

Heterogeneity of passenger exposure to air pollutants in public transport microenvironments in Hong Kong

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Abstract: Epidemiologic studies have linked human exposure to pollutants with adverse health effects. Passenger exposure in public transport systems contributes an important fraction of daily burden of air pollutants. While there is extensive literature reporting the concentrations of pollutants in public transport systems in different cities, there are few studies systematically addressing the heterogeneity of passenger exposure in different transit microenvironments, in cabins of different transit vehicles and in areas with different characteristics. The present study investigated PM_{2.5} (particulate matter with aerodynamic diameters smaller than 2.5µm), black carbon (BC), ultrafine particles (UFP) and carbon monoxide (CO) pollutant concentrations in various public road transport systems in highly urbanized city of Hong Kong. Using a trolley case housing numerous portable air monitors, we conducted a total of 119 trips during the campaign. Transit microenvironments, classified as 1). busy and secondary roadside bus stops; 2). open and enclosed termini; 3). above- and under-ground Motor Rail Transport (MTR) platforms, were investigated and compared to identify the factors that may affect passenger exposures. The pollutants inside bus and MTR cabins were also investigated together with a comparison of time integrated exposure between the transit modes. Busy roadside and enclosed termini demonstrated the highest average particle concentrations while the lowest was found on the MTR platforms. Traffic-related pollutants BC, UFP and CO showed larger variations than PM_{2.5} across different microenvironments and areas confirming their heterogeneity in urban environments. In-cabin pollutant concentrations showed distinct patterns with BC and UFP high in

diesel bus cabins and CO high in LPG bus cabins, suggesting possible self-pollution issues and/or penetration of on-road pollutants inside cabins during bus transit. The total passenger exposure along selected routes, showed bus trips had the potential for higher integrated passenger exposure compared to MTR trips. The present study may provide useful information to better characterize the distribution of passenger exposure pattern in health assessment studies and the results also highlight the need to formulate exposure reduction based air policies in large cities.

Keywords: Black carbon, CO, bus cabins, roadside bus stop, bus terminal, PM_{2.5}, subway platform, ultrafine particles

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This study was focused on the heterogeneity of pollutants among various microenvironments and personal exposure to those pollutants in Hong Kong.