FOCUS ON EVAPORATIVE COOLING TOWERS

WATER TREATMENT IN COOLING TOWERS

Cooling water

To operate an evaporative cooling tower as efficiently as possible, the consumption of cooling water should be minimized. In addition, the entire system's protection from corrosion, deposits and biological growth needs to be improved. However, since only pure water evaporates in cooling systems, the concentration of salt in the process water will steadily increase if no fresh water is added. Excessive salinity and mineral concentrations result in limescale and corrosion in the cooling system and its pipework. The formation of algae and biofilms as well as dust particles entering from the ambient air also impact negatively on the system's cooling performance and damage the materials used. For an evaporative cooling tower to run trouble-free and economically, fresh water treatment and process water conditioning are essential.

Cooling water treatment

The concentrated process water caused by evaporation has to be regularly replaced with fresh makeup water. To ensure that the salt concentration does not rise to a range where it impacts negatively on the cooling system's efficiency and materials, the concentration of the process water should be continuously monitored by means of a conductivity measurement. Automatic blow down and an appropriate supply of fresh water minimize the risk of deposits and corrosion. Additionally, corrosion inhibitor and hardness stabilizer are added directly to the supplied fresh water, proportionate to volume, in order to protect the system. Since microbiological films also reduce the efficiency of the cooling system and may provide a home for pathogenic bacteria, biofilms as well have to be combated through the addition of chemicals.

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Biocides

Biocides, used to combat microorganisms in evaporative cooling towers, must be explicitly approved for this type of application, and their effectiveness in fighting legionella must be proven. The amount of biocide added must also be adapted to the specific circumstances and kept to a minimum through proper consideration of physical, biological, chemical or other alternatives. In accordance with the German Wastewater Ordinance, only hydrogen peroxide or ozone are allowed for continuous treatment in open cooling circuits. For any other active substances with biocidal properties, only shock dosage is permitted.

Oxidizing biocides

Oxidizing biocides react with numerous cell components of microorganisms, including their cell membrane. These changes to the cell structure cause the organisms to die instantly. Because of the way oxidizing biocides work, resistant forms cannot occur. The choice of active substance used depends on the individual evaporative cooling tower being treated (water quality, materials used, existing corrosion, biological deposits, etc.)

Non-oxidizing biocides

Non-oxidizing biocides inactivate certain metabolic processes in microorganisms. While these interactions do not cause the organisms to die instantly, they do prevent the cells from reproducing further. Although this method also reduces the number of microorganisms, its downside is that it allows the organisms to develop resistance to the biocide used.

Biocide	Advantages	Disadvantages
Oxidizing biocides	Resistance not occuring	Acts aggressively on materials
Hypochlorite	Low-cost biocide Simple handling	Ineffective above pH > 7.5 AOX by-products
Hypobromite	Average price level	Ineffective above pH > 8.5 AOX by-products
Chlorine dioxide	Effective in a pH range of 5 – 10 No AOX by-products	Formation of chlorite, chlorate
Hydrogen peroxide	No toxic by-products	No penetration of biofilms Degradable by enzymatic activity
Ozone	No toxic by-products Highly toxic to target organisms	High investment costs Low depot effect
Non-oxidizing biocides	Good material compatibility	Risk of developing resistance
Quaternary ammonium salts	Effective at alkaline pH No AOX by-products	Performance reduced by dirt, oil, solids Additional defoamer needed
Isothiazolinone	Broad-spectrum biocide Low metering volume needed	Bio-accumulative Slow acting germicide
Bronopol	Broad-spectrum biocide Fast acting germicide	Low stability at higher temperatures AOX by-products