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Faucet flowrates affect biofilm accumulation

Additional submitted attachment is included below.

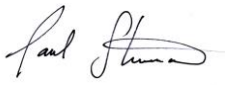
MONTANA STATE UNIVERSITY
College of ENGINEERING

9 October 2014

Matt Sigler
Technical Director
Plumbing Manufacturers International

In response to your request for more information about the potential effects from California's proposed water flowrate changes in faucets, I'd like to offer the following thoughts. It is well understood that household plumbing fixtures, including faucets accumulate attached bacterial populations – biofilms. Previous experimentation in plumbing-related systems such as pipes has shown that the flow regime within a pipe can influence the biofilm that grows on the pipe walls, particularly with regard to biofilm thickness, density and detachment. Flowrate influences shear stress on the biofilm, and biofilm grown under lower shear conditions tends to be thicker, less dense, and more easily detached than biofilm grown under high shear. The flow path within a faucet is considerably more complex than a simple pipe, but biofilm accumulation within the faucet would be expected to follow this pattern. It is also well understood that biofilms can potentially harbor frank or opportunistic pathogenic microorganisms, such as Legionella. While specific experimental results are not available to correlate pathogen survival within biofilms to biofilm thickness within faucets, it stands to reason that thicker biofilms have more capacity to harbor such organisms than do thinner biofilms.

Sincerely;



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Mountains & Minds

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17 November 2014

Matt Sigler
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As a follow-up to my comment submitted on 9 October 2014, this is to provide citations to published materials documenting that pathogenic organisms, such as *Legionella* can survive in biofilms (Donlan, 2002). Additionally, it has been understood for decades that hydrodynamic shear forces play an important part in biofilm structure, and that increased shear tends to promote biofilm detachment (Characklis, 1990).

Literature Cited

Characklis WG. Microbial fouling. In: Characklis WG, Marshall KC, editors. Biofilms. New York: John Wiley & Sons; 1990. p. 523–84

Donlan, R.M., 2002. Biofilms: Microbial Life on Surfaces. *Emerging Infectious Diseases*, Vol 8, No 9, September 2002.

Sincerely;

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