Richard Gminski et al., J Environ Anal Toxicol 2018, Volume 8
DOI: 10.4172/2161-0525-C2-015

Screening of cytotoxicity, oxidant generating capacity and inflammatory potential of two selected coal mine dusts as a contribution to the European ROCD project

Richard Gminski[1], Julia Burger[1], Enrico Furtwängler[1], Ali Arif[1], Volker Mersch Sundermann[1], Ben Williamson[2], Diane Johnson[2], Robi Lah[3], Aleksander Wrana[4], Pedro Trechera[5] and Teresa Moreno[5]

[1]University of Freiburg, Germany
[2]University of Exeter, UK
[3]Premogovnik Velenje, Slovenia
[4]Central Mining Institute, Poland
[5]Institute of Environmental Diagnostics and Water Studies-CSIC, Spain

Despite international efforts to limit worker exposure, coal mine dusts continue to impact the health of thousands of miners across Europe. Modern, practicable assessment tools and devices are urgently needed to protect workers, particularly from the fine fraction ($PM_{2.5}$), which is increasingly implicated in human disease. To predict dust toxicity of different coal mine dusts and mining scenarios, a set of toxicological assays are necessary to identify a successful improvement of risk management targeting mitigation measures. Various studies indicate that the surface area and the potential to form reactive oxidants are highly promising metrics to predict the toxic potency of fine and ultrafine dusts. In the frame of the European ROCD project, two lignite coal mine dusts with different fractions ($PM_{2.5}$ and PM_{10}) obtained from a coal mine in Velenje (Slovenia) were investigated for their cytotoxic, oxidant generating capacity and inflammatory potential in the human alveolar epithelial cell line A549. Furthermore, to relate the observed effects to the hydroxyl-radical (OH·)-generating activities of these samples. The approach is based on the aligned Electron Paramagnetic Resonance spectroscopy (EPR) technique with 5.5-Dimethyl-1-Pyrroline-N-Oxide (DMPO) as spin trap and hydrogen peroxide as substrate, and is specifically sensitive to Fenton-type reaction mediated generation of hydroxyl radicals. The results show that the two lignite coal mine dust samples investigated induce cytotoxic effects, produce ROS and release cytokine IL-8 in a concentration-dependent manner, with a similar potency to the two reference substances quartz and Coal Fly Ash (CFA). Moreover, the toxic effects of the two coal mine dusts observed in human lung cells A549 appear to correlate with the hydroxyl-radical-generating capacities of both coal mine dust samples. The two studied coal mine samples and two reference substances with known constituents reveal the intrinsic hydroxyl-radical-generation method to be a sensitive tool for prediction of adverse health effects.

Recent Publications

1. Arif A T, Machowski C, Garra P, Garcia-Käufer M, Petithory T, Trouvé G, Dieterlen A, Mersch Sundermann V, Khanaqa P, Nazarenko I, Gminski R, Gieré R (2017) Cytotoxic and geno-toxic responses of human lung cells to combustion smoke particles of *Miscanthus* straw, softwood and beech wood chips. *Atmospheric Environment*; 163: 138-154.

References

1. León Mejía G, Machado M N, Okuro R T, Silva L F O, Telles C, Dias J, Niekraszewicz L, DaSilva J, Henriques J A P, Zin W A (2018) Intratracheal instillation of coal and coal fly ash particles in mice induces DNA damage and translocation of metals to extrapulmonary tissues. *The Science of the Total Environment*; 625: 589-599.

Biography

Volker Mersch Sundermann is a professor at University of Freiburg, Germany

volker.mersch-sundermann@uniklinik-freiburg.de

Notes: