

## Variations of fine particles concentration at school environment located near to roadside

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Particles with aerodynamic diameter equal and less than 2.5  $\mu\text{m}$  which is known as fine particles ( $\text{PM}_{2.5}$ ) are among the major air pollutants that could give adverse effects on ambient and indoor air quality including in school environment. The air quality in school environment which located nearby the roadside with the distance less than 500 meter is potentially to be affected by vehicles through exhaust emission. Major contribution of vehicles emissions towards variations of fine particles is expected to be occurred during drop-off and fetch-up the children. Thus in this study, variations of ambient and indoor fine particles ( $\text{PM}_{2.5}$ ) concentrations is measured by using portable beta-attenuation monitor for outdoor and optical direct reading monitor for indoor in naturally ventilation school environment for 8 hours which is throughout the teaching and learning session. In addition, meteorological parameters such as temperature, relative humidity and wind speed were measured for both ambient and indoor condition. Pearson's correlation also has been applied in order to identify relationship between ambient and indoor condition of  $\text{PM}_{2.5}$ , temperature, relative humidity, wind speed and number of vehicles. Based on result obtained, the average ambient concentrations of  $\text{PM}_{2.5}$  is  $25 \pm 5 \mu\text{g}/\text{m}^3$  and for indoor,  $33 \pm 10 \mu\text{g}/\text{m}^3$ . For meteorological parameters, the average temperature is  $30.0 \pm 3.5 \text{ }^\circ\text{C}$  (ambient) and  $30.2 \pm 1.5 \text{ }^\circ\text{C}$  (indoor); for relative humidity, the average ambient ( $59 \pm 13\%$ ) and indoor ( $68 \pm 7\%$ ); and the average for ambient and indoor wind speed is  $1.2 \pm 0.8 \text{ m/s}$  and  $0.5 \pm 0.2 \text{ m/s}$ . The highest concentration of  $\text{PM}_{2.5}$  is to be found inside the classroom,  $65 \mu\text{g}/\text{m}^3$  compared to ambient,  $33 \mu\text{g}/\text{m}^3$ . This is caused by the resuspension of fine particles due to children activities inside the classroom. For Pearson's correlation, the results show that there is significant correlation between outdoor  $\text{PM}_{2.5}$  with ambient temperature ( $r = -0.537, p = 0.002$ ); relative humidity ( $r = 0.705, p = 0.000$ ); and wind speed ( $r = -0.703, p = 0.000$ ). For indoor condition, there is no significant between  $\text{PM}_{2.5}$  concentrations with the meteorological parameters. However, significant correlation exist between indoor temperature, relative humidity and wind speed. Furthermore, there is no significant correlation between ambient and indoor relationship of  $\text{PM}_{2.5}$  ( $p > 0.05$ ). Besides, number of vehicles also has been found did not significantly ( $p > 0.05$ ) influence the concentrations of ambient and indoor  $\text{PM}_{2.5}$ . As a conclusion, variations of ambient  $\text{PM}_{2.5}$  concentrations is influenced by meteorological parameters while for indoor  $\text{PM}_{2.5}$  concentrations, it is due to resuspension of particles from the indoor environment activities.

Keywords:  $\text{PM}_{2.5}$ , meteorological, vehicle, ambient, indoor, natural ventilation