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Source apportionment of particulate matter in a South Asian Mega City: A case study of Karachi

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Pakistan is facing unabated air pollution as a major issue and its cities are more vulnerable as compared to urban centers in the developed world. During the last few decades, there has been a rapid increase in population, urbanization, industrialization, transportation and other human activities. In year June 2015 heat wave in largest South Asian mega city Karachi more than 1500 people died in one week. Unfortunately no air quality monitoring system is operation in any city of Pakistan. There is a sharp increase in both the variety and quantity of air pollutants and their corresponding sources. In this study contributions of different sources to particulate matter concentration has estimated in urban area of Karachi. Carbonaceous species (elemental carbon, organic carbon, carbonate carbon), soluble ions (Ca++, Mg++, Na+, K+, NH4+, Cl-, NO_3-, SO4–), saccharides (levoglucosan, galactosan, mannosan, sucrose, fructose, glucose, arabitol and mannitol) were measured in atmospheric fine (PM2.5) and coarse (PM10) particles collected under pre-monsoon conditions (March – April 2009) at an urban site in Karachi (Pakistan). Average concentrations of PM2.5 were 75μg/m3 and of PM10 437μg/m3. The large difference between PM10 and PM2.5 originated predominantly from mineral dust. “Calcareous dust” and „siliceous dust” were the overall dominating material in PM, with 46% contribution to PM2.5 and 78% to PM10-2.5. 20 Combustion particles and secondary organics (EC+OM) comprised 23% of PM2.5 and 6% of PM10-2.5. EC, as well as OC ambient levels were higher (59% and 56%) in PM10-2.5 than in 22 PM2.5. Biomass burning contributed about 3% to PM2.5, and had a share of about 13% of “EC+OM” in PM2.5. The impact of bioaerosol (fungal spores) was minor and had a share of 1 and 2% of the OC in the PM2.5 and PM10-2.5 size fractions. Of secondary inorganic constituents (NH4)2SO4 contributes 4.4% to PM2.5 and no detectable quantity to PM10-2.5. The sea salt contribution is about 2% both to PM2.5 and PM10-2.5. In order to make air quality better and risk free in South Asian cities a comprehensive and integrated regional effort is required that include continuous air quality monitoring, source apportionment and implementation of regional air quality policies.