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**Assessment of cytotoxic and genotoxic effects on Mahaweli river surface water samples contaminated with Gohagoda landfill leachate using *Allium cepa* bioassay**

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Landfill leachate that potentially contains toxic compounds harms humans and the environment. Therefore, landfill leachate must be appropriately treated and disposed to avoid its environmental damage. However, conventional physicochemical analysis alone may not be adequate to evaluate the biological effects, therefore, conducting bioassay toxicity tests and traditional methods would be more appropriate. The present study assessed the potential toxic effect of Mahaweli River surface water samples contaminated with Gohagoda landfill leachate by a plant-based bioassay, *Allium cepa*. Moreover, the physio-chemical parameters have been tested. Surface water samples were collected from the river where the leachate was released into the Mahaweli River from the leachate outlet on five occasions, covering wet and dry seasons from September 2023 to January 2024. The *A. cepa* root tips were exposed to collected samples and the bioassay was carried out according to a standard method with some modifications. Aged tap water was used as the control. The statistical analyses were performed as appropriate in MINITAB-19. The study revealed that the *A. cepa* bioassay indicated significant cytogenotoxic effects on the leachate contaminated surface water compared to the control, evidenced by a percentage decrease in mitotic index (44.60%, 48.81%, 20.99%, 44.41% and 16.91%), the higher number of total nuclear abnormalities (165.20‰, 159.70‰, 154.20‰, 182.86‰ and 162.26‰), and higher number of chromosomal aberrations (352.40‰, 328.10‰, 258.00‰, 254.08‰ and 291.90‰). The presence of toxic substances in the leachate contaminated surface water, suggests a clear cytotoxic effect on exposed organisms. This is further supported by observing various nuclear abnormalities such as bi nuclei, micronuclei, and nuclear buds, predominantly in samples collected from leachate contaminated water, compared to control. These abnormalities indicate genetic damage and potential mutagenic effects, likely stemming from the discharge of leachate into the Mahaweli River. Moreover, chromosomal aberrations, including vagrant chromosomes, chromosomal bridges, and spindle disturbances, underscore the genotoxicity of the leachate. These abnormalities reflect structural changes in chromosomes and spindle apparatus, which can lead to disruptions in cell division and genetic instability. The significantly higher occurrence of these aberrations in leachate contaminated samples compared to control water samples highlights the detrimental impact of leachate contamination on the environment. All the COD and BOD<sub>5</sub> values obtained for the leachate-contaminated water exceed the CEA tolerance limit values for all five sampling events. The findings highlight that the leachate discharged directly and significantly impacts the water quality at the leachate discharging point of the Mahaweli River. Further research is recommended to confirm the toxic effects of drained leachate on sensitive aquatic organisms in the Mahaweli River since they provide a better understanding of the risks associated with drained leachate. In addition, strict leachate management measures are recommended to minimize river contamination with this leachate.

**Keywords:** Gohagoda Dump Site, Leachate, Water Pollution, Cytotoxicity, Genotoxicity