

Abstract

This work presents the effects of fireworks display during Diwali on the short-term elevation of atmospheric aerosols and associated particle deposition in human respiratory tract at Dehradun, located in the foothills of the Himalayas. During Diwali in the years 2017 and 2018, the real-time particle number count (PNC) and particulate matter (PM) with the aerodynamic diameter of 0.01 to 35 μm were measured using an aerosol spectrometer. The 2-year mean \pm SD of PNC, $\text{PM}_{1.0}$, $\text{PM}_{2.5}$ and PM_{10} during the Diwali period was observed to be $23,861 \pm 13,307$ ($\# \text{ cm}^{-3}$), 85.63 ± 38.64 , 97.10 ± 40.36 and 134.21 ± 44.80 ($\mu\text{g m}^{-3}$), respectively. Interestingly, PM mass concentration ($\text{PM}_{1.0}$, $\text{PM}_{2.5}$ and PM_{10}) and PNC during the Diwali period was 1.8–2.1 folds compared to the pre-Diwali period. Air mass back trajectory analysis revealed no long range transport or trans-boundary source during Diwali, which suggests that the air quality of Dehradun is influenced by local air pollution activities like fireworks, wood burning and automobile emissions. Furthermore, the number of particles inhalable in nucleation, Aitken and accumulation size mode was calculated using PNC and inhalation rate. Inhalable particles during Diwali were two times the pre-Diwali period. This study is first of its kind study over the foothills of Himalayas that illustrates the interferences of air pollution and their impact on human health during the festival period.

Keywords

Fireworks, Himalayas, Aerosol spectrometer, Aitken, Back trajectory