

Characteristics, sources, health risk assessment and prediction model of air pollutants in a megacity, Southwest China

XIN CHENG, YI HUANG, SHIPENG ZHANG,
SHIJUN NI, LUMING WEI

College of Earth Science, Chengdu University of Technology,
Chengdu 610059, China. hy1425@aliyun.com

Particulate matters (PM₁₀, PM_{2.5}), sulfur dioxide (SO₂), nitrogen dioxide (NO₂), ground level ozone (O₃), carbon monoxide (CO), and heavy metals are the criteria pollutants in the atmosphere. These air pollutants deteriorate the air quality and ultimately affect the climate, environment and human health [1].

Chengdu is one of the most air polluted megacities in China. The air quality of this city has been affected by various anthropogenic sources, as well as unfavorable geographical and meteorological conditions. To understand current air situations in this area, six criteria pollutants (PM₁₀, PM_{2.5}, SO₂, NO₂, CO, and 8 h O₃) as well as the meteorological parameters were investigated at an urban site during 2014. The correlations between PM and gaseous pollutants were analyzed using the Pearson correlation coefficient. Sources of metals were investigated with enrichment factor, principal component analysis and SEM-EDX. Furthermore, health risk assessment model was applied to assess health risk from hazard metals, and BP neural networks were adopted to establish the prediction model.

The results showed the daily average concentrations of both PM₁₀ and PM_{2.5} were 173.6 ± 77.9 and $104.1 \pm 71.4 \mu\text{g m}^{-3}$, respectively. There existed a marked seasonal pattern of the concentrations of all the pollutants. The existence of strong correlations between the concentrations of particulates and gaseous pollutants indicated the commonality of contributing source processes. The average content of metal in PM₁₀ was in the following order: Fe>Zn>Ti>Cu>Mn>Ba>Cr>Sr>Ni>As>V>Sb>Co>Cd>Bi. Principal component analysis revealed that the main sources of trace elements can be coal combustion, crustal dust, road traffic, construction dust, and iron and steel manufacturing dust. Six major particle types were observed according to SEM-EDX results. Health risk assessment indicated that Cr can be carcinogenic to both children and adults, and other trace elements were determined to be below the legislation threshold.

[1] Garcia, V.C., Gego, E., Lin, S., et al. (2011). Atmos. Pollut. Res. 2: 9–15.