

## **Indoor air quality at shopping malls in Kota Kinabalu, Sabah (particulate matter and ozone)**

### **Abstract**

Background: Indoor air quality (IAQ) in shopping malls is an interesting case of study since a shopping mall is a public place where people favor to spend their time. This study was conducted to investigate the IAQ of shopping malls in Kota Kinabalu, Sabah, whereby three shopping malls were selected as investigation sites. Methods: The parameters being studied include particulate matter (PM<sub>0.3-8</sub>, PM<sub>0.5-8</sub>, PM<sub>2-8</sub> and PM<sub>5-8</sub>) and ozone. Indoor and outdoor air measurements were performed in the three shopping malls on weekdays and weekends to determine the I/O ratios. Results: In this study, overall average indoor PM concentrations on weekends were higher than weekdays, reaching maxima average concentrations of  $421.44 \pm 102.96 \mu\text{g}/\text{m}^3$  for PM<sub>0.3-8</sub>,  $41.75 \pm 15.54 \mu\text{g}/\text{m}^3$  for PM<sub>0.5-8</sub>,  $1.30 \pm 0.41 \mu\text{g}/\text{m}^3$  for PM<sub>2-8</sub>, and  $0.21 \pm 0.09 \mu\text{g}/\text{m}^3$  for PM<sub>5-8</sub>. Correlation between indoor and outdoor PM concentrations mostly showed poor relationship in the three shopping malls, showing that indoor sources such as re-suspension phenomena due to occupant's activities were clearly the main contributors to indoor PM concentrations. Poor ventilation system also affected IAQ by increasing the PM accumulation. However, I/O ratios were often less than 1.0, indicating that PM in indoor air arises predominantly from outdoor air transported to indoors. Average indoor ozone concentration at all the shopping malls was measured to be below the 0.05 ppm of ICOP-IAQ 2010. Conclusion: The overall assessment of IAQ in the three shopping malls showed that SM2 has a better IAQ compared to SM1 and SM3.