

**PERFORMANCE EVALUATION OF CONSTRUCTED  
WETLAND FOR TERTIARY TREATMENT**

N. P. D. G. Punchihewa

(168885J)

Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

Sri Lanka

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N. P. D. G. Punchihewa

(168885J)

Dissertation submitted in partial fulfilment of the requirements for the  
Degree of Master of Science in Environmental Management

Department of Civil Engineering

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Sri Lanka

May 2022

**Declaration**

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N. P. D. G. Punchihewa

Date

The above candidate has carried out research for the Master of Science in Environmental Engineering and Management under my supervision.

Name of the supervisor: Prof. M.W. Jayaweera

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Prof. M. W. Jayaweera

Date:

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## **Abstract**

The textile industry in Sri Lanka is a leading apparel manufacturer worldwide, with a state-of-the-art dye house and a well-equipped automated laboratory with physical and washing test facilities. The dye plants inside the factory deploy high-tech methods such as exhaust dyeing (hank and high pressure) and piece dyeing (continuous dyeing) for polyester, nylon, and cotton fabrics. A chemical wastewater treatment plant (1,000 m<sup>3</sup>/day) has been installed to treat the factory's wastewater (process wastewater and domestic wastewater). The quality of the treated effluent meets the tolerance limits for industrial wastewater discharge into inland surface waters, reducing environmental harm. As requested by the Central Environmental Authority (CEA), a constructed wetland and fishpond have been incorporated into the existing wastewater treatment facility to improve the treated wastewater quality and ensure that no harmful chemicals remain in the treated wastewater discharged into a nearby waterway. The wetland is a sub-surface flow type where no water column is maintained, and the wetland area is around 1 acre. *Phragmites spp.* (*Phragmites karka*) has been planted. The medium in which plants are grown comprises broken burnt clay disposed of from tile factories. A 50% void ratio was maintained for the easy flowing of wastewater through the wetland. The zigzag configuration is maintained throughout the wetland to avoid the short-circuiting phenomenon. The research study showed removal efficiencies of 72.3%, 51.8%, 47.2%, 25%, and 73% for the contaminants COD, BOD, TSS, TKS, and TP, respectively. The temperature and pH almost remain the same with little variations. data showed faecal coliform levels were less than 2 MPN/100 ml throughout the data collection period. The study suggests that, if appropriately operated, constructed wetlands might have been effectively utilized for tertiary wastewater treatment under local circumstances. As a result, constructed wetlands can be included in the treatment process to modify existing underperforming wastewater treatment plants as well as a sustainable green concept.

**Keywords** - Constructed wetland, industrial, wastewater, treatment, efficiency

## List of abbreviations

APHA	- American Public Health Association
BOD	- Biological Oxygen Demand
CEA	- Central Environmental Authority
COD	- Chemical Oxygen Demand
CWs	- Constructed Wetlands
DO	- Dissolved Oxygen
DO <sub>5</sub>	- Dissolved Oxygen after 5 days
EPL	- Environmental Protection License
FVFCW	- French Vertical Flow Constructed Wetland
FWSCW	- Free Water Surface Flow Constructed Wetland
GDP	- Gross Domestic Product
HFCW	- Horizontal Flow Constructed Wetland
HLR	- Hydraulic Loading Rate
HRT	- Hydraulic Retention Time
NEA	- National Environment Act
NH <sub>4</sub> <sup>+</sup>	- Ammonium Nitrogen
NWSDB	- National Water Supply and Drainage Board
OWTSs	- Onsite Wastewater Treatment Systems
SSFCW	- Subsurface Flow Constructed Wetland
TDS	- Total Dissolved Solid
TKN	- Total Kjeldahl Nitrogen
TSS	- Total Suspended Solids
UNEP	- United Nations Environment Program
VFCW	- Vertical Flow Constructed Wetland
WWTPs	- Wastewater Treatment Plants

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