TECHNICAL BRIEF

Chemical Insights
An Institute of Underwriters Laboratories Inc.

CelTox Sampler — An Overview

Introduction

Chemical Insights Research Institute's (CIRI) Toxicology Health Sciences Center (or Center for Toxicological Sciences), is focused on evaluating the toxicity of aerosols released by consumer facing products and materials such as 3D printing and electronic nicotine delivery systems (ENDS) or e-cigarettes. CIRI has implemented a CelTox Sampler© to simulate inhalation exposure scenarios of numerous gaseous and particle pollutants which will help in identifying and characterizing respiratory hazards associated with consumer product usage.

Figure 1. Exterior view of CelTox Sampler.

What is the CelTox Sampler?

This system is a temperature and humidity regulated chamber that allows in vitro aerosol exposure studies of particles, gases and vapors (Fig. 1). The system is operated under a vacuum to reduce potential exposure to the researcher while testing various emission sources. System components and surfaces are made from stainless steel to minimize reactivity or "wall losses" of the exposure source.

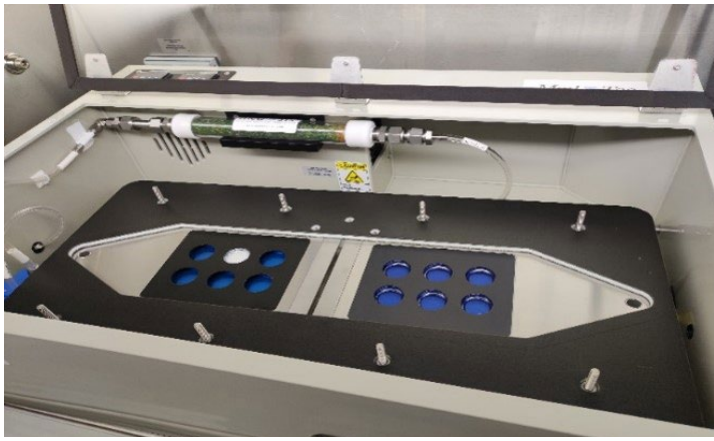

Figure 2. Interior view of the CelTox Sampler showing cell culture inserts and multi-well plates (blue).

How does it work?

A variety of exposure sources can be sampled and drawn into the chamber then delivered to cells cultured on 30-mm diameter cell culture inserts (Fig. 2). The inserts are placed in custom-designed, reusable multi-well plates that are necessary for obtaining optimal particle deposition onto the cells. To enhance aerosol-cell interactions, a unipolar charging source applied to the plate enables electrostatic particle deposition at the cell surface.

What type of cells can be used?

Primary lung cells or lung cell lines cultured in air liquid interface are utilized in the CelTox Sampler (Fig. 3). Air liquid interface (ALI) is a common culturing method that permits the delivery of aerosols to the surface of cells. The ALI culturing method enables the cell basal surfaces, which are cultured on porous membranes, to be in contact with media to maintain viability while the apical, or top of the cellular layer, is exposed to the air or the aerosol/exposure source. The most important facet of ALI is that it aids in the development of a pseudostratified mucociliary cell phenotype (Fig. 3A), which better simulates the microcellular environment and cellular responses observed in the airways during inhalation exposures (Fig. 3B).

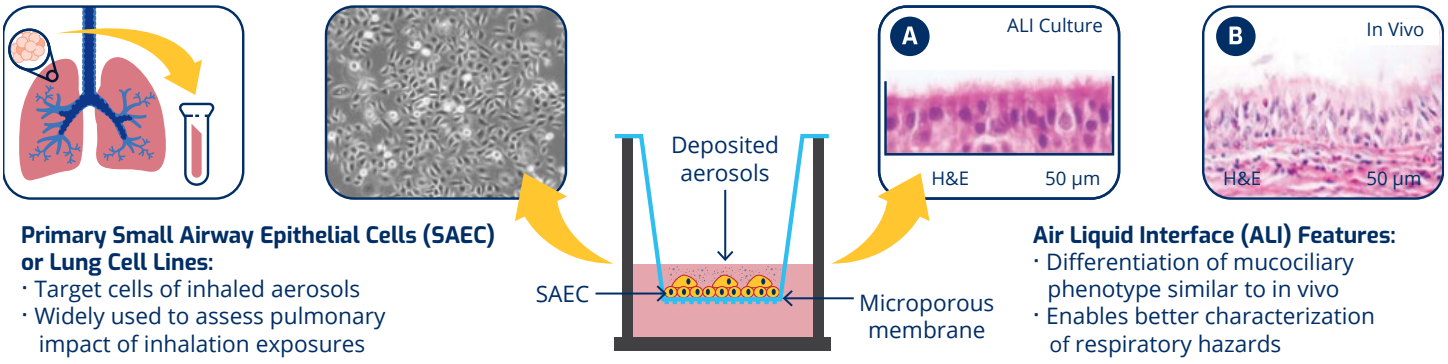

Figure 3. Diagram illustrating features and benefits of culturing cells in air liquid interface (ALI).

What data can it provide?

CIRI is focused on examining acute and chronic exposures of consumer products and technologies. After employing the CelTox Sampler to simulate particulate and chemical inhalation exposures, we will evaluate key potential toxicological outcomes associated with pathological changes within the lung to further understand potential human health risks (Fig. 4). These include:

- Cytotoxicity
- Oxidative Stress and Damage
- Inflammatory Responses
- Genotoxicity and DNA Repair
- Cell Migration and Invasion
- Alterations in Cellular Metabolism
- Systems Biology

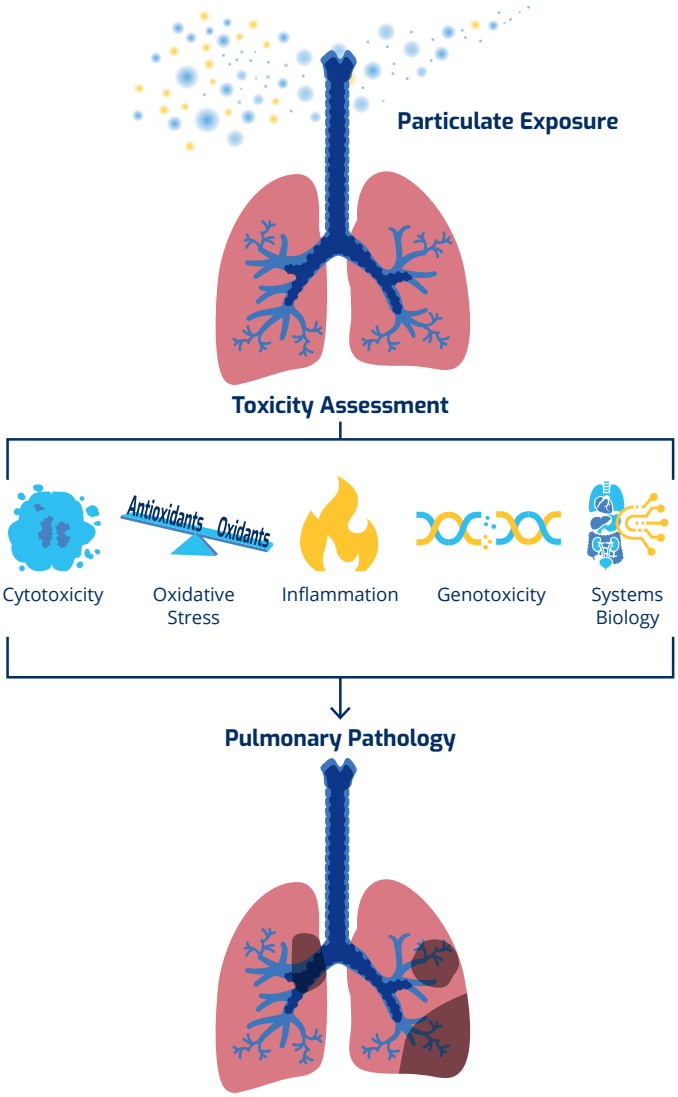

Figure 4. Exposure pathway and potential outcomes of inhaled consumer aerosols.

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References

Wright et al 2021 (Nova Science Publishing)

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