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Particulate Polycyclic Aromatic Hydrocarbons and Aerosol Active Surface Area in Different Environments of Mexico City

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Polycyclic aromatic hydrocarbons (PAHs) are highly carcinogenic, semi-volatile compounds whose main source is combustion. Previous studies have found particulate PAH concentrations in the Mexico City Metropolitan Area (MCMA) to be among the highest measured anywhere in the world. The objective of this research is to describe temporal and spatial variations in particulate PAH and surface area concentrations measured at downtown, suburban, and exurban sites encompassing different combinations of residential, commercial, industrial, undeveloped, and mixed land use. Furthermore, we investigate the relationships of PAH concentrations with meteorological parameters and other pollutants to gain new knowledge about sources of PAHs and of their evolution as they are transported throughout the megacity atmosphere.

Due to the importance of motor vehicles as sources of PAHs, the highest concentrations are usually found during rush hour at sites with dense traffic. Total particulate PAHs at Instituto Mexicano del Petróleo (T0 supersite near downtown) averaged 50 ng m^{-3} throughout the campaign and reached a maximum of 3660 ng m^{-3}, the highest concentration observed at any stationary site in Mexico City. Aerosol active surface area at T0 averaged 80 mm^2 m^{-3} during the campaign and reached a maximum of 760 mm^2 m^{-3}. Measurements at PEMEX, Pedregal, Santa Ana, Picos Tres Padres, and Tecamac (T1 supersite on the northeastern edge of the city) indicate that spatial variability in PAHs is high, that nighttime combustion sources can be significant, and that aging of particles reduces their surface PAH concentrations. Poor intersite correlations of PAHs suggest that local sources dominate ambient levels, and therefore exposure cannot be represented by a single regional-scale value. The stronger correlation of PAHs with nitrogen oxides (NO_x) rather than with carbon monoxide and carbon dioxide probably reflects the importance of diesel engines as sources of both PAH and NO_x emissions. We have also used positive matrix factorization of PAHs, active surface area, and black carbon to identify temporal patterns in three types of aerosol: fresh combustion-generated particles, aged combustion-generated particles, and non-combustion-related particles. The results of this research can be used to help develop control strategies for PAHs and to conduct risk assessments of exposure to ambient particles in the MCMA.