

Characteristics, sources, and health risks of PM_{2.5}-bound trace elements at a national forest park site in southern China

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Abstract: The health effects of trace elements in PM_{2.5} have been the subject of widespread public concern. In this study, 18 trace elements in PM_{2.5} were measured by wavelength dispersive X-ray fluorescence spectrometer at a national forest park site in southern China. The results showed that the crustal elements are the major trace elements in PM_{2.5}. Higher concentrations of crustal elements are associated with northwestern air masses and southeastern air masses, while higher concentrations of anthropogenic elements are associated with southwestern air masses. Natural sources, vehicle emission sources, coal combustion sources, biomass combustion sources, and industrial sources, were identified by both the APCS-MLR model and the PMF model. The total non-carcinogenic risk of the hazardous elements were 0.723 and 0.448 for adults and children, respectively, which was below the acceptable threshold. The total carcinogenic risk of the hazardous elements for adults and children was above the safe level of 1.99×10^{-5} and 3.63×10^{-6} , respectively, indicating that the carcinogenic risk to adults and children from these hazardous elements is not negligible. Both the APCS-MLR-HRA model and the PMF-HRA model indicate that vehicle emissions sources and industrial sources are the main contributors to non-carcinogenic risks, while industrial sources and coal combustion sources are the main contributors to carcinogenic risks. Mn was the main contributor to the non-carcinogenic risk, while As was the main contributor to the carcinogenic risk. Mn and As should be prioritized as control elements to address the higher non-carcinogenic and carcinogenic risks from vehicle emissions sources, industrial sources, and coal combustion sources.

Keywords: Trace element; Source identification; Health risk assessment; National forest park