

Lichen carbon, nitrogen and sulphur contents and their isotopic signatures for source apportionment of atmospheric pollution in the urban environment of Manchester, UK

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Project Aim

Airborne pollutants are increasingly impacting on urban populations, contributing to acute and chronic human health issues, e.g. cardiovascular and lung diseases, leading to approximately 40,000 premature deaths within the UK [1].

The aim of the study was to elucidate a high spatial resolution assessment of urban air pollution and its possible sources, in the city of Manchester, UK. Lichen carbon, nitrogen and sulphur contents, when combined with their stable-isotope-ratio signatures ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^{34}\text{S}$ values), were used for source apportionment of environmental pollution. *Xanthoria parietina* and *Physcia* spp. lichens were collected from 93 sites distributed across the city of Manchester and analysed for their CN contents (by CN analyser/IRMS), sulphur content (by ICP-OES/IRMS) and isotopic signatures (by IRMS).

Results

Lichen nitrogen and sulphur contents and their isotopic composition are spatially variable across the city of Manchester, with higher values related to distance from major roads. N and S contents (wt%), as well as all three stable-isotope ratios also vary systematically between the two lichen species. Higher $\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^{34}\text{S}$ values are indicative of urban-based influences on air quality, e.g. vehicular combustion of fossil fuels. Road traffic counts are related to $\delta^{15}\text{N}$ values for *X. parietina* and *Physcia* spp., indicating a traffic impact on lichen nitrogen-isotope ratios.

Lichen nitrate and ammonium contents and airborne NO_x diffusion tube measurements (for a 12-month period) also will be related to total N contents, $\delta^{15}\text{N}$ and possible sources.

[1] Royal College of Physicians (2016). Every breath we take: the lifelong impact of air pollution. Report of a working party. London