

## Reduction of Biofilm Formation in Closed Circuit Cooling Towers

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**Abstract :** Closed-circuit cooling towers are cooling units that operate according to the indirect cooling principle. Unlike the open-loop cooling tower, the filler material includes a closed-loop water-operated heat exchanger. The main purpose of this heat exchanger is to prevent the cooled process water from contacting with the external environment. In order to ensure that the hot water is cooled, the water is cooled by the air flow and the circulation water of the tower as it passes through the pipe. They are now more commonly used than open loop cooling towers that provide cooling with plastic filling material. As with all surfaces in contact with water, there is a biofilm formation on the outer surface of the pipe. Although biofilm has been studied very well on plastic surfaces in open loop cooling towers, studies on biofilm layer formed on the heat exchangers of the closed circuit tower have not been found. In the recent study, natural biofilm formation was observed on the heat exchangers of the closed loop tower for 6 months. At the same time, nano-silica coating, which is known to reduce the formation of the biofilm layer, a comparison was made between the two different surfaces in terms of biofilm formation potential. Test surfaces were placed into biofilm reactor along with the untreated control coupons up to 6-months period for biofilm maturation. Natural bacterial communities were monitored to analyze the impact to mimic the real-life conditions. Surfaces were monthly analyzed in situ for their microbial load using epifluorescence microscopy. Wettability is known to play a key role in biofilm formation on surfaces, because characteristics of surface properties affect the bacterial adhesion. Results showed that surface-conditioning with nano-silica significantly reduce (up to 90%) biofilm formation. Easy coating process is a facile and low-cost method to prepare hydrophobic surface without any kinds of expensive compounds or methods.

**Keywords :** biofilms, cooling towers, fill material, nano silica

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