金門縣環境保護局計畫成果中文摘要（簡要版）

一、中文計畫名稱：

107 年度金門縣在線式(online)儀器檢測 $PM_{2.5}$ 成分及貢獻來源計畫

二、英文計畫名稱：

Using online instruments to monitor the components and contributing sourece of fine particulate matters in Kinmen County on 2018.

三、計畫編號：

KEPB-107-05

四、執行單位：

祥威環境科技股份有限公司

五、計畫主持人：

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七、執行結束時間：

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八、報告完成日期：

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十三、中文摘要關鍵詞：

重金屬，細懸浮微粒，氣膠，陰陽離子

十四、英文摘要關鍵詞：

Heavy metal, $PM_{2.5}$, Aerosol, Anion and cation

十五、中文摘要：

本計畫於 2018 年 11 月 16 日至 2019 年 1 月 15 日於金門縣金城國中進行 $PM_{2.5}$、重金屬及水溶性陰陽離子之監測，並由氣象因子(風速、風向等)及濃度趨勢評估其可能污染來源，本年度計畫各工作項目執行成果，主要分述如下：

一、完成細粒徑懸浮微粒($PM_{2.5}$)連續監測共 53.45 天。

在線式微粒質量濃度分析儀(EBAM)，受濕度影響，其 $PM_{2.5}$ 測值與環保署測站內的分析儀趨勢一致，但容易有些極值產生。經篩除 RH>80%後，數據品質有明顯提升，未來如有類似應用，需留意相對濕度可能的干擾，可參考此篩選原則。

二、完成 $PM_{2.5}$ 上重金屬連續監測共 46.16 天。

由分析結果顯示， PM_{10} 日均值符合法規標準， $PM_{2.5}$ 共 7 日超標。重金屬物種濃度以地殼元素中鉀、鐵、鋅及鈣金屬元素有相對較高的平均濃度，分別為 476.3、169.3、105.5 及 92.5 ng/m^3；鉛、錳及鈦等金屬元素次之，分別為 21.7、13.5 及 12.5 ng/m^3。由濃度與風向之風玫瑰圖可得，大多數重金屬物種高濃度風向大多以西南風及東北風為主。再藉由風向機率統計結果顯示，主要盛行風為東北風，出現頻率占有效風向的 33.98%，顯示本次監測期間，當地的主要盛行風向為東北風，而以總量來看從北北東風到東北東風的夾角範圍(此範圍內的風向出現比例合計共 68.93%)亦為主要的風向趨勢之一。

三、完成 $PM_{2.5}$ 上陰陽離子與主要離子前驅氣體連續監測共 54.70 天。

以平均濃度而言，氣體以 NH_3 濃度 2.67 ppb 為較高，其次為 SO_2 濃度 1.07 ppb，濃度最低為 HCl 0.16 ppb；水溶性陽離子以 NH_4^+以 2.50 μg/m³ 為較高，以 K^+較低 0.13 μg/m³；水溶性陰離子以 SO_4^{2-}以 6.41 μg/m³ 為較高，以 NO_2^-為較低 0.39 μg/m³。其中水溶性陰陽離子占 $PM_{2.5}$ 中的比例以 SO_4^{2-}以 28.40%為較高，其次為 NO_3^- 20.70%，可得知空氣中氣膠成分於 $PM_{2.5}$ 中占有一定的比例。

由於 SOR>0.25 及 NOR>0.10，表示 SO_4^{2-}與 NO_3^-是當地產生污染物氧化外也有可能是長程傳輸污染物氧化而成，也表示此地區氧化反應較強，具有較多衍生性 $PM_{2.5}$。由極座標圖來看，多數的金屬元素和優勢陰陽離子(SO_4^{2-}、NH_4^+及 NO_3^-)的污染來源型態和 $PM_{2.5}$ 一致，高濃度主要發生在低風速時，來自西南西方。

十六、英文摘要：

This project is aimed at the monitoring of $PM_{2.5}$, heavy metals, and water-soluble anions and cations in Jin-cheng junior high school in Kinmen from November 16, 2018 to January 15, 2019. Through the meteorological factors(wind speed, and wind direction, etc.) and concentration trends are used to assess the possible sources of pollutions. The summary of the results of this project is as follows:

1. Complete continuous monitoring of fine particle($PM_{2.5}$) for 53.45 days.

   The on-line particle mass concentration analyzer (EBAM), which is affected by humidity, the trend of $PM_{2.5}$ concentration is consistent with EPA station, but it is easy to have extreme values. After screening RH>80%, the data quality is obviously improved. If there are similar applications in the future, should pay attention to the possible interference of relative humidity. You can refer to this screening principle.

2. Complete continuous monitoring of heavy metals in fine particle for

46.16 days.

The analysis results show that the daily average value of PM_{10} meets the regulatory standards, and $PM_{2.5}$ exceeds the standard for 7 days. The concentrations of heavy metal species have relatively high average concentrations of potassium, iron, zinc and calcium in the crust elements, which are 476.3, 169.3, 105.5 and 92.5 ng/m^3, respectively. The lead, manganese and titanium are second, 21.7, 13.5 and 12.5 ng/m^3 ,respectively. According to the wind and rose diagram of the concentration and wind direction, most of the heavy metal species have a high concentration of wind direction, mainly southwest and northeast. According to the statistical results of wind direction, and the main prevailing wind is the northeast wind. The frequency of occurrence is 33.98% of the effective wind direction. It shows that during the monitoring period, the main prevailing wind direction in the local area is the northeasterly wind, and the total angle from the north-north east wind to the northeast easterly wind (the total wind direction in this range is 68.93%) is also the main wind direction trend.

3. Complete continuous monitoring of anion, cations, and main ion precursor gas in fine particle for 54.70 days.

In terms of average concentration, the gas has higher NH_3 concentration of 2.67 ppb, followed by SO_2 1.07 ppb and a minimum concentration of HCl 0.16 ppb. The water-soluble cation is higher with NH_4^+ 2.50 $\mu g/m^3$ and lower with K^+ 0.13 $\mu g/m^3$. The water-soluble anion is higher with SO_4^{2-} 6.41 $\mu g/m^3$ and lower with NO_2^- 0.39 $\mu g/m^3$. Among them, the proportion of water-soluble anion and cation in $PM_{2.5}$ is higher with SO_4^{2-} 28.40%, followed by NO_3^- 20.70%. It can be known that the aerosol component in atmosphere occupies a certain proportion in $PM_{2.5}$.

Since SOR>0.25 and NOR>0.10, it means that SO_4^{2-} and NO_3^- are oxidized by local pollutants and may be oxidized by long-range transport pollutants. It also indicates that the oxidation reaction in this area is strong and has more derivative $PM_{2.5}$. According to the polar plot, most of the metal elements and the dominant anion and cation(SO_4^{2-}, NH_4^+, and NO_3^-) have the same pollution source type as $PM_{2.5}$, and the high concentration mainly occurs at low wind speeds from the southwestern west.