STUDY OF DISINFECTANT ACTION SANITIZING TOOL FOR AIR MODEL DNA

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Conducted and approved by:

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OBJECTIVE

By carrying out the following study, we wanted to test the reduction of microbial and fungi load in the air of a closed environment by a new model of ultraviolet ray device developed by the Nuova ASAV snc company.

All tests were carried out in a Microbiology Laboratory.

The chosen environment is a place where there is the possibility of contracting infections, a risk mainly due to exposure to a wide range of types of agents, from bacteria to fungi.

It was deliberately decided to go and evaluate the action of the machine during a period of work within a very critical environment from a hygienic-sanitary point of view to fully evaluate its real sanitization capabilities.

TEST PROTOCOL

The tests were conducted in the room used for microbiological analyzes of the Ali Lab Laboratory

The room used has the following characteristics:

- Single entry;
- Width: 3.8 m;
- Lenght: 6 m;
- Height: 4 m;
- Windowed surface: 2.5 m^2.

Inside there are three rows of desks arranged parallel to each other. On the desks are arranged:

- Thermostats;
- Protective cabinet Class II – Vertical laminar airflow;
- Various Analytical equipment .

The laboratory activity consists of microbiological determinations of different food matrices, surface swabs and water.

Based on the experience of the test organizer, it was decided to proceed with the determination of:

- Colony count at 30°C- UNI EN 13098:2002 + UNI EN ISO 4833-2:2013;
- Moulds - UNI EN 13098:2002 + ISO 21527-1:2008;
- Yeasts - UNI EN 13098:2002 + ISO 21527-1:2008;
- Coagulase-positive staphylococci - UNI EN 13098:2002 + ISO 6888-2:2004;
- Coliforms- UNI EN 13098:2002 + ISO 4832:2006;
- Sulfite-reducing bacteria- UNI EN 13098:2002 + ISO 15213:2003.

The methods of analysis used are indicated next to each microorganism of interest.

The medium expected by the indicated methods were prepared following the indications of the manufacturers and the internal procedures of the Laboratory (according to the Quality System in compliance with ISO 17025: 2018), sterilized in a Steam Autoclave (15min at 121 ° C) and subsequently distributed in Contact plate with a surface of 24 cm2.

The air sampling was carried out with the active method which involves the use of a SAS Surface Air System sampler positioned in two distinct areas of the room about one meter from the floor.

The use of the SAS provides for the positioning of the Contact petri dishes in the special housing positioned under a perforated cover (disinfected each time with sodium hypochlorite).

180 liters of air were sucked onto each plate and the results obtained from the sampling were brought back to 1 m^3.

The air samplings were carried out in two different areas of the laboratory:

- **Point 1:** Half room near window side;
- **Point 2:** Near door side.

The samplings were always carried out with operators present during their work activities.
The first sampling was carried out without the use of the DNA tool to have a microbiological picture of the air present in the Laboratory.

The machine to be tested was then turned on and subsequent sampling was carried out with the following sampling times:

- 10 minutes;
- 20 minutes;
- 30 minutes;
- 40 minutes;
- 50 minutes;
- 60 minutes;
- 120 minutes;
- 180 minutes;
- 240 minutes.

The Contact plates were then incubated at the temperatures expected by the analysis methods used.

RESULTS

The results of the different air samples are summarized in **Table 1**, where are reported the UFC / m^3 and the percentage reduction related to the microbiological parameters detected in the Laboratory air at the two different sampling points.

Table 2 indicates the average of the percentage reduction for the various microbiological parameters considered.

Sampling moment	CBT (UFC/m^3)	Reduction ufc (%)	Coagulase-positive staphylococci (UFC/m^3)	Reduction ufc (%)	Coliforms (UFC/m^3)	Reduction ufc (%)	Moulds (UFC/m^3)	Reduction ufc (%)	Yeasts (UFC/m^3)	Reduction ufc (%)
DNA off	38	0	24	0	13	0	41	0	8	0
after 10 min	26	32	17	29	3	77	15	63	2	75
after 20 min	14	63	13	46	1	92	9	78	2	75
after 30 min	13	66	9	63	0	100	9	78	2	75
after 40 min	11	71	6	75	0	100	8	80	2	75
after 50 min	9	76	4	83	0	100	7	83	0	100
after 60 min	7	82	1	96	0	100	7	83	0	100
after 120 min	6	84	0	100	0	100	6	85	0	100
after 180 min	5	87	0	100	0	100	3	93	0	100
after 240 min	1	97	0	100	0	100	2	95	0	100
Sampling moment	**CBT (UFC/m^3)**	**Reduction ufc (%)**	**Coagulase-positive staphylococci (UFC/m^3)**	**Reduction (%)**	**Coliforms (UFC/m^3)**	**Reduction ufc (%)**	**Moulds (UFC/m^3)**	**Reduction ufc (%)**	**Yeasts (UFC/m^3)**	**Reduction ufc (%)**
DNA off	42	0	11	0	8	0	64	0	10	0
after 10 min	27	36	9	18	2	75	41	36	7	30
after 20 min	18	57	5	55	1	88	38	41	7	30
after 30 min	14	67	4	64	0	100	32	50	7	30
after 40 min	11	74	2	82	0	100	30	53	7	30
after 50 min	9	79	1	91	0	100	9	86	4	60
after 60 min	8	81	0	100	0	100	8	88	4	60
after 120 min	7	83	0	100	0	100	2	97	2	80
after 180 min	3	93	0	100	0	100	1	98	2	80
after 240 min	0	100	0	100	0	100	1	98	0	100

Table 1. Microbial contamination levels and % reduction for Points 1 and 2.

The percentage reduction varies differently depending on the parameter considered:

Colony count at 30°C
A reduction of more than 80% is achieved after 60 minutes of use in both points considered. 100% is reached in Point 2 after 240 minutes of use.

Coagulase-positive staphylococci.
A reduction of more than 80% is achieved after at least 50 minutes of use. The percentage greater than 90% is reached from 60 minutes of appliance operation.

Coliforms.
A reduction of more than 80% - 90% is achieved after 20 minutes of use. The percentage of 100% is already reached after 30 minutes of appliance operation.

Moulds.
A reduction of more than 80% is achieved after about 50 minutes of use.

Yeasts.
In Point 1, the 100% reduction is already reached after 50 minutes of operation of the appliance.

Sampling moment	CBT reduction ufc (%)	Coagulase-positive staphylococci reduction ufc (%)	Coliforms reduction ufc (%)	Moulds reduction ufc (%)	Yeasts reduction ufc (%)
DNA off	0	0	0	0	0
after 10 min	34	24	76	50	53
after 20 min	60	50	90	59	53
after 30 min	66	63	100	64	53
after 40 min	72	78	100	67	53
after 50 min	77	87	100	84	80
after 60 min	81	98	100	85	80
after 120 min	84	100	100	91	90
after 180 min	90	100	100	96	90
after 240 min	99	100	100	97	100

Table 2 . Medium % reduction.

The table does not include data regarding the spores of the reducing sulfite Clostridia as they were not detected in the environment as early as the beginning of the sampling, i.e. with the tool off.

CONCLUSIONS

First, it is interesting to note the initial situation of the Laboratory air. The sampling showed a limited contamination of the environment mainly by Colony count at 30°C, Moulds and Staphylococci. The charges of Coliforms and Yeasts were low, and the Sulfite-reducing bacteria were completely absent.

In **Table 3** it is possible to see the % reduction relating to the two sampling points considered in the test.

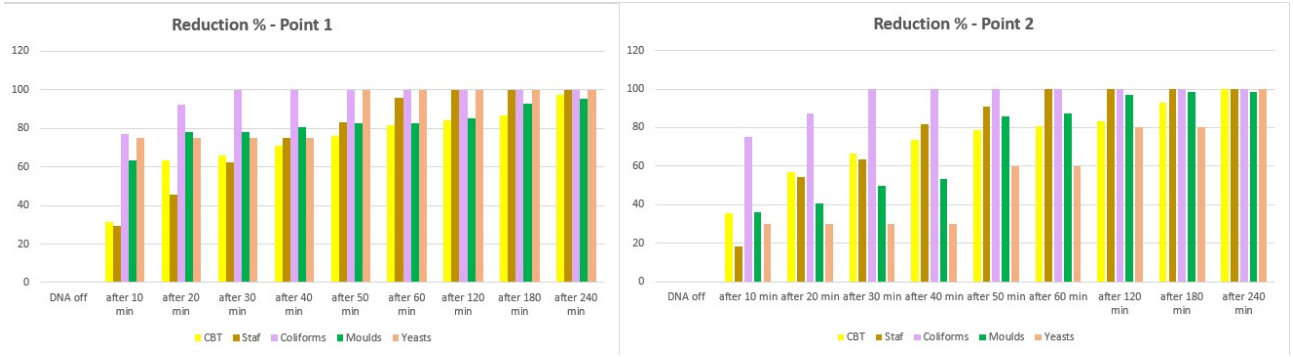

Table 3. % Reduction trend Point 1 and Point 2.

From the data in **Table 1** it can be seen that in Point 2 the initial charges of Moulds and Colony count at 30°C are much higher than in Point 1.

It is interesting to evaluate the trend of the microbial reduction of the average of the two points present in **Table 4**.

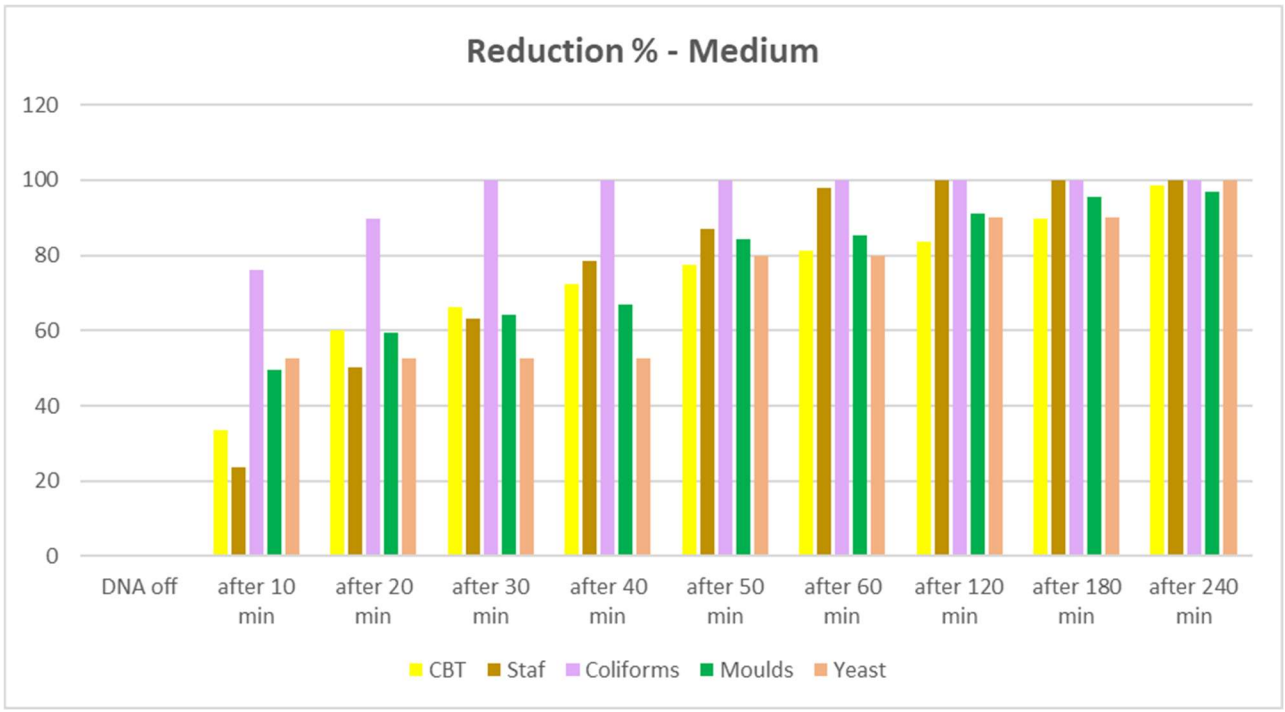

Table 4. Average % reduction trend**.**

Both in **Table 3** and in **Table 4** it is noted that from 50 minutes onwards the blast chilling power of the machine begins to become predominant, with percentages ≥ 80%. If the starting concentrations proved to be very high (such as molds and total microbial load) the abatement power is greater than 90% after 180 minutes.

The results show how DNA, already after 50-60 minutes of ignition, manages to completely break down Staphylococci and Coliforms and begins to work consistently also on Colony count at 30°C and Moulds.

The performance of the yeasts is not very significant as the charges obtained from the samples were already low at the beginning of the test, in any case, as can be seen in **Table 4**, the 100% reduction is achieved after 240 minutes of use .

The test and sampling were carried out in the worst possible conditions, with staff at work and the results obtained allow us to highlight how, the continuous use of this type of lamp represents a measure of protection for the staff who work, for many hours, inside of work activities with potential sources of air contamination.

The use of the tested equipment seems to be very useful also because it does not involve the use of chemicals or the development of secondary products potentially harmful to the working staff.