



**SETI**  
SENSOR ELECTRONIC  
TECHNOLOGY, INC.



## UV LEDs

Although invisible to the human eye, ultraviolet (UV) is part of the light spectrum that is shorter in wavelength than "visible" range. ISO-21348 defines UV in three wavelength ranges: UVA, UVB and UVC.

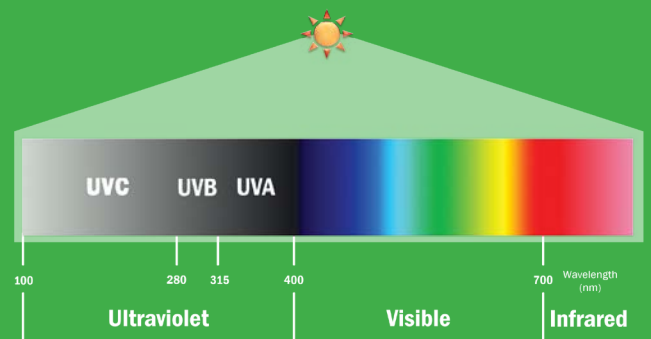
Most people are familiar with UVB and UVA from sunlight as causing suntan and sunburn. However, the sun also emits UVC light; although this region of the light spectrum does not penetrate the atmosphere and is not naturally occurring on Earth.

UV has many applications from optical sensing and

Measurement and sensing can be made in transmission mode to detect the presence and quantity of substances that block UV light or in fluorescence mode to measure substances that absorb UV light and emit light at another (longer wavelength) part of the spectrum. These techniques can be used to measure gases, impurities in substances, water "quality", protein, DNA and much more. UV measurement techniques are very powerful tools, because the output is highly dependent on the wavelength used.

Using UV light to disinfect is a fast, effective and safe technique that utilizes UVC. When exposed to UVC light, micro-organisms such as bacteria, viruses, cysts and mold are effected in a way such that they can no longer multiply, rendering them harmless. UV disinfection can be used on surfaces, in air and in water.

Visible and infrared Light Emitting Diodes (LEDs) are commonplace in many electronics and lighting applications. UV LEDs are the next wave in the LED revolution, that bring the advantages of LEDs to the UVA, UVB and UVC regions of the spectrum. Miniature, robust, and operating with a low electrical power, UV LEDs can be manufactured with a highly stable output, operating at the optimum wavelength for the application, making them ideal for compact and portable solutions.



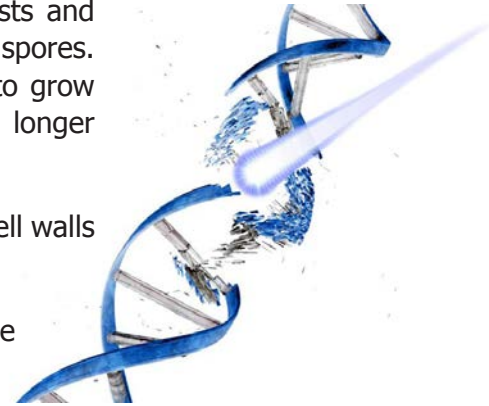
# UV LEDs for Disinfection



**WHAT IS UV DISINFECTION:** Micro-organisms such as bacteria, viruses, cysts and mold are simple lifeforms that reproduce by subdivision, budding or by producing spores. Reproduction of these organisms is vital to their life-cycle: loss of their ability to grow and multiply is classified as cellular death, and renders them harmless and no longer pathogenic.

When exposing micro-organisms to UVC light, the light penetrates through their cell walls and disrupts the structure of their DNA molecules, prohibiting reproduction.

Because UV disinfection does not rely on chemicals or filtration materials, it can be used effectively and safely in many applications including in drinking water, in air.



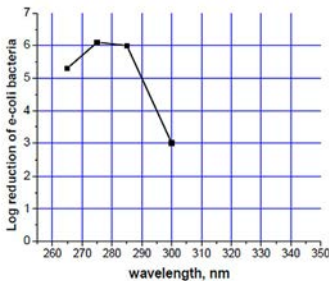
## UV DISINFECTION ADVANTAGES:

- ✓ No harmful disinfection by-products
- ✓ Works instantly
- ✓ User-friendly
- ✓ Does not taste or smell
- ✓ Safe and environmentally-friendly
- ✓ EPA recognized process

**GENERATING UV LIGHT:** The traditional approach to generating UV light for disinfection applications is by using the mercury discharge lamp: simply put, a fluorescent bulb without the phosphor coating. Mercury lamps come in two main types: a low-pressure lamp that produces a single wavelength at 254nm; and a medium pressure lamp that emits a multiple wavelength output.

A new germicidal light source is now available: UV LEDs will open new markets in UV disinfection where traditional lamps cannot be used.

**GERMICIDAL UV LEDs:** Many people consider UV LED advantages of size, weight, power consumption and lifetime, but there are additional advantages from this new technology:

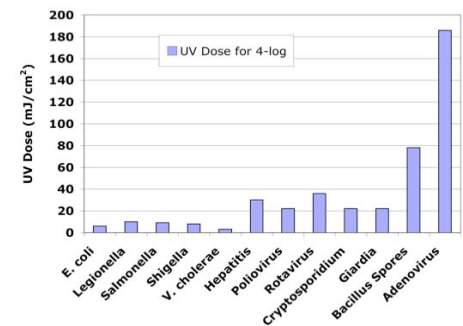


Unlike traditional light sources, whose output wavelength is fixed, UV LEDs can be manufactured to operate at the optimum wavelength for the application: 265nm is widely recognized as the peak absorption of DNA; however, SETi has demonstrated that the peak disinfection efficacy of E.coli in water occurs at 275nm.

UV LEDs also switch on and off instantly and can actually be pulsed without any detriment to lifetime, making them more user-friendly and safer for the operator.

The design rules for UV LEDs open new opportunities of what can be disinfected: we are no longer limited to a long tube, but can mount the LEDs in flat panels; on flexible circuit boards; on the outside of cylinders; the options are almost endless.

**THE POWER OF UV LED DISINFECTION:** Disinfection performance is a function of the UV dose applied to the micro-organism: dose being the product of UV power multiplied by time. Not all micro-organisms respond to UV light in the same way, as shown in the graph to the right. For example, to kill 99.99% (4-log) of E.coli, roughly 5mJ/cm<sup>2</sup> is required (or, put another way, 5mW/second/cm<sup>2</sup>). However, if time is no constraint, we can kill 99.99% of E.coli with just 0.08mW/cm<sup>2</sup> in only one minute!



With correct system design, even the UV resistant Adenovirus can be safely eradicated with the power of UV LEDs.