Aerosol emissions from combustion processes are important for human health. It is known that the initial response of lung tissue-cells onto combustion aerosols include oxidative stress, inflammation and apoptosis, but only few molecular links to the chemical composition of the particulate and gaseous part of the combustion emissions have yet been established. The Virtual Helmholtz Institute-HICE studies physical and chemical properties of anthropogenic combustion emissions as well as their biological effects on lung cells. On the one hand the chemical composition and physical parameters (size, morphology etc.) of relevant emissions are thoroughly characterized, including the application of innovative on- and off-line analytical technologies (e.g. SMPS, ELPI, AMS, ultra high resolution chromatography: GCxGC-MS, ICP-MS, ultra high resolution mass spectrometry: FT-ICRMS, TEM-XRF, on-line photoionisation-MS). On the other hand, human lung cells are exposed to the diluted combustion exhaust fumes at the air-liquid interface (ALI). A special ALI-exposure technology has been developed, allowing a realistic lung-cell exposure by simulation the situation in the lung at-site with the dilution/dose was selected to be below a measurable direct regulation strength on the different ‘omics levels) is observed: A surprisingly weak cellular effect regulation was observed for the diluted wood combustion emissions. However, interestingly biological effects as the activation pattern and molecular biological results show the complexity of PM-compounds (transition metals, organic toxicants) . This result was recently confirmed by experiments with murine RAW macrophages. Detailed analyses of the activated cellular response pathways, such as pro-inflammatory responses, xenobiotic metabolism, phagocytosis and oxidative stress were performed. The obtained holistic molecular biological results show the complexity of PM-induced biological effects as the activation pattern and strength differed considerably for the aerosol sources, suggesting a large difference in relative toxicity of different combustion sources. In addition to organic PM-composition also the content of elemental carbon (EC) and the elemental composition play a role. The most surprising result in this context was that HFO-suggesting a large difference in relative toxicity of different fuels, cell exposure, health effects

Presenting author email: ralf.zimmermann@helmholtz-muenchen.de or ralf.zimmermann@uni-rostock.de

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Studying the biological effects of combustion aerosols on air/liquid-interface exposed human and murine lung cells within the HICE-project: Composition and molecular biological effects of emissions from wood combustion, ship emissions and car engines


1Joint Mass Spectrometry Centre, Rostock University (Analyt. Chem.) &Helmholtz Zentrum München (HMGU/CMA),Germany, D; 2MDC, Berlin, D; 3ZAZUM, Technical University Munich, D; 4KIT (ITC/ITG), Karlsruhe, D; 5 University of Rostock (Inst. of Piston Machines/Int. Combust. Engines & Inst. of Physics & Chair of Systems Biology), D; 6University Eastern Finland-Kuopio; 7Uni Luxemburg; 8Cardiff University, UK; 9HMGU, D; 10Vitrocell GmbH, Waldkirch, D; 11HICE – Helmholtz Virtual Institute of Complex Molecular Systems in Environmental Health-Aerosols and Health, www.hice-vi.eu