PARTICULATE POLLUTION AND RATIO OF SPM:PM10:PM2.5 IN COLOMBO ATMOSPHERE

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Abs**tract**

Being a capital city close to the sea in a tropical country, Colombo is more vulnerable to particulate pollution i.e. Suspended Particulate Matter (SPM) in ambient air. This particulate can exit as dust, smoke or aerosol in sizes ranging from 0.001 □m to 100 □m. With the environmental health point of view the particulate less than 10 μm in diameter (coarse particulate - PM10) and particulate less than 2.5 μm in diameter (fine particulate - PM2.5) are more important since the morphology of ambient particulate is not uniform or defined.

Monitoring of the particulates, especially in Colombo is not new. Continuous PM10 monitoring data over a period of last five to six years reveals that the particulate in Colombo atmosphere is in an increasing trend. Monitoring of SPM and PM2.5 was done in parallel to PM10 monitoring to compare the levels and data show that the average SPM:PM10:PM2.5 ratio is 4 : 3 : 2 which gives that more than 70% of the Suspended Particulate Matter is in the form of PM10 and out of which 65% is PM2.5, which is considered as more toxic to human health. It also revealed that black smoke generated mostly by the combustion of fossil fuels and ambient particulate lead (Pb) is concentrated in this fine fraction of PM2.5. Sea spray is mainly concentrated in coarse fraction, which is in between 2.5 - 10 □m in diameter.

Continuous monitoring data at Fort, Colombo 11 and Meteorological Department site at Bauddhaloka Mawatha, Colombo 7, indicated that the PM10 at Fort is about 40% higher compared to that of Meteorological Department. It also indicates that the seasonal climatic changes directly influence on the level of PM10 at both locations. A maximum concentration of PM10 ranging 120 - 160 μg/m^3 occur in North-East monsoon at Fort when compared to the lower range from 60 - 70 μg/m^3 in South-West monsoon. At Meteorological Department, the upper range is 60 - 70 μg/m^3 in North-East and the lower range is 30 - 40 μg/m^3 in South-West. The annual average of PM10 at Fort, Colombo 11 in year 2000 was 84 μg/m^3 and at Meteorological Department, Colombo 07 was 54 μg/m^3. These values could be compared with the US-EPA standards for the annual average of 50 μg/m^3 for PM_{10}.

INTRODUCTION:

Colombo with a population is nearly 800,000 is located in the South - West Coast of the country. It was function as both administrative and commercial capital of Sri Lanka until the recent decision taken to shift administrative functions to the new capital Sri Jayawardanapura Kotte that is about 5 km from the Colombo. However, still main commercial and most of administrative activities are concentrated in Colombo. Therefore, a very high vehicular fleet, number of thermal power plants including medium and small scale power generators and several industries are operated in the Colombo city limits.

Air quality data reveals that the air pollution level in Colombo is increasing binomially during the resent past. The Particulate Matter is one of the parameter that concerns more in air pollution. It is very important in the health point of view since the chemical composition of PM is not defined and dependent on the source. Particulate Matter less than 10 μm in diameter causes most of the respiratory diseases such as asthma since they enter to our lungs through the respiratory system. Therefore, it is very important to study the levels of Suspended Particulate Matter (SPM), PM_{10} and $PM_{2.5}$. The objective of this paper is to present the trends in change of particulates matter concentration in Colombo atmosphere and to estimate the ratio between SPM, PM_{10} and $PM_{2.5}$.

METHODOLOGY:

The particulate matters below 10 μm (PM10) were collected on to micro fiber filter papers at the rate of 70 m^3/hour on 24-hour basis in every 4 days at two locations in Colombo. Fort railway station, Colombo 01 was selected as a peak location and Meteorological Department at Bahuddaloka Mawatha, Colombo 07 selected as background location with respect to air pollution level. In addition to PM10, samples were collected for Suspended Particulate Matter (SPM) and $PM_{2.5}$ in time to time for the calculation of PM_{10}/SPM and $PM_{2.5}/PM_{10}$ ratio at same locations in the same days.

RESULTS AND DISCUSSIONS:

Continuous PM10 monitoring data as shown in figure 01, from Fort, Colombo 01 and Meteorological Department site at Bauddhaloka Mawatha, Colombo 7, shows that the PM10 at Fort is about 40% higher compared to that of Meteorological Department. It also indicates that the seasonal climatic changes directly influence on the level of PM10 at both locations. A maximum concentration of PM10 ranging 120 - 160 $\mu g/m^3$ occur in North-East monsoon at Fort when compared to the lower range from 60 - 70 $\mu g/m^3$ in South-West monsoon. At Meteorological Department, the upper range is 60 - 70 $\mu g/m^3$ in North-East and the lower range is 30 - 40 $\mu g/m^3$ in Sowth-West. The annual average of PM10 at Fort, Colombo 01 was 84 $\mu g/m^3$ and at Meteorological Department, Colombo 07 was 54 $\mu g/m^3$. These values are high when compared with the US-EPA standards for the annual average of PM10 of 50 $\mu g/m^3$.

Measurements taken at Fort, Colombo 01 as given in figure 02, show that more than 70% of the Suspended Particulate Matter is in the form of PM10 and out of which 35% is PM2.5 which is considered as more toxic for health. The elemental analysis of PM10 and PM2.5 samples revealed that black smoke generated mostly by the combustion of fossil fuel and ambient particulate lead (Pb) is concentrated in this fine fraction of PM2.5. Sea spray is mainly concentrated in coarse fraction, which is in between 2.5 - 10 μm in diameter.

Figure 01. Concentration of PM10 in Colombo

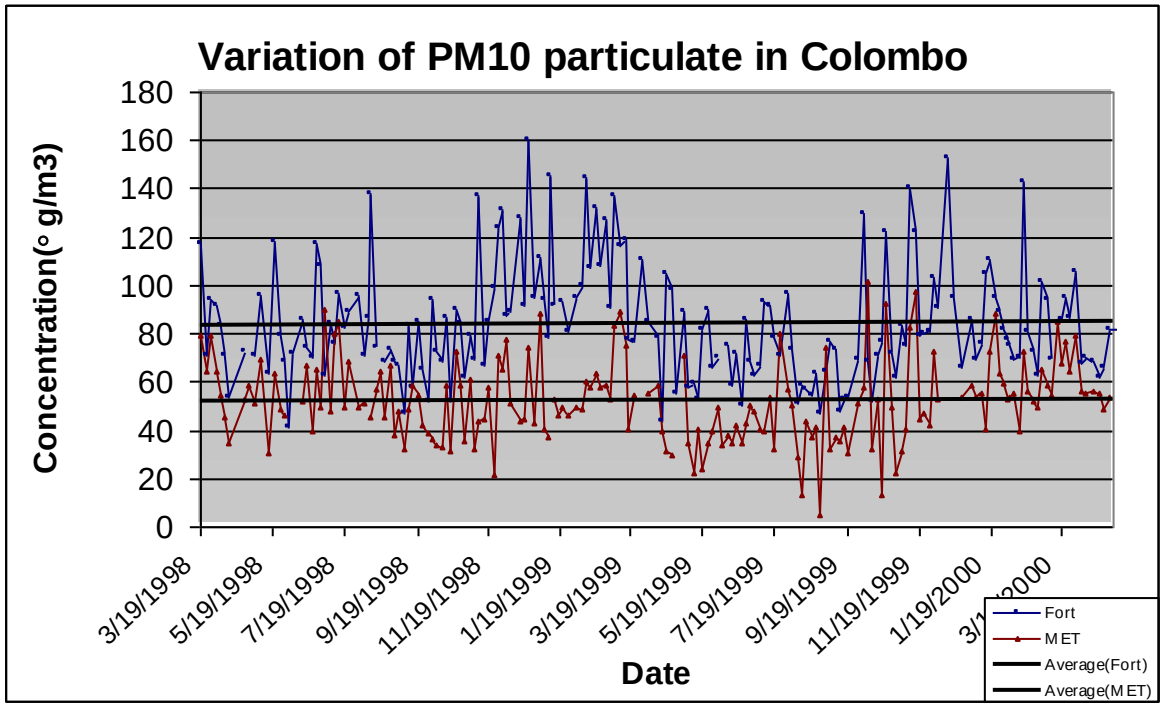

Figure 02. Comparisons of SPM, PM10 and PM2.5