C-P-2

CONCENTRATION OF TRACE METALS IN PM_{10} AT URBAN- RURAL LOCATIONS IN DELHI

Vijay Shridhar, P. S. Khillare*, Tripti Agarwal, Sharmila Ray

Air Pollution Monitoring Laboratory, SES, JNU, New Delhi, 110067

Introduction

Air quality in urban environment of big metropolitan cities has been of increasing concern. Various national and international norms have been developed in an attempt to maintain the ambient air quality.

The atmosphere is the smallest of the Earth's geological reservoirs. It is this limited size that makes the atmosphere potentially so vulnerable to contamination that even the addition of a small amount of material can lead to significant changes in the way the atmosphere behaves (Andrews et al., 1996). Anthropogenic emissions leading to atmospheric aerosol have increased dramatically over the past century and have been implicated in human health effects (Dockery et al., 1993. Airborne particles are important carriers of metals, some of which possess toxic properties and commonly are present in excess of natural levels. Many trace metals may create adverse effects on environment and human health due to their toxicity and bioaccumulation in various environmental compartments. Regarding health effects, much focus is on smaller particles (PM_{10} and less) that may penetrate deeply into the lungs.

Present study was undertaken to determine the concentration of some trace metals in PM_{10} at two representative sites in Delhi.

Material Method

Description of the sampling sites

*Corresponding author email: psk@mail.jnu.ac.in

Rural site-Natthhupura (NP)-Natthhupura is a rural site with open agricultural fields. Horticulture, floriculture and animal husbandry are other prevalent activities in the area.

Urban site-PadamNagar (PN)-Padamnagar is a congested area with high traffic density. There are several small scale industries e.g. hosiery, plastic product manufacturing units, electrical and metal product manufacturing units in the surrounding area of the site.

Sampling procedure

The sampling of PM_{10} was carried out from September 2003 to February 2004 by Anderson samplers. Sampling was done over 72-80 hours period with the frequency of one sample per month at both sites. The samplers were run at a constant flow rate of 28.1 lit/min. The collection substrate was Whatman glass fiber filter papers.

Digestion of the samples for metals extraction

The digestion was carried out as per the methods described by standard prescribed methods. The samples were analyzed by Atomic Absorption Spectrophotometer (AAS).

Result & Discussion

Mass concentration of PM_{10}

Respirable particulate matter (PM_{10}) concentration was found to be higher at urban site-PN, than at rural site-NP. At both the sites PM_{10} concentration was found to be in excess of ambient air quality standard for residential areas (60µg/m^3) prescribed by CPCB throughout the sampling time period. Monthly concentration (in microgram/ m3) of PM_{10} at two sites is given in Table 1.

Table 1. PM_{10} concentration (µgm^{-3}) at rural and urban sites in Delhi

Month	Rural site	Urban site
Sep	200	252
Oct	218	330
Nov	251	437
Dec	265	513
Jan	237	440
Feb	169	379
Average	223	392
SD	35	92

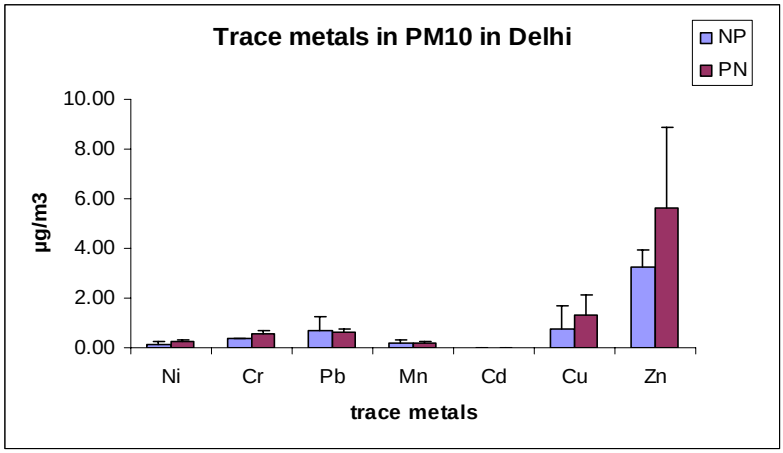
Trace metals concentration in PM_{10}

Respirable particulate matter (PM_{10}) samples, collected from two different sampling sites were analyzed for trace metals (Ni, Cr, Pb, Mn, Cd, Cu & Zn). Except Pb and Mn, concentration of all other metals was found to be higher at urban site. Most of the analysed trace metals might have originated from vehicular and industrial activities besides natural soil. Some specific sources can be understood as oil burning, tyre abrasion, brake lining, electroplating, and industrial activities. Most of the mentioned sources are more prevalent at urban site, so high concentration at urban site could be from direct source or via soil re-suspension.

At both the sites, Zn was observed to be the most abundant metal followed by Cu, Pb, Cr, Mn, Ni and Cd (Fig 1). However, at urban site, Ni concentration was more than Mn concentration. The observations are understandable on the basis of the difference in background activities of two sites. High concentration of Pb at rural site may be due to earlier deposited high concentration of lead in soil and influence of industrial activities and passing vehicles of adjacent states.

To differentiate between natural and anthropogenic extent of trace metals, enrichment factor was calculated. Enrichment factor was calculated by taking aluminum as reference element. Except Mn all analysed trace metals showed anthropogenic contribution. Cd metal was found highly enriched at urban site. While, Cd, Zn and Pb metals have recorded high degree of enrichment at both sites. High Cd, Cu, and Zn metal enrichment at urban site could be due to industrial and vehicular activities.

Fig 1. Trace metal concentration (µgm^{-3}) at rural and urban sites in Delhi



The mass concentration of trace metals in Delhi was found to be higher than reported values from USA and European studies. It was also found high for some trace

metals than China, Taiwan, Hong Kong, Korea and Japan. Some studies reported from west Asia showed comparable values for some metals.

References

1. Andrews, J.E., et al. (1996), An introduction to environmental chemistry, Blackwell Science ltd.
2. Dockery, D.W., et al (1993), The New England Journal of Medicine 329, 1753–1759.