Sink to source: Does what we put into our plumbing end up back in the water supply?

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When you see an advertisement for a detergent promising to brighten your clothes, something called a fluorescent whitening compound, or optical brightener, is probably involved. Such material absorbs UV light

and emits visible blue light via fluorescence. The result? Brighter whites, vibrant colors. Yes, your clothes are glowing.

As it turns out, these brighteners can make their way into the water supply. Luka Vucinic, a lecturer and environmental engineer at Glasgow Caledonian University in London, considers the problem of pollutants like fluorescent whitening compounds, microplastics, and other indicators of fecal contamination in karst aquifers, and will present his team's findings next week during the European Geosciences Union (EGU) General Assembly 2024.

When limestone and dolomite dissolve, they can form spectacular caves and sinkholes characteristic of a karst terrain. Karst aquifers can also feature interconnected fractures that create conduits that channel water. These aquifers are a major source of drinking water around the world. Unfortunately, they're also exceptionally vulnerable to pollution. Features that connect Earth's surface directly with an aquifer can funnel pollutants into water supplies.

Ireland relies heavily on karst groundwater, and also has more than 500,000 homes using on-site domestic wastewater treatment systems that process water from toilets, washing machines, showers and dishwashers. After a pitstop in a septic tank, the systems disperse wastewater into the ground. To obtain an integrated picture of what's going into—and coming out of—these karst aquifers, Vucinic and colleagues evaluated a range of contaminants emerging from springs.

In areas with large numbers of on-site domestic wastewater treatment systems within 200 meters of at least one direct pathway into the underlying aquifer, the team detected high concentrations of fluorescent whitening compounds and microplastics. When fluorescent whitening compounds, which definitely come from humans, and microplastics rise and fall together in water samples, that covariation indicates that

microplastic contamination is probably coming from wastewater. Indeed, this is the first study to show such a link in samples from karst springs, Vucinic said.

Researchers who study other aquatic environments may be able to use the same approach to test for this link elsewhere. The methods used for detecting fluorescent whitening compounds are inexpensive and relatively easy to apply, Vucinic explained. "This could be especially attractive for monitoring human wastewater contamination of karst aquifers worldwide, especially in developing countries."

More information: Luka Vucinic et al, Understanding the impacts of human wastewater effluent pollution on karst springs using chemical contamination fingerprinting techniques, EGU General Assembly (2024). DOI: 10.5194/egusphere-egu24-11063

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