Anglies aerozolių kilmės Maniloje, Filipinuose apibūdinimas: lyginamasis tyrimas dviejose vietose

Characterizing Carbonaceous Aerosol Origins in Metro Manila, Philippines: A Comparative Study at Two Sites

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According to the 2021 report by the World Health Organization (WHO), a staggering 99% of the global population is exposed to air quality that exceeds the guideline limits set by WHO, with elevated levels of pollutants [1]. This critical issue is particularly pronounced in urban environments, where carbonaceous aerosol particles represent a significant portion of fine particulate matter ($PM_{2.5}$) [2]. Black Carbon (BC) particles, primarily generated through combustion processes such as biomass burning and internal combustion engine emissions, pose a severe threat to human health. To address this persistent concern, it is crucial to gain a comprehensive understanding of BC particle sources, their scale, and source-specific concentrations, especially in economically developing countries. Heightening awareness about this ongoing environmental crisis is a vital initial step toward achieving sustainable development.

An extensive field campaign was conducted in the urban environments of Metro Manila, Philippines, at two locations: Quezon City's East Avenue roadside (QCG site) and Manila's North Port (Port site) as part of the "A Transdisciplinary Approach to Mitigate Emissions of Black Carbon" (TAME-BC) project. During a three-month period from December 2019 to February 2020, the mass concentration of equivalent black carbon (eBC) was measured by using a 7-wavelength Aethalometer (AE-31). To investigate the magnitude of air pollution in Metro Manila, the focus was set on the sources of eBC, as well as mass concentration variation. Wavelength dependent absorption coefficient analysis revealed that at Port site transport (eBC_{TR}) and biomass burning (eBC_{BB}) related eBC contribute approximately 86% and 14% to the total eBC mass, respectively. In the case of Quezon City, this contribution was 80% and 20%, respectively (Fig. 1a, 1b). The time series analysis in figure 1c and 1d illustrates the dynamic changes in light absorption coefficients of elemental carbon (eBC) and brown carbon (BrC) at the port and QCG sites. Notably, the light absorption coefficient of BrC at 370 nm (b_{abs},BrC) exhibited spatial variability, ranging from 0.02 to 0.80 Mm^{-1}. At the port site, eBC contributed significantly with 80%, surpassing BrC 20%, while a similar trend was observed at the QCG site, with eBC contribution 78% compared to BrC 22%.

The diurnal pattern of eBC_{TR} at both sites (QCG and Port) exhibits a higher mass concentration during the morning hours (6-8 h) and a lower mass concentration during midday (11-13 h). Both sites, QCG and Port, display a similar trend for eBC_{BB} mass concentration, which reached a maximum between 6-8 hours and minimum between 11-13 hours (Fig. 2).

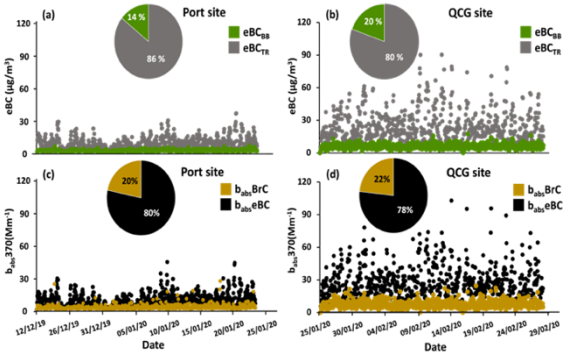

Fig. 1 Time series and contributions of the hourly average eBC_{TR} and eBC_{BB} to the total eBC, at port (**a**) and QCG (**b**) sites, as well as b_{abs} BrC and b_{abs} BC to the total b_{abs} (Mm^{-1}) at Port site (**c**) and QCG sites (**d**).

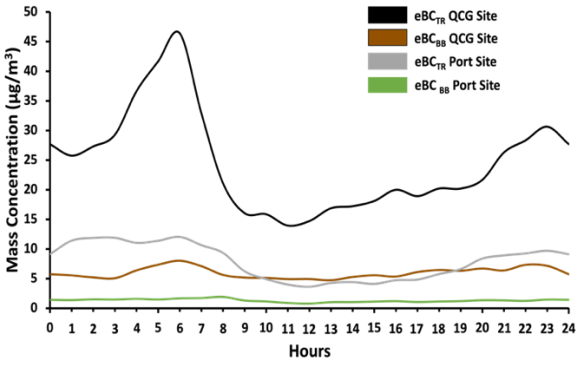

Fig. 2 eBC_{TR} and eBC_{BB} diurnal trend at Manila Port site and QCG site.

Keywords; Equivalent black carbon, source apportionment, Absorption ångström exponent.

Literature

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