Comparison of Proteomic Changes in Murine Macrophages Exposed to Diesel Exhaust Particles and Carbon Nanotubes

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Analyses of changes in cellular proteomic and metabolomic profiles can be valuable in evaluating pollutant exposure-induced effects that can permit risk identification. We compared biological changes caused by exposure of the J774 murine macrophage cell line to diesel exhaust particle (DEP), four types of carbon-based nanoparticles (single-walled and multi-walled pristine and oxidatively-modified carbon nanotubes) and carbon black (CB). Cells were exposed to the particles at 0-100 μg/cm^2 (96-well plates) in serum-free medium for 24h. Physico-chemical characteristics of carbon nano materials were conducted. Cell supernatants were analyzed for oxidatively modified protein metabolites by a HPLC-coulometric array detection method. Shotgun proteomic analyses of cell lysates were performed by direct MALDI-TOF-TOF-MS after sample clean up to remove interferences and experimental artifacts. Saturated alpha-cyano-4-hydroxycinnamic acid served as MALDI matrix. The mass spectral profiles were interrogated in the m/z region up to 6kDa using k-nearest neighbor clustering algorithm. Our results clearly indicated that J774 cells exposed to these particles exhibited characteristic m/z profiles. Endothelin-1, a marker of inflammatory status of macrophages was one of the several candidate biomarkers identified. Analysis of cellular endothelin-1 levels revealed a dose-related elevation with particle exposure. Our results indicate that association of physicochemical characteristics of these particles with induced biological changes provide new insights into mechanisms of particle toxicity.

This work was supported by Natural Resources Canada through the Program of Energy Research and Development (Advanced Fuels and Technologies for Emission Reduction Project C24.002 and Particles and Related Emissions Project C14.003).

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