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Evaluation of Ambient Air Particulate Matter (PM) Concentration in Urban Context and its Public Perception

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Abstract

Urban air pollution has become a global issue and vehicle emissions, rapid industrialization, and urbanization are known to be the main contributing factors for air pollution. Therefore, air quality monitoring is essential for detecting air pollution levels mainly in urban areas. Among the main air pollutants, particulate matters (PM) play major roles as an urban air pollutant. The objectives of this research study were (a) to evaluate and compare the $PM_{2.5}$ concentration on ambient air in selected locations in Colombo urban area (b) to calculate air quality index (AQI) to identify the pollutant levels of ambient air in selected study sites and (c) to identify the public perception and awareness regarding the PM-related air pollution. In this research, ambient $PM_{2.5}$ concentrations were measured by ambient fine dust air sampling techniques in selected locations in Colombo urban area representing commercial, construction, and residential sites. Evaluation and comparison of $PM_{2.5}$ concentration and questionnaire survey were analysed by using suitable statistical approaches and softwares. The comparisons were made with appropriate WHO standards and its related Sri Lankan standards for air quality guidelines. One sample t-test was used to compare the monitored $PM_{2.5}$ concentration with the standard $PM_{2.5}$ concentration. One way ANOVA test and Tukey pair wise comparison test were used to evaluate the significant difference between each category. All the statistical analysis was done by using Minitab 18.0 version. SPSS 16.3 version was used to analyse the survey results. Results of the study indicated that residential areas having significantly low concentrations of $PM_{2.5}$ concentration while both commercial and construction areas having high concentrations of PM2.5 concentration. The highest $PM_{2.5}$ concentration were 101.08 µg/m^3 and it was recorded in Maradana area which came under the commercial category. The lowest $PM_{2.5}$ concentration was recorded in Kotte representing the residential area. There was no any significant difference of $PM_{2.5}$ concentration between commercial and construction sites mainly including Borella, Maradana, Peliyagoda and Kelaniya areas. In addition, there was a significant difference between $PM_{2.5}$ concentrations of selected commercial and residential areas and construction and residential areas. $PM_{2.5}$ concentrations were varied into the range of 17.23 - 101.08 ɥg/m3 in commercial and construction areas and 5.68-26.08 ɥg/m^3 in residential areas. Calculated AQI by using mean PM $_{2.5}$ concentration values in air sampling locations indicated that commercial and construction areas consist with moderate air quality level under the AQI category of 51-100 and residential areas consist with good air quality level under the AQI category of 0-51. Public awareness about the PM-related air pollution is considerably low and majority of the people were mentioned that the air quality is not good in Colombo urban area. Approximately half of the interviewed people were affected to the poor air quality and its related health effects. According to public perception, vehicular emission is the main particulate matter emission source in Colombo area.

Keywords: Air quality index, Particulate matter, Urban air pollution

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