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RESEARCH ARTICLE

Toxic hazards of industrial waste receiving canal system in the lower catchment of Kelani River basin, Sri Lanka

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Abstract: Assessing toxic hazards associated with polluted riverine ecosystems is essential for the development of effective strategies for their management. The present study explored the combined utility of bioassay responses of the plant, *Allium cepa* and surface water physico-chemical characteristics to assess the toxic hazards of an industrial waste receiving canal system located in the lower catchment of the Kelani River basin, Sri Lanka. Surface water samples from seven sites, *viz*. Maha Ela upstream (Site A), Manikagara Ela (Site B), Manikagara Ela - Maha Ela confluence (Site C), Maha Ela downstream (Site D), Maha Ela - Kelani River confluence (Site E), River down-reach (Site F) and upper-reach (Site R) were analysed on three occasions in 2015 covering dry and wet periods. Irrespective of the sampling periods, exposure of *A. cepa* bulbs to water from the Sites B, C, D and E resulted in root growth retardation and mitosis depression ($p < 0.05$) in the root meristem signifying toxic/cytotoxic hazards. Occasional micronuclei evolution and nuclear bud induction were also found in the root cells exposed to Site B and C samples indicating genotoxicity. Toxic hazards were somewhat reduced towards down-reach of the river, which may be associated with self-depuration effects. The principal component analysis based on surface water characteristics and bioassay responses revealed clear separations of Sites B and C from the other sites. The results revealed that water quality of Manikagara Ela and Maha Ela needs improvements considering toxic hazards to the riverine ecosystem and human health.

Keywords: Kelani River, principal component analysis, toxic hazard, water pollution.

INTRODUCTION

Pollution trend assessments are important for effective management of riverine ecosystems impacted by the contaminants from anthropogenic activities (Kara *et al*., 2017; Barrenha *et al*., 2018; Wu *et al*., 2018). Bioassays with model organisms are considered as one of the green chemistry tools in assessing the environmental quality (Wieczerzak *et al*., 2016). The plant, *Allium cepa* has been identified as an effective, economical and sensitive model to detect cytotoxic and genotoxic hazards in environmental samples (Leme & Marine-Morales, 2009; Pathiratne *et al*., 2015) and can be used as a low cost and simple tool for toxicity assessment of surface waters in developing countries (Hemachandra & Pathiratne, 2017a).

Kelani river basin is one of the largest water sheds in Sri Lanka. The river water is used for drinking, domestic, agricultural and other purposes (Silva, 1996). Kelani River is considered as the largest recipient of industrial waste in the country (Ileperuma, 2000). The River is becoming polluted with multiple sources including industrial, urban and agricultural waste (Mahagamage & Manage, 2014; Mahagamage *et al*., 2016). Several water intake points are located in the Kelani River for provision of drinking water supply to the general

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