FACTORS INFLUENCING THE PERFORMANCE OF HORIZONTAL FLOW CONSTRUCTED WETLAND FOR MUNICIPAL WASTEWATER TREATMENT

Submitted By

Mohamed Ali Ibrahim Elekhnawy

B.Sc. of Science (Chemistry), Faculty of Science, Al-Azhar University, 2005

A thesis submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Sciences

Department of Environmental Basic Sciences
Institute of Environmental Studies and Research
Ain Shams University

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APPROVAL SHEET

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This thesis Towards a Master Degree in Environmental Science
Has been Approved by:

Name Signature

1-Prof. Dr. Nabil Mahmoud Abdel Monem
Prof. of Chemical Engineering
Faculty of Engineering
Cairo University

2-Prof. Dr. Salah A. Abo-El-Enein (D.Sc)
Prof. of Physical Chemistry and Building Materials
Faculty of Science
Ain Shams University

3-Prof. Dr. Sohair Imam Abou-Elela
Prof. of Wastewater Treatment Technology & Environmental Studies
Water Pollution Research Department
National Research Center

4-Prof. Dr. Magdy Tawfik Khalil
Prof. of Aquatic Ecology – Department of Zoology
Faculty of Science
Ain Shams University

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2-Prof. Dr. Sohair Imam Abou-Elela
Prof. of Wastewater Treatment Technology & Environmental Studies
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National Research Center

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ACKNOWLEDGEMENTS

First of all, I would like to thank **ALLAH**, the most merciful and compassionate making all this work possible and for granting me with the best family, friends and teachers that many people wish and dream of having.

I wish to express my gratitude to my supervisor **Prof. Dr. Sohair Imam Abou-Elela**, Water Pollution Research Department, National Research Center, for her guidance, motivation, and support throughout my master thesis. Her insight helped me to finish this research in such a good form. I am very thankful that I become one of her students. I would like also to express my deep thanks to **Prof. Dr. Magdy Tawfik Khalil,** Zoology Department, Faculty of Science, Ain Shams University, for his great valuable supervision.

I would like to acknowledge the support I received from Ain Shams University, Institute of Environmental Studies and Research, National Research Center and Holding Company for Water and Wastewater.

Finally, I would like to express my deep gratitude to my friends, colleagues and family for their unconditional love, encouragement and support by any possible means, without which this work would not be possible.

Mohamed Ali Elekhnawy

ABSTRACT

This study aims to optimize the different operating conditions for the treatment of municipal wastewater using HFCW planted with *Canna lily*, *Phragmites australis* and *Cyprus papyrus.*

Three separates basins of a horizontal flow subsurface constructed wetland (HFCW) pilot plants were designed, implemented and operated at the same operating conditions for almost one year for the treatment of real municipal wastewater. The first Basin (A) was planted with *Canna lily*, the second basin (B) with *Pharagmites australis* and the third basin (C) with *Cyprus papyrus*. To evaluate the performance of each basin at different operating conditions, such as hydraulic loading rate (HLR), hydraulic retention time (HRT) and organic loading rate (OLR), three sampling points at a distance 10 m apart from each others were established along each basin to represents different operating conditions. The results indicated that the pollutant removal efficiencies decreased with increase HLR. The removal efficiency at the first sampling point was the lowest for each basin. The best removal efficiency was at the third sampling point for each basin. The average removals of COD, BOD and TSS in basin A at point (A3) were 75.5 %, 83.4 % and 83.5 %, it reached 84.3%, 88.6 % and 89.1% in basin B at point (B3) while it reached 80.4%, 86.9 % and 87.5 % in basin C at point (C3). These results indicated that the *Pharagmites australis* proved to be more efficient in the removal of the organic matter compared to other plants.

The results indicated that nitrification process was influenced by the type of plants used. The removal of ammonia reached 29.5 % in basin (A) planted with *Canna lily*, 62.5% in basin (B) planted with *Pharagmites australis*, while in basin (C) planted with *Cyprus papyrus*, it reached 68.7 %. *Cyprus papyrus* proved to be more efficient compared to other plants for nitrification; this may

be due to that *Cyprus papyrus* root structures provided more microbial attachment sites, sufficient wastewater residence time, trapping and settlement of suspended particles, more surface area for pollutant adsorption and uptake accounting for its high treatment efficiency. In addition, *Cyprus papyrus* exhibited a significantly large number of adventitious roots and nitrifying bacteria attached to *Cyprus papyrus* and the corresponding nitrification activities were consistent with this finding.

Therefore, it is recommended that to use a combined mixture of *Pharagmites australis* and *Cyprus papyrus* in designing the HFCW.

Keywords: Constructed wetland**,** horizontal flow**,** wastewater, treatment, hydraulic loading rate**,** hydraulic retention time**,** *Canna lily*, *Pharagmites australis, Cyprus papyrus.*

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