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$PM_{2.5}$ pollution in a petrochemical industry city of northern China: seasonal variation and source apportionment

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Abstract:

$PM_{2.5}$ characteristics and source apportionment were comprehensively investigated in the petrochemical industry city of Zibo in northern China during one year. The results showed that the annual average $PM_{2.5}$ concentration was 164.61±79.14 μg/m^3 with the highest level in winter and the lowest in summer. The concentrations of the carbonaceous aerosol, water-soluble inorganic ions, water-soluble organic acids, crustal elements and trace elements were 36.98±22.49 μg/m^3, 78.05±42.68 μg/m^3, 0.45±0.28 μg/m^3, 9.20±6.11 μg/m^3 and 1.76±1.24 μg/m^3, respectively. S was the most abundant element in the area, which was combined with high concentration Cl^-, suggesting the influence of coal combustion. There were a high OC/EC ratio (6.68), a pronounced fractions of Ca^{2+} (1.87%) and a Ni/V ratio of 2.48 in $PM_{2.5}$, indicating the impact of petrochemical industry and its downstream enterprises. EFs showed that Al, Na, Mg, Ca, Ti and Fe originated from crust sources, while Cl, S, K, Sc, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Br, Sr, Cd, Ba and Pb were related to the human activities. Six source factors were identified by positive matrix factorization (PMF) model with an order of soil dust (29.2%) > secondary formation (25.7%) > coal combustion (16.1%) > petrochemical industry (14.9%) > biomass burning (11.3%) > vehicular emission (2.8%). These provided a significant insight into $PM_{2.5}$ characteristics and had important implications for $PM_{2.5}$ control strategies in Zibo and other petrochemical industry cities.

Keywords: $PM_{2.5}$, Chemical composition, Petrochemical industry, Source apportionment, Zibo.