An improved ALI exposure chamber for higher deposition efficiency and optimized operations

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1. Introduction

In respiratory *in vitro* toxicology, air-liquid interface (ALI) exposure chambers are a promising method for cell culture exposure. However, many ALI exposure systems are characterized by several limitations (e.g. low deposition efficiency - 35-60% for single-droplet deposition systems, risk of chemical carryover, time-consuming operations). The ALI system, on the contrary, should be able to mimic *in vivo* conditions (inhalation) while ensuring high and controlled deposition efficiency, especially when used to deliver valuable compounds (e.g., environmental particles, pharmaceuticals APIs).

2. Objective

To overcome these issues, we have recently developed an ALI exposure system with both housing and casing equipped with an integrated heating mean, thus enabling a non-intrusive heating and temperature monitoring within the housing, and quick temperature rising in the exposure chamber. This innovation allows much higher deposition rates, thanks to the reduced condensation of the aerosol on the casing walls. Additionally, we modified the lower chamber to allow housing of different format of multiwell plates. A disposable pierced lid keeps the hanging wells in place while significantly reducing the risk of chemical carryover and biological contamination. Furthermore, the time needed to set-up and clean the system post-exposure is significantly reduced.

3. Conclusions

To assess the deposition efficiency, sodium fluorescein was aerosolised and quantified after deposition on microporous membrane of hanging inserts. We found out that the deposition was 4-5 times higher in the double heated system compared to the conventional single-droplet deposition system. The use of the disposable lid reduced the operation time by 80%, removing the risk for chemical carryover and biological contamination linked to the exposure operations.

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