New biofilms study could lead to a more sustainable water industry

October 21 2020, by Sean Barton

Credit: Pixabay/CC0 Public Domain

Slightly reducing the amount of disinfectant residuals we use to maintain clean drinking water could deliver significant improvements to water quality while making our drinking water systems more sustainable,

according to new research from engineers at the University of Sheffield.

In a new study, led by Professor Joby Boxall and Dr. Katherine Fish from the University's Department of Civil and Structural Engineering, the researchers found that using a lower chlorine residual in water is beneficial in supporting the growth of biofilms that have less of an impact on water quality compared to those grown under a higher chlorine residual.

Disinfectant residuals are used to protect drinking water from the regrowth or ingress of free-living microorganisms in the water column —other microbes aside from those within biofilms that can affect the quality of water—but it was not known how these disinfectants affect biofilms and in turn what effect that can have on drinking water supplies .

Biofilms are communities of microbes that form on the walls inside pipes that supply drinking water. They have an impact on water quality and can't be permanently eliminated. Drinking water systems around the world have biofilms. However, different countries use different disinfection residuals, and in some places none, with different impacts on the biofilms and the resultant effects on water quality.

The Sheffield engineers have found that, contrary to common perceptions, using a lower chlorine residual that still provides protection from free-living microorganisms can lead to the growth of biofilms that have less of an impact on water quality.

Dr. Katherine Fish, Post-Doctoral Research Associate at the University of Sheffield, said: "We all depend on safe, clean drinking water for our health and well-being. We turn on our taps and rarely think about the journey our water has been on to reach us. It takes energy and chemicals to treat the water that then travels through vast pipelines of our drinking

water distribution system. In the UK, we have some of the best drinking water quality in the world, but we also have an aging drinking water distribution system that is having new pressures put on it with increasing population, urbanization and the climate crisis. Sustainably managing our drinking water system is critical for all of us, consumers and suppliers."

Professor Joby Boxall, Professor of Water Infrastructure Engineering at the University of Sheffield, said: "Drinking water is not sterile, and you wouldn't want to drink it if it was as it would taste horrible. It's the minerals and good bacteria in water that gives it the taste that we expect when we turn on our taps at home. Understanding the physical, chemical and biological processes, and the role of biofilms in particular, within our vast aging pipe networks is vital to protect water quality. Disinfectant residuals are an incredibly important part of how we protect and maintain our drinking water supply. They protect our water from microorganisms and ensure that the UK has access to safe and clean drinking water. Along with using disinfectant residuals, we also need to manage biofilms to maintain our drinking water supply and there's currently different approaches to managing them effectively. What we've found here at Sheffield is that using a slightly lower amount of disinfectant residuals can result in biofilms that have less of a negative impact on water quality. We hope that our findings can be fed into how water supplies are managed in the UK and around the world so that they can become more sustainable through less use of energy and chemicals and help the water industry in its efforts to tackle climate change."

The study, "Uncharted waters: the unintended impacts of residual chlorine on water quality and biofilms," is published in the journal *npj Biofilms and Microbiomes*.

More information: Katherine E. Fish et al. Unchartered waters: the unintended impacts of residual chlorine on water quality and biofilms, *npj Biofilms and Microbiomes* (2020). DOI:

10.1038/s41522-020-00144-w

Provided by University of Sheffield