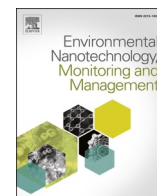




Contents lists available at ScienceDirect

Environmental Nanotechnology, Monitoring & Management

journal homepage: www.elsevier.com/locate/enmm

Application of water pollution and heavy metal pollution indices to evaluate the water quality in St. Sebastian Canal, Colombo, Sri Lanka

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ARTICLE INFO

Keywords:

Ambient water quality
Heavy Metal Pollution Index
St. Sebastian Canal
Surface water
Water Pollution Index

ABSTRACT

Anthropogenic pollution plays an important role in deteriorating the water quality of canals worldwide, especially in developing countries like Sri Lanka. The St. Sebastian Canal is one of the main canals in Sri Lanka, which runs through Colombo city that collects massive quantities of domestic, municipal, and industrial waste products. The aim of the present study is to develop water pollution and heavy metal pollution indices to assess the water pollution status of the St. Sebastian canal, Colombo by comparing water quality parameters with ambient water quality standards for aquatic life in Sri Lanka. Water samples were analyzed for physical and chemical parameters and heavy metals. Ultimately, Water Pollution Index (WPI) and Heavy Metal Pollution Index (HPI) were developed for several sites along the canal. WPI ranged from 0.64 to 1.93 with a mean value of 1.12, indicating water of St. Sebastian canal is highly polluted. The mean value of HPI was found to be 50, which is higher than the critical HPI value of 30, thus indicating that water of the canal is critically polluted with heavy metals. Further, sites 1, 5, 6, 7, 8 and 9 and sites 1, 4, 5, 6, 7, 8 and 9 were found to be highly polluted as per the WPI and HPI, respectively. This shows the importance of having both WPI and HPI to assess the level of water pollution as site 4 is being categorized as a highly polluted site by HPI and as a good water quality site by WPI. Therefore, the site-specific assessment of water pollution by WPI and HPI will help the relevant authorities to implement remediation methods with respect to the critical pollutants in a particular location, to identify the polluters and to take measures to prevent the discharges to the water body from different sources.

1. Introduction

Developing and underdeveloped countries currently have serious water resource problems due to a lack of proper water resource management (Chandrasekara et al., 2018; Uddin and Jeong, 2021). As a country with a growing trend for urbanization and rapid industrial development, Sri Lanka has also begun to exert pressures on the sectors of water supply, sewage disposal, waste management, and surface drainage in the cities (Dissanayake et al., 1987; Bandara, 2003; Jinadasa et al., 2013; Mahagamage and Manage, 2014a,b; Gunawardena et al., 2017; Kehelella et al., 2018; Wickramasinghe et al., 2018; Opallage et al., 2019).

Colombo is the major financial and commercial center in Sri Lanka. Among the water bodies in Colombo, the canal system is unique in terms of channel water regime, morphological features, and management. Although there is an independent canal system and interconnected waterways, the Colombo area is not satisfactorily drained due to malfunctioning of the canal system (Dissanayake et al., 1987; UNCHS and

UDA, 1997; Tortajada, 2006; MCUDP, 2011). However, past experiences revealed that Colombo drainage pollution has reached a critical point (Eriyagama and Ratnayake, 2008; Opallage et al., 2019; Perera, 2003; Weerasooriya et al., 1983; Jayaweera and Samarakoon, 2018a; Perera et al., 2012).

St. Sebastian Canal, one of the main canals in the Colombo area which contributes to the Colombo basin flood management was selected for this study. The water quality of the canal is degraded at an alarming rate as a result of the increasing number of houses, commercial premises and industries located on both sides of the canal (Ali and Kadija, 1991; Rajaratnam, 1999; Perera, 2003; Eriyagama and Ratnayake, 2008; Nithiyalaka et al., 2011; Lekamge et al., 2015; MCUDP, 2016). It has become a threatened running water system in Colombo city (Ali and Kadija, 1991; Perera, 2003).

Fernando (1994) had observed high turbidity, BOD₅ and COD and richer metal levels in the water of St. Sebastian canal as per the data collected by the Central Environmental Authority (CEA), Sri Lanka for a period of 23 months (from March 1991 to February 1993). Moreover,

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<https://doi.org/10.1016/j.enmm.2023.100790>

Received 14 August 2022; Received in revised form 20 January 2023; Accepted 29 January 2023

Available online 1 February 2023

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