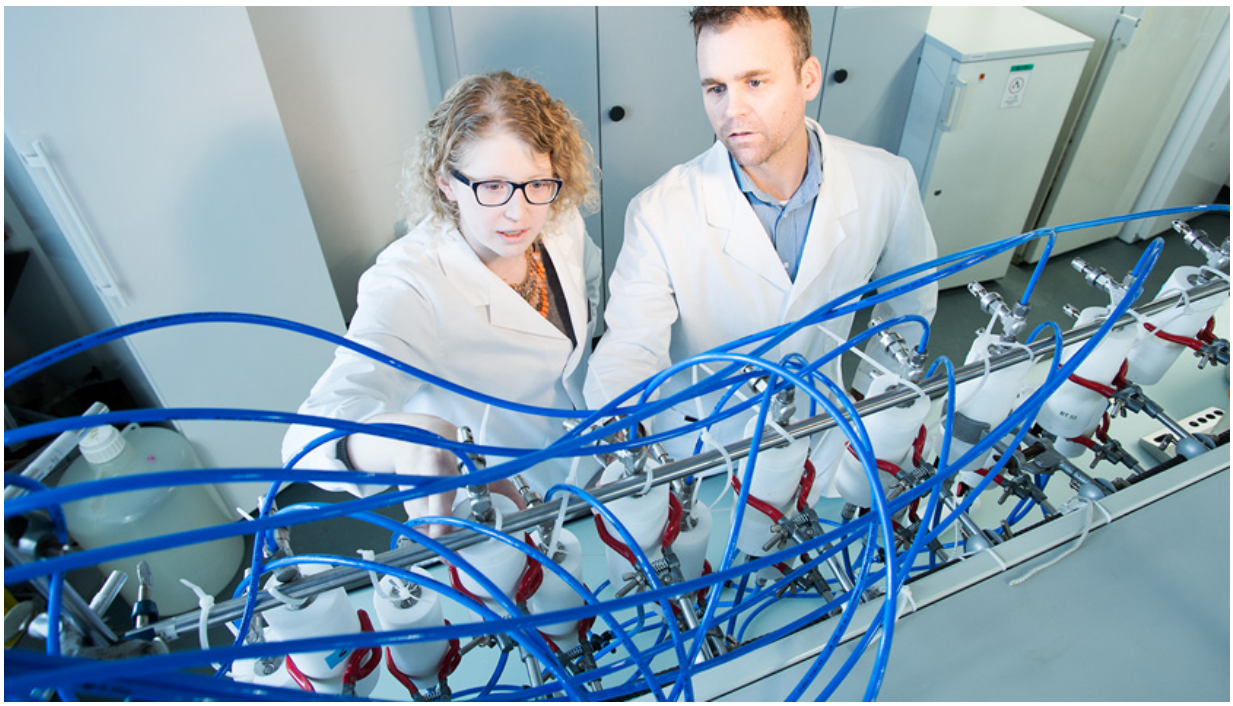


“We shouldn’t be afraid of bacteria”

February 15, 2018 | Mirella Wepf
Topics: Drinking Water | Pollutants | Climate Change & Energy

A shower hose will often contain more bacteria than the rest of the building’s plumbing system. A research team led by Frederik Hammes has been investigating this topic for the past four years. In their latest study, they analysed biofilms in 78 shower hoses from 11 countries, and in 21 of them, they detected legionella – a potential pathogen. In this interview, Hammes explains why we should not be unduly concerned.

Why are you so interested in shower hoses, in particular?

I should first explain the background: in recent years, research has increasingly focused on drinking water quality in buildings – for the good reason that premise plumbing now accounts for over 80 per cent of the total length of the drinking water network. Switzerland is a country with a high?quality water supply system, but as soon as it is inside a building, the quality of water is monitored only irregularly or not at all.

So it certainly makes sense to find out more about the microbiology of water in buildings. Here, Eawag has taken on a leading role. We now know, for example, that the amount of bacteria found in a shower hose is often greater than in all the rest of the plumbing system, with 99 per cent in the biofilm which forms on the inside of the hose and 1 per cent in the water.

Why is that?

Pipes are made of metal or high-quality plastics, but shower hoses are lined with soft plastic of lower quality. This material releases organic carbon, which favours bacterial colonization and growth. In addition, there’s always some water left in shower hoses, which also promotes biomass growth – as do

the warm temperatures typical of shower rooms.

What risks does that involve? I'm thinking of legionnaires' disease, for example.

It would be wrong to panic. Overall, we have excellent drinking water quality. And it's perfectly normal for drinking water to contain a certain amount of microorganisms.

As regards health risks, there are five or six potential pathogens in drinking water that we keep an eye on, including legionella, pseudomonas or mycobacteria. These are what we call opportunistic pathogens. In other words, they're generally harmless for healthy people, but they can be dangerous if individuals with an impaired immune system are exposed to them. Fortunately, that happens very rarely.

But the incidence of legionnaires' disease is increasing in Switzerland. In 2017, according to the Federal Office of Public Health, there were 496 cases.

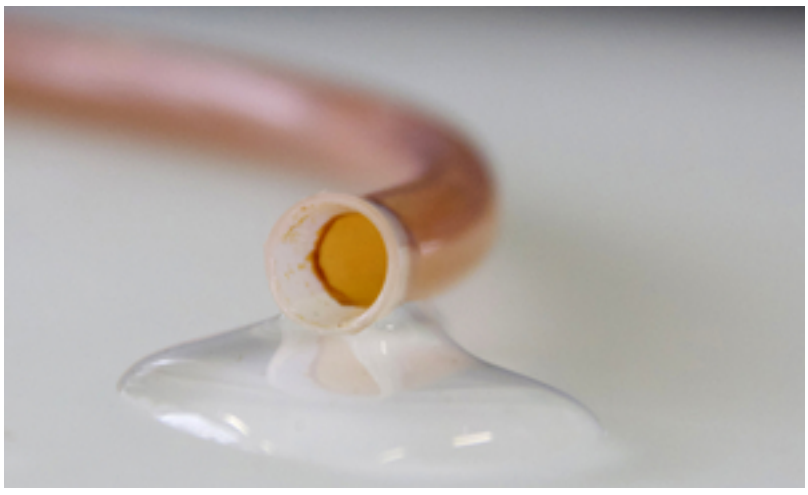
That is indeed a problematic development. This trend can be observed worldwide, and the reasons for it are not quite clear. It may be that the disease is now better recognized than it was in the past. And there have been changes in our living conditions. We now spend less time outdoors, and modern buildings have quite different types of equipment.

Legionnaires' disease is caused by inhalation of water droplets containing certain types of legionella. These bacteria live in natural waters, but they're also found in domestic plumbing, air conditioning, whirlpool baths or humidifiers. And we're increasingly using systems of these kinds.

Legionella can proliferate especially in systems where the water is not constantly renewed – i.e. in stagnant water – at temperatures between 25 and 45°C.

What preventive measures are advisable?

As I said, we're talking about small numbers of isolated cases. So there's no need for radical measures. But in the interests of sound prevention, there's certainly room for improvement in various areas. First of all, appropriate precautions should be taken when installing water pipes in a new building. And to optimize the last metre of the system, when a new shower is put in, I'd recommend a model without a hose. Nowadays, hospitals often use disposable shower hoses as an alternative.



This plastic tube inside a shower hose is coated with a brownish, iron-containing biofilm.

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(Photo: Frederik Hammes, Eawag)

As a tenant, I have to replace the shower hose myself. What type should I buy?

There's no best type of hose. And there are virtually no models made of certified material. The reason is that water from a shower hose is not legally defined as drinking water, although it comes from the same source. So the requirements are less strict. To get high-quality, certified hoses, consumers will have to put pressure on the producers.

In the future, should drinking water quality be better monitored in buildings as well?

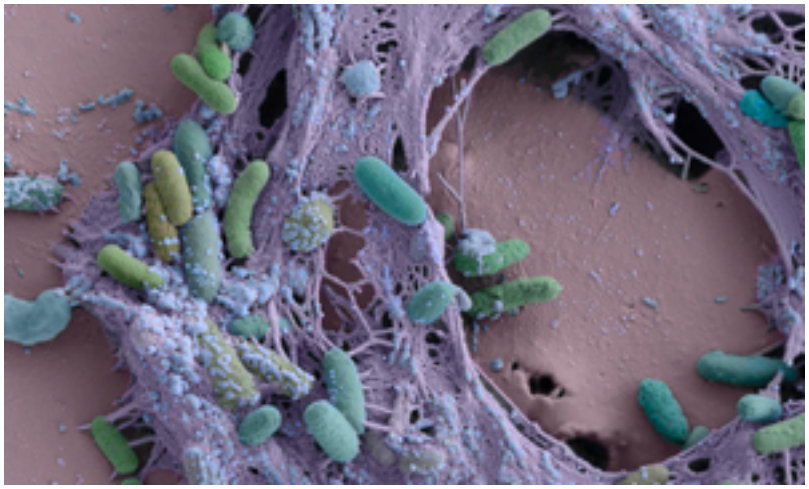
In public buildings such as hospitals and care homes, this is already being done in some cases, and monitoring could in future be increasingly carried out in schools or sports centres as well. But I don't think this would be feasible in private households, or that residents would want it. Politically, there's no evidence at the moment of a trend in this direction. I'm convinced that a high level of care when installing the relevant infrastructure – and good operational management – is more useful than subsequent monitoring.

To save energy, people are advised to reduce the boiler temperature. What level would you recommend?

60 degrees Celsius is now internationally accepted as the minimum recommended temperature. At lower temperatures, legionella and other pathogens can proliferate.

In your latest study, your team investigated 78 shower hoses from 11 countries. What were the most important findings?

For me, as a microbiologist, it was fascinating to see the large numbers of bacteria present in biofilms, and how widely community composition varies. In addition, biofilms are evidently a selective environment: we found between 2000 and 10,000 different types of bacteria in the water, but only 200 to 400 in the biofilm in each shower hose. That's a new finding. What was also striking was that considerably fewer bacteria were found in highly chlorinated drinking water systems, and diversity was also lower.



Photomicrograph of biofilm on the inside of a shower hose, comprising various types of bacteria in a layer of slime.
(Photo: Center for Microscopy and Image Analysis, University Zurich)

So should we chlorinate our water more heavily?

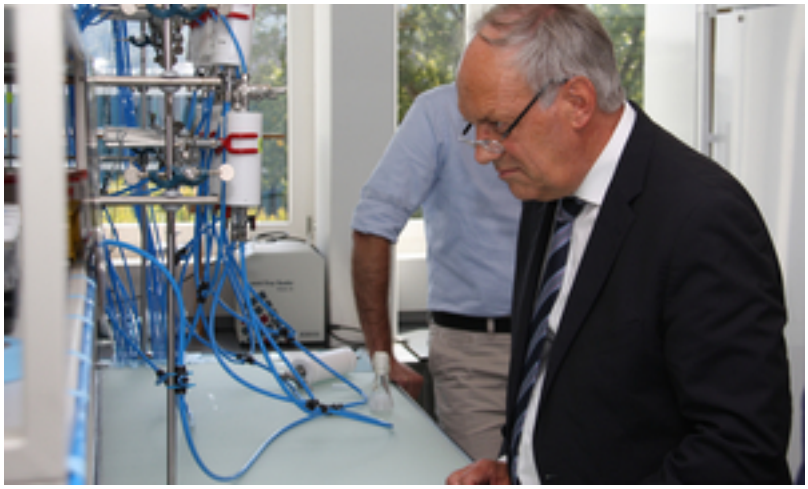
No, absolutely not! As a researcher, my view is quite clear: we shouldn't be afraid of microorganisms! Bacteria, of course, also live on our skin and in our gut. And then there's the risk of encouraging the development of chlorine-resistant bacteria.

What did you find with regard to potential pathogens?

We only detected legionella in 30 per cent of all hoses – which was surprising for me. I'd have expected 100 per cent. Intriguingly, we also found that hoses with high levels of legionella contain low levels of pseudomonas and vice versa. In other words, if we find a way of controlling legionella, we may possibly create a problem with pseudomonas.

And what will you be investigating next?

One of my doctoral students is now studying how the colonization of a shower hose actually proceeds. We're also interested in the question how the bacterial composition of the biofilm in plumbing systems could be positively influenced, for example through seeding of bacteria which we regard as beneficial. So the topic of drinking water in buildings will keep us busy for another few years.



Federal Council Johann Schneider-Ammann examines the teststation with shower hoses at Eawag. (Photo: Andri Bryner, Eawag)

Drinking water quality in buildings
Even with effective drinking water treatment, microbial growth in household plumbing is inevitable, and it may pose risks for users if, for example, a biofilm harbours opportunistic pathogens. Over the last five or six years, Eawag scientists have investigated this topic in detail, in projects supported by the Swiss National Science Foundation or the Commission for Technology and Innovation (CTI), or with EU research funding. The results of the most recent

project Biofilms in shower hoses were published in the journal Water Research in December 2017. This project was supported by a grant from MERMAID, a Marie Sk?odowska-Curie Initial Training Network.
The aim of Eawag's research is to identify the major drivers of microbial growth and community composition in this unique environment, focusing on the choice of pipe material. The identification of these factors should help to promote safer and more sustainable management of the drinking water microbiome.

Original publikation

Proctor, C. R., Reimann, M., Vriens, B., & Hammes, F. (2018). Biofilms in shower hoses. Water Research, 131, 274-286. http://doi.org/10.1016/j.watres.2017.12.027

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