摘要

為探討桃園縣大溪鎮大溪國中及楊梅鎮大同國小大氣懸浮微粒(PM, Particulate Matter)的特性，本研究分別在 2005 年 11 月、2006 年 2 月及 2006 年 4 月，以雙道PM_{10}採樣器於上述兩處校舍樓頂各進行一次 24 小時的連續採樣，以採集大氣中的懸浮微粒，並進行化學分析。研究結果顯示，在本研究採樣期間，在大溪國中及大同國小所採集到的PM_{10}濃度範圍分別為 78.25~88.32 及 78.48~111.94 μg/m^3，三次採樣平均分別為 84.04 及 94.2 μg/m^3。在大溪國中及大同國小所採集到的$PM_{2.5}$/ PM_{10}的三次採樣平均分別為 65.61 %及 65.12 %，顯示此兩處的大氣懸浮微粒皆以$PM_{2.5}$為主。在大溪國中$PM_{2.5}$微粒中的水溶性離子及TC(EC, 元素碳及OC, 有機碳)，平均所佔比例分別為 47.73 %及 28.37 %；在大同國小$PM_{2.5}$微粒的水溶性離子及TC(EC, 元素碳及OC, 有機碳)，平均所佔比例分別為 49.74 %及 28.6 %，此結果說明了二次無機及有機的氣膠在此兩個採樣點所佔$PM_{2.5}$的比例很高。

為了將來的採樣需求，本研究設計了一個多頻道的PM_{10}-$PM_{2.5}$採樣器, 它可以同時採集 4 個PM_{10}及 4 個$PM_{2.5}$的濾紙樣本, 以供微粒稱重、元素分析、離子分析及碳分析，或無機或有機氣體及微粒分析之用。本採樣器的採樣氣體體積流率採主動式的控制方式，可依大氣的溫度、壓力及濾紙的壓差而維持一個固定值，以便能得到正確的PM_{10}及$PM_{2.5}$的樣本。在實驗室的校正實驗結果顯示，PM_{10}衝擊器的截取氣動直徑約為 11 μm，與理想PM_{10}衝擊器的截取氣動直徑 10 μm相比，誤異約為 10 %，衝擊器的內部損失約為 20~25 %；$PM_{2.5}$衝擊器的截取氣動直徑約為 3.4 μm，與理想$PM_{2.5}$衝擊器的截取氣動直徑 2.5 μm相比，差異約為 36 %，衝擊器的內部損失約為 7~11 %。本PM採樣器的微粒損失，主要是發生在入口防蟲網及分接管內側管壁上，降低微粒內部損失及提高截取氣動直徑的準確性為將來需要努力的地方。

關鍵詞：懸浮微粒，空氣污染監測，微粒採樣器，懸浮微粒採樣分析

Abstract

This study conducted atmospheric aerosol sampling to characterize the PM_{10} and $PM_{2.5}$ mass concentrations and the chemical compositions from December 2005 to April 2006 in Daxi middle school and Tatung elementary school in Daxi and Yangmei. According to the study, the average PM_{10} mass concentrations in Daxi and Yangmei were 84.04 and 94.2 $\mu g/m^3$, respectively, in which the $PM_{2.5}$ fraction accounted for 63.85-67.36 % and 64.47-66.41 % in Daxi and Yangmei, respectively. This indicate $PM_{2.5}$ is the major fraction of PM_{10} in these two location. The abundant species in ambient $PM_{2.5}$ in term of mass fraction for Daxi were averaged 47.73 % for soluable ions and 28.37 % for TC, which those 49.74 % for soluable ions and 28.6 % for TC for Yangmei. Results show that the secondary inorganic and organic aerosols constitute the major fraction in $PM_{2.5}$ at there two sampling sites.

For future sampling need, this study designed and tested a multi-channel PM_{10}-$PM_{2.5}$ sampler in which four PM_{10} and four $PM_{2.5}$ filters can be taken at the same time. These samples can further be used for weighing, and analysis for elements, ions and carbons, or accurate inorganic or organic gas and particle analysis. The volumetric flow rate is controlled actively so that a fixed flow rate can be maintained based on atmospheric temperature, pressure and filter pressure drop so that accurate PM_{10}-$PM_{2.5}$ samples can be obtained. In this sampler, particles larger than 2.5 or 10 μm are retained by impaction. The laboratory calibration results showed that the cutpoint of the present PM_{10} impactors is about 11 μm, the difference from the cutpoint of the ideal PM_{10} sampler, 10 μm, is about 10 %, and the wall loss of the present PM_{10} sampler is about 20~25 %. The cutpoint of the present $PM_{2.5}$ impactors is about 3.4 μm, the difference from the cutpoint of the ideal $PM_{2.5}$ sampler, 2.5 μm, is

about 36 %, and the wall loss of the present $PM_{2.5}$ sampler is about 7~11 %. In the future, we will decrease the wall loss and the particle loss at the inlet insect screen of the PM sampler, and increase the accuracy of the cutpoints of the impactor.

Keywords: particulate matter, air pollution monitoring, particle sampler, sampling and analysis of atmospheric particles.