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The near real-time measurements of soluble ions for determining possible sources in Taipei during 2004 springtime

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In Taipei basin, the air pollution quality was mainly affected by PM10 during springtime. In order to identify the possible sources, PM10 samples were collected and measured using a TEOM analyzer with a 15-min sampling time interval from February to March 2004. The soluble ions in PM10 aerosols were simultaneously analyzed using the in-situ IC (ion chromatograph) system for measuring the concentration of Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, NO_2^-, NO_3^- and SO_4^{2-} with a 15-min sampling time interval. The sample inlet was equipped with a 16.7 LPM PM10 impactor. The in-situ IC shared the inlet with the TEOM and used the bypass flow. The 3 LPM main flow was flowed into the TEOM sensor for measuring the PM10 mass concentration. The other 13.7 LPM bypass flow was split into a 3.7 LPM filter flow and a 10 LPM in-situ IC flow after leaving denuders. Two concentric denuders were used to remove the acidic and basic gas-phase interferences. The concentrations of inorganic ionic components of the collected aerosol samples were analyzed using two IC, which permitted both the cations and anions to be determined on-line and continuously.

It was found that NH_4^+, NO_3^- and SO_4^{2-} dominated the identifiable components, and occupied 87% of total soluble ionic concentrations for PM10. The linear regression slope and intercept of the cation equivalent versus the anion equivalent were 1.08 and 0, with an r^2-value of 0.94. The possible sources of PM10 were identified by the factor analysis, characteristic ions and comparing contribution of wind aspects with wind direction frequencies. Three source categories were resolved from the measurements. The first and secondary categories were both under the predominant east wind with

high wind speed and NO_2^-, NO_3^-, SO_4^{2-}, Na^+, NH_4^+ and Mg^{2+} occupied similar compositions of total soluble inorganic species. However, the first category has lower ratio of ions to PM10 and significantly higher compositions of K^+ and Ca^{2+} indicating the dust storm source. The secondary category may be from the non-dust long-range transport source. The third category, under the predominant south and west-north wind direction with low wind speed, has higher ratio of ions to PM10 and significantly high compositions of NO_2^- and NO_3^-, mainly represent the secondary aerosol formation source.

The evidences from above soluble ion observations suggest that secondary aerosols, non-dust long-rang transport of pollutions and dust storm make a significant contribution to PM10 aerosol mass. Overall, high density of traffic emission and sufficient solar radiation under relatively calm and humid atmospheric conditions were favored the formation of secondary aerosols in Taipei basin. The local air quality was also strongly affected by the long-range transport of pollutions from the mainland China under the east-north monsoon influence.