

Mosses as passive and active indicator surrogates for investigations of atmospheric pollution and quality

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Things we know

- 1 Ubiquitous mosses are excellent bioaccumulators.
- 2 Inter- and intraspecies variations exist due to different habitat requirements, accumulation properties and uptake efficiencies.
- 3 Substrate and secondary sources or processes may contribute to element and compound levels in mosses.
- 4 Sensitivity and varying tolerance make native mosses suitable for qualitative studies.
- 5 Moss monitoring can enhance the spatial and temporal accuracy of quantitative data.

Knowledge gaps

- 6 The relationship between moss survey data and atmospheric pollution levels is difficult to determine.
- 7 There is an increasing demand for pollution source identification.
- 8 The lack of standardisation causes pitfalls for the intercomparison of moss bag surveys.
- 9 There are challenges for the further development of moss monitoring.

Introduction

Monitoring of mosses for atmospheric research was introduced by Rühling and Tyler (1968). They employed mosses as biomonitors for the accumulation of traffic-originated lead in Sweden. The first national-level surveys of mosses were completed in Scandinavia in the late 1970s from where they expanded to all of the Nordic countries and to most of the European countries in the 1980s and 1990s (Poikolainen 2004). Air pollutants, which are defined as 'any substance present in ambient air and likely to have harmful effects on human health and/or the environment as a whole' (European Commission 2008), have impacts at all spatial and temporal scales by remaining close to the emission sources, as