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Copper and Silver Water Treatment

Copper and Silver Ionisation efficacy at high and low water temperatures

Legionella

Legionella pneumophila is a disease-causing microorganism well known for causing Legionellosis (Legionnaires' disease and Pontiac fever). It is particularly dangerous for hospital patients that have a compromised immune system. L. pneumophila and other species of the genus Legionella thrives in temperatures between 20 and 45°C and multiplies rapidly in untreated or ineffectively treated water systems.

Legionella control in cold and hot water systems

Various methods are used for controlling Legionella in water systems, but not all of them will work for both cold and hot water.

In the UK, the HTM04-01 (2016) states that temperature control is the traditional method applied for the control of Legionella in water distribution systems in the UK. This control method entails obtaining 55°C and above, after running any hot water tap for 1 minute, and 20°C and below, after running any cold water tap for 2 minutes (HTM04-01, 2016). Many premises use the temperature control together with an additional modality, including chlorine dioxide and copper-silver ionisation, to control Legionella and other pathogens in water systems. In fact, **item 4.7 of the HTM** says that:

"In addition to maintaining a temperature control regimen, there may be occasions where additional biocidal treatment is required for the effective control of Legionella and other opportunistic waterborne pathogens. However, the selection of suitable treatment is complex and depends on a number of parameters, and the chosen biocide should be properly managed. This is particularly the case with cold water services compared with hot water services where, with the benefit of circulation, water is returned to the calorifier/water heater and is then pasteurised. However, it should be taken into consideration that effective concentrations of some biocides are difficult to achieve in hot water systems due to gassing off."

This is indeed the case with chlorine dioxide, which is discussed under **item 2.96, page 36 of the HSE document HSG274 Part 2 (2014).** It states that:

"In the case of hot water distribution systems with calorifiers/ water heaters operating conventionally (i.e. at 60 °C), there will be a tendency for chlorine dioxide to be lost by 'gassing off', especially if the retention time in a vented calorifier/water heater is long. In most cases, however, some level of total oxidant should be found in the hot water, although at concentrations far less than the 0.5 mg/l injected." Lower concentrations of the biocide will of course render it ineffective.

Item 2.98 of the same document states that:

"Excessive levels of chlorine dioxide should be avoided since they can encourage the corrosion of copper and steel pipework and high levels of chlorine dioxide can degrade certain types of polyethylene pipework particularly at elevated temperatures. Users of chlorine dioxide systems will need to consider these issues and when choosing a system these points should be checked to ensure that the supplier addresses them satisfactorily."

How copper and silver ionisation for Legionella control works at low and high water temperatures

Copper and silver ionisation for Legionella control, on the other hand, is one of the current techniques that not only have been shown to be effective for Legionella control (Landeen et al. 1989, Lin et al. 2011, Lin et al. 1996, BSRIA TN6/96) but also works at both hot and cold water temperature (Liu et al. 1994, Liu et al. 1998, Stout et al. 1998, Kusnetsov et al. 2001, Stout and Yu 2003 and Chen et al. 2008).

Studies of hot water systems in hospitals in the USA suggested that copper and silver ionisation eliminated L. pneumophila contamination in systems with relatively low water volume (<200 L) and without hot water storage tanks (Liu et al. 1994, Coville et al. 1993).

A new hospital building in London has been using the Orca copper and silver ionisation system since opening in 2011 with deliberately reduced water temperatures. A 100% Legionella control and 90% Pseudomonas control at temperatures between 17 and 45 °C has been achieved. The installation of a copper and silver ionisation system also minimised the use of thermostatic mixing valves due to the lower temperatures, thus eliminating the need for mixing valve maintenance regimes and corresponding costs. In addition, by allowing the system to operate at lower temperatures, a 33% reduction in energy consumption associated with heating water was achieved.

References

Building Services Research and Information Services (1996) Application Guide AG 2/93. Water treatment for building services systems. Building Services Research and Information Services (BSRIA) Technical Notes TN6/96 1996. Ionisation water treatment for hot and cold water services.

Chen, Y.S.; Lin, Y.E.; Liu, Y.C.; Huang, W.K.; Shih, H.Y.; Wann, S.R.; Lee, S.S.; Tsai, H.C.; Li, C.H.; Chao, H.L.; Ke, C.M.; Lu, H.H.; Chang, C.L. (2008). Efficacy of point-of-entry copper-silver ionisation system in eradicating Legionella pneumophila in a tropical tertiary care hospital: implications for both hospitals contaminated with Legionella in both hot and cold water. Journal of Hospital Infection 68:152-158.

Colville, A.; Crowley, J.; Dearden, D.; Slack, R.C.B.; Lee, J.V. (1993). Outbreak of Legionnaires' disease at University Hospital, Nottingham: epidemiology, microbiology and control. Epidemiol Infect 110:105-16.

DH Estates and Facilities Division (2016) Health Technical Memorandum 04-01:

Safe water in healthcare premises, Part A: Design, installation and commissioning 2016.

Health Technical Memorandum 04-01: Safe water in healthcare premises, http://www.wales.nhs.uk/sites3/Documents/254/WHTM%2004%2D01%20Part%20A%202016.pdf Part B: Operational management. Department of Health. 2016. London, UK. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/524882/DH_HTM_0401_PART_B_acc.pdf [Accessed April 2017].

Kusnetsov, J.; Iivanainen, E.; Elomaa, N.; Zacheus, O.; Martikainen, P.J. (2001). Copper and silver ions more effective against Legionella then against Mycobacteria in a hospital warm water system. Wat. Res. 35(17):4217-4225

Landeen, L.K.; Yahya, M.T.; Gerba, C.R. (1989) Efficacy of copper and silver ions and reduced levels of free chlorine in inactivation of Legionella pneumophila. Appl Environ Microbiol 55:3045-50.

Lin, Y.; Stout, J.E.; Yu, V.L. (2011) Controlling Legionella in Hospital Drinking Water: An Evidence-Based Review of Disinfection Methods. Infection Control and Hospital Epidemiology 32:166-173.

Lin, Y.S.E.; Vidic, R.D.; Stout, J.E.;Yu, V.L. (1996) Individual and combined effects of copper and silver ions on inactivation of Legionella pneumophila. Wat. Res. 30:1905-1913.

Liu, Z.; Stout, J.E.; Tedesco, L.; Boldin, M.; Hwang, C.; Divert, W.F.; et al. (1994). Controlled evaluation of copper-silver ionization in eradicating Legionella pneumophila from a hospital water distribution system. J Infect Dis 169:919-22.

Liu, Z.; Stout, J.E.; Boldin, M.; Rugh, J.; Diven, W.F.; Yu, V.L. (1998). Intermittent use of copper-silver ionisation for Legionella control in water distribution systems: A potential option in buildings housing individuals at low risk of infection. Clinical Infectious Diseases 26:138-140.

Stout J.E., Y.E. Lin, A.M. Goetz, and R.R. Muder. (1998). Controlling Legionella in hospital water systems: Experience with the superheat-and-flush method and copper silver ionization. Infection control and Hospital Epidemiology 19(12):911-914.

Stout J.E.; Yu, V.L. (2003). Experiences of the first 16 hospitals using copper silver ionisation for Legionella control: Implications for the valuation of other disinfection modalities. Infection Control and Hospital Epidemiology 24(8):563-568.