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

Created on: 17-10-2019 - Last modified on: 08-11-2019

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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

The Method relates to	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,
The Method is situated in	Basic Research, Translational - Applied Research
Type of method	In vitro - Ex vivo
Specify the type of cells/tissues/organs	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.piscltd.org.uk/vitrocell-prize

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