What is UV radiation?

Ultraviolet radiation covers wavelengths ranging from 100 to 400 nanometers and is the most energetic portion of optical radiation. UV radiation is invisible for the human eye. Based on its physical and biological characteristics, it is further divided into three wavelength ranges.

- **UVA radiation wavelength 400 - 315 nm**
- **UVB radiation wavelength 315 - 280 nm**
- **UVC radiation wavelength 280 - 100 nm**

UVA radiation directly follows visible light and is the long-wave range with wavelengths between 315 and 400 nm. UVB radiation covers wavelengths ranging from 280 to 315 nm and is often referred to as „mid-range UV“. UVC radiation is the spectrum‘s UV portion with the shortest waves and thus the highest energy levels; its wavelengths extend from 100 to 280 nm.

This means that the radiation is the more energetic the shorter its wavelength is.
While the ozone layer in the stratosphere completely withholds the high-energy UVC radiation and partially restrains UVB radiation, part of the UVB radiation and almost all of the UVA radiation reach the surface of the earth.

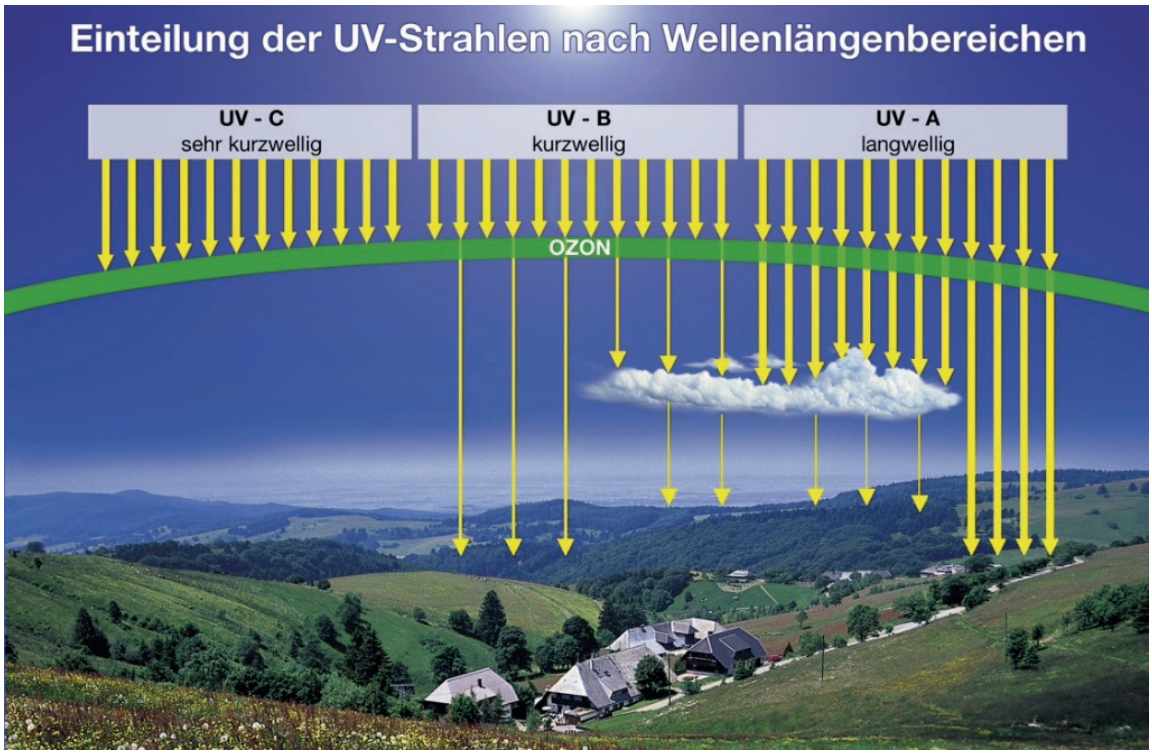
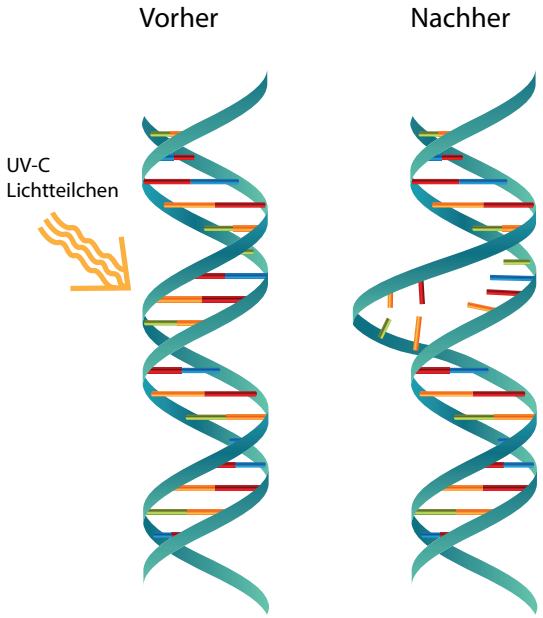


Image: source: German Federal Office for Radiation Protection [Bundesamt für Strahlenschutz, BfS])

Technologically generated ultraviolet radiation is used with great success in everyday processes for the treatment of water, air and surfaces.
Due to the speed of the reaction – with a sufficient dose microbes are inactivated within fractions of a second – UV emitters can be employed not only to disinfect surfaces, but also to disinfect water and air, for example in air streams that are led through air-conditioning ducts.
The increasing antibiotic resistance of hospital-specific germs such as MRSA will lead to a revival of the long-familiar technology as UV disinfection prevents the development of resistances due to mutation.
UV radiation is widely used in the field of drinking water treatment. Here the microbial count in the water is reliably and, depending on the dose, strongly reduced. As a basic principle, no chemicals need to be added. UV radiation particularly lends itself to inactivate chlorine-resistant pathogens such as cryptosporidia. The taste, smell and pH value of the medium remain unaltered. This is a substantial difference compared to the chemical treatment of drinking or process water.
Often, the industrial water of the sewage treatment plant outlet is used to irrigate golf courses. Here, the irrigation water is almost completely freed from germs.
The food industry has been using UV disinfection in its filling processes for many years.

Mechanism of action

UVC radiation, which is very high in energy, brings about a photochemical reaction. The wavelengths of approx. 254 nm are absorbed by the cells‘ nucleic acids. Depending on the dose, bacteria and fungal spores are killed or damaged as a result of this reaction.
Thus, UVC radiation is specifically employed to deactivate microorganisms such as bacteria, viruses, yeasts and fungi.



Dosage

The necessary dosage is calculated based on the general impact of the factors of time and power. The product of the exposure time and exposure intensity is given in mW-s/cm2