[Oral presentation]

Heavy Metal Concentrations in Urban Atmospheric Particulate Matter in Seoul: A Comparative Analysis of PM_{10} and $PM_{2.5}$

JaeHeon Jung*, Jusung Park*, Yongsuk Choi*, KwangTae Ha*, HoChan Lee*, HyunSuk Kim*, HyunSuk Choi*, JinYoung Yang*, HunGyu Lee*
* Seoul Metropolitan Government Health and Environment Research Institute

Tel: +82 2-570-3358
(E-mail: *jhjung1014@seoul.go.kr*)

ABSTRACT

This study investigated heavy metal concentrations in PM_{10} and $PM_{2.5}$ collected in Seoul from January 2024 to April 2025. Samples were analyzed using ICP-MS/OES for 11 heavy metals. Results showed different correlation patterns between particle sizes during Asian dust events and ultrafine particulate advisories, suggesting the necessity for comprehensive analysis in particulate matter research.

Keywords: PM_{10}, $PM_{2.5}$, Heavy metals, Yellow dust

Contents

Urban air pollution, particularly particulate matter (PM), poses significant health risks in metropolitan areas like Seoul. Understanding heavy metal distribution across different particle sizes is crucial for source identification and pollution control strategies. Samples were collected 4-5 times monthly from January 2024 to April 2025 at an air monitoring station in Guui-dong, Gwangjin-gu, Seoul. Mass concentrations were determined using gravimetric methods, and 11 heavy metals (Pb, Cd, Cr, Cu, Mn, Fe, Ni, As, Al, Ca, Mg) were analyzed using ICP-MS and ICP-OES. Data were classified into normal days, yellow dust, and $PM_{2.5}$ advisory periods.

Table 1. Mass concentrations and correlations under different atmospheric conditions

Condition	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	Cor. (PM10_W-PM2.5_W)	Cor. (PM10_Ca-PM2.5_Ca)	Cor. (PM10_Cr-PM2.5_Cr)
Normal days	40.0	18.7	0.6091	0.5602	0.2522
Yellow dust	183.7	36.3	0.2869	0.9048	0.2281
PM2.5 advisory	73.9	45.1	0.4473	0.1146	0.6024

Results revealed distinct patterns under different atmospheric conditions compared to normal days. Yellow dust events showed strong PM_{10}-$PM_{2.5}$ correlations for soil-derived elements but weak PM_{10}-$PM_{2.5}$ correlations for anthropogenic metals, while $PM_{2.5}$ advisories exhibited the opposite pattern with enhanced PM_{10}-$PM_{2.5}$ correlations for anthropogenic metals but reduced PM_{10}-$PM_{2.5}$ correlations for soil-derived elements. The study demonstrates that meteorological conditions significantly influence particle size-specific heavy metal distribution patterns. Comprehensive analysis of both PM_{10} and $PM_{2.5}$ is essential for effective air quality management and suggests that both particle sizes should be considered when applying machine learning techniques. This research provides foundational data for future policy development in urban environments.