

The original article can be found here:

<https://cen.acs.org/articles/93/web/2015/11/Flushing-Toilets-Seawater-Protect-Marine.html>

Latest News

Web Date: November 10, 2015

Flushing Toilets With Seawater Could Protect Marine Life

Environment: Salty wastewater is less toxic to some marine organisms than freshwater, despite concern about disinfection by-products

By Deirdre Lockwood

In Hong Kong, about 80% of residents flush their toilets with seawater, thanks to a separate water distribution system set up in the 1950s. The approach conserves the city's scarce freshwater resources, and has also been adopted by smaller communities like the Marshall Islands. As coastal populations and water demand rise, this idea may become more attractive elsewhere, though some researchers have worried about

the release of potentially toxic by-products to coastal areas from treating seawater with chlorination. To the contrary, a new study suggests that the practice not only helps conserve freshwater but also may protect wildlife in marine ecosystems (*Environ. Sci. Technol.* 2015, DOI: [10.1021/acs.est.5b03796](https://doi.org/10.1021/acs.est.5b03796)).

Chlorination during standard wastewater treatment can introduce toxic chlorinated disinfection by-products to coastal zones. Because seawater has higher concentrations of bromide and iodide than freshwater, however, treating it with chlorine can also produce brominated and iodinated by-products that may be more toxic to marine life than chlorinated ones, according to lab studies.

Xiangru Zhang of the Hong Kong University of Science & Technology wanted to understand how the chlorinated effluent, whether fresh or saline, affects the coastal ecosystem. So he and his colleagues, including Susan D. Richardson of the University of South Carolina, designed a study of two



SALTY SANITATION

Flushing toilets with saltwater could cause less damage to coastal food webs than previously thought.

Credit: Shutterstock

organisms at the base of the marine food web, a marine polychaete worm and the alga *Tetraselmis marina*.

The researchers collected effluent from two wastewater treatment plants in Hong Kong that process saline water and one that processes only freshwater. They chlorinated the effluent, removed residual chlorine, as is typically done in treatment, and added it to seawater at concentrations ranging from 0% to 100%. The researchers exposed worm embryos and algae to these samples for 12 hours and 6 days, respectively, and monitored their development and growth.

At 44% fresh wastewater, none of the worms developed normally, whereas it took higher concentrations of the saline effluents—56% to 63%—to have a similar effect. At 100% freshwater effluent, the embryos died within three minutes. The team found similar trends with the algae experiments.

These results together suggest that the chlorinated saline effluent was generally less acutely toxic to the organisms than its freshwater analog, a result Richardson calls “shocking.” Because of previous toxicity studies of disinfection by-products, “we were expecting the opposite,” she says.

The toxic by-products may be less important in this case than the problem of introducing freshwater into a marine environment. The team tested whether the shock of freshwater exposure on these marine organisms could explain the results. They incubated the worms and algae with pure water at various salinities. Embryos exposed to water with a salinity corresponding to that of both types of wastewater developed abnormally, in a similar fashion to the results of the wastewater experiments.

Seawater flushing might therefore contribute to both water and wildlife conservation by avoiding exposing marine life to high doses of freshwater near outlet areas. However, Zhang notes that it is also important to study the chronic effects of ecosystem exposure to disinfection by-products.

David A. Reckhow, an environmental engineer at the University of Massachusetts, Amherst, says the study is important and breaks new ground in determining how using seawater for toilet flushing could affect ecosystems. “It’s a good indication for the future of the technology,” he says. Despite the challenges of building a separate distribution system, he says, “more coastal communities should consider this.” He notes, however, the study provides a baseline that should be followed up, especially with chemical analysis of the disinfection by-products present.

Chemical & Engineering News

ISSN 0009-2347

Copyright © 2018 American Chemical Society