

# The persistence of respiratory viruses on filters of air handling units

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# “The persistence of respiratory viruses on filters of air handling units”

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## Introduction

Indoor as outdoor air pollution is one of the main public health problems of our century

We spend about 90% of our time in closed environments such as homes, workplaces, transport, etc.

Air transports microorganisms like bacteria, fungi and viruses from outdoors to indoors environments’

This bioaerosols indoor air pollution is associated with health problems, absenteeism at work and school and has high related costs resulting of short- and long-term exposition

## Objective

The aim of this work is to understand the fate and the persistence of respiratory viruses in closed environments those using the air handling units with a specific fiberglass filter and the importance risk of non-release of virus from the CTA

## Materials and methods

A respiratory virus model was chosen: RNA virus (Mengovirus)

This virus is cultivated respectively on Buffalo green monkey kidney cells (BGM)
Aerosolization (Flow 4.5 L/min) by a medical nebulizer Omron C29 (CompAir pro) in a vertical column of polymethylmethacrylate

4 outputs whose 3 are equipped with a fiberglass filter F7 (EN 779-2002)

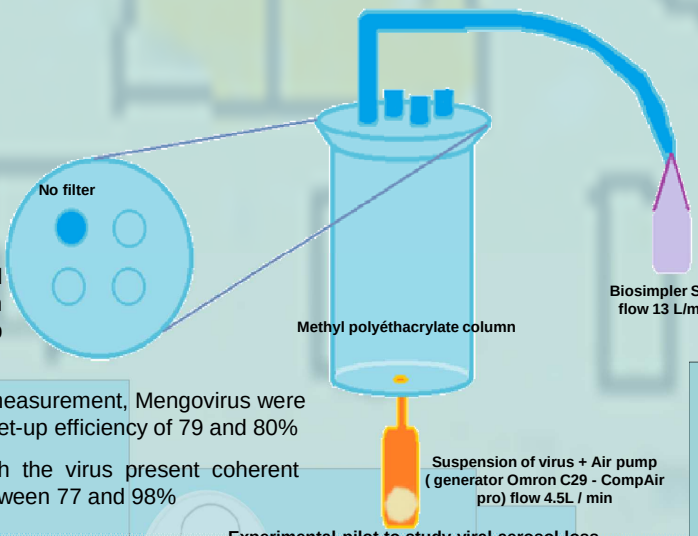
4 biosamples (SKB) collect samples of viral particles passing through the filter (Flow 13 L/min)

The detection of the virus on the filters and the samples is made by:

- qPCR for the quantitative detection
- Culture and titration by $TCID_{50}$ method for the viability and infectivity of the virus

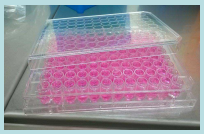


Fiberglass filter F7 (EN 779-2002)

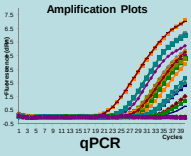



Experimental pilot to study viral aerosol loss

**Detection of the virus on the filters and the samples**



$TCID_{50}$

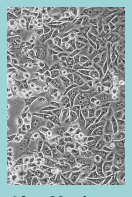



qPCR

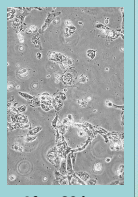
**Infection of BGM cell with Mengovirus**



BGM cell mat



After 30 minutes



After 30 hours

## Results

- The experimental set up and protocols have been validated with fluorescein leading to a set-up efficiency of 98.72% (no Data)

- Based on the qPCR and TCID test measurement, Mengovirus were recovered in the system leading to a set-up efficiency of 79 and 80%

- The experimental set up used with the virus present coherent results with filtration performances between 77 and 98%

| Exp.1 | Initial | Bios 1 | Bios 2 | Bios 3 | Bios (no filter) | Fltr 1 | Fltr 2 | Fltr 3 |
|---|---|---|---|---|---|---|---|---|
| Qualitative (PFU) | 2,54E+11 | 3,18E+04 | 1,93E+04 | 3,25E+04 | 7,15E+05 | 4,03E+03 | 4,03E+03 | 3,42E+03 |
| Quantitative (PFU) | 2,63E+11 | 8,59E+08 | 3,30E+07 | 1,10E+09 | 1,09E+10 | 7,63E+07 | 4,28E+08 | 1,21E+08 |
| Set-Up efficiency (Quantitative) | 79,44 | | | | | | | |
| Set-Up efficiency (Qualitative) | 80,93 | | | | | | | |

The quantification and the infectiousness of the Mengovirus Plaque forming unit (PFU) on the filter and the biosimpler and the set-Up efficiency

- Quantitative comparison between :
  - •the biosampler without filter upstream and the initial virus quantity show a loss of 1.5 log in the system (confirmed in fluoresceine experiment) (no data)
  - •the biosimpler with filter upstream and the filter extract show more viruses pass through the filter
- Qualitative comparison between (infectivity) :
  - •the biosimpler without filter upstream and the initial virus quantity show a loss of 6 log from the initial infectivity
  - •the biosimpler with filter upstream and the filter extract show viruses remain infectious upstream and downstream of the sys

## Perspective

-Experiments are under progress to determine the rate of infectious viruses on the filters and those passing through in different time of aerosolization

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