

## In vitro air-liquid interface (ALI) exposure method to simulate in vivo inhalation exposure

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### Contact person

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### Organisation

**Name of the organisation** Vlaamse Instelling voor Technologisch Onderzoek (VITO)

**Department** Health

**Country** Belgium

**Geographical Area** Flemish Region

### Partners and collaborations

Vlaamse Instelling voor Technologisch Onderzoek (VITO)

## SCOPE OF THE METHOD

|   |  |
|---|--|
| <b>The Method relates to</b>                    | Environment, Human health, Other: Alternative method for in vivo/human inhalation exposure. ALI exposure systems can be used to screen for human health impact of the following cases: Nano/ultrafine particles, Environmental/occupational compounds, Petroleum-derived substances, |
| <b>The Method is situated in</b>                | Basic Research, Translational - Applied Research   |
| <b>Type of method</b>                           | In vitro - Ex vivo   |
| <b>Specify the type of cells/tissues/organs</b> | Lung cells   |

## DESCRIPTION

### Method keywords

in vitro and in vivo tool  
in vitro  
cell culture  
lung  
simulation  
aerosol  
(nano)particle  
vapour  
gas

### Scientific area keywords

in vitro  
lung disease  
respiratory toxicology  
toxicity  
Biomarkers  
inflammation  
aerosol  
vapour  
gas  
(nano)particle

## Method description

VITO can offer expertise in animal-free methods for inhalation testing. VITO has an Air-Liquid Interface (ALI) platform with three ALI exposure modules: two commercial systems for bronchial studies and one in-house developed system for lower airway studies. At VITO ALI exposure modules, aerosol generation and online characterization instruments, and a battery of biological assays (e.g. TransEpithelial Electrical Resistance, cell viability/cytotoxicity, oxidative stress, and inflammatory response) can be used for screening of human health impact of e.g. Nano/ultrafine particles, Environmental/occupational compounds, Petroleum-derived substances, consumer products, pharmaceuticals (toxicity, efficacy, pharmacokinetics).

## Lab equipment

Air-liquid interface exposure system(s) ;  
(Nano)aerosol generation facilities :

- Condensation Monodisperse Aerosol generator,
- Electrospray Aerosol generator,
- Single and Six Jet atomizers,
- Solid Aerosol generator,
- and a Soot generator;

Dedicated cell culture laboratories and assay facilities for biological endpoint measurements.

## Method status

History of use  
Internally validated  
Published in peer reviewed journal

## PROS, CONS & FUTURE POTENTIAL

### Advantages

Inhalation toxicity testing has traditionally been conducted using animals. Concerns related to the weak predictive ability as well as the use of animals, cost, time, and technical difficulty of *in vivo* inhalation resulted in the development of *in vitro* efficient and accurate, human-relevant lung cell-based methods to assess the potential hazards associated with xenobiotic exposure. The first *in vitro* inhalation studies were performed with submerged lung cell cultures. While these cultures are still widely used in *in vitro* pulmonary toxicity studies due to relative ease of handling, dispersion exposures are poorly representative of aerosol inhalation in humans. To overcome this, *in vitro* systems are developed for airborne exposure of lung cells at the air-liquid interface.

### Challenges

There are different ALI exposure systems on the market. No harmonized protocols are available.

### **Modifications**

Yes.

### **Future & Other applications**

Yes, ALI technology might be of relevant for biotech/pharma sector.

## **REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION**

### **References**

Frijns E et al. 2017. A Novel Exposure System Termed NAVETTA for In Vitro Laminar Flow Electrodeposition of Nanoaerosol and Evaluation of Immune Effects in Human Lung Reporter Cells. Environmental Science & Technology, 51 (9), DOI:10.1021/acs.est.7b00493

Patent application for NAVETTA product; Flatbed air-liquid interface exposure module and methods (EP16200571.4; 2016, CN201780072888.1; 2019)

### **Links**

<http://www.pisc ltd.org.uk/vitrocell-prize>

<https://vito.be/nl/nieuws/vito-sterk-ontwikkeling-van-dierproefvervangende-test...>

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