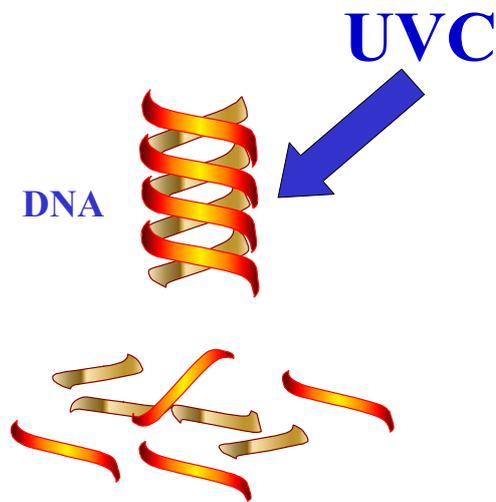


# BEET TECHNOLOGY

## PART 0081 - UVC and BEET - The ultimate disinfection method



## UVC – FREMTIDENS DESINFEKSJONSMIDDEL

Hygienic challenges for the food industry and the hospitals

Unwanted spread of pathogen microorganisms is perhaps the most serious threat currently faced by the food industry and the hospitals. Without thorough cleaning and disinfection, these problems will not be controllable.

BEET provides environmental friendly and efficient disinfection solutions for equipment, surfaces and air. Our solutions are based on the use of UVC irradiation – a well-documented disinfection method with a proven efficiency on all kinds of microorganisms.



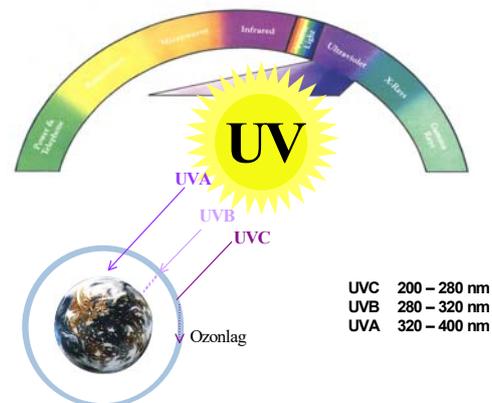
(Source: Renhold i næringsmiddelindustrien, Matforsk 1999)

The problems by chemical disinfection are increasing. This is mainly due to the large consumption of chemical disinfectants and the microbial adaptability towards such chemicals. Chemical remainders cause the microbes to adapt to them over time. The microbial adaptation is a continuous process, which constantly requires new counter measures. In contrast to when using chemicals, bacteria are not able to adapt to UVC. In addition, UVC will contribute to reduce the consumption of chemicals.

### What is UVC irradiation, and how does it work?

Ultraviolet (UV) rays are irradiated by the sun or from artificial sources. Such rays are not ionizing, and should not be confused with radioactivity, gamma rays or x-rays.

UV-rays are divided into 3 ranges of wavelength: UVA (320-400nm), UVB (280-320nm) and UVC (200-280nm). Natural UVA and UVB are found in the nature, but natural UVC is not found. This is because ozone and other gases of the atmosphere easily absorb the short wavelengths of less than 290 nm.



The use of artificial UV sources is today widespread, within both cosmetic areas (tanning studios), the medical sector (treatment of skin diseases) and industrial applications (disinfection). For disinfection purposes, normally UVC by 254 nm is used.

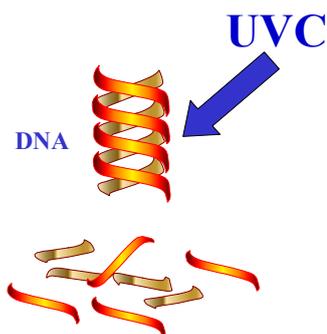
## UVC – FREMTIDENS DESINFEKSJONSMIDDEL



(Kilde: Statens Strålevern, Hefte 19 – 1999)

Generally, the shorter the wavelength of the light, the higher the energy is emitted. Thus, UVC is well suited for disinfection of cleaned surfaces, air and water. UVC has a limited ability of penetrating organic substances. As with chemical disinfection, careful cleaning is a requirement to obtain satisfactory results.

When a microorganism is UVC irradiated, its DNA or RNA is damaged. If the microbes are exposed to sufficient UVC doses, they will be inactivated (killed). The effect on microbes is significant, whether these are enclosed in water, attached to surfaces or mixed in the air.



UVC is a broadband disinfection method, working on bacteria, bacterial spores, virus, yeast fungus, mould spores and algae in dry or humid environments. Unlike chemicals, it even penetrates bio film and can eliminate bacteria within the film.

The necessary doses to eliminate the different types of microbes tend to vary (ref. table 1 and 2). Bacteria, virus and yeast are the simplest to inactivate, while spores, bacteria within bio film and algae require an extended exposure time.

### Which exposure time is necessary to disinfect a surface?

A microbe located on a surface approximately 3 meters from a UVC unit from BEET will receive a doses of 27 J/m<sup>2</sup> within one minute. With this exposure intensity, most bacteria, virus and yeast will be inactivated within few minutes (table 1 and 2). For example; to obtain 99,999% (5 Log) inactivation of *legionella*, less than 3 minutes are necessary. *Listeria Monocytogenes* requires 5 minutes and *Bacillus Cereus* 6 minutes. Even *Bacillus Cereus* spores are inactivated within 25 minutes. Fungus and algae require a longer UVC exposure time. 99,9% inactivation of the most adaptive moulds, requires 91 minutes irradiation, and the most adaptive blue-green algae 12 hours.

## UVC – FREMTIDENS DESINFEKSJONSMIDDEL

Table 1.

The table shows the necessary UVC dozes ( $J/m^2$ ) for inactivation of various types of microorganisms. Obviously, the UVC tolerance of the various microbes varies a lot.

Microbe	90% red. (1-log)	99.9% red (3-log)
<b>Virus</b> (10 genera)	18-265	20-1.750
<b>Bacteria</b> (27 genera)	15-118	31-355
<b>Yeast</b> (11)	33-220	66-3.000*
<b>Moulds</b> (17)	50-3.000	110-3.300*
<b>Algae</b>	3.000-6.000	10.000-20.000
<b>Protozoa's</b>	600-1.000	1.800-3.000
<b>Parasites</b> ( <i>Cryptosporidium parvum</i> )	16.800	-

\*99,99%

**Table 2.**

UVC dozes for elimination of selected bacteria

Bakterie	Dozes ( $J/m^2$ )	
	90% red. (1-log)	99,999% red. (5-log)
<b>Aeromonas salmonicida</b>	<b>10</b>	<b>60</b>
<b>Bacillus cereus, veg.</b>	<b>32</b>	<b>160</b>
<b>Bacillus cereus, spores</b>	<b>130</b>	<b>670</b>
<b>Campylobacter jejuni</b>	<b>29</b>	<b>145</b>
<b>Clostridium tetani</b>	<b>49</b>	<b>245</b>
<b>Enterobacterium cloaca</b>	<b>108</b>	<b>540</b>
<b>Escherichia coli</b>	<b>45</b>	<b>225</b>
<b>Legionella</b>	<b>15</b>	<b>75</b>
<b>Listeria monocytogenes</b>	<b>50</b>	<b>125</b>
<b>Pseudomonas aeruginosa</b>	<b>35</b>	<b>175</b>
<b>Salmonella</b>	<b>43</b>	<b>215</b>
<b>Staphylococcus aureus</b>	<b>40</b>	<b>200</b>
<b>Yersinia enterocolitica</b>	<b>39</b>	<b>195</b>

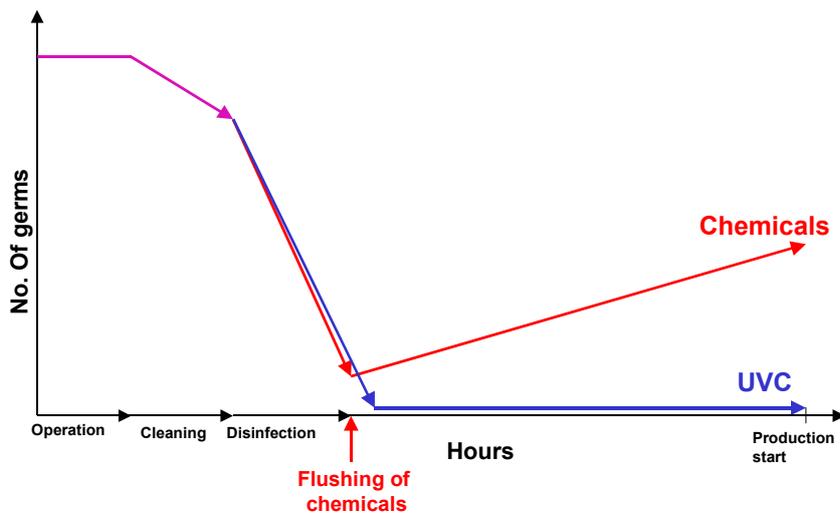
## UVC – FREMTIDENS DESINFEKSJONSMIDDEL

### Why select UVC?

UVC has a series of advantages versus chemical disinfectants:

- BEET can guarantee a maximal density of total germs of less than 25 CFU
- BEET can give a guarantee against listeria – UVC even kills Listeria in bio-film
- Disinfection process may run until production start-up. Thus, surfaces and equipment are microbe-free when the production is initiated in the morning
- UVC does not leave any harmful rest chemicals behind, and does therefore not require flushing. This gives a financial gain through reduced water and electricity consumption. Furthermore it reduces the cross-contamination danger due to less spoilt water
- UVC eliminates bacterial and moulds spores on dry as well as humid surfaces and in the air
- Environmental friendly with reduced usage of chemicals. No polluting emissions to the environment
- Operator friendly. Does not spread any harmful substances within the production environment
- Automatic disinfection ensures a satisfactory disinfection in critical areas – every day. No human factor

### UVC ensures that equipment and surfaces are hygienically clean when production is started



### The clean warrantee

We guarantee our customers that the microbial density on cleaned and UVC irradiated surfaces never will exceed 25 CFU (germs) pr 20 cm<sup>2</sup>.

This corresponds to the note “very good” according to microbial standards in Scandinavia.

### Safety

The security against unwanted exposures from UVC is well taken care of within the BEET system. The security control system ensures that UVC sources are switched off when people enter the room, or if somebody should be in the room when the system is switched on.