



Introduction

Cooling systems provide conditions which support the growth of microscopic life – predominantly algae, fungi, and bacteria. Microorganisms that attach to wetted surfaces grow there and in time form larger communities, called biofilms or slime.

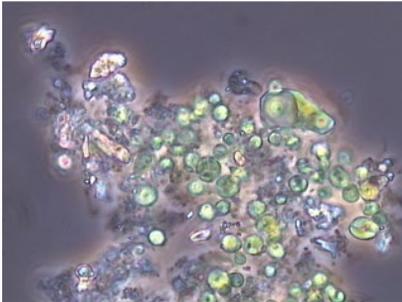


Without adequate microbiological control, effectiveness of corrosion inhibition and deposition control programs is seriously compromised. Cooling systems provide optimal conditions for growth of microorganisms; water, nutrients, optimal temperature and preferred pH range. Microorganisms reproduce at a phenomenal rate because they typically grow by cell division: a given cell grows and divides into two offspring cells. These two cells then grow and divide into four cells, then eight, etc. This leads to explosive growth and large populations.

Microorganisms are also environmentally flexible. Not only are there very many species, but they mutate rapidly, changing their basic biochemistry as the environment changes. These organisms are also nutritionally versatile in that they adapt to changes in available food and can make use of thousands of different compounds to survive.

Control

There are three general types of products use to control microbiological fouling: oxidizing biocides, nonoxidizing biocides and biodispersants. Oxidizing biocides are very reactive products that in effect, “burn” whatever compound the oxidizer contacts. Nonoxidizing biocides are much more specific in the way they attack microorganisms. Nonoxidizers either interact with the membrane surrounding an organism or they interfere with its metabolic activity. Because nonoxidizing biocides are more specific than oxidizers, a given nonoxidizing biocide may not be effective against all organisms in a cooling system. It is important to test for the right choice of biocide and the most cost-effective dosage. Biocides often have to be switched as microbial populations change.



Contact Time and Retention

Regardless of what biocide is used, there is an important principle at work. The correct concentration of biocide sustained over a certain minimum period of time (the contact time) is critical. Biocides need time to do their work.

Contact Time: 24h		----- Counts After Exposure (% Inhibition) -----		
Biocide	(ppm Levels)	Level 1	Level 2	Level 3
A	(40/ 70/105)	60 (>99%)	80 (>99%)	2,200 (95%)
B	(70/130/195)	6,000 (86%)	1,000 (98%)	150 (>99%)
C	(35/ 65/ 95)	90 (>99%)	< 10 (>99%)	< 10 (>99%)
D	(40/ 70/105)	140,000 (0%)	< 10 (>99%)	< 10 (>99%)
E	(30/ 60/ 90)	530,000 (0%)	480 (99%)	180 (>99%)
F	(65/120/185)	340 (>99%)	10 (>99%)	80 (>99%)

Initial Control: 23,000 CFU/mL
Contact Control: 43,000 CFU/mL



Innovative Solutions Provider