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Test report N.200341b-01-EN

Lille, April 22nd, 2021

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Test report N.200341b-01-EN

TEST: Evaluation of the efficiency of an air purifier for removal of virus from air
Test on Human coronavirus strain 229E for 3 minutes of contact time

The following results refer only to the tested device.
This test report has 5 pages

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Table of contents

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I- Experimental conditions

- Test period: from 04/14/2021 to 04/22/2021
- Running time: 3 minutes
- Virus strain: Human Coronavirus 229E (HCoV-229E)
- Culture medium: DMEM + glutamax, 1 % antibiotics, 2 % fetal calf serum
- Cell line: Huh-7 cells, DMEM + glutamax, 1 % antibiotics, 10 % fetal calf serum
- Incubation conditions: 6-7 days at 33 °C with 5 % CO_2
- Concentration method: Amicon columns Ultra-15
- Quantification method: Spearman- Kärber in Log $TCID_{50}$
- Number of test replications: 3

- Medical nebulizer: Respironics (Philips)
- Air sampler: Coriolis µ (Bertin Technologies) working at 150 L/min
- Sampling fluid: 15 mL Tryptone-salt with 0.005 % Tween 20

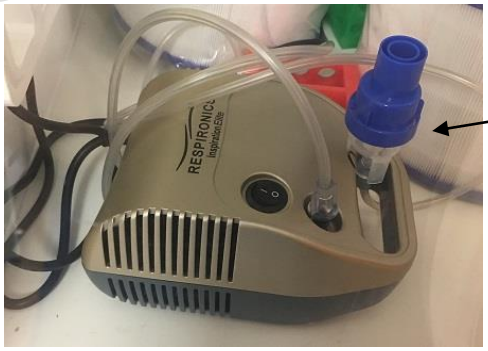
- Device: Alstom AirBubbl
  - mode ON: commercial unit with filter cartridge and ventilation system at 48m^3/h on, constant red light
  - mode OFF: commercial unit without filter cartridge and ventilation system at 48m^3/h on, constant red light

II- Test overview

Tests are conducted inside a microbiological safety cabinet, safety level 3. The inner volume is 540 litres (or 0.54 m^3). Air renewal is switched off during the tests, to prevent aerosols from getting trapped in the cabinet filters.

Micro-droplets containing the virus are aerosolised in the safety cabinet. The contaminated air passes through the air purifier where is it exposed to the decontamination system. The air sampler is switched on to collect air samples which are resuspended in a liquid medium. The efficiency of the system is assessed by the log reduction of the viral population in the air.

A medical nebulizer (Respironics, Philips) is used to generate the aerosols. This device is used to administer inhalation treatments, and therefore produces droplet sizes located in the inhalable fraction. A nebulization chamber is connected to this device, containing the viral suspension in phosphate buffer (PBS).



The air sample is collected using the Coriolis µ (Bertin Technologies), which collects the air samples in 15mL of PBS + 0.005% Tween 20 in a conical flask. Viral particles in the air are thus resuspended in this collection liquid. The sample is taken by aspirating air at 150 L / min. A concentration of the sample on an Amicon® column is carried out before analysis in order to improve the detection limit.

Two types of tests are conducted:

- Test OFF: commercial unit without filter cartridge but with ventilation on and constant red light
- Test ON: commercial unit with filter cartridge with ventilation on and constant red light

For each trial, the difference (in log units) between the nebulized quantity of microorganisms and the collected quantity of microorganisms from air is computed. For tests with air purifier OFF, this value corresponds to a 'physical', passive loss of microorganisms (wall deposit, sedimentation, natural inactivation); for tests with air purifier ON, this value corresponds to both the same 'physical' loss, plus the impact of the decontamination system itself. Therefore, the impact of the air purifier is evaluated as the difference between these two values.

Three successive tests were conducted in the same condition (air purifier with decontamination system ON or air purifier with decontamination system OFF), using the same nebulizing solution, but with a different collection flask each time.
For each experiment, a medical nebulizer containing the microbial suspension was switched on for 150 seconds. When the nebulizer was switched off, the air purifier was switched on 3 minutes. At the end of this running time, the air purifier was switched off and the air sampler was switched on for 5 minutes. At the end of the sampling time, the collection flask was removed and closed.

The infectious titers are determined by Spearman and Kärber calculating method (NF EN 14476+A2, july 2019) and expressed in infectious dose in 50% tissue culture ($TCID_{50}$).

At the end of an experimental day, the safety cabinet was decontaminated. The cabinet was aerated before new tests were performed.

Test report N.200341b-01-EN

III- Test results

Table 1: Quantity of virus nebulized and collected in each trial ($TCID_{50}$)

		Test without disinfection		Test with disinfection	
Mode	**Running time**	**Quantity of virus nebulized**	**Quantity of virus collected**	**Quantity of virus nebulized**	**Quantity of virus collected**
Constant red light	3 minutes	9.3×10^6	7.5×10^4	1.3×10^7	1.0×10^3
		9.3×10^6	1.0×10^5	1.3×10^7	2.4×10^3
		9.3×10^6	3.2×10^4	1.3×10^7	1.8×10^3

The test results represent the difference between the amount of virus nebulized and the amount of virus collected in each test, expressed as Log $TCID_{50}$.

Table 2: Virus loss in each trial (log $TCID_{50}$)

Mode	**Running time**	**Air purifier on No filter**	**Average**	**Air purifier on With filter**	**Average**
Constant red light	3 minutes	2.1	2.2	4.1	3.9
		2.0		3.8	
		2.5		3.9	

The additional loss of virus due to the air purifier and the disinfection system is **1.7 log $TCID_{50}$.**

IV- Conclusion

The air purifier AirBubbl allows a removal of **98.2 % of Human coronavirus strain 229E** from air in a 0.54 m^3 chamber after 3 minutes running time with constant red light on the device.

End of test report