CASPR™

EXECUTIVE SUMMARY

# Hydrogen Peroxide Shines as a Non-Corrosive Sanitation Agent

*There was nominal degradation despite higher concentration & exposure*

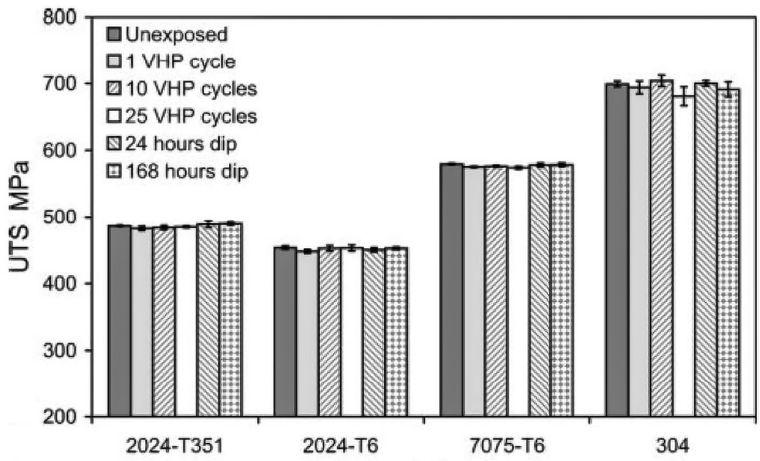
The ability of hydrogen peroxide ($H_2O_2$) to serve as a decontaminant has been known for some time, but its effects on commercial-grade materials, like those commonly used inside aircraft cabins, was previously unstudied.

Two white papers sponsored by the U.S. Office of Aerospace Medicine shed light on the benefits of vaporized hydrogen peroxide (VHP) sanitation treatments for aircraft applications. At CASPR, we believe these findings can also be applied to similar materials that are used across multiple industries, especially with technologies that produce much smaller concentrations of hydrogen peroxide onto surfaces.

The studies analyzed and summarized the effects of VHP on several commercial-grade materials often found in aircraft interiors, specifically:

- 2024-T351, 2024-T6 and 7075-T6 aluminum
- 304 stainless steel
- Carbon fiber/epoxy composites
- Glass fiber/epoxy composites (including FR4 laminate materials used for printed circuit boards)

Overall, findings showed hydrogen peroxide to be a safe sterilization agent to use with all materials studied, particularly when it is used in vapor form.




The VHP application process involved four distinct treatment phases:

- Dehumidification
- Conditioning
- Sanitation/decontamination
- Aeration to remove residual vapor

Tensile properties of the tested metallic samples were unaffected by exposures to either the vapor phase or to 35% liquid hydrogen peroxide.

The figure above illustrates this finding, showing how the different aluminums and stainless steel fared against a single VHP cycle, 10 cycles, 25 cycles, a 24-hour liquid dip and a 168-hour dip.

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*Our technology is safe for both people & surrounding spaces in most applicable settings*

There was nominal degradation despite a higher-than-usual concentration and exposure, including no discernible differences to the surfaces of the samples.

The studies also found that the carbon fiber/epoxy, glass fiber/carbon fiber epoxy, and the FR4 printed circuit-board materials exhibited no significant changes in flexural strength or strain at peak load after 10 VHP exposures.

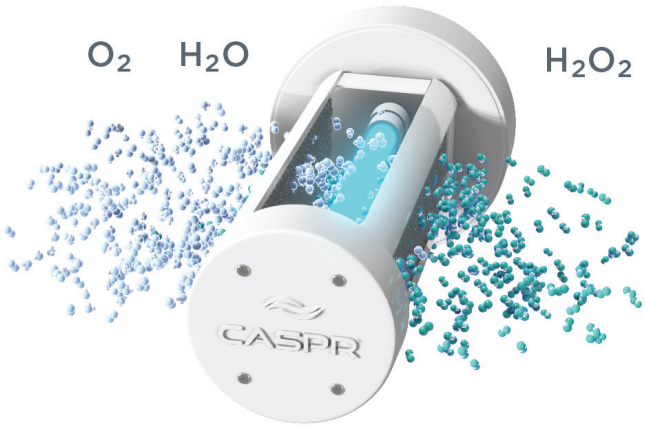
Some mechanical degradation in the composite samples was observed, however, after 168-hour exposure to 35% liquid hydrogen peroxide. Consequently, condensation of any kind should always be avoided as much as possible while applying hydrogen peroxide sanitation treatments.

When administered properly, the studies conclude VHP decontamination treatments have no harmful impact and leave no noticeable changes on any interior aircraft cabin materials.

## Applications for Continuous Air and Surface Pathogen Reduction

Given the minimal impact of such high concentrations of VHP used in the these studies, it stands to reason that hydrogen peroxide-based cleaning technologies that use lower concentrations of $H_2O_2$ can be deployed in a variety of settings and industries without major concern for degradation of surrounding materials and objects.

At CASPR, our mobile and in-duct disinfection technology uses a proprietary Natural Catalytic Converter ($NC^2I$) process that extracts oxygen and moisture from ambient air and then produces and continuously delivers between .01 and .04 ppm of gaseous hydrogen peroxide, a concentration level 8,300 times less than those used in these studies.




In addition, our products react with water molecules found in the humidity of the surrounding air to continuously create hydrogen peroxide molecules, which exit the duct and disperse throughout the targeted area, coating all surfaces with highly effective oxidizing molecules that reduce the bio-burdens of local pathogens. As a gaseous form of hydrogen peroxide, our technology prevents the wet residue reported in these studies, making our products non-corrosive on surfaces in any environment.

**This means our technology is safe for both people and surrounding spaces in most applicable settings, including hospitals, schools, churches, airports, restaurants and more.**

**Sources**

"Evaluation of the Effects of Hydrogen Peroxide on Common Aircraft Electrical Materials", DOT/FAA/AM-10/5, March 2010

"Evaluation of the Effects of Hydrogen Peroxide on Common Aviation Structural Materials", DOT/FAA/AM-09/23, December 2009