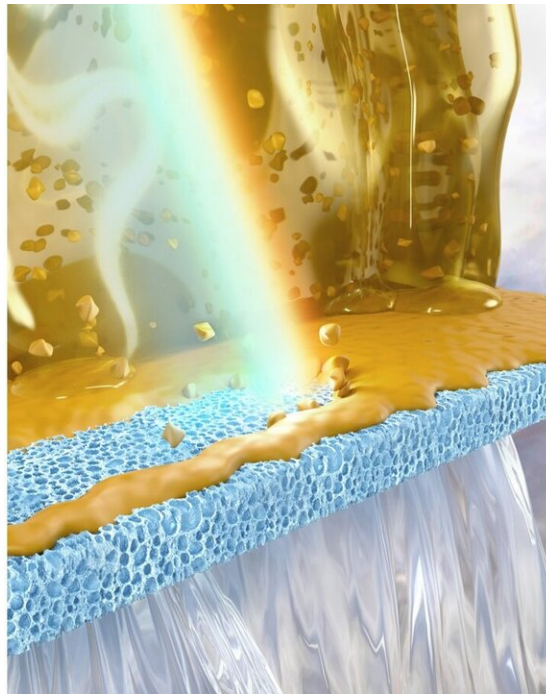


# Scientists create water filtration membranes that can clean themselves

August 20 2020, by Jo Napolitano

---



An artist's rendition of light-induced self-cleaning of a fouled membrane. Credit: Argonne National Laboratory

Scientists at the Department of Energy's (DOE) Argonne National Laboratory have developed a light-activated coating for filtration membranes—the kind used in water treatment facilities, at semiconductor manufacturing sites and within the food and beverage industry—to make them self-cleaning, eliminating the need to shut

systems down in order to repair them.

Cheap and effective, [water filtration membranes](#) have been around for years but have always been vulnerable to clogging from organic and [inorganic materials](#) that stop up its pores over time, a phenomenon known as fouling.

"Anything you stick in water is going to become fouled sooner or later," said Argonne senior scientist Seth Darling.

Darling is director of Argonne's Advanced Materials for Energy-Water Systems (AMEWS) Center, an Energy Frontier Research Center (EFRC) sponsored by the DOE.

"Almost all membranes used in the real world function by a physical mechanism, small holes that block whatever you are trying to filter out," he said. "But they are not doing any chemistry. That's what we've sought to change by putting a coating on the [membrane](#) that gives it chemical functionality."

"That's what differentiates our discovery from previous work in this area," said Seth Darling, senior scientist at the Department of Energy's Argonne National Laboratory. "The membrane can continue to be in service, eliminating the need to, for example, shut down a filtration system in order to clean or replace fouled parts."

While those who work in the area of water filtration have had some success in removing, cleaning and replacing fouled membranes, the process is far from ideal because it takes the membranes—and sometimes entire water treatment systems—out of service.

"What we're trying to do is prevent this entirely," Darling said.

He and his team's new, low-cost advancement is a game-changer for industries that rely on this type of technology.

The coating they use is based on [titanium dioxide](#), or  $\text{TiO}_2$ , which has been explored for water treatment applications for years because of its high stability, nontoxicity, low cost and biocompatibility.

Darling and his team took the technology a step further by adding a bit of nitrogen to the mix. The process, called nitrogen doping, makes the membrane sensitive to [visible light](#). The coating serves as a catalyst that breaks down foulants, releasing them from the membrane, thereby rendering it clean.

"Normal  $\text{TiO}_2$  would work but only with [ultraviolet light](#)," said Huiru Zhang, a graduate student who worked on the project. "That might make sense in some situations, but it is far less accessible than visible light."

Compared to regular  $\text{TiO}_2$ , nitrogen-doped  $\text{TiO}_2$ -coated membranes display a 24-fold higher photocatalytic efficiency under sunlight.

Argonne's success in this area is unique: Never before had scientists been able to make membranes clean themselves while they are still functioning as a filter.

"That's what differentiates our discovery from previous work in this area," Darling said. "The membrane can continue to be in service, eliminating the need to, for example, shut down a filtration system in order to clean or replace fouled parts."

Darling and his team recently published their findings in the journal *Advanced Functional Materials*.

"In principle, our discovery can be used anywhere membranes are in

water, and even as a coating on other components in water systems," Darling said.

**More information:** Huiru Zhang et al, Visible-Light-Activated Photocatalytic Films toward Self-Cleaning Membranes, *Advanced Functional Materials* (2020). [DOI: 10.1002/adfm.202002847](https://doi.org/10.1002/adfm.202002847)

Provided by Argonne National Laboratory

Citation: Scientists create water filtration membranes that can clean themselves (2020, August 20) retrieved 10 July 2024 from <https://phys.org/news/2020-08-scientists-filtration-membranes.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.