COMPARISON AND PERFORMANCE EVALUATION OF DIRECT AEROBIC SUBMERGED ATTACHED GROWTH AND ANAEROBIC CUM AEROBIC SUBMERGED ATTACHED GROWTH SYSTEMS, FOR FACTORY SEWAGE

This dissertation is submitted to the Department of Civil Engineering in partial fulfillment of the requirements for the degree of Master of Science in Environment Engineering and Management

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2010

Abstract

Most factories located outside of BOI industrial zones in Sri Lanka do not have proper sewage treatment systems. Due to the high number of employees, these factories are always encountered with the problem of handling large quantities of low strength sewage generated from lavatories, canteens and kitchens. In such factories sewage is usually handled using conventional septic tank - soakage pit systems. Such systems are commonly found infested with insects, and promote further breeding. They cause nuisance due to obnoxious odor, and is a major cause for severe ground and surface water pollution. It has been noted that these factories have critical problems of handling sewage during rainy season, especially when the factory is located in areas with high ground water table such as a marshy land or near a surface water body.

The activated sludge suspended growth aerobic systems designed to treat sewage in most of the factories have various operational problems which increase the operator involvement and therefore the plants performance are operator dependent. Activated sludge suspended growth aerobic systems are more susceptible for sludge bulking which leads to poor effluent quality and the unbulking process is very difficult and ~time consuming. In addition to this, the several parameters such as SVI, MLVSS, etc have to be monitored carefully in the conventional activated sludge systems for the proper operation and the maintenance which increase the operational and the maintenance cost. The maintenance departments of factories always request a trouble free sewage treatment plant to minimize their involvement in operation of the plant. Therefore the submerged attached growth aerobic systems are becoming the most appropriate system as an alternative of the activated sludge system for treating low strength effluent, sewage from factories. A leading company in Sri Lanka which provides turnkey solutions for waste water and sewage has introduced submerged attached growth aerobic and anaerobic treatment systems to overcome above issues . Depending on the affordability of the client and the space availability they have introduce submerged attached growth aerobic systems in two ways.

(a) Direct aerobic submerged attached growth systems where sewage is treated only with aerobic treatment
(b) Anaerobic cum submerged attached growth aerobic systems where sewage is treated with anaerobic process prior to aerobic treatment.

However no proper study has been carried out to find out the most appropriate submerged attached growth system to treat sewage generated from factories. Research suggested that the anaerobic cum submerged attached growth aerobic system is more suitable for treating factory sewage than direct aerobic submerged attached growth system in terms of quantity of sludge wasting and lower operational and maintenance cost which results to a lower unit cost per m3 of treated water.

DECLARATION

I declare that this dissertation 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 contain any material previously published or written by another person except where the acknowledgment is made in the text.

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DECLARATION

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ACKNOWLEDGEMENTS

The author gratefully acknowledges the tremendous help and support given throughout the course of the research leading to the completion of this study by a number of individuals and institutions in making this study possible.

I would, first, like to express my sincere and most profound gratitude to Dr. Jagath Manatunge and Dr. Mahesh Jayaweera, my advisors, for reading, studying and accepting the research proposal and then for allocating their valuable time, suggestions, comments, getting down articles on related topics from various websites and deep understanding and kindness despite their busy schedules.

I wish to convey my profound gratitude to Prof. Mrs. N. Ratnayake, Head of the civil Engineering Department and all the staff of the Civil Engineering department, for providing me the opportunity to pursue the Masters Degree in Environmental Engineering and assistance throughout the course.

My wholehearted gratitude is extended to Dr. Yohan Weerasuriya, Director Puritas Pvt. Ltd., for his advice and suggestions on improving the research. A special thank also due to Dr. Suren Wijeyakoon, Senior lecture, Department of Chemical & Process Engineering, for his valuable input during progress reviews.

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LIST OF ABBREVIATIONS

Abbreviation	Description
Plant A	Sewage treatment plant with direct aerobic submerged attached growth system
Plant B	Sewage treatment plant with anaerobic cum submerged attached growth aerobic system
AEC	Annual equivalent cost
$A_{r,n}$	Annuity Factor for interest rate r and no of years n
BOD	Bio-chemical Oxygen Demand
BPR	Biological Phosphorus Removal
CEA	Central Environmental Authority
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
I	Capital investment cost
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed liquor volatile suspended solids
SRT	Solids Retention Time
S_o	Influent parameter
S_e	Effluent parameter
TSS	Total suspended Solids
STP	Sewage Treatment Plant
TKN	Total Kjeldahl Nitrogen
VSS	Volatile Suspended Solids
X	Total AEC of capital cost
Y	Total annual operational and maintenance cost