BERTRONIC SRL

VERIFY EFFECTIVENESS OF VAIRUS AIR DEVICE

November 2020

INDEX

CUSTOMER

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VERIFY EFFECTIVENESS OF VAIRUS DEVICE

Acceptance n°:	2000725/2020
Sample receipt date:	15/10/2020
Test start date:	16/10/2020
Test end date:	13/11/2020

PURPOSE OF THE STUDY

The purpose of this test is to verify the abatement effectiveness of the "VAIRUS" device of bacteria, yeasts, molds and volatile substances present in the air.

SAMPLE PICTURE

EQUIPMENT AND MATERIALS

- Nitrate membranes of sterile cellulose, having porosity 0,45 µm and diameter 47 mm;
- Filtration system connected to the vacuum pump;
- Stirrer;
- Sterile laboratory glassware and pliers;
- Extracting solution: Bacteriolagical peptone (1g/l), NaCl (5g/l) with the addition of 20 (2g/l) Tween;
- *Bacillus subtilis* ATCC® 6633;
- Plates Tryptone Soy Agar (Supplier VWR international Pbi lot 111419088 expiries 20/08/2021).

All heat-stable glassware was sterilized using a validated steam cycle.
The consumables used in carrying out the test are correlated with the Producer Analysis Certificates and have been handled in such a way as to avoid any kind of unintentional contamination. The expiration dates have been met.
The equipment used was checked and found to be fully functional and suitable for the use of this test.

CHECKS

The negative control is treated like the samples, but without administration of the bacterial strain.
The positive control consists of the inoculation of a 0.1 ml aliquot of the strain, directly on the culture medium, in order to verify that the bacterium is viable.

CONDUCT OF THE TEST

The test was carried out in a 8 cubic meter chamber.

The following bacteria were placed:
- *Bacillus Subtilis*
- *Escherichia Coli*
- *Serratia Marcescens*
- *Staphylococcus aureus*

The following yeasts were placed:
- *Candida Albicans*
- *Common Yeast Cake*
- *Saccharomices Ellipsoideus*
- *Saccharomices Spores*

The following molds were placed:
- *Aspergillus Flavus*
- *Aspergillus Niger*
- *Mucor Raucemosus*
- *Penicillin Expansus*

The following volatile substances were placed:
- *Acetic Acid*
- *Toluene*
- *Formaldehyde*
- *Acetaldehyde*
- *Ammonia*

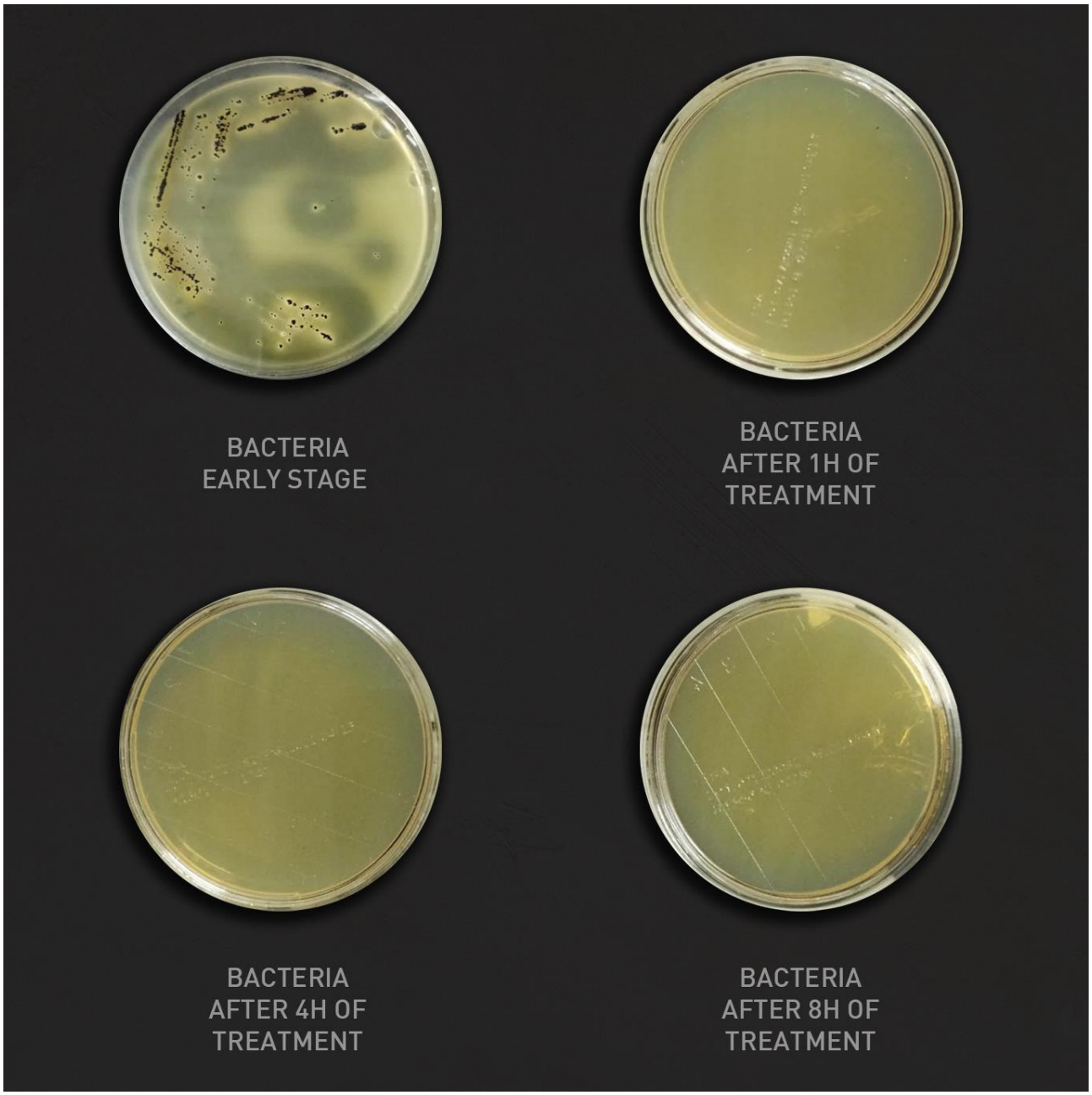
A survey of the SOVs was also carried out (volatile organic substances).
The measurements were made at time zero, after 1 (one) hour, after 4 (four) hours and after 8 (eight) hours.

The various substances investigated were vaporized inside the 8 cubic meter chamber in aeriform suspension at known concentration, as reported in the tables in the "Results" paragraph (page 6, 8, 10 and 12).

The surveys were carried out by vaporizing one substance at a time inside the chamber.

RESULTS BACTERIA TREATMENT

Below are the results obtained regarding bacteria treatment:

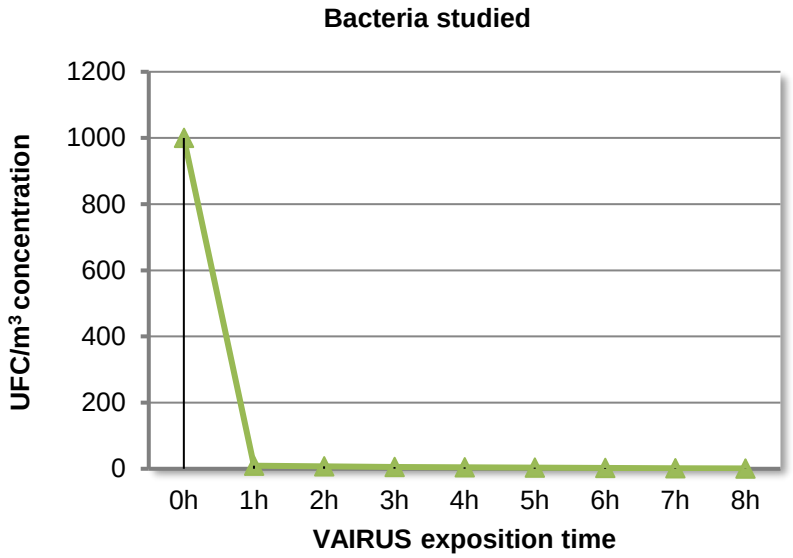


Bacteria typing was not performed after treatment as there is a 99% reduction after one hour of treatment, 99,5% after four hours and 99,9% after eight hours.

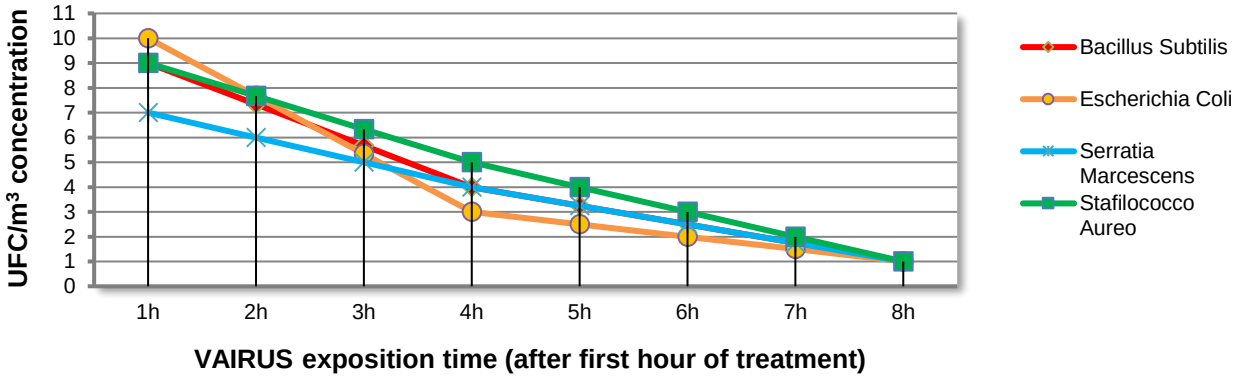
Bacteria concentration table:

Bacteria studied	Starting concentration	Concentration after 1 hour	Concentration after 4 hours	Concentration after 8 hours
Bacillus Subtilis	1000 UFC/m³	9 UFC/m³	4 UFC/m³	1 UFC/m³
Escherichia Coli	1000 UFC/m³	10 UFC/m³	3 UFC/m³	1 UFC/m³
Serratia Marcescens	1000 UFC/m³	7 UFC/m³	4 UFC/m³	1 UFC/m³
Staphylococcus aureus	1000 UFC/m³	9 UFC/m³	5 UFC/m³	1 UFC/m³

Bacteria concentration graphical representation:

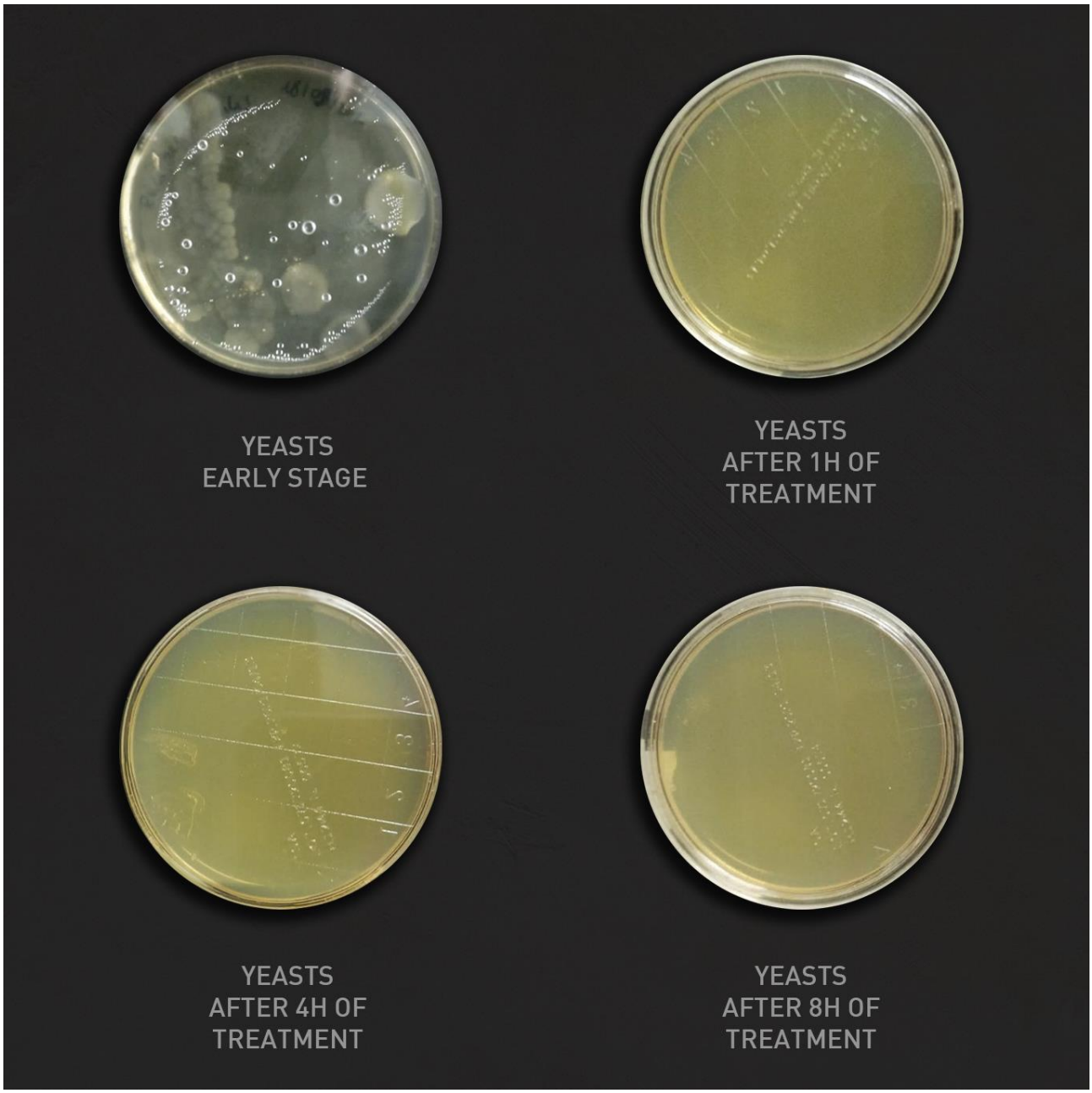


Average fall of the bacteria studied at 99.9% after 8 (eight) hours of treatment



RESULTS YEAST TREATMENT

Below are the results obtained regarding yeasts treatment:

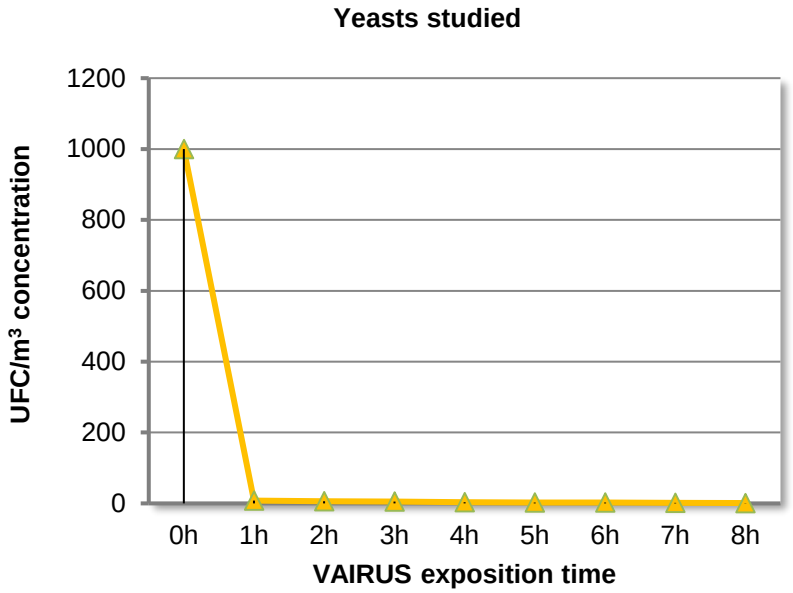


The yeasts typing was not performed following the treatment as there is a reduction of 99% after one hour of treatment, 99.5% after four hours and 99.9% after eight hours.

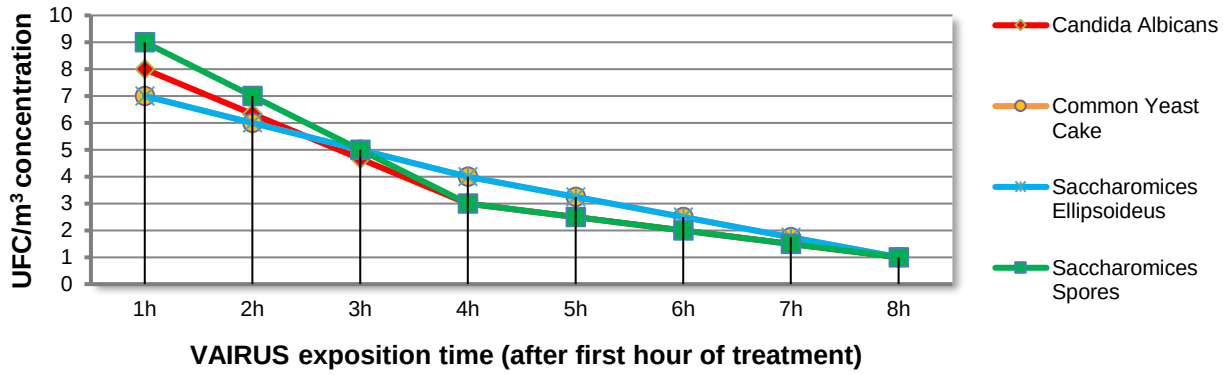
Yeasts concentration table:

Yeasts studied	Starting concentration	Concentration after 1 hour	Concentration after 4 hours	Concentration after 8 hours
Candida Albicans	1000 UFC/m³	8 UFC/m³	3 UFC/m³	1 UFC/m³
Common Yeast Cake	1000 UFC/m³	7 UFC/m³	4 UFC/m³	1 UFC/m³
Saccharomices Ellipsoideus	1000 UFC/m³	7 UFC/m³	4 UFC/m³	1 UFC/m³
Saccharomices Spores	1000 UFC/m³	9 UFC/m³	3 UFC/m³	1 UFC/m³

Yeasts concentration graphical representation:

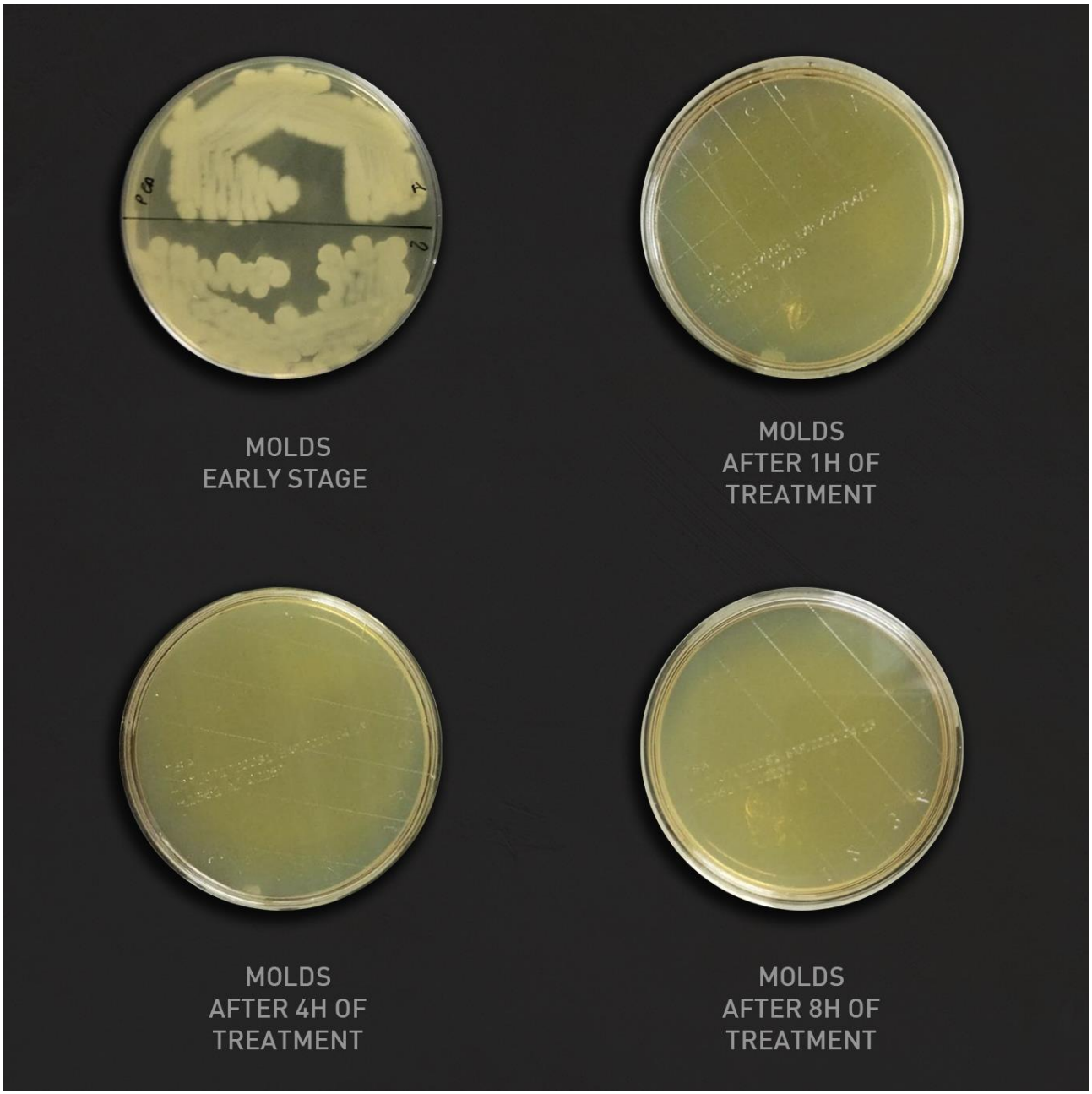


Average fall of the yeasts studied at 99.9% after 8 (eight) hours of treatment



RESULTS MOLDS TREATMENT

Below are the results obtained regarding molds treatment:

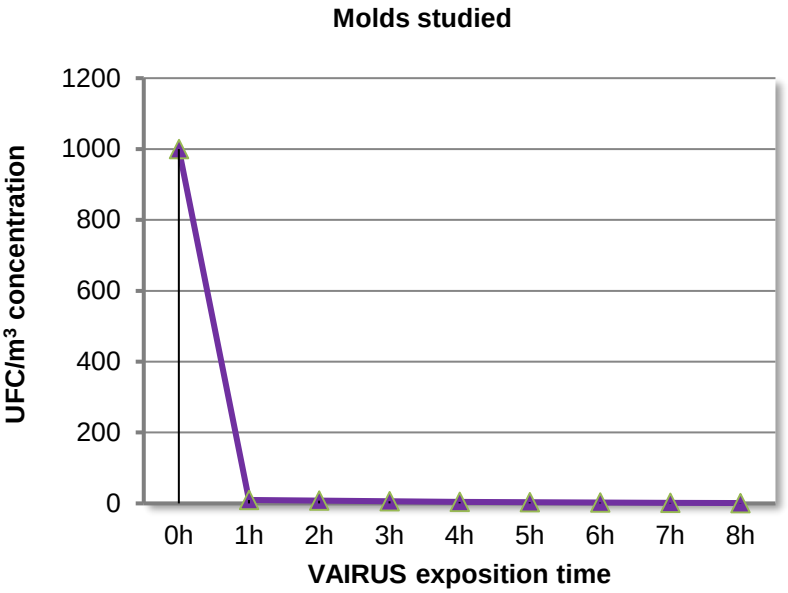


Molds typing was not performed following the treatment as there is a reduction of 99% after one hour of treatment, 99.5% after four hours and 99.9% after eight hours.

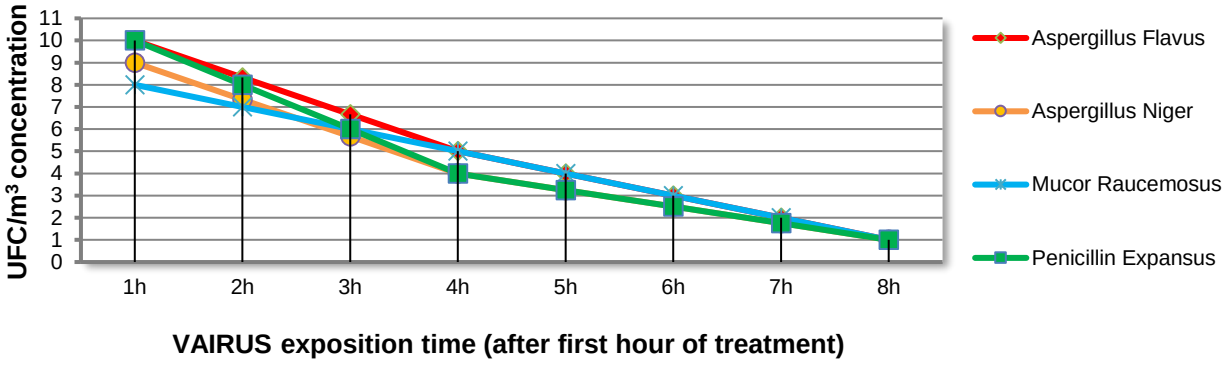
Molds concentration table:

Molds studied	Starting concentration	Concentration after 1 hour	Concentration after 4 hours	Concentration after 8 hours
Aspergillus Flavus	1000 UFC/m^3	10 UFC/m^3	5 UFC/m^3	1 UFC/m^3
Aspergillus Niger	1000 UFC/m^3	9 UFC/m^3	4 UFC/m^3	1 UFC/m^3
Mucor Raucemosus	1000 UFC/m^3	8 UFC/m^3	5 UFC/m^3	1 UFC/m^3
Penicillin Expansus	1000 UFC/m^3	10 UFC/m^3	4 UFC/m^3	1 UFC/m^3

Molds concentration graphical representation:



Average fall of the molds studied at 99.9% after 8 (eight) hours of treatment



RESULTS VOC TREATMENT

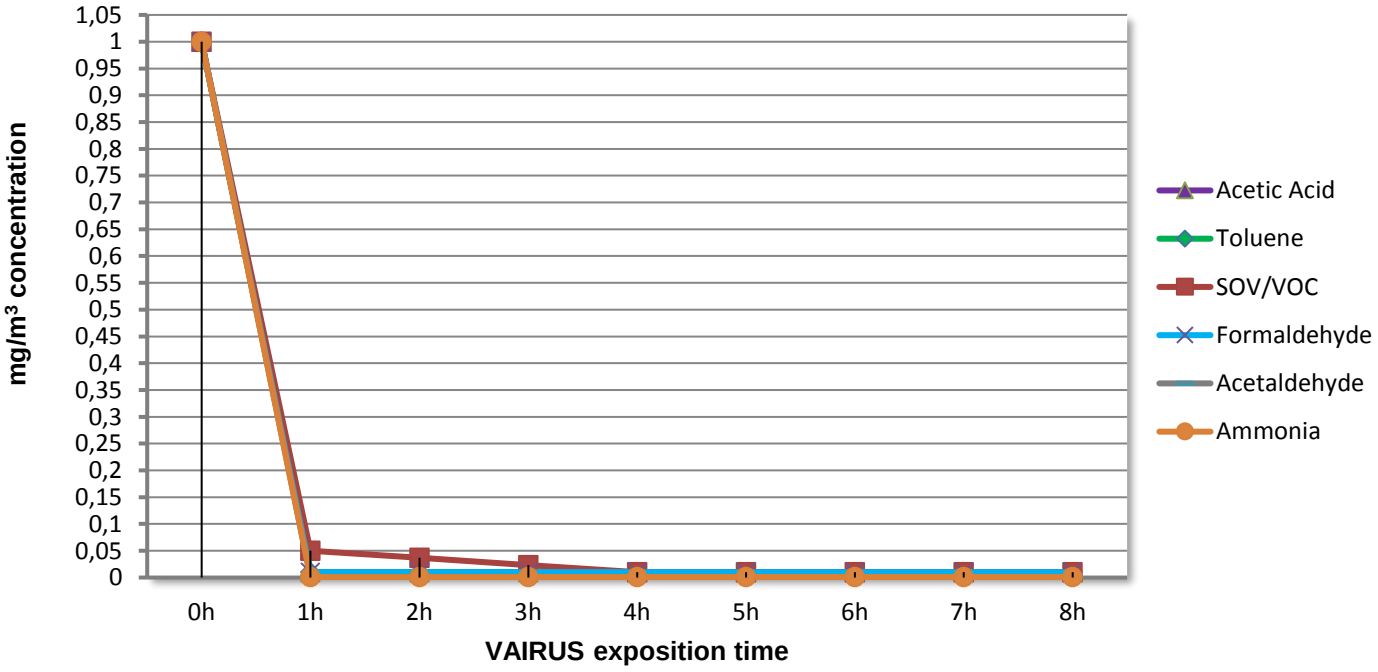
VOC concentration table:

Substances studied	Starting concentration	Concentration after 1 hour	Concentration after 4 hours	Concentration after 8 hours
Acetic Acid	1 mg/m³	<0,01 mg/m³	<0,01 mg/m³	<0,01 mg/m³
Toluene	1 mg/m³	<0,01 mg/m³	<0,01 mg/m³	<0,01 mg/m³
VOC	1 mg/m³	<0,05 mg/m³	<0,01 mg/m³	<0,01 mg/m³
Formaldehyde	1 mg/m³	<0,01 mg/m³	<0,01 mg/m³	<0,01 mg/m³
Acetaldehyde	1 mg/m³	<0,001 mg/m³	<0,001 mg/m³	<0,001 mg/m³
Ammonia	1 mg/m³	<0,001 mg/m³	<0,001 mg/m³	<0,001 mg/m³

As can be seen from the table, there is a significant reduction after one hour of treatment of all the studied substances. The determinations of the table were performed through GC/MS.

Average fall of the Acetaldehyde and Ammonia at 99,99 % already after one hour of treatment. Average fall of the Acetic Acid, Toluene and Formaldehyde at 99.9% after one hour of treatment and VOC after four hours of treatment.

VOC concentration graphical representation:



CONCLUSIONS

From the analyzes carried out, it can be said that the device VAIRUS it's effective for killing bacteria, yeasts, molds and volatile substances.

OZONE O_3

The possible production of Ozone by the device VAIRUS was monitored in a 8 m^3 sealed chamber.

Minimal quantities of Ozone are normally present in the air that we breathe.

Photocatalytic oxidation does not reduce the amount of O_3 in the air, being itself an oxidant.

Results: After 8 hours of operation at maximum power the amount of Ozone in the chamber remained unchanged, therefore, we can affirm that VAIRUS does not in any way change the normal presence of Ozone in the air.

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Antonio Vignali[i]

TECHNO ANALISYS S.r.l.

San Felice sul Panaro (MO), 17/11/2020z

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