Atmospheric aerosols from anthropogenic activities influence climate. Assessment of atmospheric Aerosols over the Northern part of India

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Introduction

Atmospheric aerosols are suspensions of liquid, solid, or mixed particles with highly variable chemical composition and size distribution. Their variability is due to the numerous sources and varying formation mechanisms. Aerosol particles are either emitted directly to the atmosphere (primary aerosols: PA) or produced in the atmosphere from precursor gases (secondary aerosols: SA). PA consist of both inorganic and organic components and have short atmospheric lifetimes, typically only a few days. Combustion processes, biomass burning, and plant/microbial materials are sources of carbonaceous aerosols, including both organic carbon (OC) and solid black carbon (BC). BC is the main anthropogenic light-absorbing constituent present in aerosols. SA particles are produced in the atmosphere from precursor gases by condensation of vapours on pre-existing particles or by nucleation of new particles and are small; they range in size from a few nanometres up to 1 mm with a lifetimes of days to weeks. SA consist of mixtures of compounds; the main components are sulphate, nitrate, and OC.

Experimental Setup

Atmospheric aerosols as particulate matter, organic carbon, elemental carbon, insoluble organic and inorganic chemical species of atmospheric aerosols, gaseous pollutants along with meteorological parameters were measured in the northern part of India and its salient feature were presented. In addition to this, we are tried to study the impact of aerosols on crops and climate and the results are also presented.

Results

![Image 1](https://example.com/image1.png)

**Fig. 1.** Spectral b_{opt} at seven wavelengths in Delhi during winter.

![Image 2](https://example.com/image2.png)

**Fig. 2.** Hourly and daily variation of the BC_{400}, BC_{450} and BC_{600} concentrations in Delhi during winter.

![Image 3](https://example.com/image3.png)

**Fig. 3.** Fractional mass contribution of measured chemical species in PM_{2.5} over Delhi and Bangladesh and Maldives.

Conclusions

- The concentrations of fine mode particle over the northern part of India during winter period are more than 200μg/m².
- The BC_{400} vs BC_{600} estimations are 72% vs 28% at 880 nm.
- During winter period, the fog water were found alkaline, however, physically the samples were found blackish due to high concentrations of carbonaceous aerosols. The higher pH value were due to neutralization by ammonium.
- There were no variability in chemistry of fog over Delhi and upwind direction at Hisar were due to dispersion of primary and secondary aerosols.
- Day by day, the concentrations of acidic species are increasing over Delhi region that are affecting regional climate.
- During the post-monsoon season, stubble burning is still a major challenge and it play a crucial role in enhancement of atmospheric aerosols.
- Gaseous exchange is adversely affected in rice plants due to PM deposition.
- The government of India has been taking several mitigation strategies for reduction of pollutants but still, it is rising. Designing for effective mitigation strategies are to be required.

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