

## Abstract

The rapidly industrialized and urbanized areas show an ascending trend of both trace metals and various diverse effects on human health. In Taichung area, the under construction of Central Taiwan Science Park (CTSP) is possibly emitting metal pollutants and damages the ambient air quality. Thus, this study investigates the ambient metal content in period of construction. Both Dry Deposition Flux (DDF) and Total Suspended Particulate (TSP) samples were collected at Tunghai University campus, which is downwind site with CTSP. The results of this study show that both TSP and DDF in the sampling period (2004.9 to 2005.8) were higher than those of past four years (2000 to 2003), additionally the metal also found high concentration. Therefore, the under construction of CTSP is a remarkable emission for increasing pollutant concentration. Meteorological parameters show the relationship of quantity with both TSP and DDF. The simulation of dry deposition ratio indicates the major parameters that are wind speed and ground surface property, while the  $C_{up}$  can modify that ratio at the cement or lawn surfaces. In addition, the statistical analyses (Conditional Probability Function (CPF), Principal Component Analysis (PCA) and Enrichment Factor (EF)) indicated that the metals are possible related to several emission sources, which included the dust and soil emitted from the CTSP construction, emission of Taichung Industrial Park and the operations of Veteran General Hospital incinerator and Taichung City Refuse Incinerator.

*Keywords:* Metal; Dry Deposition Flux; Total Suspended Particulate; Dry Deposition Ratio; Central Taiwan Science Park

## 摘 要

在快速都市與工業化的地區，均顯示金屬元素的濃度有明顯上升的趨勢，其居民健康的問題也日益嚴重。在台中地區，大型工業區的建構很可能會導致週遭空氣品質惡化的問題，其操作後亦可能排放大量空氣污染物。因此，本研究致力於園區週遭大氣中背景金屬元素濃度的調查，並分析中部科學園區（CTSP）的開發對環境的衝擊。本研究的乾沉降（DDF）與總懸浮微粒（TSP）的樣品是收集在位於 CTSP 下風處的東海大學校園裡。其調查的結果顯示採樣期間（2004 年 9 月~2005 年 8 月）的乾沉降（ $5.28 \sim 12.24 \mu\text{g}/\text{m}^2\text{s}$ ）與總懸浮微粒（ $130.7 \mu\text{g}/\text{m}^3$ ）是明顯高於前幾年（2000~2003），而大部分的金屬濃度也顯示高於其他地區，主要以 Fe、Ca、Mg 與 Zn 為主，結果顯示 CTSP 的施工，可能導致週遭環境污染物濃度的增加。氣象參數（風速、溫度、濕度與大氣壓力）顯示對乾沉降與懸浮微粒有顯著的相關性。在乾沉降比率（DDR）的模擬結果中，顯示風速跟地表特性都是影響乾沉降比率的主要參數，可用修正係數  $C_{up}$  來修正地表與風對乾沉降比率的影響。此外，經由統計分析（條件機率函數（CPF）主成分分析（PCA）與豐富因子（EF））發現，台中地區的金屬污染源，可能與中部科學園區的開發、台中市焚化爐（TCRI）、台中工業區（TIP）以及台中榮民總醫院（VGH）醫療用焚化爐的操作等相關。

**關鍵字：**金屬、乾沉降、總懸浮微粒、乾沉降比率、中部科學園區

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## Abbreviation

Abbr.	Description	Unit
AAS	Atomic Absorption Spectrophotometer	-
CPF	Conditional Probability Function	-
CSTU	College of Science in Tunghai University	-
CTSP	Central Taiwan Science Park	-
DDF	Dry Deposition Flux	$\mu\text{g}/\text{m}^2 \text{ s}$
DDP	Dry Deposition Particulate	-
DDR	Dry Deposition Ratio	-
EF	Enrichment Factor	-
EU	European Union	-
FAAS	Flame Atomic Absorption Spectrophotometer	-
GFAAS	Graphite Furnace Atomic Absorption Spectrophotometer	-
HSP	Hsinchu Science Park	-
MDL	Method Detection Limit	-
PCA	Principal Component Analysis	-
PRB	Provincial Research Building	-
QC	Quality Control	-
TCRI	Taichung City Refuse Incinerator	-
TIP	Taichung Industrial Park	-
TSP	Total Suspended Particulate	$\mu\text{g}/\text{m}^3$
VGH	Veteran General Hospital	-

## Expression

Expr.	Description	Unit
$C_D$	Drag Coefficient	-
$C_{up}$	Modification Coefficient of Upward Flux	$\mu\text{g}/\text{m}^2 \text{ s}$
$F_B$	Buoyancy Force	$\text{kg}\cdot\text{m}/\text{s}^2$
$\Sigma F_{down}$	Total Forces on Downward Particulate	$\text{kg}\cdot\text{m}/\text{s}^2$
$F_D$	Drag Force	$\text{kg}\cdot\text{m}/\text{s}^2$
$F_G$	Gravity Force	$\text{kg}\cdot\text{m}/\text{s}^2$
$\Sigma F_{up}$	Total Forces on Upward Particulate	$\text{kg}\cdot\text{m}/\text{s}^2$
Est. Ratio	Estimated Ratio	-
Obs. Ratio	Observed Ratio	-
Re	Reynolds number	-