Study on relation of hygroscopicity of PM2.5 with agricultural residue burning based on observations using low-cost sensors at Chandigarh in northern India

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Indo-Gangetic Plane in India often experiences severe air pollution from post-monsoon to winter seasons. Especially on October and November, agricultural residue burning activities mainly in Punjab and Haryana regions were reported to contribute to enhancement of PM2.5 (particle matter with aerodynamic diameters less than 2.5 micron) in downwind area including Delhi. Residential solid fuel combustions were also reported to have significant contributions in rural area in northwest India [e.g.., Pawer and Sinha, *Atmos. Environ.* (2022)]. However, *in-situ* observation of PM2.5 in rural area of northwest India is still limited. Recently, a series of low-cost PM sensors have been developed and will give promising opportunities to apply to observations especially in rural area. Typically, optical PM sensors measure light scattering from aerosol particles without drying, and therefore, potentially detect both (a fraction of) water and other chemical compositions in PM. In this study, Panasonic optical PM2.5 sensors [Nakayama *et al.*, *Aerosol Sci. Technol.* (2018)] were operated under different relative humidity (RH) conditions from 30th October 2019 to 8th January 2020 at IISER Mohali (30.667°N, 76.729°E) in Chandigarh in north India. By comparing the PM2.5 mass concentration obtained by one PM2.5 sensor under ambient RH conditions with those under lower RH conditions by another PM2.5 sensor and bata attenuation monitors (BAMs) at the same site and two nearest monitoring stations of government, parameters related to hygroscopicity of particles were estimated. As results, lower hygroscopicity was observed before the middle of December compare to those after that, likely due to significant contributions of emissions of primary organic aerosols and elementary carbons during agricultural residue burning and/or residential solid fuel combustions. After the middle of December, secondary formation of inorganic and oxygenated organic aerosols might contribute to the observed enhancement of hygroscopicity. This study demonstrates the potential of low-cost optical PM2.5 sensors to monitor variations of properties and types of aerosol particles, especially in rural area.

Keywords: PM2.5, Low-cost sensor, Hygroscopicity, Aerosol

