

# Scientific Report Examines Oxidize It™ Technology



Dr. Sheila Baker, Professor in the Department of Chemical Engineering at the University of Missouri-Columbia, scientifically examined the technology behind the Oxidize It™ Detergent-Less Laundry Solution. In her paper, Report On Ozone Laundry Systems, Dr. Baker finds that “Ozone does work for removing stains,” examining how it works, its effectiveness, as well as the threefold benefits of ozone. Below are excerpts from that report.

## Summary

Ozone does work for removing stains from laundry. It works through an oxidation mechanism whereby ozone and an OH radical, a breakdown product from ozone and water, can both work as oxidants. Ozone is a superb antimicrobial agent and can eliminate even superbugs when used properly.

Also, ozone is very economical. It works best in cold water and relaxes the fabric so

no softener is required and shortens drying times.

## History

Ozone for commercial laundry applications was first introduced in the late 1970s-early 1980s in penal institutions but their performance was poor. (1) A second generation in the 1990s had better performance, and their performance has increased since then due

mostly to a better understanding of how these systems work. By 2009, there were over 4,000 commercial laundry facilities that were using ozone laundry systems. (1) Some newer systems today offer controlled and variable levels of ozone and sensors that monitor and sometimes control ambient ozone levels.

## How Ozone Works

Ozone does work for removing stains from laundry. It works through an oxidation mechanism whereby ozone and an OH radical, a breakdown product from ozone and water, can both work as oxidants. Ozone is a superb antimicrobial agent and can eliminate even superbugs when used properly. Also, ozone is very economical. It works best in cold water and relaxes the fabric so no softener is required and shortens drying times. Due to the cold water and shorter dryer times, fabric life is often extended. As for whitening abilities, ozone is similar to hydrogen peroxide.

The method for cleaning by ozone in water is based on two reaction mechanisms – a direct and an indirect mechanism. (2, 3, 4) The direct method occurs when ozone acts as the oxidizer itself to break chemical bonds. The indirect method involves ozone reacting first with water to produce OH-radicals followed by the OH-radicals oxidizing chemical bonds. When ozone and OH-radicals come in contact with soils and stains in linen, they help break chemical bonds to release the stain or soil. One kind of reaction (direct or indirect) will dominate, depending on various factors, such as temperature, pH and chemical composition of the water. The higher the pH and temperature, the more OH-radicals will be produced. While OH-radicals have even greater oxidizing power than ozone, they are very short-lived in solution.

## Effectiveness

Ozone is considerably more effective at lower water temperatures such as cold or ambient temperature water. This is due to its increased stability and higher solubility at lower water temperatures. Thus, it is recommended to use ozone on cold water cycles. This saves energy from not needing to heat the water.

In a recent study, when compared to hydrogen peroxide, ozone utilized in cotton preparation was able to obtain a Stensby degree of whiteness of 81 of scoured samples which was comparable to hydrogen peroxide. (5) Further, no strength loss of the fabric was observed. As compared to chlorine bleach, the levels of ozone present may not always be high enough to offer the same level of bleaching stains. (1) For these cases, some chlorine may be required in conjunction with ozone to achieve the highest effectiveness. If a bleach cycle is required, a scouring agent (acid) or multiple rinse cycles may be required to lower the pH so as to prevent skin irritations. However, ozone can often be used with colored fabric without the concern for bleaching the fabric, unlike chlorine bleach. Further, for disinfection purposes, you can use ozone alone instead of bleach.

Ozone can reduce or eliminate the need for fabric softeners. Fabric softeners increase drying times due to the way they coat fabrics. However, the way in which ozone and

oxygen assist in relaxing the fabric, more water is extracted during the spin cycle so that less drying time is needed.

Due to the cold water and shorter dryer times, fabric life is often extended. Basically, ozone oxidizes the soil in the fabric allowing it to detach easier.

## Benefits of Ozone

The reported benefits of ozone are three-fold: economical, microbiological, and environmental.

### Economical

A California hotel conducted a study over a 2-month period in a facility with 104 rooms to compare traditional an EcoTex ozone laundering system. (1) They found the annual costs of ozone vs. traditional laundry was less in the categories of electrical (30% savings), natural gas (81% savings), chemical (21% savings), water (26% savings), and labor (39% savings). A 2012 hotel study entitled ‘Ozone Laundry – 95 Room Hotel Payback Study” showed similar results and a savings of almost \$780 per month. (6) They found that the ozone laundry system saved over 47% of fuel costs for boiler and dryer operation, with a 74% savings for the boilers (hot water) alone. In addition, the system eliminated softener costs, reduced electrical costs for the washers and dryers by about 13%, and reduced linen replacement costs by 10%.

### Microbiological

Ozone has been shown to effectively control, disinfect, and/or totally eradicate microorganisms normally found in soiled laundry in many studies.<sup>1</sup> For example, one study found that several microorganisms such as E. coli and many types of viruses were eradicated within minutes by ozone cold water laundering. (7) Even more impressive, the same was found for two superbugs (MRSA and C. difficile). These superbugs are often resistant to traditional hot water laundry processes. However, the disinfection is a time-dependent process. Ozone is effective in killing bacteria in 3 minutes and viruses in 6 minutes. So, in this aspect ozone laundry system out perform traditional systems. It is recommended that laundry wash cycles be 10-12 minutes in order to determine a concentration over time value that is the recommended method to report compliance with U.S. EPA disinfection requirements of drinking water.

### Environmental Impacts

The use of ozone for laundry also has environmental benefits. The strong oxidizing power of ozone and OH-radicals initiate the conversion of most organic components of the soiling materials into more readily biodegradable byproducts. (8) The discharged water from laundry wastewater systems that use ozone typically contain higher levels of oxygen which benefits receiving streams, lakes, and rivers by providing oxygen for the

natural microorganisms to do a better job of breaking down discharged pollutants into carbon dioxide and water. (8)

## About Dr. Sheila Baker

Sheila Baker is a professor in the Chemical Engineering Department at the University of Missouri. Her research is focused on designing task-specific ionic liquid systems, nanomaterials and their hybrids for clean energy applications. She is working on developing novel nanofluids designed for efficient and reversible carbon dioxide capture from flue gas. Her research also includes the development of designer ionic liquids as electrolytes and novel nanomaterial components for photovoltaic, battery and capacitor applications. In addition to these aims, another topic being pursued in her labs involves environmental sensors and studies of the impact of nanomaterials on the environment.

## References

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