Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.21899

# Oxidative Potential of Ambient Fine Aerosols during Summer and Winter time Burning at an Urban Site of Agra, India

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India, with its significant population and agricultural focus, is a major contributor to burning activities that have profound environmental and health implications. Notably, practices such as crop residue burning, wood burning, fuel combustion, and other open burning practices are prevalent [2]. These burning activities emit pollutants, including PM with organic compounds with diverse composition, leading to adverse effects such as climate change and detrimental impacts on human health. Importantly, burning activities exhibit seasonal variations, with distinct impacts during summer and winter. Thus, this study aims to assess the chemical composition of aerosols and their toxicity in terms of oxidative potential (OP), during both summer and winter burning periods. Samples were collected from an urban site in Agra from January to December 2023, utilizing low volume sampler. Analysis included determination of organic carbon (OC), elemental carbon (EC), water-soluble inorganic ions (WSII), and PAHs. OP was evaluated through the dithiothreitol (DTT) assay [1]. The findings revealed that the average concentration of $PM_{2.5}$ during winter time burning (246.7±75.6 μg $m^{-3}$) was notably higher compared to summer time burning (107.3±39.4 μg $m^{-3}$), accompanied by elevated levels of OC, EC, WSII, and PAHs. Moreover, the mass-normalized DTT activity (DTTm) and volume-normalized DTT activity (DTTv) were 33.3±20.2 pmol $min^{-1}$ $\mu g^{-1}$ and 9.7±12.6 nmol $min^{-1}$ $m^{-3}$ respectively during winter time burning while 31.3±20.2 pmol $min^{-1}$ $\mu g^{-1}$ and 1.1±2.6 nmol $min^{-1}$ $m^{-3}$ respectively during summer time burning, indicating heightened toxicity of PM during winter compared to summer. Correlation analysis between OP and PM components revealed a stronger and more significant correlation with OC ($r>0.8$; $p<0.05$) EC ($r>0.9$; $p<0.05$) and WSII ($r>0.6$; $p<0.05$), while considerable correlation was not observed with PAHs, suggesting the presence of other contributing compounds. Positive Matrix Factorization (PMF) analysis identified wood and coal burning as primary sources during winter, whereas vehicular emissions dominated during summer, with stubble burning contributing mainly through long-range transportation.

[1] Goyal, I., Verma, P. K., Kumari, K. M., & Lakhani, A. (2023), *Air Quality, Atmosphere & Health*, *16*(11), 2193-2207.

[2] Vishwakarma, P., Rajeev, P., Rabha, S., Islam, N., Saikia, B. K., & Gupta, T. (2023), *Journal of Atmospheric Chemistry*, *80*(4), 251-269.