PILOT STUDY ON FLOATING WETLANDS FOR MANAGEMENT OF ALGAL WASHOUT FROM STABILIZATION PONDS: AN APPLICATION TO HIKKADUWA WASTE STABILIZATION PONDS

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"I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any University or other institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text"

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This is to certify that this thesis is based on the work carried by Mrs. S. Kalubowila under our supervision. The thesis has been prepared according to the format stipulated and is of acceptable standard.

Certified by

Supervisor 1 Mahesh Jayaweera Date:

Signature:.....

:

Supervisor 2 Chandrika.M. Nanayakkara

Date:

Signature:.....

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ABSTRACT

Waste stabilization ponds are advantageous wastewater treatment processes, especially for developing countries. Nevertheless, in spite of the well known advantages of the implementation of the stabilization pond system, the effluent of this system has significant amount of algae and high nutrients. In order to solve this inconvenience which can be harmful to the receiving waters and can hinder the water reuse for a wide range of different applications, it is essential to look for post treatment method that can provide considerable removal of algae, nutrients and organic matter from the effluent and at the same time, assure that the treatment system as a whole will maintain the primordial advantages of the pond treatment processes. In this context, this research study intended to introduce a floating treatment wetland in which water hyacinths plants were used as macrophyte to the part of the maturation pond area to control algae and nutrients in the effluent. Hikkaduwa waste stabilization pond series were taken up for this research study. The wetland area is 1855 m^2 and total maturation pond area is 4025 m^2 of HSTP.

Six locations were selected along the pond series for sample collection and r water quality parameters such as BOD, COD, TP and TN together with algal densities were measured at each location. Sampling and testing were carried out every two weeks for a six months period and DO, TDS, pH and temperature were also monitored. By using a statistical analysis, it was proved that significant increase of removal efficiencies of above parameters has been achieved after establishment of the floating wetland.

The removal efficiencies were found to have increased in the maturation pond in terms of BOD and COD from 13.3% to 62.9% and 13.6% to 57.5%, respectively. In the case of TP and TN there were no significant reductions achieved prior to establishment of the wetland but, reductions of 74.8% for TP and 55.8% for TN were achieved since the establishment of floating wetland. It was also possible to achieve reduction of algal cell densities from 900 units/ml to zero unit/ml for the algal species of Spirulina and for Oscillatoria, the reduction was from 4300 units/ml to 280 units/ml. In case of Chlorella and Pandorina, density reductions were 830,000 units/ml to 68,000 units/ml and 4300 units/ml to 280 units/ml respectively. Accordingly, the reduction efficiencies for Spirulina, Oscilltoria, Chlorella and Pandorina were reported to be improved from 31.8% to 100% and 4.5% to 100%, 34.2% to 91.8% and 42.2% to 93.5%, respectively. Application of this research can therefore be used to polish waste stabilization pond effluent economically in order to re-use for various beneficial uses except potable use. This technique has therefore been found to replace expensive algae- removing mechanical techniques such as Dissolved Air Floatation, Micro Straining or Sonic methods or application of algae control chemicals such as $CuSO_4$.

Key words Algae; Nutrients; Macrophyte; Wetland

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LIST OF ABBREVIATIONS

Abbreviation	Description
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CO_2	Carbon Dioxide
DO	Dissolved Oxygen
FTW	Floating Treatment Wetland
HAP	High Rate Algal Pond
HRT	Hydraulic Retention Time
HSTP	Hikkaduwa Sewage Treatment Plant
HWSP	Hikkaduwa Waste Stabilization Ponds
SS	Suspended Solids
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
WHO	World Health Organization
WSP	Waste Stabilization Pond
ppt	parts per trillion

LIST OF APPENDICES