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Investigation of the heavy metal accumulation mechanism in moss (*Hyophila involuta*) and the relationship between heavy metal content and photosynthetic efficiency

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Atmospheric heavy metal contamination is a major environmental problem and moss has widely been used as a bioindicator to monitor atmospheric heavy metal deposition. However, the heavy metal accumulation mechanism in moss is not yet established clearly. In this study moss *Hyophila involuta* was selected as the bioindicator. The moss samples were collected twice a month from September 2013 to November 2013 from Kandy, Gampaha, Colombo and Matara districts which belong to four different climatic and geographical zones. Native moss species were collected from two sampling sites in each district separately (Pili mathalawa, Poigolla, Sapugaskanda, Dalugama, Orugodawaththa, Baththaramulla, Matara, Sinharaja). Heavy metal accumulation (Cu, Cr, Pb, Ni, Cd) in moss were surveyed at these seven sampling sites.

Moss cell wall has ion exchangeable sites due to the carboxylic acid groups in uronic acid. The accumulation process could be occurring through different mechanisms. Among them cation exchange could be one of the processes that occur in moss. A concentration series of analytical grade HCl (0.5, 1.0 and 2.0 mol dm⁻³) was used to obtain evidence for the ion exchange process in moss. The exchangeable heavy metal concentration in all sampling sites is given by dry weight of moss and the ranges of heavy metals were Cr (0.18 µg/g – 1.31 µg/g), Cu (0.48 µg/g – 2.22 µg/g), Pb (0.82 µg/g – 1.90 µg/g), Ni (0.55 µg/g – 4.85 µg/g) and Cd (0.27 µg/g – 1.75 µg/g). It was clearly observed that there was an exchangeable metal content in each sampling site. Another objective of this study was to determine the relationship between heavy metal content and photosynthetic efficiency of moss. Spectral reflectance properties of moss collected from each site i.e. SIPI (structural-independent pigment index), CHL (chlorophyll index) and PRI (photochemical reflectance index) were determined. According to the results, when the heavy metal content of moss was high there was a decline in chlorophyll content and therefore, the green colour of the mosses were reduced. Due to this factor photosynthetic efficiency of moss could also be reduced. This may be due to heavy metal-induced physiological alterations and oxidative stress in the moss.

Keywords: Biomonitoring, heavy metals, spectral reflectance indices