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

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Thesis submitted in partial fulfillment of the requirements for the Degree Master of Science

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September 2012
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acknowledgement any material previously submitted for a Degree or Diploma in any
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belief it does not contain any material previously published or written by another
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under our supervision. The thesis has been prepared according to the format
stipulated and is of acceptable standard.

Certified by

Supervisor 1

Supervisor 2

Chandrika.M. Nanayakkara

Signature: Date:
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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 m² and total maturation pond area is 4025 m² of HSTP.

Six locations were selected along the pond series for sample collection and 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, Oscillatoria, 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 CuSO₄.

Key words Algae; Nutrients; Macrophyte; Wetland
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<td>BOD</td>
<td>Biological Oxygen Demand</td>
</tr>
<tr>
<td>COD</td>
<td>Chemical Oxygen Demand</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>DO</td>
<td>Dissolved Oxygen</td>
</tr>
<tr>
<td>FTW</td>
<td>Floating Treatment Wetland</td>
</tr>
<tr>
<td>HAP</td>
<td>High Rate Algal Pond</td>
</tr>
<tr>
<td>HRT</td>
<td>Hydraulic Retention Time</td>
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<td>HSTP</td>
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<td>HWSP</td>
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</tr>
<tr>
<td>SS</td>
<td>Suspended Solids</td>
</tr>
<tr>
<td>TDS</td>
<td>Total Dissolved Solids</td>
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<tr>
<td>TOC</td>
<td>Total Organic Carbon</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
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<td>WSP</td>
<td>Waste Stabilization Pond</td>
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<td>ppt</td>
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