

# Zimpure Evaluation on Zortrax with ABS

This evaluation is part of the scientific research Zimple and the LSCE, CEA, are conducting together to publish a study on the nanoparticles and COV issued by FDM 3D printers. This study is under refinements to be submitted in Nanomaterials.

The Zimpure evaluation on different 3D printers has two main points to evaluate:

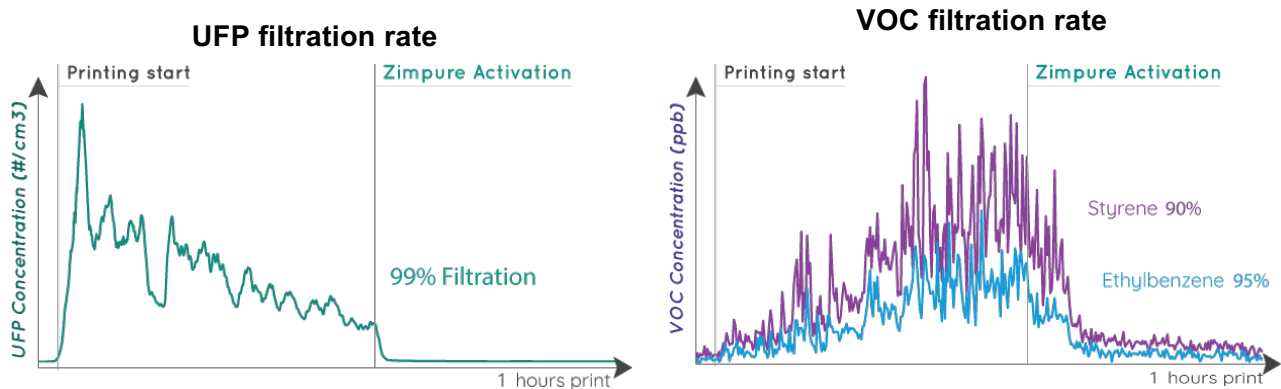
- The suction flow needs to be good enough to aspirate all the emissions even if the 3D printer isn't closed (Open configuration)
- Filters need to be efficient on what is emitted: nanoparticles (from 10 to 100nm) and COV (Close configuration)

That's why Zimpure is tested in both open and close configuration, with two different measurement instruments: a nanoparticles counter, and a mass spectrometer for measuring gases.

## Open configuration:

To know if Zimpure filtration and suction was good enough to provide an efficient filtration rate in an open configuration on both UFP and VOC, the nanoparticles counter and the mass spectrometer probes were placed directly above the printer, while the 3D printer was printing.

The experience starts without Zimpure, and then Zimpure is turned ON to see its efficiency.

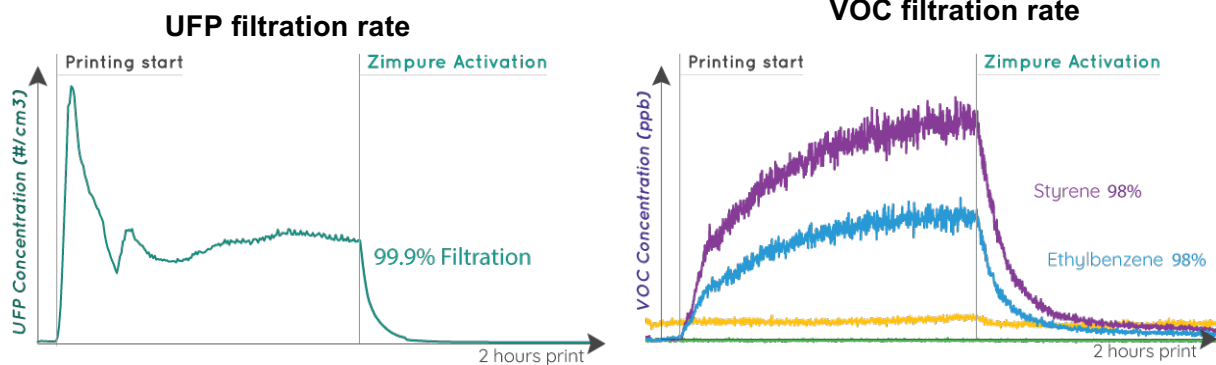


- Average UFP Concentration without Zimpure:
  - o UFP: 246 639 (#/cm3)
- Average UFP Concentration with Zimpure:
  - o UFP: 2 289 (#/cm3)
- Efficiency:
  - o UFP: 99,07%
- Average VOC concentration without Zimpure:
  - o Styrene: 9.51 (ppb)
  - o Ethylbenzene: 7.97 (ppb)
- Average VOC concentration with Zimpure:
  - o Styrene: 0.936 (ppb)
  - o Ethylbenzene: 0.402 (ppb)
- Efficiency:
  - o Styrene: 90.15%
  - o Ethylbenzene: 94.96%

## Closed configuration

In order to check Zimpure filtering efficiency, life time and stability, Zimpure has been tested in a closed and controlled environment. Zimpure was placed inside a box, with both nanoparticles counter and mass spectrometer probes.

The experience starts without Zimpure, and then Zimpure is turned ON to see its efficiency.



- Average UFP Concentration without Zimpure:
  - o UFP: 373 539 (#/cm<sup>3</sup>)
- Average UFP Concentration with Zimpure:
  - o UFP: 170 (#/cm<sup>3</sup>)
- Efficiency:
  - o *UFP: 99,9%*
- Average VOC concentration without Zimpure:
  - o Styrene: 78 (ppb)
  - o Ethylbenzene: 45 (ppb)
- Average VOC concentration with Zimpure:
  - o Styrene: 1.38 (ppb)
  - o Ethylbenzene: 0,79 (ppb)
- Efficiency:
  - o *Styrene: 98.2%*
  - o *Ethylbenzene: 98.2%*

## Settings

All these experience were made on a Zortrax M200 with ABS filament, with the following print settings:

- Layer height : 0.19mm
- Material: Zortrax ABS
- Nozzle diameter: 0.4mm
- Printer : Zortrax M200

A cube of 32cm<sup>3</sup> was printed in order to have the same extrusion flow during all the printing process.

## Conclusion

More details in the full evaluation that will be published within this year.