Moss Bags as Bioindicators of Urban Air Pollution

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INTRODUCTION

Urban air pollution poses significant risks to environment and human health. This study applies moss bag biomonitoring to evaluate the spatial distribution of airborne toxic elements in the Cluj-Napoca, Romania, providing insights into the effectiveness of passive bioindicators in urban air quality assessment.

MOSSBAG PREPARATION

The moss-bags were prepared using moss from Sphagnum species, collected from a remote area with minimal pollution, ensuring its suitability as a bioaccumulator for detecting airborne contaminants in urban environments.

Approximately 8 g of moss were used to make the moss bag, by distributing it evenly in the polyethylene bag with a size of 10x5 cm and a mesh size of 1.5x1.5 mm.

MOSSBAG EXPOSURE

Mossbags were exposed for 45 days in 5 sites from Cluj-Napoca city situated close to high traffic roads, at 160 cm height from the ground.

CONCLUSIONS

Biomonitoring of air pollution in the city of Cluj-Napoca using the moss bag method showed the presence of metal pollution in all biomonitored points. The moss bag method is suitable for long-term assessment at a high spatial resolution of the distribution of metals in ambient air and is an attractive alternative to instrumental methods of air quality monitoring.

ACKNOWLEDGEMENTS

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MOSSBAG ANALYSIS

After exposure, the content of toxic elements (Cu, Pb, Zn, Cd, Ni and Cr) in the moss was analyzed by inductively coupled plasma mass spectrometry (ICP-MS) using the ELAN DRC II equipment (Perkin Elmer, Waltham, MA, USA) after microwave assisted digestion of 1 g of dry sample with 8 ml of 65% HNO3 and 2 ml of 30% H2O2 in Teflon vessels in a microwave digestion system (MWS-3+, Berghof, Eningen, Germany). The mineralized sample was transferred to 20 ml volumetric flasks and made up to volume with ultrapure water.

RESULTS AND DISCUSSIONS

In all samples an increase in the concentration of metals was observed compared to that in the unexposed sample, the increase being more pronounced for Cu and Zn. The low concentrations of Pb accumulated in moss indicate the positive effects of eliminating Pb additives from fuels. The low concentrations of Cd determined in moss indicate the limited presence of these types of pollution sources in the city of Cluj-Napoca.

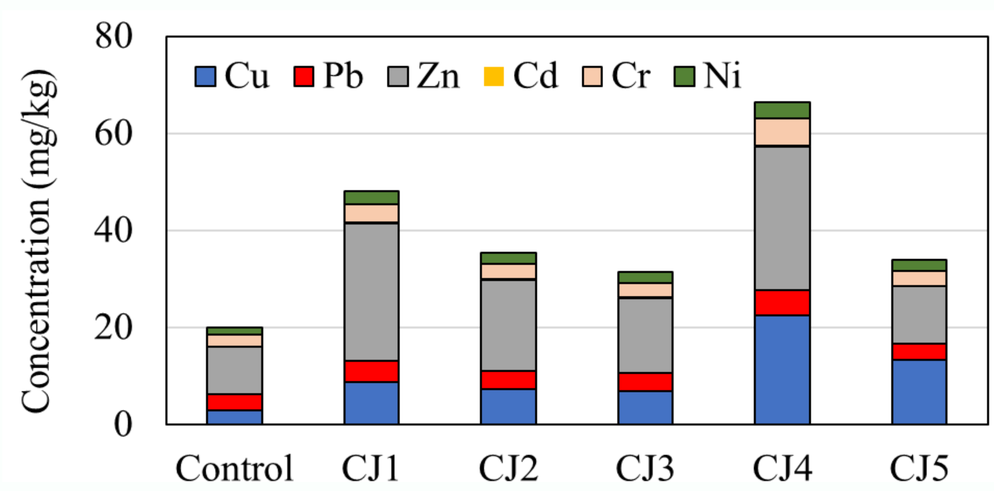

Figure 1. Concentration of metals in the moss-bag

The different metal concentrations in moss exposed in different areas of the city show the existence of local fluctuations in the concentration of airborne particles and the composition of these particles.

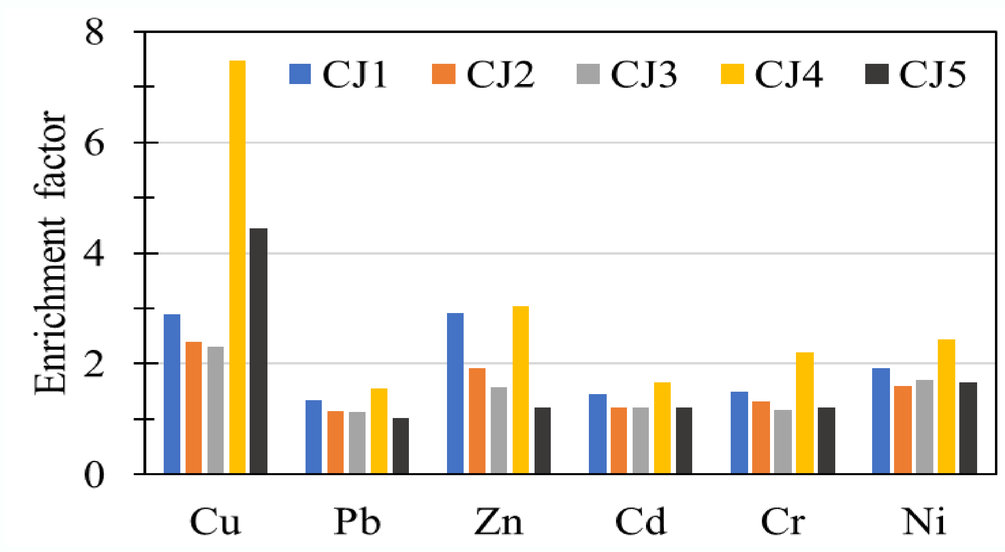

Figure 2. Enrichment of metals in the moss-bag

The high enrichment of Cu, moderate enrichment of Zn, Cd, Ni and the lack of enrichment of Pb and Cr in moss shows that exhaust gases (Co, Cr, Ni) have a lower share in air pollution than emissions due to wear of the running system (Cu, Zn).