Seasonal variations in the sulphur content of urban residential $PM_{2.5}$

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This presentation examines seasonal variations in the elemental composition of fine particulate matter ($PM_{2.5}$) in personal, indoor and outdoor microenvironments, with focus on sulphur (S) relationships. Samples of $PM_{2.5}$ were collected in Windsor, Ontario, Canada during the winter and summer seasons of 2005 and 2006 (from approx. 48 homes per year), and archived for subsequent elemental analysis [1]. ED-XRF was used to quantify S, present in $PM_{2.5}$ in the percentage range (wt%). Strong acid digestion followed by ICP-MS was used to quantify trace metals, present in $PM_{2.5}$ in the µg/g range. At the time of sampling, the Windsor area had experienced the highest number of poor air quality days in Canada, with industry and transportation being key sources of air pollutants.

As a general trend, elemental concentrations within $PM_{2.5}$ (µg/g) decreased significantly ($p<.05$) as aerosol concentrations of $PM_{2.5}$ (µg/m^3) increased, in all environments and seasons. A notable exception to this trend was S which displayed a significant positive relationship ($p<.02$) between its wt% concentration within $PM_{2.5}$ and the aerosol concentration of $PM_{2.5}$ (µg/m^3), only in the outdoor environment and only in the summer season. Another seasonal contrast in S behaviour was observed in the relationship between the S content (wt%) of personal $PM_{2.5}$ samples and outdoor $PM_{2.5}$ samples: for both years this relationship was significantly positive ($p<.01$) during the summer season, but non-existent in the winter season ($p>0.5$). Concentrations of S (wt%) and most other metals (µg/g) were generally elevated in outdoor $PM_{2.5}$ compared to indoor and personal $PM_{2.5}$. Exceptions to this trend included Ag, Cu, Cr, Ni, Sn, Sr and Ti for which median indoor/outdoor concentration ratios exceeded unity, indicating the importance of indoor sources on personal exposures.

These results help to address current data gaps in urban residential exposure assessments, especially the need for a better understanding of indoor sources of metals.

[1] Rasmussen et al. (2018) *Build. Environ.* **143**, 513-522