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

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

<table>
<thead>
<tr>
<th>The Method relates to</th>
<th>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,</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Method is situated in</td>
<td>Basic Research, Translational - Applied Research</td>
</tr>
<tr>
<td>Type of method</td>
<td>In vitro - Ex vivo</td>
</tr>
<tr>
<td>Specify the type of cells/tissues/organs</td>
<td>Lung cells</td>
</tr>
</tbody>
</table>

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


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-dierproefervangende-test...