Evaluation of pulmonary effects of 3-D printer emissions from acrylonitrile butadiene styrene using an air-liquid interface model of primary normal human-derived bronchial epithelial cells_Dataset

INTRODUCTORY INFORMATION

This study investigated the inhalation toxicity of the emissions from 3-D printing with acrylonitrile butadiene styrene (ABS) filament using an air-liquid interface (ALI) *in vitro* model. Primary normal human-derived bronchial epithelial cells (NHBEs) were exposed to ABS filament emissions in an ALI for 4 h. The mean and mode diameters of ABS emitted particles in the medium were 175 ± 24 nm and 153 ± 15 nm, respectively. The average particle deposition per surface area of the epithelium was $2.29 \times 10^7 \pm 1.47 \times 10^7$ particle/cm^2, equivalent to an estimated average particle mass of 0.144 ± 0.042 μg/cm^2.

DATA COLLECTION METHODS

1. Cell culture model

- Primary NHBEs from PromoCell (cat. C-12640, PromoCell GmbH, Germany).

2. Air-liquid interface cell exposure

2.1. Exposure system

- The same exposure system utilized previously to expose Sprague-Dawley rats to emissions generated during real-time printing via a whole-body inhalation exposure system was applied.

2.2. Cell exposure treatment

- Four different sets of treatments were employed as follows:
    - 1) ABS-exposed cells,
    - 2) exposure chamber samples,
    - 3 incubator samples,
    - 4) a positive control.

3. Evaluation of epithelial barrier integrity

4. Cytotoxicity

   4.1. Measurement of cell viability

   4.2. LDH release assay

5. Measurement of cytokine

- The concentrations of IL-17A, IL-21, IL-22, IL-23, IL-27, IL-31, MIP-3α, IL-17A/F, IL-17B, IL-17D, IL-3, IL-9, GM-CSF, IL-23p40, IL-15, IL-16, IL-17A, IL-1α, IL-5, IL-7, TNF-β, VEGF, IFN-γ, IL-10, IL-12p70, IL-13, IL-1β, IL-2, IL-4, IL-6, IL-8, TNF-α, eotaxin, eotaxin-3, IL-8(HA), IP-10, MCP-1, MCP-4, MDC, MIP-1α, MIP-1β, and TARC (pg/ml) were measured.

CITATIONS - PUBLICATIONS BASED ON THE DATASET

Farcas MT, McKinney W, Coyle J, Orandle M, Mandler WK, Stefaniak AB, Bowers L, Battelli L, Richardson D, Hammer MA, Friend SA, Service S, Kashon M, Qi C, Hammond DR, Thomas TA, Matheson J, Qian Y. Evaluation of Pulmonary Effects of 3-D Printer Emissions From Acrylonitrile Butadiene Styrene Using an Air-Liquid Interface Model of Primary Normal Human-Derived Bronchial Epithelial Cells. Int J Toxicol. 2022 Aug;41(4):312-328. doi: 10.1177/10915818221093605. Epub 2022 May 18.

PMID: 35586871

ACKNOWLEDGEMENTS

This investigation was supported by the National Institute for Occupational Safety and Health (NIOSH), Project CAN 093909NF and U.S. Consumer Product Safety Commission (CPSC).

AUTHORS

Mariana T. Farcas (CDC/NIOSH/HELD/PPRB) <woe7@cdc.gov>,

McKinney, Walter (CDC/NIOSH/HELD/PERB) <wdm9@cdc.gov>;

Coyle, Jayme (CDC/NIOSH/HELD/ACIB) <nti2@cdc.gov>;

Orandle, Marlene S. (CDC/NIOSH/HELD/PPRB) <yjj6@cdc.gov>;

Mandler, William (CDC/NIOSH/HELD/PPRB) <oex1@cdc.gov>;

Stefaniak, Aleksandr (CDC/NIOSH/RHD/FSB) <boq9@cdc.gov>;

Bowers, Lauren (CDC/NIOSH/RHD/FSB) <mju3@cdc.gov>;

Battelli, Lori (CDC/NIOSH/HELD/PPRB) <lob0@cdc.gov>;

Richardson, Diana (CDC/NIOSH/HELD/PPRB) <drw9@cdc.gov>;

Hammer, Mary Ann (CDC/NIOSH/HELD/PPRB) <mcy2@cdc.gov>;

Friend, Sherri (CDC/NIOSH/HELD/PPRB) <shf8@cdc.gov>;

Service, Samantha (CDC/NIOSH/HELD/BB) <ppf3@cdc.gov>;

Kashon, Michael L. (CDC/NIOSH/HELD/BB) <mqk1@cdc.gov>;

Qi, Chaolong (CDC/NIOSH/DFSE/EPHB) <hif1@cdc.gov>;

Hammond, Duane R. (CDC/NIOSH/DFSE/EPHB) <ahz0@cdc.gov>;

Thomas, Treye A. (CPSC) <tthomas@cpsc.gov>;

Matheson, Joanna (CPSC) <jmatheson@cpsc.gov>;

Qian, Yong (CDC/NIOSH/HELD/PPRB) <yaq2@cdc.gov>.

CONTACT INFORMATION

For further

Pathology and Physiology Research Branch (PPRB), Health effect Laboratory Division (HELD), National Institute for Occupational Safety and Health (NIOSH), Morgantown, WV. 304.285.5831