Measurement of Oxidative Potential of House Dust and Road Dust

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Over one hundred potentially toxic components including metals, pesticides, carcinogens, allergens, have been identified in house dust. Unsurprisingly, epidemiological studies have linked exposure to house dust with allergic reactions, respiratory diseases and cardiovascular diseases. Yet the combined risk in house dust is unknown. Oxidative potential (OP), the ability of particulate matter (PM) to deplete antioxidants in lungs, has been proposed as a more health-related metric for reflecting toxicity of particles than mass concentration. OP analysis of house dust can shed light on their overall redox-related toxicity.

In this study, we carried out OP analysis on fifty house dust samples collected in Canadian Healthy Infant Longitudinal Development (CHILD) project. After methanol extraction, two types of acellular OP assays, ascorbate acid (AA) assay and dithiothreitol (DTT) assay, are conducted to measure OP of samples. Optimizations to the existing assay procedure including incorporating blanks, extending reaction time and increasing analysis concentration, were made to improve assay reproducibility. AA-related OP (OP^{AA}) of house dust is 1.6 ± 0.4 pmolAA $min^{-1}\mu g^{-1}$, and DTT-related OP (OP^{DTT}) is 6.3 ± 1.8 pmolDTT $min^{-1}\mu g^{-1}$, both significantly lower than those of Canadian ambient air samples. No correlation between OP^{AA} and OP^{DTT} of the same sample was observed. These findings suggest house dust have low redox-related toxicity but may pose adverse health impact by means other than inducing oxidative stress.

Next summer, this study will investigate OP of road dust samples collected in the Greater Toronto Area. We hypothesize that road dust is more redox-toxic than house dust due to the contribution of redox active metals and organic species from traffic related emissions.