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Assessment of polycyclic aromatic hydrocarbons and heavy metals in the vicinity of an oil refinery in Sri Lanka using moss as a bioindicator

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Polyaromatic hydrocarbons (PAHs) and heavy metals are toxic compounds emitted from various anthropogenic sources and have a great effect on the human health as well as on the environment. Population living closer to the vicinity of an oil refinery may be at a greater risk of exposure to PAHs through inhalation, ingestion, and direct contact with the contaminated media. Atmospheric deposition of pollutants occur through both wet and dry deposition. Biomonitoring agent and passive monitoring technique were used in this study to evaluate heavy metal and PAH content in moss (*Hyophila Involuta*) collected from 30 sampling sites around the Sapugaskanda oil refinery with a 5 km radii. Sample collection was carried out in two separate days in September 2016. This study aimed to obtain a possible correlation between the atmospheric deposition of heavy metals and radial distribution pattern using epiphyte mosses collected from each sites.

16 PAHs were identified and quantified using High Performance Liquid Chromatography (HPLC). Bioaccumulation ability of seven heavy metals (Cr, Ni, Cd, Cu, Pb, Fe and Zn) were evaluated by Ion coupled plasma mass spectroscopy (ICP – MS). Contamination factor (CF) and Pollution loading index (PLI) were determined with reference to the background heavy metal concentration values.
Maximum heavy metal accumulation was observed in a 2 km radii from the oil refinery. All the sampling sites showed CF>1 except for heavy metals Cr and Cd in few sampling sites. Pollution loading index for each radius showed a higher value with reference to the background levels.

Low molecular weight (LMW) PAHs move away from the source (Sapugaskanda refinery) and high molecular weight (HMW) PAHs deposit near the emission source. Total concentration of carcinogenic PAHs varied from 0.25 to 13.75 ng/g. According to the study, total PAHs deposition observed around the vicinity of the oil refinery was in the range of 20 – 4398 ng/g.

Due to the similar pollution sources, PAHs have often been found to coexist with environmental pollutants including heavy metals. Correlation studies were carried out statistically. There was a positive correlation between the Fe with Low molecular weight Polyaromatic hydrocarbons (LMW PAH) and High molecular weight polyaromatic hydrocarbons (HMW PAH) ($p< 0.05$). There were few correlations among several metals. Fe showed a positive correlation with metals such as Ni, Cu and Cd whereas Ni showed positive correlation with Cu and Cd. There was no significant correlation among other metals and PAHs. ($p> 0.05$).

Keywords: Bioindicator, Heavy metals, Moss, PAH