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Current developments in the field of testing inhalable compounds *in vitro* based on the air-lifted-interface (ALI) technique

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Due to legislation (REACH), ethical, political and economical demands, the establishment of *in vitro* methods for investigations of biological effects of inhalable substances proceeded in the last years with a higher intensity. The air-lifted-interface (ALI) cell culture technique represents the state-of-the-art for investigations on biological effects of inhalable compounds *in vitro*. Using this methodology, biological test systems like cell lines, primary cells, reconstructed tissues or *ex vivo* materials like PCLS (precision cut lung slices) are exposed to airborne substances on microporous membranes or filters with a high relevance for the *in vivo* situation.

The paper will give an overview on actual experimental possibilities and applications in this field of research including available biological test systems, fundamentals in exposure testing scenarios and biological endpoints. The validation status for testing chemical gases and aerosols will be considered, including results from a recent prevalidation study on *in vitro* testing of chemical gases in Germany.

Against this background, typical pros and limitations including overall applicability and experimental possibilities with a special emphasis on the particle aerosol testing *in vitro* using ALI techniques are analysed. Ongoing developments are presented which include a more efficient workflow in the *in vitro* testing or insight into the cellular status during exposure. However, current strategies to enhance particle dosing from aerosols onto the surface of biological test systems by different technical approaches like electrostatic deposition or thermophoretic precipitation are mainly focused.

As a result it will be concluded that the efficiency of testing inhalable compounds *in vitro* has been clearly improved by current developments and that progress was made to enable testing of inhalable compounds under conditions comparable to higher throughput screening of liquid compounds *in vitro*.