



## XENON Answers Your Questions...

### Pulsed Light's Application in the Food Safety and Enhancement Space

Due to time restrictions, we were unable to answer all your questions live.

Below you will find the answers to your questions submitted about Pulsed Light.

[Watch the webinar now.](#)

**Q: Does this technology change the taste of food?**

**A:** XENON's systems have been tested on foods such as blueberries and mushrooms and have found no change. Pulsed Light has limitless ways to deliver the energy allowing the opportunity to find "Sweet Spot" with each food product. Testing for individual cases would be recommended.

**Q: How easy is the technology to deploy?**

**A:** This technology is a relatively easy retrofit to existing production lines.

**Q: How complex are these systems to integrate into existing production lines?**

**A:** This is relatively easy. XENON can custom design a solution if needed. We have an engineering and manufacturing team along with integrators who can customize a Pulsed Light operation system for your processing line.

**Q: How does this technology impact the downtime for cleaning conveyors?**

**A:** XENON's Pulsed Light technology will significantly reduce cleaning times for conveyors.

**Q: What type of power source is required? Can Pulsed Light run from a standard outlet?**

**A:** Pulsed Light can run from standard outlets – single or three phase 220V.

**Q: Is Pulsed Light more expensive than Mercury alternatives?**

**A:** Yes, Pulsed Light is more expensive, but provides greater performance.

**Q: Has this technology been reviewed by the FDA? Is it safe?**

**A:** Yes, it is FDA CFR approved.

<https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcfr/CFRSearch.cfm?fr=179.41>

**Q: Do you have CE Mark or EU Approved? Are you supplying in UAE & UK?**

**A:** The systems are CE marked.

**Q: What is the comparison between XENON and LED?**

**A:** XENON's Pulsed Light technology utilizes a vast number of photons quickly with high-peak energy in narrow, rapid pulses and a broad spectrum to be able to remove the DNA repair mechanism of microorganisms.

LED involves low-intensity energy generation which slows the continuous repair mechanism by slowing down photon activation.

The energy per pulse XENON lamp emits is significantly higher than the common LED. Pulsed light is broadband spectrum from 100-1100nm.

**Q: If you use 1000W, so energy consumption is also higher as compared to others?**

**A:** Yes, our energy consumption is higher.

**Q: Pulsed Light is a very intense application of light, how are you ensuring protection of workers with the boots flashing system? UV-C exposure can be very dangerous at the level emitted.**

**A:** This is not a safety issue when installed properly. When implemented for boot sanitization, shields are utilized to block the light.

**Q: Doesn't the heating not depend on the IR components and how much that is absorbed? Some products can heat very quickly even with larger gaps between pulses.**

**A:** Yes, correct. The heating effect will depend on how much the product absorbed. The short pulse durations mean that IR heating effect are minimal. We have seen only a few degrees rise in most cases. However, the quality of different types of food would need to be evaluated to decide the best treatment time/ pulse rate/ distance.

**Q: Are there any mutation chances of DNA during interaction with DNA damage and this germ can transform into another form with different characteristics?**

**A:** Per our application research and study there is no indication that Pulsed Light can create new germs.

**Q: How deep the pulse light can penetrate the product? How far the pulse light should be from the product to maximize the efficacy of disinfection?**

**A:** For solid food, Pulsed Light is only suitable for surface treatment. For liquids, it depends on the turbidity of the liquid. Liquid with color has very little depth penetration.

The closer the proximity of the product to the Pulse Light produces the best results. Lower results are reported when the product is further away.

**Q: Does it produce ozone that may result to product oxidation?**

**A:** Some Pulsed lamps do produce ozone. XENON does have lamps which do not emit the wavelengths which produce ozone. We have blowers and coolers connected with the Pulsed Light units for air exhaustion. To avoid oxidation, treatment parameters (exposure time, pulse rate) need to be carefully selected.

**Q: Have you done any research with Post Harvest Tomato production?**

**A:** We haven't done any research on tomatoes internally yet, but there is a university study which used a XENON system on tomatoes can be found here: <https://doi.org/10.1016/j.ifset.2015.06.003>. We are always open and available to conduct any testing required.

**Q: I would like to make sure about legislation in the EU about application of Pulse Light. Is this permitted? I have seen the equipment for conveyors – so aside from surfaces, it can be applied on food?**

**A:** According to our knowledge, there are no EU restrictions in the use of Pulsed Light for foods.

**Q: Can this be used in front of workers? Is there a limit of exposure?**

**A:** Yes, this can be used in front of workers. The lamp housing system is sealed and covered, providing shielding for direct light output. Further shielding can be provided by using external enclosures or curtains. Workers also can wear safety glasses to protect their eyes.

**Q: Please tell me what the depth penetration of your technology for foods is?**

**A:** It depends on the food itself. For solid food, Pulsed Light is only suitable for surface treatment. For liquids: it depends on the turbidity of the liquid. Liquid with color has very little depth penetration.

**Q: Please could you provide any information about safety for operators? Are there specific protection measures required?**

**A:** The lamp housing is all sealed and covered, so there will not be light leakage. Further shielding can be provided by using external enclosures or curtains. The workers also required to wear safety glasses to protect their eyes.

**Q: How much longer was the shelf-life on Mushrooms after the pulsed light treatment?**

**A:** Our experience with mushrooms is focused on Vitamin D enhancement. We are currently exploring mushroom shelf life extension.

**Q: Can you tell me about the effects of the HIPL application on food?**

**A:** The effects on food depend on the treatment parameters, longer treatment time results in better microbiological log reduction. Thus, this would need to be tested and evaluated on a case by case basis.

**Q: Any experience with shelf-life improvement of cold beverages?**

**A:** We currently do not have any experience in this area; however we are willing to explore this niche.

**Q: What about quality of the products?**

**A:** Usually, we only treat surfaces for couple pulses, this will not influence the quality of the product, however, longer treatment might cause oxidation of the food. This would need to be tested and evaluated on a case by case basis – which we are always open to do.

**Q: Have you researched increased nutrient density with any other produce products?**

**A:** Not currently. XENON's lab testing has only involved Vitamin D in mushroom or mushroom powders.

**Q: Can product packed in metallized film be subjected to pulse light and get the same log reduction similar to unpacked product?**

**A:** No. Pulsed light cannot penetrate Metallized film. If the film blocks the light (200 -1100nm), then the log reduction result will not be as good as the unpacked product. Only films that enable transmission of 200-1100nm can get the same log reduction as unpacked products.

**Q: Can Pulsed Light kill off of clostridium in beverages?**

**A:** Yes, according to University studies which used XENON system on Clostridium:  
<https://doi.org/10.1016/j.cfs.2020.03.005>

**Q: For use in an air transport system as previously asked, is there any glass risk with Pulsed Light – is it safe from this point of view?**

**A:** Our Lamp housings have a Quartz window. This window can be laminated with plastic to prevent glass breakage.

**Q: Can Pulsed Light kill at least 90% of E. coli O157:H7 and Salmonella on surfaces of Fresh beef?**

**A:** Surface treatment is very effective on certain meats. There are university publications/studies which used our units shows over 1 log reduction on the beef surface. <https://doi.org/10.1111/ijfs.14733>

**Q: Are you in discussions with packaging suppliers (especially plastic pots where you can get electrostatic charges) to prevent mold spores?**

**A:** We welcome all discussions. Currently, we use Pulsed Light to treat empty containers before filling for example.

## Broadcasted Questions with XENON

### Pulsed Light's Application in the Food Safety and Enhancement Space



**Q: Are there any risks to staff working with or near the Pulsed Light? Is it effective against food pathogens and noroviruses?**

**A:** The short answer: there won't be any risk as standard practice the Pulsed Light unit in the processing line will be sealed and covered to prevent light leakage. Also, safety glasses provide staff operating the unit with eye protection as an added option. Of course, the light is very bright and we should not look at the lamp directly without any protection.

Regarding food pathogens, Pulsed Light can kill broad spectrum of food pathogens: listeria, salmonella, E. coli, and noroviruses. We have researched data that shows we can kill norovirus to 5 log reduction. The effectiveness of course is associated with treatment conditions, like how long you treat it and what is the distance: usually longer treatment time, and shorter distance we can achieve higher log reduction.

**Q: What raw produce has this process been used on? Has it been used on herbs and spices in particular?**

**A:** We have done a lot of work with raw produce, such as berries and mushrooms for example. There is a steady stream of people trying to deploy this on everything from onions to fruits, vegetables and they have all shown to be potentially effective. We have a range of produce in the raw form which has been treated.

**Q: Can Pulsed Light be used while employees are in the area? How far away from the source? What type of PPE?**

**A:** The Pulsed Light does generate an intense amount of UV, but typically in deployment of these kinds of systems, you are dealing with an enclosed system. So, where there is light deployed inside, you'd have products going in and you're effectively shielding the light from the outside.

There are some cases where you would get some stray of light which is coming out from the ends of the tunnel and that is perfectly harmless in the sense that once the light reflected off of a surface or two the amount of intensity is so low that it wouldn't affect individuals. Generally, we mitigate the exposure by having proper shielding in and around the equipment we develop and the stray light which in some cases does come out is generally harmless.

**Q: Cost (Capex and Opex) and efficiency compared to UVC on food packaging? They're asking for the comparison, please.**

**A:** So, I think the question is how does the cost in terms of operational and capital equipment compare with other UV sources. Generally, trying to compete with replacement of things like chemical treatment or some other processes which can be mitigated because use of Pulsed Light. So, it's not so much a comparison of other UV sources like Mercury, but more of a case comparing with Pulsed Light and reducing the amount of chemicals or processes you have. The other important factor here is that in a lot of cases if UVC by itself is able to do the job, then UVC, methods should be utilized. Our advantage is specifically where these kinds of solutions don't really exist, either because of the speed of process where UVC can't keep up or that you need to have a higher degree of effectiveness; or that you want to be able to tightly control the parameters such as temperature rising on the surface of the product.

**Q: How does Pulsed Light differ from UVC and far UVC lamp used in sterilization of food and surfaces and air disinfection?**

**A:** I hope that in our discussions today, we highlighted some of the key differences. To reiterate, we use Pulsed Light; we believe this is way more effective than continuous sources when you consider all the other effects associated with having a High Peak Energy broad-spectrum source. We have a case where multiple pathway extinction and the fact you are able to dismantle repair mechanisms of the organisms so you get much better kill when compared with the continuous source alternatives.

**Q: What happens on conveyor surfaces as these are less smooth? Aluminum as a material is not used in food production due to cleaning chemical breakdown.**

**A:** Not sure we fully understood the question. Typically, conveyors that you would be used with Pulsed Light would need to be impervious to UV exposure. In that sense it limits you from using certain plastic conveyor solutions. You would have to use a stainless-steel conveyor to do the transport and when you use those kinds of conveyors, there is no damage associated with Pulsed Light.

**Q: Would Pulsed Light be used to decontaminate pathogens on surfaces of fresh beef? What will be the effective energy and dwell time, and will it affect the fresh beef quality such as color and lipid oxidation?**

**A:** This is a very good question. So, for the surface Pulsed Light has very good efficacy. For the product, if it's opaque or has some color it's not as good as the transparent thing. For example: three seconds (within 10 pulses) usually and with 2-inch distance we can get 2 to 4 log reduction, so it happens very quick. Of course, it's still associated with other treatment parameters on the conveyor such as speed, that's why we treat every case individually. We will first do the proof of concept here, then we will do the verification with customer in the real facility to see what is the optimized treatment condition.

**Q. Is the nutritional composition of the products treated affected by the HIPL application?**

**A.** In general, there should not be any significant change in the nutritional properties of the product. However, for Mushrooms there are some significant benefits (Enhancing Vitamin D). If used in germicidal applications, the treatment time is short and within the process window should not impact nutritional value. This is still something that would need to go through validation. When we do the validations with the customer, we will make sure no changes in product, but still can get the desired log reduction.

**Q. What procedure is there followed for verifying and validating the sanitation?**

**A.** Sure, so usually here we will do the sample test for verification. We will do test on the sample to prove the concept and to see how good pulse light is on the sample. For example, for surface sanitization, to verify this at XENON, we will do the microbiology challenge test. So we get the sample and artificially inoculate bacteria or even mold on it, then we will expose it to Pulsed Light to see whether we can get the required log reduction, by determining how long we need the treatment to be and what is the distance and pulse rate to achieve this goal; then we will give recommendations for the treatment condition to the customer. On the customer side, they will need to do the validation in their facility or in their process line. This is usually the procedure for verification and validation.

**Q. How can this be used in pneumatic air transport systems and silos and is it effective against yeasts and molds?**

**A.** Yes, we can install the pulsed light UV unit inside of the air transport system. If the product inside is thin, it will have a better effectiveness, and we can definitely kill yeast and mold effectively. We have data showing we can achieve 2-3 log reduction of *Aspergillus Brasilensis* within five second.

**Thank you! Kindly note these answers are recaps and include actual answers from panelists along with editing for written response. Answers in their entirety can be found in the broadcast.**

**[Currently you can re-watch the webinar here.](#)**

**For more information, kindly reach out to our team of Experts to meet your Pulsed Light needs.**



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