LIFE SCIENCES

INDUSTRY-SPECIFIC APPLICATIONS FOR UV TECHNOLOGY

APPLICATION: Microbiological Inactivation, Ozone Reduction, Chlorine & Chloramine Reduction, TOC Reduction
AQUAFINE® UV SYSTEM SERIES: OptiVenn®, VL, Avant

Trojan Technologies has the largest installed base of applications in the Life Sciences industry, meeting the demands of USP and WFI applications.

UV Technology

Regulations place not only a responsibility on the process design engineers, but also on manufacturers of water treatment systems. Trojan Technologies can supply your pre-treatment or process stream with consistent and reliable dosage levels needed to meet USP or WFI specifications.

Aquafine ultraviolet (UV) systems are engineered to focus the power of concentrated UV light utilizing one or several specially designed Aquafine Colorguard™ UV lamps, recognized in the industry for performance and reliability.

Benefits of UV:

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

UV Technology for Life Sciences

For over 70 years, Aquafine UV systems have been successfully serving the diverse Life Sciences industry. Aquafine UV systems are reliable, deliver consistent performance, and have become the brand of choice of WFI (Water-For-Injection) & USP (United States Pharmacopoeia) systems. Aquafine systems are found in both the pre-treatment and process areas of the water system. While commonly found in microbiological inactivation and ozone reduction applications, our low-pressure (LP) and low-pressure high-output (LPHO) systems also can be found in TOC (total organic carbon) reduction and chlorine/chloramine reduction applications.

Trojan Technologies offers validated systems, providing UV lamp and NIST traceable UV sensor certificates. All systems comply with cGMP and FDA requirements, and sanitary connections conform to DIN and USDA 3A standards. Select models carry the marks of cULus, CE and ANSI/NSF and can be mounted horizontally or vertically, or in skid mounted systems, maximizing installation flexibility and preserving floor space.

With Life Sciences UV system designs unparalleled in performance, Trojan Technologies is committed to providing superior quality and the latest advancements in UV technology.

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.

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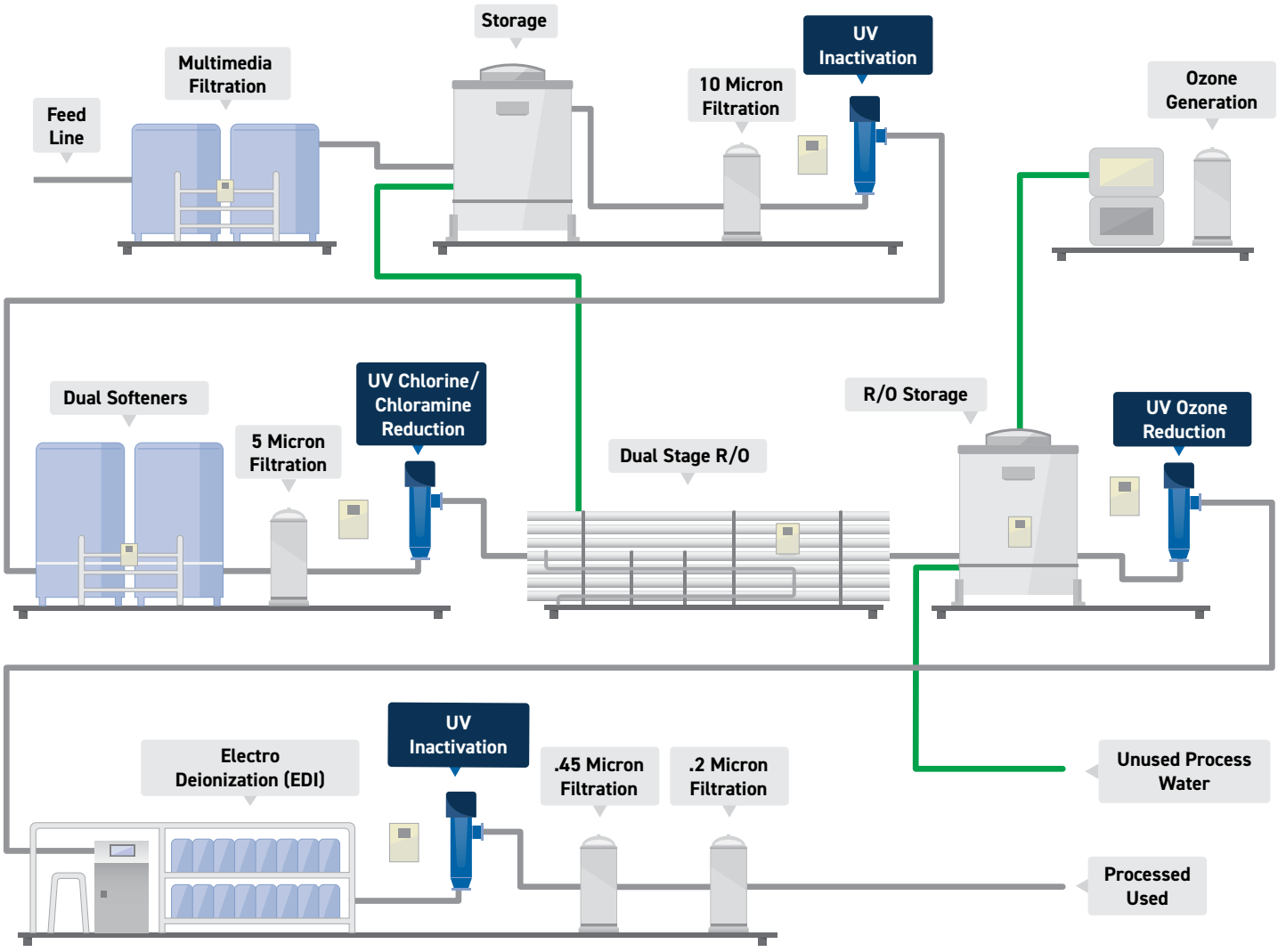
Typical Life Sciences Water Treatment Installation with UV



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Microbiological Inactivation

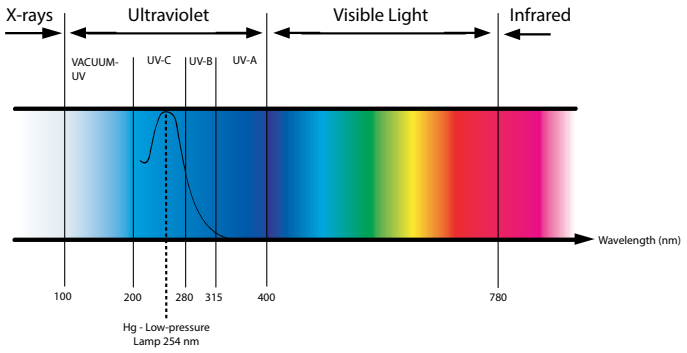
Ultraviolet (UV) light, a form of light that is invisible to the human eye, occupies the portion of the electromagnetic spectrum between X-rays and visible light. A unique characteristic of UV light is that rays in a specific range of its wavelengths, between 200 and 300 nanometers, are capable of inactivating microorganisms.*

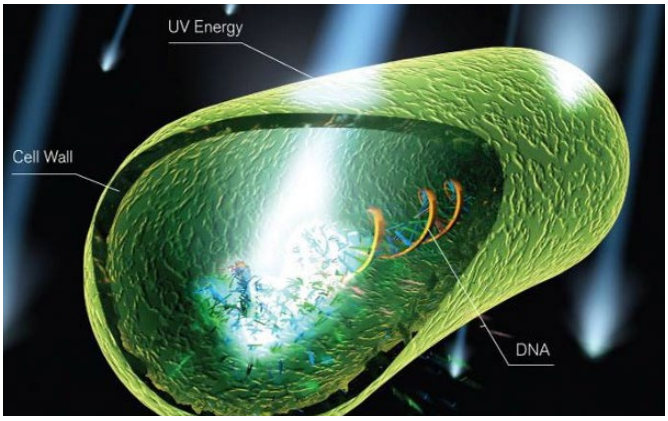
This is the most common application of UV light in water treatment. A pharmaceutical water system could have several locations where UV equipment would be installed. Some typical locations of installation would be post-carbon filter and pre-RO (reverse osmosis). When installed downstream of the carbon bed and/or directly upstream of the RO unit, a UV system can significantly reduce the microbial counts by inactivating the microorganisms present in the influent stream. Inactivation is also recommended for the process distribution loop and pre storage tank.

*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.

ELECTROMAGNETIC SPECTRUM

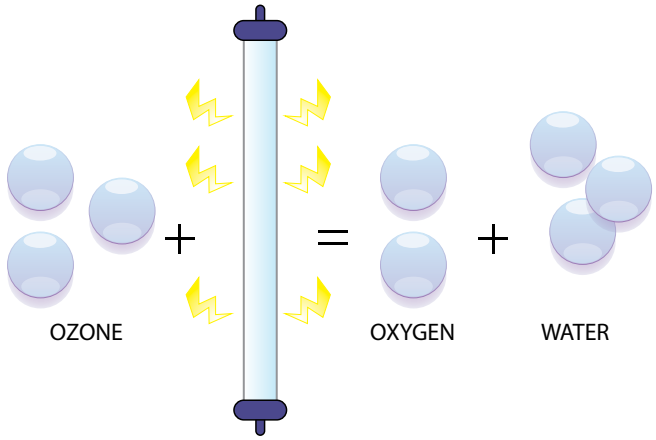




Ozone Reduction

Ozone is commonly used in the pre-treatment area of a water system, as well as for sanitizing process and recirculating systems. Prior to the point-of-use, the residual ozone needs to be reduced to ensure the process water is not compromised. Because it is a fast-acting mechanism, UV technology is the preferred method for this application. After considering the appropriate variables, a properly sized UV unit can be guaranteed to reduce the ozone to non-detectable limits, ensuring the integrity of the process and the product. A dosage of 90 mJ/cm² is recommended for reduction of ozone residuals of 1.0ppm.

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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Chlorine & Chloramine Reduction

While the addition of chloramines to municipal water may control microorganism levels, they have undesirable effects on the degradation of membrane filtration or RO. But popular methods of chloramine removal, such as carbon beds or chemical injection, have proven to be problematic. Sodium metabisulfite involves replacing one chemical with another and creates food for micro-organisms, while carbon beds can be inefficient, vulnerable to channeling, and provide breeding grounds for microorganisms.

UV technology using low-pressure lamps is a highly effective, versatile, and reliable method to address chloramine reduction. Studies have demonstrated conclusively that chloramine residuals up to 4 ppm can be successfully reduced to <0.02 ppm by the application of UV light. The breakdown products from treating monochloramine with UV are primarily non-hazardous ionic species and subsequently removed by the downstream RO system. At typical pH and dissolved oxygen levels in municipal treated waters, ammonia formation is negligible. .

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.

Water for Injection (WFI)

WFI is produced by a distillation or reverse osmosis (RO) process that removes chemicals and microorganisms from water. High intensity UV lamps are proven to reduce endotoxins, microbial loads, TOC, residual ozone, and chloramines. WFI that features UV inactivation affords several advantages over auxiliary purification methods including efficacy, cost, and customization of configuration.

A Trojan Technologies water treatment system produces WFI through reverse osmosis and UV inactivation. The water enters a WFI skid and is pretreated to remove particulates with multimedia filtration, a water softener, and 5 micron filtration stage. The water's chlorine and chloramines are then UV inactivated before undergoing reverse osmosis to remove organics, colloids, and microbes. Water is then stored and further purified in an ozonated storage tank before passing through a UV light chamber for ozone removal. Refinement continues with electro deionization and additional UV Inactivation before passing through .45 micron filtration and .2 micron filtration. The end result is ideally pure WFI that is compliant and ready for multiple points of use.

For applications that rely on high quality water of the utmost purity, WFI with UV inactivation is superior to its alternatives due to the meticulous production processes and the high level of regulatory oversight involved, which permit only the lowest amounts of contaminants. That WFI meets and exceeds these standards is why pharmacopeias like US Food and Drug Administration (FDA), the World Health Organization (WHO), European Pharmacopoeia (EP), and United States Pharmacopoeia (USP) deem it acceptable for use in the production of injectable drugs and other pharmaceutical products.

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UV Systems for Life Sciences 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.

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)

** 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.**

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

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