Waterloo leads interdisciplinary team investigating new forever chemicals in Canadian water systems

NSERC provides funding to detect, identify and treat PFAS-contaminated water and biosolids

By Media Relations

University of Waterloo is leading an interdisciplinary team to identify and treat per- and polyfluoroalkyl substances (PFAS) – better known as forever chemicals – in water systems affecting more than 2.5 million Canadians.

PFAS, are a new class of more than 4,000 environmental contaminants whose impact on human health is unknown. PFAS are used in a wide range of products such as cosmetics, textiles, fire-fighting foams and food packaging materials.

“PFAS are even more stable than plastics. Their carbon fluorine bond is one of the strongest that you can make in chemistry – very, very thermodynamically stable,” said Scott Hopkins, project lead and a professor in Waterloo’s Department of Chemistry. “Because it’s man-made, there are very few natural things that can actually impact it.”

“Traditional water treatment methods are ineffective at destroying these chemicals,” said Hopkins. “Many smaller Canadian communities do not have the capacity to test for pollutants like PFAS or the ability to implement new water and wastewater treatment technologies. As a result, pollutants will stay in their ecosystems and biomagnify, or build-up, in the local food web.”

Hopkins has partnered with professor Franco Berruti from Western University, along with USP Technologies, Brown and Caldwell, the Ontario Clean Water Agency, Ontario Water Consortium, Canadian Water and Wastewater Association, and seven regional water supply systems in Ontario.

“To tackle large, complex issues like this, you need to engage many experts who bring unique and valuable skills to the table. Our team has leading experts in chemistry, chemical engineering, artificial intelligence, water treatment, policy and regulation,” said Hopkins. “We have members from academia, industry, non-profit, and government agencies, all invested in solving this problem.”

Samples will be taken from input and along various points throughout the treatment process. Researchers will focus on catchment areas of Union Water Supply System, Lake Huron Primary Water Supply System, Elgin Area Primary Water Supply System, Lambton Area Water Supply System, Peel Region, the City of Cornwall Water System, and the cities of Durham and London.

Hopkins and his team will focus on the detection, characterization, and use of machine learning models to predict the physicochemical properties of PFAS and the transformation products generated by the treatment processes.

“Our specialty in ion mobility and mass spectrometry allows us to separate complex mixtures and see what’s in them,” said Hopkins. “We also use machine learning to infer things about the chemical processes that we’re dealing with and find the optimal treatment conditions so we can make the best use of the instrumentation we have.”

Western will focus on the treatment as Berruti, and his ICFAR colleagues have already made considerable advances in the destruction of PFAS in biosolids using thermochemical treatment (pyrolysis), and in water via UV treatment. This work is done in collaboration with Domenico Santoro, senior manager, research and innovation at USP Technologies Inc. and adjunct research professor at Western.

“This (NSERC Alliance Option 2) funding allows us to further our advancements in best practices for removing forever chemicals from Canada’s water supply,” said Franco Berruti, a professor from Western University. “In partnership with industry, municipalities, and colleagues from the University of Waterloo, ICFAR is extremely proud of our expanding research activities aimed at developing new innovations in water purification while making a direct impact on the community.”

This joint research project will determine which PFAS are present in Ontario waters, determine the chemical and physical processes underpinning treatment technologies, and provide key information to inform Canadian water systems of potential PFAS contaminants and treatment options.

The project is funded by the NSERC Alliance Option 2 grant. Alliance grants encourage university researchers to collaborate with partner organizations, which can be from the private, public or not-for-profit sectors. These grants support research projects led by strong, complementary, collaborative teams that will generate new knowledge and accelerate the application of research results to create benefits for Canada. Under Alliance Option 2, NSERC provides increased financial support to research projects that aim to address important issues that directly impact society.