



A Long Term Study on Characterization and Source Apportionment of Particulate Pollution in Klang Valley, Kuala Lumpur

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ABSTRACT

Samples of airborne particulate matter, PM_{2.5} and PM_{10-2.5} were collected using a Gent stacked filter sampler at an urban site, Klang Valley, Kuala Lumpur between January 2002–December 2011. The samples were analyzed for their elemental composition and black carbon content by Particle Induced X-ray Emission (PIXE) and light absorption, respectively. The annual average for PM_{2.5}, PM_{10-2.5} and PM₁₀ ranged from 21 to 35, 18 to 26 and 44 to 56 μg m⁻³, respectively. Factor analysis method and the Positive Matrix Factorisation (EPA PMF3) technique were also applied to the fine fraction data set in order to identify the possible sources of particulate matter and their contributions to the ambient particulate matter concentrations in the Klang Valley. A five factor PMF solution was found for PM_{2.5} particulate matter. The sources identified were; motor vehicles, industry, smoke/biomass burning, secondary sulphate and soil. It was found that the primary source of haze air particulate matter was locally generated mostly from vehicular emissions which contribute about 35% of the PM_{2.5} mass. The Hybrid Single Particle Lagrangian Intergrated Trajectory (HYSPLT) model was also used to explore possible long range transport of pollution. Smoke trans-boundary events were identified based on fine potassium from the data base in 2004, 2006 and 2008.

Keywords: Klang Valley; Elemental composition; Positive Matrix Factorization; Airborne particulate.

INTRODUCTION

Klang Valley (Fig. 1) is a rapidly growing urban area with the highest growth rate in Malaysia. The area comprises of Kuala Lumpur (lat 3°8'N; long 101°44'E), its suburbs, and adjoining cities and towns in the state of Selangor. The weather is hot and humid with uniform temperatures throughout the year from 25°C to 35°C and the humidity is almost the same throughout the year 70%–80% during the night-time and 50–60% during daytime. There are uniform periodic changes in the wind flow patterns namely, the southwest monsoon, northeast monsoon and inter-monsoon seasons. The southwest monsoon season is usually established in the latter half of May or early June and ends in September while the northeast monsoon season usually commences in early November and ends in March. During the two inter-

monsoon seasons, the winds are generally light and variable. There are many sources that contribute to the fine and coarse particles in the area. Potential sources can originate from major highways that run throughout the Klang Valley, growth in population, unplanned and uncontrolled development of industrial premises that lead to higher emissions of organic and inorganic gases, chemicals and dust as well as noise pollution and vibration disturbance. However the sources of the pollutants and their contributions not only originate from local activities to the local factors such as open burning, construction and increasing industrialization programs, but also from the foreign activities such as forest fires and land clearing in Sumatra and Kalimantan. Emissions from these fires has caused trans-boundary haze pollution events that have affected the entire Southeast Asian region. The haze episodes in Malaysia were reported as early as the 1980s followed by a number of haze episodes that were less intense and did not receive as much public attention. The first serious haze event in the country was reported in August 1991 followed by events in 1994, 1997, 1998, 2002, 2004, 2005, 2006 and 2009 (Keywood, 2003, Tangang *et al.*, 2010). These phenomenon have now become regular features in

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