the CWST and therefore in the system. This technique has been used in Shearings Hotels where cost of dosing equipment is a real consideration.

In some hospitals hydrogen peroxide monitors have been used to monitor the level of Huwa-San DW TR50. There are different types of on-line monitoring equipment. One such system is comprises a flow system which takes treated water through a probe housing where the membrane protected probe monitors the level amperometrically and sends the signal back to a monitor. In Ailsa hospital the dosing system was built after the water treatment plant was in place and the hospital were unwilling to cut into the pipework to install a contact water meter. The dosing pumps are therefore controlled using the hydrogen peroxide concentration in the treated water. In East Ayrshire Community Hospital we have a system where the hydrogen peroxide concentration is controlled by the contact meter and simply measured by the amperometric system.

The Success of Huwa-San DW TR50 in Continuous Dosing Applications

The strategy to use Huwa-San DW TR50 has proved to be very successful and has established the product as a safe and convenient method for eradicating Legionella and other bacteria from some very old and complex water systems. The effectiveness of the product is down to its ability to remove biofilm from the internal surfaces of a water system. It is this which dictates the time it takes to “clean a system up or remediation” and achieve a system water which is virtually sterile.

The low cost of a suitable dosing system will encourage more users to adopt the Huwa-San DW TR50 approach to ensuring that legionella is eradicated from their water system. The progress of continuous Huwa-San DW TR50 dosing has been curbed by a view in the United Kingdom that the product was relatively unknown . This opinion has been altered by the NSF product registration which allows continuous addition up to 16 ppm Huwa-San DW TR50 into potable water.

Recently Teesside University carried out some calculations which helped quantify the energy savings which could be made if the temperature of the domestic hot water in a building was reduced from 60 °C to 50 °C. At present buildings need to control legionella by delivering Domestic Hot water from their calorifiers at 60 °C to ensure that legionella is killed. The low cost continuous dosing of Huwa-San which removes the need for temperature control can save up to 10 % of the heating bill of a building. It is for this reason that Shetland Islands Council installed the system in 3 different buildings to allow them to monitor their energy savings.

This report presents overwhelming evidence based on the treatment of a large number of buildings that the correct application of Huwa-San DW TR50 to the domestic water system in any building will eradicate legionella. Continuous Dosing of the product can therefore be used as the basis for control and allow hot water temperatures to be reduced.

References

1. Huwa-San DW TR50 – Antibacterial Activity against legionella – TNO Laboratories (ARMMO3-1799 /HAB KNC July 17th 2003
2. Amoebicidal Activity of Silver hydrogen peroxides McMichael J. March 2005
3. Evaluation of Huwa-San DW TR50 for the Removal of biofilm Goemer SG (VITO) and Huysman K (PIDPA) April 2004 (Private Paper)
4. The Continuous Dosing of Huwa-San DW TR50 to Hospital Domestic Water Systems Waterline Wilson R Summer 2007
5. Hydrogen Peroxide and Silver Their Uses as a Disinfectant Guiot P Wilson R et al Water line June 2004
6. The Effect of Continuous Dosing with silver stabilised Hydrogen Peroxide on Legionella found in a complex water system Alderton J McDonald AJ Wilson R June 2009 – Currently submitted for peer review
7. Pathogenic Free Living Amoebae- Australian Water Quality Centre

Dosing Systems Examples



Individual items which make up the product dosing bypass system



Installed Bypass with contact water meter and injection fitting



Bunded Dosing Tank fitted with Intelligent Dosing Pump



Dosing system installed in Clickimin Leisure Centre, Lerwick



Penrith and Eden Dosing System



The Bypass system is installed in PVC

Biofilm examples



Biofilm removal from contaminated water system in Nazareth House Glasgow



More of the same



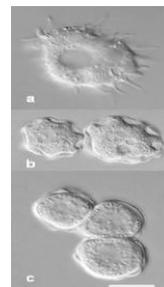
Valve in poultry Broiler house prior to Huwa-San Treatment



And following Huwa-San Treatment



Biofilm being removed from Shearings Hotel



Acanthamoeba life cycles stages
Trophozoite and spores scale bar 10 μ

Premises Extracts



Nazareth House Glasgow



Perth Royal Infirmary



Starwood Glasgow



Sheraton Grand Edinburgh



Turnberry Hotel



Whalsay Leisure Centre where the DHW is treated using Huwa-San DW TR50

Ailsa Hospital



Huwa-San DW TR50 Dosing and Control System Ailsa Hospital



Dosing Tank on Alibert bund



Hydrogen Peroxide Probe and monitor

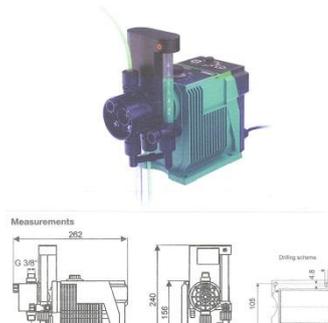


Close up of dosing pumps with calibration fitting and degas head



Conex Controller with probe above rotameter

Primus 208 with Plus[®] system
The dosing pump with calibration unit for difficult liquids



Ailsa Dosing Pump