Characterization of atmospheric soot particles using aethalometer and SEM-EDX

Pratima Gupta[1], Ashok Jangid[2], and Ranjit Kumar[1]*

[1]*Department of Chemistry,* [2]*Department of Physics and Computer Science, Faculty of Science, Dayalbagh Educational Institute (Deemed University), Dayalbagh, Agra-282005 (India).*

[3]*Indian Institute of Tropical Meteorology, New Delhi -110060 (India).*

The present study assesses the speciation of soot particles which contains variety of carbonaceous compound in the ambient air of Agra, located in the Indo-Gangetic basin (IGB) region. The average mass concentrations of soot particles were found to be 7.4 μg m^{-3}. The mean concentration of light absorbing soot particle was highest at $UVPM_{370}$ (9.3 µg m^{-3}) followed by blue carbon at 470 nm (7.6 µg m^{-3}), green carbon at 590 nm (7.2 µg m^{-3}), yellow carbon at 520 nm (7.1 µg m^{-3}), red carbon at 660 nm (6.7 µg m^{-3}), IR-2 carbon at 950 nm (6.6 µg m^{-3}) and black carbon at 880 nm (6.5µg m^{-3}). The concentration of soot particles at a shorter wavelength (UV range) to longer wavelength (IR range) has shown large variations. This large variability was due to variation in the anthropogenic sources as well as meteorological conditions. The source identification of soot particle has been analyzed by the absorption coefficient (β_{abs}) and Absorption Exponent Coefficient (α_{abs}) shows higher values of soot particle in the winter (1.5) season, however, the lowest was in the monsoon (0.75) season. In the visible region (440-660 nm), the absorption coefficient (β_{abs}) followed the same trend as highest in winter followed by post-monsoon. The monthly variation of absorption exponent coefficient (α_{abs}) is found to be higher during November followed by December month. This suggests that soot particles over Agra are mainly generated from crop burning, waste burning; automobile exhaust and long-range transport from Punjab and Haryana as the present site are downwind. A comparative analysis reveals that the mean ratio of soot particle at 370 nm to that at 880 nm was 1.3 throughout the study period, which clearly indicated the dominance of biomass burning and emission from fossil fuel combustion especially diesel during the winter and post-monsoon seasons. The SEM-EDX analysis of soot particles reveals the confirmation of the various elements which are emitted from various sources like burning of biomass and fossil fuel, tobacco smoke, dust particles, sand particles, vehicular emission and mineral dust. Tobacco smoke often has a yellow coloration which includes the elements of Al, K, Na, Ca and S. The dust particles which have red coloration may change the response at 660 nm wavelength. The presence of Si, Fe, F and Ca indicates the natural sources viz., mineral, soil and sand dust.

Key words: Soot particles, spectral variation, absorption coefficient, Absorption Angstrom Exponent