FOOD & BEVERAGE

INDUSTRY-SPECIFIC APPLICATIONS FOR UV TECHNOLOGY

APPLICATION: Microbiological Inactivation, Chlorine & Chloramines Reduction, Ozone Reduction
SYSTEM SERIES: SwiftBeverage®, OptiVenn®, Avant, Logic®, VL

UV is a proven and reliable water treatment technology that has been utilized by leading brands in a diverse range of food & beverage facilities including bottled water, food packaging, meat & poultry processing, and carbonated & non-carbonated beverages such as concentrates, soft drinks, tea, and beer.

UV systems can be installed in locations throughout the plant to solve multiple water treatment challenges. Whether it's treating process water or the product water that will be used as an ingredient in the final product, UV can help ensure product quality and regulatory requirements are being met. The technology can effectively & efficiently inactivate microorganisms as well as reduce chlorine/chloramine and ozone in the water. UV can be used as an alternative to carbon filters and heat pasteurization processes.

How UV Works

UV systems are essentially made up of a stainless steel chamber that houses UV lamps and a panel that monitors and controls its operation. When water enters the chamber, treatment occurs as water passes by specially designed UV lamps. The speed and efficiency of the treatment process allow the footprint of UV systems to be relatively small with no need for storage or contact tanks.

The UV inactivation process adds nothing to the water but UV light, and therefore does not impact the taste, odor, or color of water. This is particularly beneficial when treating product water for beverages.

UV is treating water in facilities such as:

- Bottled water
- Food packaging
- Carbonated and non-carbonated beverages (including treatment of liquids with low UVT such as sugar syrups)
- Meat and poultry processing

Benefits of UV:

- Contact time required is minimal
- Compact system footprint
- No impact on taste, odor, or color

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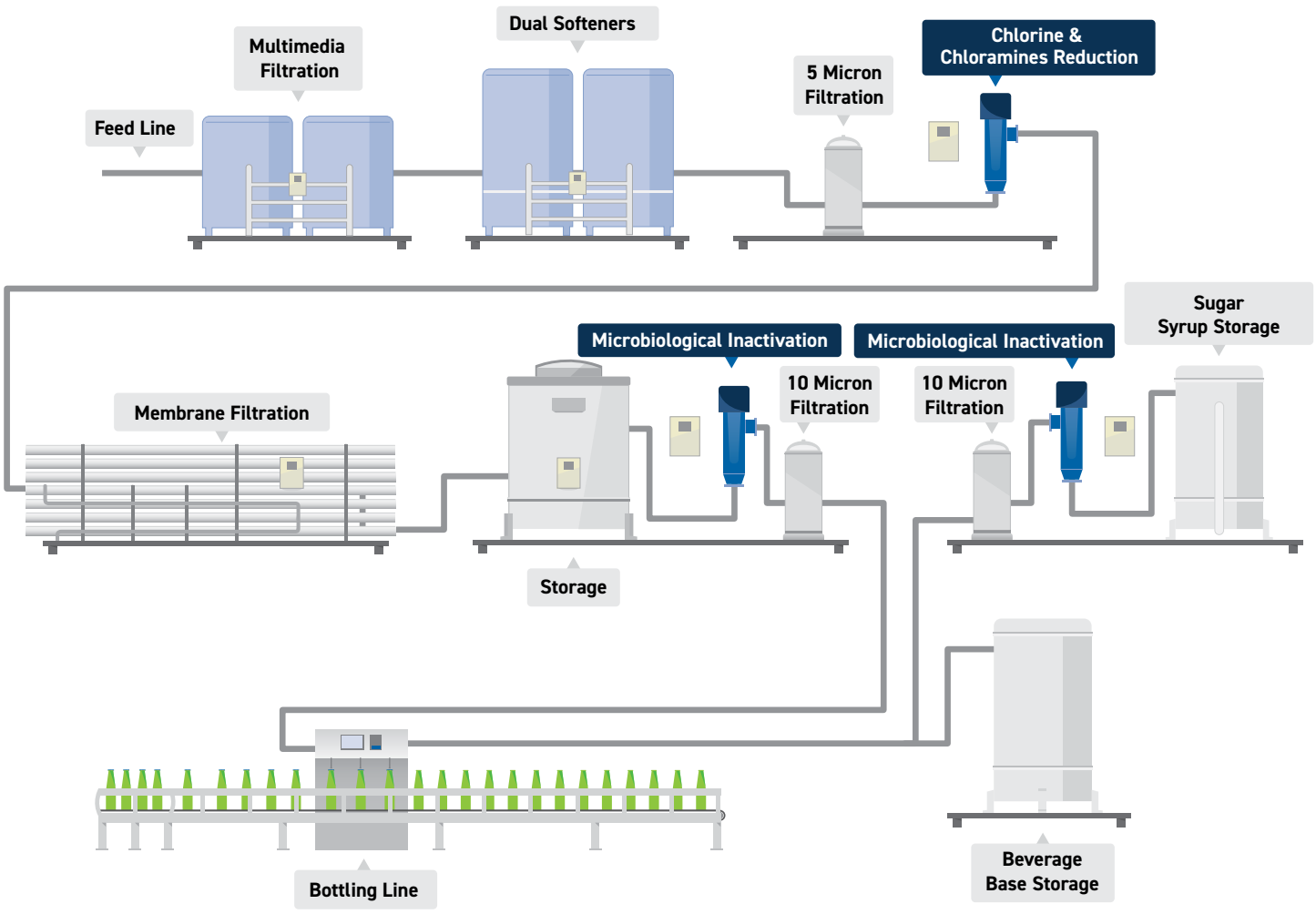
Typical Beverage Installation with UV Treatment



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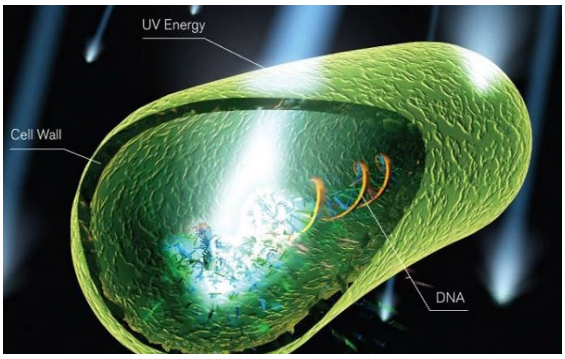
Microbiological Inactivation

UV is highly effective at inactivating microorganisms* which has been proven in industrial installations around the world and in other applications; from small household UV systems to some of the largest municipal water treatment plants around the world, including our systems that treat the drinking water for New York City.

There are multiple locations throughout a food and beverage facility where UV can be installed to treat microorganisms. Some typical locations would be points-of-fill, points-of-rinse, post-carbon filter, pre-membrane filtration or reverse osmosis, post-water, and pre-syrup storage tanks.

*Specific UV systems manufactured by Trojan Technologies have been validated through microbial testing. Through this testing, performance data has been generated for UV dose delivery to inactivate Escherichia coli (E. coli), fecal coliform, Poliovirus, Cryptosporidium, Giardia, and Adenovirus. For a detailed list of UV systems and target organisms, visit www.trojantechnologies.com/en/support/treatment-claims



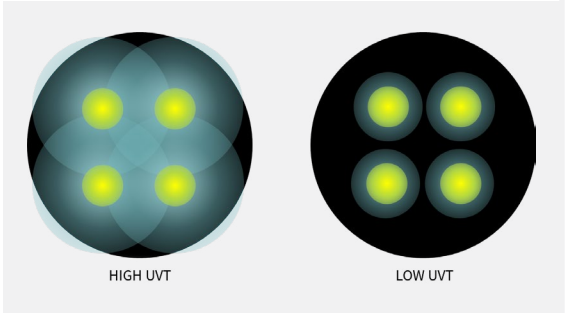
When microorganisms are exposed to wavelengths of UV light, their DNA is damaged, and they are instantaneously rendered incapable of reproducing.

Treatment of Sugar Syrups & Low UVT Fluids

It's a common misconception that UV cannot treat cloudy or darker fluids, such as sugar syrups. On the contrary, UV can be very effective at treating these liquids. UV's effectiveness is not limited by the color or other visual characteristics of the fluid being treated, but to its UV Transmittance (UVT).

UVT is the ratio of light entering a fluid to that exiting the fluid. Simply put, fluids with high UVT allow more UV light to reach the organisms you are trying to treat. Fluids with a low UVT reduce the amount of UV light that is able to penetrate and provide treatment.

The UVT of a fluid is impacted by the concentration of chemicals and particles, whether visible to the human eye or not, that absorb or deflect UV light. As a result, UV's effectiveness cannot be assumed based on a fluid's visual appearance. UVT must be assessed with testing equipment, which is easily done by sending a sample to our in-house labs. We have years of experience and the latest technologies to measure the key parameters of your water or fluid which helps ensure a UV system is built to meet your specific treatment objectives.



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An Alternative to Thermal Treatment of Sugar Syrups

If left untreated, microorganisms in sugar syrups can cause food discoloration, adverse flavors, undesired odors and reduced product shelf-life. For those products that can tolerate the temperature, heat pasteurization may be an option. Although thermal treatment has been known to lead to the potential formation of possible carcinogens such as Hydroxymethylfurfural (5-HMF)1. As an alternative, UV can provide some significant benefits:

- **UV can treat thermophilic spores that are tolerant to pasteurization**
- **UV can be less energy-intensive and therefore less expensive to operate**
- **UV often has a smaller footprint**

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Chlorine & Chloramine Reduction

Municipalities are required to add a residual to drinking water to ensure the control of microorganisms in their distribution lines. This is done with chlorine or chloramine, with many now turning to monochloramine as the residual of choice because it has better chemical stability, stays longer in the water distribution network, and generates a much lower level of by-products.

While controlling microorganisms is a critical step for municipalities, it can cause an extra pre-treatment step for food & beverage producers. If left in the incoming facility water, chlorine & chloramine can potentially damage metal piping and degrade rubber, such as o-rings, gaskets or seals. It can also potentially negatively impact the flavor of any beverage to which it's introduced, leaving a metallic or chemical tang.

Did you Know?

Monochloramine, a type of chloramine, is becoming the residual of choice for many municipalities because it:

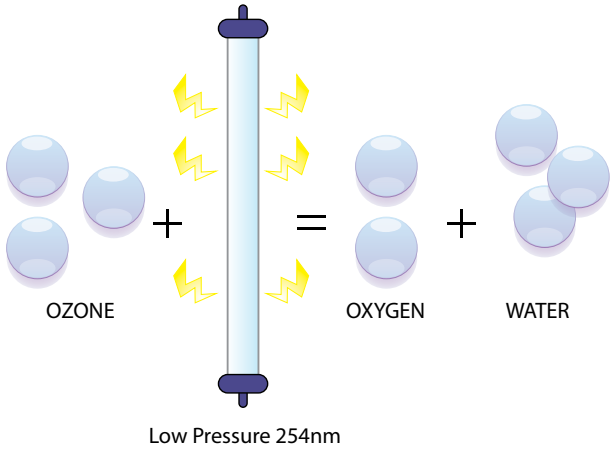
- Has better chemical stability
- Stays longer in the water distribution network
- Generates a much lower level of by-products

An Alternative to Adsorption Dechlorination

We pioneered UV dechlorination technology which can augment or replace adsorption dechlorination. Adsorption dechlorination uses carbon filters; most commonly granular activated carbon for the removal of chlorine and catalytic carbon for the removal of chloramine. Monochloramine can be significantly harder to remove with carbon. The treatment process requires an extended period of contact time, which comes with the risk of carbon beds becoming a breeding ground for bacteria to thrive and grow. Carbon filters also require backwashing & sanitization and a larger footprint compared to UV.

Ozone Reduction

Some food and beverage plants use ozone to treat microorganisms and degrade organic contaminants. A drawback to this treatment method is that the resulting residual ozone that is left in the water can potentially damage downstream equipment and impact the desired quality of product water. A UV system installed post-ozone can help solve this problem by breaking down ozone and reducing its concentration in the water.



When exposed to UV light, the ozone residual absorbs the light which breaks it down to its elemental components of oxygen and water.

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UV Systems for Food & Beverage Treatment

All our products are backed by our Lifetime Performance Guarantee** and global customer support that is available from our Authorized Distributor Network and our 24/7 Technical Assistance Center.

SwiftBeverage Series

Bioassay validated treatment

Flow range: 106 - 832 GPM (24 - 189 m³/h)

OptiVenn Series

High-performance, cost-effective system for mid-flow applications

Flow range: 12 - 2,200 GPM (3-500 m³/h)

Certified to EC 1935/2004

Avant Series

Compact, skid-mounted design for flexible, low-footprint installation

Flow range: 50 - 900 GPM (11 - 204 m³/h)

Certified to EC 1935/2004

VL Series

A compact design and economical system for low-flow applications

Flow range: 11 – 20 GPM (2.5 – 4.5 m³/h)

Logic Series

For high-flow applications and features the industry's most advanced low-pressure, high-output amalgam lamp technology

230 - 8,141 GPM (52 – 1,850 m³/h)

** With every system we provide a performance policy that, when you use genuine Aquafine parts, it guarantees that your system will meet the treatment requirement specified at purchase, provided that the system's original design parameters haven't changed (e.g., flow rate, UV transmittance) and maintenance is completed per the UV system's O&M manual.

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We're Here to Help

If you have questions about UV and your application, call us at (888) 220-6118, visit **trojantechnologies.com/contactus,** or contact your local **authorized Aquafine sales and service representative.**

References

1: Unlike glucose and sucrose, fructose is prone to 5-HMF conversion due to its relatively unstable ring structure (van Dam et al., 1986). 5-HMF formation in the food industry is typically the result of heat processing and inadequate storage conditions. 5-HMF at 250 mg/L in HFCS was shown to be toxic to honey bees and has subsequently been implicated in colony collapse disorder (LeBlanc et al. 2009). In rats, furan has been shown to be carcinogenic at concentrations between 2-8 mg/kg; prompting International Agency for Research on Cancer to declare that it is "possible carcinogenic to humans" (IARC, 1995). In carbonated drinks HMF content was found in the range of 7.8-0.17 mg/L, grape juice- 12 mg/L, apple juice- 8.87 mg/L, jujube juice- 22.53 mg/L (zhang et al, 2012)

To learn more about the brands and affiliates of Trojan Technologies, please visit www.trojantechnologies.com

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