

Introduction

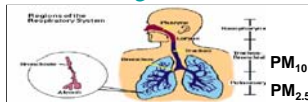
Epidemiological research has highlighted the detrimental effects of airborne particulate matter (PM) on human health. However there is still a wide debate over which characteristics of PM are responsible for the adverse health effects. The sources of PM are fairly well understood but their trace element composition and mechanism by which they exert their toxic effects still remains unclear. To a first approximation, the smaller the particle the further it will penetrate the lung so the greater the toxicity.

PM is generally classified by two factors: SIZE and (more recently) CHEMICAL COMPOSITION.

The size classification is as follows: **PM₁₀** (particulate matter with a diameter less than 10 μm) and **PM_{2.5}** (that less than 2.5 μm). Chemical analysis shows PM to comprise many inorganic, organic and elemental materials, several of which are toxic. For example, solubilized **metal ions** such as zinc have been found to be linked to lung injury and **polyaromatic hydrocarbons (PAHs)** exhibit carcinogenic and or mutagenic properties, which cause marked stress on lung tissue. Hence the necessity for integrated collection/analysis/toxicology projects of the type described here.

Aims

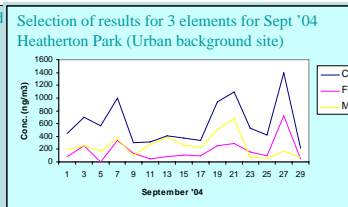
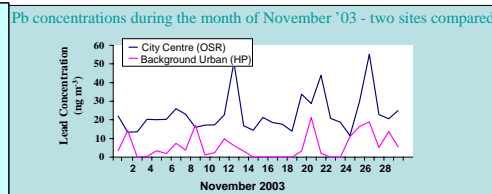
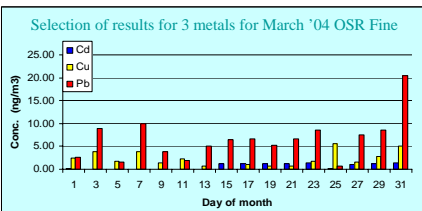
- Collection of PM_{10-2.5} and PM_{2.5} in Cork (Roadside, Urban Background and Rural sites)
- “Total” physico-chemical analysis method development to determine composition
- THIS WILL LEAD TO:**
- Characterization of ambient particulate matter and related species for the determination of source receptor relationships and also atmospheric processing pathways.
- Data retrieval from the total chemical analysis to develop a Computer Model for determining the origin & distribution of PM in Cork.
- Determination of biochemical/toxicological effects for airborne particulate components.



Selected Results (Year 1)

ICP-AES Analysis: metal components

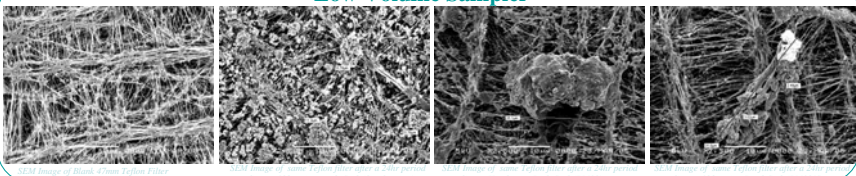
Metals Analysed: Ca, Mn, Fe, Ni, Zn, Mg, Cr, V, Cd, Cu, Pb, As, Ti, Al, Si



- Higher concentrations of lead were found at the city centre site when compared to Heatherton Park
- Ca, Fe, and Mg were found to follow similar trends through out each of the months analysed suggesting the same crustal sources

Scanning Electron Microscope Analysis: sizing the particulate components

Low Volume Sampler

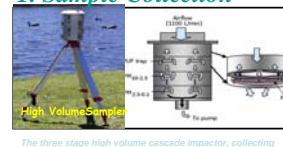


High Volume Sampler

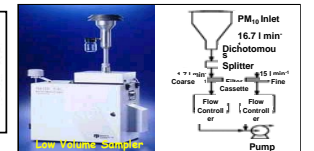


Methodology

1. Sample Collection



The three stage high volume cascade impactor, collecting PM_{10-2.5} and PM_{2.5} onto polystyrene foam.



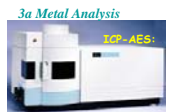
The Paros sampler with the aluminum splitter for the collection of PM_{10-2.5} and PM_{2.5} on PTFE filters.

2. Sample preparation



An Anton Paar MULTIWAVE microwave

3. Sample Analysis



Perkin Elmer Optima 2000DV Optical Emission Spectrometer

3a Metal Analysis



Shimadzu IC3 2000 Series Ion Chromatograph

3b Inorganic Ions Analysis

3c Elemental Species Analysis



Philips Magiscan Pw4025

3d Microscopy Analysis



JEOL JSM-5510 Scanning Electron Microscope

Year 2

Toxicological studies begin
 Sampling, analysis and method development continue

Acknowledgements

- Dr A. Whittaker, Dr J. Lopez and Dr J. Wenger
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