

Green Cleaning with Engineered Water

Stabilized Aqueous Ozone is a powerful substance that can be used to disinfect and clean most surfaces.



The Impact

Transitioning to Stabilized Aqueous Ozone (SAO) as a cleaning solution can eliminate the use of all cleaning chemicals. Since the solution is created using tap water in the building, filling up a reusable spray bottle, the use of SAO also greatly reduces plastic waste associated with single-use cleaning containers. The solution has no safety concerns, meaning that switching to SAO has a great, positive, impact on users' health.

Where It's Been Implemented

Stanford University began using SAO in 2014 with an experimental pilot in a sorority house. The solution is now used in 92 buildings on campus, with about 8,800 residents benefiting from it. Both custodians and students use the solution, dispensed through Tersano's Lotus Pro machine. Stanford estimates that, with SAO, it now avoids purchasing (and disposing of) 5,500 gallons of chemicals a year.

Other notable case studies using SAO products include the Colorado Convention Center and Arkansas's Clinton International Airport. Companies using SAO technology for cleaning include Bank of America, Google, Domino's, AstraZeneca, UC Davis, Procter & Gamble, Microsoft and Nestle.

Description

SAO is created by using electricity to add an oxygen molecule to O_2 , creating ozone (O_3) which is then infused with tap water. In the natural environment, a similar process takes place when sunlight transforms oxygen molecules in the air into ozone. For 24 hours after its creation, SAO can kill 99.99

percent of viruses and bacteria. SAO also works against odors, mold and mildew. After 24 hours, SAO no longer works as a disinfectant (but still works as a cleaner) as it begins to convert back into water and oxygen. After a week, the solution will have fully converted back into water and oxygen, meaning that it is completely safe to dispose of the solution.

SAO can be used to clean almost any surface, including glass, showers, sinks, toilets, counters, floors, carpet, clothing stains and laundry, appliances, and other furniture.

To create SAO, one needs to first install a machine to a sink and have access to electricity. For individuals, there are handheld devices (similar to a spray bottle) that create SAO when filled with cold tap water. Tersano's products have a Green Seal Approval, are NSF Registered Products, are compliant with LEED (Leadership in Energy and Environmental Design) requirements, and have a 0-0-0 safety rating (on a scale of 0-4 for health, flammability, and physical hazard, SAO has a 0 rating for each category). Other companies that sell aqueous ozone machines, such as Clean Core, have similar safety ratings and green approval.

Key Drivers

There are a variety of negative impacts of cleaning products on human and environmental health.

In general, cleaning chemicals can cause a variety of symptoms (depending on the type of chemical and ingredients of the cleaning products), including sore throats, headaches, skin rashes, irritated eyes, shortness of breath, nosebleeds, coughing/wheezing and asthma. Volatile organic compounds (VOC) in cleaning products can negatively affect air quality indoors and outdoors. Bleach can cause asthma over time and cause asthma to worsen. Bleach can also irritate eyes and skin.

Cleaning chemicals enter the environment through evaporation or by going down the drain. Many ingredients in cleaners are toxic to aquatic species and can cause reproductive problems for wildlife if the wastewater is not cleaned properly. Furthermore, cleaning product ingredients that contain nitrogen and phosphorus can contribute to waterways' eutrophication (oxygen depletion caused by excess nutrients and plant growth).

Even Green-Seal—approved cleaning products can have health concerns.

Key Factors for Success

A key factor for successful implementation of SAO is support from custodians and/or other users of the solution. Easily available resources, presentations about SAO, trainings about how to clean with SAO as well as the new cleaning practices, and surveys to identify any issues are all important in transitioning to using SAO as the primary cleaning product.

Key Obstacles

One main obstacle to implementing SAO in buildings is that it completely changes the way people clean. It may be difficult to convince people to break habits as well as accept that SAO works as well as the chemicals they previously used. Because SAO does not have a smell, does not come packaged in an official bottle, does not whiten and can be used for all surfaces, it can be difficult to believe in its effectiveness. Stanford Sustainability and Utilities Manager Kristin Parineh found that the best way to combat these obstacles was to prove SAO works by showing each custodian bacteria testing done on surfaces cleaned with SAO. Another solution is investing time in education about the product and how it is used as well as investing in new equipment (e.g., mops, towels, buckets, spray bottles) to show the custodians that they are valued.



Another obstacle is paying the upfront cost of the machine and installation, which can cost around \$1,500 to \$2,500 (depending on the building setup). However, after the initial costs, using SAO means no chemicals need to be purchased in the future. Stanford estimates the payback period to be between two and a half to five and a half years; this estimate only looks at chemical cost savings and does not take into account employee health savings, environmental health savings, or increased water and electricity costs. Furthermore, since the machine can dispense as much SAO as desired, multiple residents/businesses/groups in a building can split the cost of one machine that they all share or otherwise consider how multiple parties can split the cost and share the machine.

Timeline to Implementation

Stanford has been working on implementing SAO cleaning on campus since 2014, ensuring that in each building with SAO, the custodians and/or residents are educated about the product and are convinced of its effectiveness.

The timeline for each building and organization will be different, depending on building size, size of the custodian staff (or number of residents), and organization priorities.

References and Resources

- Kristin Parineh, Sustainability and Utilities Manager, Stanford University, kparineh@stanford.edu
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- Safety Data Sheet for Tersano lotus® PRO SAO Dispenser & iClean mini, https://cdn.shopify.com/s/files/1/0298/2389/3557/files/SDS_lotusPRO_iClean_mini_EN_191111.pdf?v=1607372423
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