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MWHI BLUE LIGHT

PUNAHOMEEN TORJUNTA JA DON-ARVOJA LASKUUN UUDEN SINIVALOTEKNOLOGIAN AVULLA

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1. Yleisesti miksi sinistä valoa käytetään desinfioinnissa ja miten sitä voidaan käyttää?

2. Miten ja miksi sininen valo tappaa mikrobeja?
   - Sininen valo ei ole UV valoa!

3. Sininen valo Fusariumin torjunnassa (DON-arvojen alentaminen)


Healthcare-associated infections – a threat to patient safety in Europe
In 2016 and 2017, ECDC coordinated point prevalence surveys to collect data on healthcare-associated infections (HAIs) in hospitals and long-term care facilities in EU/EEA countries. Although some HAIs can be treated easily, others may more seriously affect a patient's health, increasing their stay in the hospital and hospital costs. HAIs in hospitals alone cause more deaths in Europe than any other infectious disease under surveillance at ECDC.
On any given day:
Hospitals
1 / 15
hospital patients have at least one HAI.
98 000
patients have at least one HAI.
Long-term care facilities
Facts
EUROPEAN ANTIBIOTIC AWARENESS DAY
A EUROPEAN HEALTH INITIATIVE
ecdc
Antibiotic resistance: a growing threat to human health
Antibiotic resistance is the ability of bacteria to combat the action of one or more antibiotics. Bacteria, not humans or animals, become antibiotic-resistant.
More than 35000 deaths
Each year, more than 35 000 people die from antibiotic-resistant infections in the European Union, Iceland and Norway. This is equivalent to the number of passengers on 13 cruise ships.
World Health Organization
DID YOU KNOW THAT SUPERBUGS CAN BE FOUND IN FOOD?
Saved to this
environment.ec.europa.eu/news/clean-and-circular-electronics-commission-ends-use-mercury-lamps-...
An official website of the European Union How do you know?
European Commission
Energy, Climate change, Environment
English
Environment
Home > News > Clean and circular electronics: Commission ends use of mercury in lamps as mercury-free alternatives prevail
NEWS ARTICLE | 16 December 2021 | Directorate-General for Environment
Clean and circular electronics: Commission ends use of mercury in lamps as mercury-free alternatives prevail
The Commission has adopted a package of rules ending a broad range of existing exemptions for the use of mercury in lamps. Under EU rules restricting the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive), electronics that contain mercury cannot be placed on the market, except if time-limited and application-specific exemptions are granted by the Commission. Most of these exemptions for general lighting will be discontinued as assessments conducted by the Commission since 2016 concluded that safe, mercury-free alternatives are widely available for fluorescent lamps. The new rules aim to increase the protection of health and the environment form this hazardous substance, as well as boost innovation and promote cleaner products.
Executive Vice-President for the European Green Deal, Frans Timmermans, said:
Chemicals are part and parcel of our daily life, and they allow us to develop innovative solutions to green our economy. But we need to make sure that chemicals are produced and used in a way that does not damage human health and the environment. It is especially important to stop using the most harmful chemicals, like mercury, in everyday consumer products, such as lamps.

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BENEFITS – WHY CUSTOMERS CHOOSE SPECTRAL BLUE

Safe & sustainable

- Safe for people & materials
- Chemical-free
- UV-free

Automatic & consistent

- Continuous
- Always the same disinfection result
- Multi-wavelength, high-intensity technology
- Eliminates biofilm

Economical

- Maintenance-free operation for up to 10 years*
- Use of chemicals and associated labor can be reduced

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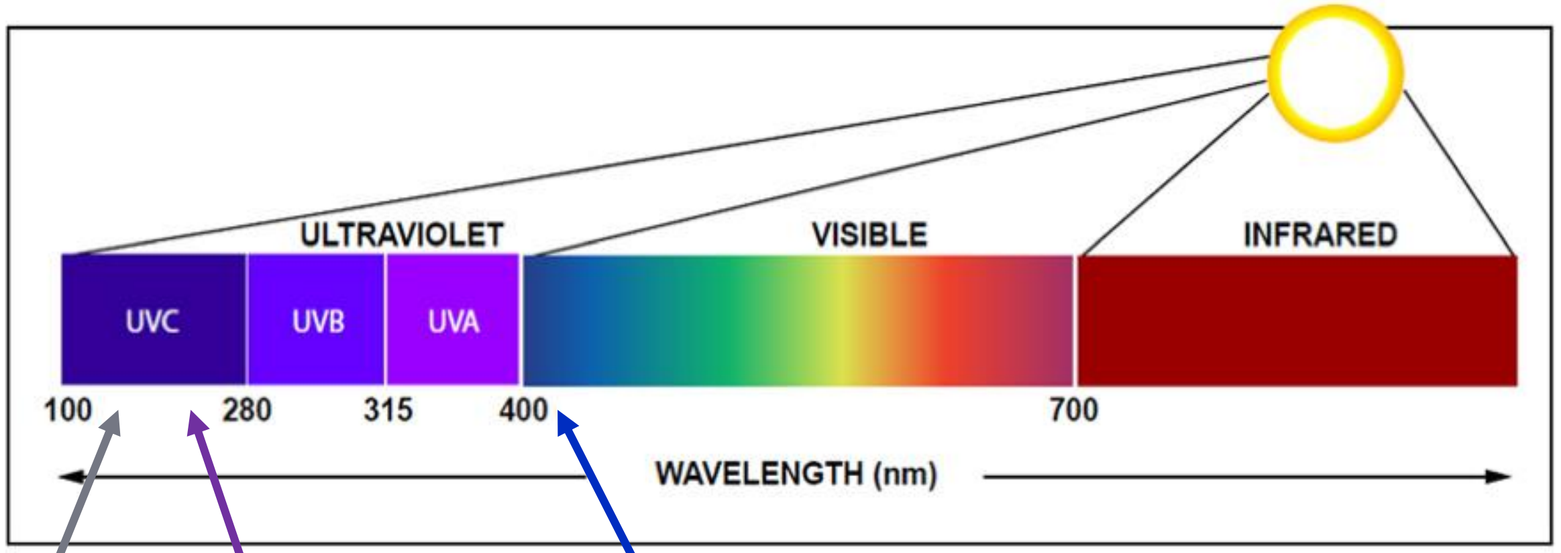
** Avg. expected lifetime for LED components is 50.000 hours*

WHAT IS BLUE LIGHT?

SPECTRUM OF LIGHT



222 nm:
Far-UVC

254 nm:
UVC tubes

400-500 nm:
Visible blue light

OUR PATENTED INVENTION

SAFE FOR PEOPLE:

No photobiological hazard for human eye in normal use

(EN 62471 / RG1)

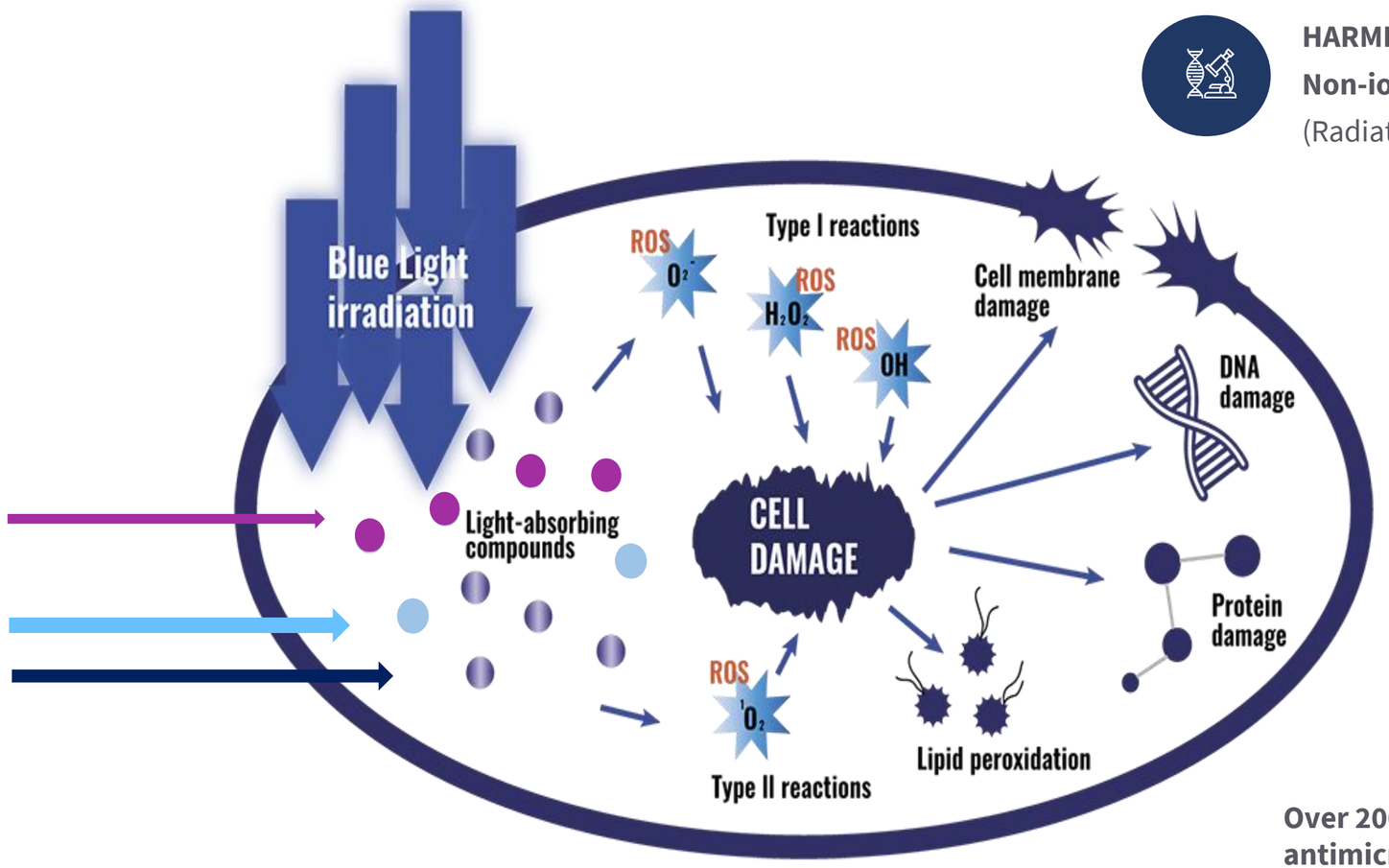
HARMLESS TO MATERIALS:

Non-ionizing

(Radiation and nuclear safety authority of Finland)

Activated by 405nm

Activated by other blue wavelengths



Over 2000 scientific articles published on antimicrobial properties of blue light, showing it works on all bacteria, mold and yeasts

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THE IDEA OF COMPUTER-AIDED PLANNING

We use special software to optimize the number of Spectral Blue devices needed for disinfection.

The process is straightforward:

1. We draw a 3D model of your target room.

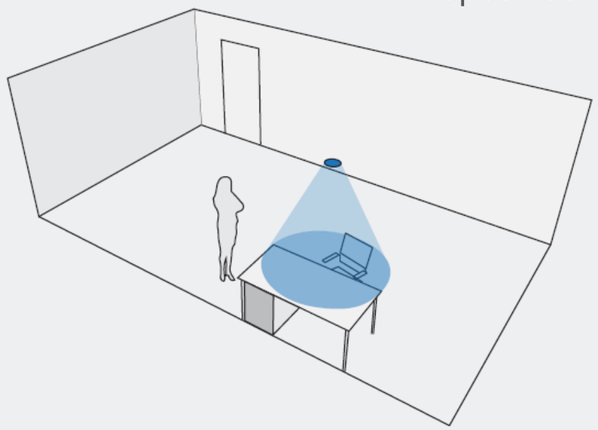
2. We place digital versions of Spectral Blue disinfection devices in the room.

The software then calculates the resulting blue light intensity on target surfaces:

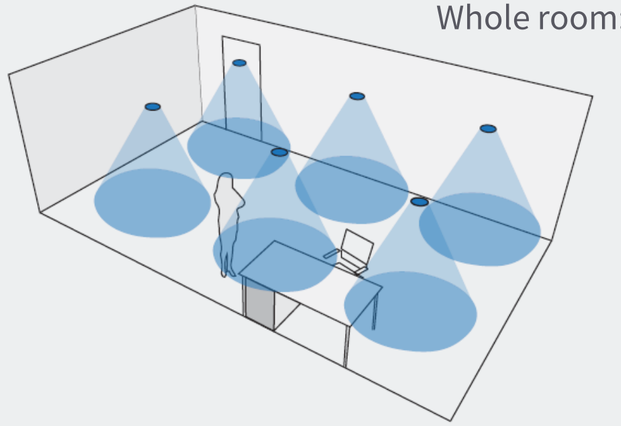
- Desks, workbenches
- Equipment, machines
- Whole rooms

OUR CUSTOMERS ALWAYS GET A WORKING DISINFECTION SOLUTION

Specific area:



Whole room:



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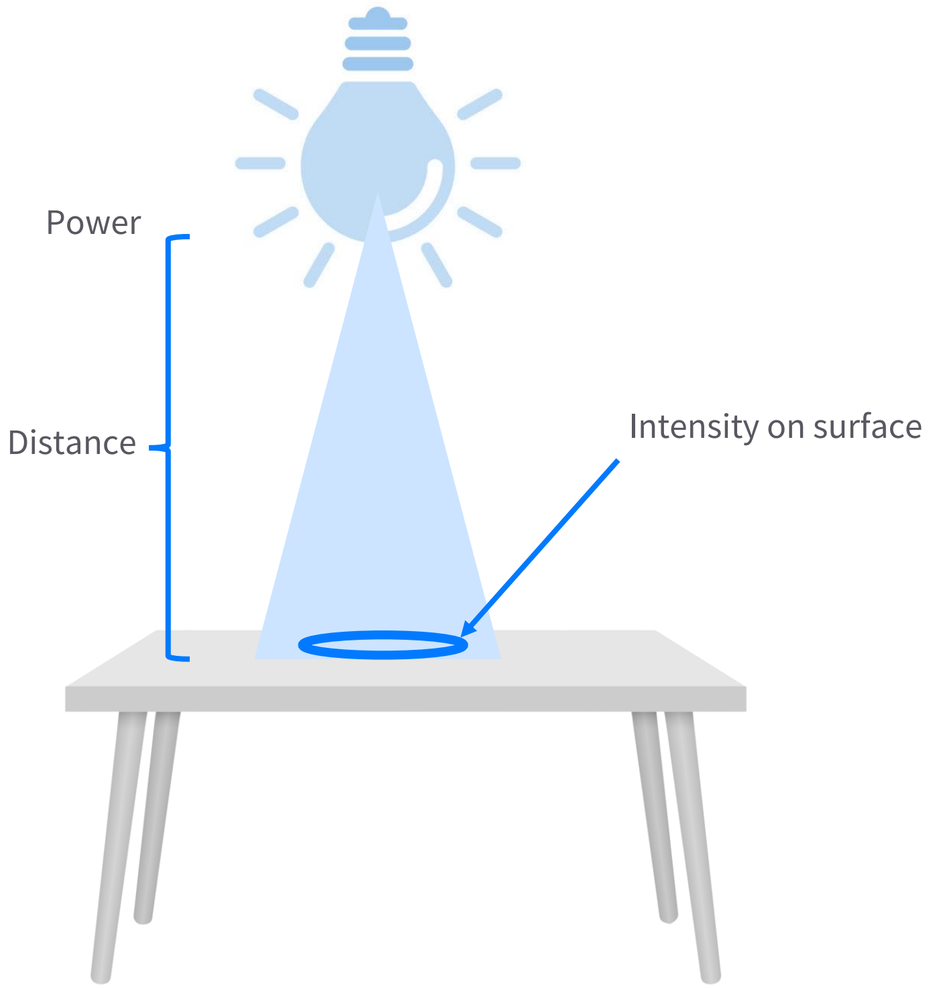
INTENSITY [mW / cm²]

A measure of how much light we get on the target surface, for example a desk.

- A certain blue light intensity triggers the chemical reactions inside the microbial cells.

- Intensity depends on device power and distance. The farther we go from the light source, the smaller the intensity.



ENERGY DOSE [J / cm²]

To eliminate microbes, the blue light needs to be on for a long enough time.

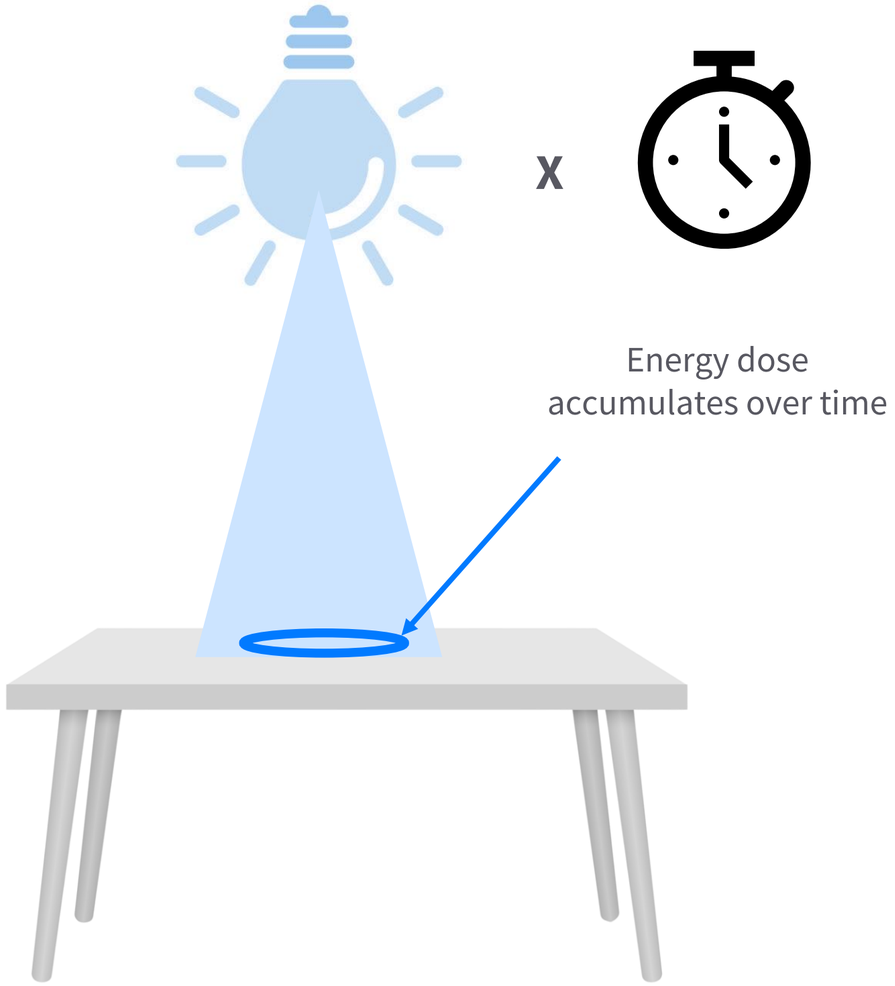
Energy dose is a measure of high much blue light energy we have projected to the target surface over time.

Energy = Intensity x Time

Energy dose grows when intensity or time increases.

- Imagine a blue light installation that achieves complete disinfection of a laboratory workbench in 2 hours.

- If we are ok with 4 hours disinfection time instead, we can halve the number of devices.



2000+ PEER-REVIEWED PAPERS ON BLUE LIGHT

Cause of healthcare infection, ECDC 2011 (% of all cases)	Microbe tested in the blue light study	Wavelength	Dose	Reduction		References
Escherichia coli (15.9%)	Escherichia Coli	405 nm	65 J/cm^2	> 99,9 %	3,6 $\log_{10}$	(Barneck et al., 2016)
Staphylococcus aureus (12.3%)	MRSA	470 nm	55 J/cm^2	> 99,999 %	> 5 $\log_{10}$	(Bumah et al., 2015; Bumah, Masson-Meyers and Enwemeka, 2015)
Enterococcus spp. (9.6%),	Enterococcus faecalis	405 nm	540 J/cm^2	> 99,99 %	≤ 4 $\log_{10}$	(Shehatou et al., 2019)
Pseudomonas aeruginosa (8.9%)	Pseudomonas aerunginosa	405 nm	36 J/cm^2	≤ 99,99 %	≤ 4 $\log_{10}$	(Barneck et al., 2016, (Shehatou et al., 2019))
Klebsiella spp. (8.7%)	Klebsiella pneumoniae	405 nm	144 J/cm^2	99,99 %	4 $\log_{10}$	(Shehatou et al., 2019)
Coagulase-negative staphylococci (7.5%)	Staphylococcus epidermidis	405 nm	50-122 J/cm^2	99-99,999 %	5,1 $\log_{10}$	(Gupta et al., 2015, Shehatou et al., 2019, Lu et al., 2020)
Candida spp. (6.1%)	Candida albicans	415 nm	70 J/cm^2	> 99,999 %	5,4 $\log_{10}$	(Zhang et al., 2016)
Clostridium difficile (5.4%)	Clostridium difficile	405 nm	48 J/cm^2	> 99,99 %	4 $\log_{10}$	(MacLean et al., 2013)
Enterobacter spp. (4.2%)	Enterobacter cloacae	400 nm	92 J/cm^2	> 90 %	1 $\log_{10}$	(Halstead et al., 2016)
Proteus spp. (3.8%)	Proteus vulgaris	405 nm	144 J/cm^2	> 99,99 %	4,7 $\log_{10}$	(Maclean et al., 2009)
Acinetobacter spp. (3.6%).	Acinetobacter baumannii	405 nm	108 J/cm^2	> 99,99 %	4,2 $\log_{10}$	(Maclean et al., 2009)

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RELEVANT LAB TESTS WITH OUR DEVICES

University Clinic of Bonn (2023)

A European reference laboratory tested the efficacy against several reference pathogens according to DIN standard EN 17387 (when applicable).

- Included *Salmonella typhimurium*

University of Eastern Finland (2019)

Master's thesis evaluated the ability of blue light to inactivate *L. Monocytogeneses, S. Enterica* and *C. Albincans* inoculated **on food products in cold conditions +4°C**

University of Helsinki (2022)

A leading virus laboratory tested efficacy on SARS-CoV-2 (delta variant), the agent behind COVID-19.

- Effectivenesss on viruses such as SARS-CoV-2 and Influenza A is relevant for e.g. IBV and H5N1 (infection control at farms)

Atria QA lab (2024)

A leading Nordic food producer tested MWHI blue light's efficacy against *Listeria monocytogenes* in a biosafety cabinet.

BLUE LIGHT AND FUSARIUM

Fusarium studies by Senior scientist Marja Jalli for Natural Resourses Institute Finland (2017)

“According to the preliminary trials, there is a clear evidence that blue light has efficacy on Fusarium sp on seed and has a positive effect on seed quality.”

In these trials, blue light decreased the frequency of *Fusarium* sp infected kernels 10 – 90 % according to the seed lot (Figure 1). The germination in blue light treated seed lots was in average 2 % higher compared to the untreated control.

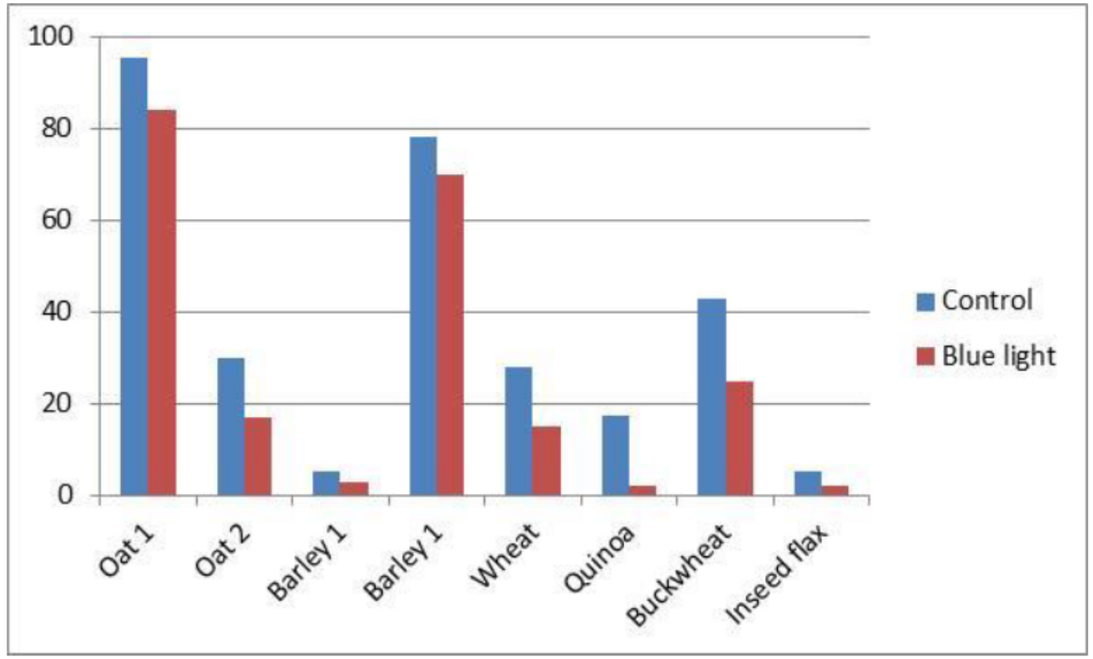

Figure 1. The frequency of *Fusarium* sp in control and blue light treated seed lots. Each column is an average of four replicates.

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RESULTS OF FUSARIUM MYCOTOXIN AFFCETED OATS TREATED WITH SPECTRAL BLUE, SPRING 2024

Results, spring 2024 (2023 years harvest)

Oatfarmer in Ostrobothnia, Finland

DON-value limit; 1,750

Grain	Lot identifier	Silo no.	Before blue light treatment Approved/Rejected	Species	Amount (tn	Orginal DON-value	DON-value after blue light treatment	Comments
Organic pure oats	Kuivuri 1	1	Rejected	Avenue	11	2,03	0,92	
Organic pure oats	Kuivuri 2	2	Approved	Oiva	14	1,37	0,92	
Organic pure oats	Kuivuri 1	3	Approved	Matty	16	1,15	0,92	
Organic pure oats	Kuivuri 2	4	Rejected	Oiva	10	>7,5	0,54	
Organic pure oats	Kuivuri 2	7	Rejected	Matty	15	>7,5		
Organic pure oats	Kuivuri 2	8	Rejected	Matty	10	>7,5		
Organic pure oats	Kuivuri 2	1	Rejected	Matty, Avenue	11	7,01		
Organic pure oats	Kuivuri 2	3	Rejected	Matty	20	>7,5		
Organic pure oats	Kuivuri 1	2	Rejected	Avenue	20	>7,5	0,54	
Organic pure oats	Kuivuri 1	4	Rejected	Matty	16	>7,5	0,54/0,92	
Organic pure oats	Kuivuri 2	6	Rejected	Matty	17	2,14	<0,25	
					160			

Summary	ton
Total harvest	160
Delivers to the mill; 19900kg + 47700kg +33200kg =	100
Approved before blue light treatments	30
Total	**70** **ton oats rescued with blue light treatment**

Sifter used for blue light treatment of oats

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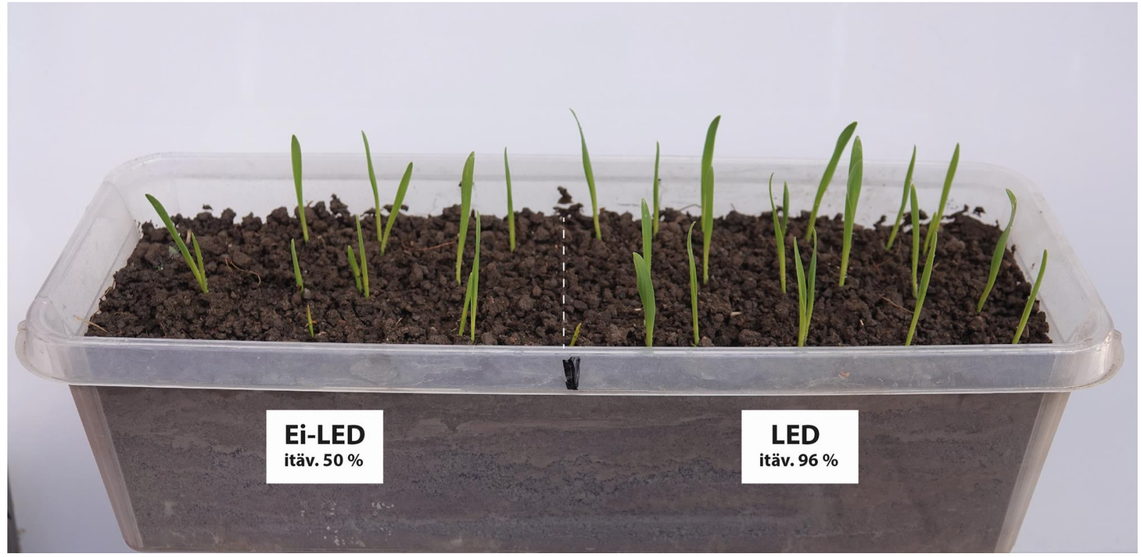
KONEVIESTI: 26.7.2024 ja 2.10.2024

Punahomeen eli Fusarium-ongelmien selätys sinivalon avulla – LED-tekniikkaa hyödynnetään viljankäsittelyssä

Viljojen Fusarium ja mykotoksiinipitoisuudet taas tapetilla – keinoja ongelman selättämiseksi on löytynyt

Vaikuttavuus itävyyteen halutaan testaillä lisää!



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TÄRKEIMMÄT

Kaikki sinivalo ei tapa mikrobeja (tai Fusarium-home)

- Tarvitset oikeat aallonpituudet ja että tarpeeksi korkea intensiteetti saavuttaa mikrobit
- Jos käytät jotain muuta teknologiaa, varmista että on testattu ettei vahingoita elintarviketta (viljaa) tai voi aiheuttaa muita ongelmia, esimerkiksi ravintoarvojen muuttaminen

Havainnot kentältä ja kenttätestauksista:

- DON-arvot saattavat muuttua varastoinnin aikana. Esimerkkinä syksyllä mitattu DON-arvoksi 2140µg/kg kaurasta, kevällä samasta siilosta ja erästä mitattu niin arvo oli yli 5000 µg/kg. Havaittu mysö että heti kuivauksen jälkeen DON-arvo voi olla erittäin alhainen, 500 µg/kg, ja jo pari vuorokautta myöhemmin 2000-4000 µg/kg.
- Havaittu että talvella saadaan Wisdom SEED rikkaseulalla DON-arvot tippumaan nopeammin/enemmän kun jos on korkeammat ilmalämpötilat (ja korkeampi ilmakosteus). Tämän hetkinen suositus on että ulkolämpötila olisi mielellään alle +10°C, saa myös olla pakkasen puolella.

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THANK YOU!