UV-C AIR DISINFECTION SCIENTIFICALLY VERIFIED

- UV-C AIR DISINFECTION **WHITE PAPER** BY DR. THIERRY K.S. JANSSENS

- **LAB REPORT** BY PROF. WACLAW DABROWSKI (INSTITUTE OF AGRICULTURE AND FOOD BIOTECHNOLOGY)

- **COMMENTS** ON LAB REPORT BY DR. THIERRY K.S. JANSSENS

UV-C Air Disinfection verified by Prof. Waclaw Dabrowski (Institute of Agriculture and Food Biotechnology)

The sudden Covid-19 pandemic has woken up the globalized society and economy about its susceptibility to emerging pathogens. The novel coronavirus that is spreading over the human population exhibited unexpected properties that put a challenge on health care systems worldwide. Individuals that are present as dense crowds are especially prone to the spread of respiratory infections, as has been shown in the last year how venues of recreation, sports and celebration were reported as hotspots for the spread of the SARS-CoV-2 virus. Therefore, all public indoor places with regular presence or turnover of crowds are potentially high-risk for transmission of the coronavirus. Consequently, the economic fallout of the Covid-19 pandemic most hit the arts, entertainment and recreation sector and accommodation and food services sector (McKinsey, 2020), as they are under strict guidelines from the authorities, suffer from consumer FUD and their recovery period to pre-pandemic levels would take up to five years and the high proportion of small businesses involved.

Measures such as hand washing, face masks, surface disinfection, social distancing, crowd management, testing and contact tracing have been instrumental to slowly open up the society after lock down measures during the first global wave of SARS-CoV-2 infections. Still, pre-pandemic numbers in crowds remain a challenge for e.g. recreational, business or religious events, educational organizations or the thriving of food services in restaurants and bars.

The scientific debate on the transmission of SARS-CoV-2 in the air is still going on (Lewis, 2020), and has caused public agitation about the formulation of guidelines, such as the distance to be kept between individuals and the contrast of the indoor versus outdoor risks. The distinction between droplets and aerosols in the spread of the virus remains in the fact that it could be spread respectively by coughing/sneezing only or also by talking or singing. There has been ample evidence of the detection of SARS-CoV-2 genetic material in aerosols, but the infectiousness is also highly determined by the magnitude of the viral load and duration of the exposure. Also, influenza virus (which is comparable in structural sensitivity to the novel coronavirus) has been shown to be most infective in aerosols at lower humidity levels (Noti *et al*, 2013), such as the situation in heated indoor air. Following the concurrent growing consensus on the significant role of aerosols in the airborne transmission and the subsequent risk of super-spreading events in large crowds (The Lancet COVID-19 Commission, 2020), ventilation and disinfection of recirculated indoor air have become indispensable measures to assure a safer indoor ambient with minimized risk for infection by SARS-CoV-2 and other respiratory pathogens. In addition to the behavioral and maintenance guidelines, the proper treatment of indoor air will become an additional layer of biological safety in Covid-19 safe venues, as seen worldwide in initiatives to formulate guidelines for safety at venues; for example by REHVA (Federation of European Heating, Ventilation and Air Conditioning Associations (Kurnitski *et al.*, 2020)).

Ultraviolet germicidal inactivation (UVGCI) is an effective technique to eliminate micro-organisms (bacteria, viruses, fungi and molds). This high energy and low wavelength irradiation destroys the genetic material without any remaining residues and with limited chance of emergence of resistance compared to the use of biocides/antimicrobials. It can be applied on suitable surfaces and fomites in the absence of non-target organisms, such as humans, but has also shown its value in the topical treatment of infections, disinfection of culture water in aquaculture and indoor air in ventilation systems. It is a non-selective mode of eliminating micro-organisms, but not all cells and viruses are equally susceptible (Malayeri *et al.*, 2016). Cell walls, spore structures and dense viral capsids can require higher dose of UV-C radiation to reach the genetic material. Viruses - and especially the groups with single stranded genetic material - are more susceptible to UVGCI than cellular micro-organisms (Tseng *et al.*, 2005). Therefore the SARS-CoV-2 is quickly eliminated by this treatment, even at high densities (Heilingloh *et al.*, 2020).

The Luxibel type B Air V2 (2x 55W TUV disinfection lamp) makes use of this same principle to treat indoor air and because of its aerodynamic design and vertical structure it samples in a laminar mode of flow in the middle of the air column above the crowds. As such, the MADS (Mid-Air Disinfection

System) avoids the turbulent distribution of aerosols and minimizes the spread of airborne pathogens by aerosols.

In a study executed by the IBPR (Prof. Wacław Dąbrowski Institute of Agriculture and Food Biotechnology) in Poland, our apparatus exhibits an almost immediate effect on the microbial air quality, by a reduction of 71 and 49 % of respectively total microbial and fungal count after 2 hours of operation in a setup of 1,3 fold treatment of indoor air volume per hour (See Figure 1). After 20 hours the reduction in viable count were reduced with 98% and 93% of the initial burden respectively.

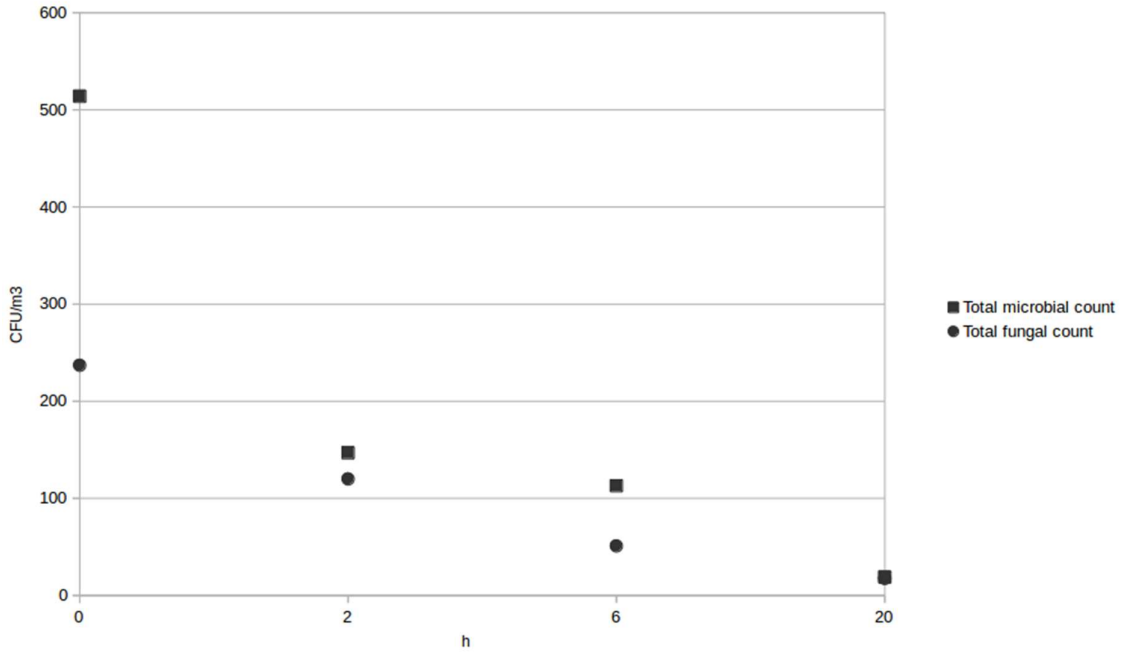

Figure 1: Total microbial and fungal viable counts upon sampling of 1 m^3 of indoor air (MAS-100 ECO™ air sampler, MBV), after growth on media.

Upon 20 hours of treatment of indoor air in a closed room, the burden of viable of microbial cells in the sampled air was reduced to levels that are observed in operation theaters (Shaw *et al.*, 2018) or in occasional positive samples in production clean rooms (Tršan *et al.*, 2019).

The positioning of the air disinfection units along the principles of the patent-pending MADS principle can reduce the most dangerous aerosols in a more efficient way versus classic wall mounted systems, or clean room techniques.

In addition to the recommend measures to combat the spread of Covid-19, as by the measures and guidelines issued by authorities, integrating the Luxibel type B Air V2 (2x 55W UV disinfection unit) into a well-dimensioned ventilation system will make any indoor public space or venue prepared to reduce the risk of infection by SARS-CoV-2 or any other airborne pathogens, both during the concurrent crisis and post-pandemic. This will results in a more hassle free use of public indoor spaces and a quicker than predicted economic recovery for the collapsed economic sectors.

Dr. Thierry K.S. Janssens
Molecular Biologist

Reference list

- https://www.mckinsey.com/featured-insights/coronavirus-leading-through-the-crisis/charting-the-path-to-the-next-normal/covid-19-recovery-in-hardest-hit-sectors-could-take-more-than-5-years
- Heilingloh, C. S., Aufderhorst, U. W., Schipper, L., Dittmer, U., Witzke, O., Yang, D., ... & Steinmann, E. (2020). Susceptibility of SARS-CoV-2 to UV irradiation. American Journal of Infection Control.
- Kurnitski J, Boerstra A, Franchimon F, Mazzarella L, Hogeling J, Hovorka F, *et al.* REHVA COVID-19 guidance document , March 17 , 2020 (updates will follow as necessary) How to operate and use building services in order to prevent the spread of the coronavirus (SARS-CoV-2) disease (COVID-19) in workplaces. 2020;2020(i):1–6.
- Lewis, D. (2020). Is the coronavirus airborne? Experts can't agree. *Nature*, *580*(7802), 175.
- Malayeri, A. H., Mohseni, M., Cairns, B., Bolton, J. R., Chevrefils, G., Caron, E., ... & Linden, K. G. (2016). Fluence (UV dose) required to achieve incremental log inactivation of bacteria, protozoa, viruses and algae. IUVA News, 18(3), 4-6.
- Noti, J. D., Blachere, F. M., McMillen, C. M., Lindsley, W. G., Kashon, M. L., Slaughter, D. R., & Beezhold, D. H. (2013). High humidity leads to loss of infectious influenza virus from simulated coughs. *PloS one*, *8*(2), e57485.
- Shaw, L. F., Chen, I. H., Chen, C. S., Wu, H. H., Lai, L. S., Chen, Y. Y., & Der Wang, F. (2018). Factors influencing microbial colonies in the air of operating rooms. BMC infectious diseases, 18(1), 4.
- The Lancet COVID-19 Commissioners, Task Force Chairs, and Commission Secretariat (2020) Lancet COVID-19 Commission Statement on the occasion of the 75th session of the UN General Assembly. Published Online September 14, 2020, https://doi.org/10.1016/S0140-6736(20)31927-9
- Tršan, M., Seme, K., & Srčič, S. (2019). The environmental monitoring in hospital pharmacy cleanroom and microbiota catalogue preparation. Saudi Pharmaceutical Journal, 27(4), 455-462.
- Tseng, C. C., & Li, C. S. (2005). Inactivation of virus-containing aerosols by ultraviolet germicidal irradiation. Aerosol Science and Technology, 39(12), 1136-1142.

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1/1
Łódź, 26-08-2020

Test report: No. K/313/01/2020
Research object: Flow disinfection luminaire UV type B Air 2 x 55W

Client:AED Distribution
Luxibel
Bedrijvenpark de Veert 13/004
2830 Willebroek, Belgium

The test object was collected and delivered by the client: 13-08-2020
Research started on: 19-08-2020

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The research has been completed on: 25-08-2020

Type of marking / feature	Analytical method	Results	
Microbiological parameters			
Testing of the level of air pollution during the operation of the lamp in a room of 30 m2 and 2.9 m height	Own methodology using the MAS- 100 ECO™ microbial air sampler - MAS-100 Eco™ instruction manual	*[cfu/l m3]	Reduction of microbes
- total number of microbes at time 0		514	-
- total number of microbes after 2 hours		147	R_{2h} = 71,40%
- total number of microbes after 6 hours		113	R_{6h} = 78,02 %
- total number of microbes after 20 hours		19	$R_{20}h$ = 96,31%
- number of molds and yeasts at time 0		237	-
- number of molds and yeasts after 2 hours		120	R_{2h} = 49,37%
- number of molds and yeasts after 6 hours		51	R_{6h} = 78,48 %
- number of molds and yeasts after 20 hours		17.5	R2011 92,62 %

* *The* results are the average number of microbes from two measurements
Authorised by:

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LABORATORY OF MICROBIOLOGY
Dr. Beata Paziak-Domańska
Adjunct

Approved by:
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Dr. Beasta Bartodziejska

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Assessment of the effectiveness of air disinfection using the B Air 2 x 55W UV flow disinfection luminaire

Scope and purpose of the test

The aim of the test was to determine the effectiveness of air disinfection by means of the UV disinfection flow-through luminaire type B Air 2 x 55W (Test report K/313/01/2020) on the basis of testing the total number of microbes and the number of moulds and yeasts by the aspiration method after 2, 6 and 20 hours of lamp operation in a room with an area of 30 m2 and height of 2.90 m.

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Method of testing

The test was carried out in accordance with our own methodology and the MAS-100 ECO ™ instruction manual (Microbiological Air Sampler) in a room with an area of 30 m^2 . Before switching on the lamp, the total number of microbes and the number of moulds and yeasts in the air filling the room was tested. The degree of air pollution was measured at a distance of approx. 2 meters from the lamp after 2, 6 and 20 hours of operation. The test was carried out with the aspiration method using the MAS-100 ECO™ microbial air sampler, which draws 1000 litres of air through a perforated plate. The air stream containing the particles was directed to the surface of PCA or YGC agar in a standard petri dish. Upon completion of the air sampling cycle, the panes were incubated at 30°C for 72 hours or at 25°C for 5 days, then the colonies grown were counted and the number of microbes in 1 m2 of the air was determined, taking into account the correction of the Feller statistical conversion table.

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Adjunct

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Repertory number: **1924/2020**
Date: **07/09/2020**

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Łódź, 26-08-2020

Sprawozdanie z badań Nr K/313/01/2020

Obiekt badania: Przepływowa oprawa dezynfekcyjna UV typu B Air 2 x 55W

Klient: **AED Distribution**
Luxibel
Bedrijvenpark de Veert 13/004
2830 Willebroek, Belgium

Obiekt do badania pobrał i dostarczył Klient: 13-08-2020
Badania rozpoczęto: 19-08-2020
Badania zakończono: 25-08-2020

Rodzaj oznaczenia / cecha	Metoda analityczna	Wyniki	
Parametry mikrobiologiczne			
Badanie poziomu zanieczyszczenia powietrza podczas działania lampy w pomieszczeniu o powierzchni 30 m^2 i wysokości 2,9 m	Metodyka własna przy użyciu mikrobiologicznego próbnika powietrza MAS-100 ECO™ Instrukcja MAS-100 Eco™	*[jtk/1 m^3]	Redukcja drobnoustrojów
- ogólna liczba drobnoustrojów w czasie 0		**514**	-
- ogólna liczba drobnoustrojów po 2 godz.		**147**	R_{2h} = 71,40%
- ogólna liczba drobnoustrojów po 6 godz.		**113**	R_{6h} = 78,02 %
- ogólna liczba drobnoustrojów po 20 godz.		**19**	R_{20h} = 96,31%
- liczba pleśni i drożdży w czasie 0		**237**	-
- liczba pleśni i drożdży po 2 godz.		**120**	R_{2h} = 49,37%
- liczba pleśni i drożdży po 6 godz.		**51**	R_{6h} = 78,48 %
- liczba pleśni i drożdży po 20 godz.		**17,5**	R_{20h} = 92,62 %

*Wyniki stanowią średnią liczbę drobnoustrojów z dwóch pomiarów

Autoryzował:
PRACOWNIA MIKROBIOLOGII
dr Beata Paziak-Domańska
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Zatwierdził:
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dr Beata Bartodziejska

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Ocena skuteczności dezynfekcji powietrza przy użyciu Przepływowej oprawy dezynfekcyjnej UV typu B Air 2 x 55W

Cel i zakres badania

Celem badania było określenie skuteczności dezynfekcji powietrza za pomocą **Przepływowej oprawy dezynfekcyjnej UV typu B Air 2 x 55W** (Sprawozdanie z badań K/313/01/2020) na podstawie badania ogólnej liczby drobnoustrojów oraz liczby pleśni i drożdży metodą aspiracyjną po 2, 6 i 20 godzinach pracy lampy w pomieszczeniu o powierzchni 30 m^2 i wysokości **2,90 m.**

Sposób wykonania badania

Badania przeprowadzono zgodnie z własną metodyką oraz instrukcją MAS-100 ECO™ (Mikrobiologiczny Próbnik Powietrza) w pomieszczeniu o powierzchni 30 m^2. Przed włączeniem lampy wykonano badanie ogólnej liczby drobnoustrojów oraz liczby pleśni i drożdży w powietrzu wypełniającym pomieszczenie. Pomiaru stopnia zanieczyszczenia powietrza dokonywano w odległości ok. 2 metrów od lampy po 2, 6 i 20 godzinach pracy urządzenia. Badania wykonano metodą aspiracyjną przy użyciu mikrobiologicznego próbnika powietrza MAS-100 ECO™, pobierającego 1000 litrów powietrza przez perforowaną płytkę. Strumień powietrza zawierający cząstki, kierowany był na powierzchnię agaru PCA lub YGC w standardowej szalce Petriego. Po ukończeniu cyklu pobierania próbki powietrza, szalki inkubowano w temperaturze 30°C przez 72h lub w temperaturze 25°C przez 5 dni, a następnie zliczano wyrosłe kolonie i określano liczbę drobnoustrojów w 1 m^3 powietrza, uwzględniając korektę statystycznej tablicy przeliczeniowej Fellera.

B. Paziak-Domańska

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Comments on the test report (K/313/01/2020)

Luxibel Type B Air V2 (2x 55W UV-C air disinfection lamp) by the IBPR (Prof. Wacław Dąbrowski - Institute of Agriculture and Food Biotechnology)

In this report the effect of the UV-C disinfection lamp on the viability of cultivable microorganisms in indoor ambient air has been described. If the lamp was used at its nominal pumping rate, 117 m^3/h, the air in the 87 m^3 room would be irradiated 1,3 time per hour. In order to assess the effect on the environmental micro-organisms present in the room, an active microbial sampling method was applied, which better approaches the number of inhaled micro-organisms, as opposed to passive sampling methods, such as settling of microbial cells on exposed culture plates.

The applied microbial air sampler, makes use of the Andersen sampling method, by directing the sampled air through pores in a perforated plate to solid culture media, i.e. sterile agar plates. By applying the maximum sampling volume of 1m^3, the limit of detection was most optimal to detect a decrease in microbial burden.

The growth on the culture media after incubation is reported as counts of (colony forming) units, recalculated according to the statistical corrections for the design of the sampling device.
These counts of colony upon growth on the two culture media PCA and YGC respectively indicate the total number of viable of aerobic and cultivable micro-organisms (including moulds and yeast) and the number of viable yeast/mould cells (excluding bacteria). In this method no distinction is made between pathogenic and harmless micro-organisms and the presence of viruses is not taken into account. (The detection of infectious viral burden from environmental sources is very laborious and semi-quantitative, and would require the application of nebulized viral pathogens.)

The performance of the Type Luxibel B Air V2 (2x 55W UV-C air disinfection lamp) after 20 hours in reducing the microbial load in indoor air is effective, as it reduces the values of actively sampled total microbial counts to values below the average reported value in operation rooms (Shaw *et al*, 2018*)* and it approaches contamination levels that are observed in occasional positive samples in clean room situations (Tršan *et al.*, 2019). The relative reduction in counts (92,6%) is lower for the fungi (yeasts and moulds), as compared to the total microbial count (98,1%), as the former are known to be more UV-C resistant given their thick cell walls. Airborne viruses, and especially those with a single stranded nucleic acid genome (like SARS-CoV-2), are more susceptible than fungi and endospore-forming bacteria (Tseng *et al.*, 2005) (which are included in the total microbial count as well). Therefore, it is expected that the relative reduction of airborne infectious viral particles will be higher than 98,1%.
In order to assess the energy of UV-C radiation transmitted to the airflow, and how it relates to the susceptibility of the different groups of airborne micro-organisms, additional measurements and technical information on the disinfection device are required.

The methodology used in this study is appropriate and straightforward. However, I have some minor comments and questions.

- Given the midair sampling design of the Type B Air V2 (2x 55W UV-C air disinfection lamp), it would be informative to indicate how the sampling device was located according to the generated airflow.

- The manufacturer recommends an application time of 24 h, therefore it would have been informative to extend the duration of the experiment and observe the long term effect of the disinfection lamp, by adding additional time points.
.
- What was the relative humidity (RH) and temperature during the test? The water film on microbial cells can scatter the UV light and make the UV treatment less effective. By providing the RH the results in the performance of the disinfection lamp could be better assessed in other conditions.

- How many microbial air samplers were used or how were the agar plates replaced sterilely? Has there been an influx of ambient air from outside?

- Replicate values/variances are lacking.

References

Shaw, L. F., Chen, I. H., Chen, C. S., Wu, H. H., Lai, L. S., Chen, Y. Y., & Der Wang, F. (2018). Factors influencing microbial colonies in the air of operating rooms. BMC infectious diseases, 18(1), 4.

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About Dr. Thierry K.S. Janssens

Thierry Janssens is an experienced scientist with expertise in molecular biology, microbial ecology, virology and bioinformatics. He graduated with a MSc in Biology and an MSc in Biotechnology from Ghent University. Subsequently he attained his PhD in Biology from VU University Amsterdam, where he studied evolutionary processes in the framework of toxicity of heavy metals and oxidative stress. At later stage in his career he has conducted genomics and bioinformatics research on diverse applied toxicology, microbiology and bio prospection projects, but he also developed bioassays for studying the effects of novel antimicrobial candidate compounds. In the last few years he has conducted research at the Dutch National Institute of Public Health and the Environment (RIVM) on the use of metagenomics for an improved surveillance of respiratory viral pathogens.

About Prof. Wacław Dąbrowski - Institute of Agriculture and Food Biotechnology

Prof. Wacław Dąbrowski Institute of Agricultural and Food Biotechnology works on research, development and application of new biotechnological and technical methods in the food industry. These applications cover several areas, like: technical microbiology, food microbiology, cell engineering, process engineering, chemistry and biochemistry, food technology and human diet. We are working also in agricultural food areas, like: yeast production, alcohol production, winery, vinegary, brewery, fruits and vegetables processing, cereals processing and storage, starch and potatoes processing, bakery industry, food concentrates, cooled and frozen food, sugar industry, meet and fat industry as well as production of microbiologically active confection (enzymatic, probiotic, initiation culturesi etc.).
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