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A Comparison On PM-induced Toxicity From Emissions Of Public Transport And Ambient Atmospheric Conditions In Hong Kong

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***Abstract*— Adverse health effects were noted with exposure to airborne particulate matter (PM), which is one of the important components of environmental pollution. PM in association with volatile organic compounds, transitional metals, and etcetera poses severe pulmonary and cardiovascular effects in the living beings. Complexity of its association depends on the environmental conditions such as temperature, relative humidity, etcetera and as well as on source and spatial apportionment. In a city like Hong Kong, where more than 7 million people densely populated in a small area of 426 square miles, are prone to different levels of PM exposure based on living standards. A majority of people in Hong Kong and around the world commutes through public transport (MTR train, Bus) and few others on private vehicles. Mixed emissions of these transport vehicles at MTR undergrounds, platform levels and ambient sites can lead to different levels of size segregated PM exposure. This study is aimed at comparing different levels of toxicity with reference to different modes of exposure. A sensitive macrophage-based ROS activity was determined on volume (per m^3 of air) and mass (per nanogram PM) basis, on a time and dose dependent manner. While the air volume based unit represents the level of human exposure to the atmospheric PM induced oxidative species, the mass based unit better relates to the intrinsic oxidative potential of PM. Cell viability decreased with increase in concentration of PM and time of exposure. At ambient sites, large spatial variation of ROS was observed, where highest ROS levels were resulted for fine and coarse PM at urban and traffic sites, respectively. In addition, different size fraction of PM was found to have differential contribution to the total burden of PM induced oxidative stress, with coarse PM appears to be more redox active than fine PM on per PM mass basis. Also, PM induced endogenous ROS activity was observed significantly higher than exogenous ROS. However, the toxicity varied by a greater extent at underground subways, which resulted in higher fine PM induced ROS activity compared to coarse PM, suggesting important role of mixed environments in varied exposure levels. Similarly, PM induced exogenously ROS was significantly higher than the endogenous ROS, highlighting the complexity of mechanisms that may drive ROS generation in physiological system at different degree of surface exposures. Lastly, we investigated potent water soluble metals that had positive association with the PM induced ROS, and are noted as possible surrogates of PM induced oxidative potential, however, there also exists an inconsistency of such association by PM from ambient sites, but a very high degree consistent positive and negative associations were noted at below ground level, suggesting direct impact of metal ions on cellular activity in less complex environments. This comparison indicated possible synergistic and/or antagonistic effects of ROS generation and the need for multiple-component model of surrogate for PM oxidative potential.**

***Keywords*—particulate matter, oxidative potential, public transport, hong kong, ambient**

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