

MECHANISM OF GERMICIDAL ULTRA VIOLET LIGHT DISINFECTION:

The narrow band of UV light lying between the wavelengths of 200 to 300 nm has often been called the germicidal region because UV light in this region is lethal to micro-organisms given the Exposure Time to achieve the required Fluence / Dose (mJ/cm²) Value to kill the Micro-organism which includes: Bacteria, Protozoa, Viruses, Moulds, Yeasts, Fungi, Nematode eggs and Algae.

The most destructive DNA / RNA wavelengths are around 260 to 265 nm which is very close to the wavelength of 254 nm produced by Low-pressure Germicidal Ultra Violet Lamps. As an example, the ability to kill the faecal coliform bacteria *Escherichia coli*, is directly related to the ability of its genetic material (i.e., nucleic acid) to absorb UVC light. UVC light causes molecular rearrangements in the genetic material of micro-organisms and this prevents them from reproducing. Most micro-organisms have relatively short life cycles and therefore depend on rapid reproduction to sustain and grow their population. Therefore, if a micro-organism cannot reproduce then it is considered to be dead. Normally when DNA replicates, the Thymine (T) must join the Adenine (A), and the Cytosine (C) must join with Guanine (G). When DNA is exposed to Ultraviolet Light at the wavelength of 254 nm, an error occurs in the replication process. The Thymine forms a dimer, that is, a double bond between the Thymine molecules. This error prevents the Micro-organism from reproducing properly, so eventually it dies.

Germicidal Ultra Violet Light Disinfection is Energy (Irradiance) x Time (In Seconds) = Fluence (Dose) Value (mJ/cm²). It is a non-ionising form of radiation; it will not pass through anything solid.

It does not matter what the Disinfection application is, be it for Air, Water, or a Surface, the Micro-organism(s) that are required to be controlled must be known, along with the Log Reduction, so the Fluence / Dose Value (mJ/cm²) can be established. Once the Fluence Value is known, then and only then can the type of UVC Lamp(s) necessary to achieve it be determined.

Germicidal Ultra Violet Light Disinfection is a complex technology, you are dealing with a non-ionising form of radiation and it is easily absorbed and poorly reflected by most materials. The key is always, you must know the Fluence Value and actually achieve it, to be able to kill the Micro-organism(s) for each application.

Definitions:

Sanitation - 2 to 3-Log Reduction

Disinfection - 5 to 6-Log Reduction

Sterilisation - Absolute (Refers to any process that removes, kills, or deactivates all forms of life in particular referring to Micro-organisms)