



XENON PULSE LIGHT GAINING TRACTION AS AN EFFECTIVE WAY TO DISINFECT

THIS WHITE PAPER EXAMINES THE DIFFERENT WAYS TO THINK ABOUT THE IMPACT OF LIGHTING ON THE ELIMINATION OF VIRUSES AND PATHOGENS IN WORK AND HOME ENVIRONMENTS

There are a number of general trends developing as people learn to handle pathogens in more sustainable ways. Many companies are trying to find the best way to treat these viruses using a variety of chemical and non-chemical alternatives. It is becoming increasingly apparent that pulse light is recognized as a safe and effective alternative to chemical treatments and provides a better option for use in disinfection for water treatment and food processing applications.

These systems can be integrated in-line or as standalone units to supplement existing systems, making it turnkey and cost effective for organizations to implement. Organizations are beginning to use robots utilizing pulse light to disinfect in many different places including:

- Hospital rooms and nursing homes where concentrated disinfection is required to kill pathogens right at the surface.
- Pulse light being used to complement HVAC/ventilation systems to scrub the air and disinfect standalone businesses or large office buildings where clean air free of viruses is required to allow employees to return to work free of worry.
- In water, where pulse light is being considered to disinfect fishponds, removing harmful pathogens thus improving overall yield.

This White Paper will identify and describe several methods currently in place to deal with viruses and pathogens. It will also examine different methods used to eliminate viruses and pathogens in both work and home environments.

What is High Intensity Pulsed Light vs Mercury UV light?

High energy pulsed light (HIPL) is emitted from a xenon flash lamp. The light emitted appears as white light and includes all wavelengths from deep UV to the upper range of visible light. The lamp contains only inert xenon gas. The frequency of the flash and the energy of each flash can be controlled to suit the application. The traditional mercury UV lamp is a low energy lamp containing mercury. It generates principally a 254 nm wavelength of light.

Comparisons to Other Technologies for Air Disinfection

Upper Room Air Disinfection with Mercury UV Lamps

Many of these units have no fan to force the air past their UV light. They depend on air circulation within a room to bring the air within reach of their UV light. Those that do have fans must be run slowly so that the mercury UV lamp has time to disinfect the air. Amglo's system contains a fan that actively moves the air past the high intensity flash lamp.

Cold Plasma

Cold plasma generates ozone and is best used in the food industry. It is not suitable for occupied spaces. Pulsed xenon lamps do not produce ozone as the quartz they are made of prevents the transmission of the wavelengths that create ozone.



Needlepoint Bipolar Air Ionization

Air ionization is used mainly to remove particulate material from the airstream. Air ionization produces ozone, a known dangerous pollutant. Smaller units for use in a single room often include HEPA and/or carbon filters to remove particulate matter and ozone. These filters need to be replaced, adding to the cost of the system.

Without ozone the –ve and +ve ions released into the air of a room have negligible killing effect on pathogens in that air. Air ionization units have metal plates to which the charged particles electrostatically stick. These plates must be cleaned regularly. If the unit lacks these plates then the charged particles simply stick to the sides of the device, the walls of the room, etc. The filters in a high-capacity industrial unit require more expensive high horsepower motors to overcome the back pressure of the filter. Some high-capacity units are designed to produce ozone and are run without occupants present. People cannot be present for some time after this is done due to the ozone, which is why this type of ionization is often done at night when occupants are not present. Pulsed light air disinfection units do not require filters or cleaning. They produce no ozone and are perfectly safe to run in an occupied room as long as the light is enclosed and not visible to the eye.

Is Pulsed Light More Effective than a Mercury UV Lamp?

A mercury UV lamp is turned on and left on. Over time it will eventually deactivate microorganisms – some of which go on to recover and reproduce. A pulsed light unit is a much higher powered device. The energy of each pulse is compressed into a very short pulse width making the peak power of each pulse extremely high. To visualize this, a sharp knife of the same weight as a dull hammer is much more effective in cutting through an organism. This sharp pulse can be delivered multiple times per second. Another way to look at the effect of a pulse is to consider that if you take 1 joule of energy and take a whole second to deliver that joule then you have 1 watt of power delivered. If that one watt can be delivered in 1/1000 of a second then the peak power can be considered to be 1000 watts. The pulse frequency of pulsed light can be dynamically adjusted to match the air flow or water flow depending on the application.

A traditional mercury UV lamp is turned on and, after a warm-up phase, it stays at constant output unable to adjust to changing air flow. The pulse energy of each pulse can be adjusted dynamically to match the quality of the air. A mercury lamp's output is reduced by extremes in temperature while a pulsed xenon lamp is not affected by temperature. A pulsed xenon lamp kills instantly while a mercury UV lamp takes much longer. This puts the mercury UV lamp at a disadvantage in a fast-flowing air stream or water flow. Advantages of pulsed light for air disinfection include the following:

- Pulsed light is on demand an instant-on lamp without any warm up time required
- Traditional mercury UV lamps have a lengthy warm-up phase
- When the air flow stops traditional mercury UV lamps continue to heat the residual air
- The pulsed light is on only when the air is flowing
- Pulsed light delivers instant kill
- Pulsed light can deliver dynamic dosing by automatically instead of dynamically adjusting flash rates to match changing air flows
- The pulse rate can be dynamically adjusted to the speed of the air flow
- The on demand feature should positively impact operating costs during idle times

Instant Cell Death

- Mercury UV treatment can cause dormancy allowing recovery of the pathogens at a later time
- With pulsed light technology, pathogens are viable for a period of time following treatment and will eventually die
- Pulsed light technology – only technology that can instantly burst the cell wall with no chance of recovery

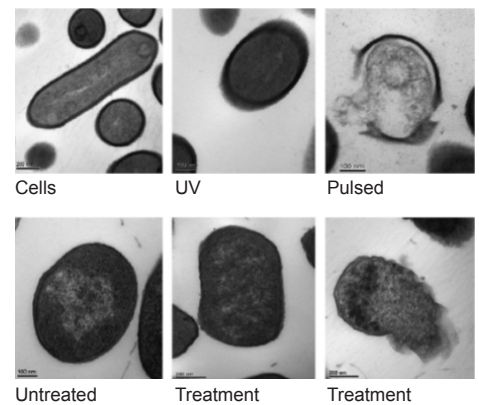
Dynamic Dosing

The frequency and energy of the pulse can be adjusted dynamically for:

- Changing air flow rates
- Traditional mercury UV must be left on constantly and sized for maximum flow of the system

Sanitation Advantages

- There are no harmful chemicals or ozone with Amglo's pulsed light device
- Disinfection of the air can occur while a room is occupied
- Speed of disinfection is key as people arrive and leave a room
- The air disinfection unit runs unattended with only a periodic lamp change, there are no filters or plates to change



Applications for High Energy Pulsed Xenon Light Devices Can Be Used to Disinfect Surfaces, Water and Air

Disinfection of the interior of bottles on a bottling line

- Amglo is currently testing this use in a bottling facility in the Netherlands.

Ballast water disinfection

- Amglo developed and successfully tested a lab scale unit at a US Coast Guard Certified Lab. Results were very favorable even in low transmittance water. A traditional mercury UV lamp failed as the water transmittance of the light was decreased.

Aquaculture

- Amglo is currently testing a prototype disinfection unit for the recycled water used in tank-based aquaculture. The power of the pulsed light allows it to penetrate very dark (low transmittance) water. Reduction of pathogens in aquaculture is critical to the success of that industry.

Hand Held Sani Gun

- Amglo has developed a hand held disinfection gun designed to disinfect high touch surfaces. It can deliver a 99.9% reduction of virus in 2-4 seconds. This was developed as a tool to fight Covid-19.

Ventilation

- Amglo is currently working on the development of a prototype air disinfection unit capable of turning the air over 18 times per hour in a 20 x 20-foot room.

Maintenance Advantages

Typically, the only maintenance is a periodic lamp change for a high-energy pulsed light system. In a liquid environment there is an additional need for an upstream filter to remove any particulate matter that may damage the lamp or shield microorganisms from the high-intensity flash. This filter would have to be changed.

Air Quality Advantages

Many buildings were constructed with a focus on energy conservation. With the current coronavirus pandemic, the air turnover rate of interior spaces is inadequate to protect occupants from serious COVID-19 infections. This situation can be corrected by disinfecting the air quickly and recirculating it within an interior space to augment the effect of the fresh air that is brought into that space. Adding this type of device, for example, would allow a bar to open for business or a school classroom to be safely occupied.



Environmental Considerations

Disposal of a xenon pulsed lamp is not problematic as it only contains inert xenon gas. The mercury in a traditional mercury UV lamp becomes a disposal issue.

In conclusion, pulsed xenon light is gaining momentum in treating pathogens without harmful use of chemicals or harmful UV light.

Amglo Kemplite Laboratories, Inc., established in 1935, is a global manufacturer of specialty lamps. The company services O.E.M. equipment manufacturers and distributors in the fields of aerospace lighting, airfield lighting, medical lighting, vehicular lighting, obstruction lighting, railroad lighting and laser lamp industries. The company's mission is simple: Provide quality products that meet the needs of customers in a timely manner with the best customer service experience. Amglo has manufacturing facilities in the U.S. and Mexico. For more information, visit www.amglo.com.



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