

前瞻性環境科技未來發展趨勢

--PM

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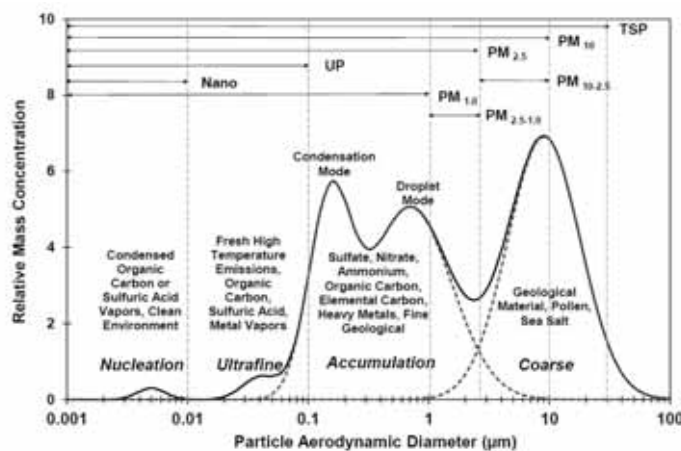
102年環境科技論壇
集思台大會議中心, 台北市
102年6月10日

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PM檢測技術及空氣品質管理發展趨勢

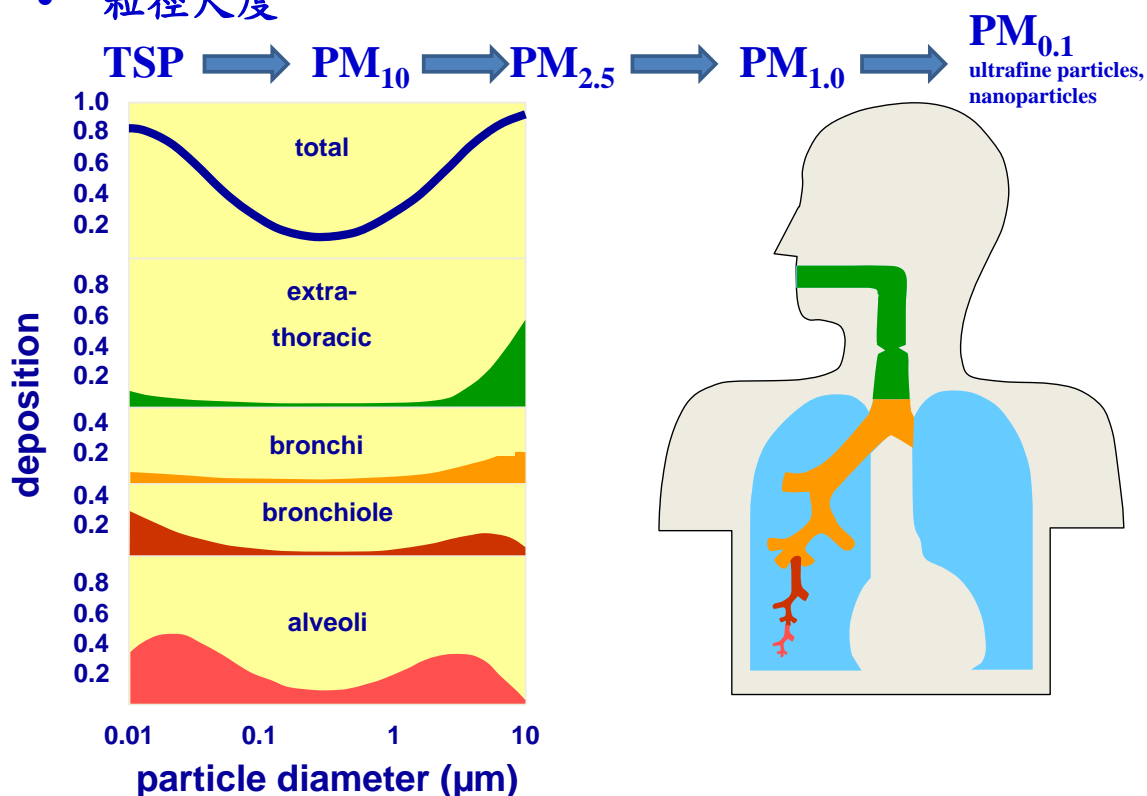
- 粒徑尺度

TSP → PM₁₀ → PM_{2.5} → PM_{1.0} → PM_{0.1}
ultrafine particles, nanoparticles



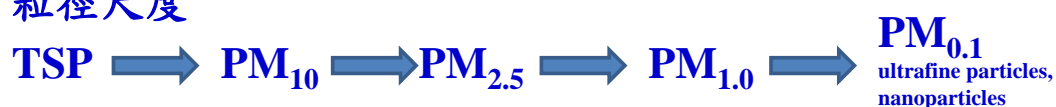
PM檢測技術及空氣品質管理發展趨勢

- 粒徑尺度



PM檢測技術及空氣品質管理發展趨勢

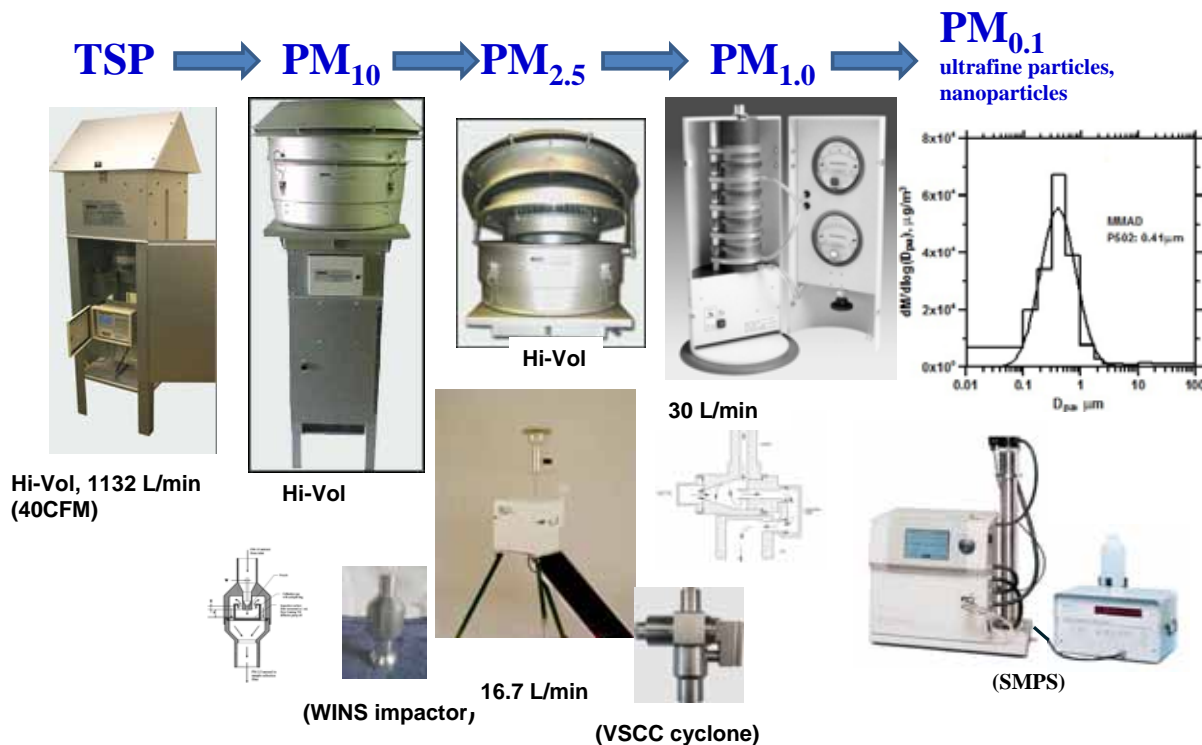
- 粒徑尺度



Implementation Document	Indicator ^a	Averaging Time	Concentration Level	Statistical Form
U.S. EPA, 1971	TSP	24-hr	260 µg m ⁻³	Not to be exceeded more than once per year
U.S. EPA, 1971	TSP	1-yr	75 µg m ⁻³	Annual geometric mean
U.S. EPA, 1987	PM ₁₀	24-hr	150 µg m ⁻³	Not to be exceeded more than once per year on average over a 3-year period
U.S. EPA, 1987	PM ₁₀	1-yr	50 µg m ⁻³	Annual arithmetic mean averaged over 3 years
U.S. EPA, 1997b	PM _{2.5}	24-hr	65 µg m ⁻³	98 th percentile averaged over 3 years
U.S. EPA, 1997b	PM _{2.5}	1-yr	15 µg m ⁻³	Annual arithmetic mean averaged over 3 years.
U.S. EPA, 2006	PM _{2.5}	24-hr	35 µg m ⁻³	98 th percentile average over 3 years
U.S. EPA, 2006	PM _{2.5}	1-yr	15 µg m ⁻³	Same as 1997 NAAQS
U.S. EPA, 2006	PM ₁₀	24-hr	150 µg m ⁻³	Same as 1987 NAAQS
U.S. EPA, 2006	PM ₁₀	1-yr	None	Annual average was vacated
U.S. EPA, 2013	PM _{2.5}	24-hr	35 µg m ⁻³	Same as 2006 NAAQS
U.S. EPA, 2013	PM _{2.5}	1-yr	12 µg m ⁻³	Annual arithmetic mean averaged over 3 years
U.S. EPA, 2013	PM ₁₀	24-hr	150 µg m ⁻³	Same as 1987 NAAQS

PM檢測技術及空氣品質管理發展趨勢

- 粒徑尺度: FRM (federal reference method, integrated samples)

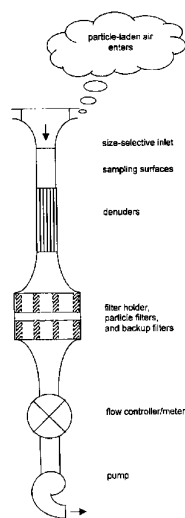


PM檢測技術及空氣品質管理發展趨勢

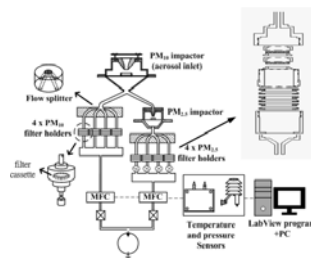
- 粒徑尺度: FRM (federal reference method, integrated samples)

TSP → PM₁₀ → PM_{2.5} → PM_{1.0} → PM_{0.1} ultrafine particles, nanoparticles

However, FRM sampler is not a complete sampling system which needs a denuder



(Partisol 2300)

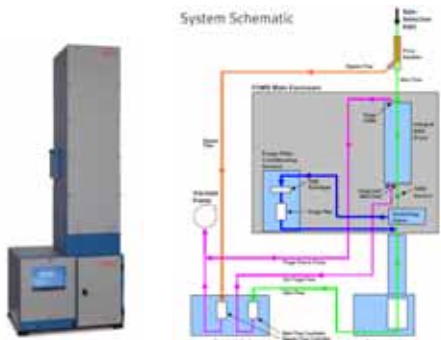
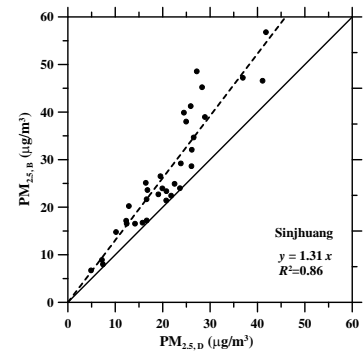
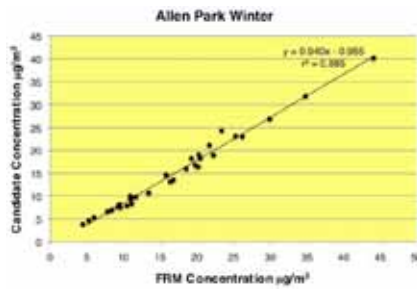


(NCTU MFPPS)

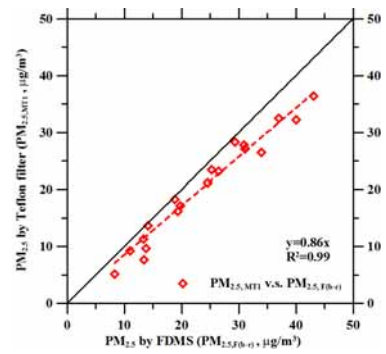
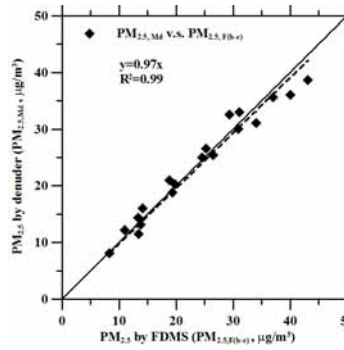
- 時間尺度: FEM (federal equivalent method, hourly samples)



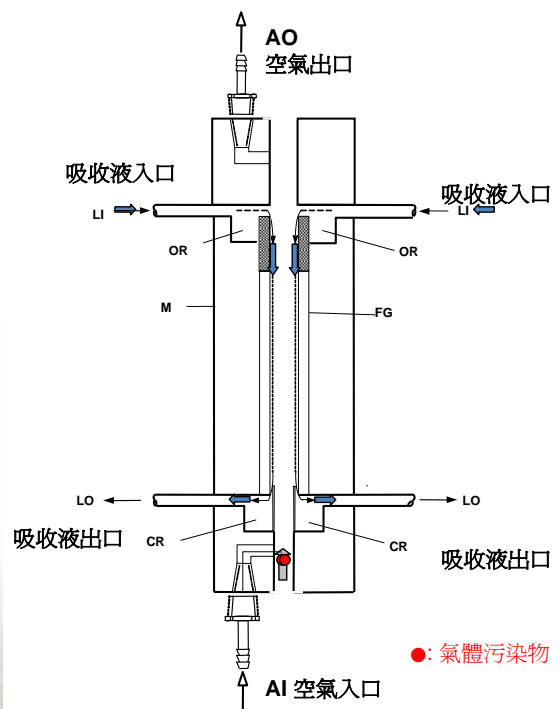
Beta-gauge



TEOM-FDMS



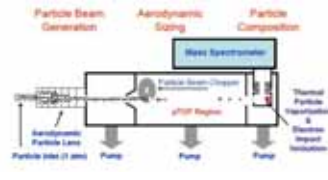
- 化學尺度: 水溶性氣體及微粒即時化學成份分析儀



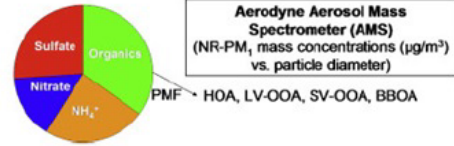
• 化學尺度：微粒即時分徑化學成份分析質譜儀

AMS (Aerodyne)
(aerosol mass spectrometer)
(most commonly used)

1-10 sec



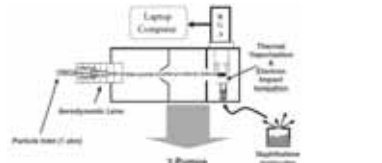
bulk mass concentrations of non-refractory (NR) species (typically organics, sulfate, nitrate, and ammonium)



positive matrix factorization (PMF) and high-resolution TOF mass analyzers

ACSM (Aerodyne)
(aerosol chemical speciation mass monitor)

30 minute



ATOFMS (TSI)
(aerosol time-of-flight mass spectrometer)

10 minute

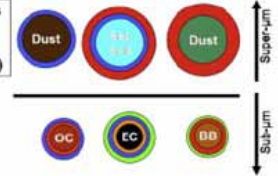


(discontinued)



Aerosol Time-of-Flight Mass Spectrometer (ATOFMS)
#/cm³, number fraction vs. ticle diameter, mixing state)

Secondary species:
● Sulfate
● Nitrate
● Ammonium
● Oxidized-OC

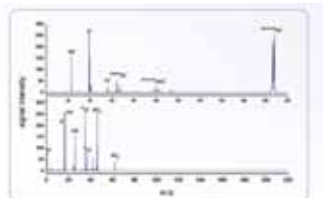
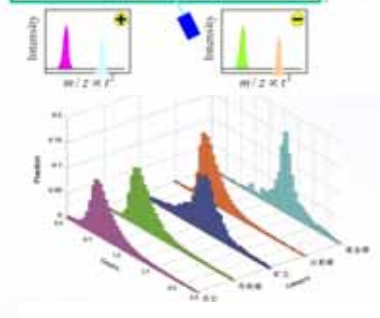
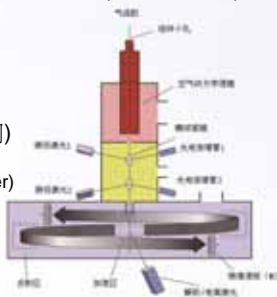


size-resolved chemical composition refractory and NR species

SPAMS

(大陸禾信公司)
(single particle mass spectrometer)

10 minute



• 空間尺度：排放源、環境空氣品質、室內空氣品質、個人暴露、跨境傳輸、多重空氣污染物及其效應等...

- 排放源PM_{2.5}前趨物的檢測及排放資料庫
- 排放源PM_{2.5}及前趨氣體之排放管制濃度及控制效率
- 排放源PM_{2.5}及前趨氣體管末最佳可行技術
- 排放源源PM_{2.5}及前趨氣體自動監測技術
- 台灣與大陸、東南亞等國的PM_{2.5}聯合觀測
- PM_{2.5}生成機理、模式模擬、跨境傳輸、本地及外地污染來源
- PM_{2.5}室內空氣品質
- PM_{2.5}個人暴露
- 多重污染物綜合控制技術
- PM_{2.5}環境容量及減量成本效益分析

- 空間尺度：排放源、環境空氣品質、室內空氣品質、個人暴露、跨境傳輸、多重空氣污染物及其效應等…

