ALBEMARLE™ CORPORATION

STABROM® 909 Biocide Effect Against Biofilm

STABROM 909 biocide is a liquid, single-drum, ready-to-feed, stabilized bromine biocide for cooling water systems.

STABROM 909 biocide is effective at controlling biofilm, the thin layers of bacteria and slime attached to cooling system surfaces, which can diminish cooling system performance. Biofilms can reduce heat transfer efficiency and contribute to underdeposit corrosion. A laboratory study, conducted by the Biofilm Research Group at the University of Calgary, indicates that it takes less STABROM 909 biocide than most conventional oxidizing and non-oxidizing biocides to control biofilm. The study also suggests that the effectiveness of the biocides depends on the age of the biofilm. All the oxidizing biocides tested were effective at eradicating the one-day old biofilm at halogen residuals of 2-4 ppm as Cl_2. However, as figure 1 shows, it takes less STABROM 909 biocide than BCDMH and activated sodium bromide and considerably less than bleach to eradicate the 7-day-old biofilm.

Figure 1

7-Day Biofilm

Biofilm densities:
~ 5 x 10^6 CFUs/peg

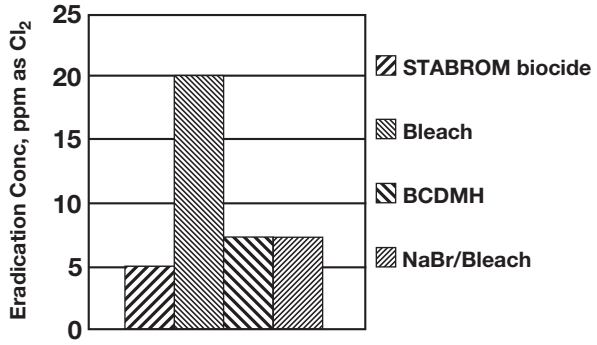
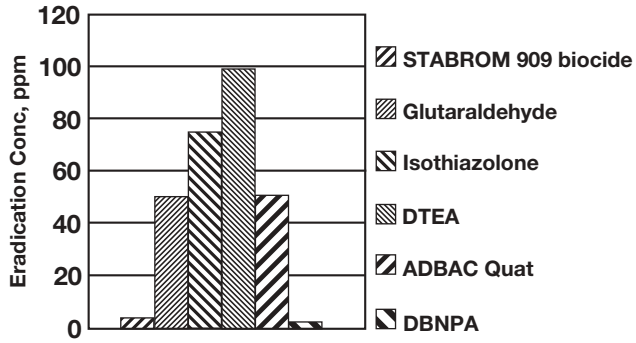


Figure 2 reports the effectiveness of STABROM 909 biocide versus the common non-oxidizing biocides. Data indicate that it takes less STABROM 909 biocide or DBNPA than the others to control a 1-day-old biofilm.

Figure 2

1-Day Biofilm

Biofilm densities:
~ 1 x 10^7 CFUs/peg



The concentrations of the non-oxidizers are as active ingredient (AI). STABROM 909 biocide is ppm as Cl_2.

Biofilm can lead to reduced system service life and increased system operating costs. It compromises system performance by decreasing heat-exchanger efficiency, increasing metal corrosion and pitting, and contributing to the fouling of high-efficiency cooling tower film fills. This work shows that, when properly applied, STABROM 909 biocide can be part of an overall water treatment program that incorporates effective microbiological control, scale- and corrosion-inhibition strategies, and regular maintenance practices.

The Biofilm Studies were performed by the Biofilm Research Group at the University of Calgary, Calgary, Alberta, Canada, using the Calgary Biofilm Device (CBD).

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System Description

The Calgary Biofilm Device (CBD) allows the growth of 96 identical biofilms under carefully controlled conditions. The CBD is a two-part vessel comprised of an upper plate containing 96 pegs that seals against a bottom plate. The bottom plate can consist of either a trough (for biofilm growth) or a standard 96-well plate (for biocide challenge). The technique consists of growing identical biofilms on the pegs using a rocker table to generate the required shear force and then challenging the biofilms with selected antibiotics or biocides for one hour. After the challenge, the biofilms are placed into individual wells of growth media and ultra-sonicated to remove any surviving organisms. Following overnight culture, the wells are checked for turbidity. Clear, transparent wells indicate complete deactivation of biofilm bacteria. Conversely, turbidity ("growth") indicates incomplete deactivation. The minimum biofilm eradication concentration (MBEC) is defined as the minimum concentration of agent that results in complete biofilm deactivation. All of the biocide challenge work was performed with synthetic water containing 200 ppm calcium hardness (as $CaCO_3$), 150 ppm alkalinity (as $CaCO_3$), 150 ppm chloride at pH 8.0 (±0.1). The results reported represent the average of at least two determinations.

Glossary:

BCDMH:	bromochlorodimethylhydantoin
DTEA:	decylthioethaneamine hydrochloride
ADBAC quat:	alkyldimethylbenzyl ammonium chloride
DBNPA:	dibromonitrilopropionamide

For further information on this study, please refer to papers presented by Dr. C.J. Nalepa of Albemarle Corporation at Corrosion 2000 (paper 00347) and Corrosion 2001 (paper 01278) conferences by NACE International.

For further information on this product, please refer to the technical data sheet, material safety data sheet and startup guide, which are available on request.

ALBEMARLE™ CORPORATION

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