

Comparison of Brake Wear Dust and Reference Diesel Particulate Matter Pro-Inflammatory Responses in Human THP-1 Macrophage-Like Cells

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Traffic-related sources are a major contributor to urban particulate matter. With increasingly strict tailpipe emission regulations, the relative contribution from non-tailpipe emissions, in particular brake wear dust, has become more significant. Brake wear dust contributes as much as 55% to total non-exhaust PM₁₀ (particulate matter with an aerodynamic diameter of 10 μm or less) mass and as much as 21% to traffic-related PM. Brake wear dust is metal-rich, as compared to carbonaceous-rich tailpipe emissions. Studies considering the effect of brake wear dust on cellular responses are limited. The aim of this study is to compare the cellular response in THP-1 macrophage-like cells to brake wear dust and NIST standard diesel particulate matter under air-liquid interface conditions. Using a Celtox sampler, a dose of 2 $\mu\text{g}/\text{cm}^2$ of brake wear dust and reference diesel was administered to the cells. After 24-hour of exposure, changes in viability, apoptosis, and release of pro-inflammatory markers (IL-8) were measured for each treatment. For cellular viability and apoptosis, the cells treated with particles behaved similarly to that of non-treated cells. A significant increase in the release of pro-inflammatory marker (IL-8) was observed for brake dust treatments, likely due to the high metal content. For reference diesel exposure, inflammatory marker (IL-8) was lower than non-treated cells, likely due to the suppression of inflammation caused by the presence of polyaromatic hydrocarbons (PAHs) on reference diesel particles. This study emphasizes the importance of brake wear dust as a contributor to PM and its health effects.