

Comparison of Exposure to Particulate Matter and Volatile Organic Compounds while Commuting in Kandy City Using Different Transportation Modes

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The main objective of the work is to understand the exposure level of inhalable suspended Particulate Matter less than 10 μm and 2.5 μm (PM_{10} and $\text{PM}_{2.5}$) and Volatile Organic Compounds (VOC) while commuting in different transport modes (bus, car, three-wheeler, motor bicycle). A fixed route- multi transport study was carried out along Kandy-Panideniya route. The aforementioned pollution levels were measured by a commuter travelling in each of these travel modes with a portable monitor that records 1-minute average pollutant concentrations. Moreover, Time Weighted Average Exposure Concentrations (TWAEC) and inhalation doses for different travel modes were compared. No statistical relationship or difference between the four modes was found for temperature (one-way ANOVA, $p=0.75$ $R^2=0.003$) and relative humidity (one-way ANOVA, $p=0.82$, $R^2=0.002$). Observed concentration levels of PM_{10} and $\text{PM}_{2.5}$ seemed to be substantially lower than those found in previous studies conducted in different locations in Kandy, as this study was carried out in the rainy season and also in the morning. However, in some instances, exposure concentrations exceeded the National Ambient Air Quality Standards when traffic congestion is high and queuing in roads for longer time periods. Three-wheeler (on average $\text{PM}_{10} = 71 \pm 31 \mu\text{g}/\text{m}^3$, $\text{PM}_{2.5} = 31 \pm 12 \mu\text{g}/\text{m}^3$) and bus (on average $\text{PM}_{10} = 61 \pm 10 \mu\text{g}/\text{m}^3$, $\text{PM}_{2.5} = 28 \pm 3 \mu\text{g}/\text{m}^3$) commuters had the highest level of TWAEC to PM_{10} and $\text{PM}_{2.5}$. While motor bicycle (on average $5.3 \pm 0.5 \text{ mg}/\text{m}^3$) and car (on average $3.8 \pm 2.5 \text{ mg}/\text{m}^3$) commuters had the highest level of TWAEC to VOC. Combination of exposure concentration, travel time, and inhalation rates led to a different inter-mode comparison with inhalation dose. Hence inhalation dose of PM_{10} and $\text{PM}_{2.5}$ for bus commuters were high as the trip time was comparatively high, while inhalation dose of VOC for motor bicycle commuters was high as the exposure concentration was comparatively high.

Keywords: PM_{10} , $\text{PM}_{2.5}$, VOC, Kandy, Inhalation dose

National Research Council, Sri Lanka (NRC Grant No.18-066) is gratefully acknowledged for financial assistance.