

## **Chemical composition of rainwater and the acid neutralizing effect at Beijing and Chizhou city, China**

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The chemical compositions were measured in rainwater samples collected during 2011-2012 from two representative cities, Beijing in north China and Chizhou city in south China. The rainwater was highly acidic with a volume-weighted mean (VWM) pH of 4.56, ranging from 3.77 to 5.67, and about 94% of the samples had pH below 5.0 in Chizhou. The pH values of rainwater in Beijing ranged from 3.78 to 6.62, with a VWM value of 4.85. The dominated ions in the precipitation were quite similar between the two cities; they are  $\text{SO}_4^{2-}$ ,  $\text{Ca}^{2+}$  and  $\text{NH}_4^+$ .  $\text{SO}_4^{2-}$  accounted for 79.1% and 85.4% of the total measured anions,  $\text{Ca}^{2+}$  and  $\text{NH}_4^+$  accounted for 86.8% and 93.8% of the total measured cations in precipitation of Beijing and Chizhou, respectively. The concentrations of almost all species in Beijing rainwater were higher than those in Chizhou. In particular,  $\text{SO}_4^{2-}$  concentration in Beijing rainwater was about twice of that in Chizhou. However, due to the weaker neutralization of acidity, the rainwater from Chizhou had relatively low pH values. According to the results of linear regression analysis, the percentage of the potential acidity counteracted by  $\text{Ca}^{2+}$  and  $\text{NH}_4^+$  was higher in rainwater in Beijing (90.7%) than that in Chizhou (70.8%). Using Na as an indicator of marine origin, and Al for the terrestrial inputs, the proportions of sea salt and terrestrial elements were estimated from elemental ratios. More than 98% of  $\text{SO}_4^{2-}$  and  $\text{Ca}^{2+}$  in rainwater samples are non-sea-salt origin at both sites. Coal combustion may be the main source of  $\text{SO}_4^{2-}$ , and local and remote soil dust may be an important source of  $\text{Ca}^{2+}$  in Beijing rainwater. The high concentrations of alkaline ions ( $\text{Ca}^{2+}$  and  $\text{NH}_4^+$ ) have played an important role to neutralize the acidity of rainwater in Beijing.